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Experiences of patients and professionals participating in the HITS home blood pressure telemonitoring trial: a qualitative study

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Abstract

Objectives: To explore the experiences of patients and professionals taking part in a randomised controlled trial (RCT) of remote blood pressure (BP) telemonitoring supported by primary care. To identify factors facilitating or hindering the success of the intervention and those likely to influence its potential translation to routine practice.

Design: Qualitative study adopting a qualitative descriptive approach.

Participants: Twenty five patients, 11 nurses and 9 doctors who were participating in an RCT of BP telemonitoring. A maximum variation sample of patients based on age, sex, and deprivation status of the practice was sought.

Setting: Six primary care practices in Scotland.

Method: Data were collected via taped semi-structured interviews. Initial thematic analysis was inductive. Multiple strategies were employed to ensure that the analysis was credible and trustworthy.

Results: Prior to the trial both patients and professionals were reluctant to increase medication based on single BP measurements taken in the surgery. BP measurements based on multiple electronic readings were perceived as more accurate as a basis for action. Patients using telemonitoring became more engaged in the clinical management of their condition. Professionals reported that telemonitoring challenged existing roles and work practices and increased workload. Lack of integration of telemonitoring data with the electronic health record (EHR) was perceived as a drawback.

Conclusions: BP telemonitoring in a usual care setting can provide a trusted basis for medication management and improved BP control. It increases patients' engagement in the management of their condition, but supporting telemetry and greater patient engagement can increase professional workloads and demand changes in service organisation. Successful service design in practice would have to take account of how additional roles and responsibilities could be re-aligned with existing work and data management practices

The embedded qualitative study was included in the protocol for the HITS trial registered with ISRCTN no. 72614272.

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Summary

Article Summary **- This should consist of three headings: 'Article focus' (up to three bullet points on the research questions or hypotheses addressed); 'Key messages' (up to three bullet points showing the key messages or significance of the study); and a 'Strengths and limitations of this study' section.**

Article Focus

- Qualitative exploration of the experiences of patients and professionals taking part in a randomised controlled trial (RCT) of remote blood pressure (BP) telemonitoring supported by primary care.
- Identification of factors facilitating or hindering the success of the intervention and those likely to influence its potential translation to routine practice

Key Messages

- BP telemonitoring in a usual care setting can provide a trusted basis for medication management and improved BP control.
- It increases patients' engagement in the management of their condition,
- Supporting telemonitoring and greater patient engagement can increase professional workloads and demand changes in service organisation.

Strengths and limitations of this study

The strengths of the study are that it is based on experience of using the systems by the patients' own practitioners in a usual care context. The trial context permitted triangulation with quantitative data. Because the protocol permitted evolution in practice, it gives an indication of some of the issues which would need to be addressed for BP telemonitoring to be used in routine practice. The weaknesses are that participation in the study was relatively short for each practice with limited patient numbers so any longer term barriers to evolution in practice were not identified. It is also possible that participants in this study differ from non-participants.

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Background

Long term illness is increasingly prevalent and telemonitoring (remote self-monitoring of health parameters with electronic transmission of data to a health care provider) is considered to be a promising way of supporting patient care within existing resources.[1] However, despite policy statements and numerous pilots, telemonitoring has not yet been widely adopted.[2] This qualitative study examined patient and professional experiences of BP telemonitoring in the context of an RCT. As an embedded qualitative study its purpose was to help explain the trial results and to generate insights regarding factors likely to influence the adoption of this approach within routine care.

Hypertension (persistently raised BP >140/90 mmHg), is a major cardiovascular risk factor, which is frequently poorly controlled,[3] with evidence of under treatment in many cases, sometimes described as 'therapeutic inertia.'[4] This is despite the availability of guidelines[5],[6] or (as in the UK) financial incentives to primary care doctors.[7] In day-to-day practice effective assessment of BP is problematic. Single BP measurements taken in the surgery are poorer indicators of risk than estimates based on multiple measures from ambulatory or home monitoring[8,9,10] and 'white coat hypertension' – raised BP when measured in the surgery, but not at home [11]– is a complicating factor. However, for practical reasons, surgery-based measurements are still the basis of treatment decision making in most cases. Telemonitoring can overcome these measurement issues by allowing patients to take multiple BP readings at home and share them with healthcare professionals in almost real time, potentially providing motivation for improvements in self-care whilst facilitating professional input if necessary. Although we have been unable to identify previous qualitative studies of telemonitoring in hypertension in a usual care setting, some common themes are emerging from qualitative studies where the self-monitoring was either part of a larger intervention such as specialist nursing support or self-management of medication,[12,13] or the patients were simply self-monitoring with no data transmission.[14,15] The common themes were that patients generally find self-monitoring to be a positive experience which is empowering, reassuring and motivational.

The trial which formed the context for this study[16] (see Box 1 for summary of the intervention) involved patients who had a BP higher than 135/85mmHg on daytime ambulatory BP monitoring and found that for those using telemonitoring, BP reduced by a mean of 4.3/ 2.6 mmHg compared with the group receiving usual care. Other trials in this field also strongly suggest that telemonitoring in hypertension can be effective in achieving clinically important reductions in systolic and diastolic BP[17,18] but some studies have shown poorer outcomes.[19] The introduction of telemonitoring may be regarded as a complex sociotechnical intervention involving changes in behaviour in addition to a purely technological solution. It is therefore important to understand how components of the

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intervention and contextual factors contribute to the outcome.[20] These issues can be difficult to explore using quantitative methods alone[21] and proponents of 'realist evaluation' suggest using qualitative methods to tease out what works in different contexts.[22]The aim of this study, therefore, was to qualitatively explore the experiences of patients and professionals taking part in a trial of BP telemonitoring based in a usual care setting, to identify what contributed to the success of the intervention, what limited its success and what may be required for the success of the trial to be translated into routine care.

Methods

Overview

This study was embedded within an RCT of BP telemonitoring in routine care for patients whose BP was above target[16] (Box 1). Patients who had diabetes or previous stroke or transient ischaemic attack were not included as they were asked to take part in separate trials. A qualitative descriptive approach was employed,[23] acknowledging that in health services research the need of the researcher is not simply to provide a description of the phenomenon, but also to produce an interpretive account which will help to guide health care innovation whilst, at the same time, recognising the subjective nature of the encounter between the subject and the researcher.[24]

Ethics and governance considerations

The study received ethical approval from the South East Scotland Ethics Service (08/S1101/38) and R&D approval from NHS Lothian. Patients were made aware that they may be approached for the embedded qualitative study when they agreed to participate in the trial, but that participation in this study would be optional. Patients and professionals approached were sent a separate information sheet about the qualitative study and signed an additional consent prior to participation.

Sampling and recruitment

Twenty GP practices and 401 patients participated in the RCT. Of these, patients and staff from five socio-economically diverse practices (based on the Scottish Index of Multiple Deprivation[25]) were initially approached to participate in the qualitative study. A sixth practice was added later to increase the number of professionals participating and ensure data saturation. A maximum variation patient sample of at least 20 patients overall from these practices was sought based on age, sex, and the deprivation status of the practice. Patients participating in the trial were purposively sampled and checks were made with the practice to ensure that it was still appropriate

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to approach the patient before they were contacted by letter. Those who did not respond were replaced by patients with similar characteristics. The aim of this sampling strategy was to capture a broad range of patient experiences across the socio-economic spectrum included within the trial.

Data generation and handling

Qualitative data were gathered through semi-structured interviews with patients, nurses and doctors. The initial topic guides were based on issues identified by our previous acceptability study[26]and interviews with patients participating in the trial pilot study. The interview topic guides were refined iteratively in response to the initial interviews. The final topic guides are shown in Appendix 1.Most patients were interviewed face-to-face in their own home, and professionals at their workplace, with interviews carried out by telephone where this was not possible. Most healthcare professionals were interviewed individually, but two nurses were interviewed together, as were three doctors. Interviews were carried out by JU, an experienced female qualitative researcher with a background in education and psychology who was not involved in the RCT.

Data handling and analysis

All interviews were recorded, fully transcribed and the transcript checked against the recording. They were analysed thematically with initial codes and themes identified inductively from the data. Patient and professional data were coded separately. Coding was marked on the transcripts using the comments facility in Microsoft Word and the text associated with each code stored on an Excel spreadsheet. Initial coding took place after small groups of interviews and interviewing continued until data saturation (no new themes arising) was achieved

A range of strategies was employed to ensure that the analysis was credible and trustworthy. Constant comparison was used to ensure consistency in coding and negative cases were sought for each coding category. Coding was checked and iteratively refined using paired analysis of transcripts by two researchers. Researcher reflexivity was supported by discussing emerging findings with the wider research group where different explanations were explored and the coding and thematic analysis reviewed and refined. Following this, the thematic analysis was presented by JH to a discussion group of 21 patients, professionals and researchers who had participated. The presentation introduced the themes and illustrative quotes and the whole dataset (all the text associated with each code) was made available to the participants. This discussion, which lasted for 90 minutes, was moderated by BM, recorded, transcribed and coded. It was used to validate the

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initial grouping of data into codes and themes, but also to extend the discussion of how telehealth may change the provision of primary care. The coding is shown in Appendix 2.

The themes were grouped into the four overarching themes presented here. The groupings were broadly informed by the purpose of the study and also by the normalisation process model as applied to telehealth, with its constructs of interactional workability, relational integration, skill set workability and contextual integration [27]. Appendix 2 shows the codes, (with the number of text extracts coded against each), and how they have been grouped into themes and overarching themes. Where it was possible to triangulate findings arising from the qualitative data against the quantitative trial data (eg workload impacts), this was also done. Three overarching themes are presented here. The fourth theme comprised comments about the study and is shown in Appendix 2.

Results

Thirty four patients were approached (28 from the intervention arm and eight from the control arm) and 25 patients (5 from the control arm of the trial) participated. The patient characteristics are shown in Table 1. Eleven practice nurses (all female) and 9 GPs (4 male, 5 female) took part.

The telemonitoring service employed in this study was novel in that self-monitoring was integrated with usual care. For this reason we present the patient and professional data together here, highlighting areas of concordance, divergence and evolution in practice both between and within the professional and patient groups.

The Patient Experience

Patients' accounts of their response to the initial diagnosis of hypertension differed, as did their level of concern and their personal approaches to self-management. Some were not concerned, did not think of their hypertension often and left the management to their doctor or nurse. For others the diagnosis had caused practical problems (e.g. in taking out life insurance) or anxiety, particularly where they had experience of a family member suffering a stroke. Anxiety about what was happening to their BP between appointments had led some to self-monitor their BP prior to this study. Contrasting perspectives are illustrated in the quotations below.

> *Oh I just take my tablet. I don't think about it…..I'm not the worrying kind ……I don't see the point in worrying over things.* *(Patient 1)*

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And I'm conscious of it because what I'm looking to do you do have to have a medical, and blood pressure is one of the key things that they don't want, if you have high blood pressure you're out. So I'm looking to get it down *(Patient 20*)

I can't remember if they…if I was advised to go and buy a home monitoring machine but I decided to do it anyway……I knew that my blood pressure would be checked every time, regularly at the surgery but certainly twice a year, …… but until that I would like more information than that. *(Patient 8)*

The differing levels of patient concern about hypertension at the start of the study is clearly a factor which could influence outcomes, but was not something which was directly measured in the trial[16]. However, it was possible to compare outcomes between the 30% who self-monitored prior to the trial and those who did not (this analysis not included in the published trial results). Although the results were not statistically significant, there was a trend towards a better outcome with telemetry supported home monitoring for those who had monitored their own BP before the trial compared with those who had never previously used a home monitor. In the telemonitoring group the mean reduction in systolic daytime ambulatory BP for those who had used home monitoring before the trial was 7.16mmHg (95% CI 3.67 to 10.64mmHg) compared to those receiving usual care, but amongst those who had never used home-monitoring before the trial, the difference in outcome between those using telemonitoring and the control group in was 2.89 mmHg (95% CI -0.06 to 5.85mmHg). This suggests that patients' concern about their BP was one factor in the success of the intervention. It also suggests that the telemetry and communication with the practice contributed to the outcome rather than just the home monitoring.

Patients saw hypertension largely as a lifestyle issue and many tried to ascribe a cause within their lifestyle such as reduced physical activity and stress, although some also mentioned familial tendency to high BP.

"I wasn't say like grossly overweight, I wasn't…didn't smoke at all, it was difficult to…I mean I did have a more difficult lifestyle at the time, a lot of commuting, a lot of driving"

(Patient 6)

Most were aware that lifestyle change could help control BP and had been given advice. Lifestyle advice was received from multiple sources and perceived to be general rather than being targeted at the reasons for them individually developing hypertension.

"...a proper balanced diet and not too much fat and all these sort of things. But it's strange if anyone doesn't know about that nowadays" *(Patient 17)*

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Some participants had modified their lifestyle prior to the trial in response to the diagnosis of hypertension

> *What I did do [when diagnosed with hypertension] and I've stuck to it, I've cut out salt. I was overweight a few years ago and I cut out butter, so now I don't have butter and I don't have salt. (I) just (use) general knowledge, just tried to reduce salt, reduce weight. And salt brings up your blood pressure so…* *(Patient 12)*

Some of the patients interviewed had modified their lifestyle during the trial, and considered that the system provided motivation

> *"…. I had lost a stone in weight during the course of that six months as well that I was being on the monitor and I think that did. I think that was a contributory factor to my BP balancing out"* *(Patient 7*)

> *"When I was taking the blood pressure I couldn't bear looking at a hundred and forty, a hundred and fifty over a hundred and ten and I wanted to just be able to see better readings in a way. So over the summer as well, starting to get more walking exercise, that kind of thing…. I didn't want beta blockers because they had various side effects which…….. I kind of felt the conventional medicine options were maybe a bit limited in terms of what I wanted out of it or in terms of avoiding side effects, so it did spur me on to look for alternative…"*
>
> (*Patient 2*)

> *"So I like having the machine there because it prompts me, and I've done things like I've done some exercise and then I've taken my blood pressure to see whether it has made an impact, and it did, it does, every time."*
>
> *(Patient 20*)

However, many others were aware of the need for lifestyle change but found it too difficult to implement .

> *"....obviously I'm overweight, I'm trying to do something about that but it just doesn't happen".* *(Patient 4)*

The quantitative results of the trial[16] did not show any significant changes to lifestyle variables relating to diet, exercise or medication adherence in either the intervention or control groups.

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However, closer examination of the trial data did show that in both groups a small number of individuals (10 overall) had, as described by Patient 7, lost more than 1 stone (6.5Kg) in weight.

Using the system increased some patients' engagement with the medical management of their hypertension. They used it to negotiate treatment and, in a very small number of cases, titrate their own medication.

> *"It's certainly given me more meaningful data to speak to the doctor rather than, "Well, I think my BP has probably gone up." "* *(Patient 6)*

> *"…I've got 16 milligrams and eight milligrams [tablets of antihypertensive drug] and the last time I saw Dr B he said; the maximum you can have is 32. Well what I probably could do is go and see the nurse and say can I take it upon myself to move it up to 32 by taking another eight"*
>
> *(Patient 19)*

Generally, both patients and professionals thought the increased patient engagement in BP management was beneficial.

> *"Yes. I really thought that it (system)was a brilliant idea. And it has helped me a lot, to understand more"* *(Patient 4)*

> *"…the positive thing about it was it definitely helps patients to become much more involved in their care which is a good thing and they definitely take much more interest in it I think because they're measuring it, they can see it, you know it's much more real to them I think"*
>
> *(Practice Nurse 9)*

However, a note of caution was sounded, again by both patients and professionals, that for a small number of people home monitoring could provoke anxiety

> *"I felt it was intrusive. I started worrying about my BP"* *(Patient 12)*

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"….and then you've got others; 'Oh, I feel a bit ill today, I'll better check my BP'... and I think that that's the danger of home monitoring, I think people can become obsessed with it..."

(Practice Nurse 6)

Although both patients and professionals raised the issue of anxiety generated by home monitoring, it was a much stronger theme amongst the professionals. It was only raised by one patient during the interviews, but several professionals. This accords with our previous telehealth work where there is considerable concern amongst professional about the possibility of telehealth putting patients in a 'sick role' and making them dependent or anxious, but this concern is not widely echoed by patients[28,29].

Using the telemonitoring system

The simple telemonitoring system used in this study generally worked well, although some design issues were highlighted as described below. Generally, patients had little difficulty measuring their BP, transmitting their readings or finding a routine for measuring their BP. Some also accessed the on-line record of their readings. However, the wording of the automated feedback messages sent by the system to was not found to be valuable although the messages in themselves did remind some patients to maintain their engagement with the system.

"it's the same message from presumably a machine [laughs] which doesn't help a lot. Because it's obviously coming from a machine and it tells me have I contacted my medical practice or nurse, which I have but it doesn't seem to know that, you see? "(Patient 9)

The main clinical advantage provided by the system was that that it facilitated management of BP using average BP, based on multiple readings taken at home, which was seen by both patients and professionals as a more trustworthy basis for action than single BP measurements taken in the surgery. Both patients and professionals commented that, prior to the system being introduced, there were sometimes long delays in initiating appropriate treatment in people with less markedly raised BP, driven by reluctance by healthcare staff to prescribe medication which may not be absolutely necessary. The data from the patients who were not in the intervention group suggested that, for them, medication changes remained infrequent and this was supported by the trial data[16].

"[prior to the trial]… you have a BP maybe 148 over 88, you might say 'let's see you again in six months', when actually it's too high" *(Practice Nurse 10)*

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"[prior to the trial] …We're all guilty of it...'we'll just see how it goes, you know, maybe watch it. I'll check it again tomorrow' and they probably maybe sit on it a bit longer than they…it's just a natural thing isn't it" *(Practice Nurse 9)*

"…and this patient in particular has been quite reluctant to increase the medication because of her belief that her high BP is just a temporary thing because of what's going on her life…she doesn't think that she should be on medication at all" *(Practice Nurse 11)*

There was consensus between both patients and professionals that the home monitoring system provided a more accurate assessment of BP than surgery measurements and better evidence for action, facilitating rapid tailoring of medication.

"you're getting a more accurate insight into true BP readings'" *(Practice Nurse 6)*

"Well I tried everything. I had it on the table, I had my arm on a pillow and I was trying to relax as much as I could, but there's no way you're going to cheat the machine so it's… it is a good thing like. You cannot kid yourself on with it" *(Patient 4)*

One consequence of the professionals now feeling that they had an ongoing accurate estimate of the patient's average BP was to raise new questions about what to do if it BP was near, but not at, the target.

"The only problem I had with it in a way is these people that were coming up as uncontrolled who were one millimetre above the control level. And I just thought, oh come on, are you really going to add in another drug to bring this down from 81 to 80?"

(GP1)

For healthcare staff the main practical issue with the system was the lack of integration of the BP data with the main patient electronic records and the fact that not all members of the healthcare team regularly accessed the online system and were able to see the patient-recorded readings. This caused problems when patients consulted with other members of the team.

