



Simple telehealth in primary care: what do patients think?

Journal:	<i>BMJ Open</i>
Manuscript ID:	bmjopen-2012-001392
Article Type:	Research
Date Submitted by the Author:	27-Apr-2012
Complete List of Authors:	Cottrell, Elizabeth; Keele University, Arthritis Research UK Primary Care Centre Chambers, Ruth; NHS Stoke on Trent, McMillan, Kate; Furlong Medical Practice,
Primary Subject Heading:	Cardiovascular medicine
Secondary Subject Heading:	General practice / Family practice, Qualitative research
Keywords:	PRIMARY CARE, Hypertension < CARDIOLOGY, Telehealth, Patient experience, Text message

SCHOLARONE™
Manuscripts

Peer review only

Simple telehealth in primary care: what do patients think?

Elizabeth Cottrell, Kate McMillan, Ruth Chambers

E Cottrell, Arthritis Research UK Primary Care Centre, Primary Care Sciences, Keele University, Staffordshire, ST5 5BG, UK

Dr E Cottrell NIHR Academic Clinical Fellow in GP Specialty Training

K McMillan, Furlong Medical Practice, Tunstall, Stoke on Trent

Dr K McMillan Foundation Year 2 Doctor, General Practice placement

R Chambers, NHS Stoke on Trent Clinical Commissioning Group, Herbert Minton Building, 79 London Road, Stoke on Trent ST4 7PZ

Dr R Chambers Clinical director of practice development & performance

Correspondence to: Dr E Cottrell ecottrell@doctors.org.uk, 140 Lichfield Road, Stone, Staffordshire, ST15 8PY

Abstract

Objective. To determine the patient experience of using a simple telehealth strategy to manage hypertension in adults.

Design. As part of a pragmatic service evaluation, the acceptability of, satisfaction with and ease of use of a simple telehealth strategy was determined via text, telephone, case studies, discussion groups and informal feedback from practices. This simple telehealth approach required patients to take home blood pressure (BP) readings and text them to a secure server ('Florence') for immediate automatic analysis and individual healthcare professional review.

Participants. 124 intervention patients who used the Florence system.

Setting Ten volunteer GP practices in Stoke on Trent, UK, with poor health and high levels of material deprivation took part.

Results Patient satisfaction was high. In particular, patients found the system easy to use, were very satisfied about the feedback from their GP regarding their BP readings, found the advice sent via Florence useful and preferred to send BP readings using Florence rather than having to go to the practice monthly to get BP checked. Overall satisfaction with the system was 4.81/5.00 at week 13 of the programme. Other advantages of being enrolled with Florence were improved education about hypertension, a greater feeling of support and companionship and flexibility which allowed self-care to occur at a time that suited the patient rather than their practice.

Conclusions This simple telehealth strategy for managing hypertension in the community was met with high levels of patient satisfaction and feelings of control and support. This management approach should thus be considered for widespread implementation for clinical management of hypertension and other long term conditions involving monitoring of patients' bodily measurements and symptoms as a large number of meaningful readings can be obtained from many patients in a prompt, efficient, interactive and acceptable way.

Keywords. primary health care, hypertension, telehealth, patient experience, text message

Article Summary

Article Focus

- Home BP readings are a valuable source of information upon which clinical management decisions can be made and are acceptable to patients
- Although studies have shown that patients are receptive to the idea of simple telehealth strategies for managing BP and that they respond well to text messages, details of the patient experience when actually using simple telehealth in this way is lacking.

- This paper examines the experiences of and feedback from intervention patients who used an innovative interactive simple telehealth strategy to monitor and manage their hypertension.

Key messages

- Patients find that simple telehealth is a flexible, convenient, easy to use and acceptable means of them jointly managing their hypertension with a responsible health professional
- The interactive nature of such a simple telehealth strategy provides support and companionship for some patients and builds their confidence in their health and wellbeing
- Patients are supportive of wider use of this technology in the future for hypertension and other long term conditions.

Strengths and limitations of this study

- As this is a service evaluation, the results obtained accurately reflect actual use of the technology in the clinical setting
- Due to the fact this was a service evaluation, not all patients provided feedback using all the means employed, therefore there may be some missing data

Introduction.

Hypertension is common and carries the risk of great morbidity and mortality. Current management strategies are not adequately controlling this significant problem and new and innovative means of diagnosing and managing hypertension are required. For the best part of the last century the concept of home BP readings to improve the accuracy of measurement and prevent inappropriate treatment of white coat hypertension has been recognised. However the early machines utilised were not reliable and useful readings were limited. (1) Twenty years ago, Aylett (1) outlined that patients became more actively involved in their care with self BP monitoring, compared with ambulatory BP monitoring. Ten years ago a literature review concluded that home BP measurements using automated devices are equivalent to ambulatory readings taken into health settings. (2) The programme evaluated here for patient acceptability and satisfaction brings these historic ideas about improving blood pressure management into the present day. Utilising an electronic sphygmomanometer, to obtain home BP readings, patients text their results into a secure server ('Florence') and receive immediate automated feedback regarding any required further actions, based upon the level of the reading. This is an innovative system that allows 'closed loop' management in the main, i.e. automatic responses, however individualised patient management is provided from the patient's own healthcare professional who reviews their BP recordings weekly, or more frequently if indicated. Clinically, this type of clinical management strategy has a number of benefits; it allows multiple readings, and thus meaningful averages to be calculated, from patients in their own environment, collected at any time of the day or night. Thus personal, social or occupational factors need not be barriers to accessing prompt and effective care for hypertension.

1
2
3 Florence had not been used in this healthcare setting prior to undertaking this programme,
4 although local pilot work for other conditions resulted in positive healthcare professional and
5 patient anecdotal feedback. However, previous work by other groups have suggested that
6 this innovative system was likely to be well accepted by patients. In 2003, when availability
7 of home electronic sphygmomanometers was relatively new, Rickerby et al (3) reported that
8 home BP measurements were easy to obtain with little or no formal training and are
9 acceptable for certain patients, particularly those who wish to accept responsibility for the
10 management of their hypertension as it facilitates more regular BP monitoring than could be
11 realistically possible if measurements were only obtained in the clinical setting. Bostock et al
12 (4) investigated the acceptability of the concept of remote management of BP using mobile
13 phones among healthcare professionals and patients and discovered that patients were
14 generally welcoming to this approach provided that reassurances and action strategies were
15 in place should high readings be returned. Further, Liew et al (5) demonstrated that receipt
16 of text messages resulted in behaviours equivalent to conventional (direct 1:1 telephone)
17 reminder systems, thus supporting the use of interactive text message feedback both from
18 Florence and the healthcare professionals reviewing the readings.
19
20
21

22 This paper reports the qualitative findings of a service evaluation undertaken in primary care
23 to determine the acceptability and levels of patient satisfaction with the use of a simple
24 telehealth intervention for monitoring BP. (6)
25
26

27 **Method.**

28
29 This paper describes the qualitative feedback obtained as part of a service evaluation of the
30 implementation of an innovative simple telehealth strategy for managing hypertension, the
31 results of which on the management of BP are described in an accompanying paper. (6) The
32 telehealth strategy used was innovative as it employed the use of home electronic BP
33 measurements and mobile phones so that patients could text their BP results to a secure
34 server ('Florence') for automatic assessment and immediate response according to the level
35 of BP received and personalised, human review of results at least weekly, by the patient's
36 usual primary healthcare team for advice on further management and changes (e.g. to
37 medication) that are required. Patients were enrolled to use Florence for 3 months, or a
38 shorter period if they became, or were found to be, normotensive.
39
40
41

42 Qualitative information on patient satisfaction, ease of use of Florence and acceptability of
43 this management strategy was obtained using a variety of means. Patients received two
44 questions monthly (week 4, 8 and 12) via text throughout their time using the system. These
45 were 'It is easy to use the Florence system to record my blood pressure' and 'I am satisfied
46 with the feedback from my GP about my blood pressure as a result of using the system'.
47 Patients were required to respond using a 5 point Likert scale (1 = strongly disagree, 2 =
48 disagree, 3 = neither disagree/agree, 4 = agree, 5 = strongly agree). At week 13 patients
49 were texted a further question to answer using a satisfaction score of one to five, 'how
50 satisfied are you with your experience of using the Florence system to manage your blood
51 pressure?'
52
53

54 At least two patients per practice were contacted by telephone by practice staff to complete
55 a questionnaire which, using a Likert scale as above, enquired about the patients' attitudes
56 to ease of use of Florence, satisfaction with feedback from GP or practice nurse, usefulness
57
58
59
60

1
2
3 of advice from Florence, preference of using Florence compared to monthly BP reviews at
4 their general practice.

5
6 When patients stopped using Florence they were contacted by practice staff to enquire
7 about their reasons for stopping, their experiences of using Florence and the likelihood that
8 they would get involved in a similar project in the future should one be available for other
9 health conditions. Length of time of using Florence and problems experienced using the
10 system were also noted as appropriate.

11
12 An overview of the patient experience of using Florence is summarised from all of the above
13 means of feedback and responses from practice staff. Feedback has then been summarised
14 according to topic.

15 16 17 **Results.**

18
19 This service evaluation analysed data from 124 patients intervention patients. At the point of
20 final data collection, eight patients had not completed six months on the programme; of
21 those who had, 19 were still using Florence. The average length of use of Florence was 78
22 days (median 87 days).

23
24 In total, 95 patients were sent the monthly questions via Florence, of which, 76% responded
25 to at least one question. Nine of these patients stopped using Florence before completing
26 three months so did not get sent week 12 and 13 questions. Sixty-three patients provided
27 feedback via the questionnaire administered by practice staff over the telephone. Average
28 time between recruitment and administration of the questionnaire among these patients was
29 5.2 months (range 1 to 9 months). Twenty-four people participated in discussion groups. (7)

30
31 Patient feedback about the programme was collected from 82 patients. Forty patients left the
32 programme by choice and 42 left because their BP was found to be, or became, controlled
33 within the normotensive range. Of the 40 patients who were classified as leaving the
34 programme by choice, 17 left because they had completed the allocated three months, four
35 because they were unable to devote the required time or were not in the country to
36 undertake the programme, three left due to struggling to use or having limited access to a
37 mobile phone, two patients preferred review by the doctor face-to-face, two patients left their
38 GP practice, two felt unable to relax enough to take their own BP themselves, one patient
39 only wanted to use it short term, one could not access Florence, one misunderstood that the
40 programme should have continued and one was advised by secondary care to have their BP
41 monitored at the hospital. Of the remaining six patients two patients reported that they did
42 not want to continue with the programme anymore but gave no specific reasons and no
43 explanation was provided for four patients.

