

## ORIGINAL ARTICLE

# Self-blood-pressure monitoring—a questionnaire study: response, requirement, training, support-group popularity and recommendations

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The objective of this study was to survey hypertensive patients' response to, requirement for and training in self-blood pressure monitoring (SBPM). A total of 222 hypertensives were invited to complete a questionnaire even when not participating in the project. Questions supplied information on demographics, monitoring frequency, convenience of attending the surgery, monitor ownership and preference for and ease of self-monitoring. Comments supplied qualitative data. Training group questionnaires supplied similar data as well as SBPM data before and after training. Of 133 respondents, a higher educated, younger, wider age range wanted to participate (76; 57.2%) and tended to self-monitor. However, only an increase in further education (FE) was associated with an increased probability of participation and inclination to self-monitor in the multivariate analyses. A positive relationship exists between age and frequency in both groups. About a sixth of respondents own monitors and owner-

ship is correlated to FE. Although most patients found it convenient to visit the surgery, the percentage finding it convenient was lower in patients attending training sessions than in the original survey, possibly indicating that independence is important for SBPM. Younger, higher-educated patients tended to self-monitor although FE was again the significant factor. Training increased preference for the idea of SBPM, prospective monitor ownership (64.8% of non-owners) and self-monitoring intention (76.1%). Patients found recording card listed cardiovascular disease (CVD) risks valuable and 69.6% (32) wanted to establish a support group. Comments and interviews indicated haphazard knowledge, routines and uncertainty about SBPM. A standardised procedure including patient assessment, SBPM protocol and lifestyle education is needed for SBPM to be successful.

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## Introduction

Hypertension is known to be one of the reversible risk factors leading to heart attacks and strokes,<sup>1,2</sup> two of the major causes of premature deaths in the UK.<sup>3</sup> Although there has been extensive research into drugs and combination therapies,<sup>1,4</sup> control rates remain disappointing in many countries,<sup>5</sup> and well under half of people with high BP are treated successfully.<sup>6</sup>

The government is promoting patient involvement in health care to provide better and more responsive services.<sup>7</sup> Self-monitoring is one way that patients can participate in their health care, although if this

does not help to reduce the incidence of hypertension, self-blood-pressure monitoring (SBPM) application and procedures may have to be reviewed or qualified. SBPM has been shown to be as reliable as professional monitoring.<sup>8,9</sup> As it is carried out in the patient's home white coat hypertension (WCH) is usually not evident. WCH describes consistent hypertension in the clinic with consistent normotension by ambulatory blood pressure monitoring (ABPM). The clinic–ABPM difference is related to the level of clinic blood pressure and WCH is only considered to be present when the clinic–ABPM difference exceeds the population average difference.<sup>10</sup> WCH is exhibited in about 20% of patients depending upon the definition used.<sup>11</sup> Moreover, SBPM may also help to deliver cost-effective health services.<sup>12</sup>

Recently, target BP was set at 140/85 in all those with hypertension and 140/80 for patients with

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diabetes in the UK National Service Framework (NSF).<sup>13</sup> The potential increase in GPs' workloads because of the new NSF guidelines<sup>14</sup> and the increased numbers of patients categorised as hypertensive mean that it is even more important to introduce an efficient and appropriate regime to maintain patients below the new level. This should include lifestyle modification that can reverse and control hypertension<sup>10</sup> as well as embracing effective drug therapies.

However, the advantages of self-monitoring may be outweighed by other factors such as poor maintenance of equipment and incorrect technique.<sup>15–18</sup> In addition, other drawbacks have been demonstrated such as a reduction in drug use<sup>19</sup> and low-level patient education leading to inaccurate readings.<sup>20</sup> Consequently, it has to be achieved properly to be successful and as it is often not, patients need to be trained properly.<sup>15</sup> Therefore, the training of patients in SBPM is prudent.<sup>21</sup>

One aim of this study was to evaluate the demand for self-monitoring among hypertensive patients and to determine hypertensive patients' opinions about and reactions to training, willingness to self-monitor, buy machines and form a support group. Another objective was to determine what role SBPM can play before there is extensive promotion among hypertensive patients. Suggested recommendations are based on questionnaire response, interviews and previous work by others.

## Methods

### Background

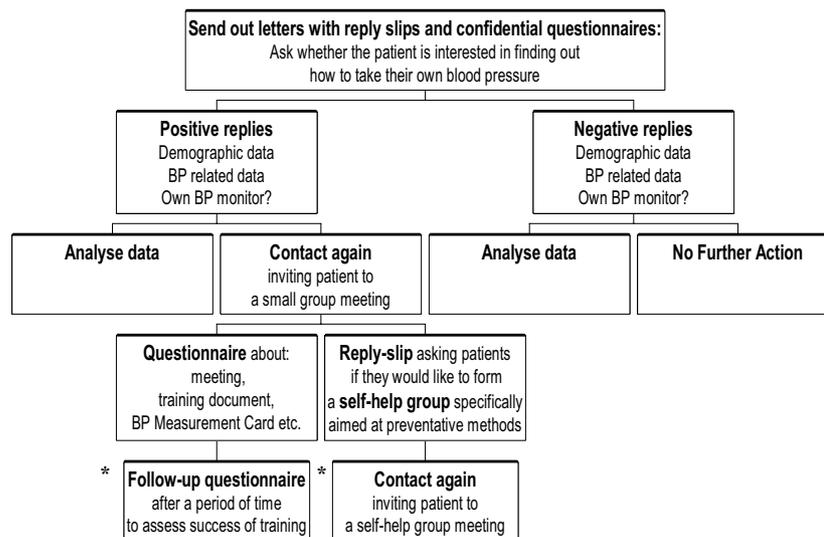
The project was based at Hadfield Medical Centre, Glossop, Derbyshire, UK. The person selected to

demonstrate the machines for self-monitoring (the project patient demonstrator) has been monitoring his BP (using a Sunbeam aneroid 7683 manual machine with stethoscope) since 1993 when he had a stroke. His decision to monitor his own BP followed a discussion with the GP and occasional surgery visits to verify measurements. Patients with hypertension were periodically referred to the demonstrator who taught SBPM and explained the benefits and sources of monitors, but allowed patients free choice of equipment. The surgery obtained BP cards (so that patients can record measurements and report any upward trends) and sought to evaluate the project to encourage all the practice's hypertensive patients to self-monitor.

