Self-monitoring blood pressure in hypertension – internet based survey of UK general practitioners

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Abstract (249/250 words)

Background

Previous research suggests most UK General Practitioners (GPs) use self-monitoring of blood pressure (SMBP) to monitor control of hypertension rather than for diagnosis. This study sought to assess current practice in the use of self-monitoring and any changes in practice following more recent guideline recommendations.

Aim

To survey views and practice with regard to SMBP of UK GPs in 2015 and to compare to a previous survey in 2011.

Design and setting

Web-based survey of a regionally representative sample of 300 UK GPs.

Method

GPs completed an on-line questionnaire concerning the use of SMBP in the management of hypertension. Analyses comprised descriptive statistics, tests for between group differences (z test, Wilcoxon, chi square), and multivariate logistic regression.

Results

Results were available from 300 GPs (94% of those who started the survey). GPs reported using self-monitoring for diagnosing hypertension (169/291 (58% (95%CI 52-64))) and to monitor control (245/291 (84% (80-88))), the former significantly increased since 2011 (from 37% (33-41), $p<0.001$) with no change in monitoring for control. More than half of the GPs used higher systolic thresholds for diagnosis and treatment than recommended in guidelines and under half (120/169 GPs (42% (95%CI 36-47))) adjusted SMBP results for use in guiding treatment decisions.

Conclusion

Since new UK national guidance in 2011, GPs are more likely to use SMBP in the diagnosis of hypertension but significant proportions continue to use non-standard diagnostic and monitoring thresholds. The use of out of office methods to improve the accuracy of diagnosis is unlikely to be beneficial if sub optimal thresholds are used.

Keywords: General Practice; Hypertension; Blood Pressure Monitoring

How this fits in

Self-monitored blood pressure (SMBP) has shown promise in improving the diagnosis and ongoing management of hypertension, and UK guidelines were updated in 2011 to reflect this. This study shows that compared to immediately after the guideline update, general practitioners (GPs) are now more likely to use SMBP in the diagnosis of hypertension, but significant proportions continue to use non-standard diagnostic and monitoring thresholds. GPs were aware of the benefits of self-monitoring, as well as the practicalities of incorporating SMBP into routine care. There remains room for improvement in implementing appropriate thresholds for diagnosis with SMBP; encouragement and training of SMBP for patients; and incorporating new ways of communicating the results of SMBP.

Introduction

How, where and when blood pressure is measured are key aspects in the diagnosis and management of hypertension.(1) In the United Kingdom (UK) and increasingly elsewhere, 24 hour ambulatory BP (ABPM) has replaced clinic measurement as the gold standard for diagnosis of hypertension.(2-4)

Patient self-monitoring of BP (SMBP) provides an alternative to clinic measurement: it is a better predictor of cardiovascular risk than clinic measurements(5, 6); monitors are widely available and less expensive than ABPM(7); SMBP is generally more acceptable to patients,(8, 9) and SMBP provides information about day-to-day variability of BP whereas ABPM is generally only used over a single 24 hour period.(10) Self-monitoring involves patients in the management of their own health, and has been shown to lead to small but significant improvements in BP, potentially important given ongoing suboptimal blood pressure in the community.(11, 12) SMBP has been shown to support medication adherence in patients, and aid in overcoming clinical inertia in the doctors managing their care.(13, 14)

In the United Kingdom (UK), the National Institute for Health and Care Excellence (NICE) updated their guidelines for the clinical management of hypertension in adults in 2011 to include recommendations for self-monitoring in response to the developing evidence base.(1) A survey was conducted immediately before their release in 2011 to assess knowledge and practice of SMBP in UK general practitioners (GPs).(15) The aim of the current survey was to reassess GPs use of SMBP in the diagnosis and management of hypertension in light of the change in guidance.