"…So they're coming in to see the doctor, the doctor takes their BP, one forty five ninety; 'oh, that's fine, what are you worried about?' ... And then you go and you look at it the next week and you think; they've seen the doctor and yet their BP's still really high"

(Practice Nurse 11)

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The trial thus flagged wider implementation issues such as the need for reconfiguration of work practices to accommodate new roles, and ensure synergies across a more distributed care team, as well as more integrated access to patient data from disparate data sources.

Adjusting to new responsibilities and new ways of working

The new service and increased patient engagement challenged organisation within practices. Professionals reported that monitoring the electronic data, increased patient contact and the need for more rapid decision making raised workloads. The consensus was that a nurse-led service would be the best model, but monitoring the system needed to be an acknowledged part of the practice nurses' role with regular formal time set aside for an electronic clinic. Not all practices succeeded in monitoring the electronic data regularly throughout the trial. The trial data confirmed the increased workload with patients in the telemonitoring group having, on average, two additional consultations with the practice (one with the GP and one with the practice nurse, half of which were by telephone) over the 6 months of the trial compared to the control group.[16]

Care had traditionally been face- to- face, but continuing to use this model to try to respond quickly to the telemetry data had its frustrations.

> *"We would phone them and say your BP's up, we need to increase your medication or you need to come in and see someone … And they never made appointments and then we had to phone them again and say 'You've still not made an appointment, are you coming in?"*
>
> *(Practice Nurse 3)*

Some professionals began to change how they worked, reducing reliance on face-to-face contact with the patients. Telephone contact increased although it was also found to be a time consuming way of reaching patients who were frequently not available during working hours.

> *"I feel like I'm phoning these patients all the time. If they can't get them in and you'rehaving to leave a message then you're going to have to leave a message in the book to make sure they've got the message. You're checking to see if they've picked up a prescription because you're then checking their blood pressure - it's still high - 'Have they taken their medication?' You're phoning them… "*
>
> (Practice nurse 4)

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There was some experimentation in using email with appropriate safeguards and, although only a small number were involved, this worked well.

> *"…I got an email from the doctor every week from the readings and he was able to advise me without me having to visit the doctor.*
>
> *(Researcher…. how did you feel about that?)*
>
> *Well I was quite happy with that. I thought that was great. It was very time saving for me.*
>
> *(Researcher: Ahah. So you find the time saving aspect then very useful?)*
>
> *Oh, yes, yes definitely. No effort making appointments, you just got an automatic email every week. They give suggestions and like "Take more of the tablets. Take less of the tablets" and that's how it went until I got a good reading regularly, good readings".*
>
> *(Patient 7)*

Some patients also changed the way they accessed services because they now knew what they wanted e.g. bypassing the practice nurses and going directly to the GP because they thought the nurse could not prescribe a change in medication.

When the data were presented for validation to a discussion group of patients, professionals and researchers, it is this theme, of adapting to new roles and responsibilities, which dominated the discussion. Echoing the themes presented above, patients in the discussion group emphasised the role of telemetry-enabled home monitoring as being motivating, an incentive to improve self-care and evidence which facilitated meaningful conversation and dialogue with professionals. However, despite having been presented with the qualitative data on increased professional workloads and contact with patients (the figures from the trial were not available at that point), they thought that in the longer term home monitoring should lead to a reduction in the need for surgery attendance which would be appreciated by patients. The need for clarity in roles (what the patient was expected to do and what the practice was expected to do) was emphasised.

Discussion

Both patients and clinicians participating in this study considered that a measurement based on the average of multiple readings from the home monitoring system was trustworthy and could be used as a basis for action. Although patients generally saw hypertension as a lifestyle issue and were aware of lifestyle interventions, only a few achieved significant lifestyle changes during the trial and some were from the control group. However, the system was described by patients as a motivator

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to achieve BP control and the instantly available, shared and trusted reading facilitated more rapid tailoring of medication. This was partially driven by patients who increased their engagement with the medical management of their condition, initiating contacts and negotiating treatment, and partially by the healthcare professionals who contacted people with unsatisfactory readings. The cost to the practices of achieving improved BP control was increased patient contacts and workloads for professionals during the trial (where all participants had uncontrolled BP at the start). However, when this outcome was discussed with patients and professionals they expressed the view that in the longer term the system could reduce the need for surgery visits. There was an example of this where one patient described asynchronous communication with the practice in the form of email which resulted in tailoring of medication without the need for frequent phone calls and surgery visits.

Prior to the intervention, patients differed in their levels of concern about their hypertension and some already owned home monitors and there was a trend within the trial data for those who already used home monitors to show greater improvement in their BP. This is consistent with the health beliefs model of behaviour[30] where perceived severity of the condition is one of the factors influencing health behaviour. Some clinicians were concerned that, for a small number of people, monitoring and increased engagement in the medical management of their hypertension may have provoked anxiety or dependency. This was echoed by one patient although generally increased engagement seen to be a positive change by both patients and clinicians.

Within the practices, doctors and nurses found that traditional ways of working, which prioritise face to face consultations and split responsibilities for BP monitoring and anti-hypertensive prescribing, may not easily support the increased patient engagement or rapid treatment adjustment that successful telemonitoring requires and there was some evolution of working practices during the study. A lack of integration of telemonitoring data with the patients' electronic records also limited multi-disciplinary working within the practices. The acceptance by professionals that they had an accurate estimate of the patients' BP raised questions about the best management when BP was near the recommended level which was not covered in the guidelines available at the time.

The strengths of the study are that it is based on real experience of using the systems and, because the protocol permitted evolution in practice, it gives an indication of some of the issues which would need to be addressed for BP telemonitoring to be used in routine practice. These include integrating of telemonitoring data with the electronic patient record, enabling communication channels between patients and professionals which are rapid and efficient for both, implementing inter-professional working practices which support rapid tailoring of medication and additional clinical

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guidance. The review by Mair et al[31] on factors affecting the success of telehealth implementations chimes with many of these, as do earlier qualitative studies such as May et al[32]. Feedback from participants and triangulation with trial data add weight to these interpretations. However, practices were only involved in the trial for a short period (about 8 months) and evolution of practice to meet the needs of patients who are telemonitoring could be limited by factors which have not yet been identified. It is also possible that both patients and practices who agree to participate in a trial may differ in some way from those who choose not to participate, and thus not all opinions about telemonitoring may have been captured. A request to seek opinions about telemonitoring from those who did not want to participate in the trial was declined by the Ethics Committee. A weakness of the study was that triangulation data showing the effectiveness of the intervention amongst those who already owned a home monitor was only received after the end of data collection and the opportunity was lost to interview more of this group and more systematically investigate what they considered that telehealth added to their home monitoring.

No direct comparators to this qualitative study, which examined telemonitoring provided in a usual care context, have been found. The HITS trial[16], which was the context for this study, showed that patients using telemonitoring in their usual primary care setting had a greater reduction in BP than the control group. Patients found the equipment easy to use and the measurements easy to understand. This was similar to experience reported in other studies with effective interventions incorporating telemonitoring such as TASMINH2,[13] and differed from a recent US based study where difficulties in using the system were reported[33] and the effect was much smaller.[19] System design (hardware, software and the associated guidance and support) clearly has a part to play, and providing the service via the patient's usual practitioners, rather than as a separate stand-alone service, may have also helped in terms of patient support. There is also a possibility that some of the usability issues may be related to the populations involved. In the US study issues with poor literacy were identified[33] whereas, although the population for the trial which underpinned this study[16] was drawn from across the spectrum of social privilege and deprivation in Scotland, this was not a concern raised at any point. In some of the trials of larger interventions incorporating BP telemonitoring[12,18,19,] it is hard to unravel the impact of the telemonitoring from the impact of the rest of the intervention. This study, and the trial outcome, suggests that the telemonitoring itself can overcome some of the barriers to improved BP control. The added value of the additional interventions such as pharmacist support[12] or medication self-management plans[18] needs to be determined. Interestingly, the qualitative study associated with a trial which included telemonitoring and medication self-management suggested that although many participants would be happy to continue with the telemonitoring, few would be happy to continue with the medication self-management plans.[13.]

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The consensus amongst the professionals interviewed was that a nurse-led monitoring service would be most appropriate, but some patients perceived that nurses could not prescribe the changes to medication which the patients thought they needed. This could be a limiting factor on the efficiency of the service. The legislative and training framework for independent nurse prescribing has been established in Scotland [34] but the number of nurse prescribers is still very limited, although growing.[35]Increasing nurse prescribing in long-term conditions may be key to providing the organisational infrastructure to maximize the efficiency of this model of telemonitoring. Integration of the telemonitoring data with electronic patient records would also be essential; patients are free to consult with other members of the primary health care team and expect their BP data to be available. Further consideration needs to be given to the workload issues for the practices involved. The trial did increase their workloads[16], but the discussion group considered that telemonitoring could reduce the need for practice visits in the longer term. This raises the question of whether telemonitoring should be a short or longer term intervention. A model where initial professional surveillance of BP gives way to patient self monitoring once control is established, should be investigated.

In conclusion, this qualitative study indicates that in a UK context BP telemonitoring in a usual care setting can provide a trusted basis for medication management and improved BP control. It increases patients' engagement in the management of their condition, but professional time for supporting telemetry support and greater patient engagement can increase workloads and demand changes in service organisation. However, if these issues are overcome, BP telemonitoring could be an effective tool in the management of hypertension.

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Contributions and Declaration

Contributors: Brian McKinstry, Janet Hanley and Claudia Pagliari designed the study. Janet Hanley and Brian McKinstry led the research. Jenny Ure collected the data and led the analysis. Aziz Sheikh provided advice throughout the trial. All authors were involved in writing the paper.

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All authors had full access to all of the data in the study and can take responsibility for the integrity of the data and the accuracy of the data analysis.

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Box 1 Description of the telemonitoring intervention

The intervention

The practices and patients were asked to use a system which comprised a validated electronic home BP monitor and mobile phone technology that enabled the transfer of BP readings via SMS to a secure website which was accessible to the user and their doctor or nurse, and also provided automated feedback to the patient. The BP monitor linked to a mobile phone wirelessly, via Bluetooth. The components of the intervention were:

Home BP monitoring: Patients were asked to record their BP as agreed with the healthcare team, or more frequently as they wished. Guidance was initially to record BP twice in the morning and twice in the evening for a week in line with the European guideline on BP monitoring , to build a baseline average. Thereafter, they were asked to take weekly measurements preferably at different times of day if their average BP was within the recommended range, but if they had made any lifestyle or medication change which would impact on their BP, they were asked to measure their BP for a more intensive period of monitoring to allow the rolling average to change and to more quickly assess the effect.

Transmission of data: This simply required the phone to be switched on and to have a signal when the BP measurement was taken. Patients just had to apply the cuff and press a button on the BP monitor. The reading and transmission occurred automatically. Mobile phone problems did not lead to loss of data because all readings were stored in the monitor and any untransmitted readings were sent when the next reading was taken.

Feedback to patients (closed loop feedback): In addition to optionally accessing their BP record on-line, patients could also opt to receive reports via text message or email. These gave advice on the current status of their BP based on the average of the last 10 readings, and whether they should contact their doctor or nurse. Reports were generated every 10 readings or weekly, whichever was sooner, with a reminder to check BP if this had not been done. These reports could reassure them that their average BP was within target (<135/85mmHg)or tell them that their BP average was improved on the last report but not yet to target and to maintain current therapy, or that their BP was not at target and that they should contact their clinician. If an individual BP reading was very high (>220/120mmHg) an immediate text or email report was generated reinforcing the written advice in the patient information leaflet to rest for 30 minutes, check again and contact the practice if BP remained very high.

Sharing the readings with the healthcare team: Members of the healthcare team were able to access the records of their patients online via a secure login to a summary screen which listed their patients, their average BP over the last 10 readings, and the date of their last reading. Average BPs outside the recommended limits (set at 135/85mmHg for the study) were highlighted. Clicking on the each individual patient led to lists or graphs of all their readings. Clinicians could then check the patients' electronic GP record to see if there had been recent advice regarding medication or lifestyle change and if not, could contact the patient to make a change. Clinicians were recommended to check the website weekly, but the frequency of log-on could be chosen by them.

Usual Care

Patients allocated to the usual care group were asked to continue to attend the practice for BP checks according to the usual routine of the practice. If they were already home monitoring they were not discouraged from continuing.

All patients

For all patients the GP/practice nurse were informed that the ambulatory monitoring used to screen for eligibility for the HITS trial had shown that their average BP was above the target range, but they were not given the actual reading. All patients were given an information pack containing a range of publicly available leaflets on hypertension management and lifestyle modification.

What This Paper Adds

The trial which formed the context for this paper shows that BP telemonitoring integrated into hypertension patients' usual primary care primary care provision can lead to improvements in management. However, it is a complex social intervention and the qualitative literature on BP telemonitoring, which is mainly based on trials where the telemonitoring is only part of a larger intervention, or there is little involvement of the usual care provider, does not explain why telemonitoring in this context is effective, or what may be required for the success of the trial to be translated into routine care.

This study showed that both patients and professionals were reluctant to increase medication based on single BP measurements taken in the surgery. The telemonitoring measurements based on multiple readings were perceived as being more accurate and there was a willingness to act on them. Patients using telemonitoring became more engaged in the management of their condition. Professionals found that telemonitoring increased their workloads, and some changes in working practices were needed to support it effectively.

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Table1. Patient details

Patient	Sex		Age			Group		Deprivation level of practice		
	M	F	<50	50-69	70+	Monitoring	Not monitoring	Least deprived	Mixed	Deprived
1		X			X		X			X
2	X		X			X			X	
3	X			X		X				X
4	X			X			X		X	
5	X				X	X				X
6	X			X		X			X	
7		X		X		X				X
8	X			X			X		X	
9	X		X				X			X
10		X		X		X			X	
11	X				X	X		X		
12	X			X		X			X	
13	X			X		X		X		
14		X			X	X			X	
15		X			X	X		X		
16		X		X		X			X	
17	X				X	X		X		
18		X			X	X		X		
19	X				X	X		X		
20	X		X			X		X		
21		X			X		X	X		
22	X		X			X		X		
23		X	X			X			X	
24		X			X	X		X		
25	X			X		X				X

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APPENDIX 1: Topic Guides for interviews with the healthcare team and patients

Nurse/GP Topic Guide v2.

Experience of using the system

- how they use it/ find it?
- day to day management
- problems/concerns
- technical issues?
- clinical issues?
- organisational issues?

Impact on how BP managed by care team

- has it changed management of BP
- communication with care team
- changes to medication
- adherence to treatment regime
- impact of feedback
- workload
- re-organisation

Impact on how BP managed by patients

- how they use it
- changes in way they see /manage their condition
- anxiety / reassurance/ control/passive/active/self-care
- impact of feedback on
- medicalisation (e.g. some patients found the monitoring made them focus too much on being ill, and not enough on being well)

Implications for use in practice

Patient Topic Guide + Prompts v.2

Non-monitored and Monitored Groups

Experience of the screening process
- own monitor?
- impact?

How they manage their BP / feel about managing it
- day to day management
- do they comply or not with advice and if so why / why not
- anxiety
- adherence to regime/lifestyle and drug ttmnt
- sense of control
- have they changed the way they see /manage their condition/if so why

Experience of managing BP with monitor/ without monitor
- technical
- clinical
- personal (anxiety; reassurance)
- organisational

What advice given
- what did they think of advice given
- other factors in lifestyle that might affect this
- what were they told by GP or nurse / what did they understand? do they see it differently?
- do they feel that suggestions are not appropriate for them? Why?

Have views of/ approaches to management changed since first diagnosis / if so why
- information/advice
- readings
- opportunities to change
- other factors – e.g. life events, illness, GP advice

How they feel about it / want to deal with it

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impact on lifestyle
sense of control / anxiety/ reassurance
inconvenience

Additional Themes for Monitored group

Describe how they use it in practice
Experience of how nurse/doctor has used it
Perceived impact?
onQoL?
on seeking help?
on care
onself care/self management?
facilitate passive or active control
on understanding of BP
on communication with care team
on appointments.
Perceived benefits
Perceived problems
Which groups would benefit from it in particular?

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Appendix 2 Themes/subthemes

The thematic headings are derived from the indicator codes.