### Study design (Figure 1)

This paper is based on a blood pressure self-monitoring evaluation instigated by Glossopdale Primary Care Sub-group<sup>22</sup> that used questionnaire tick-boxes to obtain quantitative data using rating scaling methods.<sup>23</sup> Patient written comments were employed to acquire qualitative data.

A confidential explanatory letter and survey were sent during the week 3–7 of April 2000 to all the practice's 222 patients deemed hypertensive by the GP. Patients were requested to complete the attached questionnaire even if they did not intend to participate. Questions included those to supply demographic and biographic details such as age, gender, ethnicity and education. The questionnaire also assessed BP monitoring frequency, convenience of attending the surgery, BP monitor ownership and type, preference for self-monitoring and whether the



\* Not yet completed

Figure 1 Flowchart to show evaluation plan.

patient found it easy. A space for comments was supplied at the end.

The patients who agreed to participate were contacted by Hadfield Medical Centre and asked if they would like to attend evening SBPM training meetings (TMs). Patients were given an introductory talk and handouts including a project summary, BP recording card and training leaflet. Different types of BP monitors were demonstrated and four sessions were held so that everyone could individually test the monitors.

Additionally, patients were provided with an explanatory letter and a questionnaire with a support group tear-off section to complete at the end of the session. This questionnaire was similar to the original survey, but it also supplied data on whether the patient preferred the idea of SBPM before and after training, how easy it was to understand SBPM and whether different BP monitors were easy to use. These were an Omron HEM 705CP sited in the surgery waiting room, a Boots automatic digital and a Sunbeam manual aneroid 7683. An Omron RX wrist monitor was available at two meetings, but not assessed quantitatively by the questionnaire. Patients were asked if they understood the verbal explanations. They were also asked if the BP recording card was easy to use, whether the listed cardiovascular disease (CVD) risk factors on the card front were of value and if there needed to be a short reminder of how to use the card and the BP monitor. The usefulness of verbal and leaflet information was also assessed and whether patients intended to self-monitor after training and if they did, whether they would use the waiting room monitor or buy their own and if so, what type. Spaces were left for comments at the end of each section.

The introductory letter and talk suggested the formation of a support group and afterwards the discussion and interviews included ideas for meetings. Suggestions covered general discussions on patients' experiences and speakers on SBPM improvements, fitness, diet, stress-relief and other lifestyle modifications aimed at a reduction in medication. Interested patients filled in their names and addresses on the tear-off section.

Written comments and training meeting interviews were employed to acquire qualitative data. Interviews were utilised to avoid the restrictions created by writing especially for those who do not find writing easy and the interviews were informal and conversation-based to ensure that patients were relaxed and gave opinions freely. The tick-box categories were ranked numerically to allow analysis. Demographic and biographic data were analysed and correlated with SBPM and other data. Patients who responded but did not indicate whether they intended to either participate or not participate were deemed to be non-participants. Suggested recommendations are based on the results and previous work of others.

## Statistical analyses

Proportional hazard models were used to calculate the risk of responding 'Yes' to participation in the study relative to the risk of responding 'No' after adjusting for potential confounding variables.<sup>24</sup> Similar models were used to calculate the relative risk of owning a self-monitoring machine. These models were fitted using the robust variance estimator option in the STATA software package. Age and further education (FE) were included in the models as continuous variables; therefore, the relative risk estimates of these factors are a measure of the constant change in risk with increasing age or increasing level of FE.

## Results

The response rate to the original survey was good (133; 59.9%).<sup>23</sup> However, of the 133 patients who responded to the survey, only 76 (57%) wanted to participate in the project. Younger people ( $P=0.003$ ) and those with FE ( $P<0.001$ ) were more likely to respond 'Yes' to participation (Table 1). After adjusting for other factors in the model, only an increase in FE ( $P=0.008$ ) was associated with an increase in probability of responding 'Yes' to participation in the project.

Most machines owned by patients are digital, the Omron wrist monitor being most popular (4), followed by the Omron M4, Omron HEM, German Visomat OZ20, Sunbeam Oster manual (two each) and various others. The prevalence of monitor ownership increased with level of FE. Among patients with no FE, 9.1% owned their own BP monitor, this increased to 17.2% among patients with some FE and to 57.1% among patients who had attended university. Even after adjusting for other factors in the model, patients who had gone on to FE were much more likely to own their own monitor than patients who had no FE ( $P<0.001$ ).

The frequencies of patients' written comments (Tables 2 and 3) do not necessarily reflect tick-box response frequency on a particular category because comments are only used when emphasis or qualification is needed. Oral interviews at meetings were also given (Table 3).

Although 76 patients had indicated they would participate in the project, only 46 (or 20.7%) attended the TMs of which 45 completed the questionnaire. Among these patients, 77.8% intended to self-monitor and 69.6% were interested in forming a support group. Table 4 shows the distribution of demographic factors and responses to the questionnaire for patients who attended the TMs and completed the questionnaire.