Methods

Participants and recruitment

An invitation to participate in the survey was available to GPs on the Doctors.net.uk (DNUK) web-site for 6 days from 26-31/05/2015. DNUK provides information services to 212,000 UK registered doctors, of whom 60,000 are GPs.(16) 8125 GPs were active on the site at the time of the survey. Responses were accepted until there were at least 300 completed questionnaires and responses had been received from GPs in each region of the UK in approximate proportion to the number in each region. This was achieved using a sampling algorithm. Only doctors who identified themselves as GPs were able undertake the survey. This is the same methodology as was used in the original survey in 2011.(15)

As part of a linked methodological study carried out in November 2014, in addition to the responses reported here, the same questionnaire was tested through passive recruitment (i.e. open link on web-site available to all as utilised here) and direct recruitment (representative sample of GPs were invited directly). The purpose was to investigate response rates, compare demographic characteristics and to determine whether different recruitment strategies introduce any bias.

Questionnaire

The questionnaire was designed to ascertain: the current use of SMBP in both diagnosing hypertension, and managing control in treated patients; protocols for use and communication of SMBP; interpretation of the results of SMBP; training and influences on practice with regard to SMBP; and participant demographics. The questionnaire replicated a number of questions from a survey carried out in 2011 to allow comparison.(15) The questionnaire was piloted among both academic and non-academic GPs and is available as a supplementary file (Appendix 1).

Sample size

It was hypothesised that a greater proportion of GPs would report using SMBP in the diagnosis of hypertension, and a sample size of 300 GPs would detect a 10% difference compared to previous results (1-tailed, with 95% confidence and 90% power).

Data analysis

Descriptive statistics with confidence intervals around means are reported. The proportions of GPs who reported using SMBP to confirm a diagnosis of hypertension in 2011 and 2015 was compared

using a z-test. BP thresholds were compared between 2011 and 2015 using a Wilcoxon signed rank test. Analyses were performed using Stata for Windows version 12.

Multivariate logistic regression was used to examine the association between physician and practice characteristics and the use of SMBP in the diagnosis of hypertension. Demographic variables hypothesised to be predictive of GP use of SMBP in diagnosis were chosen *a priori* for inclusion based on the clinical judgement of the authors: gender, age, GP role, year of qualification, country of training, years as a GP, UK region, practice setting, practice list size. Predictor variables were tested pairwise for correlation before entry into the model.

Results

Participants

In total 341 doctors opened the study link and after exclusions for exceeding regional quotas and clinical role (i.e. hospital doctor), 319 GPs started the survey of whom 300 (94%) completed all of the questions. Participant flow through the study is shown in Figure 1.

[Figure 1 here]

The characteristics of the respondents are summarised in Table 1 along with data from the 2011 survey and NHS national workforce data up to 2014 where available.(17) In the linked methodological study, the response rate for individuals who were directly targeted was 83% (248/300) and 79% (237/300) completed the survey. Participant demographics were similar for passive and direct recruitment, and compared well with the participants in this survey. (Data in Appendix 2). The regional distribution of respondents matched national proportions.(17)

Only 6% of respondents (95%CI 4-9%) reported being involved in research in the past 5 years involving hypertensive treatment; 3% (95%CI 2-6) in research involving ambulatory monitors; and 4% (95%CI 2-6) were involved in research involving SMBP in the past five years.

All but one GP was involved in the management of hypertension (99% (95%CI 98-100)). The vast majority of GPs (97% (95%CI 95-99)) were aware of self-monitoring amongst their patients, which represents an increase from 90% (95%CI 87-92) in 2011. The denominator for the remainder of the results is those participants who were aware of patient self-monitoring, unless otherwise stated (n=291). GPs estimated that 38% (95%CI 35-41) of their patients self-monitored; an increase from 28% (95%CI 25-31) in 2011.

[Table 1 here]

Services available for blood pressure monitoring

Table 2 summarises the services available to support BP measurement/monitoring.