Overarching Theme	Themes/subthemes :patient interviews The frequency of occurrence of codes is given as a number *Coded to more than 1 theme	Themes/ subthemes: Nurses and doctors The frequency of occurrence of codes is given as a number, in brackets the number of interviews in which it occurred, and an indication of how many of these were with a nurse or a GP.	Themes/ subthemes: Discussion group
The patient experience	**Diagnosis (**Routine check up / out of the blue 4,Diagnosis in relation to other study 1) **Perceptions of causes / triggers for high bp (**Stress/work stress 4**,** Weight/lack of exercise 2**,** Genetics1**,** Smoking 2) **Experience of care** (Positive perception of usual care 5, Advice (helpful/vague/negative/excessive) 6, Organisation of medication 3*) (also coded as more rapid organisation of medication in using the system) **Impact (of diagnosis) on self care/ lifestyle 26** (Carried on as usual/ BP checks/ medication 12,Trigger for Change In Lifestyle 7(Starting to/trying to make changes 5,impact on work prospects motivate change2,medication routine 3,complies with medication/ self monitors due to fear of stroke 4)**,**Barriers to lifestyle changes 3 **(**Other conditions 1, Hard to find the motivation 1, Knowing what but not how 1)) **Greater awareness 24** (Greater awareness/ greater acceptance of problem 4*,Readings prompt /challenge/ reinforce change 3*,Basis for understanding own patterns/ causes in own lifestyle 8*,Awareness of variation in context	**Concerns about medication/ putting off taking action 8 (1GP3N)** **Patient compliance** (Barriers (to compliance)13 (2GP7N), General lack of compliance in patients 3(1GP 2N),Other issues a priority 1N,lack of Motivation 1(1N),Compliance tails off 1N,General (Work, Holiday) 3(1GP2N)) **Readings/monitoring help patient buy in to treatment 12 (3GP4N)** **Positive patient experience 7(2gp2n) (**Patient Perception of Better Service 2(2GP),They like it/like being monitored 3(1gp1N,)They USE it 1(1GP),They avoid unnecessary visits to GP 2(1GP1N),Good outcomes for patients 1(1N)) **Readings prompt/empower patients to take a more active role 14(3gp3n)** **Readings can provide reinforcement (1N)** **Readings /reminders can generate anxiety 9(1GP3N)**	**Perceptions of tele monitoring (**For self (IT not reqd),For others (IT reqd.)) **Telemonitoring as incentive (**Somebody watching, Motivating in sense that data is being looked at, Sense of obligation, Enhances compliance, Poor TM compliance can be flag for non-compliance in other areas (medic.),Example of compliance that led to control, and subsequent reduction in drugs) **T.monitoring as evidence (**Evidence facilitates meaningful conversation and dialogue)

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	5,Variation between home/surgery 3, Interest in variation 1) **Readings can be reassuring and/or intrusive & anxiety provoking 6** **(**Sometimes worrying 4) **Readings as evidence /empower patients 4**		
Using the telemetry service	**Training** (sufficient 2, more needed 3) **Usability** (Generally straightforward to use 9,Setting up an easy routine with set time& place 4,Usability for older patients/ dexterity/ familiarity with IT 2,Communication/reminder issues 5 **(**Messaging error1,messages can be alarming, not encouraging 3,messages could be more encouraging/less negative 1)Cuff 5 **(**Fine/no problem 3,Query tightness 1**,** cuff reinflation 1),Mobile phone straightforward (exc. for minor issues) 5(Switching on and off 1,Easy and interesting 1,Transmission failure 2,Signal failure 1) **24 hour monitoring intrusive uncomfortable 3** **Difficulty understanding readings 1** **STANDARD VS.INDIVIDUAL MODELS 4** (Need for individual benchmark 1,Need to consider variation over time 3)	**Initial workload getting to grips with system 8(2GP4N)** (Messy & Time-consuming 3(1GP;3N),Initially anxious about it 2(1GP;1N), Aligning monitoring process with other clinical processes / Lack of data interoperability with other clinical systems 3 (2GP 1N)) **Rethinking data management process 4(2GP2N)** **Usability/Technical/ training issues** (Ease of use 8(2GP3N), Easy for most people 6(1GP2N), Harder for some older, and or anxious patients 2(1gp1n), Mobile monitoring kit 9(1gp3n)(Calibration 1(1N),Charging(PATIENT) 5(2N), Transmission Problems (Unknown Unknowns) 1GP) Website 11(3gp3n) (Monitoring screen 2(1gp1n),Lack of intuitive graphs diagrams for use in surgery context 1GP,Icons 1GP,Limited use/awareness of options 1N,Time constraints limited use 2(1N1GP)) Messaging can create anxiety 4(1gp3n)) **Dealing with technical problems 10(3gp4n) (**No problems/few problems /quickly sorted 7(2GP3N),Supportive IT help 2N**,** Learning by doing1N) **Set up and training 6(1GP4N) (**Set up and training positive 2(1GP),Potential of sharing training/setup info with nurses & patients 4(4N)) **Better evidence 6(1gp3n)**(More accurate understanding (e,g, white coat hypertension) 2(2N),Better detection 2(1GP1N), Better evidence for understanding and treating individuals 2(2N), Faster control of bp to target	

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		13(2GP2N)More intensive treatment 5(2GP3N),Faster cycling through barriers to treatment 2(2GP),More successful focus on reaching target 8(2GP2N)) **Tension between standard and individual ltargets 14** (Target very tight /cost benefit issues)11(3GP3N,)Standard vs individual approaches to cv risk 3(1GP1N))	
Adjusting to new roles and responsibilities	**Rethinking roles/relationships in shared care 9** (Rethinking patient role/responsibility in shared care 3, More effective gp: patient relationship 1, Changing patient:nurse (or gp) roles: 4, Changing nurse:gp roles 1) **Supports different models of self care 14(**Changes made to lifestyle (standard) 7,Changing lifestyle (alternative) 3,More awareness/knowing what is happening 1,Saves time on appointments 2,Control 1) **Views of use** 7***(** would be best for monitoring For a period of instability 1,would prefer Automatic monitoring1, Delighted to continue – will miss it 2, Interesting – but interest tailing off 1, Mixed Feelings 1,Reassurance 2)	**Increased frequency of contact with patients 8(4GP4N)** (More communication 1N, More frequent contact /better relationship 2(1GP 1N), More frequent contact /worse relationship (2GP), More frequency but not more time-consuming (1N), No Impact (1GP)) **Appropriateness of monitoring for different groups. 15(4GP4N)** (Patients who will use it 'sensibly' not obsessively 1 (1N),Proactive/educated patients 1(1GP,)Anyone who wants it/can benefit from it 5(3GP1N,)Uncontrolled hypertensives 1(1GP),Type 2 diabetics 1(1GP),Motivated groups 2(1GP1N),Not patients with complex conditions/other conditions 1(1N),Not elderly/with cognitive, mobility/anxiety problems 2(1GP1N), Need flexibility to exclude/alter who participates (1GP),Don't Know (1GP). **Increasing empowerment or dependence? 5(1GP4N)** (Self monitoring not self management (Increasing Dependence) 2(2N), Using reminders to prompt/manipulate patient compliance 2(2N), Balancing reminders against intrusion 1(1GP)) **Enabling factors 7(1GP3N)** (Having a routine 2N,Feel Someone Checking Up (1GP),Being made to feel Special (1GP),Unknown 4(1GP1N)) **Rethinking roles and processes in shared care 31 (**Lack of clarity of/ commitment to roles 4(2N), Reconfiguring roles of GPs and nurses	**T. Monitoring as reducing need to attend surgery** (Bridges barriers to visiting GP (distance, work, parking, travel),Benefit is not having to go to surgery,Some patients don't got to surgery anyway) **T.monitoring as streamlining the process** (Speed /currency of patient data sharing, T. Monitoring as a Means of Overcoming Misconceptions and Selective Reporting, T.Monitoring as Cheap in Comparison with Cost of Treatment/Other systems) **Perceived benefits of t.monitoring** (Positive experiences from most patients) **Perceived problems with t.monitoring** (Some patients complained they were not contacted, Perceived lack of Integration of services, Only niggles, Continuity of care, Impact on workload (Phoning; lack of ring-fenced time), Lack of clarity on roles) **Reconfiguring roles / workload** (Telephoning time-consuming,Different way of working, Dedicated time needs to be set aside, Some nurses pro-actively asked for ring fenced time, In some practices it wasn't integrated, making it difficult to manage)

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		12(4N),Role of gp(compliance/ non-compliance with protocol) 8(3N),Role of nurse (negotiating ring fenced time for monitoring) 3(2N)) **Nurse:patient roles (communication) 7(2GP4N)** (Clarifying communication roles/ responsibilities 5(GPfoc.4N),Developing a shared understanding of readings 1(1N)) **Rethinking communication processes 8(3GP2N)** (Benefits of email-based communication 4(1GP1N),Constraints of phone communication 1(1N),Risks of phone communication 1 (1GP)) **Impact on/factors in workload 46** (Workload / anxiety following up patients who don't respond16(5GP6N), Finding time as a key barrier 7(6N1GP), Workload impacted by patient numbers/ stage/ compliance 6(2GP 6N), Workload impacted by practice work (flu/busy spells/bloods) 3(1GP2N), Workload impacted by need to download + document readings 2(1GP1N), Workload impacted by lack of clarity /compliance with role 4(4N), No impact (1GP), We forgot about it (1GP)) **Scalability issues 4 (1GP2N)** **Administrative problems of patients moving to other practices (1N)**	**Reconfiguring roles/ communicating new roles clearly** (Patients unclear who to contact/who does what -nurse or GP,Patients need to be advised what new roles are,Roles could be made clear by a surgery 'menu,'Protocols agreed/integrated in policy/ not always agreed/ integrated in practice **Reconfiguring roles/gp& nurse care role** Nurse prescribing would take pressure off GPS/be quicker, Nurse prescribing (instead of GP) implies need for patient culture shift, Doctors taking broader picture (not ticking boxes), Doctors more likely to discuss balance of risks with patients,Literature from Royal Pharm. Soc. In 1990's on GP and patient negotiation) **Impact on practice**(Varied across surgeries,Changed practice in some surgeries,Benefits dependent on practice, managementImpact on medical inertia) **Annotation /eannotation as a basis for understanding/ explaining/ discussing** (Patients often annotate on paper to identify causes, Diary linked to mobile phone is an annotation option for some, Annotation provides basis for explanation to self, Annotation provides basis for discussion with GP) **Optimal use of tm** (Most useful in first few weeks/months to achieve BP control)Workload and use both tail off after first few weeks/months **Lessons learned from the study (care process;data process)**

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			Business models **Concerns re service implementation /using nhs24/at scale**(Fear of phoning NHS 24 in case end up in hospital , as not usual care team,Lack of continuity of care staff militates against use (Also an issue in large practices),Lack of integrated services limits usability (eg call service to pharmacy services),May be successful if shared with the patient record
The study	**Overall perception of service/study 23** **Useful/helpful/ worthwhile/interesting 9** **Delighted to continue – will miss it 2** **Interesting – but interest tailing off 1** **recruitment: too much literature 2**	**Good study 5(2gp3n)** **Hits nurses/team were great 2 (2n)** **A window on the future 2(2gp)** **Non-monitored patients disappointed 1n**	**Trial design** **T.monitoringvs home monitoring** **Queries about added value of tm** **Reconfiguring care_paradigm shift** (Two separate systems running uncomfortably in parallel, Slow transition)

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R Relevance of study question	To explore the experiences of patients and professionals taking part in a randomised controlled trial (RCT) of remote blood pressure (BP) telemonitoring supported by primary care. To identify factors facilitating or hindering the success of the intervention and those likely to influence its potential translation to routine practice.
A Appropriateness of qualitative method	Qualitative study adopting a qualitative descriptive approach
T Transparency of procedures	
Sampling	
Is the sampling strategy appropriate?	Twenty five patients, 11 nurses and 9 doctors who were participating in an RCT of BP telemonitoring. A maximum variation sample of patients based on age, sex, and deprivation status of the practice was sought.
Recruitment	
Was recruitment conducted using appropriate methods?	Patients participating in the trial were purposively sampled and checks were made with the practice to ensure that it was still appropriate to approach the patient before they were contacted by letter. Those who did not respond were replaced by patients with similar characteristics.
Is the sampling strategy appropriate?	
Could there be selection bias?	Thirty four patients were approached (28 from the intervention arm and eight from the control arm) and 25 patients (5 from the control arm of the trial) participated.

	The patient characteristics are shown in Table 1. Eleven practice nurses (all female) and 9 GPs (4 male, 5 female) took part. Non-participation in the interviews was mainly due to difficulty in arranging a suitable time
Data collection	
Was collection of data systematic and comprehensive?	Interview guide provided
Are characteristics of the study group and setting clear?	Table 1 gives description of each patient
Why and when was data collection stopped, and is this reasonable?	Data saturation
Role of researchers	
Is the researcher(s) appropriate? How might they bias (good and bad) the conduct of the study and results?	Interviews were carried out by JU, an experienced female qualitative researcher with a background in education and psychology who was not involved in the RCT
Ethics	
Was informed consent sought and granted?	Patients were made aware that they may be approached for the embedded qualitative study when they agreed to participate in the trial, but that participation in this study would be optional. Patients and professionals approached were sent a separate information sheet about the qualitative study and signed an additional consent prior to participation

Were participants' anonymity and confidentiality ensured?	Patients identified by number
Was approval from an appropriate ethics committee received?	The study received ethical approval from the South East Scotland Ethics Service (08/S1101/38) and R&D approval from NHS Lothian.
S Soundness of interpretive approach	
Analysis	
Is the type of analysis appropriate for the type of study? • *thematic:* exploratory, descriptive, hypothesis generating • *framework:* e.g., policy • *constant comparison/grounded theory:* theory generating, analytical •	All interviews were recorded, fully transcribed and the transcript checked against the recording. They were analysed thematically with initial codes and themes identified inductively from the data.
Are the interpretations clearly presented and adequately supported by the evidence?	
Are quotes used and are these appropriate and effective?	Appendix 2 shows the codes, (with the number of text extracts coded against each), and how they have been grouped into themes and overarching themes.
Was trustworthiness/reliability of the data and interpretations checked?	Constant comparison was used to ensure consistency in coding and negative cases were sought for each coding category. Coding was checked and iteratively refined using paired analysis of transcripts by two researchers. Researcher reflexivity was supported by discussing emerging findings with the wider research group where different explanations were explored and the coding and thematic analysis

	reviewed and refined. Following this, the thematic analysis was presented by JH to a discussion group of 21 patients, professionals and researchers who had participated. The presentation introduced the themes and illustrative quotes and the whole dataset (all the text associated with each code) was made available to the participants. Where it was possible to triangulate findings arising from the qualitative data against the quantitative trial data (eg workload impacts), this was also done
Discussion and presentation	
Are findings sufficiently grounded in a theoretical or conceptual framework? Is adequate account taken of previous knowledge and how the findings add?	The themes were grouped into the four overarching themes presented here. The groupings were broadly informed by the purpose of the study and also by the normalisation process model as applied to telehealth, with its constructs of interactional workability, relational integration, skill set workability and contextual integration. Additional theoretical perspectives are considered in the discussion
Are the limitations thoughtfully considered?	Strengths and limitations explicitly described and discussed
Is the manuscript well written and accessible?	
Are red flags present? These are common features of ill-conceived or poorly executed qualitative studies, are a cause for concern, and must be viewed critically. They might be fatal flaws, or they may result from lack of detail or clarity.	

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Experiences of patients and professionals participating in the HITS home blood pressure telemonitoring trial: a qualitative study

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Manuscripts

Experiences of patients and professionals participating in the HITS home blood pressure telemonitoring trial: a qualitative study

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Abstract

Objectives: To explore the experiences of patients and professionals taking part in a randomised controlled trial (RCT) of remote blood pressure (BP) telemonitoring supported by primary care. To identify factors facilitating or hindering the effectiveness of the intervention and those likely to influence its potential translation to routine practice.

Design: Qualitative study adopting a qualitative descriptive approach.

Participants: Twenty five patients, 11 nurses and 9 doctors who were participating in an RCT of BP telemonitoring. A maximum variation sample of patients from within the trial based on age, sex, and deprivation status of the practice was sought.

Setting: Six primary care practices in Scotland.

Method: Data were collected via taped semi-structured interviews. Initial thematic analysis was inductive. Multiple strategies were employed to ensure that the analysis was credible and trustworthy.

Results: Prior to the trial both patients and professionals were reluctant to increase medication based on single BP measurements taken in the surgery. BP measurements based on multiple electronic readings were perceived as more accurate as a basis for action. Patients using telemonitoring became more engaged in the clinical management of their condition. Professionals reported that telemonitoring challenged existing roles and work practices and increased workload. Lack of integration of telemonitoring data with the electronic health record (EHR) was perceived as a drawback.

Conclusions: BP telemonitoring in a usual care setting can provide a trusted basis for medication management and improved BP control. It increases patients' engagement in the management of their condition, but supporting telemetry and greater patient engagement can increase professional workloads and demand changes in service organisation. Successful service design in practice would have to take account of how additional roles and responsibilities could be re-aligned with existing work and data management practices

The embedded qualitative study was included in the protocol for the HITS trial registered with ISRCTN no. 72614272.

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Summary

Article Focus

- Qualitative exploration of the experiences of patients and professionals taking part in a randomised controlled trial (RCT) of remote blood pressure (BP) telemonitoring supported by primary care.
- Identification of factors facilitating or hindering the success of the intervention and those likely to influence its potential translation to routine practice

Key Messages

- BP telemonitoring in a usual care setting can provide a trusted basis for medication management and improved BP control.
- It increases patients' engagement in the management of their condition,
- Supporting telemonitoring and greater patient engagement can increase professional workloads and demand changes in service organisation.

Strengths and limitations of this study

The strengths of the study are that it is based on experience of using the systems by the patients' own practitioners in a usual care context. The trial context permitted triangulation with quantitative data. Because the protocol permitted evolution in practice, it gives an indication of some of the issues which would need to be addressed for BP telemonitoring to be used in routine practice. The weaknesses are that participation in the study was relatively short for each practice with limited patient numbers so any longer term barriers to evolution in practice were not identified. It is also possible that participants in this study differ from non-participants.

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Background

Long term illness is increasingly prevalent and telemonitoring (remote self-monitoring of health parameters with electronic transmission of data to a health care provider) is considered to be a promising way of supporting patient care within existing resources.[1] However, despite policy statements and numerous pilots, telemonitoring has not yet been widely adopted.[2] This qualitative study examined patient and professional experiences of BP telemonitoring in the context of an RCT. As an embedded qualitative study its purpose was to help explain the trial results and to generate insights regarding factors likely to influence the adoption of this approach within routine care.

Hypertension (persistently raised BP >140/90 mmHg), is a major cardiovascular risk factor, which is frequently poorly controlled,[3] with evidence of under treatment in many cases, sometimes described as 'therapeutic inertia.'[4] This is despite the availability of guidelines[5],[6] or (as in the UK) financial incentives to primary care doctors.[7] In day-to-day practice effective assessment of BP is problematic. Single BP measurements taken in the surgery are poorer indicators of risk than estimates based on multiple measures from ambulatory or home monitoring[8,9,10] and 'white coat hypertension' – raised BP when measured in the surgery, but not at home [11]– is a complicating factor. However, for practical reasons, surgery-based measurements are still the basis of treatment decision making in most cases. Telemonitoring can overcome these measurement issues by allowing patients to take multiple BP readings at home and share them with healthcare professionals in almost real time, potentially providing motivation for improvements in self-care whilst facilitating professional input if necessary. Although we have been unable to identify previous qualitative studies of telemonitoring in hypertension in a usual care setting, some common themes are emerging from qualitative studies where the self-monitoring was either part of a larger intervention such as specialist nursing support or self-management of medication,[12,13] or the patients were simply self-monitoring with no data transmission.[14,15] The common themes were that patients generally find self-monitoring to be a positive experience which is empowering, reassuring and motivational.

The trial which formed the context for this study[16] (see Box 1 for summary of the intervention) involved patients from primary care hypertension registers whose surgery BP measures in the previous 6 months had been > 140/90mmHg, who had a BP higher than 135/85mmHg on daytime ambulatory BP monitoring performed as screening for the trial, and did not have diabetes, previous stroke or transient ischaemic attack, atrial fibrillation or other major illness. It found that for those using telemonitoring, BP reduced by a mean of 4.3/ 2.6 mmHg compared with the group receiving usual care. Other trials in this field also strongly suggest that telemonitoring in hypertension can be effective in achieving clinically important reductions in systolic and diastolic BP[17,18] but some studies

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have shown poorer outcomes.[19] The introduction of telemonitoring may be regarded as a complex sociotechnical intervention involving changes in behaviour in addition to a purely technological solution. It is therefore important to understand how components of the intervention and contextual factors contribute to the outcome.[20] These issues can be difficult to explore using quantitative methods alone[21] and proponents of 'realist evaluation' suggest using qualitative methods to tease out what works in different contexts.[22]The aim of this study, therefore, was to qualitatively explore the experiences of patients and professionals taking part in a trial of BP telemonitoring based in a usual care setting, to identify what contributed to the effectiveness of the intervention, what limited its effectiveness and what may be required for the success of the trial to be translated into routine care.

Methods

Overview

This study was embedded within an RCT of BP telemonitoring in routine care for patients whose BP was above target[16] (Box 1). A qualitative descriptive approach was employed,[23] acknowledging that in health services research the need of the researcher is not simply to provide a description of the phenomenon, but also to produce an interpretive account which will help to guide health care innovation whilst, at the same time, recognising the subjective nature of the encounter between the subject and the researcher.[24]

Ethics and governance considerations

The study received ethical approval from the South East Scotland Ethics Service (08/S1101/38) and R&D approval from NHS Lothian. Patients were made aware that they may be approached for the embedded qualitative study when they agreed to participate in the trial, but that participation in this study would be optional. Patients and professionals approached were sent a separate information sheet about the qualitative study and signed an additional consent prior to participation.