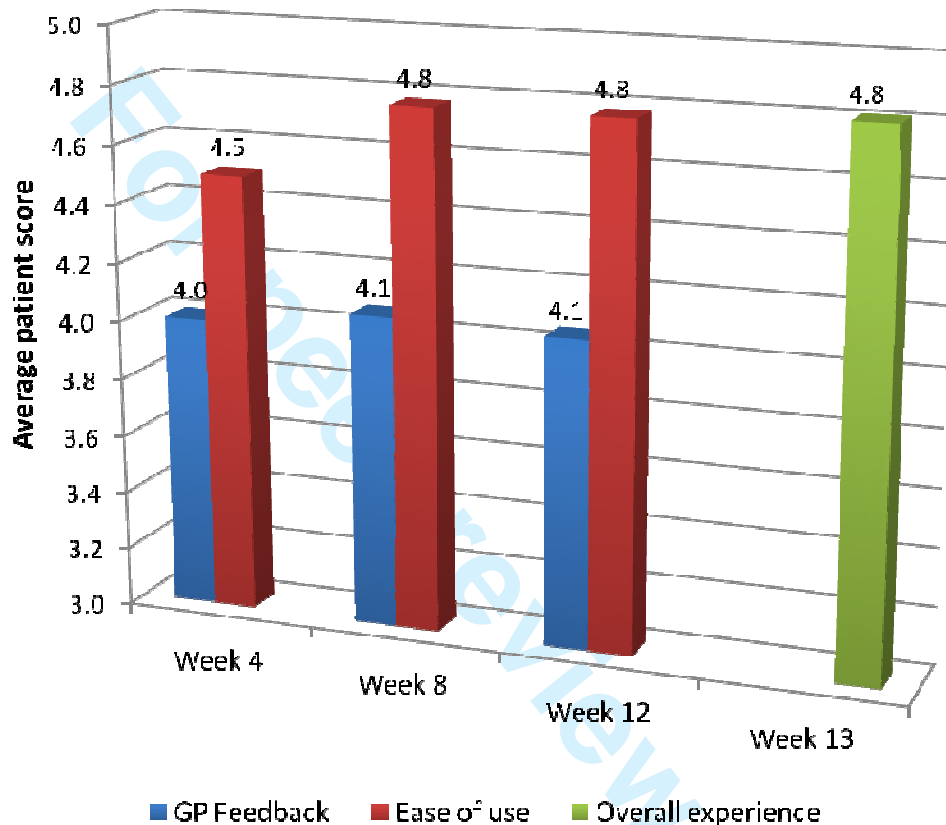
44 45 46 **Patients found Florence easy to use**

47
48 The statement 'It is easy to use the Florence system to record my blood pressure' was
49 posed on a number of occasions using a five-point Likert scale (1 = strongly disagree, 3 =
50 neither disagree/agree, 5 = strongly agree), and at each stage, results were favourable.
51 Average scores out of a maximum of 5.00, from months one, two and three of the
52 programme were 4.49, 4.77 and 4.78, respectively, see Figure 1. An average score of 4.79
53 was obtained using the questionnaire over the telephone and, among patients who left the
54 programme a score of 4.31 was obtained from those leaving through choice and 4.71 from
55 those who left due to being normotensive. Further, a number of patients offered the overall
56
57
58
59
60

1
2
3 feedback that the system was 'easy to use' and they had 'no problems' implementing it and
4 the feedback from discussion groups was that it 'seemed to be easy to use'. (7)
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60

For peer review only

Figure 1: Average patient satisfaction scores for feedback from GP/practice nurse, ease of use of the Florence system and the overall experience of using Florence (1 = strongly disagree, 3 = neither disagree/agree, 5 = strongly agree)



Patients were satisfied with the feedback they obtained through Florence

The statement 'I am satisfied with the feedback from my GP about my BP as a result of using the Florence system' was also asked multiple times using a the same five-point Likert scale as above. Again, results were positive. Average scores out of a maximum of 5.00, from months one, two and three of the programme were 4.04, 4.07 and 4.05, respectively, see Figure 1. An average score of 4.53 was obtained using the questionnaire over the telephone and, among patients who left the programme a score of 4.14 was obtained from those leaving through choice and 4.53 from those who left due to being normotensive.

This satisfaction does not appear to be one-sided, an indicator that this route of service provision is satisfactory to healthcare professionals and promotes efficiencies in care is highlighted by the following: '[A doctor involves recalls that she] had just finished texting her instructions to a patient informing him that he would need a prescription following his blood pressure result – she took the prescription out to reception within five minutes of sending the message, and he was already standing there waiting for the prescription, having jumped into his car and driving to collect it!'

'Self-care' that suits the patient rather than the surgery

A key benefit highlighted by patients and fed back by practices was the flexibility proffered by the Florence system. BP readings could be taken and submitted at any time of the day or night. This assisted patients who may be at risk of 'white coat' hypertension. (8) One man, who exited the Florence system due to his BP becoming controlled, stated that home BP readings were beneficial as he was 'less stressed, more disciplined' and he 'learned how BP was affected by...work and was much lower at weekends - he could then tell how to look after his BP better'. Similarly, one patient 'was delighted by the fact that he could communicate with his GP without the necessity of travelling to the surgery...he often had to tackle rush hour traffic...to attend...his appointment and felt that he was not in a sufficiently relaxed state to have his BP taken when he'd completed that battle'. The theme of being more 'relaxed' or 'less anxious' when taking home BP and submitting them to Florence was repeated by a number of patients.

Further, Florence also suited patients whose lifestyles conflict with attending GP surgeries. For example one patient who 'doesn't get up until the afternoon' sent in multiple readings in the middle of the night. Elderly patients who rely on others to transport them to the GP surgery were 'delighted not to have the inconvenience of attending surgery for the blood pressures to be taken'. Carers benefited from this flexibility also; 'a 59 year old male who lives with and cares for his 84 year old father...he felt very happy and felt that someone is looking after him...without him coming to the surgery...he hadn't been into the surgery since November and rarely comes in due to caring full time for his father'.

Florence provided reassurance for patients with uncertain diagnoses of hypertension

Although patients without confirmed hypertension did not meet our 'specific' inclusion criteria for this project, this was a service evaluation and these patients were recruited for clinically appropriate reasons and gained significant benefit from being involved. For example, 25 patients with high clinic systolic BP readings at recruitment used Florence and discovered they had normal home readings, without making any changes to their medication, so could be reassured and discharged from the system. This reassurance was positively noted by some of the patients themselves who fed back 'no treatment needed – reassuring...long term monitoring gives a better picture', reassuring to monitor in home environment' and 'reassured no problem'. Such use of Florence represents an extension to the current National Institute for Health and Clinical Excellence (NICE) recommendations for 24 hour ambulatory or home monitoring of BP to determine a diagnosis of hypertension. (8)

Reinforces care and advice from primary healthcare team

Florence was noted to reinforce health messages from the primary healthcare team and lead to control of hypertension among patients who had previously been difficult to manage. Someone in the discussion group fed back 'my partner was struggling with his blood pressure, and telehealth has made a world of difference'. (7) Patients specifically commented on liking 'to see BP reading and be aware that it is normal'. Another discussion group member commented that telehealth 'helped me to learn to live with the disease and become more involved in monitoring my own health'. (7) This involvement and knowledge about BP readings and the significance of the result obtained promoted a new attitude of compliance with management of their hypertension among certain patients. For example, one patient who had previously stopped his own medication had been strongly counselled about the dangers of his uncontrolled BP continued to have significant hypertension. He

1
2
3 joined the Florence system and gained better control of his BP, practice staff reported that
4 'he could take his BP at home, where the readings would be done in a less stressful
5 situation...the process has helped his understanding of his condition...it does seem to be a
6 combination of the nurse's firm advice, and Florence's routine readings that have combined
7 to stabilise his condition'. A similar situation was noted in another patient 'the system has
8 highlighted just how high her BP actually is'. The intensive nature of Florence made one
9 patient feel 'he had a strong support from his GP and that it was a really worthwhile
10 illustration of the quality of NHS service'.
11
12

13 A few patients fed back that being involved in the programme prompted them to find out
14 more about 'blood pressure', educated them about the relevance and interpretation of the
15 BP values and highlighted the importance of good BP control. '[A 25 year old male] found
16 the scheme helped him to understand more about the importance of keeping his BP under
17 control especially with regards to his ongoing kidney problems'. 'A 73 yr old male...on the
18 whole felt that [being involved in the programme] had helped him to understand his BP and
19 control a bit better.' '[A 60 year old female] found that using this system helped her
20 considerably as she was more relaxed plus she found the accompanying literature very
21 helpful and it prompted her to research further about hypertension on the internet, therefore
22 increasing her understanding.' One patient highlighted their ability to continue to can still
23 exert their autonomy despite improved understanding of the condition 'once information
24 became knowledge I understood my disease. Then I had a choice: should I do something
25 about it or not – it was my choice'.
26
27
28

29 Florence also helped to promote more comprehensive management of high risk patients,
30 such as 'a 25 year old male...noted to have proteinuria at his new patient check
31 and...BP...145/84mmHg. Over time he was noted to have persisting proteinuria with mid
32 stream urine samples negative for infection. He had a history of gout and associated anti-
33 inflammatory drug use. [Blood tests revealed] creatinine 275, urea 11.7 and eGFR 25 [so he
34 was diagnosed with] CKD Stage 4. Following referral to nephrology he was found to have
35 small kidneys and signs of longstanding CKD...he was advised that he needed good BP
36 control and was invited to join the Florence programme...He was not on any BP medication
37 at baseline (the new patient check) but was started on amlodipine by nephrology soon
38 afterwards. Having previously not self-monitored his BP, while involved in this programme he
39 monitored it twice per week and found the texts useful as they reminded him to take his BP'.
40
41
42

43 **Florence was a companion to patients**

44 An unexpected role that Florence was found to fulfil was of companionship of the patients it
45 serves. 'A 67 year old lady was very happy with using Florence – she said that when she
46 finished using the system she missed the contact and felt that she had "lost a friend"'. Other
47 indicators of this role of Florence were that patients reported 'that using the system gave her
48 a sense of comfort to have the feedback from the GP to reassure her that she was managing
49 her condition very well' and 'as getting texts from Flo has given him a break in his daily
50 routine, as it feels that he has someone to talk to'.
51
52

53 **Few problems were encountered**

54 Problems using the simple telehealth system were identified among only a few patients.
55 Among patients who chose to leave the programme by choice, six had problems sending or
56 receiving text messages using Florence and one reported having a problem taking their own
57 BP, but this was due to them being 'too anxious'. Among the six patients who had problems
58
59
60

1
2
3 sending or receiving text messages, one patient was texting in words, not numbers, got
4 frustrated as submissions were not recognised and left the programme, one reported not
5 being 'a technical person', two patients required other family members to text in readings,
6 one reported not being able to access the Florence system and the final patient only had
7 problems returning messages from survey questions, rather than BP readings. Among
8 patients who left the programme with controlled BP, four reported problems sending or
9 receiving text messages using Florence and one had a problem taking their own BP due the
10 resultant effects of having a previous stroke. Of the four patients who reported problems
11 sending or receiving text messages, two had problems initially transferring readings but after
12 further advice had no problems thereafter, one patient reported having incongruous
13 responses after submitting readings and one patient reported a problem but gave no
14 explanation. Another patient also reported getting conflicting advice, they were 'told by
15 phone that BP's okay but had to contact surgery regarding medication'.

16
17
18
19 Some patients fed back that multiple messages a day prompting them to submit readings
20 and providing advice was a little excessive. However, this was balanced by another patient
21 who stated that they 'felt at first that taking BP each day was a bit much but soon realised
22 the benefits and could not fault it'.

23
24 Focus group discussions among patients also highlighted that this type of service would not
25 be suitable for all patients, especially those with limited cognitive abilities. They also
26 suggested that older people may not manage to use a mobile phone or other equipment,
27 however, this is not a universal problem as patients up to the age of 86 years used the
28 system.

31 **Simple telehealth and the future**

32 Among the 40 patients who left the programme by choice, an average score of 3.71/5.00
33 was obtained in response to the statement 'I would be interested in using this type of
34 programme in the future for this or another type of health problem'. A score of 4.52 was
35 obtained (from a five-point Likert scale where 1 = strongly disagree and 5 = strongly agree)
36 in relation to the same question among the 42 patients who left the programme with
37 controlled BP.

38
39
40 Further evidence of a positive attitude towards future use of a similar programme was
41 obtained when patients were asked to respond to the statement 'I prefer to send daily BP
42 readings via Florence rather than having to go to my doctors surgery to get my BP checked
43 monthly', an average score of 4.19 was obtained.

44
45
46 Positive attitudes among patients for utility of simple telehealth in the future were underlined
47 by feedback from the discussion groups. This highlighted the areas in which patients felt that
48 telehealthcare may be of value in the future. Such uses include monitoring of other chronic
49 conditions such as renal, heart, respiratory conditions and diabetes and certain 'medium
50 term afflictions' (e.g. pre-eclampsia). However, patients also saw a role for telehealthcare as
51 prompting service particularly for those with learning disabilities, dementia and carers,
52 assisting patients to remember to take medications, fluids and food and managing patients
53 pre-operatively. Finally, patients imagined this type of intervention could help the 'well' to
54 stay that way by monitoring health parameters to prevent illness.