Although TM patient numbers were low, observations can be made from their responses, as their answers were mainly unequivocal. Most patients found it either very easy or easy to understand how to take BP (Table 5). Patients' ease of understanding

**Table 1** Demographic and other comparisons between participating and nonparticipating patients who responded to the questionnaire

Factor	Wanted to participate (n=76)	Did not want to participate (n=57)	Crude relative risk of participation	Adjusted relative risk of participation
	n (row %)	n (row %)		
<i>Gender</i>				
Male	34 (61.8)	21 (38.2)	1.00	1.00
Female	42 (59.2)	29 (40.8)	0.96 (0.72, 1.27)	1.18 (0.89, 1.57)
No response	0	7		
<i>Age group (years)</i>				
30–39	1 (100.0)	0 (0.0)	0.85 (0.76, 0.94)	0.98 (0.85, 1.12)
40–49	8 (100.0)	0 (0.0)		
50–59	7 (46.7)	8 (53.3)		
60–69	29 (72.5)	11 (27.5)		
70 or older	31 (49.2)	32 (50.8)		
No response	0	6		
<i>Further education</i>				
No	35 (53.0)	31 (47.0)	1.33 (1.15, 1.54)	1.31 (1.07, 1.59)
College	21 (72.4)	8 (27.6)		
University	13 (92.9)	1 (7.1)		
No response	7	17		
<i>BP measured at the surgery</i>				
Not convenient	23 (69.7)	10 (30.3)	1.00	1.00
Conv./V. Conv.	47 (59.5)	32 (40.5)	0.85 (0.64, 1.14)	0.84 (0.60, 1.17)
No response	6	15		
<i>Own BP monitor</i>				
No	63 (60.6)	41 (39.4)	1.00	1.00
Yes	13 (61.9)	8 (38.1)	1.02 (0.71, 1.48)	0.95 (0.66, 1.36)
No response	0	8		

verbal explanations was found to be either excellent or good by 91.2% (31) of respondents. Similarly, most patients thought the usefulness of verbal (94.7%; 36) and training document information (88.9%; 24) was either good or excellent. The majority (88.6%; 31) of patients found the BP card easy to use and most patients (72.2; 26) thought the listed risk factors were valuable. Only 33% (11) of patients wanted a written reminder of how to use the BP monitor (Table 5).

After training, 13 patients had changed their response to indicate they were more likely to self-monitor and five patients indicated they were less likely, indicating a shift towards a preference for self-monitoring ( $P=0.059$ ). This meant that 76.1% of patients intended to self-monitor after attending the meeting, although half of these responded that they would self-monitor at the surgery. Only 20% of the patients owned a BP monitor before attending the training meeting. When asked which type of machine they intended to buy, almost half of the patients did not respond, but 28.9% patients indicated that they would buy a fully automatic machine, 8.8% a wrist monitor, 2.2% each a Boots automatic or Omron HEM705CP and 11.1% were undecided. Nevertheless, most patients who responded preferred the Omron when tested.

Table 6 reveals trends that took place throughout the project from nonparticipants vs participants to nonattendees vs attendees.

## Discussion

As only a third (34.2%) of surveyed patients were interested enough in SBPM to participate in the project and one-fifth (20.7%) to attend training sessions, the majority remain unconvinced. Comments from non-participants that may allude to this included patients not wanting to be responsible for their own BP, not wanting to become preoccupied with their BP, wanting to visit the doctor, lack of confidence and advanced age (Table 2). The latter is an important factor because of the expected increase in the frequency of hypertension with age in the UK and in other countries.<sup>25–27</sup>

The unadjusted analysis of both sets of data suggested that younger and higher-educated people are more likely to consider SBPM, but the effect of age disappeared in the multivariate analysis. Moreover, trends throughout the study (Table 6) reveal that the only category in which patients were more likely to participate and attend meetings was among those who had a higher level of FE. However, the age

**Table 2** Comments by patients who responded to the questionnaire (selected and summarised)

Category	Comments	
	Nonparticipants	Participants
Self-monitor at surgery	None	(1) Found that using practice equipment was reassuring and getting to the surgery on time raises BP. (2) Used old surgery monitor—very erratic readings, will only use if it is checked regularly by qualified person
Self-monitor at home	(1) Already uses BP machine. (2) Uses Omron R1 wrist, Suggests: late evening appointments and electronic access to surgery to report home readings. (3) Owns Omron M4. Has taken own BP since buying it	(1) Would prefer to measure BP at home. (2) Takes BP occasionally. Not sure when to see doctor. (3) Not into routine with BP monitor yet. BP taken when necessary by GP or when hospitalised. (4) Omron digital HEM 413C owned for over 10 years—not sure about accuracy of calibration
Owns monitor, but not used	(1) Does not use BP machine even though he/she owns one	(1) Does not like taking own BP because it does not appear well controlled and he/she becomes over-anxious but sees the advantage of self-monitoring
BP measured by HCP	(1) BP taken at diabetic centre and MRI every 3 months. (2) Has had problems with BP and does not want to be responsible for it. (3) Prefers nurse to take BP. (4) BP measurement often varies, by doctor or nurse. (5) Needs to attend Doctor to have BP taken. (6) Not confident to take his own BP and has poor eyesight. (7) Does not want to become preoccupied with his/her BP and wants to continue to visit Doctor occasionally. (8) BP taken every quarter. Has to get taxi because surgery not on bus route. (9) BP taken every 3 months. Would rather have the Doctor take it because he/she will be 76 years of age soon	(1) Found auto-machine at hospital uncomfortable because of double inflation—sent his/her BP up
Considering buying a monitor	(1) BP taken every 2 weeks then once a month. Is considering buying a BP machine	None
Wants BP measured more often	None	(1) Likes to have BP taken more often to monitor health. (2) Would be happier having BP taken more frequently than every 6 months
Lifestyle change?	None	(1) Feels that she relies on medication too much and neglects to make an appointment

effect is actually correlated with FE and probably relates to the unavailability of FE in the past, rather than any inferences about the intelligence of the older non-participants. Therefore, although FE may be used as a guide to the patient most likely to SBPM, other factors have to be considered such as socioeconomic status, general intellect, clinical parameters and physical ability.

