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Understanding Measurement of Postural Hypotension (UMPH): a nationwide survey of general practice in England

Short title: Postural Hypotension in English General Practice

Sinéad TJ McDonagh PhD[1] NIHR SPCR Research Fellow ORCID ID: 0000-0002-0283-3095
Rosina Cross, PhD[1] NIHR SPCR Research Fellow ORCID: 0000-0002-2548-2398
Jane Masoli PhD[1] Associate Professor of Ageing Research and Honorary Consultant Geriatrician
ORCID ID: 0000-0003-3794-7065
Judit Konya[1] MD NIHR Academic Clinical Lecturer in General Practice
ORCID ID: 0000-0002-8592-9702
Gary Abel, PhD[1] Professor of Medical Statistics and Health Services Research
ORCID ID: 0000-0003-2231-5161
James P Sheppard, PhD[2] Professor of Applied Health Data Science ORCID ID: 0000-0002-4461-8756
Bethany Jakubowski[3] Research Fellow ORCID ID: 0000-0003-1033-2730
Cini Bhanu, PhD[4] NIHR Academic Clinical Lecturer ORCID ID: 0000-0002-3168-4172
Jayne Fordham[5] MSc Nurse Prescriber
Katrina Turner[6] PhD, Professor of Primary Care Research. ORCID ID: 0000-0002-6375-2918
Sarah E Lamb[1] Mireille Gillings Professor of Health Innovation ORCID ID: 0000-0003-4349-7195
Rupert A Payne PhD[1] Professor of Primary Care and Clinical Pharmacology
ORCID ID: 0000-0002-5842-4645
Richard J McManus PhD[7] Professor of Primary Care ORCID ID: 0000-0003-3638-028X
John L Campbell, MD[1] Professor of General Practice and Primary Care
ORCID ID: 0000-0002-6752-3493
Christopher E Clark, PhD[1] Associate Professor of Primary Care Cardiovascular Medicine
ORCID ID: 0000-0002-7526-3038

1. Exeter Collaboration for Academic Primary Care (APEx), Department of Health and Community Sciences, Faculty of Health and Life Sciences, University of Exeter, St Luke's Campus, Magdalen Road, Exeter, Devon, England EX1 2LU

2. Nuffield Dept of Primary Care Health Sciences, University of Oxford, Radcliffe Observatory Quarter, Woodstock Road, Oxford, England OX2 6GG

3. London School of Hygiene and Tropical Medicine, Keppel Street, London, England WC1E 7HT

4. University College London, Primary Care & Population Health Department, Rowland Hill Street, London, United Kingdom

5. Mid Devon Medical Practice, Witheridge, Devon, England EX16 8EZ

6. Centre for Academic Primary Care, University of Bristol, 39 Whatley Rd, Clifton Bristol, England BS8 2PS

7. Brighton & Sussex Medical School, University of Sussex, Falmer Campus, Brighton, England BN1 9QG

Correspondence to Dr Sinéad McDonagh: s.t.j.mcdonagh@exeter.ac.uk

Department of Health and Community Sciences, University of Exeter Medical School, Smeall Building, St Luke's Campus, Magdalen Road, Exeter, Devon, England, EX1 2LU

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Abstract

Background

Postural hypotension (PH) is associated with excess mortality, falls and cognitive decline. PH is poorly recorded in routine general practice (practice) records. Few practice studies have explored measurement and diagnosis of PH.

Aim

To understand how PH is measured, diagnosed and managed in practice.

Design and setting

Online survey of practice staff in England.

Method

Clinical Research Networks distributed the survey to practices, seeking individual responses from any clinical staff involved in routine blood pressure (BP) measurement. Responses were analysed according to role and demographic data using descriptive statistics. Multivariable modelling of undertaking postural BP measurements was performed.

Results

703 responses were received from 243 practices (mean practice-level response rate 17%). Half (362; 51%) of respondents were doctors, 196 (28%) practice nurses and 77 (11%) healthcare assistants (HCAs). Eight percent did not routinely check for PH, usually citing time constraints. For the remaining 92%, postural symptoms were the predominant reason for checking (97% respondents); only 24% cited any other guideline indication for PH testing. 77% used sit-to-stand BP measurements; only 25% measured standing BP for more than one minute. On regression modelling,

other professionals tested less for PH than doctors (Odds ratios: nurses 0.323 (95% confidence interval 0.117 to 0.894), HCAs 0.102 (0.032 to 0.325), pharmacists 0.986 (0.024 to 0.412)).

Conclusion

Awareness of reasons, besides symptoms, and adherence to guidelines for PH testing, are low. Time is the key barrier to improved testing for PH. Clarity on pragmatic methods of measuring PH in practice would also facilitate measurement uptake.

Key words

General Practice, postural hypotension, orthostatic hypotension, blood pressure measurement, frailty, healthy aging, long term conditions, survey

How this fits in

- Postural hypotension is common in older people and is associated with excess falls, cognitive decline and mortality.
- Whilst estimated prevalence approaches 20% of older adults, postural hypotension is only recorded in <1% of their English primary care records.
- Few studies have explored postural hypotension measurement and management methods in general practice. This study surveyed over 700 general practitioners, nurses, and allied health professionals who actively measure blood pressure in primary care.
- Findings showed limited awareness of reasons to check for postural hypotension unless postural symptoms were reported. Adherence to formal standards of testing for postural hypotension was low. Perceived lack of time and lack of awareness were key reasons given for not testing for postural hypotension.

Introduction

Orthostatic or postural hypotension (PH) describes the fall in blood pressure (BP) on rising to a standing position from sitting or lying. It is usually defined as a sustained reduction in either systolic BP ≥ 20 mmHg or diastolic BP ≥ 10 mmHg within three minutes of standing from lying.[1] PH is common, particularly amongst adults aged 60 and over.[2] Our recent systematic review found a pooled prevalence, according to the consensus definition stated, of 19% (95% confidence interval 15 to 25%) for 23 studies of primary care cohorts (median cohort age 73 years; inter-quartile range 63 to 79 years).[3] In contrast to such data, we found a recorded diagnosis of PH in less than 1% of 3 million UK primary care records for over 50-year olds.[4] This discrepancy suggests that PH is currently under-diagnosed, and/or under-recorded, in UK primary care.

Such a recording deficit, irrespective of cause, is important. PH, being prospectively and independently associated with increased risks of falls, is one major contributor.[5-8] In 2013, falls were estimated to cost the National Health Service (NHS) £2.3 billion per year (equating to £3.1 billion in 2025).[9] Prevalences of both falls and PH rise steeply with age and falls are the leading cause of disability and death from injury for people over 75 years of age.[2 3 6 10] PH is also associated with between a 36% and 50% increase in hazards of all-cause mortality,[11-13] and up to 42% increased risks of cognitive impairment or development of dementia.[14] Consequently, recognition and diagnosis of PH is important to mitigate such risks.

Primary care is well placed to play a central role in identifying PH at an early stage, however, current guidance is varied and is based on limited evidence.[15] About half of people with PH are asymptomatic, therefore, detection of PH cannot rely on symptoms and should be targeted at those most likely to suffer from it.[16] UK and international hypertension guidelines recognise the associations of PH with older age or co-morbidities by advocating checking of standing BP in people over 80 years of age, or with diabetes, as well as in those reporting postural symptoms.[17 18] However, current evidence suggests that primary care practice in testing for PH is almost exclusively symptom-led. We previously found, in a survey of general practitioners (GPs) from Southwest England that, without postural symptoms, PH was not routinely tested for, ostensibly due to workload

implications. This, and concerns over the validity of applying lying-to-standing diagnostic thresholds to sit-to-stand measurements, means that many asymptomatic people with PH go undiagnosed.[19 20] The reasons underlying the paradox of low recording rates for PH in primary care records despite much higher expected prevalence of PH have not been researched in detail: a range of practice and population level factors can have an impact on BP care.[15 19 21 22] It is important that any general practice intervention is considered both worthwhile and feasible if it is to be successfully implemented.[23] A thorough understanding of current practices, barriers to, and facilitators of, PH testing, diagnosis and management is needed to achieve this. This article details findings from a national survey that aimed to describe current practice for PH measurement in English general practice.