Sampling and recruitment

Twenty GP practices and 401 patients participated in the RCT. Of these, patients and staff from five socio-economically diverse practices (based on the Scottish Index of Multiple Deprivation[25]) were initially approached to participate in the qualitative study. A sixth practice was added later to increase the number of professionals participating and ensure data saturation. A maximum variation patient sample of at least 20 patients overall from these practices was sought based on

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age, sex, and the deprivation status of the practice. Patients participating in the trial were purposively sampled and checks were made with the practice to ensure that it was still appropriate to approach the patient before they were contacted by letter. Those who did not respond were replaced by patients with similar characteristics. The aim of this sampling strategy was to capture a broad range of patient experiences across the socio-economic spectrum included within the trial.

Data generation and handling

Qualitative data were gathered through semi-structured interviews with patients, nurses and doctors. The initial topic guides were based on issues identified by our previous acceptability study[26]and interviews with patients participating in the trial pilot study. The interview topic guides were refined iteratively in response to the initial interviews. The final topic guides are shown in Appendix 1.Most patients were interviewed face-to-face in their own home, and professionals at their workplace, with interviews carried out by telephone where this was not possible. Most healthcare professionals were interviewed individually, but two nurses were interviewed together, as were three doctors. Interviews were carried out by JU, an experienced female qualitative researcher with a background in education and psychology who was not involved in the RCT.

Data handling and analysis

The data were collected between July 2009 and June 2010 and, with a little variation due to availability, in tranches reflecting different start dates of different practices. Provisional coding and identification of themes took place after each tranche of interviews. Interviewing continued until the researcher, in discussion with the wider research team, considered that data saturation was achieved. Although there is discussion on the concept of data saturation, in the context of this study which was focused and involved a relatively homogeneous population, data saturation was considered to have occurred when the researcher was not identifying any new themes or codes within the provisional themes in sequential interviews, and thought this would be unlikely in subsequent interviews. Detailed re-coding and checking took place from May-December 2010 with the validation focus group taking place in May 2011.

All interviews were recorded, fully transcribed and the transcript checked against the recording. They were analysed thematically with initial codes and themes identified inductively from the data. Patient and professional data were coded separately. Coding was marked on the transcripts using

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the comments facility in Microsoft Word and the text associated with each code stored on an Excel spreadsheet

A range of strategies was employed to ensure that the analysis was credible and trustworthy. Constant comparison was used to ensure consistency in coding and negative cases were sought for each coding category. Coding was checked and iteratively refined using paired analysis of transcripts by two researchers. Researcher reflexivity was supported by discussing emerging findings with the wider research group where different explanations were explored and the coding and thematic analysis reviewed and refined. Following this, the thematic analysis was presented by JH to a discussion group of 21 patients, professionals and researchers who had participated. The presentation introduced the themes and illustrative quotes and the whole dataset (all the text associated with each code) was made available to the participants. This discussion, which lasted for 90 minutes, was moderated by BM, recorded, transcribed and coded. It was used to validate the initial grouping of data into codes and themes, but also to extend the discussion of how telehealth may change the provision of primary care. The coding is shown in Appendix 2.

The themes were grouped into the four overarching themes presented here. The groupings were broadly informed by the purpose of the study and also by the normalisation process model as applied to telehealth, with its constructs of interactional workability, relational integration, skill set workability and contextual integration [27]. Appendix 2 shows the codes, (with the number of text extracts coded against each), and how they have been grouped into themes and overarching themes. Where it was possible to triangulate findings arising from the qualitative data against the quantitative trial data (including workload impacts, lifestyle change and the impact of telemonitoring compared with simple home monitoring), this was also done. Three overarching themes are presented here. The fourth theme comprised comments about the study and is shown in Appendix 2.

Results

Thirty four patients were approached (28 from the intervention arm and eight from the control arm) and 25 patients (5 from the control arm of the trial) participated. The patient characteristics are shown in Table 1. Eleven practice nurses (all female) and 9 GPs (4 male, 5 female) took part. Five patients from the control group were interviewed because it was possible that their treatment may have been different than usual during the trial. There was no evidence from the interviews that this had happened. The telemonitoring service employed in this study was novel in that self-monitoring was integrated with usual care. For this reason we present the patient and professional data

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together here, highlighting areas of concordance, divergence and evolution in practice both between and within the professional and patient groups.

The Patient Experience

Patients' accounts of their response to the initial diagnosis of hypertension differed, as did their level of concern and their personal approaches to self-management. Some were not concerned, did not think of their hypertension often and left the management to their doctor or nurse. For others the diagnosis had caused practical problems (e.g. in taking out life insurance) or anxiety, particularly where they had experience of a family member suffering a stroke. Anxiety about what was happening to their BP between appointments had led some to self-monitor their BP prior to this study, and one practice provided patients with a home monitor to use during diagnosis. Contrasting perspectives are illustrated in the quotations below.

> *Oh I just take my tablet. I don't think about it…..I'm not the worrying kind ……I don't see the point in worrying over things.*
>
> *(Patient 1, control group, previous experience of home monitoring with practice monitor)*

> *And I'm conscious of it because what I'm looking to do you do have to have a medical, and blood pressure is one of the key things that they don't want, if you have high blood pressure you're out. So I'm looking to get it down*
>
> *(Patient 20, monitoring group, no previous experience of home monitoring*)

> *I can't remember if they…if I was advised to go and buy a home monitoring machine but I decided to do it anyway……I knew that my blood pressure would be checked every time, regularly at the surgery but certainly twice a year, …… but until that I would like more information than that*.
>
> *(Patient 4, control group, previous experience of home monitoring with own monitor)*

The differing levels of patient concern about hypertension at the start of the study is clearly a factor which could influence outcomes, but was not something which was directly measured in the trial[16].

Patients saw hypertension largely as a lifestyle issue and many tried to ascribe a cause within their lifestyle such as reduced physical activity and stress, although some also mentioned familial tendency to high BP.

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"I wasn't say like grossly overweight, I wasn't…didn't smoke at all, it was difficult to…I mean I did have a more difficult lifestyle at the time, a lot of commuting, a lot of driving"

(Patient 6, monitoring group, no previous experience of home monitoring)

Most were aware that lifestyle change could help control BP and had been given advice. Lifestyle advice was received from multiple sources and perceived to be general rather than being targeted at the reasons for them individually developing hypertension.

"...a proper balanced diet and not too much fat and all these sort of things. But it's strange if anyone doesn't know about that nowadays"

(Patient 17, monitoring group, no previous experience of home monitoring,)

Some participants had modified their lifestyle prior to the trial in response to the diagnosis of hypertension

What I did do [when diagnosed with hypertension] and I've stuck to it, I've cut out salt. I was overweight a few years ago and I cut out butter, so now I don't have butter and I don't have salt. (I) just (use) general knowledge, just tried to reduce salt, reduce weight. And salt brings up your blood pressure so…

(Patient 12 monitoring group, no previous experience of home monitoring)

Some of the patients interviewed had modified their lifestyle during the trial, and considered that the system provided motivation

"…. I had lost a stone in weight during the course of that six months as well that I was being on the monitor and I think that did. I think that was a contributory factor to my BP balancing out"

(Patient 7, monitoring group, previous experience of home monitoring with practice monitor)

"When I was taking the blood pressure I couldn't bear looking at a hundred and forty, a hundred and fifty over a hundred and ten and I wanted to just be able to see better readings in a way. So over the summer as well, starting to get more walking exercise, that kind of thing…. I didn't want beta blockers because they had various side effects which…….. I kind of felt the conventional medicine options were maybe a bit limited in terms of what I wanted out of it or in terms of avoiding side effects, so it did spur me on to look for alternative…"

(*Patient 2, monitoring group, no previous experience of home monitoring,*)

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"So I like having the machine there because it prompts me, and I've done things like I've done some exercise and then I've taken my blood pressure to see whether it has made an impact, and it did, it does, every time."

(Patient 20 monitoring group, no previous experience of home monitoring,)

However, many others were aware of the need for lifestyle change but found it too difficult to implement .

"....obviously I'm overweight, I'm trying to do something about that but it just doesn't happen". *(Patient 4, control group, previous experience of home monitoring with own monitor)*

The quantitative results of the trial[16] did not show any significant changes to lifestyle variables relating to diet, exercise or medication adherence in either the intervention or control groups. However, closer examination of the trial data did show that in both groups a small number of individuals (10 overall) had, as described by Patient 7, lost more than 1 stone (6.5Kg) in weight.

Using the system increased some patients' engagement with the medical management of their hypertension. They used it to negotiate treatment and, in a very small number of cases, titrate their own medication.

"It's certainly given me more meaningful data to speak to the doctor rather than, "Well, I think my BP has probably gone up." "

(Patient 6, monitoring group, no previous experience of home monitoring)

"…I've got 16 milligrams and eight milligrams [tablets of antihypertensive drug] and the last time I saw Dr B he said; the maximum you can have is 32. Well what I probably could do is go and see the nurse and say can I take it upon myself to move it up to 32 by taking another eight"

(Patient 19, monitoring group, no previous experience of home monitoring)

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These data suggest that the interaction between patient and doctor or nurse facilitated by the telemetry is important rather than just the home monitoring. This is supported by trial data where it was possible to compare outcomes between the telemonitoring group and control group for the 30% of patients who had self-monitored prior to the trial (this analysis was not included in the published trial results). Within this group, those randomised to telemonitoring had a mean reduction in systolic daytime ambulatory BP of 7.16mmHg (95% CI 3.67 to 10.64mmHg) compared to those receiving usual care.

Generally, both patients and professionals thought the increased patient engagement in BP management was beneficial.

> *"Yes. I really thought that it (system)was a brilliant idea. And it has helped me a lot, to understand more"*
>
> *(Patient 6, monitoring group, no previous experience of home monitoring)*

> *"…the positive thing about it was it definitely helps patients to become much more involved in their care which is a good thing and they definitely take much more interest in it I think because they're measuring it, they can see it, you know it's much more real to them I think"*
>
> *(Practice Nurse 9)*

However, a note of caution was sounded, again by both patients and professionals, that for a small number of people home monitoring could provoke anxiety

> *"I felt it was intrusive. I started worrying about my BP"*
>
> *(Patient 12 monitoring group, no previous experience of home monitoring,)*

> *"….and then you've got others; 'Oh, I feel a bit ill today, I'll better check my BP'... and I think that that's the danger of home monitoring, I think people can become obsessed with it..."*
>
> *(Practice Nurse 6)*

Although both patients and professionals raised the issue of anxiety generated by home monitoring, it was a much stronger theme amongst the professionals. It was only raised by one patient during the interviews, but several professionals. This accords with our previous telehealth work where there is considerable concern amongst professional about the possibility of telehealth putting

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patients in a 'sick role' and making them dependent or anxious, but this concern is not widely echoed by patients[28],[29] .

Using the telemonitoring system

The simple telemonitoring system used in this study generally worked well, although some design issues were highlighted as described below. Generally, patients had little difficulty measuring their BP, transmitting their readings or finding a routine for measuring their BP. Some also accessed the on-line record of their readings. However, the wording of the automated feedback messages sent by the system to was not found to be valuable although the messages in themselves did remind some patients to maintain their engagement with the system.

> *"it's the same message from presumably a machine [laughs] which doesn't help a lot. Because it's obviously coming from a machine and it tells me have I contacted my medical practice or nurse, which I have but it doesn't seem to know that, you see? "*
>
> (Patient 9, monitoring group, previous experience of home monitoring with practice monitor)

The main clinical advantage provided by the system was that that it facilitated management of BP using average BP, based on multiple readings taken at home, which was seen by both patients and professionals as a more trustworthy basis for action than single BP measurements taken in the surgery. Both patients and professionals commented that, prior to the system being introduced, there were sometimes long delays in initiating appropriate treatment in people with less markedly raised BP, driven by reluctance by healthcare staff to prescribe medication which may not be absolutely necessary. The data from the patients who were not in the intervention group suggested that, for them, medication changes remained infrequent and this was supported by the trial data[16].

> *"[prior to the trial]… you have a BP maybe 148 over 88, you might say 'let's see you again in six months', when actually it's too high"* *(Practice Nurse 10)*
>
> *"[prior to the trial] …We're all guilty of it...'we'll just see how it goes, you know, maybe watch it. I'll check it again tomorrow' and they probably maybe sit on it a bit longer than they…it's just a natural thing isn't it"* *(Practice Nurse 9)*
>
> *"…and this patient in particular has been quite reluctant to increase the medication because of her belief that her high BP is just a temporary thing because of what's going on her life…she doesn't think that she should be on medication at all"* *(Practice Nurse 11)*

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There was consensus between both patients and professionals that the home monitoring system provided a more accurate assessment of BP than surgery measurements and better evidence for action, facilitating rapid tailoring of medication.

> *"you're getting a more accurate insight into true BP readings'" (Practice Nurse 6)*

> *"Well I tried everything. I had it on the table, I had my arm on a pillow and I was trying to relax as much as I could, but there's no way you're going to cheat the machine so it's… it is a good thing like. You cannot kid yourself on with it"*

> *(Patient 6, monitoring group, no previous experience of home monitoring)*

One consequence of the professionals now feeling that they had an ongoing accurate estimate of the patient's average BP was to raise new questions about what to do if it BP was near, but not at, the target.

> *"The only problem I had with it in a way is these people that were coming up as uncontrolled who were one millimetre above the control level. And I just thought, oh come on, are you really going to add in another drug to bring this down from 81 to 80?"*
>
> *(GP1)*

For healthcare staff the main practical issue with the system was the lack of integration of the BP data with the main patient electronic records and the fact that not all members of the healthcare team regularly accessed the online system and were able to see the patient-recorded readings. This caused problems when patients consulted with other members of the team.

> *"…So they're coming in to see the doctor, the doctor takes their BP, one forty five ninety; 'oh, that's fine, what are you worried about?' ... And then you go and you look at it the next week and you think; they've seen the doctor and yet their BP's still really high"*
>
> *(Practice Nurse 11)*

The trial thus flagged wider implementation issues such as the need for reconfiguration of work practices to accommodate new roles, and ensure synergies across a more distributed care team, as well as more integrated access to patient data from disparate data sources.

Adjusting to new responsibilities and new ways of working

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The new service and increased patient engagement challenged organisation within practices. Professionals reported that monitoring the electronic data, increased patient contact and the need for more rapid decision making raised workloads. The consensus was that a nurse-led service would be the best model, but monitoring the system needed to be an acknowledged part of the practice nurses' role with regular formal time set aside for an electronic clinic. Not all practices succeeded in monitoring the electronic data regularly throughout the trial. The trial data confirmed the increased workload with patients in the telemonitoring group having, on average, two additional consultations with the practice (one with the GP and one with the practice nurse, half of which were by telephone) over the 6 months of the trial compared to the control group.[16]

Care had traditionally been face- to- face, but continuing to use this model to try to respond quickly to the telemetry data had its frustrations.

> *"We would phone them and say your BP's up, we need to increase your medication or you need to come in and see someone … And they never made appointments and then we had to phone them again and say 'You've still not made an appointment, are you coming in?"*
>
> *(Practice Nurse 3)*

Some professionals began to change how they worked, reducing reliance on face-to-face contact with the patients. Telephone contact increased although it was also found to be a time consuming way of reaching patients who were frequently not available during working hours.

> *"I feel like I'm phoning these patients all the time. If they can't get them in and you'rehaving to leave a message then you're going to have to leave a message in the book to make sure they've got the message. You're checking to see if they've picked up a prescription because you're then checking their blood pressure - it's still high - 'Have they taken their medication?' You're phoning them… "*
>
> (Practice nurse 4)

There was some experimentation in using email with appropriate safeguards and, although only a small number were involved, this worked well.

> *"…I got an email from the doctor every week from the readings and he was able to advise me without me having to visit the doctor.*
>
> *(Researcher…. how did you feel about that?)*

Well I was quite happy with that. I thought that was great. It was very time saving for me.

(Researcher: Ahah. So you find the time saving aspect then very useful?)

Oh, yes, yes definitely. No effort making appointments, you just got an automatic email every week. They give suggestions and like 'Take more of the tablet's. 'Take less of the tablets'" and that's how it went until I got a good reading regularly, good readings".

(Patient 7, monitoring group, previous experience of home monitoring with practice monitor)

Some patients also changed the way they accessed services because they now knew what they wanted e.g. bypassing the practice nurses and going directly to the GP because they thought the nurse could not prescribe a change in medication.

When the data were presented for validation to a discussion group of patients, professionals and researchers, it is this theme, of adapting to new roles and responsibilities, which dominated the discussion. Echoing the themes presented above, patients in the discussion group emphasised the role of telemetry-enabled home monitoring as being motivating, an incentive to improve self-care and evidence which facilitated meaningful conversation and dialogue with professionals. However, despite having been presented with the qualitative data on increased professional workloads and contact with patients (the figures from the trial were not available at that point), they thought that in the longer term home monitoring should lead to a reduction in the need for surgery attendance which would be appreciated by patients. The need for clarity in roles (what the patient was expected to do and what the practice was expected to do) was emphasised.

Discussion

Both patients and clinicians participating in this study considered that a measurement based on the average of multiple readings from the home monitoring system was trustworthy and could be used as a basis for action. Although patients generally saw hypertension as a lifestyle issue and were aware of lifestyle interventions, only a few achieved significant lifestyle changes during the trial and some were from the control group. However, the system was described by patients as a motivator to achieve BP control and the instantly available, shared and trusted reading facilitated more rapid tailoring of medication. This was partially driven by patients who increased their engagement with the medical management of their condition, initiating contacts and negotiating treatment, and partially by the healthcare professionals who contacted people with unsatisfactory readings. The cost to the practices of achieving improved BP control was increased patient contacts and workloads

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for professionals during the trial (where all participants had uncontrolled BP at the start). However, when this outcome was discussed with patients and professionals they expressed the view that in the longer term the system could reduce the need for surgery visits. There was an example of this where one patient described asynchronous communication with the practice in the form of email which resulted in tailoring of medication without the need for frequent phone calls and surgery visits.

Prior to the intervention, patients differed in their levels of concern about their hypertension and there was an acknowledgement not all patients would respond to telemonitoring in the same way.Some clinicians were concerned that, for a small number of people, monitoring and increased engagement in the medical management of their hypertension may have provoked anxiety or dependency. This was echoed by one patient although generally increased engagement seen to be a positive change by both patients and clinicians.