As there was no significant difference in monitor ownership between non-participants, participants and meeting attendees, project participation appears to have been for different reasons. Non-participation may sometimes have been because of patients' satisfaction with their current regimen as shown by the comments of nonparticipants who own monitors or conversely, disinterest or dissatisfaction with SBPM. Four commenting participants specified uncertainties and may have participated to

solve problems or to obtain more information (Table 2). Four meeting attendees appeared satisfied with home monitoring, but another expressed dissatisfaction (Table 3).

One potential SBPM difficulty revealed by the original survey is over-frequent measurement<sup>15</sup> possibly leading to obsession. Two participants want their BPs measured more often (Table 2), possibly their reason for considering SBPM. As the GP should decide on an optimal frequency for each patient, numerous readings are unnecessary except for diagnostic, calibration or familiarisation reasons. Some patients are aware of the danger of obsession/preoccupation as one commented (Table 2).

Another problematic group is surgery non-attendees such as the participant who commented that she relied too much on medication and neglects to make an appointment (Table 2). Although this

**Table 3** Comments by and interviews with patients who attended the training meetings and responded to the questionnaires (selected and summarised)

Category	Comments
Self-monitor at surgery	Will take own BP at surgery
Self-monitor at home	(1) Takes own BP and submits readings to Doctor. (2) Has tried manual and electronic—prefers electronic. (3) Owns Rio-Dezac Ltd semi-auto. (4) Takes BP every 10 days—does not want to become obsessed. (5) Has stethoscope type, but cannot use very well
Considering buying a monitor	(1) Will decide which BP machine to buy later. (2) Would like to buy a machine, but does not think that he/she can afford one
TM comments	(1) Very informative session. Suggests 12 subdivisions on card. (2) Interesting session. (3) More information needed on card. (4) There was no advice on how to use the blue card. (5) Good verbal introduction, but not enough time to individually test equipment. (6) Omron and wrist monitors take too long and make too much noise. This must add to each reading. (7) Lines on graph indistinct for people with poor eyesight
TM interviews	(1) One person takes his BP every morning for reassurance. This may be interpreted as obsessive over-measurement. (2) An elderly infirm man had suffered a serious heart attack and prescribed aspirin. After taking aspirin for a time he underwent a stomach haemorrhage. He may be an unsuitable subject for self-BP measurement. (3) An unemployed patient suggested a lending scheme for BP machines, as he could not afford one. (4) When an Omron RX wrist monitor was brought to two TMs by patients, the people present preferred it to the demonstration models

remark shows promising potential interest in the lifestyle modification, once SBPM is established, surgery visiting may be avoided, leading to a possible gradual rise in systolic BP because of lack of therapeutic updating.<sup>19</sup> Therefore, it is important that measurements are recorded properly and any upward trends reported to the GP. Self-monitoring may be inadvisable for patients in failing health. The elderly heart attack patient (Table 3) may benefit from frequent check-ups and SBPM may delay these, leading to health conditions remaining undiagnosed.

Although all responding patients were more likely to find it convenient than inconvenient to attend surgery and there was no significant difference in this factor for nonparticipants and participants, TM attendees were significantly more likely to find it inconvenient than nonattendees ( $P < 0.001$ ) (Table 6). Taking this factor together with age and education, it may be surmised that independence is an important factor for SBPM.

There were high numbers of 'non-responders' in many categories, apparently caused by either indecision, for example, monitor preference or for fear of causing offence when asked to assess project verbal or written material (Table 5). Noncommittal answering was also high, for example, 'neither yes nor no'.

The potential problems revealed by patients' comments such as haphazard knowledge, routines and uncertainty about SBPM make it evident that training and education are needed for these factors not to lead to adverse health outcomes. Training is needed<sup>21</sup> to prevent errors, for instance, over-frequent and poor measurement standardisation, wrong technique,<sup>15</sup> inaccurate measurements,<sup>16</sup> at

various times, pulse rate omission, nondocumentation and pulse rate and pulse pressure (PP) omission.<sup>18</sup> The latter is recognised as being increasingly important because although diastolic BP (DBP) is the strongest predictor of coronary heart disease (CHD) in those < 50 years of age, there is a transition through systolic BP (SBP) to PP, which in those > 60 years old is the strongest CHD predictor and when DBP becomes negatively related to CHD risk.<sup>28</sup> Project training addressed most of these factors apart from pulse rate, measurement frequency, standardisation and most importantly PP. These need to be considered in future training.

Training proved an effective motivator because patients were more likely to indicate that they would self-monitor after training, than before ( $P = 0.059$ ). Interviews indicated that patients favoured the Omron HEM 705CP when tested because it was easier to use than the Boots digital or Sunbeam Manual and also possibly because this Omron is British Hypertension Society (BHS) recommended<sup>29</sup> and is sited in GP surgery waiting room, indicating quality. This contrasts with actual ownership where no BHS-recommended monitors are possessed by respondents, probably because of the original practice policy of allowing free choice of monitors. Some patients own the least popular Sunbeam possibly because it was used to demonstrate SBPM prior to the project. Therefore, price and experience were probably the determining factors of ownership.