Methods

We undertook a survey of general practice clinical staff with responsibility for BP measurements in England. Questions were designed to ascertain current practice in the measurement, diagnosis and management of PH in English general practices.

Questionnaire design and distribution

The online survey (Appendix 1) was designed, taking account of relevant national and international guidelines,[15 17 18 24] and existing research findings,[3 4 15 19 25] incorporating the clinical experiences of a multidisciplinary research team. We also consulted with GP and nursing colleagues and our project patient and public involvement and engagement team members throughout the design process. The survey was hosted on a secure online survey platform (Joint Information Systems Committee (JISC), Online surveys v2.0, Bristol, UK) and all data processed in compliance with General Data Protection Regulations.

A draft survey was piloted by healthcare staff in general practices independent of the research team, and the survey was finalised in response to their feedback before going live.

Recruitment and participants

The survey was publicised and distributed by 16 of the 17 regional NIHR Clinical Research Networks (CRNs) in England. Recruitment was supported by social media posts and by CRN reminders. Practices in regions with no or few responses received at least three reminders to maximise variation in settings and practice populations. Access to the survey link was restricted to CRN advertising only, to permit estimation of the general practice-level denominator for responses. Consequently, distribution was to research-active practices engaged with their CRN – representing approximately 60% of all general practices in England.

Responses were sought from any general practice-based primary care staff involved in day-to-day BP measurement (i.e. GPs, practice nurses, healthcare assistants (HCAs), pharmacists, paramedics, and

other professionals sometimes involved in BP assessment). Practices were invited to distribute the survey invitation to all such staff members.

Sample size

We set out to initially approach 500 practices. From experience, we anticipated a 30% practice-level response rate, i.e. around 150 practices with, on average, ten multidisciplinary team members regularly measuring BP totalling around 1500 potential respondents. We assumed a 25% response rate, resulting in 375 responders. This would result in a 95% confidence interval of 7% to 13% for an observed proportion of 10% (e.g. respondents routinely measuring standing BP) and 0.3% to 2.7% around an observed proportion of 2%.

Data management and analysis

Data were exported from the JISC platform as an Excel spreadsheet, anonymised and then analysed using Stata v18 (Statacorp, Texas, USA). As we anticipated that approaches to PH vary between members of the multidisciplinary team, the primary unit of analysis was based on individual responses. Survey responses were summarised using descriptive statistics, and between-group differences were tested with χ^2 or Wilcoxon rank-sum tests as appropriate to the data. Responses were compared across respondent age-category, gender, professional role, training status, time in practice, as well as practice list size, rurality and deprivation status of patient populations where at least ten responses were received per group. As this resulted in 376 cross-comparisons (47 questions across 8 respondent/practice characteristics) we were alert to the potential for chance findings due to multiple testing. To address this risk, we initially examined a matrix of overall patterns of significance and focussed on those characteristics where associations were significant at $p<0.05$ for at least 20% of responses, and thus highly unlikely to represent chance findings. In addition, we restricted reporting of findings to a significance level of $p<0.001$.

Exploration of the data showed substantial variations in reported practice-level categorical characteristics (rurality, practice size and deprivation status) between individual responses within practices. Therefore, using practice codes, we matched publicly available data (Office for National

Statistics (ONS) 2011 Rural or Urban Classification, quintiles of Office for Improvement and Disparities 2019 Index of Multiple Deprivation (IMD) score and quintiles of NHS Digital data for practice size November 2022) for use in analyses. Consequently, analyses using matched data were restricted to responses that included a valid practice code.

We used a mixed effects logistic regression model, with a random intercept for practice, to examine factors associated with checking for PH in primary care. Covariates included in this model were age-category, gender, professional role, training status, time in practice, practice list size, rurality and deprivation status of patient populations.

Results

Description of survey respondents

The survey was open from 10th August to 8th December 2022 and distribution to 1551 practices was confirmed by 10 CRNs in total. 703 individual responses were received; 628 (89%) included some practice identifier for 243 individual practices (overall practice response rate 17.3%, individual CRN response rates ranged from 0% to 69%, Supplementary table S1). All 703 responses were included in descriptive analyses. Practice identifiers were matched to NHS Business Authority practice codes for 606 responses from 221 practices; of these a single response was received from 116 practices (52%), three or more responses from 33% of practices (maximum 18 responses, Supplementary table S2 & figure S1).

Half (362/703, 51%) of the responses received were from GPs, 196 (of 703, 28%) from nurses, 77 (of 703, 11%) from HCAs and 68 (of 703, 10%) were from various other roles. Most respondents (631/703, 90%) stated that they were fully qualified; 40 (of 703, 6%) described themselves as trainees (Table 1). Median age was 45 (inter-quartile range (IQR): 38 to 53), 505/703 (72%) identified as female, 187/703 (27%) male and one as other; ten preferred not to say; five identified by a gender different to their birth sex. Proportions of female respondents varied from 55% of doctors to 95% of nurses and 97% of HCAs. Respondents had worked in general practice for a median of 11 (IQR 5 to 20) years.

Most responses (615/703, 87%) were from personnel working in medium or larger-sized practices (Supplementary table S3) reported to be in urban (385/703, 55%) or semi-rural (289/703, 41%) settings (Supplementary table S4). Respondents described their practice populations as affluent (130/703, 18%), neither affluent nor deprived (319/703, 45%) or deprived (227/703, 32%).

It can be seen from Appendix 2 that most (74% 34/47) associations between role and question responses were significant at $p<0.05$. This is much higher than the 2.35 of 47 associations that would

be expected to return a p-value <0.05 by chance alone, therefore we concluded that these associations were broadly likely to be real. Just half (43% 20/47) of associations with gender were statistically significant, again much higher than expected by chance. Trainee status, time in role and age had fewer significant associations (17% 8/47, 23% 11/47, and 25% 12/47), but still many more than expected by chance, although some caution is encouraged interpreting individual associations which will be more susceptible to type 1 errors than the p-value indicates. Significant associations with practice-level variables were entirely consistent with chance.

Measuring postural blood pressure changes

Fifty-eight (of 703, 8%) respondents did not routinely check for postural BP changes, with variation by role from 10 (of 362, 3%) GPs and 16 (of 196, 8%) nurses to 14 (of 77, 18%) HCAs (Table 2). Common reasons given for not checking were “not part of my role” (22/58, 38%), “I don’t have the time” (14/58, 24%) or “Postural changes have never been mentioned to me before” (13/58, 22%; supplementary table S5).

The dominant reason given by the 645 respondents for considering measurement of postural BP changes was suspected postural symptoms (627/645, 97%); all other reasons were cited much less frequently, the commonest of these being checking over 80-year-olds cited by 157/645 (24%; Table 3). GPs were less likely than nurses, HCAs, pharmacists or paramedics to measure postural BP changes for people with diabetes, hypertension, or within a medication review, however, GPs did more often check for PH in people with Parkinson’s disease (Appendix 2).

Over three quarters of respondents (486/645, 77%) used a sit-to-stand technique for postural BP measurement, 141 (of 645, 22%) used lying- to-stand, and two measured lying to sitting BP changes. Nurses and HCAs used a lying-to-stand protocol more often than GPs, pharmacists or paramedics (Supplementary table S6).

Only two thirds (401/629; 64%) used a sitting rest period before standing; the median feasibility rating (out of 10) of using a rest period was 3 (IQR 2 to 5; Figure 1a). GPs were less likely to do this than other team members (Supplementary table S7) and rated feasibility of doing so lower than any

other health professionals. Median rest period was 5 (IQR 2 to 5) minutes. A median of two (IQR 1 to 3) resting measurements were reported, with doctors collecting fewer than nurses or healthcare assistants (Supplementary table S8).

Obtaining standing BP measurements was rated more feasible than using a rest period (median rating 7; IQR 5 to 10; Figure 1b). Half of respondents (315/629; 50%) measured standing BP once (median 1, IQR 1 to 2); GPs were least likely to repeat standing BP measurements more than once (Supplementary table S9). Two thirds (420/629, 67%) of respondents measured for 1 minute or less after standing (Supplementary table S10).