[Table 2 here]

A large proportion of GPs offered ABPM (82% (95%CI 77-86)) and 65% (95%CI 59-70, n=189/291) saw SMBP as complementary to 24h ABPM, down from 81% (95%CI 78-84, n=453/557) in 2011.

In 2015 compared with 2011, GPs reported an increase in the availability of most services. However, fewer GPs reported that BP monitors were available for patient use in pharmacies in 2015 than in 2011: 32% (95%CI 27-38) v 43% (95%CI 39-47).

Reasons for self-monitoring

Reasons given by responding GPs for use of self-monitoring are reported in Table 3.

[Table 3 here]

The proportion of GPs using self-monitoring to diagnose hypertension was 58% (95%CI 52-64), compared with 37% (95%CI 33-41) in 2011, an absolute increase of 21% (95%CI 14-28, p<0.001), or 57% relative increase. 87% (95%CI 83-90) and 54% (95%CI 48-59) of GPs used SMBP to exclude or confirm white-coat and masked hypertension.

Similar proportions of GPs reported using SMBP to monitor control in treated patients in 2015 as in 2011. Half of the GPs used SMBP as an aid to monitor medication adherence and the effects of lifestyle change.

Certain patient groups were identified that might particularly benefit from SMBP by 62% of participants (95%CI 56-67), with the most commonly reported group being those with white coat hypertension 45% (95%CI 38-52). A further 52% (95%CI 47-58) recognised groups that would not benefit of which those with anxiety was the most common factor quoted (60% (95%CI 52-67)).

[Table 4 here]

Diagnosis of hypertension

For reference: the current NICE guidelines set a threshold of 135/85mmHg for stage 1 hypertension and 150/95mmHg for stage 2 hypertension when using SMBP. The suggested protocol for diagnosis with SMBP is: for each BP recording, two consecutive measurements should be taken, at least 1 minute apart and with the person seated; and BP should be recorded twice daily, ideally in the morning and evening and; BP recording should continue for at least 4 days, ideally for 7 days.(1)

The protocols used for diagnosis with SMBP are presented in Figure 2. GPs most commonly reported recommending SMBP for diagnosis with readings twice a day (60% (95%CI 52-67)) for 7 days (50% (95%CI 40-55)).

[Figure 2 here]

The mean threshold for diagnosis using SMBP was 141.7mmHg systolic (95%CI 140.9-142.6) and 87.2mmHg diastolic (95%CI 86.6-87.7). This compares with a mean thresholds in 2011 of 145.9mmHg systolic (95%CI 145.2-146.6) and 89.5mmHg diastolic (95%CI 89.0-90.0) (t test $p<0.0001$ for the both systolic and diastolic comparison). 70% of GPs (95%CI 63-76) used a systolic threshold ≥136mmHg, and 54% (95%CI 46-61) had a diastolic threshold >85mmHg for diagnosis.

The majority of GPs (81% (95%CI 75-86)) reported different diagnostic thresholds for some groups of patients, most commonly diabetes (73% (95%CI 66-79)) and chronic kidney disease (40% (95%CI 33-47). Fewer reported different thresholds for patients with cardiovascular diseases (11% (95%CI 7-16) or because of advanced age (14% (95%CI 9-20).

Use of SMBP in managing control in treated patients with hypertension

Overall the median treatment target in 2015 was 140mmHg systolic (IQR 135-145) and 89mmHg diastolic (IQR 85-90) which had decreased from 150mmHg systolic (IQR 140-150) and 90mmHg diastolic (IQR 90-90) in 2011 (Mann-Whitney tests: systolic, $p<0.0001$; diastolic $p<0.0001$).

GPs differed as to how often they would request a set of measurements from patients: ranging from 24% monthly (95%CI 20-30), to 6% annually (95%CI 4-10). The most popular frequency of measurement was twice a year (34% (95%CI 28-40)).