Another training achievement was the prospective increase of monitor ownership in those attending. Among patients who did not own a monitor before training, 64.8% (95% CI 43.6–77.8) indicated that they would purchase their own BP monitoring

**Table 4** Distribution of demographic factors and responses to the questionnaire for patients who attended the training meetings and completed the questionnaire

Demographic factor	N	% (95% CI)
<i>Gender</i>		
Male	18	42.9 (27.7, 59.0)
Female	24	57.1 (41.0, 72.3)
Unknown	3	
<i>Age group (years)</i>		
Under 50	3	6.8 (1.4, 18.7)
50–59	8	18.2 (8.2, 32.7)
60–70	14	31.8 (18.6, 47.6)
Over 70	19	43.2 (28.3, 59.0)
Unknown	1	
<i>Further education</i>		
None	13	35.1 (20.2, 52.5)
College	17	45.9 (29.5, 63.1)
University	7	18.9 (8.0, 35.2)
Unknown	8	
<i>Convenient to attend surgery</i>		
Very inconvenient or inconvenient	5	11.1 (3.7, 24.1)
Neither convenient nor inconvenient	16	35.6 (21.9, 51.2)
Very convenient or convenient	24	53.3 (37.9, 68.3)
<i>Prefer to measure own blood pressure compared with doctor measuring it (before)</i>		
Much more or more	25	59.5 (43.3, 74.4)
No difference	13	31.0 (17.6, 47.1)
Much less or less	4	9.5 (2.7, 22.6)
Unknown	3	
<i>Prefer to measure own blood pressure compared with GP measuring it (after)</i>		
Much more or more	27	65.9 (49.4, 79.9)
No difference	9	22.0 (10.6, 37.6)
Much less or less	5	12.2 (4.1, 26.2)
Unknown	4	
<i>Frequency of BP measured by GP or nurse</i>		
Weekly	5	11.6 (3.9, 25.1)
Monthly	6	14.0 (5.3, 27.9)
3 monthly	12	27.9 (15.3, 43.7)
6 monthly	11	25.6 (13.5, 41.2)
Yearly	9	20.9 (10.0, 36.0)
Unknown	2	

**Table 5** Patients responses to learning to monitor their own BP at training sessions by those who answered questionnaires

Patients response	n	% (95% CI)
<i>Find it easy to understand how to take your BP?</i>		
Very easy or easy	32	72.7 (57.2, 85.0)
Neither easy nor difficult	10	22.7 (11.5, 37.8)
Very difficult or difficult	2	4.5 (0.6, 15.5)
Unknown	1	
<i>Understand verbal explanation?</i>		
Excellent/good	31	91.2 (76.3, 98.1)
Satisfactory	3	8.8 (1.9, 23.7)
Poor/very poor	0	0.0 (0.0, 10.3)
Unknown	11	
<i>Card easy to use?</i>		
Excellent/good	31	88.6 (73.3, 96.8)
Satisfactory	4	11.4 (3.2, 26.7)
Poor/very poor	0	0.0 (0.0, 10.0)
Unknown	10	
<i>Risk factors given on card of value?</i>		
Yes	26	72.2 (54.8, 85.8)
Neither yes nor no	7	19.4 (8.2, 36.0)
No	3	8.3 (1.8, 22.5)
Unknown	9	
<i>Preferred short reminder?</i>		
Yes	11	33.3 (18.0, 51.8)
Neither yes nor no	7	21.2 (9.0, 38.9)
No	15	45.5 (28.1, 63.6)
Unknown	12	
<i>Enough explanation on how to use the card?</i>		
Yes	21	60.0 (42.1, 76.1)
Neither yes nor no	2	5.7 (0.7, 19.2)
No	13	37.1 (21.5, 55.1)
Unknown	9	
<i>Usefulness of verbal information?</i>		
Excellent/good	36	94.7 (82.3, 99.4)
Satisfactory	2	5.3 (0.6, 17.7)
Poor/very poor	0	0.0 (0.0, 9.3)
Unknown	7	
<i>Usefulness of training pack?</i>		
Excellent/good	24	88.9 (70.8, 97.6)
Satisfactory	3	11.1 (2.4, 29.2)
Poor/very poor	0	0.0 (0.0, 12.8)
Unknown	18	

machine. A positive aspect of this is that monitor ownership contributes to hypertensive patients' education.<sup>30</sup> Most patients wanted a fully automatic machine, some a wrist monitor, but only a few specified a Boots automatic or Omron HEM 705CP and many did not respond, probably owing to indecision because of the limited time available to test the monitors (as observed by one patient). Therefore, although most patients preferred the Omron, make of monitor appears to be trivial when patients are considering purchase.

The policy of siting a BP monitor in the surgery waiting room offers all the benefits of SBPM (except surgery attendance is necessary) including the reduction of WCH for patients who cannot afford

or do not want to own a monitor. As half of the patients who intended to self-monitor indicated that they would do so at the surgery it appears to be popular. In the original survey, one participant remarked that surgery monitoring was reassuring and convenient, whereas another had difficulties. The emotional effect of talking has been shown to contribute to WCH,<sup>31</sup> but evidence suggests that WCH is not lessened by lone self-monitoring in the surgery.<sup>32</sup> Moreover, hypertensives are affected adversely by stress-inducing situations.<sup>33</sup> It is possible then that WCH may pertain in the stress-inducing surgery situation even without a health-

**Table 6** Trends revealed by number (percentage) of patients in each category, number in each category who wanted to participate and the number in each category who actually attended the meetings