1
2
3 Not only did patients see scope for this type of service provision in the future, feedback
4 indicated that the lessons learned through the use of this system will be taken into the future
5 by individual patients. For example, one man 'is continuing to take his own blood pressure at
6 home with a machine he has purchased and will continue to monitor himself accordingly so
7 that he can bring the results into surgery on his review appointment'.
8

9 10 **Discussion**

11
12 This service evaluation demonstrates that patients found this simple telehealth strategy for
13 managing hypertension easy to use, convenient and acceptable. Patients liked feeling
14 increased levels of support and Florence had a role as a companion, in promoting patients to
15 educate themselves further and providing reassurance about normotension in cases of white
16 coat hypertension. As previously found (3), the skills and knowledge gained by patients from
17 using Florence has led some patients to commence longer term health behaviours such as
18 self-directed ongoing monitoring and purchase of their own home machines.
19

20
21 The problems encountered with using the system were relatively minor and many could be
22 eliminated by careful recruitment of patients (ensuring dexterity to use BP machine and
23 mobile phone and access to equipment needed), through thorough counselling about what
24 they will be expected to do (one patient reported it feeling 'awkward' initially but was 'fine
25 when got used to it') and what they should expect to receive from the system before
26 embarking on the programme and/or tailor the number of requests more precisely to the
27 needs of the patient. For example, if, clinically, only once weekly readings are required then
28 Florence can be 'instructed' to only send prompts at this regularity. Such down regulation in
29 the frequency of prompts from Florence is expected to occur in all patients using the system
30 as hypertension becomes controlled. Discussion groups raised the concern that 'older
31 people won't want to change, maybe they wouldn't manage the mobile phone or other
32 equipment, they would need a lot of teaching about it so they were able to use it. If there
33 wasn't confidence in being able to use the equipment, it would make them feel worse'. (7)
34 However, this concern did not affect the majority of Florence users as only three patients
35 could not manage the mobile phone enough to continue with the programme. In line with
36 previous experience (3), this management approach just does not seem to suit some
37 patients' preferences, who would rather see a doctor and/or are concerned about using
38 home BP machines or mobile phones. However this only appears to apply to a small
39 minority of patients.
40
41
42

43
44 These results are from a pragmatic service evaluation so they reflect patient experience in
45 the actual clinical setting. However data was thus not obtained systematically. The same
46 question may have been asked of the same patient on multiple occasions and at varying
47 time points throughout their use of the programme. Data is also missing from some patients
48 who could not be contacted or if practice staff did not have capacity to contact all patients
49 involved to obtain feedback. The effect on the data of this missing information is likely to be
50 minimal as patients were not systematically excluded from providing feedback and the
51 feedback from practice staff in all ten participating practices ensured that overall patient
52 experience was summarised.
53
54

55
56 In line with the findings of McManus et al(9) and Jones et al (10), intervention patients were
57 supportive of home or self-monitoring in the future and, once the programme had finished,
58 some wished to continue using Florence. Generally there was no evidence that undertaking
59
60

1
2
3 home readings increased anxiety. Only one patient specifically reported that they withdrew
4 from the programme as she 'would have preferred to send BP readings in monthly...[as daily
5 readings] made her feel anxious [as] she knew each day when she got up she had to text in'.
6 This is in accordance with the findings of previous studies investigating home BP readings
7 by Little et al in 2002 (11), McManus et al in 2005 (9) and Ovaisi et al in 2011(12) which all
8 found good levels of acceptability of home readings among patients and no evidence of
9 detrimental effects of increased anxiety. In general, patients in this service evaluation found
10 home readings to be beneficial as they were more relaxed and less anxious than they would
11 be in the GP surgery. It may be for this reason that the patients investigated by Jones et al
12 (10) felt that home readings were more 'natural'.
13
14

15 Patient concordance with jointly agreed management strategies between the patient and
16 their responsible health professional is essential in maximising the health benefits obtained.
17 Therefore ease of use of any intervention needs to be high to minimise barriers to use. This
18 evaluation identified that this simple telehealth intervention was generally found to be easy to
19 use, a finding which is supported by Clarke et al(13), who undertook a systematic review of
20 telemonitoring and structured telephone support programmes for patients with chronic heart
21 failure. They reported generally high patient acceptance, satisfaction and ease of use scores
22 among the studies they examined.
23
24

25 Utilising this simple telehealth strategy has benefits over patients taking home readings and
26 reporting them to the GP for two reasons: BP readings are transmitted and recorded in real
27 time, therefore there is no scope for missing or lost results at GP review; and one recent
28 study of home BP readings among stroke patients identified that even though all patients
29 understood the importance of having a high BP reading, when one was obtained, they did
30 not all seek help or direction from their primary care team.(12) The simple health strategy
31 used in this service evaluation eliminates this barrier to seeking appropriate care as all
32 results that are sent to Florence are reviewed on the dedicated server by the primary
33 healthcare team at regular intervals.
34
35
36

37 In agreement with a previous systematic review of telemonitoring for heart failure(14), which
38 concluded that telemonitoring was generally 'favourable compared with usual care', this
39 service evaluation indicates that patients feel the same about simple telehealth monitoring of
40 hypertension. The flexibility, control and education that Florence provides were well received
41 and appear to have empowered patients who had previously been uncontrolled and/or non-
42 compliant with usual care.
43
44

45 When used in clinical practice, there should be scope to continue using Florence for
46 prolonged periods even after normotension is reached, albeit with readings at reduced
47 intervals. Not only would this ensure enduring control it may help to allay patients' concerns
48 that arose during the discussion groups about 'slipping through the net' due to lack of face-
49 to-face contact. Some patients within this service evaluation, and those who were
50 interviewed by Jones et al (10) following a similar intervention, were keen to continue self-
51 monitoring in the same way. The number of BP readings requested by Florence each week
52 or month can be adjusted down accordingly in these situations.
53
54

55 In summary, there is a clear need for new and improved clinically driven strategies for
56 hypertension control in primary care to prevent morbidity and mortality. Simple telehealth
57 strategies such as that used in this service evaluation may not only be effective in doing this
58
59
60

1
2
3 but do so in a way that is easy, flexible, affordable, acceptable and, in many cases
4 preferable, when compared with usual care. However, careful selection and counselling of
5 patients is required at recruitment onto such an intervention to ensure that they understand
6 and agree with the process involved and that they are physically and cognitively able to
7 operate the simple equipment involved.
8

9 10 **References**

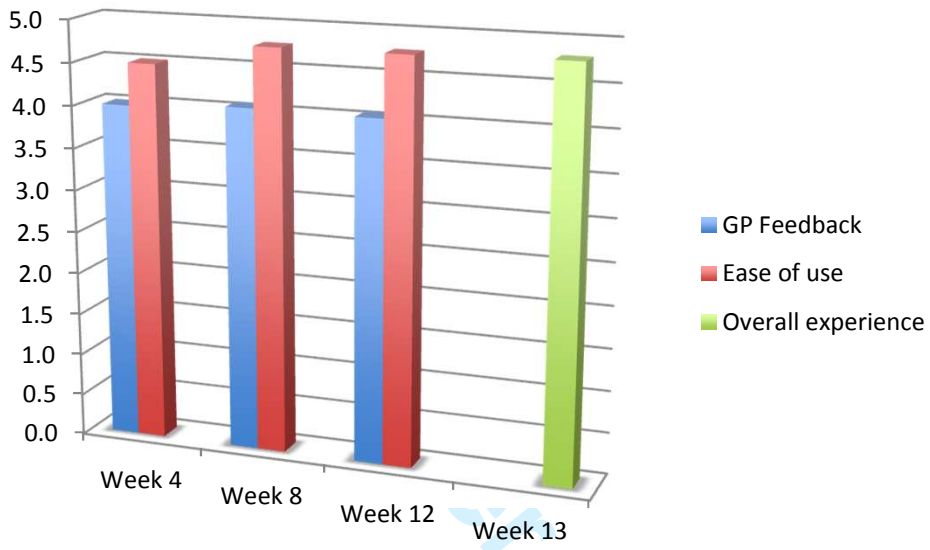
- 11 1. Aylett MJ. Ambulatory or self blood pressure measurement? Improving the diagnosis of
12 hypertension. *Fam Pract.* 1994;11:197-200
- 13
- 14 2. Rickerby J. The role of home BP measurement in managing hypertension – an evidence
15 based review. *J Hum Hypertens.* 2002;16: 469-72.
- 16
- 17 3. Rickerby J, Woodward J. Patients' experiences and opinions of home blood pressure
18 measurement. *J Hum Hypertens.* 2003;17:495-503.
- 19
- 20 4. Bostock Y, Hanley J, McGown D, Pinnock H, Padfield P, McKinstry B. *The acceptability to*
21 *patients and professionals of remote blood pressure monitoring using mobile phones.* *Prim*
22 *Health Care Res Dev.* 2009;10:299-308.
- 23
- 24 5. Liew SM, Tong SF, Lee VKM, Ng CJ, Leong KC, Teng CL. *Text messaging reminders to*
25 *reduce non-attendance in chronic disease follow-up: a clinical trial.* *Br J Gen Pract.*
26 2009;59:916-20.
- 27
- 28
- 29 6. Cottrell E, Chambers R, O'Connell P. *Using simple telehealth in primary care to reduce*
30 *blood pressure: a service evaluation.* 2012. [Unpublished – submitted alongside this paper].
- 31
- 32 7. Stoke on Trent Community Health Voice. *Telehealthcare event on 27th January 2012.*
33 Unpublished.
- 34
- 35 8. National Institute of Health and Clinical Excellence. *Hypertension: clinical management of*
36 *primary hypertension in adults.* London: NICE; 2011.
- 37
- 38 9. McManus RJ, Mant J, Roalfe A, Oakes RA, Bryan S, Pattison HM, Hobbs FDR. *Targets*
39 *and self monitoring in hypertension: randomised controlled trial and cost effectiveness*
40 *analysis.* *BMJ.* 2005; doi:10.1136/bmj.38558.393669.E0.
- 41
- 42
- 43 10. Jones MI, Greenfield SM, Bray EP, Baral-Grant S, Hobbs FDR, Holder R, Little P, Mant
44 J, Virdee SK, Williams B, McManus RJ. Patients' experiences of self-monitoring blood
45 pressure and self-titration of medication: the TASMING2 trial qualitative study. *Br J Gen*
46 *Pract.* 2012;62:e135-42: doi:10.3399/bjgp12X625201
- 47
- 48 11. Little P, Barnett J, Barnsley L, Marjoram J, Fitzgerald-Barron A, Mant D. *Comparison of*
49 *acceptability of and preferences for different methods of measuring blood pressure in primary*
50 *care.* *BMJ.* 2002;325:258-9.
- 51
- 52
- 53 12. Ovaisi S, Ibison J, Leontowitsch M, Cloud G, Oakeshott P, Kerry S. *Stroke patients'*
54 *perceptions of home blood pressure monitoring: a qualitative study.* *Br J Gen Pract.* 2011;
55 doi: 10.3399/bjgp11X593893.
56
57
58
59
60

1
2
3 13. Clark RA, Inglis SC, McAlister FA, Cleland JGF, Stewart S. *Telemonitoring or structured*
4 *telephone support programmes for patients with chronic heart failure: systematic review and*
5 *meta-analysis*. BMJ. 2007; doi:10.1136/bmj.39156.536968.55.
6

