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Abstract (250 words; currently 250)

Background

Prehypertension (blood pressure (BP) 120–139/80–89 mmHg) affects 40% of UK adults increasing cardiovascular risk. While BP self-monitoring is effective in hypertension, its feasibility in

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prehypertension is unclear. Concerns include lack of interest, medicalisation and unintended consequences, despite evidence suggesting it may empower individuals in risk management and prevention.

Aim:

To determine the feasibility of BP self-monitoring for prehypertension.

Design and Setting

A prospective, non-randomised, mixed-methods, feasibility study across primary care in Lancashire and South Cumbria.

Method

People with prehypertension were recruited from 5 general practices, 3 pharmacies and 1 BP-checking provider. Participants received a BP monitor and training, then self-monitored BP on the first three days of each month for six months. Participants submitted their results to the research team. Outcome data was collected at baseline, 6-months and 12-months and analysed mainly using descriptive statistics.

Results

Of 162 expressions of interest, 80 were eligible and consented; 78 from general practice, one each from pharmacy and community providers. Of those recruited, 66 (83%) and 33 (41%) completed 6-month and 12-month follow-up, respectively, with minimal missing data. No adverse effects were reported. Illness perceptions significantly improved (Mean 26.6 (SD 8.6) to Mean 22.6 (SD 8.7), p=0.002), with no other significant changes. There was only one non-white participant.

Conclusion

BP self-monitoring for prehypertension is feasible in general practice, but requires further exploration with pharmacy, and community providers. The homogenous sample limits generalisability highlighting the need for targeted outreach Findings need confirming in an effectiveness trial.

Keywords

Prehypertension, Prevention, Self-Monitoring, Blood Pressure, Cardiovascular Disease, Primary Care

How this fits in

Blood pressure within the prehypertension thresholds increases risk of developing cardiovascular disease and hypertension.

Blood pressure self-monitoring for the management of hypertension is well evidenced, and established in clinical practice, but it is unclear whether it would be feasible for use in prehypertension management.

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This work shows that blood pressure self-monitoring for prehypertension is feasible in general practice, with no reported negative unintended consequences.

Further collaboration with pharmacy and community providers is needed, and improved inclusion of under-served groups would be needed in any future effectiveness trial.

Introduction

High blood pressure (BP) is a key modifiable risk factor for preventing cardiovascular disease [1-3] (CVD) and stroke.[4,5] However, evidence now shows that BP below the traditional hypertensive threshold (140/90 mmHg) also poses risk. [5, 6] Prehypertension (BP between 120-139/80-89 mmHg), affects around 40% of UK adults,[7] and although not classified as a disease, adults with prehypertension, even without existing CVD, are at increased risk of developing hypertension and CVD [8-16] compared to those with normal BP (<120/80 mmHg) over relatively short follow-up period.[8, 9] One study [17] reported that CVD risk increased steadily from 115/75 mmHg, doubling with each 20/10 mmHg increment. Recent RCTs and meta-analyses indicate that lowering SBP to below 120mmHg, rather than 140 mmHg, reduces CV events, stroke and mortality, including in those with no prior CVD. [18-22]

Despite this, UK guidelines do not define or acknowledge prehypertension. NICE[23] recommends remeasuring clinic BP at least every five years, and more frequently when readings are close to 140/90 mmHg usually relying on single opportunistic clinic measurements. These are known to be inaccurate, and guidelines offers no details on follow-up, leaving a gap in how to monitor and support people whose BP is below treatment thresholds but still associated with risk.

Taken together, these findings suggest that prehypertension offers an important window for prevention. Non-pharmacological lifestyle interventions can reduce SBP by up to 10 mmHg, reverse prehypertension, and delay or prevent progression to hypertension [24, 25] While self-monitoring is established in hypertension care,[26-30] its feasibility and acceptability in prehypertension remains uncertain. Concerns include anxiety,[31] poorer self-rated health,[32] and stigma,[33] alongside worries about labelling and medicalising normal BP variation. However, awareness may be beneficial,[34,35] empowering individuals to take ownership of their health. A trial is needed to determine whether self-monitoring can support awareness, detection, and management of prehypertension, and whether it may help postpone hypertension and CVD. This feasibility study will explore the acceptability and practicality of monitoring prehypertension at home, and inform the design of a future multi-centre, randomised trial.

Aims and objectives

Determine the feasibility and acceptability of BP self-monitoring amongst people with BP in the Prehypertension range, and healthcare professionals (HCPs)

This paper focuses on the feasibility, with main objectives to:

- Determine the willingness of people with prehypertension, and HCPs, to engage with BP self-monitoring
- Determine the feasibility of recruitment and attrition of people with prehypertension and healthcare providers
- Assess the feasibility of data collection and completeness

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- Evaluate UNCs (depression, quality-of-life, health resource use)
- Explore changes in lifestyle and psychosocial factors

Methods

Design and setting

REVERSE was a prospective, non-randomised, mixed-methods, feasibility study based across primary care in Lancashire and South Cumbria. The study is registered (ISRCTN13649483) and favourable ethical opinion was received from London–Fulham NHS Research Ethics Committee (REF: 22/PR/0108) and the University of Lancashire Health Ethics Review Panel (HEALTH 0299).

Study population

People with prehypertension were identified from GP records or health checks/ BP checks conducted in pharmacies or in the community.