Diagnosis of postural hypotension

There was some evidence that the adoption of set diagnostic criteria reduced with increasing age and/or years in practice (Appendix 2). The consensus diagnostic thresholds for PH proposed by Freeman et al. (≥20/10 mmHg) were most frequently cited (by 332/622, 55%) whilst 48 (of 622, 8%) cited the lower sit-to-stand diagnostic threshold of ≥15/7 mmHg proposed by Shaw et al (Table 4).[1 20] There was no evidence of an association between resting posture (i.e. lying or sitting) and choice of diagnostic criterion (Supplementary table S11). A majority of nurses (98/170; 58%) and HCAs (47/58; 81%) did not diagnose PH, instead passing results to the GP for diagnosis, consequently, approaches to diagnosis differed markedly according to role (Supplementary table S12).

Recognition and management of postural BP changes

Most respondents had observed postural BP falls (595/629, 95%). Their usual response was to review BP lowering medication (401/595, 64%); ninety-six (15%) would standardise their care to standing BP values (Supplementary table S13). Considering postural rises in BP; 480 (of 629, 76.3%) reported awareness of this with considerable heterogeneity of actions taken in response. The commonest choice (195/480, 41%), particularly for GPs, was to take no action (Supplementary table S14). Continuing to monitor changes was an option chosen across all professional roles.

Whilst the COVID-19 pandemic had minimal impact on postural BP measurement, with only 46 (of 703, 7%) GPs and nurses changing their approach, more GPs (208/703, 30%) did change their approach to BP measurement in general, mainly by increasing use of patients' home BP measurements (Data supplement; Supplementary tables S15 & S16).

Home postural blood pressure measurement

Almost half (335/703, 48%) of respondents had asked patients to collect home postural BP measurements. Another quarter (178/703, 25%) had never considered this approach and 80 (of 703, 11%) thought this might be unsafe for patients (Supplementary table S17). Safety was an issue of concern for trainees more often than for fully qualified staff (12/40, 30% vs. 68/663, 10%). GPs considered patients unable to undertake home postural testing (82/362, 23%) more often than nurses or HCAs (23/196, 12% and 0/77, 0% respectively); trainees also made this judgement twice as often as qualified staff (13/40, 33% vs. 99/663, 15%). Respondents relied on sphygmomanometers belonging to the patient in two thirds (234/335, 70%) of cases; the usual alternative was a practice-owned machine on loan (Supplementary table S18).

Sphygmomanometer types used in practice were evenly split between automated (360/680, 51%) or manual (318, 47%) devices (Supplementary table S19).

Modelling of measurement of postural hypotension

Full data for 561 respondents contributed to regression modelling. Professional role was strongly associated with practitioner decisions to test for PH. When compared with GPs, non-GPs were far less likely to test (ORs for nurses 0.323 (0.117 to 0.894), HCAs 0.102 (0.032 to 0.325), pharmacists 0.986 (0.024 to 0.412); overall $p < 0.001$). There was no evidence of an association with any other factor considered after adjustment for the other factors had taken place, except for practice deprivation; professionals working in practices serving populations with higher deprivation being increasingly likely to test (OR for most deprived vs least deprived quintile 3.942 (1.015 to 15.307); overall $p = 0.0953$; Table 5).

Discussion

Summary of main findings

This national survey examined current practice in the measurement and management of PH in English primary care. Half of responses were from GPs, the remainder from nurses and allied health professionals. Most (92%) respondents actively test for PH, but usually only in response to postural symptoms being reported. Other guideline-recommended reasons for checking, such as age (over 80) or monitoring of comorbidities such as diabetes or hypertension were reported less often. Three quarters of respondents used sitting-to-standing measurement of PH; lying-to-standing being more often used by nurses or HCAs. Overall, only 56% were aware that the consensus definition of PH relies on lying-to-standing measurement.[1] Use of recommended rest periods before BP measurement, and repetition of resting and standing measurements was inconsistent.

Strengths and limitations

The sample of over 700 survey responses was near double that anticipated in planning this survey, making it the largest such survey, to our knowledge, to date. Our recruitment of individuals through practice invitation was pragmatic; it permitted estimation of an overall practice-level response rate of 17.3%. Practice identifiers were missing from 13.8% of responses, thus the number of individual contributing practices reported is likely to be an under-estimate. Since the survey was a CRN portfolio study, it was distributed to research-active practices who were incentivised to participate by CRN adoption. Our methods did not allow knowledge of individual-level response rates either overall or by profession, so caution may be required in generalising the findings to non research-active practices or specific clinical groups such as physician associates which were poorly represented. We did not enquire about our respondents' ethnicity, therefore, our level of inclusion for groups of professionals who may be under-represented in research is unknown. We sought recruitment by all 17 English CRNs but we were unable to elicit the reasons for no responses from some CRNs; one CRN did not distribute our invitations. Despite this, we believe that our sample is reasonably representative of English general practices.

Due to heterogeneity of reporting for practice list size, rurality and deprivation status between multiple respondents within practices, we instead used national practice-level data in analyses for consistency. To avoid selective reporting, and to account for the potential impact of multiple testing, we summarised all outcomes but only present findings with a significance level of $p<0.001$.

Comparison with existing literature

The survey referred to relevant national and international guidelines for who should be tested for PH.[15 17 24] We have previously found that prevalence of PH in older adults approaches 20%, yet a recorded diagnosis of PH appears in only 1% of English routine primary care records.[3 4] This study confirms earlier findings that PH is not currently systematically tested for, rather being led by symptomatic presentation.[15 19] The low implementation of testing, irrespective of symptoms, for groups of people identified to be at risk of PH by guidelines may, in part, account for the discrepancy between observed and recorded prevalences of PH in primary care.

The consensus definition of PH (≥ 20/10 mmHg drop) relies on measurement of BP on standing from lying supine (or on tilt-table testing) and was proposed by specialists in neurology and autonomic dysfunction.[1] BP changes on sit-to-stand testing - the standard of care in this study - differ in magnitude and under-diagnose PH in comparison to lying-to-standing tests.[26 27] Consequently, a lower diagnostic threshold has been proposed for sit-to-stand testing (≥ 15/7 mmHg drop).[20] Although it seems likely that sit-to-stand testing also under-diagnoses PH in primary care, all available evidence is from specialised cohorts and settings, making it hard to generalise to the primary care setting. The survey revealed inconsistency in approaches to PH testing that are likely to also contribute to under-diagnosis of PH.[28]

Implications for research and/or practice

Our findings imply that a minority of GPs do not measure postural changes in BP. However, nurses and HCAs reported performing postural BP measurement at the request of a GP, so it is plausible that GPs may, in fact, simply be delegating measurement to other team members.

Awareness of both the diagnostic criteria for PH, and for whom testing is recommended, seems sub-optimal from the survey findings. Since half of all people with PH either lack, or are unaware of, postural symptoms, systematic testing for PH cannot be led by patients' postural symptoms. Healthcare professionals generally recognise dizziness, however, other symptoms such as coat hanger syndrome, platypnoea, blurry or dimmed vision, or nausea can be vague and under-recognised by both patients and professionals.[15 29 30] Many guidelines advise postural BP measurement protocols based on the consensus definition but differ from each other (in terms of rest periods, standing periods and numbers of required measurements).[3 15] These have not been developed or validated in primary care populations; this study found diagnostic confusion around PH protocols, suggesting that clarity on methods of practical primary care measurement and diagnosis of PH is needed.

Diagnosis of PH is a pre-requisite of any intervention. Fall prevention interventions are highly cost-effective, but require recognition of risk markers such as PH to be implemented successfully.[9 24 31] Management of PH per se targets symptom control, mainly through non-pharmacological interventions and medication review. Evidence for impact of interventions for PH on long-term outcomes such as mortality is lacking, and the effects of ameliorating PH symptoms at the expense of BP elevation (by either medication withdrawal or prescribing of pressor agents) on long-term outcomes is unknown.[32]

In November 2023, taking account of our findings, NICE amended guidance on PH testing. They accepted sit-to-standing testing as a pragmatic means of initial assessment. However, if not diagnostic, formal lying-to-standing measurement should be used where suspicion of postural changes remained.[17] Our findings have confirmed that time and practical considerations are a

significant barrier to uptake of PH measurement, raising concerns that this modified NICE guidance may not fully be feasible in primary care.