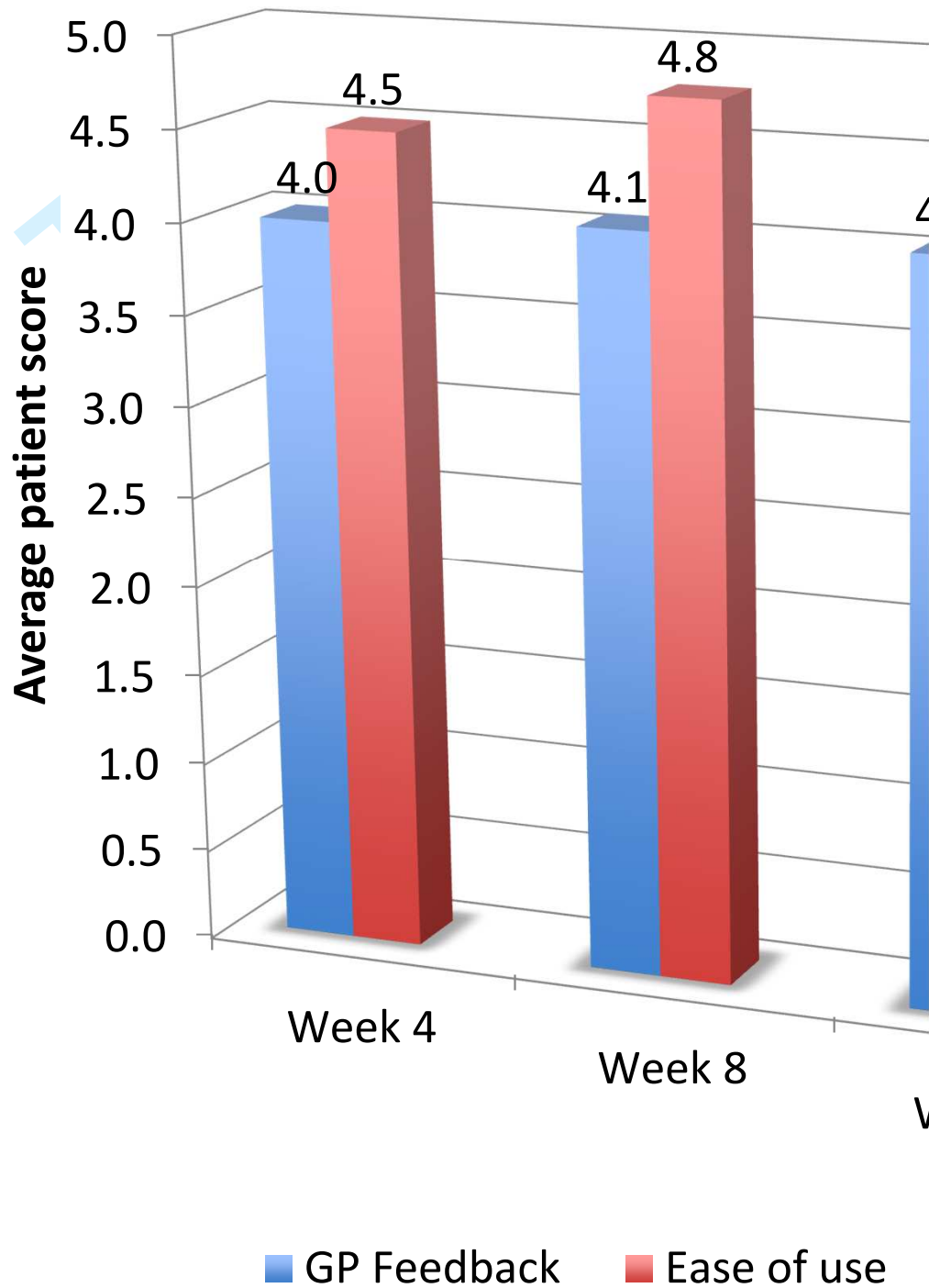
7 14. Polisena J, Tran K, Cimon K, Hutton B, McGill S, Palmer K, Scott RE. *Home*
8 *telemonitoring for congestive heart failure: a systematic review and meta-analysis*. J
9 *Telemed Telecare*. 2010;16:68-76.
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60

For peer review only

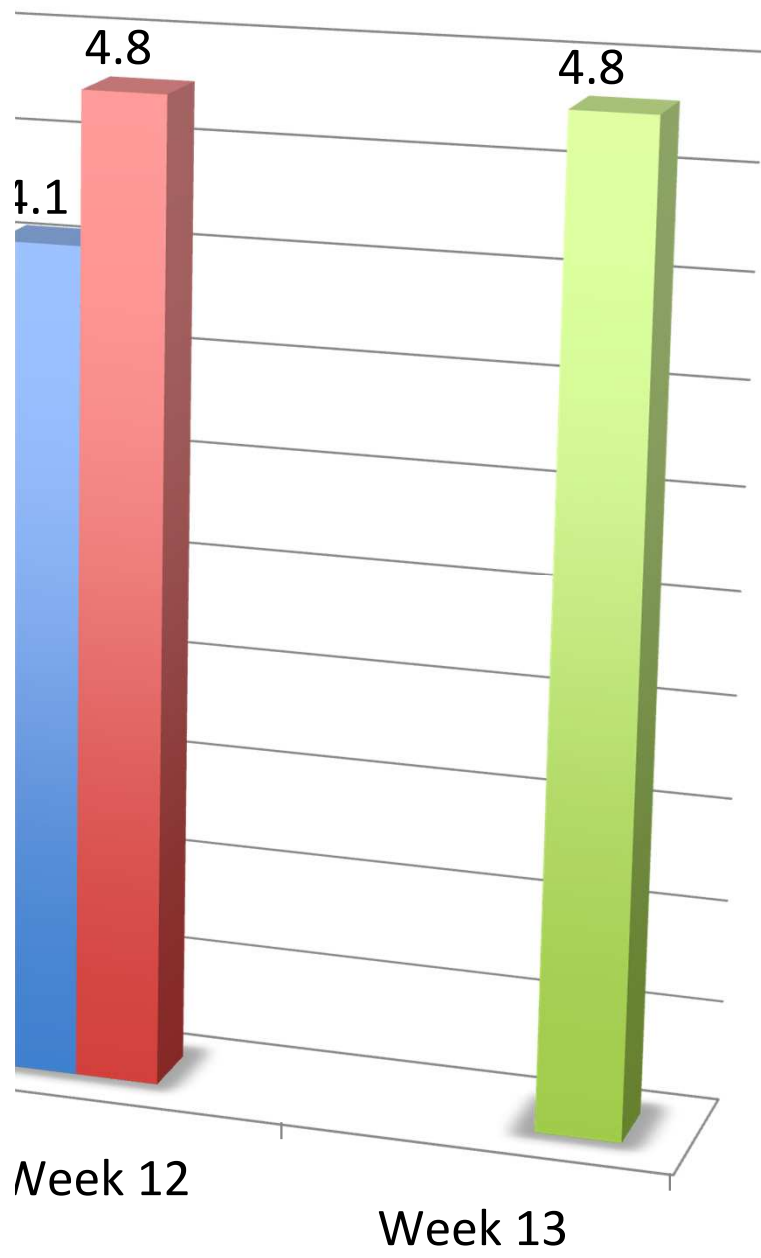
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60



Patient Satisfaction (ma:	Week 4	Week 8	Week 12	Week 13
GP Feedback	4.0	4.1	4.1	
Ease of use	4.5	4.8	4.8	
Overall experience				4.8



1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60



■ Overall experience

only

Please wait...

If this message is not eventually replaced by the proper contents of the document, your PDF viewer may not be able to display this type of document.

You can upgrade to the latest version of Adobe Reader for Windows®, Mac, or Linux® by visiting http://www.adobe.com/go/reader_download.

For more assistance with Adobe Reader visit <http://www.adobe.com/go/acrreader>.

Windows is either a registered trademark or a trademark of Microsoft Corporation in the United States and/or other countries. Mac is a trademark of Apple Inc., registered in the United States and other countries. Linux is the registered trademark of Linus Torvalds in the U.S. and other countries.

Please wait...

If this message is not eventually replaced by the proper contents of the document, your PDF viewer may not be able to display this type of document.

You can upgrade to the latest version of Adobe Reader for Windows®, Mac, or Linux® by visiting <http://www.adobe.com/products/acrobat/readstep2.html>.

For more assistance with Adobe Reader visit <http://www.adobe.com/support/products/acrreader.html>.

Windows is either a registered trademark or a trademark of Microsoft Corporation in the United States and/or other countries. Mac is a trademark of Apple Inc., registered in the United States and other countries. Linux is the registered trademark of Linus Torvalds in the U.S. and other countries.

To view the full contents of this document, you need a later version of the PDF viewer. You can upgrade to the latest version of Adobe Reader from www.adobe.com/products/acrobat/readstep2.html

For further support, go to www.adobe.com/support/products/acrreader.html



Simple telehealth in primary care: what do patients think?

Journal:	<i>BMJ Open</i>
Manuscript ID:	bmjopen-2012-001392.R1
Article Type:	Research
Date Submitted by the Author:	13-Jul-2012
Complete List of Authors:	Cottrell, Elizabeth; Keele University, Arthritis Research UK Primary Care Centre Chambers, Ruth; NHS Stoke on Trent, McMillan, Kate; Furlong Medical Practice,
Primary Subject Heading:	Cardiovascular medicine
Secondary Subject Heading:	General practice / Family practice, Qualitative research
Keywords:	PRIMARY CARE, Hypertension < CARDIOLOGY, Telehealth, Patient experience, Text message

SCHOLARONE™
Manuscripts

Peer review only

1
2
3
4
5
6
7
8 **Simple A service evaluation of simple telehealth in primary care: what**
9 **do patients think?**

10 Elizabeth Cottrell, Kate McMillan, Ruth Chambers

11 E Cottrell, Arthritis Research UK Primary Care Centre, Primary Care Sciences, Keele
12 University, Staffordshire, ST5 5BG, UK

13 Dr E Cottrell NIHR Academic Clinical Fellow in GP Specialty Training

14 K McMillan, Furlong Medical Practice, Tunstall, Stoke on Trent, [ST6 5UD](#)

15 Dr K McMillan Foundation Year 2 Doctor, General Practice placement

16 R Chambers, NHS Stoke on Trent Clinical Commissioning Group, Herbert Minton Building,
17 79 London Road, Stoke on Trent ST4 7PZ

18 Dr R Chambers Clinical director of practice development & performance

19 Correspondence to: Dr E Cottrell e.cottrell@doctors.org.uk, [Arthritis](http://cphc.keele.ac.uk)
20 [Research UK Primary Care Centre, Primary Care Sciences, Keele University, Staffordshire,](http://cphc.keele.ac.uk)
21 [ST5 5BG, UK](http://cphc.keele.ac.uk) ~~140 Lichfield Road, Stone, Staffordshire, ST15 8PY~~

Field Code Changed

Abstract

Objective. To determine the patient experience of using a simple telehealth strategy to manage hypertension in adults.

Design. As part of a pragmatic service evaluation, the acceptability of, satisfaction with and ease of use of a simple telehealth strategy was determined via text, telephone, case studies, discussion groups and informal feedback from practices. This simple telehealth approach required patients to take home blood pressure (BP) readings and text them to a secure server ('Florence') for immediate automatic analysis and individual healthcare professional review.

Participants. 124 intervention patients who used the Florence system.

Setting Ten volunteer GP practices in Stoke on Trent, UK, with poor health and high levels of material deprivation took part.

Results Patient satisfaction was high. In particular, patients found the system easy to use, were very satisfied about the feedback from their GP regarding their BP readings, found the advice sent via Florence useful and preferred to send BP readings using Florence rather than having to go to the practice monthly to get BP checked. Overall satisfaction with the system was 4.81/5.00 at week 13 of the programme. Other advantages of being enrolled with Florence were improved education about hypertension, a greater feeling of support and companionship and flexibility which allowed self-care to occur at a time that suited the patient rather than their practice.

Conclusions This simple telehealth strategy for managing hypertension in the community was met with high levels of patient satisfaction and feelings of control and support. This management approach should thus be considered for widespread implementation for clinical management of hypertension and other long term conditions involving monitoring of patients' bodily measurements and symptoms as a large number of meaningful readings can be obtained from many patients in a prompt, efficient, interactive and acceptable way.

Keywords. primary health care, hypertension, telehealth, patient experience, text message

Article Summary

Article Focus

- Home BP readings are a valuable source of information upon which clinical management decisions can be made and are acceptable to patients
- Although studies have shown that patients are receptive to the idea of simple telehealth strategies for managing BP and that they respond well to text messages, details of the patient experience when actually using simple telehealth in this way is lacking.

- This paper examines the experiences of and feedback from intervention patients who used an innovative interactive simple telehealth strategy to monitor and manage their hypertension.

Key messages

- Patients find that simple telehealth is a flexible, convenient, easy to use and acceptable means of them jointly managing their hypertension with a responsible health professional
- The interactive nature of such a simple telehealth strategy provides support and companionship for some patients and builds their confidence in their health and wellbeing
- Patients are supportive of wider use of this technology in the future for hypertension and other long term conditions.

Strengths and limitations of this study

- As this is a service evaluation, the results obtained accurately reflect actual use of the technology in the clinical setting
- Due to the fact this was a service evaluation, not all patients provided feedback using all the means employed and data collection did not continue until it reached saturation, therefore there may be some missing data

Introduction.

Hypertension is common and carries the risk of great morbidity and mortality. Current management strategies are not adequately controlling this significant problem and new and innovative means of diagnosing and managing hypertension are required. For the best part of the last century the concept of home BP readings to improve the accuracy of measurement and prevent inappropriate treatment of white coat hypertension has been recognised. However the early machines utilised were not reliable and useful readings were limited. (1) Twenty years ago, Aylett (1) outlined that patients became more actively involved in their care with self BP monitoring, compared with ambulatory BP monitoring. Ten years ago a literature review concluded that home BP measurements using automated devices are equivalent to ambulatory readings taken into health settings. (2) The programme evaluated here for patient acceptability and satisfaction brings these historic ideas about improving blood pressure management into the present day. Utilising an electronic sphygmomanometer, to obtain home BP readings, patients text their results into a secure server ('Florence') and receive immediate automated feedback regarding any required further actions, based upon the level of the reading. This is an innovative system that allows 'closed loop' management in the main, i.e. automatic responses, however individualised patient management is provided from the patient's own healthcare professional who reviews their BP recordings weekly, or more frequently if indicated. Clinically, this type of clinical management strategy has a number of benefits; it allows multiple readings, and thus meaningful averages to be calculated, from patients in their own environment, collected at any time of the day or night. Thus personal, social or occupational factors need not be barriers to accessing prompt and effective care for hypertension.