Adjustment of self-monitored results

The proportion of GPs who reported that they would adjust SMBP readings rather than use them directly increased from 32% (95%CI 29-36) in 2011 to 41% (95%CI 36-47) in 2015. The mean adjustment reported was 8.3mmHg systolic (95%CI 7.5-9.1), and 5.6mmHg diastolic (96% CI 5.1-6.2).

Type of monitor and calibration

The majority of GPs recommended that patients use an upper arm monitor (81% (95%CI 76-85)), with the remaining 19% (95%CI 15-24) not recommending any monitor in particular. 36% (95%CI 30-42) specifically warned against certain types of monitor, most commonly wrist or finger monitors (91% (95%CI 84-95)).

Checking the accuracy of their patients' monitors was suggested by 89% (95%CI 85-92) of GPs: most recommending annual checks (74% (95%CI 69-79)) by the practice nurse (57% (95%CI 50-63)). Only 10% (95%CI 7-15) of GPs were willing to check patients' monitors themselves.

Patient recording and communication of SMBP results

The majority of GPs recommended that their patients record their SMBP results in a written diary (86% (95%CI 81-89)) or using a computer spreadsheet (30% (95%CI 25-36)), and that they bring the results in person to consultation (69% (95%CI 64-74)) rather than communicate by phone (13% (95%CI 9-17)), text (1% (95%CI 0-3)) or email (6% (95%CI 4-10)).

Regression analysis

Logistic regression analysis showed that none of the following variables in the model were significant predictors of GPs' use of SMBP to diagnose hypertension: gender, GP role, year of qualification, country of training, UK region, practice location, and practice list size. Full results are available in Appendix 3. Backwards selection did not result in a model with any significant predictors.

Discussion

Summary

This survey has shown that the majority of GPs now use self-monitoring of blood pressure in the diagnosis of hypertension, an increase of more than 50% since the implementation of the NICE hypertension guideline in 2011. In contrast the proportions of GPs using self-monitoring in general and for ongoing management have stayed stable and at a high level. The increase in use of self-monitoring in diagnosis might be expected to reduce unnecessary treatment of white coat hypertension but interestingly, over 80% of GPs also reported access to ambulatory monitoring. This suggests a mixed picture with a combination of self- and ambulatory monitoring being used. To our knowledge these data are unique.

There remains significant variation in diagnostic threshold and protocol for measurement. Over half of GPs reported a threshold higher than the NICE threshold for diagnosis with SMBP (135/85mmHg). This proportion was less than in 2011, but given that self-monitored blood pressure is usually lower than clinic blood pressure, this may result in under treatment and worse outcomes.(18). Potential explanations for the discrepancy between guidelines and practice include: not being aware of the different threshold; using self-imposed higher target to avoid over diagnosis; or having different individual practice policies.

The majority of GPs reported using SMBP to monitor BP control in treated patients, despite a relative paucity of evidence.(12) As with diagnostic thresholds, GPs generally reported a higher target for treatment than recommended by guidelines but again this had improved since 2011.

There has been an almost universal increase in the services delivered by GPs to support SMBP since 2011, suggesting increasing enthusiasm for SMBP, but only a minority offer training to patients in self-monitoring (currently 39%). Modern monitors are relatively easy to use but minimal training – especially in cuff position – might be expected to improve accuracy of measurement. This need not be a GP led service and could equally well be delivered by pharmacists or district nurses.

GPs generally recommended that their patients record SMBP results in a written diary and bring them to consultation. Few GPs wanted their patients to communicate their results by phone, text or email which may be a missed opportunity or simply reflect the realities of contemporary practice in the NHS: a number of trials have demonstrated the potential benefits of communicating by text or telemonitoring, and that this is well liked by patients and clinicians.(12) Blood pressure telemonitoring has been shown to be cost effective, with the costs of equipment and technology offset by lower medical costs.(19) Patients have also been shown to have a generally positive attitude towards

telemonitoring, and a high level of compliance with telemonitoring programs and data transfer.(20) Remote communication of results – not routinely available in the NHS - would be of particular benefit to those patients who have difficulty getting to the clinic for appointments, groups GPs identified as potentially benefitting most from SMBP in this survey.