Factor	Total (n=133)	Wanted to participate (n=76)	Attended meeting (n=45 <sup>a</sup> )	Crude relative risk (95% CI)	
				Wanted vs not wanted	Attended vs not attended
<i>Gender</i>					
Male	55	34 (61.8)	18 (36.0)	1.00	1.00
Female	71	42 (59.2)	24 (35.3)	0.96 (0.72, 1.27)	1.03 (0.63, 1.71)
No response	7		3		
<i>Age group (years)</i>					
30–39	1	1 (100.0)	1 (100.0)		
40–49	8	8 (100.0)	2 (25.0)		
50–59	15	7 (46.7)	8 (61.5)		
60–69	40	29 (72.5)	14 (38.9)		
70 or older	63	31 (49.2)	19 (31.1)	0.85 (0.76, 0.94)	0.87 (0.69, 1.08)
No response	6		1		
<i>Further education</i>					
No	66	35 (53.0)	13 (21.3)		
College	29	21 (72.4)	17 (63.0)		
University	14	13 (92.9)	7 (50.0)	1.33 (1.15, 1.54)	1.70 (1.27, 2.28)
No response	24	7	8		
<i>BP measured at the surgery</i>					
Not conv	33	23 (69.7)	21 (65.6)	1.00	1.00
Conv/v. conv	79	47 (59.5)	24 (32.0)	0.85 (0.64, 1.14)	0.48 (0.31, 0.73)
No response	21	6			
<i>Own BP monitor</i>					
No	104	63 (60.6)	36 (36.7)	1.00	1.00
Yes	21	13 (61.9)	9 (47.4)	1.02 (0.71, 1.48)	1.24 (0.71, 2.17)
No response	8				

<sup>a</sup>Although 46 patients attended the meetings one did not complete the questionnaire.

care professional's (HCP) presence. Hence, a BP-monitor-renting scheme may be a viable alternative as suggested by a patient (Table 3). Nevertheless, it may be possible that even patients' awareness of taking their own BP may be enough to raise it. One patient intimated that noise generated by the Omron and wrist monitors produces stress-induced BP rise (Table 3). Consequently, for such patients any BP monitoring may be difficult.

Many patients found an Omron RX wrist monitor easier to use than conventional arm monitors when available to try. This is problematic because it is not recommended by the BHS<sup>29</sup> as it measures BP over the radial rather than the brachial artery and is very much position dependent. Moreover, the growing popularity of wrist monitors is associated with increasing measurement errors.<sup>34,35</sup> Nevertheless, the government does not recommend any particular monitor type or make, detailing merits and drawbacks of all types.<sup>36</sup>

The project BP recording card was assessed by patients as generally satisfactory, but needed some improvement. Importantly, most patients found the CVD risks listed on the card front valuable, showing that patients may be ready for additional education and lifestyle modification if needed. Hypertension is often accompanied by CVD risk factors such as

lipid abnormalities, hyperglycaemia, elevated fibrinogen and obesity, mainly in those with a sedentary lifestyle and in smokers.<sup>37,38</sup> Consequently, it is important to address all these factors in patient assessment for SBPM.

Prior to the project, before scrutiny was advised, patients were referred individually by the GP to the patient demonstrator who had no professional help. The unsatisfactory outcome was unsupervised patients using unvalidated machines at an unspecified frequency that is unacceptable in the present climate. Hence, it is very important that skilled, trained<sup>21</sup> professional staff teach a correct SBPM protocol<sup>15,18,35</sup> to prevent SBPM mistakes.<sup>15,18</sup> Moreover, when physicians increase their emphasis on patient education BP control rates improve.<sup>39</sup> It is equally, if not more, important to educate patients about hypertension and CVD prevention. Hence, primarily, educational strategies should include an assessment of patient knowledge of hypertension.<sup>40</sup> Then information about hypertension and cardiovascular risk together with BP-measurement procedures, equipment and use, protocols, and interpretation of data<sup>35</sup> should be given as an integrated unit.

Project synthesis offers the suggested recommendation of a standardised procedure that may be

considered for use by HCPs. Firstly, patient assessment has been shown to be important in preventing increased risk for vascular complications.<sup>41</sup> Therefore, awareness of the profile of patients who may be prepared for SBPM (younger, independent, FE) and *vice versa* together with clinical parameters can be used in the decision. For instance, those who are opposed to SBPM may benefit most from it, for example, capable patients over 75 years old.<sup>42</sup> However, there must be caution, for example, in dealing with CVD patients, because of lowered surgery visiting. The effects of level of education<sup>20</sup> and physical or mental disabilities<sup>35</sup> on performing the technique must also be considered. Conversely, some self-monitoring patients with milder hypertension may be able to control their own drug dose.<sup>43</sup>

In patients <50 years old, it may be wise to set the conservative SBPM upper limit of 135/85 mmHg rather than the WHO suggested level of 140/90 mm,<sup>34</sup> but to apply flexibility when considering all other patient factors.<sup>44</sup> As most hypertensives are >50 years old, SBP and especially PP must be considered<sup>28</sup> because DBP lowers because of arterial stiffness with age.<sup>28</sup> Patients exhibiting WCH can be eliminated from the protocol using ambulatory special procedures<sup>45</sup> although clear guidelines are still needed.<sup>46</sup>

Once a patient is assessed as suitable for SBPM, an education programme (including literature,<sup>47</sup> as used here) and protocol should be agreed between the patient and HCP. This should include monitor type (BHS validated), measurement procedure, data interpretation, GP check-up frequency and optimum SBPM frequency. The latter is a difficult and negotiable decision,<sup>34</sup> but it need not be too frequent,<sup>48</sup> as SBPM should not encumber a BP-lowering healthy lifestyle that is widely advocated as the initial BP-lowering therapy<sup>10</sup> even for elderly patients,<sup>49</sup> especially as combination drug therapy possibly worsens lipid profile.<sup>50</sup> Patient education should emphasise that monitoring is only a tool to help lower BP along with appropriate lifestyle changes,<sup>51</sup> which are well documented.<sup>10</sup> Also counselling,<sup>52</sup> relaxation and stress education<sup>53</sup> may be beneficial. Before a patient is considered competent, SBPM proficiency must be confirmed and an annual re-evaluation<sup>21,34</sup> of technique and lifestyle<sup>47</sup> is advisable.

Once the patient has been correctly trained and drawbacks eliminated, SBPM has several advantages (Table 7). Many studies report successes including medication compliance,<sup>54</sup> and patient satisfaction, for example, for elderly hypertensives.<sup>42</sup> To aid the HCP, expert patients could assist in training and offer the option of joining a support group.