1
2
3
4
5
6
7 Florence had not been used in this healthcare setting prior to undertaking this programme,
8 although local pilot work for other conditions resulted in positive healthcare professional and
9 patient anecdotal feedback. However, previous work by other groups have suggested that
10 this innovative system was likely to be well accepted by patients. In 2003, when availability
11 of home electronic sphygmomanometers was relatively new, Rickerby et al (3) reported that
12 home BP measurements were easy to obtain with little or no formal training and are
13 acceptable for certain patients, particularly those who wish to accept responsibility for the
14 management of their hypertension as it facilitates more regular BP monitoring than could be
15 realistically possible if measurements were only obtained in the clinical setting. Bostock et al
16 (4) investigated the acceptability of the concept of remote management of BP using mobile
17 phones among healthcare professionals and patients and discovered that patients were
18 generally welcoming to this approach provided that reassurances and action strategies were
19 in place should high readings be returned. Further, Liew et al (5) demonstrated that receipt
20 of text messages resulted in behaviours equivalent to conventional (direct 1:1 telephone)
21 reminder systems, thus supporting the use of interactive text message feedback both from
22 Florence and the healthcare professionals reviewing the readings.

23
24 This paper reports the qualitative findings of a service evaluation undertaken in primary care
25 to determine the acceptability and levels of patient satisfaction with the use of a simple
26 telehealth intervention for monitoring BP. (6)

27 **Method.**

28
29 This paper describes the qualitative feedback obtained as part of a service evaluation of the
30 implementation of an innovative simple telehealth strategy for managing hypertension, the
31 results of which on the management of BP are described in an accompanying paper. (6) The
32 telehealth strategy used was innovative as it employed the use of home electronic BP
33 measurements and mobile phones so that patients could text their BP results to a secure
34 server ('Florence') for automatic assessment and immediate response according to the level
35 of BP received and personalised, human review of results at least weekly, by the patient's
36 usual primary healthcare team for advice on further management and changes (e.g. to
37 medication) that are required. Patients were enrolled to use Florence for 3 months, or a
38 shorter period if they became, or were found to be, normotensive. [Data collection continued
39 for six months after enrolment onto the programme.](#)

40
41 Qualitative information on patient satisfaction, ease of use of Florence and acceptability of
42 this management strategy was obtained using a variety of means. Patients received two
43 questions monthly (week 4, 8 and 12) via text throughout their time using the system. These
44 were 'It is easy to use the Florence system to record my blood pressure' and 'I am satisfied
45 with the feedback from my GP about my blood pressure as a result of using the system'.
46 Patients were required to respond using a 5 point Likert scale (1 = strongly disagree, 2 =
47 disagree, 3 = neither disagree/agree, 4 = agree, 5 = strongly agree). At week 13 patients
48 were texted a further question to answer using a satisfaction score of one to five, 'how
49 satisfied are you with your experience of using the Florence system to manage your blood
50 pressure?'

51
52 At least two patients per practice were contacted by telephone by practice staff to complete
53 a questionnaire which, using a Likert scale as above [and a selection of attitude statements,](#)
54 enquired about the patients' attitudes [to-towards and ease-of-use-of Florence,](#) satisfaction

1
2
3
4
5
6
7 with ~~feedback from GP or practice nurse, usefulness of advice from using~~ Florence,
8 ~~preference of using Florence compared to monthly BP reviews at their general practice.~~
9 Attitude statements included 'The Florence (text messaging) system is easy to use', 'I am
10 satisfied with the feedback from by GP about my blood pressure as a result of using the
11 Florence system', 'I find the advice/information I receive from Florence to be useful' and 'I
12 prefer to send daily BP readings via Florence rather than having to go to my doctor's surgery
13 to get my BP checked monthly'. Patients were selected by convenience sampling as some
14 patients were not contactable by telephone. Only one questionnaire was administered to
15 each patient but this data was collected at various time points after enrolment to Florence so
16 they provide an overview of patient satisfaction at all stages of the programme.

17
18 When patients stopped using Florence they were contacted by telephone by practice staff to
19 enquire about their reasons for stopping and/or any problems encountered, their
20 experiences of using Florence and the likelihood that they would get involved in a similar
21 project in the future should one be available for other health conditions. Patients had to
22 respond to the same attitude statements detailed above. They were also asked to describe
23 an problems encountered and to provide any further comments where they felt this to be
24 appropriate and this supplementary information was recorded as free text. -Length of time of
25 using Florence ~~and problems experienced using the system were~~ was also noted so that an
26 average usage could be calculated, as appropriate.

27
28 Nine months after the start of the programme, an educational event was held for patients to
29 learn about more about telehealth technology and its wider application. Discussion groups
30 were also held at during this event for patients to provide feedback about their experiences
31 of being involved in the intervention. Non-attendees were able to remotely provide feedback
32 remotely. The discussion groups were semi-structured and p. Patients were asked questions
33 about using telehealth in general, ease of use of the technology in this specific programme
34 and satisfaction with seeing healthcare professionals less frequently given the closer
35 monitoring using telehealth.

36
37 Feedback from practice staff was a dynamic process. Comments from practice staff over the
38 course of the programme were noted. During data collection, patients that appeared to be
39 clinically interesting (e.g. many readings in the middle of the night) were flagged and
40 practices were asked to provide case studies on these patients. Further, practices provided
41 case studies of patients they felt had particularly benefitted from being involved in the
42 programme.

43
44 Patient feedback obtained via the Likert scales was summarised descriptively and average
45 scores were calculated. An overview of the patient experience of using Florence obtained
46 through free text feedback on the questionnaires, written and verbal feedback from practice
47 staff and during the discussion groups is was summarised ~~from all of the above means of~~
48 feedback and responses from practice staff. Feedback has then been summarised according
49 to topics as they emerged.

50 Results.

51
52 This service evaluation analysed data from 124 patients intervention patients. At the point of
53 final data collection, the six month follow up period was not complete for eight-five patients
54 had not completed six months on the programme; . Fifty-one patients stopped using the
55
56
57
58
59
60

1
2
3
4
5
6
7 [programme at three months, as per the protocol and an addition 37 patients continued using](#)
8 [Florence after the three month programme period had ended. Of these these 37 patients,](#)
9 [who had, 19 were still continued to submit BP readings to using Florence six months post](#)
10 [recruitment. The average length of use of Florence was 78 days \(median 87 days\).](#)

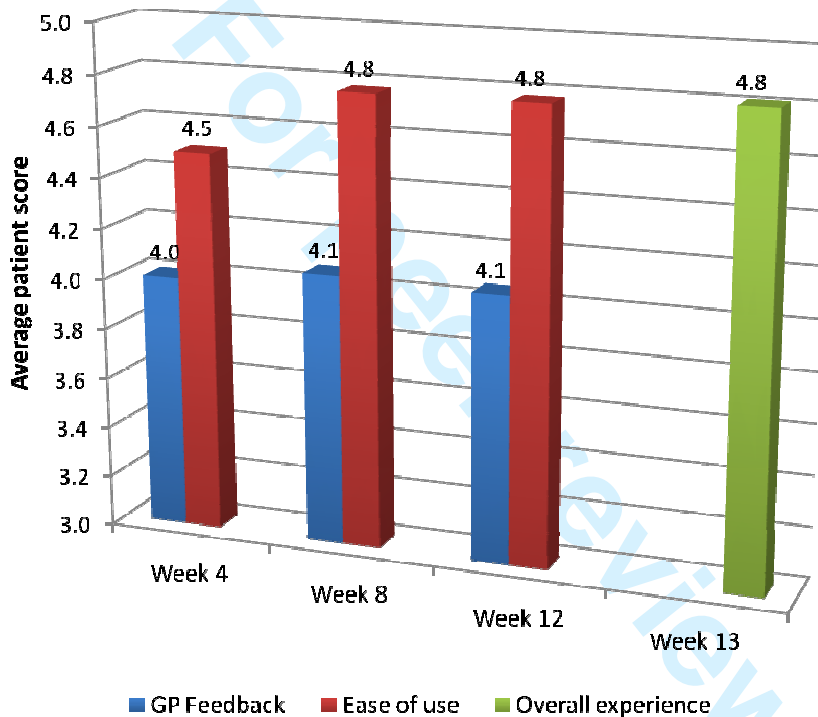
11 In total, 95 patients were sent the monthly questions via Florence, of which, 76% responded
12 to at least one question. Nine of these patients stopped using Florence before completing
13 three months so did not get sent week 12 and 13 questions. Sixty-three patients provided
14 feedback via the questionnaire administered by practice staff over the telephone. Average
15 time between recruitment and administration of the questionnaire among these patients was
16 5.2 months (range 1 to 9 months). Twenty-four people participated in discussion groups. (7)

17
18 [Patient feedback about the programme obtained using the telephone questionnaire at](#)
19 [various time points during the data collection period was collected from 64 patients. Another](#)
20 [was collected from 82 questionnaires were completed by patients who were contacted after](#)
21 [leaving the programme. Forty of these patients left the programme by choice and 42 left](#)
22 [because their BP was found to be, or became, controlled within the normotensive range. Of](#)
23 [the 40 patients who were classified as leaving the programme by choice, 17 left because](#)
24 [they had completed the allocated three months, four because they were unable to devote](#)
25 [the required time or were not in the country to undertake the programme, three left due to](#)
26 [struggling to use or having limited access to a mobile phone, two patients preferred review](#)
27 [by the doctor face-to-face, two patients left their GP practice, two felt unable to relax enough](#)
28 [to take their own BP themselves, one patient only wanted to use it short term, one could not](#)
29 [access Florence, one misunderstood that the programme should have continued and one](#)
30 [was advised by secondary care to have their BP monitored at the hospital. Of the remaining](#)
31 [six patients two patients reported that they did not want to continue with the programme](#)
32 [anymore but gave no specific reasons and no explanation was provided for four patients.](#)

33 34 **Patients found Florence easy to use**

35 The statement 'It is easy to use the Florence system to record my blood pressure' was
36 posed on a number of occasions using a five-point Likert scale (1 = strongly disagree, 3 =
37 neither disagree/agree, 5 = strongly agree), and at each stage, results were favourable.
38 Average scores out of a maximum of 5.00, from [the text questions on](#) months one, two and
39 three of the programme were 4.49, 4.77 and 4.78, respectively, see Figure 1. [In response to](#)
40 [the attitude statement 'The Florence \(text messaging\) system is easy to use', An average](#)
41 [score of 4.79 was obtained using from the telephone questionnaire over the telephone](#)
42 [during the programme period](#) and, among patients who left the programme a score of 4.31
43 was obtained from those leaving through choice and 4.71 from those who left due to being
44 normotensive. Further, a number of patients offered the [overall free text](#) feedback that the
45 system was 'easy to use' and they had 'no problems' implementing it and the feedback from
46 discussion groups was that it 'seemed to be easy to use'. (7)

Figure 1: Average patient satisfaction scores for feedback from GP/practice nurse, ease of use of the Florence system and the overall experience of using Florence (1 = strongly disagree, 3 = neither disagree/agree, 5 = strongly agree)



Patients were satisfied with the feedback they obtained through Florence

The statement 'I am satisfied with the feedback from my GP about my BP as a result of using the Florence system' was also asked multiple times using a ~~the same~~ five-point Likert scale ~~as above~~. Again, results were positive. Average scores out of a maximum of 5.00, from ~~the text questions during~~ months one, two and three of the programme were 4.04, 4.07 and 4.05, respectively, see Figure 1. An average score of 4.53 was obtained ~~using from~~ the ~~telephone~~ questionnaire ~~over the telephone and administered during the programme period and~~, among patients who left the programme, a score of 4.14 was obtained from those ~~who left leaving~~ through choice and 4.53 from those who left due to being normotensive.

This ~~level of~~ satisfaction does not appear to be one-sided, ~~a~~ ~~an~~ indication ~~of~~ that ~~this route of service provision is simple telehealth was also~~ satisfactory to healthcare professionals and promoted ~~de~~ efficiencies in care is highlighted by the following: '[A doctor involves recalls that she] had just finished texting her instructions to a patient informing him that he would need a prescription following his blood pressure result – she took the prescription out to reception

1
2
3
4
5
6
7 within five minutes of sending the message, and he was already standing there waiting for
8 the prescription, having jumped into his car and driving to collect it!