Whilst home BP measurement is used routinely to manage hypertension, it was only occasionally considered for diagnosis of PH with some respondents expressing concerns over safety. There is limited evidence to support this process at present. It requires further research but appears to be safe and has the potential to increase incident diagnosis of PH.[33]

In conclusion, this survey found that PH is not routinely tested for in English primary care in the absence of postural symptoms. Testing, when it does occur, does not follow diagnostic criteria and standards, and there is little awareness of current guidelines, the prevalence of asymptomatic PH and its associated conditions. Practice considerations, diagnostic confusion, and the absence of primary care evidence are significant barriers to greater uptake of PH testing.

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The views expressed are those of the authors and not necessarily those of the SPCR, NIHR, the NHS or the Department of Health.

Ethical Approval

Ethical approval for the Understanding Measurement of Postural Hypotension study was granted by HRA and Health and Care Research Wales (REC reference: 22/HRA/4354). The HRA advised that REC review was not required for the survey reported in this paper.

Competing interests statement

The authors have declared no completing interests.

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Legends for tables and figures

Table 1 – Roles of survey respondents

Table 2 – Proportions checking for postural changes by role

Table 3 – Reasons for measuring postural changes

Table 4 – Diagnostic criteria adopted for diagnosing postural hypotension

Table 5 – Multivariable model of checking for postural hypotension

Figure 1 – Feasibility of a) including a rest period before measurement and b) obtaining a standing blood pressure measurement

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526 Table 1 – Roles of survey respondents

Professional role	**Total**
GP	362 (23)
Nurse (any)	196
Practice Nurse	111 (1)
Advanced Nurse Practitioner	31 (4)
Nurse Prescriber	19
Nurse Practitioner	15
Research Nurse	10
Nursing Associate	7 (4)
Other nurse¶	3
HCA	77 (3)
Pharmacist	25
Paramedic	11
Physician Associate	6
Advanced Clinical Practitioner	6 (1)
Other*	4
Urgent Care Practitioner	3
Manager	3
Pharmacy Technician	3
Phlebotomist	3 (2)
Research Psychologist	3 (2)
Physiotherapist	1
Total	703

Notes:
Figures in parentheses = numbers describing themselves as trainees
¶Other nurse includes one frailty matron, one older adult nurse and one respiratory nurse specialist *Other includes one each of administrator, clinical care coordinator, research practitioner and "inactive" (own description) which could not be classified into above groups

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530 Table 2 – Proportions checking for postural changes by role

	Do you check for postural blood pressure changes?		
Professional role*	No	Yes	Total
GP	10 (2.8%)	352 (97.2%)	362
Nurse	16 (8.2%)	180 (91.8%)	196
Healthcare Assistant	14 (18.2%)	63 (81.8%)	77
Pharmacist	5 (20%)	20 (80%)	25
Paramedic	0 (0%)	11 (100%)	11
Total			671

* where more than 10 role responses received ; $p<0.001$ for differences by role.
Roles with fewer than 10 responses (as summarised in Table 1) are not included

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534 Table 3 – Reasons for considering measurement of postural BP changes

Reason	N	%
Check when symptoms present	627	97.2%
Check when diabetes present	69	11.0%
Check when reviewing hypertension	109	16.9%
Check when Parkinson's disease present	134	20.8%
Check when patients are over 80	157	24.3%
Check when reviewing medications	77	11.9%
Check if asked by GP*	40	6.2%
Check for other specified reason¶	18	2.8%

*this reason specifically reported by 23 (13%) nurses and 17 (27%) healthcare assistants only

¶Other reasons (number) given were: frailty (2), research (6), low BP (4), patient unwell (3), eating disorders (2)

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539 Table 4 – Diagnostic criteria adopted for diagnosing postural hypotension

Criterion	N	%
A drop in systolic blood pressure by at least 15 mmHg or a drop in diastolic blood pressure by at least 7 mmHg within 3 minutes of standing (Shaw)	48	7.6
A drop in systolic blood pressure by at least 20 mmHg or a drop in diastolic blood pressure by at least 10 mmHg within 3 minutes of standing (Freeman)	346	55.6
I check for postural changes in blood pressure but I don't diagnose	155	24.9
I don't work to a particular diagnostic definition	73	11.7
I don't know	2	0.3
Other	5	0.8

Other = 1 each of: A drop of 10 mmHg, A drop of 15/10 mmHg, A drop consistently >20mmHg; A drop of 20/20 mmHg after 1 minute and, Anything 10-20 systolic

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542 Table 5 – Multivariable model of checking for postural hypotension

Variable	Odds ratio	95% confidence interval	p-value
Role			
GP (ref)	1	NA	
Nurse	0.323	0.117 – 0.894	
HCA	0.102	0.032 – 0.325	
Pharmacist	0.099	0.023 – 0.411	<0.001
Fully qualified (ref)	1	NA	
Trainee	0.871	0.146 – 5.191	0.879
Male (ref)	1	NA	
Female	0.846	0.422 – 1.699	0.639
Age quintile (years)			
20 to 36 (ref)	1	NA	
37 to 42	0.798	0.209 – 3.045	
43 to 49	0.681	0.182 – 2.540	
50 to 55	0.712	0.174 – 2.913	
56 to 67	0.475	0.114 - 1.987	0.879
-			
Years in practice quintile			
0 to 4 (ref)	1	NA	
5 to 8	1.190	0.368 – 3.842	
9 to 14	0.689	0.222 - 2.138	
15 to 21	1.012	0.264 – 3.874	
22 to 40	1.502	0.324 – 6.967	0.762
Rural practice (ref)	1	NA	
Urban practice	1.690	0.571 – 4.999	0.343
IMD deprivation quintile			
1 (least deprived; ref)	1	NA	
2	1.183	0.435 – 3.220	
3	2.555	0.822 – 7.943	
4	3.751	1.051 – 13.386	
5 (most deprived)	3.942	1.015 – 15.307	0.095
Practice list size quintile			
2,789 to 7,724 (ref)	1	NA	
7,779 to 10,256	1.023	0.346 – 3.029	
10,293 to 14,902	2.327	0.667 – 8.112	
15,058 to 21,535	1.354	0.421 – 4.349	
21,902 to 67,402	1.564	0.467 – 5.236	0.687
Constant	15.098	1.294 – 176.116	0.030