Strengths and limitations

This is the first study to compare self-monitoring practice in UK GPs with data both before and after changes to national guidelines. Both surveys used the same methodology for sampling, as well as the same questions. Additional questions and options were added to strengthen and fill gaps identified through feedback from the previous survey. A regionally representative sample of UK GPs were recruited, and respondents were similar to national data across a range of demographics, with the greater proportion of males GPs in the survey the only significant difference. The average practice list size reported by GPs was slightly higher than the national average (8,590 v 7,171), however this may well be due to this being a comparison of self-reported data with general practice census data. Larger practices may have more resource for home and ambulatory monitoring but small differences such as this are unlikely to have an effect on the results.

Recruitment of the sample was passive by placing an advert on-line rather than directly contacting GPs. It is therefore impossible to know how many of the GPs active on the web-site saw the advert; however a high proportion of those who clicked on the link completed the questionnaire. This method was used to allow comparison with the 2011 data. The linked methodological study using the same questionnaire with direct targeting via the same website found comparable demographics with similar responses to the questionnaire used to those recruited passively suggesting that passive recruitment did not introduce significant bias.

Decision to complete the survey may have been influenced by the extent to which the respondent was interested in the topic. This is unlikely to have affected the validity of the comparison between 2011 and 2015, but may have led to over-estimation of the proportion of GPs that use SMBP.

Comparison with existing literature

GPs estimated that just over a third of their patients with hypertension currently self-monitor BP, which was slightly higher than the results of a cross-sectional survey in the UK in 2011.(21) Despite this, the number self-monitoring still fell behind estimates from other countries where the figure is over 70%.(22-24) GPs could help increase this number by communicating the potential benefits of self-monitoring to patients, as well as providing services to support SMBP.

GPs reported being concerned that SMBP may be unsuitable for anxious or neurotic patients. However a review of qualitative studies found that few patients shared this concern, and that in fact many patients felt empowered by, and enjoyed self-monitoring.(25)

Implications for practice

Since guidelines changed in 2011, GPs appear more aware of the benefits of self-monitoring, as well as the practicalities of incorporating SMBP into routine care. However there remains room for improvement in: implementing appropriate thresholds for diagnosis with SMBP; encouragement and training of SMBP for patients; and incorporating new ways of communicating the results of SMBP. Guidance for clinicians and patients could be standardised in order to provide useful information to guide practice, while not being over-burdensome to either group.

Conclusions

Since new NICE guidance in 2011, UK GPs are more likely to use SMBP in the diagnosis of hypertension but significant proportions continue to use different diagnostic and monitoring thresholds than recommended. The use of out-of-office methods to improve the accuracy of diagnosis is unlikely to be beneficial if sub optimal thresholds are used.

Additional information

Funding

This study was funded by the British Hypertension Society and the NIHR. Ben Fletcher receives funding from the National Institute for Health Research (NIHR) School for Primary Care Research (SPCR) Doctoral Studentship. Richard McManus holds an NIHR Professorship (RP-02-12-015)) and receives funding from the NIHR Oxford CLAHRC. This article presents independent research funded by the NIHR. The views expressed are those of the authors and not necessarily those of the NHS, the NIHR or the Department of Health.

Ethical approval

This study was approved by the Medical Sciences Inter Divisional Research Ethics Committee at the University of Oxford; reference number MSD-IDREC-C1-2014-120

Competing interests

BRF, LH, EPB, AH, JFP and JM declare no competing interests. FDRH has received limited research support in terms of blood pressure devices from Microlife and BpTRU. RM has received research funding in the form of BP monitoring equipment from Lloyds Pharmacies and Omron.