Support group formation was popular (69.6% of TM patients) and has the advantages of continuing the education already provided by the GP, experience sharing, SBPM updating and examining alternative ways of lowering BP leading to potential medication reduction or cessation. Interviewed

**Table 7** Advantages and disadvantages of SBPM

Main advantages of self-monitoring are

- Elimination of WCH—achieving greater accuracy and validity
- Cost saving in doctors' and nurses' time thereby offering huge savings in NHS resources
- Greater patient involvement
- Convenience and time saving (for both patient and doctor)
- Prioritisation (so that the doctor can spend time on other tasks)
- Enhanced patient self-help perception.

Main drawbacks of self-monitoring are

- Obsessive over-measurement of BP
- Inaccurate readings because of the use of low-quality machines, inadequate training or low-level education
- Gradual increase in BP with time because of the patient not going to see the GP and therefore not taking adequate medication
- The perpetuation of obsession with one's health because of having to remember to take BP oneself rather than periodic surgery visiting and getting on with life between visits
- Other problems may be missed if a health professional does not take a patient's BP

patients indicated that the latter was an incentive for support group formation. It has been demonstrated elsewhere that lifestyle modification, particularly weight loss, was motivated by and led to medication cessation.<sup>55</sup>

## Conclusion and recommendations

Hypertension is a chronic problem in many countries.<sup>5,6</sup> Often, the first warning the patient has of raised BP is a heart attack, heart failure or stroke. Screening of patients over 50 years may be a solution, but this would add to the burden of an increasing population of known hypertensives. Therefore, a more efficient regime has to be specified that may include self-monitoring. However, SBPM is futile if it does not affect BP morbidity outcomes. The inertia in the reduction of hypertension frequency despite better drug regimes could be because of a concomitant drop in exercise that has been observed,<sup>56</sup> and drugs may have taken the place of or used as an excuse to reduce exercise. For selected patients an SBPM regime may be useful, but this requires correct training and a specific schedule implemented by a trained HCP including simultaneous lifestyle education that will ensure that hypertension is ameliorated or eliminated.

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## References

- Pieper JA. Management of coronary heart disease risk factors and progression with calcium blockers. *Pharmacotherapy* 2001; **21**: 195S–208S.
- Ruilope LM, Schiffrin EL. Blood pressure control and benefits of antihypertensive therapy: does it make a difference which agents we use? *Hypertension* 2001; **38**: 537–542.
- Department of Health. *Saving lives: our healthier nation*. Department of Health 1999; pp 72–73.
- PROGRESS Collaborative Group. Randomised trial of a perindopril-based blood-pressure-lowering regimen among 6105 individuals with previous stroke or transient ischaemic attack. *Lancet* 2001; **358**: 1033–1041.
- Mensah GA. Refining strategies for the prevention and control of hypertension and related complications. *Ethn Dis* 1999; **9**: 327–332.
- Department of Health. *Saving lives: our healthier nation*. Department of Health 1999; pp 76–77.
- Department of Health. *Patient and public involvement in the new NHS*. Department of Health Report 1999. Also found at: <http://www.doh.gov.uk/pub/docs/doh/ppinvolvement.pdf>.
- Jula A, Puukka P, Karanko. Multiple clinic and home blood pressure measurements versus ambulatory blood pressure monitoring. *Hypertension* 1999; **34**: 261–266.
- Comas A *et al*. The evaluation of the hypertensive patient via self-measured blood pressure at home. *Atten Primaria* 1998; **22**: 142–148.
- Ramsay LE *et al*. Guidelines for management of hypertension: report of the third working party of the British Hypertension Society. *J Hum Hypertens* 1999; **13**: 569–592.
- Torres Jimenez J *et al*. Variations in the prevalence and patient profile of white-coat syndrome, according to its definition using self-measurement of blood pressure at home. *Atten Primaria* 2001; **28**: 234–240.
- Balas EA, Iakovidis I. Distance technologies for patient monitoring. *BMJ* 1999; **319**: 1309.
- Department of Health. *National Service Frameworks Coronary Heart Disease Modern Standards and Service Models*. Department of Health, 2000.
- Hippisley-Cox J, Pringle M. General practice workload implications of the national service framework for coronary heart disease: cross sectional study. *BMJ* 2001; **323**: 269–270.
- Stergiou GS *et al*. Home monitoring of blood pressure: limited value in general practice. *J Hum Hypertens* 1996; **10**: 219–223.
- Merrick RD *et al*. Factors influencing the accuracy of home blood pressure measurement. *South Med J* 1997; **90**: 1110–1114.
- Johnson KA, Partsch DJ, Rippole LL, McVey DM. Reliability of self-reported blood pressure measurements. *Arch Intern Med* 1999; **159**: 2689–2693.
- Jeck T *et al*. Performing self-measurement of blood pressure: a patient survey. *Schweiz Rundsch Med Prax* 1991; **80**: 456–461.
- Bailey B, Carney SL, Gillies AA, Smith AJ. Antihypertensive drug treatment: a comparison of usual care with self blood pressure measurement. *J Hum Hypertens* 1999; **13**: 147–150.
- Nordmann A *et al*. Reliability of patients measuring blood pressure at home: prospective observational study. *BMJ* 1999; **319**: 1172.
- Birkett NJ *et al*. Self-measurement of blood pressure: issues related to the training of patients. Canadian Coalition for High Blood Pressure Prevention and Control. *Can J Cardiol* 1995; **11**: 23H–27H.
- Tyson M. *Blood pressure self-monitoring evaluation*. July 2001, 69pp.
- Moser C, Kalton G. *Survey Methods in Social Investigation*. 2nd edn. Dartmouth Publishing Company Limited, Hants, UK, 1979.
- Lee J, Chia KS. Estimation of prevalence rate ratios for cross sectional data: an example in occupational epidemiology. *Br J Ind Med* 1993; **50**: 861–864.
- Jo I *et al*. Prevalence, awareness, treatment, control and risk factors of hypertension in Korea: the Ansan study. *J Hypertens* 2001; **19**: 1523–1532.
- Ibrahim MM *et al*. Hypertension prevalence, awareness, treatment and control in Egypt. Results from the Egyptian National Hypertension Project (NHP). NMP Investigative Team. *Hypertension* 1995; **26**: 886–890.
- Sonmez HM *et al*. The epidemiology of elevated blood pressure as an estimate for hypertension in Aydin, Turkey. *J Hum Hypertens* 1999; **13**: 399–404.
- Franklin SS *et al*. Does the relation of blood pressure to coronary heart disease risk change with aging? *Circulation* 2001; **103**: 1245.
- O'Brien E *et al*. Blood pressure measuring devices: recommendations of the European Society of Hypertension. *BMJ* 2001; **322**: 531–536.
- Hanon O *et al*. Blood pressure self-monitoring contributes to improved patient education among hypertensive subjects. *Arch Mal Coeur Vaiss* 2001; **94**: 879–883.
- Le Pailleur C *et al*. Talking effect and 'white coat' effect in hypertensive patients: physical effort or emotional content? *Behav Med* 2001; **26**: 149–157.
- Myers MG, Meglis G, Polemidiotis G. The impact of physician vs automated blood pressure readings on office-induced hypertension. *J Hum Hypertens* 1997; **11**: 491–493.
- Aivazyan TA *et al*. Psychophysiological interrelations and reactivity characteristics in hypertensives. *Health Psychol* 1988; **7** (Suppl): 139–144.
- Un S, Mengden T, Vetter H. Your patient self-monitors his blood pressure. Other limit values are applicable. *MMW Fortschr Med* 2000; **142**: 28–30.
- Mengden T *et al*. User procedure for self-measurement of blood pressure. First International Consensus Conference on Self Blood Pressure Measurement. *Blood Press Monit* 2000; **5**: 111–129.
- Medical Devices Agency. *Blood Pressure Measurement Devices—Mercury and Non-mercury*. Device bulletin MDA DG2000 (03: Department of Health 2000).
- Kannel WB *et al*. The Framingham Study: ITS 50-year legacy and future promise. *J Atheroscler Thromb* 2000; **6**: 60–66.
- Paganini-Hill A, Perez Barreto M. Stroke risk in older men and women: aspirin, estrogen, exercise, vitamins, and other factors. *J Genet Specif Med* 2001; **4**: 18–28.
- Butler RN *et al*. Hypertension: setting new goals for lower readings. *Geriatrics* 1999; **54**: 20–21, 25–26, 29–30.