Eligibility criteria

Inclusion criteria; aged 18+, BP between 120-139/80-89 mmHg, no previous hypertension diagnosis.

Exclusion criteria; prescribed BP lowering medication, pregnancy, actively BP self-monitoring and not willing to follow study protocol, diagnosis of a life-limiting illness.

Recruitment

The North West Coast Primary Care Clinical Research Network (CRN), and Community Pharmacy Lancashire advertised the study to practices and pharmacies through their usual channels. Although there are approximately 210 GP practices and 360 community pharmacies across Lancashire and South Cumbria, the invitation process was likely selective, with sites approached based on prior research participation and/or alignment with our demographic requirements. From those expressing interest, Participant Identification Centres (PICs) were selected using Index of Multiple Deprivation (IMD) to ensure socio-economic diversity. Between June 2022 and February 2023, GPs sent invitation letters to eligible patients identified via electronic records, while pharmacies and community providers distributed invitations to patients following a health/BP check. The invitation letter and information sheet are provided in the Supplementary Files 1-3).

Patients contacted the study team by phone or email to express interest. In GP, eligibility was assessed in two stages: initial phone screening followed by an in-person BP check, usually conducted by the research team, but occasionally via self-monitoring. Eligible, patients were enrolled and completed baseline questionnaires during the appointment. For those identified via a health/BP check, eligibility was confirmed during the initial call, and baseline data were collected via video call. Each participant received a BP monitor to keep.

Self-monitoring procedures

All enrolled participants received online or in-person BP measuring and recording training, supported by a booklet and video. After a practice week to ensure competency, participants began monthly self-monitoring.

Participants were asked to measure BP on the first three days of each month for six months, at a consistent time of their choosing, at least 30 minutes after food or exercise, and with medication

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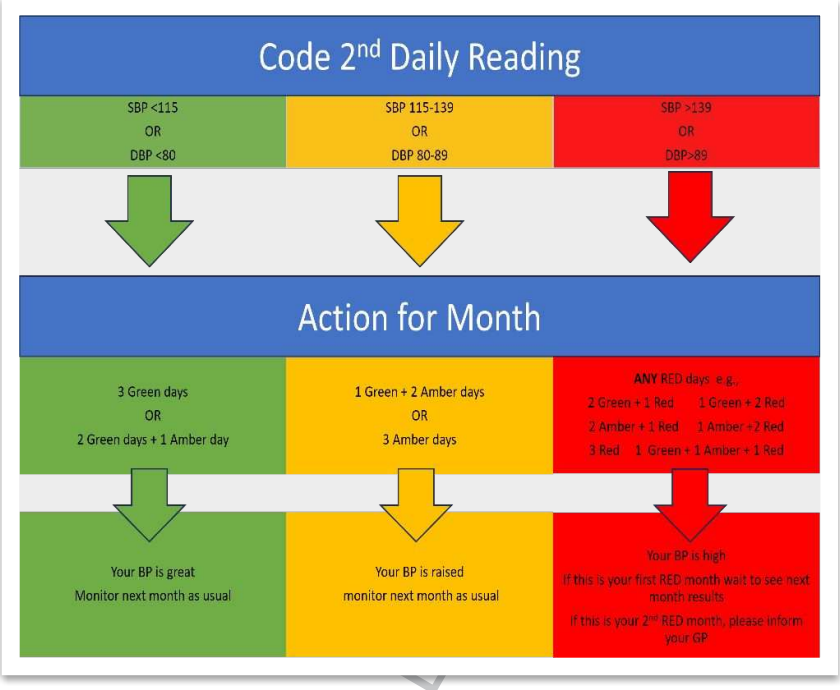
timing, in relation to the reading, kept consistent. They were asked to rest for five minutes before the first reading.

On each measurement day, two readings were taken five minutes apart and recorded with the time in their study booklet. Participants colour-coded the 2nd reading each day and the overall month, using a traffic light system (Figure 1), then submitted their sheet to the research team who checked the coding for protocol fidelity. If readings were Red for two consecutive months, participants were advised to inform their GP using a provided template.

Figure 1: BP coding algorithm. Note; based on standard clinical guidelines and reduced by 5/5 mmHg as recommended in the literature for home readings.



Outcomes

The main feasibility outcomes reported in this paper are outlined in Table 1

Table 1: Outcomes for each study outcome

Objective	Outcome and Measure
Determine the willingness of people with BP in the prehypertension range, and service providers, to engage with a self-monitoring intervention	Number and proportion of services approached and expressing an interest in the study Number and proportion of patients expressing an interest in the study
Determine the feasibility of recruitment and attrition of people with BP in prehypertension range as well as primary care providers	Recruitment rates of sites and participants **Sites** - Time taken to recruit - Proportion of sites enrolled and actively recruiting **Participants**