Acknowledgements

The authors would like to thank James Sharman, Mark Nelson and Sean Mahon-Daly (University of Tasmania, Australia) for their assistance with the development of the survey instrument. The authors also thank the GPs who completed the survey.

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Figure 1 – Participant flow

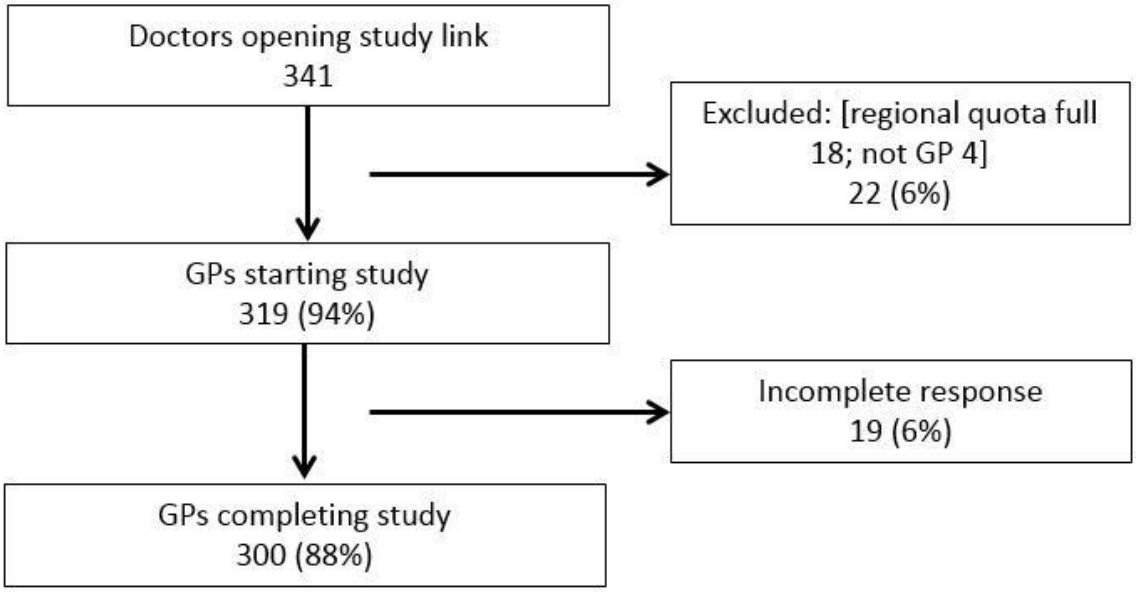
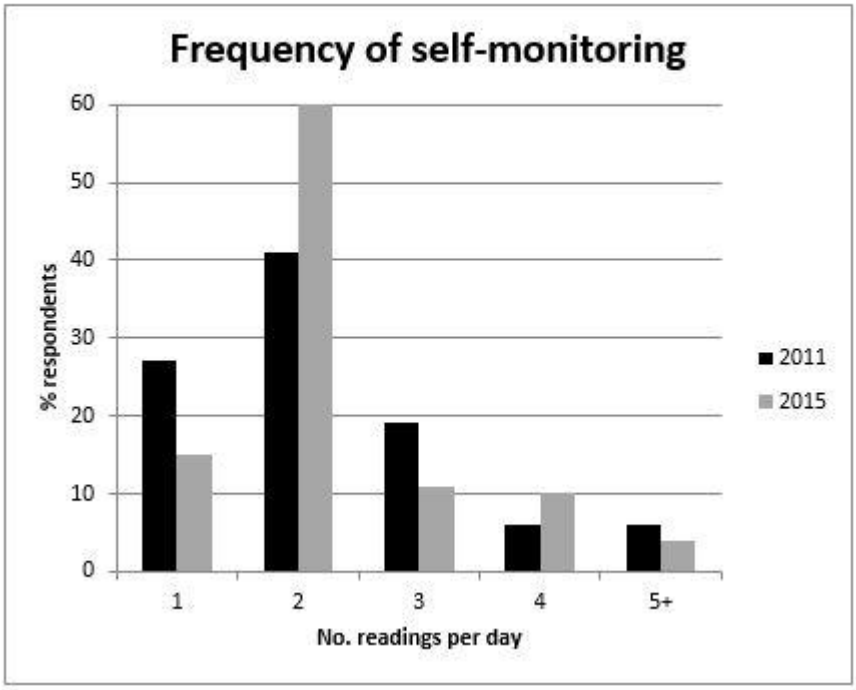