(ref) denotes reference category

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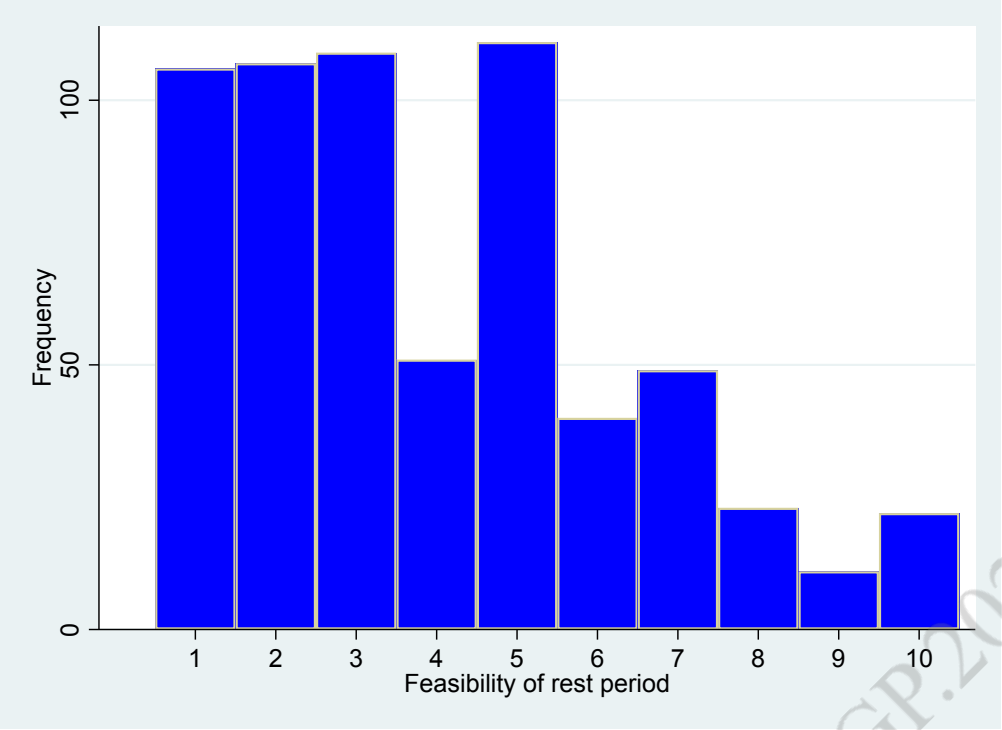
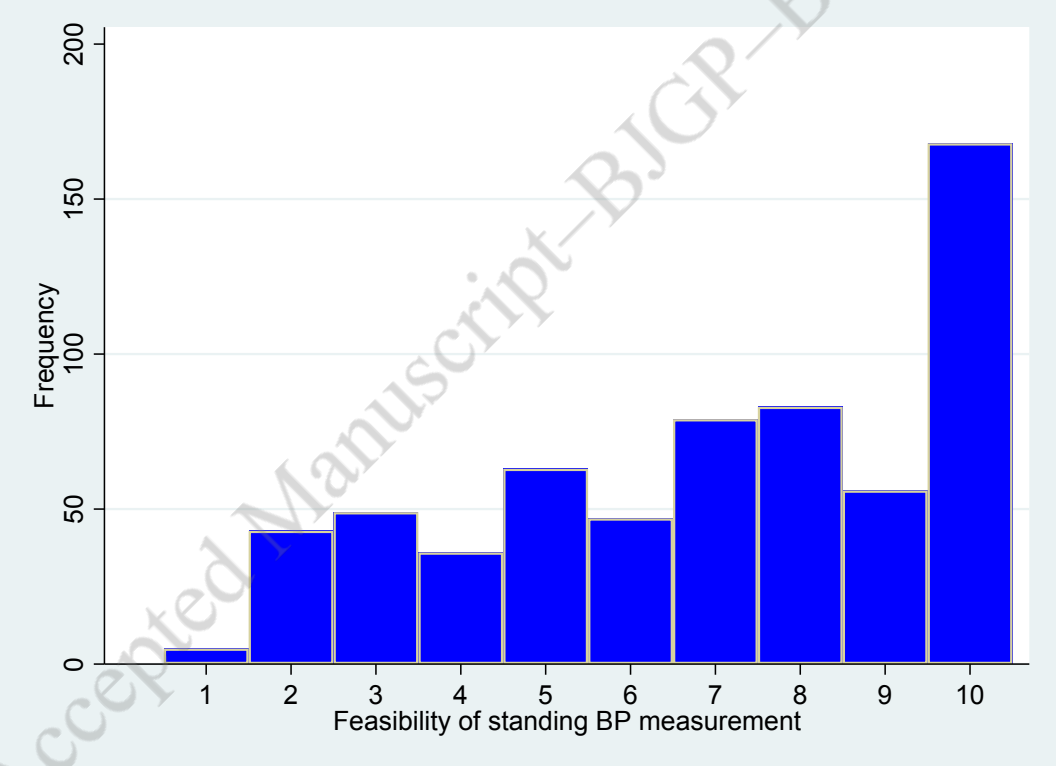


a)



b)

Feasibility rated from 1 (not feasible at all) to 10 (completely feasible)

Figure 1 – feasibility of a) including a rest period before measurement and b) obtaining a standing blood pressure measurement

Data Supplement

Contents

Table S19 – types of practice blood pressure measurement devices used

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Figure S2 – Distribution of Office for National Statistics urban/rural classification by survey response

Figure S3 – Distribution of Indices of Multiple Deprivation quintiles by survey response

Figure S4 – Distributions of standard deviation between numerically coded rurality judgements by practice

Figure S5 - Distributions of standard deviation between numerically coded deprivation judgements by practice

Figure S6 - Distributions of standard deviation between numerically coded practice size judgements by practice

Appendix 1 – the UMPH survey

You will be asked a number of questions relating to the measurement and management of postural changes in blood pressure that may occur in daily general practice. Please answer the questions as accurately as you can to help us understand more about postural hypotension testing in England.

Please select one option for each answer unless otherwise stated.

1) What is your job role?

- Nurse
  - Nurse practitioner
  - Nurse prescriber
  - Advanced Nurse Practitioner
  - Practice Nurse
  - Other, please state……
- Doctor
- Physiotherapist
- Healthcare assistant
- Pharmacist
- Other

  Please state……

1b) Are you a trainee or fully qualified healthcare professional?

- Trainee
- Fully qualified
- n/a

2) Do you check for postural changes in blood pressure?

- Yes
  - **If yes: When do you typically check for postural changes in blood pressure? Please select all relevant answers:**
    - When symptoms are present (e.g. falls or dizziness)
    - In patients with diabetes mellitus
    - In patients aged over 80 years of age
    - During hypertension reviews
    - In patients with Parkinson's disease
    - During medication reviews
    - Other

    Please state……
- No
  - **If no: Is there any reason you do not check for postural changes in blood pressure? Please select all relevant answers:**
    - Postural changes have never been mentioned to me before
    - I don't have the time
    - I don't know how to measure postural changes in blood pressure
    - I don't know how to interpret the blood pressure changes
    - I don't know how to treat postural changes in blood pressure
    - It is not part of my role
    - Don't know
    - Other

    Please state ……

3) How do you most commonly check for postural hypotension?

- Lying followed by standing blood pressure measurement
- Lying followed by sitting blood pressure measurement
- Sitting followed by standing blood pressure measurement

4) **Do you ask your patient to rest before testing for changes in postural blood pressure?**
    - **Yes**
        - **If yes: How long is the rest period in minutes?**
            - (box restricted to numerical input)
            - No formal rest period
    - **No**

5) **In your everyday practice, how feasible is it to include a rest period before testing for postural hypotension?**

    Visual scale. 1-10: 1- Not feasible at all – 10: Completely feasible

6) **How many times do you measure blood pressure in the resting position?**
    - (box restricted to numerical input) (?reject zero)

7) **How many times do you measure blood pressure once the patient has moved from the resting position to standing or sitting?**
    - (box restricted to numerical input)

8) **In your everyday practice, how feasible is it to measure standing blood pressure?**

    Visual scale 1-10 1- Not feasible at all – 10: Completely feasible

9) **At what time interval(s) do you measure blood pressure, once the patient has moved from the lying or sitting resting position to sitting or standing?** *Please tick all options that apply.*
    - Immediately on rising to a more upright position
    - 1 minute
    - 3 minutes
    - 5 minutes
    - Other

      Please state……

10) What definition do you use to diagnose postural hypotension?

- A drop in systolic blood pressure by at least 20 mmHg or a drop in diastolic blood pressure by at least 10 mmHg within 3 minutes of standing (Freeman et al. 2011)
- A drop in systolic blood pressure by at least 15 mmHg or a drop in diastolic blood pressure by at least 7 mmHg within 3 minutes of standing (Shaw et al. 2017)
- I don't work to a particular diagnostic definition
- I check for postural changes in blood pressure but I don't diagnose
- Other, please state…….

11) Do you ever observe decreases in blood pressure when checking for postural changes?

- **No**
- **Yes**
  - **If yes:** On noticing a postural drop in blood pressure, what action do you take?
    - None
    - Continue to monitor postural blood pressure changes
    - Standardise treatment to standing blood pressure values
    - Review blood pressure lowering medication
    - Refer

      Please state to whom you would refer
    - Other

      Please state…….