Accepted Manuscript - BJGP.2025.0231

	- Proportion of those expressing an interest who enrolled and started study - Time taken from expression of interest to being study active - Proportion of participants attending follow-ups - Proportion withdrawing from the study
Assess the feasibility of data collection and the completeness of collected data	Follow-up response rates Proportion of missing data at each time point (Baseline, 6-months, 12-months)
Evaluate UNCs (depression, Quality-of-Life, and health resource use)	Change from baseline to 6-months - Depression score (Patient Health Questionnaire -9[36]) - Healthcare utilisation (including consultations, medications and referrals attributable to the intervention) - Quality-of-Life[37] score (converted from EQ-5D-5L into 3L utility scores)
Explore changes in lifestyle and psychosocial factors	Change from baseline to 6-months - Lifestyle behaviours (SLIQ[38], Determinants of lifestyle behaviour questionnaire[39]) - Illness perceptions (Adapted Brief Illness Perception Questionnaire[40] (IPQ-Brief)) - Risk perception (10-year and lifetime risk[41]) - Health locus-of-control (Multidimensional Health locus-of-control - form C[42])

Abbreviations: BP – Blood Pressure; PHT – Prehypertension; ED-5D-5L –EuroQol 5-dimensional, 5-level questionnaire;

Data collection

Patient reported outcome data was collected at three time-points: baseline, 6-months (primary outcome) and 12-months. Baseline and 6-month data were collected by a researcher at a face-to-face or online video call. 12-month data was collected to explore the feasibility of using an online questionnaire. Aside from attrition and completeness of data, this paper will only report the 6-month primary outcome data. In addition to the data outlined in Table 1, participant socio-demographic and clinical data were also collected.

Statistical analysis

Data were analysed using mainly descriptive statistics. The mean total scores of selected secondary outcomes were analysed in terms of change over time (pre- and post-intervention) by using summary statistics and parametric (paired samples t-tests with related 95% confidence intervals (CIs) reported) or nonparametric (Wilcoxon signed-rank test with related Z-statistics and p-values reported) statistical tests (where appropriate). Health-related quality-of-life was assessed using the EQ-5D-5L with the related responses converted into EQ-5D-3L utility scores (following NICE guidance[43]).

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Results

Willingness to engage

Expressions of interest (EOIs) were received from 15 GPs, 8 pharmacies, 1 community provider and 1 community health check event exceeding the target of 6 GPs and pharmacies, and 1 community provider. Initially we invited 3 GPs based on IMD, with two added later due to low pharmacy recruitment. All invited GPs accepted. Three of eight invited pharmacies also accepted.

In general practice 24,397 eligible patients were identified, with 1,340 invitation letters sent in batches. Mean patient EOI rate was 11.5% (n = 154) (Table 2).

Table 2: Invitation and EOIs received from potential participants contacted by General Practices (GP).

	GP01	GP02	GP03	GP04	GP05	Total
Identified from electronic search *n*	14747	1115	1084	3298	4153	**24,397**
Letters sent *n (%)*	327 (2.2)	416 (37.3)	138 (12.7)	197 (6)	262 (6.3)	**1340 (5.5)**
Patient EOI received *n (%)*	31 (9.5)	61 (14.7)	30 (21.7)	14 (7.1)	18 (6.9)	**154 (11.5)**

Engagement from the pharmacies and community provider was limited, making it difficult to assess patient willingness to engage. Twenty-four BP checks were reported in total from two of the three pharmacies, with 10 patients eligible (42%), three (30%) taking an invitation pack, and one contacting the research team (EOI rate; 10%). At the University-based community event, 15 invitations (10%) were handed out from 150 BP checks, with one EOI (EOI rate; 7%). No data was received from the community provider. In total, 162 patient EOIs were received (Figure 2).

Feasibility of recruitment

Sites

Time from EOI to study active averaged 85 days in GPs (range 77-92), and 114 days in pharmacy (range 18-186). The initial community provider withdrew with a replacement found late in the recruitment period (EOI to active:5 days). The community event was active within a week. Only 1 pharmacy provided recruitment data, and none was received from the community provider. Two additional GPs were invited to compensate for this poor engagement.

Participants

The recruitment target was 114 consented participants (38 per provider) to retain 90 at 6-months. Overall, 80 participants consented; only 1 participant from each of pharmacy and community, but 78 from general practice. The original target was achieved in general practice in 4.5 months. Overall, from 162 EOIs, 147 (94%) were screened, 80 were eligible and consented, and 75 began BP monitoring (Figure 2).

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Sample characteristics

Demographic and clinical data for the 66 complete cases and 14 lost to follow-up are in Table 3. Missing data was low: 1.8% at baseline, 3.9% at 6-months (Appendix 1). Apparent missing data for subjective norm was due to 'not applicable' or 'don't know' responses, not actual omissions. At 12-months, where the questionnaire was delivered by email, missing data rose to 8.7%, still within target (>85% complete).