Figure 2 – Frequency of SMBP for diagnosis



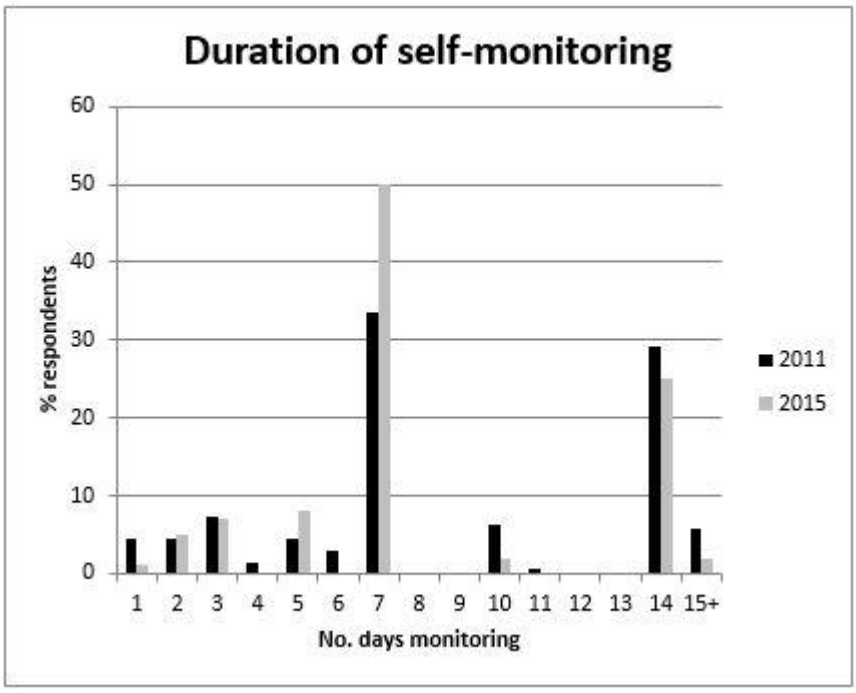


Table 1 – characteristics of respondents

Characteristic	Detail	2015 survey (n=300)	2011 Survey where available (n=625)	2014 National data where available*
Practice role	Principal/partner	200 (**67%**)	357 (**57%**)	**65%**
	Salaried/locum	71 (**24%**)	190 (**30%**)	**24%**
	Registrar	28 (**9%**)	60 (**10%**)	**11%**
	Other	1 (**0%**)	18 (**3%**)	**1%**
Sex	Male	181 (**60%**)	370 (**59%**)	**48%**
	Female	119 (**40%**)	255 (**41%**)	**52%**
Age	<30	1 (**0%**)		**1%**
	30-39	114 (**38%**)		**28%**
	40-49	99 (**33%**)		**31%**
	50-59	65 (**22%**)		**30%**
	>60	21 (**7%**)		**9%**
Year of qualification	Median	1997	1995	
Country of training	United Kingdom	259 (**86%**)		**78%**
	Europe (excluding United Kingdom)	23 (**8%**)		**5%**
	Asia	11 (**4%**)		**13%**
	Africa	5 (**2%**)		**3%**
	Other	2 (**1%**)		**1%**
Practice list size	Median	8,500	7,800	
	Mean (s.d.)	8,590 (4,100)	9,154 (4,530)	7,171
Practice setting	Urban	128 (**43%**)		
	Suburban	78 (**26%**)		
	Semi-rural	63 (**21%**)		
	Rural	31 (**10%**)		
Region	East Midlands	20 (**7%**)	40 (**6%**)	**6%**
	East of England	26 (**9%**)	53 (**8%**)	**8%**
	London	36 (**12%**)	75 (**12%**)	**12%**
	North East	13 (**4%**)	28 (**4%**)	**4%**
	North West	35 (**12%**)	66 (**11%**)	**11%**
	South Central	20 (**7%**)	40 (**6%**)	**6%**
	South East Coast	19 (**6%**)	41 (**7%**)	**7%**
	South West	29 (**10%**)	58 (**9%**)	**10%**
	West Midlands	26 (**9%**)	51 (**8%**)	**9%**
	Yorkshire and Humber	25 (**8%**)	52 (**8%**)	**9%**
	Northern Ireland	8 (**3%**)	18 (**3%**)	**3%**
	Scotland	29 (**10%**)	74 (**12%**)	**10%**
	Wales	14 (**5%**)	29 (**5%**)	**5%**