12) **Do you ever observe increases in blood pressure when checking for postural changes?**
    - ○ **No**
    - ○ **Yes**
        - **If yes:** On noticing a postural rise in blood pressure, what action do you take?
            - ○ None
            - ○ Continue to monitor postural blood pressure changes
            - ○ Standardise treatment to standing blood pressure values
            - ○ Review blood pressure lowering medication
            - ○ Other

              Please state…….

13) **Does your measurement of postural changes in blood pressure differ from the practice that was in place before the COVID-19 pandemic?**
    - ○ No
    - ○ Yes
        - **If yes:** Please describe how your practice has changed……

14) **Has your approach to blood pressure measurement in general changed since the onset of the COVID-19 pandemic?**
    - ○ No
    - ○ Yes
        - **If yes:** Please describe how your practice has changed……

15) Do you ever ask patients to check for changes in postural blood pressure at home?

- **No**
  - **If no: Why do you not ask patients to measure their postural blood pressure at home?**
    - Postural blood pressure changes have never been mentioned to me before
    - Lack of blood pressure monitor availability
    - It might be unsafe for patients
    - I don't think patients will be able to do this
    - I wouldn't know what to do with the results
    - Never thought of it
    - Other

      Please state ……
- **Yes**
  - **If yes: Who owns the blood pressure monitor that is used by the patient at home?**
    - The patient
    - The practice
    - Other:

      Please state ……

16) What type of device do you use to measure blood pressure?

- Automated device (I press a button on a device to inflate the cuff and obtain the blood pressure reading)
- Manual device (I have to inflate the cuff myself and determine the blood pressure reading)
- Semi-manual device (I have to inflate the cuff myself but the device provides an automated reading)
- Don't know
- Other

  Please state……

17) Please supply some information about yourself and your practice

- What is your age in years?

  Please state ……

- What is your sex assigned at birth?
  - Male
  - Female
  - Prefer not to say

- How long have you worked at your practice in years?
  - Numerical input box here
  - Less than 1 year

- How many patients are registered in your general practice surgery?
  - 0-2000
  - 2001-5000
  - 5001-10000
  - More than 10000
  - Don't know

- Would you describe your practice as?
  - Urban – we have specialist services in the same town
  - Semi-rural – my patients would travel to another town or city for specialist services. Public transport is available.
  - Rural/Remote – I am not in a town and it is a substantial journey to gain access to specialist services. Public transport to specialists' centres is not easily accessible.

- How would you describe your patient population?
  - Deprived
  - Neither deprived nor affluent
  - Affluent
  - Don't know

- We would be grateful if you could supply your GP practice code (for sampling and data analysis purposes and not for identification purposes):
  Please state …….

We would like to invite you to participate in the second part of this study. This will involve taking part in <u>one short telephone or MS Teams interview (up to 30 minutes in duration)</u> to gain a more in-depth understanding of current general practice approaches to the measurement and management of postural changes in blood pressure. We would be grateful for your participation. We will offer a shopping voucher as a 'thank you' for your time and participation in the study.

Please can we contact you about participating in the second part of our study?

- **Yes**
  Please provide the following details so that we can get in touch with you:
  Name ……
  Email address…….
- **No**

Thank you for taking the time to complete this survey.

Appendix 2 – Outcome matrix of significance levels for all cross-comparisons according to characteristics

Question No	Question	Denominator	Variable (survey response)					Variable (national data)		
			Role	Trainee	Time in practice	Age	Gender	Practice size	Rurality	Deprivation
2	Check for PH (Y/N)?	703	0.000	0.110	0.279	0.920	0.510	0.659	0.379	0.239
2a	If no, reasons if not checking	58								
	Never mentioned	13	0.000	0.721	0.452	0.942	0.189	0.204	0.117	0.628
	Don't have time	14	0.000	0.652	0.007	0.419	0.000	0.976	0.586	0.939
	Not part of my role	22	0.097	0.520	0.066	0.526	0.088	0.309	0.121	0.612
2b	If yes, indications for checking	645								
	Symptoms	627	0.000	0.956	0.370	0.023	0.057	0.826	0.374	0.724
	Diabetes	69	0.000	0.133	0.913	0.009	0.988	0.468	0.671	0.640
	Hypertension	109	0.000	0.905	0.515	0.026	0.146	0.253	0.306	0.940
	Parkinson's	134	0.000	0.978	0.712	0.740	0.052	0.008	0.977	0.006
	Age over 80	157	0.004	0.179	0.468	0.405	0.465	0.577	0.936	0.065
	Medication review	77	0.000	0.291	0.912	0.681	0.157	0.071	0.702	0.674
	If asked by GP	40	0.000	0.937	0.102	0.093	0.001	0.995	0.124	0.044
	Other specified reason	10	0.631	0.452	0.838	0.392	0.620	0.339	0.837	0.141
3	How do you check for PH? (posture)	629	0.000	0.020	0.216	0.238	0.000	0.468	0.834	0.834
4	Do you adopt a rest period (Y/N)?	629	0.004	0.233	0.130	0.833	0.400	0.463	0.374	0.719
4a	If yes, duration	401	0.401	0.297	0.579	0.486	0.017	0.857	0.073	0.887
5	How feasible is a rest period?	629	0.000	0.501	0.077	0.085	0.740	0.313	0.672	0.487

6	No of resting BP measurements	629	0.000	0.031	0.975	0.015	0.008	0.376	1.000	0.142
7	No of standing BP measurements	629	0.000	0.603	0.249	0.062	0.922	0.884	0.055	0.151
8	How feasible is standing BP measurements?	629	0.387	0.032	0.917	0.097	0.605	0.372	0.090	0.443
9	Time interval for standing BP measurements	629	0.227	0.199	0.031	0.167	0.456	0.643	0.865	0.996
10	Definition of PH used - all responses	622	0.000	0.349	0.000	0.000	0.000	0.480	0.104	0.498
10s	Definition of PH used if do diagnose (excluding "I don't diagnose")	467	0.003	0.197	0.000	0.000	0.011	0.392	0.109	0.431
11	Do you ever observe BP falls?	629	0.000	0.514	0.165	0.140	0.003	0.247	0.594	0.296
11a	If yes, what action taken?	595								
	Continue to monitor	157	0.002	0.152	0.232	0.005	0.033	0.277	0.758	0.279
	Adopt standing BP values	93	0.000	0.610	0.075	0.456	0.038	0.114	0.029	0.842
	Review BP Rx	400	0.000	0.890	0.000	0.069	0.000	0.078	0.495	0.169
	Refer to another clinician	231	0.000	0.002	0.000	0.091	0.000	0.111	0.819	0.743
	Other	47	0.008	0.758	0.285	0.834	0.004	0.458	0.269	0.736
12	Do you ever observe BP rises?	629	0.016	0.093	0.924	0.248	0.025	0.847	0.036	0.095
12a	If yes, what action taken?	480								
	None	195	0.000	0.943	0.062	0.386	0.000	0.888	0.293	0.609
	Continue to monitor	111	0.001	0.675	0.013	0.041	0.859	0.322	0.701	0.420
	Adopt standing BP values	38	0.163	0.793	0.572	0.888	0.819	0.273	0.526	0.473
	Review BP Rx	108	0.000	0.429	0.858	0.286	0.199	0.489	0.917	0.775
	Refer to another clinician	135	0.000	0.814	0.000	0.013	0.000	0.771	0.726	0.234
	Other	29	0.729	0.882	0.119	0.677	0.001	0.859	0.114	0.108