Figure 2: Consort diagram; Flow diagram of the REVERSE study from EOI

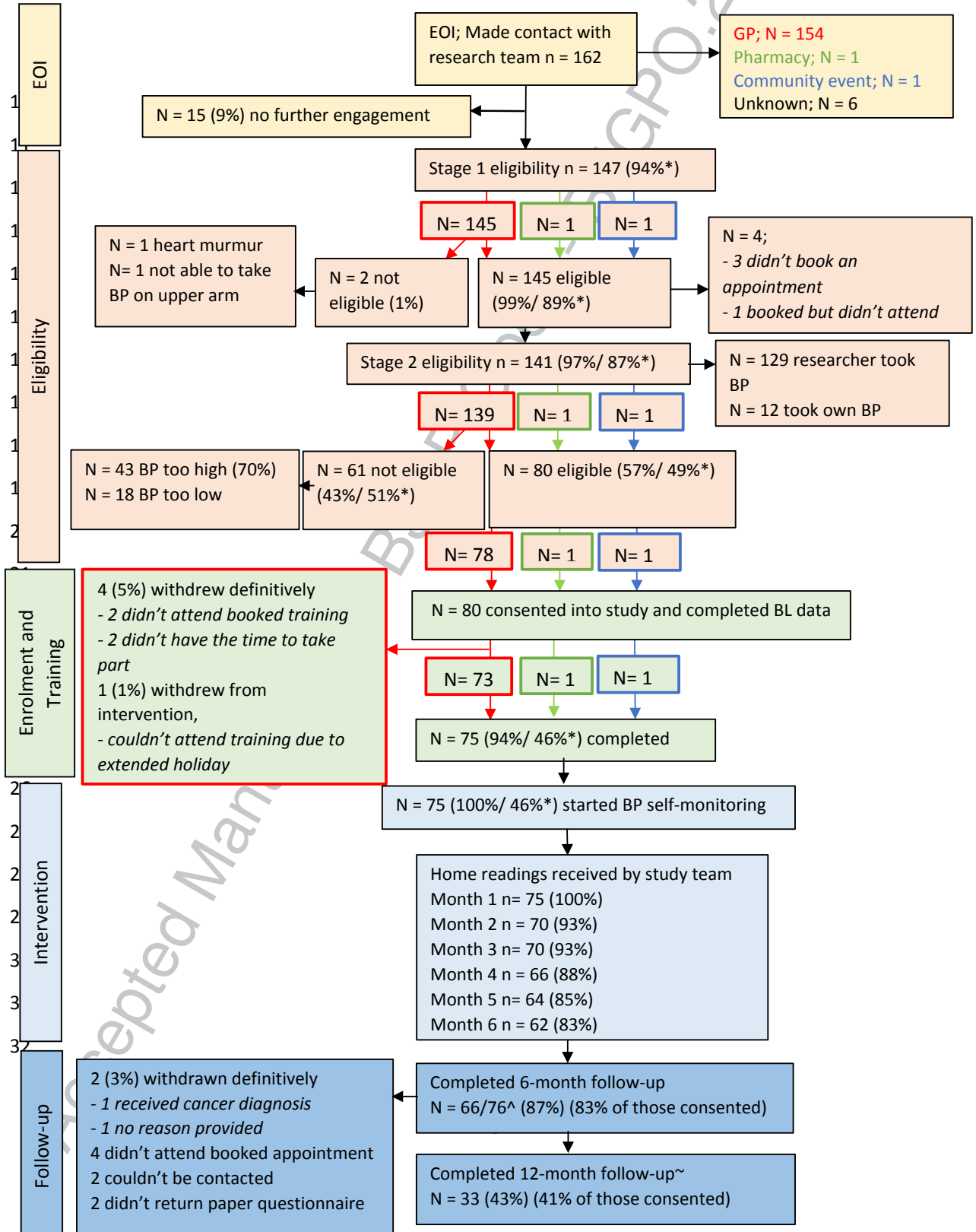

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Table 3: Demographic and clinical data for complete and lost to follow up cases.

	Baseline (n=66 complete cases)	6-months (n=66 complete cases)	Baseline (n=14 lost to follow-up)
Age median (IQR)	58.5 (52.0 to 65.75)	-[a]	57.0 (50.0 to 71.3)
Gender n (%)		-[a]	
- Female	39 (59.1)		6 (42.9)
- Male	27 (40.9)		8 (57.1)
Ethnicity n (%)	(n=64)	-[a]	(n=13)
- White	64 (100.0)		12 (92.3)
- Non-White	0 (0.0)		1 (7.7)
Index of multiple deprivation n (%)		-[a]	
- 1st decile (most deprived)	0 (0.0)		2 (14.3)
- 2nd decile	0 (0.0)		0 (0.0)
- 3rd decile	5 (7.6)		3 (21.4)
- 4th decile	4 (6.1)		3 (21.4)
- 5th decile	9 (13.6)		1 (7.1)
- 6th decile	11 (16.7)		1 (7.1)
- 7th decile	7 (10.6)		1 (7.1)
- 8th decile	8 (12.1)		2 (14.3)
- 9th decile	14 (21.2)		1 (7.1)
- 10th decile (least deprived)	8 (12.1)		0 (0.0)
Working status n (%)		-[a]	
- Full time	32 (48.5)		7 (50.0)
- Part-time	11 (16.7)		1 (7.1)
- Not working	2 (3.0)		1 (7.1)
- Retired	21 (31.8)		5 (35.7)
Highest education obtained n (%)		-[a]	(n=12)
- GCSE or equivalent	13 (19.7)		5 (41.7)
- A-level of equivalent	14 (21.2)		2 (16.7)
- Degree or equivalent	14 (21.2)		2 (16.7)
- Post-grad/ prof qualification	19 (28.8)		3 (25.0)
- Doctoral	2 (3.0)		0 (0.0)
Household income n (%)		(n=65 valid cases)	
- <=£20,000	2 (3.0)	3 (4.5)	4 (26.6)
- £20,001-£40,000	18 (27.3)	22 (33.3)	0 (0.0)
- £40,001-£60,000	16 (24.2)	11 (1.7)	4 (26.6)
- £60,001 - £80,000	5 (7.6)	6 (9.1)	1 (7.1)
- £80,001-£100,000	4 (6.1)	5 (7.6)	0 (0.0)
- > £100,000	6 (9.1)	8 (12.1)	0 (0.0)
- Don't know / rather not say	15 (22.7)	10 (15.2)	5 (35.7)
BP Median (interquartile range) in mmHg	(n=64 valid cases)	(n=58 valid cases)	(n=13 valid cases)
- Systolic	128.5 (122.0 to 135.0)		