9 **'Self-care' that suits the patient rather than the surgery**

10 A key benefit highlighted by patients and fed back by practices was the flexibility proffered by
11 the Florence system. BP readings could be taken and submitted at any time of the day or
12 night. This assisted patients who may be at risk of 'white coat' hypertension. (8) One man,
13 who exited the Florence system due to his BP becoming controlled, stated that home BP
14 readings were beneficial as he was 'less stressed, more disciplined' and he 'learned how BP
15 was affected by...work and was much lower at weekends - he could then tell how to look
16 after his BP better'. Similarly, one patient 'was delighted by the fact that he could
17 communicate with his GP without the necessity of travelling to the surgery...he often had to
18 tackle rush hour traffic...to attend...his appointment and felt that he was not in a sufficiently
19 relaxed state to have his BP taken when he'd completed that battle'. The theme of being
20 more 'relaxed' or 'less anxious' when taking home BP and submitting them to Florence was
21 repeated by a number of patients.
22

23 Further, Florence also suited patients whose lifestyles conflict with attending GP surgeries.
24 For example one patient who 'doesn't get up until the afternoon' sent in multiple readings in
25 the middle of the night. Elderly patients who rely on others to transport them to the GP
26 surgery were 'delighted not to have the inconvenience of attending surgery for the blood
27 pressures to be taken'. Carers benefited from this flexibility also; 'a 59 year old male who
28 lives with and cares for his 84 year old father...he felt very happy and felt that someone is
29 looking after him...without him coming to the surgery...he hadn't been into the surgery [since](#)
30 [November](#)[\[for over six months\]](#) and rarely comes in due to caring full time for his father'.
31

32 **Florence provided reassurance for patients with uncertain diagnoses of hypertension**

33 Although patients without confirmed hypertension did not meet our 'specific' inclusion criteria
34 for this project, this was a service evaluation and these patients were recruited for clinically
35 appropriate reasons and gained significant benefit from being involved. For example, 25
36 patients with high clinic systolic BP readings at recruitment used Florence and discovered
37 they had normal home readings, without making any changes to their medication. [These](#)
38 [patients](#), ~~so~~ could be reassured and discharged from the system. This reassurance was
39 [positively noted/welcomed](#) by some of the patients [themselves](#) who [fed back-reported that](#)
40 'no treatment needed – reassuring...long term monitoring gives a better picture', 'reassuring
41 to monitor in home environment' and 'reassured no problem'. Such use of Florence
42 represents an extension to the current National Institute for Health and Clinical Excellence
43 (NICE) recommendations for 24 hour ambulatory or home monitoring of BP to determine a
44 diagnosis of hypertension. (8)
45

46 **Reinforces care and advice from primary healthcare team**

47 Florence was noted to reinforce health messages from the primary healthcare team and lead
48 to control of hypertension among patients who had previously been difficult to manage.
49 Someone in the discussion group fed back 'my partner was struggling with his blood
50 pressure, and telehealth has made a world of difference'. (7) Patients specifically
51 commented on liking 'to see BP reading and be aware that it is normal'. Another discussion
52 group member commented that telehealth 'helped me to learn to live with the disease and
53 become more involved in monitoring my own health'. (7) [This-The enhanced](#) involvement
54 and knowledge about BP readings and the significance of the result obtained, [promoted by](#)
55
56
57
58
59
60

1
2
3
4
5
6
7 | [the training and accompanying literature for the programme, lead to](#) a new attitude of
8 compliance with management of their hypertension among certain patients. For example,
9 one patient who had previously stopped his own medication had been strongly counselled
10 about the dangers of his uncontrolled BP continued to have significant hypertension. He
11 joined the Florence system and gained better control of his BP, practice staff reported that
12 'he could take his BP at home, where the readings would be done in a less stressful
13 situation...the process has helped his understanding of his condition...it does seem to be a
14 combination of the nurse's firm advice, and Florence's routine readings that have combined
15 to stabilise his condition'. A similar situation was noted in another patient 'the system has
16 highlighted just how high her BP actually is'. The intensive nature of Florence made one
17 patient feel 'he had a strong support from his GP and that it was a really worthwhile
18 illustration of the quality of NHS service'.

19
20 A few patients fed back that being involved in the programme prompted them to find out
21 more about 'blood pressure', educated them about the relevance and interpretation of the
22 BP values and highlighted the importance of good BP control. 'A 25 year old male] found
23 the scheme helped him to understand more about the importance of keeping his BP under
24 control especially with regards to his ongoing kidney problems'. 'A 73 yr old male...on the
25 whole felt that [being involved in the programme] had helped him to understand his BP and
26 control a bit better.' 'A 60 year old female] found that using this system helped her
27 considerably as she was more relaxed plus she found the accompanying literature very
28 helpful and it prompted her to research further about hypertension on the internet, therefore
29 increasing her understanding.' ~~However, o~~One patient individual highlighted ~~their that~~
30 ~~despite improved understanding, patients remain free to ability to continue to can still~~ exert
31 their autonomy ~~despite improved understanding of the condition~~ 'once information became
32 knowledge I understood my disease. Then I had a choice: should I do something about it or
33 not – it was my choice'.

34
35 Florence also helped to promote more comprehensive management of high risk patients,
36 such as 'a 25 year old male...noted to have proteinuria at his new patient check
37 and...BP...145/84mmHg. Over time he was noted to have persisting proteinuria with mid
38 stream urine samples negative for infection. He had a history of gout and associated anti-
39 inflammatory drug use. [Blood tests revealed] creatinine 275, urea 11.7 and eGFR 25 [so he
40 was diagnosed with] CKD Stage 4. Following referral to nephrology he was found to have
41 small kidneys and signs of longstanding CKD...he was advised that he needed good BP
42 control and was invited to join the Florence programme...He was not on any BP medication
43 at baseline (the new patient check) but was started on amlodipine by nephrology soon
44 afterwards. Having previously not self-monitored his BP, while involved in this programme he
45 monitored it twice per week and found the texts useful as they reminded him to take his BP'.

46 **Florence was a companion to patients**

47 | An unexpected role that Florence was found to fulfil was of companionship ~~of to~~ the patients
48 it serves. 'A 67 year old lady was very happy with using Florence – she said that when she
49 finished using the system she missed the contact and felt that she had "lost a friend"'. Other
50 indicators of this role of Florence ~~were that was from a~~ patient ~~whos~~ reported 'that using the
51 system gave her a sense of comfort to have the feedback from the GP to reassure her that
52 she was managing her condition very well' and ~~another who reported that~~ 'as getting texts
53 from Flo has given him a break in his daily routine, as it feels that he has someone to talk to'.
54
55
56
57
58
59
60

Few problems were encountered

Problems using the simple telehealth system were identified among only a few patients. Among patients who chose to leave the programme by choice, six had problems sending or receiving text messages using Florence and one reported having a problem taking their own BP, but this was due to them being 'too anxious'. Among the six patients who had problems sending or receiving text messages, one patient was texting in words, not numbers, got frustrated as submissions were not recognised and left the programme, one reported not being 'a technical person', two patients required other family members to text in readings, one reported not being able to access the Florence system and the final patient only had problems returning messages from survey questions, rather than BP readings. Among patients who left the programme with controlled BP, four reported problems sending or receiving text messages using Florence and one had a problem taking their own BP due the resultant effects of having a previous stroke. Of the four patients who reported problems sending or receiving text messages, two had problems initially transferring readings but after further advice had no problems thereafter, one patient reported having incongruous responses after submitting readings and one patient reported a problem but gave no explanation. Another patient also reported getting conflicting advice, they were 'told by phone that BP's okay but had to contact surgery regarding medication'.

Some patients fed back that multiple messages a day prompting them to submit readings and providing advice was a little excessive. However, this was balanced by another patient who stated that they 'felt at first that taking BP each day was a bit much but soon realised the benefits and could not fault it'.

Focus group discussions among patients also highlighted that this type of service would not be suitable for all patients, especially those with limited cognitive abilities. They also suggested that older people may not manage to use a mobile phone or other equipment, however, this is not a universal problem as patients up to the age of 86 years used the system.

Simple telehealth and the future

Among the 40 patients who left the programme by choice, an average score of 3.71/5.00 was obtained in response to the statement 'I would be interested in using this type of programme in the future for this or another type of health problem'. A score of 4.52 was obtained (from a five-point Likert scale where 1 = strongly disagree and 5 = strongly agree) in relation to the same question among the 42 patients who left the programme with controlled BP.

Further evidence of a positive attitude towards future use of a similar programme was obtained when patients were asked to respond to the statement 'I prefer to send daily BP readings via Florence rather than having to go to my doctors surgery to get my BP checked monthly', an average score of 4.19 was obtained.

Positive attitudes among patients for utility of simple telehealth in the future were underlined by feedback from the discussion groups. This highlighted the areas in which patients felt that telehealthcare may be of value in the future. Such uses include monitoring of other chronic conditions such as renal, heart, respiratory conditions and diabetes and certain 'medium term afflictions' (e.g. pre-eclampsia). However, patients also saw a role for telehealthcare as prompting service particularly for those with learning disabilities, dementia and carers,

1
2
3
4
5
6
7 assisting patients to remember to take medications, fluids and food and managing patients
8 pre-operatively. Finally, patients imagined this type of intervention could help the 'well' to
9 stay that way by monitoring health parameters to prevent illness.

10 Not only did patients see scope for this type of service provision in the future, feedback
11 indicated that the lessons learned through the use of this system will be taken into the future
12 by individual patients. For example, one man 'is continuing to take his own blood pressure at
13 home with a machine he has purchased and will continue to monitor himself accordingly so
14 that he can bring the results into surgery on his review appointment'.
15

16 Discussion

17
18 This service evaluation demonstrates that patients found this simple telehealth strategy for
19 managing hypertension easy to use, convenient and acceptable. Patients liked feeling
20 increased levels of support and Florence had a role as a companion, in promoting patients to
21 educate themselves further and providing reassurance about normotension in cases of white
22 coat hypertension. As previously found (3), the skills and knowledge gained by patients from
23 using Florence has led some patients to commence longer term health behaviours such as
24 self-directed ongoing monitoring and purchase of their own home machines.
25

26 The problems encountered with using the system were relatively minor and many could be
27 eliminated by careful recruitment of patients (ensuring dexterity to use BP machine and
28 mobile phone and access to equipment needed), through thorough counselling about what
29 they will be expected to do (one patient reported it feeling 'awkward' initially but was 'fine
30 when got used to it') and what they should expect to receive from the system before
31 embarking on the programme and/or tailor the number of requests more precisely to the
32 needs of the patient. For example, if, clinically, only once weekly readings are required then
33 Florence can be 'instructed' to only send prompts at this regularity. Such down regulation in
34 the frequency of prompts from Florence is expected to occur in all patients using the system
35 as hypertension becomes controlled. Discussion groups raised the concern that 'older
36 people won't want to change, maybe they wouldn't manage the mobile phone or other
37 equipment, they would need a lot of teaching about it so they were able to use it. If there
38 wasn't confidence in being able to use the equipment, it would make them feel worse'. (7)
39 However, this concern did not affect the majority of Florence users as only three patients
40 could not manage the mobile phone enough to continue with the programme. In line with
41 previous experience (3), this management approach just does not seem to suit some
42 patients' preferences, who would rather see a doctor and/or are concerned about using
43 home BP machines or mobile phones. However this only appears to apply to a small
44 minority of patients.
45

46 These results [presented](#) are from a pragmatic service evaluation. [They are therefore](#)
47 [valuable as](#) ~~so~~ they reflect patient experience in the actual clinical setting [when the](#)
48 [programme is delivered by the patients' usual clinical staff](#). However data was thus not
49 obtained systematically [nor until the point of data saturation](#). The same question may have
50 been asked of the same patient on multiple occasions and at varying time points throughout
51 their use of the programme. Data is also missing from some patients who could not be
52 contacted or if practice staff did not have capacity to contact all patients involved to obtain
53 feedback. The effect on the data of this missing information is likely to be minimal as patients
54 were not systematically excluded from providing feedback and the feedback from practice
55
56
57
58
59
60

1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60

staff in all ten participating practices ensured that overall patient experience was summarised. [Predominantly, patient feedback was very positive. Thus it is important to consider the risk of missing opposing views. It was clear if and when patients stopped using Florence as there were no further readings submitted to the server. If submissions of readings appeared to have ceased practice staff were requested to contact the patient to establish if they were still using Florence and, if not, they completed the telephone questionnaire to find out the reasons why not and establish if any problems had been encountered. Of the 124 patients enrolled on the programme, 82 completed questionnaires upon cessation of their use of Florence. Of the remaining patients, 19 were still submitting BP readings to using Florence after six months had elapsed since their enrolment. Therefore it is unlikely that any significant negativity about the programme was missed unless dissatisfied patients were regularly using the programme and not feeding this dissatisfaction back to the team.](#)

In line with the findings of McManus et al(9) and Jones et al (10), intervention patients were supportive of home or self-monitoring in the future and, once the programme had finished, some wished to continue using Florence. Generally there was no evidence that undertaking home readings increased anxiety. Only one patient specifically reported that they withdrew from the programme as she 'would have preferred to send BP readings in monthly...[as daily readings] made her feel anxious [as] she knew each day when she got up she had to text in'. This is in accordance with the findings of previous studies investigating home BP readings by Little et al in 2002 (11), McManus et al in 2005 (9) and Ovaisi et al in 2011(12) which all found good levels of acceptability of home readings among patients and no evidence of detrimental effects of increased anxiety. In general, patients in this service evaluation found home readings to be beneficial as they were more relaxed and less anxious than they would be in the GP surgery. It may be for this reason that the patients investigated by Jones et al (10) felt that home readings were more 'natural'.