*General and Personal Medical Services in England 2004-2014; Health and Social Care Information Centre

Table 2 – services available for blood pressure monitoring

Service	**2015 survey [n] % (95%CI)**	**2011 survey [n] % (95%CI)**
	N=291	**N=557**
Clinic measurement by general practitioner	[248] **85%** (81-89)	
Clinic measurement by nurse/allied healthcare professional	[250] **86%** (81-89)	
Ambulatory monitors for 24 hour measurement	[239] **82%** (77-86)	
Monitors to lend to patients	[134] **46%** (40-52)	[191] **34%** (30-38)
Patient training for self-monitoring	[114] **39%** (34-45)	[171] **31%** (27-35)
Monitor in waiting room	[103] **35%** (30-41)	[122] **22%** (19-25)
Monitors available for use in local pharmacies	[94] **32%** (27-38)	[239] **43%** (39-47)
Blood pressure taken by pharmacy staff	[148] **51%** (45-57)	
General practitioner training	[57] **20%** (15-25)	[52] **9%** (7-11)
Other	[4] **1%** (1-3)	
None of the above	[0] **0%**	

Table 3 – Reasons for self-monitoring

	2015 (n=291) **[n] % (95%CI)**	**2011 (n=557)** **[n] % (95%CI)**
For diagnosis	[169] **58%** (52-64)*	[206] **37%** (33-41)*
To exclude or confirm white coat hypertension	[253] **87%** (83-90)	[465] **83%** (80-86)
To exclude or confirm masked hypertension	[156] **54%** (48-59)	
To monitor control	[245] **84%** (80-88)	[462] **83%** (80-86)
As an aid to medication adherence	[148] **51%** (45-57)	[260] **47%** (43-51)
As an aid to lifestyle change	[143] **49%** (43-55)	
Other	[14] **5%** (3-8)	[19] **3%** (2-5)
None of the above	[3] **1%** (0-3)	[4] **0%** (0-2)

*z test p<0.001

Table 4 – patients who would or would not benefit from self-monitoring

Response	**Would benefit from SMBP (n=179) [n] % (95%CI)**	**Would not benefit from SMBP (n=151) [n] % (95%CI)**
White coat/potential white coat hypertension	[80] **45%** (38-52)	
Difficulty attending surgery due to time or mobility issues	[33] **18%** (13-25)	
Anxious	[26] **15%** (10-20)	[90] **60%** (52-67)
Diabetes	[12] **7%** (4-11)	
Poor compliance with medication	[10] **6%** (3-10)	
Elderly	[8] **4%** (2-9)	[18] **12%** (8-18)
Cognitive impairment/dementia		[19] **13%** (8-19)
Neurotic/obsessive		[11] **7%** (4-13%)
Other	[54] **30%** (24-37)	[22] **15%** (10-21)

Note: multiple responses accepted