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- Diastolic	81.0 (76.3 to 85.0)	134.0 (124.8 to 142.0) 82.0 (75.8 to 88.3)	127.0 (123.0 to 135.5) 81.0 (71.5 to 85.0)
BMI median (IQR)	(n=65 valid cases) 25.8 (22.9 to 28.8)	(n=64 valid cases) 24.8 (22.8 to 28.0)	(n=13 valid cases) 25.5 (22.1 to 28.7)
Waist circumference median (IQR) in cm	(n=58 valid cases) 90.0 (79.0 to 98.3)	(n=60 valid cases) 86.0 (76.0 to 91.0)	(n=12 valid cases) 88.0 (81.8 to 91.0)
Clinical history of: n (%)			
- Diabetes	0 (0.0)	0 (0.0)	0 (0.0)
- CKD	0 (0.0)	0 (0.0)	0 (0.0)
- AF/ irregular heartbeat	1 (1.5)	0 (0.0)	1 (7.1)
- High cholesterol	7 (10.6)	4 (6.1)	2 (14.3)
- CVD	0 (0.0)	0 (0.0)	0 (0.0)
- Dementia	0 (0.0)	0 (0.0)	0 (0.0)
Previous BP self-monitoring n (%)		-[a]	
- Yes	21 (31.8)		4 (28.6)
- No	45 (68.2)		10 (71.4)

-[a] = Data not re-collected at this time point

Unintended negative consequences (UNCs e.g., QoL, depression, health resource use)

Reported quality-of-life was high and depression low, at both baseline and 6-months (Table 4). Although the study was not powered to detect change over time, exploratory analyses showed no significant changes from baseline to 6-months: EQ-5D-3L utility scores (N=66; mean change: 0.01 (SD: 0.11); 95% CI: -0.02 to 0.04), PHQ-9 (n=65; mean change in total score: 0.1 (2.9), Z = -1.07, p= 0.29.

Seven participants used healthcare resources linked to raised BP from baseline to 6-months. This included appointments with a GP (n=5 participants), another NHS professional (n=3) or a private nurse (n=1), purchase of over-the-counter medications (n=1), and obtaining newly prescribed medications (n=2). Four additional participants reported BP-related NHS appointment at 6-months than at baseline.

Table 4: Unintended Negative Consequences (UNCs) for whole sample (N=80) and complete cases (n=66) with change from Baseline to 6 Months.

	Baseline (N=80)	**Baseline (n=66 complete cases)**	**6-Month (n=66 complete cases)**	**Change Baseline to 6-months (n=66 complete cases)**
PHQ-9		(n=65 valid cases)		(n=65 valid cases)
Total mean (SD; range)	3.4 (3.7; 0 to 21)	3.3 (3.2; 0 to 13)	3.3 (2.8; 0 to 14)	0.1 (2.9); p = 0.29
Minimal n (%)	56 (70.9)	46 (70.8)	44 (66.7)	
Mild n (%)	17 (21.5)	14 (21.5)	21 (31.8)	
Moderate n (%)	5 (6.3)	5 (7.7)	1 (1.5)	
Moderately severe n (%)	0 (0.0)	0 (0.0)	0 (0.0)	
Severe n (%)	1 (1.3)	0 (0.0)	0 (0.0)	
EQ-5D-5L				

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- 3-level utility score mean (SD; range)	0.86 (0.13; 0.37 to 0.99)	0.85 (0.12; 0.37 to 0.99)	0.86 (0.14; 0.40 to 0.99)	0.01 (0.11); 95% CI: -0.02 to 0.04

Change in lifestyle factors and blood pressure (BP).

Feasibility of collecting lifestyle and psychosocial data was supported. Although not powered to detect change, illness perceptions significantly decreased (M 26.6 (SD 8.6) to M 22.6 (SD 8.7), p = 0.002). No other significant changes were observed (Appendix 2).

Although change in BP was not a study outcome due to the feasibility nature of this study, exploratory analyses showed that the mean changes from baseline to 6-months in BP Systolic and Diastolic were respectively 4.5 mmHg (n=56; SD: 12.1; 95% CI: 1.2 to 7.7) and 1.7 mmHg (n=56: SD: 9.1; 95% CI: -0.7 to 4.1). Forty percent (23/58) of the participants had a BP in the hypertensive range at 6-month follow-up.

Discussion

This study explored the feasibility of a primary care-based BP self-monitoring intervention for individuals with prehypertension, focusing on engagement, recruitment, and data collection. Recruitment was successful in general practice, where targets were exceeded within the planned timeframe. However, attempts to recruit participants through pharmacies and community providers were largely ineffective. While patient EOI was lower than anticipated, conversion from EOI to screening was high, and most eligible participants consented and began the intervention. Retention at 6-months was strong, exceeding the 80% threshold, although 12-month follow-up was lower, likely due to its self-completed method. Importantly, there was no evidence of UNCs, and exploratory findings suggest that self-monitoring may positively impact beliefs, intentions, and behaviours related to CVD risk.