13	PH approach different post-COVID (Y/N)?	629	0.093	0.092	0.056	0.396	0.408	0.087	0.828	0.133
13a	If yes, how has it changed?	46	0.563	NA*	0.867	0.541	0.659	0.836	0.805	0.727
14	BP approach different post-COVID (Y/N)?	703	0.000	0.015	0.000	0.788	0.004	0.406	0.577	0.200
14a	If yes, how has it changed?	208	0.005	0.995	0.131	0.245	0.000	0.008	0.532	0.570
15	Ever request patient home PH testing (Y/N)?	703	0.473	0.048	0.191	0.410	0.596	0.746	0.416	0.123
15a	if no, why not?	368								
	I don't think patients will be able to do it	112	0.000	0.003	0.095	0.000	0.170	0.638	0.397	0.246
	Postural BP changes have never been mentioned	19	0.000	0.054	0.781	0.487	0.166	0.880	0.072	0.524
	Lack of blood pressure monitor availability	62	0.422	0.000	0.014	0.005	0.120	0.527	0.312	0.006
	It might be unsafe for patients	80	0.009	0.000	0.021	0.001	0.032	0.337	0.351	0.403
	I have never thought of it	178	0.128	0.282	0.848	0.910	0.574	0.334	0.685	0.692
15b	If yes, who owns BP monitor?	335	0.000	0.305	0.640	0.050	0.128	0.868	0.174	0.176
16	What type of device do you use for BP?	680	0.543	0.203	0.125	0.421	0.466	0.748	0.705	0.578
Summary:	**Number of comparisons**		**47**	**46**	**47**	**47**	**47**	**47**	**47**	**47**
	Number of results p <0.05		**34**	**9**	**11**	**12**	**20**	**2**	**2**	**3**
	Proportion of comparisons with p<0.05		**72%**	**20%**	**23%**	**26%**	**43%**	**4%**	**4%**	**6%**

Note:
red values denote p<0.05

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Blood pressure measurement responses to COVID-19 pandemic

The pandemic appeared to have had a minimal impact on approaches to postural BP measurement; only 46 (7.3%) GPs and nurses reported a change in their approach. The most common adaptations were to either accept that postural measurements could not be obtained, or to ask patients to self-measure postural changes (Supplementary table S15). More GPs (208; 29.6%) changed their approach to BP measurement in general, predominantly making greater use of home BP measurements made by patients. These were usually (for 65%) manually added to patient practice records, although 27% of respondents did receive automated uploads of BP readings. Less than 3% increased their adoption of ambulatory BP measurement (Supplementary table S16).

Table S1 – practice level response rate

Clinical Research Network	Practices contacted	Practices responding	Practice response rate
North East and North Cumbria	181	24	13.3%
North West Coast	286	58	20.3%
Yorkshire and Humber*	284	0	0.0%
Greater Manchester	183	37	20.2%
East Midlands*	263	0	0.0%
West Midlands	314	5	1.6%
West of England	96	66	68.8%
Thames Valley and South Midlands	126	24	19.0%
East of England*	0	0	N/A
Kent, Surrey and Sussex	199	11	5.5%
Wessex*	55	0	0.0%
South West Peninsula	166	44	26.5%
North Thames*	288	0	0.0%
South London*	165	0	0.0%
North West London*	307	0	0.0%
North East and North Cumbria	181	24	13.3%
North West Coast	286	58	20.3%
Totals	2913	269	9.2%
Total excluding non-responding CRNs	1551	269†	17.3%

*East of England CRN advised, after survey closure, that they had not distributed any invitations; confirmation of distribution and reasons for zero responses to , and confirmation of distribution from other CRNs recruited have not been discovered.

†Not all responses included a unique practice identifier hence total here, based on PCRN data, exceeds total individual unique practice responses reported in results

Table S2 – distribution of numbers of responses by NHS Business Authority practice code

Number of responses per practice	Number of practices	Cumulative number of responses	Cumulative percentage of responses
1	116	116	19%
2	33	182	30%
3	13	221	36%
4	20	301	50%
5	14	371	61%
6	8	419	69%
7	3	440	73%
8	1	448	74%
9	2	466	77%
10	4	506	83%
11	2	528	87%
12	2	552	91%
18	3	606	100%
Total	221	606	

Table S3 – practice size

Practice size	N	%
0-2000	1	0.1
2001-5000	38	5.4
5001-10000	215	30.6
More than 10000	400	56.9
Don't know	49	7.0

Table S4 – practice description

Practice description	N	%
Rural/Remote – I am not in a town and it is a substantial journey to gain access to specialist services. Public transport to specialists' centres is not easily accessible.	29	4
Semi-rural – my patients would travel to another town or city for specialist services. Public transport is available.	289	41
Urban – we have specialist services in the same town	385	55
Total	703	

Table S5 – reasons given by 58 participants for not measuring postural changes in blood pressure

Reason	N	%
It is not part of my role	22	37.9
I don't have the time	14	24.1
Postural changes have never been mentioned to me before	13	22.4
I don't know how to treat postural changes in blood pressure	5	8.6
Don't know	4	6.9
I don't know how to measure postural changes in blood pressure	2	3.4
I don't know how to interpret the blood pressure changes	1	1.7
Other specified reason*	5	8.6

Responses were not mutually exclusive

*Other individual reasons each given by one participant were: Currently off sick, I do telephone reviews with home BP and it is complex to explain and expect patients to measure postural drop themselves (pharmacist), not stated in sponsor protocol (research nurse), the clinic I run usually requires only siting BPs (phlebotomist), and This is done my HCA's (practice nurse)

NB – more than one option could be selected

Table S6 – Postural changes adopted for measurement by role where more than 10 role responses received

Professional role	Lying-to standing	Sit-to standing	Total
Doctor	41 (11.8%)	307 (88.2%)	348
Nurse	66 (38.6%)	105 (61.4%)	171
Healthcare Assistant	27 (46.6%)	53.5%)	58
Pharmacist	3 (15.0%)	17 (85.0%)	20
Paramedic	0 (0%)	11 (100%)	11
Total			608

p< 0.001 for differences by role

Table S7 – Adoption of a rest period for measurement by role where more than 10 role responses received

Professional role	No	Yes	Total
Doctor	146 (41.8%)	203 (58.2%)	349
Nurse	48 (27.9%)	124 (72.1%)	172
Healthcare Assistant	20 (34.5%)	38 (65.5%)	58
Pharmacist	3 (15.0%)	17 (85.0%)	20
Paramedic	2 (18.2%)	9 (81.8%)	11
Total			610

p = 0.004 for differences by role

Table S8 – Number of repeated resting blood pressure measurements compared to median by role where more than 10 role responses received

Professional role	Below median	Above median	Total
Doctor	295 (85%)	54 (15%)	349
Nurse	108 (63%)	64 (37%)	172
Healthcare Assistant	29 (50%)	29 (50%)	58
Pharmacist	5 (25%)	15 (75%)	20
Paramedic	10 (91%)	1 (9%)	11
Total			610

p<0.001 for differences by role

Table S9 – Number of repeated standing blood pressure measurements compared to median by role where more than 10 role responses received

Professional role	**Below median**	**Above median**	**Total**
Doctor	327 (93.7%)	22 (6.3%)	349
Nurse	136 (79.1%)	36 (20.9%)	172
Healthcare Assistant	40 (69.0%)	18 (31%)	58
Pharmacist	15 (75%)	5 (25%)	20
Paramedic	11 (100%)	0 (0%)	11
Total			610
p<0.001 for differences by role			

Table S10 – Time interval used for standing blood pressure measurements

Interval	**N (%)**
Immediately, or < 1 minute	139 (22.1%)
1 minute	281 (44.7%)
2 minutes	9 (1.4%)
3 minutes	144 (22.9%)
1 & 3 minutes |	13 (2.1%)
5 minutes	37 (5.9%)
1, 3 & 5 minutes	4 (0.6%)
repeated until BP stops falling	2 (0.3%)

Table S11 – Diagnostic criteria for postural hypotension used according to resting posture

	Measurement protocol used		**Totals**
Diagnostic criterion	Lying to standing	Sitting to standing	
20/10 mmHg (Freeman)	66 (19.1%)	279 (80.9%)	345
15/7 mmHg (Shaw)	7 (14.6%)	41 (85.4%)	48
Pearson chi^2 = 0.576; p=0.448			