Patient concordance with jointly agreed management strategies between the patient and their responsible health professional is essential in maximising the health benefits obtained. Therefore ease of use of any intervention needs to be high to minimise barriers to use. This evaluation identified that this simple telehealth intervention was generally found to be easy to use, a finding which is supported by Clarke et al(13), who undertook a systematic review of telemonitoring and structured telephone support programmes for patients with chronic heart failure. They reported generally high patient acceptance, satisfaction and ease of use scores among the studies they examined.

Utilising this simple telehealth strategy has benefits over patients taking home readings and reporting them to the GP for two reasons: BP readings are transmitted and recorded in real time, therefore there is no scope for missing or lost results at GP review; and one recent study of home BP readings among stroke patients identified that even though all patients understood the importance of having a high BP reading, when one was obtained, they did not all seek help or direction from their primary care team.(12) The simple health strategy used in this service evaluation eliminates this barrier to seeking appropriate care as all results that are sent to Florence are reviewed on the dedicated server by the primary healthcare team at regular intervals. [Further, due to the at least weekly review of BP readings by the patients' usual primary care team, any persistently suboptimal readings that have not been recognised by the patient will be detected more quickly than they will have](#)

1
2
3
4
5
6
7 [been had the patient been asked to record their blood pressure at home and return after a](#)
8 [month or so.](#)

9
10 In agreement with a previous systematic review of telemonitoring for heart failure(14), which
11 concluded that telemonitoring was generally 'favourable compared with usual care', this
12 service evaluation indicates that patients feel the same about simple telehealth monitoring of
13 hypertension. The flexibility, control and education that Florence provides were well received
14 and appear to have empowered patients who had previously been uncontrolled and/or non-
15 compliant with usual care.

16
17 When used in clinical practice, there should be scope to continue using Florence for
18 prolonged periods even after normotension is reached, albeit with readings at reduced
19 intervals. Not only would this ensure enduring control it may help to allay patients' concerns
20 that arose during the discussion groups about 'slipping through the net' due to lack of face-
21 to-face contact. Some patients within this service evaluation, and those who were
22 interviewed by Jones et al (10) following a similar intervention, were keen to continue self-
23 monitoring in the same way. The number of BP readings requested by Florence each week
24 or month can be adjusted down accordingly in these situations.

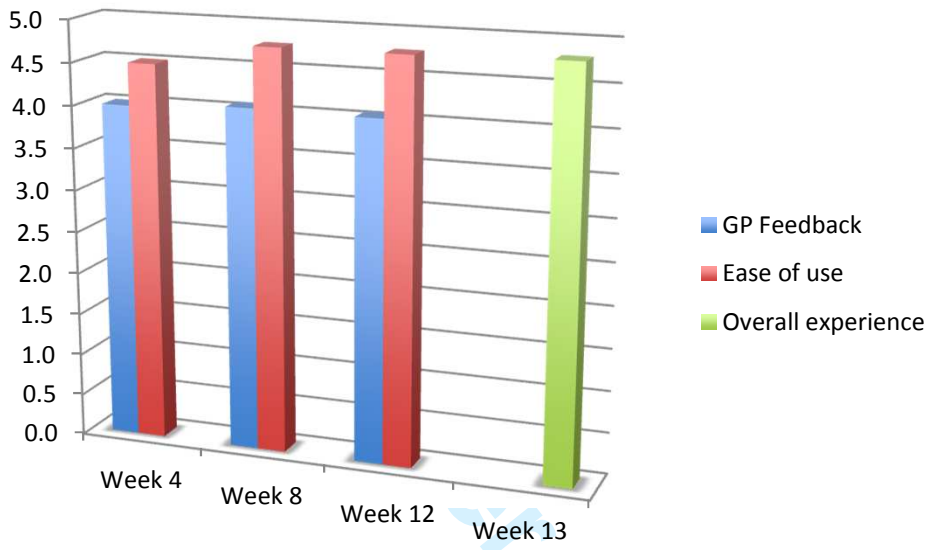
25
26 In summary, there is a clear need for new and improved clinically driven strategies for
27 hypertension control in primary care to prevent morbidity and mortality. [This pragmatic](#)
28 [service evaluation indicates that s](#)Simple telehealth strategies [such as that used in this](#)
29 [service evaluation](#) may not only be effective in doing this [in actual clinical practice](#) but do so
30 in a way that is easy, flexible, affordable, acceptable and, in many cases preferable, when
31 compared with usual care. [Not only does simple telehealth deliver a service that patients](#)
32 [appreciated and believed in, it appeared to become a companion to some patients.](#)
33 [However, Our results indicate that](#) careful selection and counselling of patients is required at
34 recruitment onto such [an interventiona programme](#) to ensure that they understand and agree
35 with the [nature and frequency of the](#) processes involved and that they are physically and
36 cognitively able to operate the simple equipment [involved](#).

37 References

- 38 1. Aylett MJ. Ambulatory or self blood pressure measurement? Improving the diagnosis of
39 hypertension. *Fam Pract.* 1994;11:197-200
- 40 2. Rickerby J. The role of home BP measurement in managing hypertension – an evidence
41 based review. *J Hum Hypertens.* 2002;16: 469-72.
- 42 3. Rickerby J, Woodward J. Patients' experiences and opinions of home blood pressure
43 measurement. *J Hum Hypertens.* 2003;17:495-503.
- 44 4. Bostock Y, Hanley J, McGown D, Pinnock H, Padfield P, McKinstry B. *The acceptability to*
45 *patients and professionals of remote blood pressure monitoring using mobile phones.* *Prim*
46 *Health Care Res Dev.* 2009;10:299-308.
- 47 5. Liew SM, Tong SF, Lee VKM, Ng CJ, Leong KC, Teng CL. *Text messaging reminders to*
48 *reduce non-attendance in chronic disease follow-up: a clinical trial.* *Br J Gen Pract.*
49 2009;59:916-20.
- 50
- 51
- 52
- 53
- 54
- 55
- 56
- 57
- 58
- 59
- 60

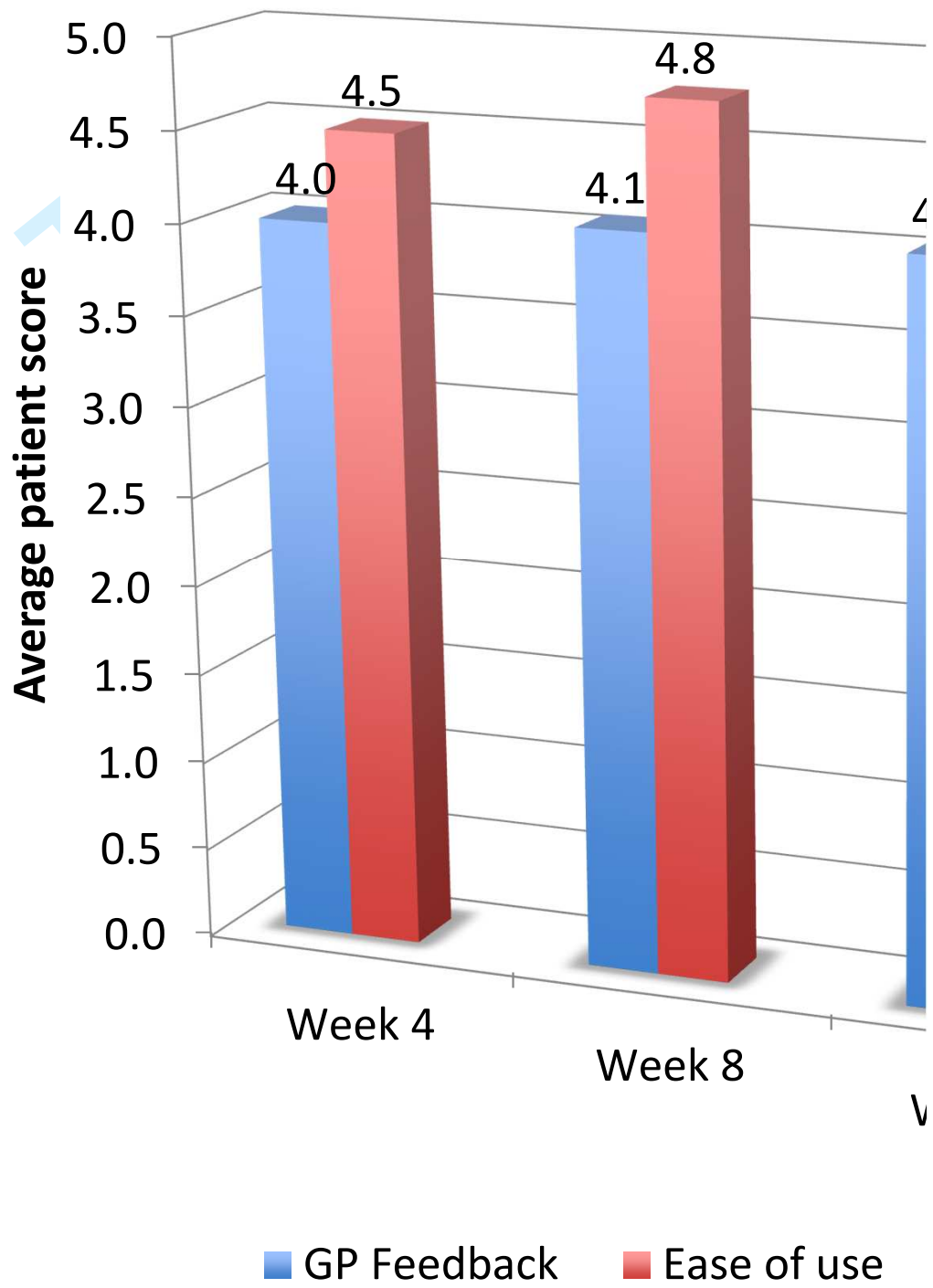
- 1
2
3
4
5
6
7 6. Cottrell E, Chambers R, O'Connell P. *Using simple telehealth in primary care to reduce*
8 *blood pressure: a service evaluation*. 2012. [Unpublished – submitted alongside this paper].
9
10 7. Stoke on Trent Community Health Voice. *Telehealthcare event on 27th January 2012*.
11 Unpublished.
12
13 8. National Institute of Health and Clinical Excellence. *Hypertension: clinical management of*
14 *primary hypertension in adults*. London: NICE; 2011.
15
16 9. McManus RJ, Mant J, Roalfe A, Oakes RA, Bryan S, Pattison HM, Hobbs FDR. *Targets*
17 *and self monitoring in hypertension: randomised controlled trial and cost effectiveness*
18 *analysis*. BMJ. 2005; doi:10.1136/bmj.38558.393669.E0.
19
20 10. Jones MI, Greenfield SM, Bray EP, Baral-Grant S, Hobbs FDR, Holder R, Little P, Mant
21 J, Virdee SK, Williams B, McManus RJ. Patients' experiences of self-monitoring blood
22 pressure and self-titration of medication: the TASMINH2 trial qualitative study. Br J Gen
23 Pract. 2012;62:e135-42: doi:10.3399/bjgp12X625201
24
25 11. Little P, Barnett J, Barnsley L, Marjoram J, Fitzgerald-Barron A, Mant D. *Comparison of*
26 *acceptability of and preferences for different methods of measuring blood pressure in primary*
27 *care*. BMJ. 2002;325:258-9.
28
29 12. Ovaisi S, Ibison J, Leontowitsch M, Cloud G, Oakeshott P, Kerry S. *Stroke patients'*
30 *perceptions of home blood pressure monitoring: a qualitative study*. Br J Gen Pract. 2011;
31 doi: 10.3399/bjgp11X593893.
32
33 13. Clark RA, Inglis SC, McAlister FA, Cleland JGF, Stewart S. *Telemonitoring or structured*
34 *telephone support programmes for patients with chronic heart failure: systematic review and*
35 *meta-analysis*. BMJ. 2007; doi:10.1136/bmj.39156.536968.55.
36
37 14. Polisena J, Tran K, Cimon K, Hutton B, McGill S, Palmer K, Scott RE. *Home*
38 *telemonitoring for congestive heart failure: a systematic review and meta-analysis*. J
39 *Telemed Telecare*. 2010;16:68-76.
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60