Within the practices, doctors and nurses found that traditional ways of working, which prioritises face to face consultations and where there may be split responsibilities for BP monitoring and anti-hypertensive prescribing, may not easily support the increased patient engagement or rapid treatment adjustment that successful telemonitoring requires and there was some evolution of working practices during the study. A lack of integration of telemonitoring data with the patients' electronic records also limited multi-disciplinary working within the practices. The acceptance by professionals that they had an accurate estimate of the patients' BP raised questions about the best management when BP was near the recommended level which was not covered in the guidelines available at the time.

The strengths of the study are that it is based on real experience of using the systems and, because the protocol permitted evolution in practice, it gives an indication of some of the issues which would need to be addressed for BP telemonitoring to be used in routine practice. These include integrating of telemonitoring data with the electronic patient record, enabling communication channels between patients and professionals which are rapid and efficient for both, implementing inter-professional working practices which support rapid tailoring of medication and additional clinical guidance. The review by Mair et al[30] on factors affecting the success of telehealth implementations chimes with many of these, as do earlier qualitative studies such as May et al[31]. Feedback from participants and triangulation with trial data add weight to these interpretations. However, practices were only involved in the trial for a short period (about 8 months) and evolution of practice to meet the needs of patients who are telemonitoring could be limited by factors which have not yet been identified. It is also possible that both patients and practices who agree to participate in a trial may

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differ in some way from those who choose not to participate, and thus not all opinions about telemonitoring may have been captured. A request to seek opinions about telemonitoring from those who did not want to participate in the trial was declined by the Ethics Committee. A weakness of the study was that triangulation data showing the effectiveness of the intervention amongst those who already owned a home monitor was only received after the end of data collection and the opportunity was lost to interview more of this group and more systematically investigate what they considered that telehealth added to their home monitoring.

No direct comparators to this qualitative study, which examined telemonitoring provided in a usual care context, have been found. The HITS trial[16], which was the context for this study, showed that patients using telemonitoring in their usual primary care setting had a greater reduction in BP than the control group. Patients found the equipment easy to use and the measurements easy to understand. This was similar to experience reported in other studies with effective interventions incorporating telemonitoring such as TASMINH2,[13] and differed from a recent US based study where difficulties in using the system were reported[32] and the effect was much smaller.[19] System design (hardware, software and the associated guidance and support) clearly has a part to play, and providing the service via the patient's usual practitioners, rather than as a separate stand-alone service, may have also helped in terms of patient support. There is also a possibility that some of the usability issues may be related to the populations involved. In the US study issues with poor literacy were identified[32] whereas, although the population for the trial which underpinned this study[16] was drawn from across the spectrum of social privilege and deprivation in Scotland, this was not a concern raised at any point. In some of the trials of larger interventions incorporating BP telemonitoring[12,18,19,] it is hard to unravel the impact of the telemonitoring from the impact of the rest of the intervention. This study, and the trial outcome, suggests that the telemonitoring itself can overcome some of the barriers to improved BP control. The added value of the additional interventions such as pharmacist support[12] or medication self-management plans[18] needs to be determined. Interestingly, the qualitative study associated with a trial which included telemonitoring and medication self-management suggested that although many participants would be happy to continue with the telemonitoring, few would be happy to continue with the medication self-management plans.[13.]

The consensus amongst the professionals interviewed was that a nurse-led monitoring service would be most appropriate, but some patients perceived that nurses could not prescribe the changes to medication which the patients thought they needed. This could be a limiting factor on the efficiency of the service. The legislative and training framework for independent nurse prescribing has been established in Scotland [33] but the number of nurse prescribers is still very limited, although

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growing.[34]Increasing nurse prescribing in long-term conditions may be key to providing the organisational infrastructure to maximize the efficiency of this model of telemonitoring. Integration of the telemonitoring data with electronic patient records would also be essential; patients are free to consult with other members of the primary health care team and expect their BP data to be available. Further consideration needs to be given to the workload issues for the practices involved. The trial did increase their workloads[16], but the discussion group considered that telemonitoring could reduce the need for practice visits in the longer term. This raises the question of whether telemonitoring should be a short or longer term intervention. A model where initial professional surveillance of BP gives way to patient self monitoring once control is established, should be investigated.

In conclusion, this qualitative study indicates that in a UK context BP telemonitoring in a usual care setting can provide a trusted basis for medication management and improved BP control. It increases patients' engagement in the management of their condition, but professional time for supporting telemetry support and greater patient engagement can increase workloads and demand changes in service organisation. However, if these issues are overcome, BP telemonitoring could be an effective tool in the management of hypertension.

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Contributions and Declaration

Contributors: Brian McKinstry, Janet Hanley and Claudia Pagliari designed the study. Janet Hanley and Brian McKinstry led the research. Jenny Ure collected the data and led the analysis. Aziz Sheikh provided advice throughout the trial. All authors were involved in writing the paper.

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All authors had full access to all of the data in the study and can take responsibility for the integrity of the data and the accuracy of the data analysis.

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Box 1 Description of the telemonitoring intervention

The intervention

The practices and patients were asked to use a system which comprised a validated electronic home BP monitor and mobile phone technology that enabled the transfer of BP readings via SMS to a secure website which was accessible to the user and their doctor or nurse, and also provided automated feedback to the patient. The BP monitor linked to a mobile phone wirelessly, via Bluetooth. The components of the intervention were:

Home BP monitoring: Patients were asked to record their BP as agreed with the healthcare team, or more frequently as they wished. Guidance was initially to record BP twice in the morning and twice in the evening for a week in line with the European guideline on BP monitoring , to build a baseline average. Thereafter, they were asked to take weekly measurements preferably at different times of day if their average BP was within the recommended range, but if they had made any lifestyle or medication change which would impact on their BP, they were asked to measure their BP for a more intensive period of monitoring to allow the rolling average to change and to more quickly assess the effect.

Transmission of data: This simply required the phone to be switched on and to have a signal when the BP measurement was taken. Patients just had to apply the cuff and press a button on the BP monitor. The reading and transmission occurred automatically. Mobile phone problems did not lead to loss of data because all readings were stored in the monitor and any untransmitted readings were sent when the next reading was taken.

Feedback to patients (closed loop feedback): In addition to optionally accessing their BP record on-line, patients could also opt to receive reports via text message or email. These gave advice on the current status of their BP based on the average of the last 10 readings, and whether they should contact their doctor or nurse. Reports were generated every 10 readings or weekly, whichever was sooner, with a reminder to check BP if this had not been done. These reports could reassure them that their average BP was within target (<135/85mmHg)or tell them that their BP average was improved on the last report but not yet to target and to maintain current therapy, or that their BP was not at target and that they should contact their clinician. If an individual BP reading was very high (>220/120mmHg) an immediate text or email report was generated reinforcing the written advice in the patient information leaflet to rest for 30 minutes, check again and contact the practice if BP remained very high.

Sharing the readings with the healthcare team: Members of the healthcare team were able to access the records of their patients online via a secure login to a summary screen which listed their patients, their average BP over the last 10 readings, and the date of their last reading. Average BPs outside the recommended limits (set at 135/85mmHg for the study) were highlighted. Clicking on the each individual patient led to lists or graphs of all their readings. Clinicians could then check the patients' electronic GP record to see if there had been recent advice regarding medication or lifestyle change and if not, could contact the patient to make a change. Clinicians were recommended to check the website weekly, but the frequency of log-on could be chosen by them.

Usual Care

Patients allocated to the usual care group were asked to continue to attend the practice for BP checks according to the usual routine of the practice. If they were already home monitoring they were not discouraged from continuing.

All patients

For all patients the GP/practice nurse were informed that the ambulatory monitoring used to screen for eligibility for the HITS trial had shown that their average BP was above the target range, but they were not given the actual reading. All patients were given an information pack containing a range of publicly available leaflets on hypertension management and lifestyle modification.

What This Paper Adds

The trial which formed the context for this paper shows that BP telemonitoring integrated into hypertension patients' usual primary care primary care provision can lead to improvements in management. However, it is a complex social intervention and the qualitative literature on BP telemonitoring, which is mainly based on trials where the telemonitoring is only part of a larger intervention, or there is little involvement of the usual care provider, does not explain why telemonitoring in this context is effective, or what may be required for the success of the trial to be translated into routine care.

This study showed that both patients and professionals were reluctant to increase medication based on single BP measurements taken in the surgery. The telemonitoring measurements based on multiple readings were perceived as being more accurate and there was a willingness to act on them. Patients using telemonitoring became more engaged in the management of their condition. Professionals found that telemonitoring increased their workloads, and some changes in working practices were needed to support it effectively.

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Table1. Patient details

Patient	Sex		Age			Group		Deprivation level of practice		
	M	F	<50	50-69	70+	Monitoring	Not monitoring	Least deprived	Mixed	Deprived
1		X			X		X			X
2	X		X			X			X	
3	X			X		X				X
4	X			X			X		X	
5	X				X	X				X
6	X			X		X			X	
7		X		X		X				X
8	X			X			X		X	
9	X		X				X			X
10		X		X		X			X	
11	X				X	X		X		
12	X			X		X			X	
13	X			X		X		X		
14		X			X	X			X	
15		X			X	X		X		
16		X		X		X			X	
17	X				X	X		X		
18		X			X	X		X		
19	X				X	X		X		
20	X		X			X		X		
21		X			X		X	X		
22	X		X			X		X		
23		X	X			X			X	
24		X			X	X		X		
25	X			X		X				X

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Experiences of patients and professionals participating in the HITS home blood pressure telemonitoring trial: a qualitative study

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Abstract

Objectives: To explore the experiences of patients and professionals taking part in a randomised controlled trial (RCT) of remote blood pressure (BP) telemonitoring supported by primary care. To identify factors facilitating or hindering the effectiveness~~success~~ of the intervention and those likely to influence its potential translation to routine practice.

Design: Qualitative study adopting a qualitative descriptive approach.

Participants: Twenty five patients, 11 nurses and 9 doctors who were participating in an RCT of BP telemonitoring. A maximum variation sample of patients from within the trial based on age, sex, and deprivation status of the practice was sought.

Setting: Six primary care practices in Scotland.

Method: Data were collected via taped semi-structured interviews. Initial thematic analysis was inductive. Multiple strategies were employed to ensure that the analysis was credible and trustworthy.

Results: Prior to the trial both patients and professionals were reluctant to increase medication based on single BP measurements taken in the surgery. BP measurements based on multiple electronic readings were perceived as more accurate as a basis for action. Patients using telemonitoring became more engaged in the clinical management of their condition. Professionals reported that telemonitoring challenged existing roles and work practices and increased workload. Lack of integration of telemonitoring data with the electronic health record (EHR) was perceived as a drawback.

Conclusions: BP telemonitoring in a usual care setting can provide a trusted basis for medication management and improved BP control. It increases patients' engagement in the management of their condition, but supporting telemetry and greater patient engagement can increase professional workloads and demand changes in service organisation. Successful service design in practice would have to take account of how additional roles and responsibilities could be re-aligned with existing work and data management practices

The embedded qualitative study was included in the protocol for the HITS trial registered with ISRCTN no. 72614272.

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Summary

Article Focus

- Qualitative exploration of the experiences of patients and professionals taking part in a randomised controlled trial (RCT) of remote blood pressure (BP) telemonitoring supported by primary care.
- Identification of factors facilitating or hindering the success of the intervention and those likely to influence its potential translation to routine practice

Key Messages

- BP telemonitoring in a usual care setting can provide a trusted basis for medication management and improved BP control.
- It increases patients' engagement in the management of their condition,
- Supporting telemonitoring and greater patient engagement can increase professional workloads and demand changes in service organisation.

Strengths and limitations of this study

The strengths of the study are that it is based on experience of using the systems by the patients' own practitioners in a usual care context. The trial context permitted triangulation with quantitative data. Because the protocol permitted evolution in practice, it gives an indication of some of the issues which would need to be addressed for BP telemonitoring to be used in routine practice. The weaknesses are that participation in the study was relatively short for each practice with limited patient numbers so any longer term barriers to evolution in practice were not identified. It is also possible that participants in this study differ from non-participants.

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Background

Long term illness is increasingly prevalent and telemonitoring (remote self-monitoring of health parameters with electronic transmission of data to a health care provider) is considered to be a promising way of supporting patient care within existing resources.[1] However, despite policy statements and numerous pilots, telemonitoring has not yet been widely adopted.[2] This qualitative study examined patient and professional experiences of BP telemonitoring in the context of an RCT. As an embedded qualitative study its purpose was to help explain the trial results and to generate insights regarding factors likely to influence the adoption of this approach within routine care.

Hypertension (persistently raised BP >140/90 mmHg), is a major cardiovascular risk factor, which is frequently poorly controlled,[3] with evidence of under treatment in many cases, sometimes described as 'therapeutic inertia.'[4] This is despite the availability of guidelines[5,6] or (as in the UK) financial incentives to primary care doctors.[7] In day-to-day practice effective assessment of BP is problematic. Single BP measurements taken in the surgery are poorer indicators of risk than estimates based on multiple measures from ambulatory or home monitoring[8,9,10] and 'white coat hypertension' – raised BP when measured in the surgery, but not at home [11]– is a complicating factor. However, for practical reasons, surgery-based measurements are still the basis of treatment decision making in most cases. Telemonitoring can overcome these measurement issues by allowing patients to take multiple BP readings at home and share them with healthcare professionals in almost real time, potentially providing motivation for improvements in self-care whilst facilitating professional input if necessary. Although we have been unable to identify previous qualitative studies of telemonitoring in hypertension in a usual care setting, some common themes are emerging from qualitative studies where the self-monitoring was either part of a larger intervention such as specialist nursing support or self-management of medication,[12,13]or the patients were simply self-monitoring with no data transmission.[14,15] The common themes were that patients generally find self-monitoring to be a positive experience which is empowering, reassuring and motivational.

The trial which formed the context for this study[16] (see Box 1 for summary of the intervention) involved patients from primary care hypertension registers whose surgery BP measures in the previous 6 months had been > 140/90mmHg, who had a BP higher than 135/85mmHg on daytime ambulatory BP monitoring performed as screening for the trial, and did not have diabetes, previous stroke or transient ischaemic attack, atrial fibrillation or other major illness. It~~and~~ found that for those using telemonitoring, BP reduced by a mean of 4.3/ 2.6 mmHg compared with the group receiving usual care. Other trials in this field also strongly suggest that telemonitoring in hypertension can be effective in achieving clinically important reductions in systolic and diastolic

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BP[17,18] but some studies have shown poorer outcomes.[19] The introduction of telemonitoring may be regarded as a complex sociotechnical intervention involving changes in behaviour in addition to a purely technological solution. It is therefore important to understand how components of the intervention and contextual factors contribute to the outcome.[20] These issues can be difficult to explore using quantitative methods alone[21] and proponents of 'realist evaluation' suggest using qualitative methods to tease out what works in different contexts.[22]The aim of this study, therefore, was to qualitatively explore the experiences of patients and professionals taking part in a trial of BP telemonitoring based in a usual care setting, to identify what contributed to the effectiveness ~~success~~ of the intervention, what limited its effectiveness~~success~~ and what may be required for the success of the trial to be translated into routine care.

Methods

Overview

This study was embedded within an RCT of BP telemonitoring in routine care for patients whose BP was above target[16~~16~~] (Box 1). ~~Patients who had diabetes or previous stroke or transient ischaemic attack were not included as they were asked to take part in separate trials.~~ A qualitative descriptive approach was employed,[23] acknowledging that in health services research the need of the researcher is not simply to provide a description of the phenomenon, but also to produce an interpretive account which will help to guide health care innovation whilst, at the same time, recognising the subjective nature of the encounter between the subject and the researcher.[24]

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Ethics and governance considerations

The study received ethical approval from the South East Scotland Ethics Service (08/S1101/38) and R&D approval from NHS Lothian. Patients were made aware that they may be approached for the embedded qualitative study when they agreed to participate in the trial, but that participation in this study would be optional. Patients and professionals approached were sent a separate information sheet about the qualitative study and signed an additional consent prior to participation.

Sampling and recruitment

Twenty GP practices and 401 patients participated in the RCT. Of these, patients and staff from five socio-economically diverse practices (based on the Scottish Index of Multiple Deprivation[25]) were initially approached to participate in the qualitative study. A sixth practice was added later to increase the number of professionals participating and ensure data saturation. A maximum

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variation patient sample of at least 20 patients overall from these practices was sought based on age, sex, and the deprivation status of the practice. Patients participating in the trial were purposively sampled and checks were made with the practice to ensure that it was still appropriate to approach the patient before they were contacted by letter. Those who did not respond were replaced by patients with similar characteristics. The aim of this sampling strategy was to capture a broad range of patient experiences across the socio-economic spectrum included within the trial.

Data generation and handling

Qualitative data were gathered through semi-structured interviews with patients, nurses and doctors. The initial topic guides were based on issues identified by our previous acceptability study[26]and interviews with patients participating in the trial pilot study. The interview topic guides were refined iteratively in response to the initial interviews. The final topic guides are shown in Appendix 1.Most patients were interviewed face-to-face in their own home, and professionals at their workplace, with interviews carried out by telephone where this was not possible. Most healthcare professionals were interviewed individually, but two nurses were interviewed together, as were three doctors. Interviews were carried out by JU, an experienced female qualitative researcher with a background in education and psychology who was not involved in the RCT.

Data handling and analysis

The data were collected between July 2009 and June 2010 and, with a little variation due to availability, in tranches reflecting different start dates of different practices. Provisional coding and identification of themes took place after each tranche of interviews. Interviewing continued until the researcher, in discussion with the wider research team, considered that data saturation was achieved. Although there is discussion on the concept of data saturation, in the context of this study which was focused and involved a relatively homogeneous population, data saturation was considered to have occurred when the researcher was not identifying any new themes or codes within the provisional themes in sequential interviews, and thought this would be unlikely in subsequent interviews. Detailed re-coding and checking took place from May-December 2010 with the validation focus group taking place in May 2011.

All interviews were recorded, fully transcribed and the transcript checked against the recording. They were analysed thematically with initial codes and themes identified inductively from the data. Patient and professional data were coded separately. Coding was marked on the transcripts using

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the comments facility in Microsoft Word and the text associated with each code stored on an Excel spreadsheet

A range of strategies was employed to ensure that the analysis was credible and trustworthy. Constant comparison was used to ensure consistency in coding and negative cases were sought for each coding category. Coding was checked and iteratively refined using paired analysis of transcripts by two researchers. Researcher reflexivity was supported by discussing emerging findings with the wider research group where different explanations were explored and the coding and thematic analysis reviewed and refined. Following this, the thematic analysis was presented by JH to a discussion group of 21 patients, professionals and researchers who had participated. The presentation introduced the themes and illustrative quotes and the whole dataset (all the text associated with each code) was made available to the participants. This discussion, which lasted for 90 minutes, was moderated by BM, recorded, transcribed and coded. It was used to validate the initial grouping of data into codes and themes, but also to extend the discussion of how telehealth may change the provision of primary care. The coding is shown in Appendix 2.