Strengths and Limitations

A key strength was the high conversion rate from EOI to screening and consent, suggesting that once individuals engaged, they were motivated to participate. Thirty percent of patients identified as prehypertensive in GP records, were found to have hypertensive-range BP at baseline (43/141), supporting our rationale for intervening early. While this may reflect progression to hypertension and highlight potential gaps in routine BP monitoring over the five-year search period (including the COVID-19 pandemic), methodological limitations should also be considered. Elevated baseline readings may not reflect true progression in all cases and could be influenced by white-coat hypertension or by search-strategy limitations, which did not capture home BP readings, that are often lower than clinic measurements.

Retention at 6-months was strong, with 83% completing follow-up, and missing data was low, supporting the feasibility of data collection. The intervention was well-received, with no indication of increased depression, reduced quality-of-life, or medicalisation of prehypertension; concerns often raised with self-monitoring interventions.[35,44] The traffic light system for BP categorisation appeared well understood and acceptable to participants. Forty percent of participants at 6-month follow-up had BP in the hypertensive range. Although high, this should be interpreted cautiously, as 6-month BP was self-measured at a single time point, and cannot be taken as a definitive diagnosis.

Accepted Manuscript - BJGP Open - BJGPO.2025.0231

However, there were limitations. Patient EOI was lower than expected, and recruitment was only successful in general practice. Pharmacy and community provider engagement was ineffective, and despite efforts to understand participant identification, data from these settings was not provided. This limited our ability to assess how many patients were approached and what barriers may have influenced recruitment. We considered whether the preventative nature of the intervention, or conflicting messages about BP status between the research team and usual care providers, may have contributed to low EOI. However, interview findings (in preparation) suggest this was not a major barrier, likely due to the clear, patient-informed wording used in study materials.

In pharmacy settings, we speculate that low numbers of BP checks (possibly due to prioritisation of the COVID-19 vaccination programme), alongside limited research infrastructure and time constraints, contributed to poor recruitment. For the community provider, timing was likely a factor, as their involvement coincided with the end of the recruitment phase and the Christmas period.

Despite a recruitment strategy aimed at reaching ethnically and socioeconomically diverse individuals, the final sample was predominately white, well-educated and from areas of low deprivation. This limits generalisability and highlights the need for improved strategies to engage under-served populations in future research.

Comparisons with existing literature

Our findings align with limited existing literature on barriers to pharmacy involvement in research, which cite time constraints, lack of funding, limited research training, and unsupportive environments as key challenges.[45,46] While pharmacists are willing to engage in research, these systemic issues appear to have hindered participation.

Similarly, our exploratory findings support existing evidence that self-monitoring can be beneficial,[35,44] and does not lead to increased, unnecessary healthcare use. Although non-significant, the increase in personal control and dietary intentions aligns with theoretical models suggesting self-monitoring can enhance awareness and empower individuals to make lifestyle changes.[45,48] The significant reduction in illness perceptions is particularly noteworthy, as this may represent an early mechanism through which self-monitoring could support long-term behaviour change and risk reduction.

Implications for research/ practice

Future research should prioritise early and sustained engagement with community and pharmacy providers to better understand and address participation barriers. While general practice recruitment was successful, relying solely on this setting conflicts with the aim of delivering a community-based, patient-managed intervention. Community-based recruitment remains essential, to reduce the burden on general practice and also to reach those who may not regularly attend GP appointments.

Improving participant diversity is also critical. Future studies should include targeted outreach to non-white and less affluent populations, who are often at greater risk of prehypertension and its progression to CVD. Many community providers now deliver health checks in workplaces, places of worship and leisure settings, routes that could be leveraged to improve reach and inclusivity. Co-

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designing recruitment strategies with community partners and patient representatives may also help to build trust and relevance.

Further investigation into the psychological and behavioural impacts of self-monitoring in prehypertension is warranted. While this study was not powered to detect change, the observed shifts in illness perceptions, personal control and dietary intentions suggest that self-monitoring may support behaviour change to reduce cardiovascular risk over time. Future trials should explore these mechanisms more fully.

Finally, the lower response rate at 12-months highlights the need to consider alternative follow-up methods. While email-based data collection is efficient, it may not be suitable for all participants or for longer-term follow-up. Mixed-methods approaches, as used at 6-months, (e.g., telephone and on-line), may improve retention and data completeness.

Conclusions

This feasibility study indicates that BP self-monitoring for prehypertension is acceptable and feasible in general practice, with strong participant engagement, high retention and minimal missing data. However, recruitment was not feasible in pharmacy or community provider settings, highlighting the need for further collaboration and tailored strategies in these areas. Data collection with researcher-led follow-up resulted in higher completion rates than online self-report methods. No unexpected negative consequences were reported, and early findings suggest that self-monitoring may positively influence psychological and behavioural factors linked to CVD risk. With improved inclusion of under-served groups and more diverse recruitment strategies, these feasibility findings support development of a future effectiveness trial to determine the impact of self-monitoring in people with prehypertension.