- 40 Kjellgren KI, Svensson S, Ahlner J, Saljo R. Hypertensive patients' knowledge of high blood pressure. *Scand J Prim Health Care* 1997; **15**: 188–192.
- 41 Trilling JS, Froom J. The urgent need to improve hypertension care. *Arch Fam Med* 2000; **9**: 794–801.
- 42 Bortolotto LA *et al.* Feasibility and importance of self-monitoring in patients over 75 years old. *Arch Mal Coeur Vaiss* 1999; **92**: 1159–1162.
- 43 Ashida T *et al.* Profiles of patients who control the doses of their antihypertensive drugs by self-monitoring of home blood pressure. *Hypertens Res* 2001; **24**: 203–207.
- 44 White WB *et al.* Task force VI: self-monitoring of the blood pressure. *Blood Press Monit* 1999; **4**: 343–351.
- 45 Veglio F *et al.* Ambulatory blood pressure monitoring and clinical characteristics of the true and white-coat resistant hypertension. *Clin Exp Hypertens* 2001; **23**: 203–211.
- 46 Addison C, Varney S, Coats A. The use of ambulatory blood pressure monitoring in managing hypertension according to different treatment guidelines. *J Hum Hypertens* 2001; **15**: 535–538.
- 47 Jeck T *et al.* Self measurement of blood pressure: patient education. *Schweiz Rundsch Med Prax* 1989; **78**: 1346–1349.
- 48 Brook RD. Home blood pressure: accuracy is independent of monitoring schedules. *Am J Hypertens* 2000; **13**: 625–631.
- 49 Stanton JA, Lowenthal DT. The evidence for lifestyle modification in lowering blood pressure in the elderly. *Am J Geriatr Cardiol* 2000; **9**: 27–33.
- 50 Maitland-van der Zee *et al.* The association between antihypertensive drug therapies and plasma lipid levels in the general population. *J Hum Hypertens* 2001; **15**: 701–705.
- 51 Tomaszewski M *et al.* Some aspects of non-pharmacologic treatment of hypertension. *Przegl Lek* 1999; **56**: 579–583.
- 52 Boulware LE *et al.* An evidence-based review of patient-centered behavioral interventions for hypertension(1). *Am J Prev Med* 2001; **21**: 221–232.
- 53 Jacob RG *et al.* Relaxation therapy for hypertension: setting-specific effects. *Psychosom Med* 1992; **54**: 87–101.
- 54 Ashida T *et al.* Relationship between home blood pressure measurement and medication compliance and name recognition of antihypertensive drugs. *Hypertens Res* 2000; **23**: 21–24.
- 55 Reid CM, Maher T, Jennings GL. Heart Project Steering Committee. Substituting lifestyle management for pharmacological control of blood pressure: a pilot study in Australian general practice. *Blood Press* 2000; **9**: 267–274.
- 56 Reilly JJ, Dorosty AR. Epidemic of obesity in UK children. *Lancet* 1999; **354**: 1874–1875.