Table S12 - Diagnostic criteria used by professional role

	Diagnostic criteria reported				
Role	≥20/10 mmHg	≥15/7 mmHg	No set criteria	Measure but do not diagnose	Totals
Doctor	237 (69%)	42 (12%)	63 (18%)	2 (1%)	344
Nurse	63 (37%)	5 (3%)	4 (2%)	98 (58%)	170
Healthcare Assistant	6 (10%)	1 (2%)	4 (2%)	47 (81%)	58
Pharmacist	17 (85%)	0	0	3 (15%)	20
Paramedic	9 (82%)	0	0	2 (18%)	11
Totals	332 (55%)	48 (8%)	71 (12%)	152 (25%)	603

P<0.001 for differences by role

Table S13 – Actions taken on observing a postural fall in BP

Action	**N**	**%**
None	5	0.8
Continue to monitor postural blood pressure changes	157	26.4
Standardise treatment to standing blood pressure values	96	16.1
Review blood pressure lowering medication	401	67.3
Refer to another primary care clinician*	238	40.0
Other†	35	5.9

*the clinician usually being the GP (in 227/238 (95.4%) responses), other clinicians mentioned were nurse (5; 2.1%), pharmacist (5; 2.1%) and in one response (0.4%) a physician associate

† other actions included: enquire about fluid intake (8), give postural movement advice (6), enquire about postural symptoms (5), consider compression stockings (2)

Decisions to monitor postural changes were specific to GPs; decisions to standardise treatment to standing BP were made by both GPs and nurses, whilst medication reviews were considered by all types of clinicians apart from HCAs. Referral to GP a doctor was a choice for all other allied health professionals.

NB – more than one option could be selected

401 ## Table S14 – Actions taken on observing a postural rise in BP

Action		**N**	**%**
None		195	40.6
Continue to monitor postural blood pressure changes		111	23.1
Standardise treatment to standing blood pressure values		38	7.9
Review blood pressure lowering medication		108	22.5
Refer to another primary care clinician	GP 125 (92.6%) Nurse 5 (3.7%) Pharmacist 4 (3.0%) Physician Associate 1 (0.7%)	135	28.1
Other*		29	4.6

*Other actions included considering a rise in BP to be normal and adopting sitting BP for future management

Doctors were more likely than other professionals to take no action on detecting a postural rise. Healthcare assistants did not undertake to review medications and were most likely to refer such a finding to the doctor. Continuing to monitor changes appeared to be a choice for all professional roles.

NB – more than one option could be selected

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404 ## Table S15 – Adaptations to postural measurement during the pandemic

Postural measurement adaptations to COVID pandemic	**N (%)**
I rely more on home blood pressure readings, so I cannot check for changes in postural blood pressure	19 (41.3%)
I rely more on home blood pressure readings and I ask patients to take standing blood pressure measurements	19 (41.3%)
I rely more on home blood pressure readings and ask the community nursing team to check for changes in postural blood pressure	3 (6.5%)
I rely more on ambulatory blood pressure readings and don't look for hypotension	1 (2.2%)
A mixture of the above	1 (2.2%)
During the pandemic home visits were limited, now I am able to visit and assess face to face again.	1 (2.2%)
I rely on home BP measurements more - but I will bring patients in for another appointment if I suspect postural hypotension	1 (2.2%)
Other - no explanation given	1 (2.2%)

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Table S16 – Adaptations to general blood pressure measurement during the pandemic

BP measurement adaptations to COVID pandemic	N (%)
I rely more on home blood pressure readings which the practice manually upload to the patient's record	136 (65.4%)
I rely more on home blood pressure readings which are automatically uploaded to the patient's record	56 (26.9%)
I rely more on ambulatory blood pressure readings	6 (2.9%)
I use home blood pressure readings, upload method not stated	3 (1.4%)
I rely more on home blood pressure readings that are measured by the community nursing team	2 (1.0%)
A mixture of the above	3 (1.4%)
Other unspecified reason	2 (1.0%)

Table S17 – reasons for not asking patients to measure their home blood pressures

Reason	N	%
I have never thought of it	178	25.3%
I don't think patients will be able to do this	112	15.9%
It might be unsafe for patients	80	11.4%
Lack of blood pressure monitor availability	62	8.8%
Postural blood pressure changes have never been mentioned to me before	19	2.7%
Not within role or protocol	9	1.3%
I wouldn't know what to do with the results	7	1.0%
I would rather assess face to face	7	1.0%
Other specified reason	7	1.0%
Not thought to be feasible	6	0.9%

*Uncertainty over reliability or accuracy (2), never found to be indicated or needed (3), would ask patient to monitor BP in general (1) no reason given (1)

Table S18 – origins of home blood pressure machines

Owner	N	%
Patient	234	69.9%
Practice	54	16.1%
Both patient and practice owned machines used	31	9.25%
BP @ Home Service	6	1.8%
Any of the above	7	2.1%
Other owner*	3	0.9%

*Nursing home, care home or community nurse (1 response each)

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418 Table S19 – types of practice blood pressure measurement devices used

Device	N	%
Automated device (I press a button on a device to inflate the cuff and obtain the blood pressure reading)	360	52.9%
Manual device (I have to inflate the cuff myself and determine the blood pressure reading)	318	46.8%
A mixture of the either of the above	18	2.6%
Semi-manual device (I have to inflate the cuff myself but the device provides an automated reading)	2	0.3%
Don't know	4	0.6%
No longer check blood pressure	1	0.1%

Note:
Five respondents commented on selecting device type according to patient factors, with three specifically citing selecting manual over automated devices in the presence of arrhythmia.

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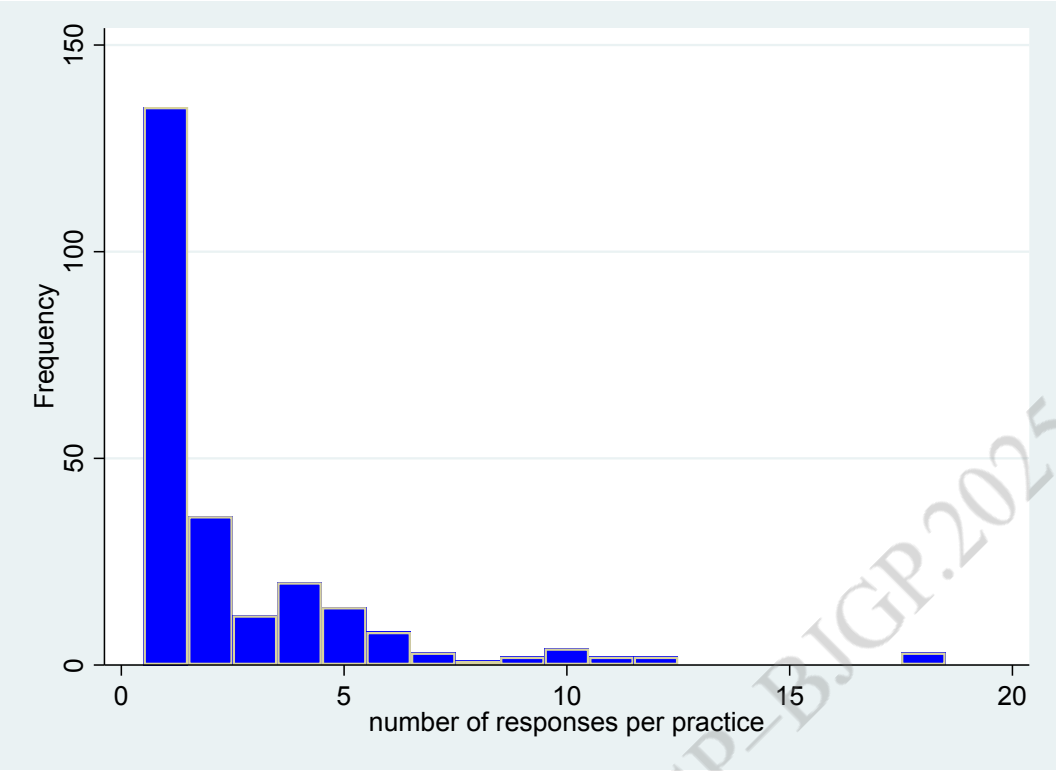

Figure S1 - Responses per practice for 628 responses with practice identifiers