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References

1. Kjeldsen SE. Hypertension and cardiovascular risk: general aspects. Pharmacol Res, 2018, 129 pp. 95-99. doi.org/10.1016/j.phrs.2017.11.003

2. Huang Y, Wang S, Cai X, et al. Prehypertension and incidence of cardiovascular disease: a meta-analysis. BMC Med, 2013, 11, p.177. doi.org/10.1186/1741-7015-11-177

3. Vasan RS, Larson MG, Leip EP, et al. Impact of high-normal blood pressure on the risk of cardiovascular disease. N Engl J Med, 2001 345, pp. 1291-1297. DOI: 10.1056/NEJMoa003417

4. Gorelick PB. New horizons for stroke prevention: PROGRESS and HOPE. Lancet Neurol, 2002, 1, pp. 149-156. DOI: 10.1016/s1474-4422(02)00070-4

5. Huang Y, Cai X, Li Y, et al. Prehypertension and the risk of stroke: a meta-analysis. Neurology, 2014, 82, pp. 1153-1161

6. Han M, Li Q, Liu L, et al. Prehypertension and risk of cardiovascular diseases: a meta-analysis of 47 cohort studies. J Hypertens. 2019; 37(12), pp. 2325–2332

7. Joffres M, Falaschetti E, Gillespie C, et al. Hypertension prevalence, awareness, treatment and control in national surveys from England, the USA and Canada, and correlation with stroke and ischaemic heart disease mortality: a cross-sectional study. *BMJ Open*. 2013;3:e003423.

8. Wang Q, Wang Z, Yao W, et al. Anthropometric indices predict the development of hypertension in normotensive and pre- hypertensive middle-aged women in Tianjin, China: A prospective cohort study. Med Sci Monit. 2018; 24:1871-9.

9. Zheng L, Sun Z, Zhang X, et al. Predictors of progression from prehypertension to hypertension among rural Chinese adults: Results from Liaoning Province. Eur J Cardiovasc Prev and Rehab. 2010;17(2):217-22.

10. Huang Y, Su L, Cai X, et al. Association of all-cause and cardiovascular mortality with prehypertension: A meta-analysis. Am Heart Journal. 2014;167(2):160-8.e1.

11. Guo X, Yingxian S. Quantitative association between prehypertension and different types of cardiovascular outcomes and diabetes: A systematic review and meta-analysis of prospective studies worldwide. Heart. 2013;3:A115.

12. Li Y, Xia P, Xu L, Wang Y, Chen L. A Meta-analysis on prehypertension and chronic kidney disease. PLoS ONE. 2016;11(6):e0156575.

13. Kanno A, Kikuya M, Ohkubo T, et al. Pre-hypertension as a significant predictor of chronic kidney disease in a general population: The Ohasama Study. Nephrol Dial Transplant. 2012;27(8):3218-23.

14. Huang Y, Cai X, Liu C, et al. Prehypertension and the risk of coronary heart disease in Asian and western populations: A meta-analysis. JAHA. 2015;4(2):e001519.

15. Lee M, Saver JL, Chang B, et al. Baseline pre-hypertension and risk of incident stroke: A meta-analysis. Stroke. 2011;42(3):e49-e50.

16. Winegarden CR. From “prehypertension” to hypertension? Additional evidence. Ann Epidemiol. 2005;15(9):720-5.

Accepted Manuscript - BJGP Open - BJGPO.2025.0231

17. Ho JE, Enserro D, Brouwers FP, et al. Predicting heart failure with preserved and reduced ejection fraction: The International Collaboration on Heart Failure Subtypes. *Circ Heart Fail* 2016; 9(6):pii:003026

18. Bundy JD, Li C, Stuchlik P. Systolic blood pressure reduction and risk of cardiovascular disease and mortality: A systematic review and network meta-analysis. JAMA Cardiology. 2017. 2(7), pp. 775–781. doi:10.1001/jamacardio.2017.1421

19. Kitagawa K, Yamamoto Y, Arima H, et al. Effect of Standard vs Intensive Blood Pressure Control on the Risk of Recurrent Stroke: A randomized clinical trial and meta-analysis. *JAMA Neurology*. 2019; 76(11), pp. 1309–1318. doi:10.1001/jamaneurol.2019.2167

20. Manta E, Thomopoulos C, Kariori M, et al. Revisiting cardiovascular benefits of blood pressure reduction in primary and secondary prevention: Focus on targets and residual risk—A systematic review and meta-analysis. *Hypertension*, 2024; 81(5), pp. 1076–1086. doi:10.1161/HYPERTENSIONAHA.123.22610

21. Whelton PK, Bundy JD, & Carey RM. Intensive blood pressure treatment goals: Evidence for cardiovascular protection from observational studies and clinical trials', *Am J Hypertens*. 2022; 35(11), pp. 905–914. doi:10.1093/ajh/hpac045

22. Zhang Z, Nie Z, Chen K, et al. Association between intensive blood pressure lowering and stroke-free survival among patients with and without diabetes. *Scientific Reports*. 2024; 14, Article 72211. doi:10.1038/s41598-024-72211-7

23. NICE guidelines: Hypertension in adults: diagnosis and management (NG136) 28 August 2019, updated 2023.

24. Krishnamoorthy Y, Nagarajan R & Murali S. Effectiveness of multiple combined lifestyle interventions in reducing blood pressure among patients with prehypertension and hypertension: a network meta-analysis. J Public Health. 2022; 45(2), e319–e331. doi:10.1093/pubmed/fdac027 ,

25. Li W, Liu H, Wang X, et al. Interventions for reducing blood pressure in prehypertension: a Bayesian network meta-analysis. Front Public Health. 2023; 11, Article 1139617. doi:10.3389/fpubh.2023.1139617

26. McManus RJ, Mant J, Franssen M, et al. Efficacy of self-monitored blood pressure, with or without telemonitoring, for titration of antihypertensive medication (TASMINH4): an unmasked randomised controlled trial. Lancet. 2018;391(10124):949-959.