The themes were grouped into the four overarching themes presented here. The groupings were broadly informed by the purpose of the study and also by the normalisation process model as applied to telehealth, with its constructs of interactional workability, relational integration, skill set workability and contextual integration [27]. Appendix 2 shows the codes, (with the number of text extracts coded against each), and how they have been grouped into themes and overarching themes. Where it was possible to triangulate findings arising from the qualitative data against the quantitative trial data (including~~eg~~ workload impacts, lifestyle change and the impact of telemonitoring compared with simple home monitoring), this was also done. Three overarching themes are presented here. The fourth theme comprised comments about the study and is shown in Appendix 2.

Results

Thirty four patients were approached (28 from the intervention arm and eight from the control arm) and 25 patients (5 from the control arm of the trial) participated. The patient characteristics are shown in Table 1. Eleven practice nurses (all female) and 9 GPs (4 male, 5 female) took part. Five patients from the control group were interviewed because it was possible that their treatment may have been different than usual during the trial. There was no evidence from the interviews that this had happened.

The telemonitoring service employed in this study was novel in that self-monitoring was integrated with usual care. For this reason we present the patient and professional data together here,

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highlighting areas of concordance, divergence and evolution in practice both between and within the professional and patient groups.

The Patient Experience

Patients' accounts of their response to the initial diagnosis of hypertension differed, as did their level of concern and their personal approaches to self-management. Some were not concerned, did not think of their hypertension often and left the management to their doctor or nurse. For others the diagnosis had caused practical problems (e.g. in taking out life insurance) or anxiety, particularly where they had experience of a family member suffering a stroke. Anxiety about what was happening to their BP between appointments had led some to self-monitor their BP prior to this study, and one practice provided patients with a home monitor to use during diagnosis. Contrasting perspectives are illustrated in the quotations below.

> *Oh I just take my tablet. I don't think about it…..I'm not the worrying kind ……I don't see the point in worrying over things.*
>
> *(Patient 1, control group, previous experience of home monitoring with practice monitor)*

> *And I'm conscious of it because what I'm looking to do you do have to have a medical, and blood pressure is one of the key things that they don't want, if you have high blood pressure you're out. So I'm looking to get it down*
>
> *(Patient 20, monitoring group, no previous experience of home monitoring)*

> *I can't remember if they…if I was advised to go and buy a home monitoring machine but I decided to do it anyway……I knew that my blood pressure would be checked every time, regularly at the surgery but certainly twice a year, ……. but until that I would like more information than that.*
>
> *(Patient 4, control group, previous experience of home monitoring with own monitor)*

The differing levels of patient concern about hypertension at the start of the study is clearly a factor which could influence outcomes, but was not something which was directly measured in the trial[16~~16~~].

~~However, it was possible to compare outcomes between the 30% who self-monitored prior to the trial and those who did not (this analysis not included in the published trial results). Although the results were not statistically significant, there was a trend towards a better outcome with telemetry supported home monitoring for those who had monitored their own BP before the trial compared with those who had never previously used a home monitor. In the telemonitoring group the mean~~

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~~reduction in systolic daytime ambulatory BP for those who had used home monitoring before the trial was 7.16mmHg (95% CI 3.67 to 10.64mmHg) compared to those receiving usual care, but amongst those who had never used home-monitoring before the trial, the difference in outcome between those using telemonitoring and the control group in was 2.89 mmHg (95% CI -0.06 to 5.85mmHg). This suggests that patients' concern about their BP was one factor in the success of the intervention. It also suggests that the telemetry and communication with the practice contributed to the outcome rather than just the home monitoring.~~

Patients saw hypertension largely as a lifestyle issue and many tried to ascribe a cause within their lifestyle such as reduced physical activity and stress, although some also mentioned familial tendency to high BP.

> *"I wasn't say like grossly overweight, I wasn't…didn't smoke at all, it was difficult to…I mean I did have a more difficult lifestyle at the time, a lot of commuting, a lot of driving"*
>
> *(Patient 6, monitoring group, no previous experience of home monitoring)*

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Most were aware that lifestyle change could help control BP and had been given advice. Lifestyle advice was received from multiple sources and perceived to be general rather than being targeted at the reasons for them individually developing hypertension.

> *"...a proper balanced diet and not too much fat and all these sort of things. But it's strange if anyone doesn't know about that nowadays"*
>
> *(Patient 17, monitoring group, no previous experience of home monitoring,)*

Some participants had modified their lifestyle prior to the trial in response to the diagnosis of hypertension

> *What I did do [when diagnosed with hypertension] and I've stuck to it, I've cut out salt. I was overweight a few years ago and I cut out butter, so now I don't have butter and I don't have salt. (I) just (use) general knowledge, just tried to reduce salt, reduce weight. And salt brings up your blood pressure so…*
>
> *(Patient 12 monitoring group, no previous experience of home monitoring)*

Some of the patients interviewed had modified their lifestyle during the trial, and considered that the system provided motivation

> *"…. I had lost a stone in weight during the course of that six months as well that I was being on the monitor and I think that did. I think that was a contributory factor to my BP balancing out"*

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(Patient 7, monitoring group, previous experience of home monitoring with practice monitor)

"When I was taking the blood pressure I couldn't bear looking at a hundred and forty, a hundred and fifty over a hundred and ten and I wanted to just be able to see better readings in a way. So over the summer as well, starting to get more walking exercise, that kind of thing…. I didn't want beta blockers because they had various side effects which…….. I kind of felt the conventional medicine options were maybe a bit limited in terms of what I wanted out of it or in terms of avoiding side effects, so it did spur me on to look for alternative…"

(*Patient 2, monitoring group, no previous experience of home monitoring,)*

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"So I like having the machine there because it prompts me, and I've done things like I've done some exercise and then I've taken my blood pressure to see whether it has made an impact, and it did, it does, every time."

(Patient 20 monitoring group, no previous experience of home monitoring,)

However, many others were aware of the need for lifestyle change but found it too difficult to implement .

"….obviously I'm overweight, I'm trying to do something about that but it just doesn't happen".

(Patient 4, control group, previous experience of home monitoring with own monitor)

The quantitative results of the trial[16,16] did not show any significant changes to lifestyle variables relating to diet, exercise or medication adherence in either the intervention or control groups. However, closer examination of the trial data did show that in both groups a small number of individuals (10 overall) had, as described by Patient 7, lost more than 1 stone (6.5Kg) in weight.

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Using the system increased some patients' engagement with the medical management of their hypertension. They used it to negotiate treatment and, in a very small number of cases, titrate their own medication.

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"It's certainly given me more meaningful data to speak to the doctor rather than, "Well, I think my BP has probably gone up." "

(Patient 6, monitoring group, no previous experience of home monitoring)

"…I've got 16 milligrams and eight milligrams [tablets of antihypertensive drug] and the last time I saw Dr B he said; the maximum you can have is 32. Well what I probably could do is go and see the nurse and say can I take it upon myself to move it up to 32 by taking another eight"

(Patient 19, monitoring group, no previous experience of home monitoring)

These data suggest that the interaction between patient and doctor or nurse facilitated by the telemetry is important rather than just the home monitoring. This is supported by trial data where it was possible to compare outcomes between the telemonitoring group and control group for the 30% of patients who had self-monitored prior to the trial (this analysis was not included in the published trial results). Within this group, those randomised to telemonitoring had a mean reduction in systolic daytime ambulatory BP of 7.16mmHg (95% CI 3.67 to 10.64mmHg) compared to those receiving usual care.

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Generally, both patients and professionals thought the increased patient engagement in BP management was beneficial.

"Yes. I really thought that it (system)was a brilliant idea. And it has helped me a lot, to understand more"

(Patient 6, monitoring group, no previous experience of home monitoring)

"…the positive thing about it was it definitely helps patients to become much more involved in their care which is a good thing and they definitely take much more interest in it I think because they're measuring it, they can see it, you know it's much more real to them I think"

(Practice Nurse 9)

However, a note of caution was sounded, again by both patients and professionals, that for a small number of people home monitoring could provoke anxiety

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"I felt it was intrusive. I started worrying about my BP"

(Patient 12 monitoring group, no previous experience of home monitoring,)

"….and then you've got others; 'Oh, I feel a bit ill today, I'll better check my BP'... and I think that that's the danger of home monitoring, I think people can become obsessed with it..."

(Practice Nurse 6)

Although both patients and professionals raised the issue of anxiety generated by home monitoring, it was a much stronger theme amongst the professionals. It was only raised by one patient during the interviews, but several professionals. This accords with our previous telehealth work where there is considerable concern amongst professional about the possibility of telehealth putting patients in a 'sick role' and making them dependent or anxious, but this concern is not widely echoed by patients[28],[29] .

Using the telemonitoring system

The simple telemonitoring system used in this study generally worked well, although some design issues were highlighted as described below. Generally, patients had little difficulty measuring their BP, transmitting their readings or finding a routine for measuring their BP. Some also accessed the on-line record of their readings. However, the wording of the automated feedback messages sent by the system to was not found to be valuable although the messages in themselves did remind some patients to maintain their engagement with the system.

"it's the same message from presumably a machine [laughs] which doesn't help a lot. Because it's obviously coming from a machine and it tells me have I contacted my medical practice or nurse, which I have but it doesn't seem to know that, you see? "

(Patient 9, monitoring group, previous experience of home monitoring with practice monitor)

The main clinical advantage provided by the system was that that it facilitated management of BP using average BP, based on multiple readings taken at home, which was seen by both patients and professionals as a more trustworthy basis for action than single BP measurements taken in the surgery. Both patients and professionals commented that, prior to the system being introduced, there were sometimes long delays in initiating appropriate treatment in people with less markedly raised BP, driven by reluctance by healthcare staff to prescribe medication which may not be

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absolutely necessary. The data from the patients who were not in the intervention group suggested that, for them, medication changes remained infrequent and this was supported by the trial data[16].

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> *"[prior to the trial]… you have a BP maybe 148 over 88, you might say 'let's see you again in six months', when actually it's too high"* *(Practice Nurse 10)*

> *"[prior to the trial] …We're all guilty of it…'we'll just see how it goes, you know, maybe watch it. I'll check it again tomorrow' and they probably maybe sit on it a bit longer than they…it's just a natural thing isn't it"* *(Practice Nurse 9)*

> *"…and this patient in particular has been quite reluctant to increase the medication because of her belief that her high BP is just a temporary thing because of what's going on her life…she doesn't think that she should be on medication at all"* *(Practice Nurse 11)*

There was consensus between both patients and professionals that the home monitoring system provided a more accurate assessment of BP than surgery measurements and better evidence for action, facilitating rapid tailoring of medication.

> *"you're getting a more accurate insight into true BP readings'"* *(Practice Nurse 6)*

> *"Well I tried everything. I had it on the table, I had my arm on a pillow and I was trying to relax as much as I could, but there's no way you're going to cheat the machine so it's… it is a good thing like. You cannot kid yourself on with it"*
>
> *(Patient 6, monitoring group, no previous experience of home monitoring)*

One consequence of the professionals now feeling that they had an ongoing accurate estimate of the patient's average BP was to raise new questions about what to do if it BP was near, but not at, the target.

> *"The only problem I had with it in a way is these people that were coming up as uncontrolled who were one millimetre above the control level. And I just thought, oh come on, are you really going to add in another drug to bring this down from 81 to 80?"*
>
> *(GP1)*

For healthcare staff the main practical issue with the system was the lack of integration of the BP data with the main patient electronic records and the fact that not all members of the healthcare team regularly accessed the online system and were able to see the patient-recorded readings. This caused problems when patients consulted with other members of the team.

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"…So they're coming in to see the doctor, the doctor takes their BP, one forty five ninety; 'oh, that's fine, what are you worried about?' ... And then you go and you look at it the next week and you think; they've seen the doctor and yet their BP's still really high"

(Practice Nurse 11)

The trial thus flagged wider implementation issues such as the need for reconfiguration of work practices to accommodate new roles, and ensure synergies across a more distributed care team, as well as more integrated access to patient data from disparate data sources.

Adjusting to new responsibilities and new ways of working

The new service and increased patient engagement challenged organisation within practices. Professionals reported that monitoring the electronic data, increased patient contact and the need for more rapid decision making raised workloads. The consensus was that a nurse-led service would be the best model, but monitoring the system needed to be an acknowledged part of the practice nurses' role with regular formal time set aside for an electronic clinic. Not all practices succeeded in monitoring the electronic data regularly throughout the trial. The trial data confirmed the increased workload with patients in the telemonitoring group having, on average, two additional consultations with the practice (one with the GP and one with the practice nurse, half of which were by telephone) over the 6 months of the trial compared to the control group.[1616]

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Care had traditionally been face- to- face, but continuing to use this model to try to respond quickly to the telemetry data had its frustrations.

"We would phone them and say your BP's up, we need to increase your medication or you need to come in and see someone … And they never made appointments and then we had to phone them again and say 'You've still not made an appointment, are you coming in?"

(Practice Nurse 3)

Some professionals began to change how they worked, reducing reliance on face-to-face contact with the patients. Telephone contact increased although it was also found to be a time consuming way of reaching patients who were frequently not available during working hours.

"I feel like I'm phoning these patients all the time. If they can't get them in and you'rehaving to leave a message then you're going to have to leave a message in the book to make sure they've got the message. You're checking to see if they've picked up a prescription because

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you're then checking their blood pressure - it's still high - 'Have they taken their medication?' You're phoning them… "

(Practice nurse 4)

There was some experimentation in using email with appropriate safeguards and, although only a small number were involved, this worked well.

"…I got an email from the doctor every week from the readings and he was able to advise me without me having to visit the doctor.

(Researcher…. how did you feel about that?)

Well I was quite happy with that. I thought that was great. It was very time saving for me.

(Researcher: Ahah. So you find the time saving aspect then very useful?)

Oh, yes, yes definitely. No effort making appointments, you just got an automatic email every week. They give suggestions and like '"Take more of the tablet's. 'Take less of the tablets'" and that's how it went until I got a good reading regularly, good readings".

(Patient 7, monitoring group, previous experience of home monitoring with practice monitor)

Some patients also changed the way they accessed services because they now knew what they wanted e.g. bypassing the practice nurses and going directly to the GP because they thought the nurse could not prescribe a change in medication.

When the data were presented for validation to a discussion group of patients, professionals and researchers, it is this theme, of adapting to new roles and responsibilities, which dominated the discussion. Echoing the themes presented above, patients in the discussion group emphasised the role of telemetry-enabled home monitoring as being motivating, an incentive to improve self-care and evidence which facilitated meaningful conversation and dialogue with professionals. However, despite having been presented with the qualitative data on increased professional workloads and contact with patients (the figures from the trial were not available at that point), they thought that in the longer term home monitoring should lead to a reduction in the need for surgery attendance which would be appreciated by patients. The need for clarity in roles (what the patient was

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expected to do and what the practice was expected to do) was emphasised.

Discussion

Both patients and clinicians participating in this study considered that a measurement based on the average of multiple readings from the home monitoring system was trustworthy and could be used as a basis for action. Although patients generally saw hypertension as a lifestyle issue and were aware of lifestyle interventions, only a few achieved significant lifestyle changes during the trial and some were from the control group. However, the system was described by patients as a motivator to achieve BP control and the instantly available, shared and trusted reading facilitated more rapid tailoring of medication. This was partially driven by patients who increased their engagement with the medical management of their condition, initiating contacts and negotiating treatment, and partially by the healthcare professionals who contacted people with unsatisfactory readings. The cost to the practices of achieving improved BP control was increased patient contacts and workloads for professionals during the trial (where all participants had uncontrolled BP at the start). However, when this outcome was discussed with patients and professionals they expressed the view that in the longer term the system could reduce the need for surgery visits. There was an example of this where one patient described asynchronous communication with the practice in the form of email which resulted in tailoring of medication without the need for frequent phone calls and surgery visits.

Prior to the intervention, patients differed in their levels of concern about their hypertension and there was an acknowledgement not all patients would respond to telemonitoring in the same way.~~and some already owned home monitors and there was a trend within the trial data for those who already used home monitors to show greater improvement in their BP. This is consistent with the health beliefs model of behaviour[30] where perceived severity of the condition is one of the factors influencing health behaviour.~~ Some clinicians were concerned that, for a small number of people, monitoring and increased engagement in the medical management of their hypertension may have provoked anxiety or dependency. This was echoed by one patient although generally increased engagement seen to be a positive change by both patients and clinicians.

Within the practices, doctors and nurses found that traditional ways of working, which prioritises face to face consultations and where there may be split responsibilities for BP monitoring and anti-hypertensive prescribing, may not easily support the increased patient engagement or rapid treatment adjustment that successful telemonitoring requires and there was some evolution of

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working practices during the study. A lack of integration of telemonitoring data with the patients' electronic records also limited multi-disciplinary working within the practices. The acceptance by professionals that they had an accurate estimate of the patients' BP raised questions about the best management when BP was near the recommended level which was not covered in the guidelines available at the time.

The strengths of the study are that it is based on real experience of using the systems and, because the protocol permitted evolution in practice, it gives an indication of some of the issues which would need to be addressed for BP telemonitoring to be used in routine practice. These include integrating of telemonitoring data with the electronic patient record, enabling communication channels between patients and professionals which are rapid and efficient for both, implementing inter-professional working practices which support rapid tailoring of medication and additional clinical guidance. The review by Mair et al[31] on factors affecting the success of telehealth implementations chimes with many of these, as do earlier qualitative studies such as May et al[32]. Feedback from participants and triangulation with trial data add weight to these interpretations. However, practices were only involved in the trial for a short period (about 8 months) and evolution of practice to meet the needs of patients who are telemonitoring could be limited by factors which have not yet been identified. It is also possible that both patients and practices who agree to participate in a trial may differ in some way from those who choose not to participate, and thus not all opinions about telemonitoring may have been captured. A request to seek opinions about telemonitoring from those who did not want to participate in the trial was declined by the Ethics Committee. A weakness of the study was that triangulation data showing the effectiveness of the intervention amongst those who already owned a home monitor was only received after the end of data collection and the opportunity was lost to interview more of this group and more systematically investigate what they considered that telehealth added to their home monitoring.

No direct comparators to this qualitative study, which examined telemonitoring provided in a usual care context, have been found. The HITS trial[16], which was the context for this study, showed that patients using telemonitoring in their usual primary care setting had a greater reduction in BP than the control group. Patients found the equipment easy to use and the measurements easy to understand. This was similar to experience reported in other studies with effective interventions incorporating telemonitoring such as TASMINH2,[13] and differed from a recent US based study where difficulties in using the system were reported[33] and the effect was much smaller.[18] System design (hardware, software and the associated guidance and support) clearly has a part to play, and providing the service via the patient's usual practitioners, rather than as a separate stand-alone service, may have also helped in terms of patient support. There is also a possibility that some of the

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usability issues may be related to the populations involved. In the US study issues with poor literacy were identified[33,28] whereas, although the population for the trial which underpinned this study[16,16] was drawn from across the spectrum of social privilege and deprivation in Scotland, this was not a concern raised at any point. In some of the trials of larger interventions incorporating BP telemonitoring[12,12,18,17,19,18], it is hard to unravel the impact of the telemonitoring from the impact of the rest of the intervention. This study, and the trial outcome, suggests that the telemonitoring itself can overcome some of the barriers to improved BP control. The added value of the additional interventions such as pharmacist support[12] or medication self-management plans[18,17] needs to be determined. Interestingly, the qualitative study associated with a trial which included telemonitoring and medication self-management suggested that although many participants would be happy to continue with the telemonitoring, few would be happy to continue with the medication self-management plans.[13,13].