27. Bray E, Holder R, Mant J, McManus RJ. Does self-monitoring reduce blood pressure? Meta-analysis with metaregression of randomized controlled trials. AnnMed. 2010;42(5):371-86.

28. McManus RJ, Mant J, Bray EP, et al. Telemonitoring and self-management in the control of hypertension (TASMINH2): a randomised controlled trial. Lancet. 2010;376(9736):163–172.

29. Tucker KL, Sheppard JP, Stevens R, et al. Self-monitoring of blood pressure in hypertension: A systematic review and individual patient data meta-analysis. PLOS Medicine. 2017;14(9):e1002389.

30. McManus RJ, Mant J, Haque S, et al. Effect of Self-monitoring and Medication Self-titration on Systolic Blood Pressure in Hypertensive Patients at High Risk of Cardiovascular Disease: The TASMIN-SR Randomized Clinical Trial. JAMA. 2014;312(8):799-808. doi:10.1001/jama.2014.10057

Accepted Manuscript - BJGP Open - BJGPO.2025.0231

31. Hamer M, Batty GD, Stamatakis E, Kivimaki M. Hypertension awareness and psychological distress. Hypertension. 2010;56(3):547-50.

32. Barger SD, Muldoon MF. Hypertension labelling was associated with poorer self-rated health in the Third US National Health and Nutrition Examination Survey. J Hum Hypertens. 2006;20:117-23.

33. Schabert J, Browne JL, Mosely K, Speight J. Social Stigma in Diabetes. The Patient- Patient-Centred Outcomes Research. 2013;6(1):1-10.

34. Wood D. A third way of achieving cardiovascular health. Lecture presented at the 6th annual Cardiovascular Disease (CVD) Prevention Conference; 2019; Public Health England.

35. Viera A, Lingley K, Esserman D. Effects of labelling patients as prehypertensive. Clin Transl Sci2010; 3(2): S21.

36. Kroenke K, Spitzer RL, Williams JBW. Validity of a Brief Depression Severity Measure. J Gen Intern Med. 2021: 16; 606-613.

37. Rabin, R, de Charro, F. EQ-5D: a measure of health status from the EuroQol Group. Ann Med 2001. 33(5):337-343. DOI: 10.3109/07853890109002087

38.Godwin M, Streight S, Dyachuk E, et al. Testing the Simple Lifestyle Indicator Questionnaire: Initial psychometric study. Can Fam Physician. 2008;54(1):76-7

39.Lakerveld J, Bot SD, Chinapaw MJ et al. Measuring pathways towards a healthier lifestyle in the Hoorn Prevention Study: The Determinants of Lifestyle Behavior Questionnaire (DLBQ). Patient Educ Couns. 2011. 85(2):e53-8.

40.Broadbent E, Petrie KJ, Main J, Weinman J. The brief illness perception questionnaire. J Psychosom Res. 2006. 60(6):631-7.

41. Brewer NT, Weinstein ND, Cuite CL, Herrington JE. Risk perceptions and their relation to risk behavior. Ann Behav Med. 2004;27(2):125-30.

42. Wallston KA, Wallston BS. Development of the Multidimensional Health Locus of Control (MHLC) Scales. Health Education Monographs. 1995. 6 (2); 160-171.

43. NICE guidelines https://www.nice.org.uk/process/pmg36

44. Spruill TM, Feltheimer SD, Harlapur M, et al. Are there consequences of labeling patients with prehypertension? An experimental study of effects on blood pressure and quality of life. J Psychosom Res. 2013;74(5):433-8.

45. Awaisu A, Alsalimy N. Pharmacists' involvement in and attitudes toward pharmacy practice research: A systematic review of the literature. Res Soc Adm Pharm. 2015: 11; 6, 725-748. doi.org/10.1016/j.sapharm. 2014.12.008

46. Stewart D, Paudyal V, Cadogan C, et al. A survey of the European Society of Clinical Pharmacy members' research involvement, and associated enablers and barriers. Int J Clin Pharm 2020:42; 1073–1087. doi.org/10.1007/s11096-020-01054-9.

47. Yu J, Fu Y, Du H, et al. The effectiveness of nudge-based interventions on self-monitoring behaviours among patients with cardiometabolic diseases: a systematic review and meta-analysis. Health Psychol Rev. 2025 Dec; 19 (4):878-905. DOI: 10.1080/17437199.2025.2532017

Accepted Manuscript - BJGP Open - BJGPO.2025.0231

48. Natale P, Ni JY, Martinez-Martin D et al. Perspectives and Experiences of Self-monitoring of Blood Pressure Among Patients With Hypertension: A Systematic Review of Qualitative Studies, Am J Hypertens. 2023. 36 (7); Pages 372–384. 84. doi.org/10.1093/ajh/hpad021

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