The consensus amongst the professionals interviewed was that a nurse-led monitoring service would be most appropriate, but some patients perceived that nurses could not prescribe the changes to medication which the patients thought they needed. This could be a limiting factor on the efficiency of the service. The legislative and training framework for independent nurse prescribing has been established in Scotland [34] but the number of nurse prescribers is still very limited, although growing.[35]Increasing nurse prescribing in long-term conditions may be key to providing the organisational infrastructure to maximize the efficiency of this model of telemonitoring. Integration of the telemonitoring data with electronic patient records would also be essential; patients are free to consult with other members of the primary health care team and expect their BP data to be available. Further consideration needs to be given to the workload issues for the practices involved. The trial did increase their workloads[16,16], but the discussion group considered that telemonitoring could reduce the need for practice visits in the longer term. This raises the question of whether telemonitoring should be a short or longer term intervention. A model where initial professional surveillance of BP gives way to patient self monitoring once control is established, should be investigated.

In conclusion, this qualitative study indicates that in a UK context BP telemonitoring in a usual care setting can provide a trusted basis for medication management and improved BP control. It increases patients' engagement in the management of their condition, but professional time for supporting telemetry support and greater patient engagement can increase workloads and demand changes in service organisation. However, if these issues are overcome, BP telemonitoring could be an effective tool in the management of hypertension.

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Contributions and Declaration

Contributors: Brian McKinstry, Janet Hanley and Claudia Pagliari designed the study. Janet Hanley and Brian McKinstry led the research. Jenny Ure collected the data and led the analysis. Aziz Sheikh provided advice throughout the trial. All authors were involved in writing the paper.

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Competing interests: All authors have completed the Unified Competing Interest form atwww.icmje.org/coi_disclosure.pdf (available on request from the corresponding author) and declare: no support from any organisation for the submitted work; no financial relationships with any organisations that might have an interest in the submitted work in the previous 3 years; no other relationships or activities that could appear to have influenced the submitted work

All authors had full access to all of the data in the study and can take responsibility for the integrity of the data and the accuracy of the data analysis.

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Box 1 Description of the telemonitoring intervention

The intervention

The practices and patients were asked to use a system which comprised a validated electronic home BP monitor and mobile phone technology that enabled the transfer of BP readings via SMS to a secure website which was accessible to the user and their doctor or nurse, and also provided automated feedback to the patient. The BP monitor linked to a mobile phone wirelessly, via Bluetooth. The components of the intervention were:

Home BP monitoring: Patients were asked to record their BP as agreed with the healthcare team, or more frequently as they wished. Guidance was initially to record BP twice in the morning and twice in the evening for a week in line with the European guideline on BP monitoring , to build a baseline average. Thereafter, they were asked to take weekly measurements preferably at different times of day if their average BP was within the recommended range, but if they had made any lifestyle or medication change which would impact on their BP, they were asked to measure their BP for a more intensive period of monitoring to allow the rolling average to change and to more quickly assess the effect.

Transmission of data: This simply required the phone to be switched on and to have a signal when the BP measurement was taken. Patients just had to apply the cuff and press a button on the BP monitor. The reading and transmission occurred automatically. Mobile phone problems did not lead to loss of data because all readings were stored in the monitor and any untransmitted readings were sent when the next reading was taken.

Feedback to patients (closed loop feedback): In addition to optionally accessing their BP record on-line, patients could also opt to receive reports via text message or email. These gave advice on the current status of their BP based on the average of the last 10 readings, and whether they should contact their doctor or nurse. Reports were generated every 10 readings or weekly, whichever was sooner, with a reminder to check BP if this had not been done. These reports could reassure them that their average BP was within target (<135/85mmHg)or tell them that their BP average was improved on the last report but not yet to target and to maintain current therapy, or that their BP was not at target and that they should contact their clinician. If an individual BP reading was very high (>220/120mmHg) an immediate text or email report was generated reinforcing the written advice in the patient information leaflet to rest for 30 minutes, check again and contact the practice if BP remained very high.

Sharing the readings with the healthcare team: Members of the healthcare team were able to access the records of their patients online via a secure login to a summary screen which listed their patients, their average BP over the last 10 readings, and the date of their last reading. Average BPs outside the recommended limits (set at 135/85mmHg for the study) were highlighted. Clicking on the each individual patient led to lists or graphs of all their readings. Clinicians could then check the patients' electronic GP record to see if there had been recent advice regarding medication or lifestyle change and if not, could contact the patient to make a change. Clinicians were recommended to check the website weekly, but the frequency of log-on could be chosen by them.

Usual Care

Patients allocated to the usual care group were asked to continue to attend the practice for BP checks according to the usual routine of the practice. If they were already home monitoring they were not discouraged from continuing.

All patients

For all patients the GP/practice nurse were informed that the ambulatory monitoring used to screen for eligibility for the HITS trial had shown that their average BP was above the target range, but they were not given the actual reading. All patients were given an information pack containing a range of publicly available leaflets on hypertension management and lifestyle modification.

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What This Paper Adds

The trial which formed the context for this paper shows that BP telemonitoring integrated into hypertension patients' usual primary care primary care provision can lead to improvements in management. However, it is a complex social intervention and the qualitative literature on BP telemonitoring, which is mainly based on trials where the telemonitoring is only part of a larger intervention, or there is little involvement of the usual care provider, does not explain why telemonitoring in this context is effective, or what may be required for the success of the trial to be translated into routine care.

This study showed that both patients and professionals were reluctant to increase medication based on single BP measurements taken in the surgery. The telemonitoring measurements based on multiple readings were perceived as being more accurate and there was a willingness to act on them. Patients using telemonitoring became more engaged in the management of their condition. Professionals found that telemonitoring increased their workloads, and some changes in working practices were needed to support it effectively.

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Table1. Patient details

Patient	Sex		Age			Group		Deprivation level of practice		
	M	F	<50	50-69	70+	Monitoring	Not monitoring	Least deprived	Mixed	Deprived
1		X			X		X			X
2	X		X			X			X	
3	X			X		X				X
4	X			X			X		X	
5	X				X	X				X
6	X			X		X			X	
7		X		X		X				X
8	X			X			X		X	
9	X		X				X			X
10		X		X		X			X	
11	X				X	X		X		
12	X			X		X			X	
13	X			X		X		X		
14		X			X	X			X	
15		X			X	X		X		
16		X		X		X			X	
17	X				X	X		X		
18		X			X	X		X		
19	X				X	X		X		
20	X		X			X		X		
21		X			X		X	X		
22	X		X			X		X		
23		X	X			X			X	
24		X			X	X		X		
25	X			X		X				X

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APPENDIX 1: Topic Guides for interviews with the healthcare team and patients

Nurse/GP Topic Guide v2.

Experience of using the system
- how they use it/ find it?
- day to day management
- problems/concerns
- technical issues?
- clinical issues?
- organisational issues?

Impact on how BP managed by care team
- has it changed management of BP
- communication with care team
- changes to medication
- adherence to treatment regime
- impact of feedback
- workload
- re-organisation

Impact on how BP managed by patients
- how they use it
- changes in way they see /manage their condition
- anxiety / reassurance/ control/passive/active/self-care
- impact of feedback on
- medicalisation (e.g. some patients found the monitoring made them focus too much on being ill, and not enough on being well)

Implications for use in practice

Patient Topic Guide + Prompts v.2

Non-monitored and Monitored Groups

Experience of the screening process
- own monitor?
- impact?

How they manage their BP / feel about managing it
- day to day management
- do they comply or not with advice and if so why / why not
- anxiety
- adherence to regime/lifestyle and drug ttmnt
- sense of control
- have they changed the way they see /manage their condition/if so why

Experience of managing BP with monitor/ without monitor
- technical
- clinical
- personal (anxiety; reassurance)
- organisational

What advice given
- what did they think of advice given
- other factors in lifestyle that might affect this
- what were they told by GP or nurse / what did they understand? do they see it differently?
- do they feel that suggestions are not appropriate for them? Why?

Have views of/ approaches to management changed since first diagnosis / if so why
- information/advice
- readings
- opportunities to change
- other factors – e.g. life events, illness, GP advice

How they feel about it / want to deal with it

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impact on lifestyle
sense of control / anxiety/ reassurance
inconvenience

Additional Themes for Monitored group

Describe how they use it in practice
Experience of how nurse/doctor has used it
Perceived impact?
onQoL?
on seeking help?
on care
onself care/self management?
facilitate passive or active control
on understanding of BP
on communication with care team
on appointments.
Perceived benefits
Perceived problems
Which groups would benefit from it in particular?

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Appendix 2 Themes/subthemes

The thematic headings are derived from the indicator codes.

Overarching Theme	**Themes/subthemes :patient interviews** The frequency of occurrence of codes is given as a number *Coded to more than 1 theme	**Themes/ subthemes: Nurses and doctors** The frequency of occurrence of codes is given as a number, in brackets the number of interviews in which it occurred, and an indication of how many of these were with a nurse or a GP.	**Themes/ subthemes: Discussion group**
The patient experience	**Diagnosis** (Routine check up / out of the blue 4,Diagnosis in relation to other study 1) **Perceptions of causes / triggers for high bp** (Stress/work stress 4, Weight/lack of exercise 2, Genetics 1, Smoking 2) **Experience of care** (Positive perception of usual care 5, Advice (helpful/vague/negative/excessive) 6, Organisation of medication 3*) (also coded as more rapid organisation of medication in using the system) **Impact (of diagnosis) on self care/ lifestyle 26** (Carried on as usual/ BP checks/ medication 12,Trigger for Change In Lifestyle 7(Starting to/trying to make changes 5,impact on work prospects motivate change2,medication routine 3,complies with medication/ self monitors due to fear of stroke 4),Barriers to lifestyle changes 3 (Other conditions 1, Hard to find the motivation 1, Knowing what but not how 1)) **Greater awareness 24** (Greater awareness/ greater acceptance of problem 4*,Readings prompt /challenge/ reinforce change 3*,Basis for understanding own patterns/ causes in own lifestyle 8*,Awareness of variation in context	**Concerns about medication/ putting off taking action 8 (1GP3N)** **Patient compliance** (Barriers (to compliance)13 (2GP7N), General lack of compliance in patients 3(1GP 2N),Other issues a priority 1N,lack of Motivation 1(1N),Compliance tails off 1N,General (Work, Holiday) 3(1GP2N)) **Readings/monitoring help patient buy in to treatment 12 (3GP4N)** **Positive patient experience 7(2gp2n) (**Patient Perception of Better Service 2(2GP),They like it/like being monitored 3(1gp1N,)They USE it 1(1GP),They avoid unnecessary visits to GP 2(1GP1N),Good outcomes for patients 1(1N)) **Readings prompt/empower patients to take a more active role 14(3gp3n)** **Readings can provide reinforcement (1N)** **Readings /reminders can generate anxiety 9(1GP3N)**	**Perceptions of tele monitoring (**For self (IT not reqd),For others (IT reqd.)) **Telemonitoring as incentive (**Somebody watching, Motivating in sense that data is being looked at, Sense of obligation, Enhances compliance, Poor TM compliance can be flag for non-compliance in other areas (medic.),Example of compliance that led to control, and subsequent reduction in drugs) **T.monitoring as evidence (**Evidence facilitates meaningful conversation and dialogue)

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	5,Variation between home/surgery 3, Interest in variation 1) **Readings can be reassuring and/or intrusive & anxiety provoking 6** **(**Sometimes worrying 4) **Readings as evidence /empower patients 4**		
Using the telemonitoring systemetry service	**Training** (sufficient 2, more needed 3) **Usability** (Generally straightforward to use 9,Setting up an easy routine with set time& place 4,Usability for older patients/ dexterity/ familiarity with IT 2,Communication/reminder issues 5 **(**Messaging error1,messages can be alarming, not encouraging 3,messages could be more encouraging/less negative 1)Cuff 5 **(**Fine/no problem 3,Query tightness 1**,** cuff reinflation 1),Mobile phone straightforward (exc. for minor issues) 5(Switching on and off 1,Easy and interesting 1,Transmission failure 2,Signal failure 1) **24 hour monitoring intrusive uncomfortable 3** **Difficulty understanding readings 1** **STANDARD VS.INDIVIDUAL MODELS 4** (Need for individual benchmark 1,Need to consider variation over time 3)	**Initial workload getting to grips with system 8(2GP4N)** (Messy & Time-consuming 3(1GP;3N),Initially anxious about it 2(1GP;1N), Aligning monitoring process with other clinical processes / Lack of data interoperability with other clinical systems 3 (2GP 1N)) **Rethinking data management process 4(2GP2N)** **Usability/Technical/ training issues** (Ease of use 8(2GP3N), Easy for most people 6(1GP2N), Harder for some older, and or anxious patients 2(1gp1n), Mobile monitoring kit 9(1gp3n)(Calibration 1(1N),Charging(PATIENT) 5(2N), Transmission Problems (Unknown Unknowns) 1GP) Website 11(3gp3n) (Monitoring screen 2(1gp1n),Lack of intuitive graphs diagrams for use in surgery context 1GP,Icons 1GP,Limited use/awareness of options 1N,Time constraints limited use 2(1N1GP)) Messaging can create anxiety 4(1gp3n)) **Dealing with technical problems 10(3gp4n) (**No problems/few problems /quickly sorted 7(2GP3N),Supportive IT help 2N**,** Learning by doing1N) **Set up and training 6(1GP4N) (**Set up and training positive 2(1GP),Potential of sharing training/setup info with nurses & patients 4(4N)) **Better evidence 6(1gp3n)**(More accurate understanding (e,g, white coat hypertension) 2(2N),Better detection 2(1GP1N), Better evidence for understanding and treating individuals 2(2N), Faster control of bp to target	

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		13(2GP2N)More intensive treatment 5(2GP3N),Faster cycling through barriers to treatment 2(2GP),More successful focus on reaching target 8(2GP2N)) **Tension between standard and individual ltargets 14** (Target very tight /cost benefit issues)11(3GP3N,)Standard vs individual approaches to cv risk 3(1GP1N))	
Adjusting to new ~~roles and~~ responsibilities and new ways od working	**Rethinking roles/relationships in shared care 9** (Rethinking patient role/responsibility in shared care 3, More effective gp: patient relationship 1, Changing patient:nurse (or gp) roles: 4, Changing nurse:gp roles 1) **Supports different models of self care 14(**Changes made to lifestyle (standard) 7,Changing lifestyle (alternative) 3,More awareness/knowing what is happening 1,Saves time on appointments 2,Control 1) **Views of use** 7***(** would be best for monitoring For a period of instability 1,would prefer Automatic monitoring1, Delighted to continue – will miss it 2, Interesting – but interest tailing off 1, Mixed Feelings 1,Reassurance 2)	**Increased frequency of contact with patients 8(4GP4N)** (More communication 1N, More frequent contact /better relationship 2(1GP 1N), More frequent contact /worse relationship (2GP), More frequency but not more time-consuming (1N), No Impact (1GP)) **Appropriateness of monitoring for different groups. 15(4GP4N)** (Patients who will use it 'sensibly' not obsessively 1 (1N),Proactive/educated patients 1(1GP,)Anyone who wants it/can benefit from it 5(3GP1N,)Uncontrolled hypertensives 1(1GP),Type 2 diabetics 1(1GP),Motivated groups 2(1GP1N),Not patients with complex conditions/other conditions 1(1N),Not elderly/with cognitive, mobility/anxiety problems 2(1GP1N), Need flexibility to exclude/alter who participates (1GP),Don't Know (1GP). **Increasing empowerment or dependence? 5(1GP4N)** (Self monitoring not self management (Increasing Dependence) 2(2N), Using reminders to prompt/manipulate patient compliance 2(2N), Balancing reminders against intrusion 1(1GP)) **Enabling factors 7(1GP3N)** (Having a routine 2N,Feel Someone Checking Up (1GP),Being made to feel Special (1GP),Unknown 4(1GP1N)) **Rethinking roles and processes in shared care 31 (**Lack of clarity of/ commitment to roles 4(2N), Reconfiguring roles of GPs and nurses	**T. Monitoring as reducing need to attend surgery** (Bridges barriers to visiting GP (distance, work, parking, travel),Benefit is not having to go to surgery,Some patients don't got to surgery anyway) **T.monitoring as streamlining the process** (Speed /currency of patient data sharing, T. Monitoring as a Means of Overcoming Misconceptions and Selective Reporting, T.Monitoring as Cheap in Comparison with Cost of Treatment/Other systems) **Perceived benefits of t.monitoring** (Positive experiences from most patients) **Perceived problems with t.monitoring** (Some patients complained they were not contacted, Perceived lack of Integration of services, Only niggles, Continuity of care, Impact on workload (Phoning; lack of ring-fenced time), Lack of clarity on roles) **Reconfiguring roles / workload** (Telephoning time-consuming,Different way of working, Dedicated time needs to be set aside, Some nurses pro-actively asked for ring fenced time, In some practices it wasn't integrated, making it difficult to manage)

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		12(4N),Role of gp(compliance/ non-compliance with protocol) 8(3N),Role of nurse (negotiating ring fenced time for monitoring) 3(2N)) **Nurse:patient roles (communication) 7(2GP4N)** (Clarifying communication roles/ responsibilities 5(GPfoc.4N),Developing a shared understanding of readings 1(1N)) **Rethinking communication processes 8(3GP2N)** (Benefits of email-based communication 4(1GP1N),Constraints of phone communication 1(1N),Risks of phone communication 1 (1GP)) **Impact on/factors in workload 46** (Workload / anxiety following up patients who don't respond16(5GP6N), Finding time as a key barrier 7(6N1GP), Workload impacted by patient numbers/ stage/ compliance 6(2GP 6N), Workload impacted by practice work (flu/busy spells/bloods) 3(1GP2N), Workload impacted by need to download + document readings 2(1GP1N), Workload impacted by lack of clarity /compliance with role 4(4N), No impact (1GP), We forgot about it (1GP)) **Scalability issues 4 (1GP2N)** **Administrative problems of patients moving to other practices (1N)**	**Reconfiguring roles/ communicating new roles clearly** (Patients unclear who to contact/who does what -nurse or GP,Patients need to be advised what new roles are,Roles could be made clear by a surgery 'menu,'Protocols agreed/integrated in policy/ not always agreed/ integrated in practice **Reconfiguring roles/gp& nurse care role** Nurse prescribing would take pressure off GPS/be quicker, Nurse prescribing (instead of GP) implies need for patient culture shift, Doctors taking broader picture (not ticking boxes), Doctors more likely to discuss balance of risks with patients,Literature from Royal Pharm. Soc. In 1990's on GP and patient negotiation) **Impact on practice**(Varied across surgeries,Changed practice in some surgeries,Benefits dependent on practice, managementImpact on medical inertia) **Annotation /eannotation as a basis for understanding/ explaining/ discussing** (Patients often annotate on paper to identify causes, Diary linked to mobile phone is an annotation option for some, Annotation provides basis for explanation to self, Annotation provides basis for discussion with GP) **Optimal use of tm** (Most useful in first few weeks/months to achieve BP control)Workload and use both tail off after first few weeks/months **Lessons learned from the study (care process;data process)**

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			Business models **Concerns re service implementation /using nhs24/at scale**(Fear of phoning NHS 24 in case end up in hospital , as not usual care team,Lack of continuity of care staff militates against use (Also an issue in large practices),Lack of integrated services limits usability (eg call service to pharmacy services),May be successful if shared with the patient record
The study	**Overall perception of service/study 23** **Useful/helpful/ worthwhile/interesting 9** **Delighted to continue – will miss it2** **Interesting – but interest tailing off 1** **recruitment: too much literature 2**	**Good study 5(2gp3n)** **Hits nurses/team were great 2 (2n)** **A window on the future 2(2gp)** **Non-monitored patients disappointed 1n**	**Trial design** **T.monitoringvs home monitoring** **Queries about added value of tm** **Reconfiguring care_paradigm shift** (Two separate systems running uncomfortably in parallel, Slow transition)

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R Relevance of study question	To explore the experiences of patients and professionals taking part in a randomised controlled trial (RCT) of remote blood pressure (BP) telemonitoring supported by primary care. To identify factors facilitating or hindering the success of the intervention and those likely to influence its potential translation to routine practice.
A Appropriateness of qualitative method	Qualitative study adopting a qualitative descriptive approach
T Transparency of procedures	
Sampling	
Is the sampling strategy appropriate?	Twenty five patients, 11 nurses and 9 doctors who were participating in an RCT of BP telemonitoring. A maximum variation sample of patients based on age, sex, and deprivation status of the practice was sought.
Recruitment	
Was recruitment conducted using appropriate methods?	Patients participating in the trial were purposively sampled and checks were made with the practice to ensure that it was still appropriate to approach the patient before they were contacted by letter. Those who did not respond were replaced by patients with similar characteristics.
Is the sampling strategy appropriate?	
Could there be selection bias?	Thirty four patients were approached (28 from the intervention arm and eight from the control arm) and 25 patients (5 from the control arm of the trial) participated.

	The patient characteristics are shown in Table 1. Eleven practice nurses (all female) and 9 GPs (4 male, 5 female) took part. Non-participation in the interviews was mainly due to difficulty in arranging a suitable time
Data collection	
Was collection of data systematic and comprehensive?	Interview guide provided
Are characteristics of the study group and setting clear?	Table 1 gives description of each patient
Why and when was data collection stopped, and is this reasonable?	Data saturation
Role of researchers	
Is the researcher(s) appropriate? How might they bias (good and bad) the conduct of the study and results?	Interviews were carried out by JU, an experienced female qualitative researcher with a background in education and psychology who was not involved in the RCT
Ethics	
Was informed consent sought and granted?	Patients were made aware that they may be approached for the embedded qualitative study when they agreed to participate in the trial, but that participation in this study would be optional. Patients and professionals approached were sent a separate information sheet about the qualitative study and signed an additional consent prior to participation

Were participants' anonymity and confidentiality ensured?	Patients identified by number
Was approval from an appropriate ethics committee received?	The study received ethical approval from the South East Scotland Ethics Service (08/S1101/38) and R&D approval from NHS Lothian.

S Soundness of interpretive approach

Analysis

Is the type of analysis appropriate for the type of study? • *thematic:* exploratory, descriptive, hypothesis generating • *framework:* e.g., policy • *constant comparison/grounded theory:* theory generating, analytical • Are the interpretations clearly presented and adequately supported by the evidence?	All interviews were recorded, fully transcribed and the transcript checked against the recording. They were analysed thematically with initial codes and themes identified inductively from the data.
Are quotes used and are these appropriate and effective?	Appendix 2 shows the codes, (with the number of text extracts coded against each), and how they have been grouped into themes and overarching themes.
Was trustworthiness/reliability of the data and interpretations checked?	Constant comparison was used to ensure consistency in coding and negative cases were sought for each coding category. Coding was checked and iteratively refined using paired analysis of transcripts by two researchers. Researcher reflexivity was supported by discussing emerging findings with the wider research group where different explanations were explored and the coding and thematic analysis

	reviewed and refined. Following this, the thematic analysis was presented by JH to a discussion group of 21 patients, professionals and researchers who had participated. The presentation introduced the themes and illustrative quotes and the whole dataset (all the text associated with each code) was made available to the participants. Where it was possible to triangulate findings arising from the qualitative data against the quantitative trial data (eg workload impacts), this was also done
Discussion and presentation	
Are findings sufficiently grounded in a theoretical or conceptual framework? Is adequate account taken of previous knowledge and how the findings add?	The themes were grouped into the four overarching themes presented here. The groupings were broadly informed by the purpose of the study and also by the normalisation process model as applied to telehealth, with its constructs of interactional workability, relational integration, skill set workability and contextual integration. Additional theoretical perspectives are considered in the discussion
Are the limitations thoughtfully considered?	Strengths and limitations explicitly described and discussed
Is the manuscript well written and accessible?	
Are red flags present? These are common features of ill-conceived or poorly executed qualitative studies, are a cause for concern, and must be viewed critically. They might be fatal flaws, or they may result from lack of detail or clarity.	

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APPENDIX 1: Topic Guides for interviews with the healthcare team and patients

Nurse/GP Topic Guide v2.

Experience of using the system

- how they use it/ find it?
- day to day management
- problems/concerns
- technical issues?
- clinical issues?
- organisational issues?

Impact on how BP managed by care team

- has it changed management of BP
- communication with care team
- changes to medication
- adherence to treatment regime
- impact of feedback
- workload
- re-organisation

Impact on how BP managed by patients

- how they use it
- changes in way they see /manage their condition
- anxiety / reassurance/ control/passive/active/self-care
- impact of feedback on
- medicalisation (e.g. some patients found the monitoring made them focus too much on being ill, and not enough on being well)

Implications for use in practice

Patient Topic Guide + Prompts v.2

Non-monitored and Monitored Groups

Experience of the screening process
- own monitor?
- impact?

How they manage their BP / feel about managing it
- day to day management
- do they comply or not with advice and if so why / why not
- anxiety
- adherence to regime/lifestyle and drug ttmnt
- sense of control
- have they changed the way they see /manage their condition/if so why

Experience of managing BP with monitor/ without monitor
- technical
- clinical
- personal (anxiety; reassurance)
- organisational

What advice given
- what did they think of advice given
- other factors in lifestyle that might affect this
- what were they told by GP or nurse / what did they understand? do they see it differently?
- do they feel that suggestions are not appropriate for them? Why?

Have views of/ approaches to management changed since first diagnosis / if so why
- information/advice
- readings
- opportunities to change
- other factors – e.g. life events, illness, GP advice

How they feel about it / want to deal with it

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impact on lifestyle
sense of control / anxiety/ reassurance
inconvenience

Additional Themes for Monitored group

Describe how they use it in practice
Experience of how nurse/doctor has used it
Perceived impact?
onQoL?
on seeking help?
on care
onself care/self management?
facilitate passive or active control
on understanding of BP
on communication with care team
on appointments.
Perceived benefits
Perceived problems
Which groups would benefit from it in particular?

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Appendix 2 Themes/subthemes

The thematic headings are derived from the indicator codes.

Overarching Theme	Themes/subthemes :patient interviews The frequency of occurrence of codes is given as a number *Coded to more than 1 theme	Themes/ subthemes: Nurses and doctors The frequency of occurrence of codes is given as a number, in brackets the number of interviews in which it occurred, and an indication of how many of these were with a nurse or a GP.	Themes/ subthemes: Discussion group
The patient experience	**Diagnosis** (Routine check up / out of the blue 4,Diagnosis in relation to other study 1) **Perceptions of causes / triggers for high bp** (Stress/work stress 4, Weight/lack of exercise 2, Genetics1, Smoking 2) **Experience of care** (Positive perception of usual care 5, Advice (helpful/vague/negative/excessive) 6, Organisation of medication 3*) (also coded as more rapid organisation of medication in using the system) **Impact (of diagnosis) on self care/ lifestyle 26** (Carried on as usual/ BP checks/ medication 12,Trigger for Change In Lifestyle 7(Starting to/trying to make changes 5,impact on work prospects motivate change2,medication routine 3,complies with medication/ self monitors due to fear of stroke 4),Barriers to lifestyle changes 3 (Other conditions 1, Hard to find the motivation 1, Knowing what but not how 1)) **Greater awareness 24** (Greater awareness/ greater acceptance of problem 4*,Readings prompt /challenge/ reinforce change 3*,Basis for understanding own patterns/ causes in own lifestyle 8*,Awareness of variation in context	**Concerns about medication/ putting off taking action 8 (1GP3N)** **Patient compliance** (Barriers (to compliance)13 (2GP7N), General lack of compliance in patients 3(1GP 2N),Other issues a priority 1N,lack of Motivation 1(1N),Compliance tails off 1N,General (Work, Holiday) 3(1GP2N)) **Readings/monitoring help patient buy in to treatment 12 (3GP4N)** **Positive patient experience 7(2gp2n) (**Patient Perception of Better Service 2(2GP),They like it/like being monitored 3(1gp1N,)They USE it 1(1GP),They avoid unnecessary visits to GP 2(1GP1N),Good outcomes for patients 1(1N)) **Readings prompt/empower patients to take a more active role 14(3gp3n)** **Readings can provide reinforcement (1N)** **Readings /reminders can generate anxiety 9(1GP3N)**	**Perceptions of tele monitoring (**For self (IT not reqd),For others (IT reqd.)) **Telemonitoring as incentive (**Somebody watching, Motivating in sense that data is being looked at, Sense of obligation, Enhances compliance, Poor TM compliance can be flag for non-compliance in other areas (medic.),Example of compliance that led to control, and subsequent reduction in drugs) **T.monitoring as evidence (**Evidence facilitates meaningful conversation and dialogue)

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	5,Variation between home/surgery 3, Interest in variation 1) **Readings can be reassuring and/or intrusive & anxiety provoking 6** **(**Sometimes worrying 4) **Readings as evidence /empower patients 4**		
Using the telemonitoring system	**Training** (sufficient 2, more needed 3) **Usability** (Generally straightforward to use 9,Setting up an easy routine with set time& place 4,Usability for older patients/ dexterity/ familiarity with IT 2,Communication/reminder issues 5 **(**Messaging error1,messages can be alarming, not encouraging 3,messages could be more encouraging/less negative 1)Cuff 5 **(**Fine/no problem 3,Query tightness 1**,** cuff reinflation 1),Mobile phone straightforward (exc. for minor issues) 5(Switching on and off 1,Easy and interesting 1,Transmission failure 2,Signal failure 1) **24 hour monitoring intrusive uncomfortable 3** **Difficulty understanding readings 1** **STANDARD VS.INDIVIDUAL MODELS 4** (Need for individual benchmark 1,Need to consider variation over time 3)	**Initial workload getting to grips with system 8(2GP4N)** (Messy & Time-consuming 3(1GP;3N),Initially anxious about it 2(1GP;1N), Aligning monitoring process with other clinical processes / Lack of data interoperability with other clinical systems 3 (2GP 1N)) **Rethinking data management process 4(2GP2N)** **Usability/Technical/ training issues** (Ease of use 8(2GP3N), Easy for most people 6(1GP2N), Harder for some older, and or anxious patients 2(1gp1n), Mobile monitoring kit 9(1gp3n)(Calibration 1(1N),Charging(PATIENT) 5(2N), Transmission Problems (Unknown Unknowns) 1GP) Website 11(3gp3n) (Monitoring screen 2(1gp1n),Lack of intuitive graphs diagrams for use in surgery context 1GP,Icons 1GP,Limited use/awareness of options 1N,Time constraints limited use 2(1N1GP)) Messaging can create anxiety 4(1gp3n)) **Dealing with technical problems 10(3gp4n) (**No problems/few problems /quickly sorted 7(2GP3N),Supportive IT help 2N**,** Learning by doing1N) **Set up and training 6(1GP4N) (**Set up and training positive 2(1GP),Potential of sharing training/setup info with nurses & patients 4(4N)) **Better evidence 6(1gp3n)**(More accurate understanding (e,g, white coat hypertension) 2(2N),Better detection 2(1GP1N), Better evidence for understanding and treating individuals 2(2N), Faster control of bp to target	

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		13(2GP2N)More intensive treatment 5(2GP3N),Faster cycling through barriers to treatment 2(2GP),More successful focus on reaching target 8(2GP2N)) **Tension between standard and individual ltargets 14** (Target very tight /cost benefit issues)11(3GP3N,)Standard vs individual approaches to cv risk 3(1GP1N))	
Adjusting to new responsibilities and new ways od working	**Rethinking roles/relationships in shared care 9** (Rethinking patient role/responsibility in shared care 3, More effective gp: patient relationship 1, Changing patient:nurse (or gp) roles: 4, Changing nurse:gp roles 1) **Supports different models of self care 14(**Changes made to lifestyle (standard) 7,Changing lifestyle (alternative) 3,More awareness/knowing what is happening 1,Saves time on appointments 2,Control 1) **Views of use** 7***(** would be best for monitoring For a period of instability 1,would prefer Automatic monitoring1, Delighted to continue – will miss it 2, Interesting – but interest tailing off 1, Mixed Feelings 1,Reassurance 2)	**Increased frequency of contact with patients 8(4GP4N)** (More communication 1N, More frequent contact /better relationship 2(1GP 1N), More frequent contact /worse relationship (2GP), More frequency but not more time-consuming (1N), No Impact (1GP)) **Appropriateness of monitoring for different groups. 15(4GP4N)** (Patients who will use it 'sensibly' not obsessively 1 (1N),Proactive/educated patients 1(1GP,)Anyone who wants it/can benefit from it 5(3GP1N,)Uncontrolled hypertensives 1(1GP),Type 2 diabetics 1(1GP),Motivated groups 2(1GP1N),Not patients with complex conditions/other conditions 1(1N),Not elderly/with cognitive, mobility/anxiety problems 2(1GP1N), Need flexibility to exclude/alter who participates (1GP),Don't Know (1GP). **Increasing empowerment or dependence? 5(1GP4N)** (Self monitoring not self management (Increasing Dependence) 2(2N), Using reminders to prompt/manipulate patient compliance 2(2N), Balancing reminders against intrusion 1(1GP)) **Enabling factors 7(1GP3N)** (Having a routine 2N,Feel Someone Checking Up (1GP),Being made to feel Special (1GP),Unknown 4(1GP1N)) **Rethinking roles and processes in shared care 31 (**Lack of clarity of/ commitment to roles 4(2N), Reconfiguring roles of GPs and nurses	**T. Monitoring as reducing need to attend surgery** (Bridges barriers to visiting GP (distance, work, parking, travel),Benefit is not having to go to surgery,Some patients don't got to surgery anyway) **T.monitoring as streamlining the process** (Speed /currency of patient data sharing, T. Monitoring as a Means of Overcoming Misconceptions and Selective Reporting, T.Monitoring as Cheap in Comparison with Cost of Treatment/Other systems) **Perceived benefits of t.monitoring** (Positive experiences from most patients) **Perceived problems with t.monitoring** (Some patients complained they were not contacted, Perceived lack of Integration of services, Only niggles, Continuity of care, Impact on workload (Phoning; lack of ring-fenced time), Lack of clarity on roles) **Reconfiguring roles / workload** (Telephoning time-consuming,Different way of working, Dedicated time needs to be set aside, Some nurses pro-actively asked for ring fenced time, In some practices it wasn't integrated, making it difficult to manage)

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		12(4N),Role of gp(compliance/ non-compliance with protocol) 8(3N),Role of nurse (negotiating ring fenced time for monitoring) 3(2N)) **Nurse:patient roles (communication) 7(2GP4N)** (Clarifying communication roles/ responsibilities 5(GPfoc.4N),Developing a shared understanding of readings 1(1N)) **Rethinking communication processes 8(3GP2N)** (Benefits of email-based communication 4(1GP1N),Constraints of phone communication 1(1N),Risks of phone communication 1 (1GP)) **Impact on/factors in workload 46** (Workload / anxiety following up patients who don't respond16(5GP6N), Finding time as a key barrier 7(6N1GP), Workload impacted by patient numbers/ stage/ compliance 6(2GP 6N), Workload impacted by practice work (flu/busy spells/bloods) 3(1GP2N), Workload impacted by need to download + document readings 2(1GP1N), Workload impacted by lack of clarity /compliance with role 4(4N), No impact (1GP), We forgot about it (1GP)) **Scalability issues 4 (1GP2N)** **Administrative problems of patients moving to other practices (1N)**	**Reconfiguring roles/ communicating new roles clearly** (Patients unclear who to contact/who does what -nurse or GP,Patients need to be advised what new roles are,Roles could be made clear by a surgery 'menu,'Protocols agreed/integrated in policy/ not always agreed/ integrated in practice **Reconfiguring roles/gp& nurse care role** Nurse prescribing would take pressure off GPS/be quicker, Nurse prescribing (instead of GP) implies need for patient culture shift, Doctors taking broader picture (not ticking boxes), Doctors more likely to discuss balance of risks with patients,Literature from Royal Pharm. Soc. In 1990's on GP and patient negotiation) **Impact on practice**(Varied across surgeries,Changed practice in some surgeries,Benefits dependent on practice, managementImpact on medical inertia) **Annotation /eannotation as a basis for understanding/ explaining/ discussing** (Patients often annotate on paper to identify causes, Diary linked to mobile phone is an annotation option for some, Annotation provides basis for explanation to self, Annotation provides basis for discussion with GP) **Optimal use of tm** (Most useful in first few weeks/months to achieve BP control)Workload and use both tail off after first few weeks/months **Lessons learned from the study (care process;data process)**

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			Business models **Concerns re service implementation /using nhs24/at scale**(Fear of phoning NHS 24 in case end up in hospital , as not usual care team,Lack of continuity of care staff militates against use (Also an issue in large practices),Lack of integrated services limits usability (eg call service to pharmacy services),May be successful if shared with the patient record
The study	**Overall perception of service/study 23** **Useful/helpful/ worthwhile/interesting 9** **Delighted to continue – will miss it2** **Interesting – but interest tailing off 1** **recruitment: too much literature 2**	**Good study 5(2gp3n)** **Hits nurses/team were great 2 (2n)** **A window on the future 2(2gp)** **Non-monitored patients disappointed 1n**	**Trial design** **T.monitoringvs home monitoring** **Queries about added value of tm** **Reconfiguring care_paradigm shift** (Two separate systems running uncomfortably in parallel, Slow transition)

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