1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60

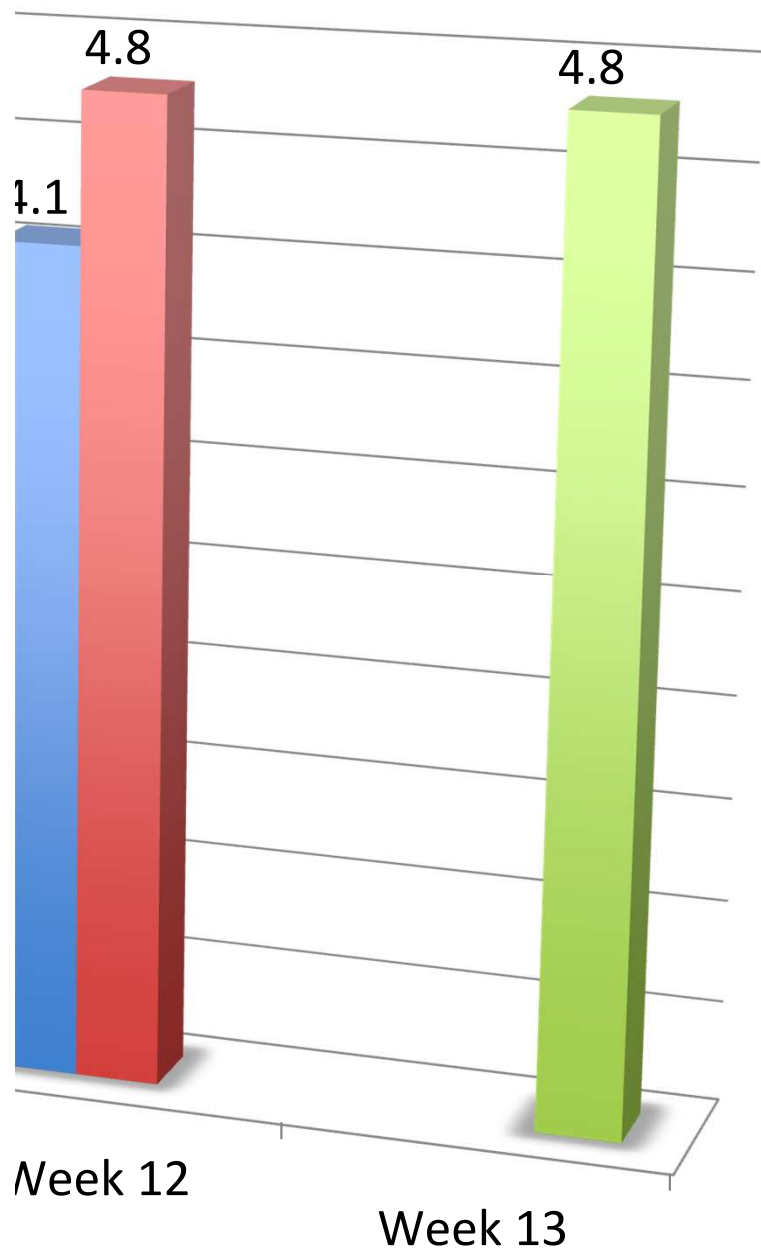


Patient Satisfaction (ma:	Week 4	Week 8	Week 12	Week 13
GP Feedback	4.0	4.1	4.1	
Ease of use	4.5	4.8	4.8	
Overall experience				4.8

1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60



1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60



only

Overall experience

Please wait...

If this message is not eventually replaced by the proper contents of the document, your PDF viewer may not be able to display this type of document.

You can upgrade to the latest version of Adobe Reader for Windows®, Mac, or Linux® by visiting http://www.adobe.com/go/reader_download.

For more assistance with Adobe Reader visit <http://www.adobe.com/go/acrreader>.

Windows is either a registered trademark or a trademark of Microsoft Corporation in the United States and/or other countries. Mac is a trademark of Apple Inc., registered in the United States and other countries. Linux is the registered trademark of Linus Torvalds in the U.S. and other countries.

Please wait...

If this message is not eventually replaced by the proper contents of the document, your PDF viewer may not be able to display this type of document.

You can upgrade to the latest version of Adobe Reader for Windows®, Mac, or Linux® by visiting <http://www.adobe.com/products/acrobat/readstep2.html>.

For more assistance with Adobe Reader visit <http://www.adobe.com/support/products/acrreader.html>.

Windows is either a registered trademark or a trademark of Microsoft Corporation in the United States and/or other countries. Mac is a trademark of Apple Inc., registered in the United States and other countries. Linux is the registered trademark of Linus Torvalds in the U.S. and other countries.

To view the full contents of this document, you need a later version of the PDF viewer. You can upgrade to the latest version of Adobe Reader from www.adobe.com/products/acrobat/readstep2.html

For further support, go to www.adobe.com/support/products/acrreader.html



A cross-sectional survey and service evaluation of simple telehealth in primary care: what do patients think?

Journal:	<i>BMJ Open</i>
Manuscript ID:	bmjopen-2012-001392.R2
Article Type:	Research
Date Submitted by the Author:	16-Oct-2012
Complete List of Authors:	Cottrell, Elizabeth; Keele University, Arthritis Research UK Primary Care Centre Chambers, Ruth; NHS Stoke on Trent, McMillan, Kate; Furlong Medical Practice,
Primary Subject Heading:	Cardiovascular medicine
Secondary Subject Heading:	General practice / Family practice
Keywords:	PRIMARY CARE, Hypertension < CARDIOLOGY, Telehealth, Patient experience, Text message

SCHOLARONE™
Manuscripts

Peer review only

1
2
3
4
5 **A cross-sectional survey and service evaluation of simple telehealth in**
6 **primary care: what do patients think?**
7

8 Elizabeth Cottrell, Kate McMillan, Ruth Chambers
9

10 E Cottrell, Arthritis Research UK Primary Care Centre, Primary Care Sciences, Keele
11 University, Staffordshire, ST5 5BG, UK
12

13 Dr E Cottrell NIHR Academic Clinical Fellow in GP Specialty Training
14

15 K McMillan, Furlong Medical Practice, Tunstall, Stoke on Trent, ST6 5UD
16

17 Dr K McMillan Foundation Year 2 Doctor, General Practice placement
18

19 R Chambers, NHS Stoke on Trent Clinical Commissioning Group, Herbert Minton Building,
20 79 London Road, Stoke on Trent ST4 7PZ
21

22 Dr R Chambers Clinical director of practice development & performance
23

24 Correspondence to: Dr E Cottrell e.cottrell@keele.ac.uk, Arthritis Research UK Primary Care
25 Centre, Primary Care Sciences, Keele University, Staffordshire, ST5 5BG, UK
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60

Abstract

Objective. To determine the patient experience of using a simple telehealth strategy to manage hypertension in adults.

Design. As part of a pragmatic service evaluation, the acceptability of, satisfaction with and ease of use of a simple telehealth strategy was determined via text, cross-sectional questionnaire survey administered by telephone, case studies, discussion groups and informal feedback from practices. This simple telehealth approach required patients to take home blood pressure (BP) readings and text them to a secure server ('Florence') for immediate automatic analysis and individual healthcare professional review.

Participants. 124 intervention patients who used the Florence system.

Setting Ten volunteer GP practices in Stoke on Trent, UK, with poor health and high levels of material deprivation took part.

Results Patient satisfaction was high. In particular, patients found the system easy to use, were very satisfied about the feedback from their GP regarding their BP readings, found the advice sent via Florence useful and preferred to send BP readings using Florence rather than having to go to the practice monthly to get BP checked. Overall satisfaction with the system was 4.81/5.00 at week 13 of the programme. Other advantages of being enrolled with Florence were improved education about hypertension, a greater feeling of support and companionship and flexibility which allowed self-care to occur at a time that suited the patient rather than their practice.

Conclusions This simple telehealth strategy for managing hypertension in the community was met with high levels of patient satisfaction and feelings of control and support. This management approach should thus be considered for widespread implementation for clinical management of hypertension and other long term conditions involving monitoring of patients' bodily measurements and symptoms as a large number of meaningful readings can be obtained from many patients in a prompt, efficient, interactive and acceptable way.

Keywords. primary health care, hypertension, telehealth, patient experience, text message

Article Summary

Article Focus

- Home BP readings are a valuable source of information upon which clinical management decisions can be made and are acceptable to patients
- Although studies have shown that patients are receptive to the idea of simple telehealth strategies for managing BP and that they respond well to text messages, details of the patient experience when actually using simple telehealth in this way is lacking.

- This paper examines the experiences of and feedback from intervention patients who used an innovative interactive simple telehealth strategy to monitor and manage their hypertension.

Key messages

- Patients find that simple telehealth is a flexible, convenient, easy to use and acceptable means of them jointly managing their hypertension with a responsible health professional
- The interactive nature of such a simple telehealth strategy provides support and companionship for some patients and builds their confidence in their health and wellbeing
- Patients are supportive of wider use of this technology in the future for hypertension and other long term conditions.

Strengths and limitations of this study

- As this is a service evaluation, the results obtained accurately reflect actual use of the technology in the clinical setting
- Due to the fact this was a service evaluation, not all patients provided feedback using all the means employed and data collection did not continue until it reached saturation, therefore there may be some missing data

Introduction.

Hypertension is common and carries the risk of great morbidity and mortality. Current management strategies are not adequately controlling this significant problem and new and innovative means of diagnosing and managing hypertension are required. For the best part of the last century the concept of home BP readings to improve the accuracy of measurement and prevent inappropriate treatment of white coat hypertension has been recognised. However the early machines utilised were not reliable and useful readings were limited. (1) Twenty years ago, Aylett (1) outlined that patients became more actively involved in their care with self BP monitoring, compared with ambulatory BP monitoring. Ten years ago a literature review concluded that home BP measurements using automated devices are equivalent to ambulatory readings taken into health settings. (2) The programme evaluated here for patient acceptability and satisfaction brings these historic ideas about improving blood pressure management into the present day. Utilising an electronic sphygmomanometer, to obtain home BP readings, patients text their results into a secure server ('Florence') and receive immediate automated feedback regarding any required further actions, based upon the level of the reading. This is an innovative system that allows 'closed loop' management in the main, i.e. automatic responses, however individualised patient management is provided from the patient's own healthcare professional who reviews their BP recordings weekly, or more frequently if indicated. Clinically, this type of clinical management strategy has a number of benefits; it allows multiple readings, and thus meaningful averages to be calculated, from patients in their own environment, collected at any time of the day or night. Thus personal, social or occupational factors need not be barriers to accessing prompt and effective care for hypertension.

1
2
3 Florence had not been used in this healthcare setting prior to undertaking this programme,
4 although local pilot work for other conditions resulted in positive healthcare professional and
5 patient anecdotal feedback. However, previous work by other groups have suggested that
6 this innovative system was likely to be well accepted by patients. In 2003, when availability
7 of home electronic sphygmomanometers was relatively new, Rickerby et al (3) reported that
8 home BP measurements were easy to obtain with little or no formal training and are
9 acceptable for certain patients, particularly those who wish to accept responsibility for the
10 management of their hypertension as it facilitates more regular BP monitoring than could be
11 realistically possible if measurements were only obtained in the clinical setting. Bostock et al
12 (4) investigated the acceptability of the concept of remote management of BP using mobile
13 phones among healthcare professionals and patients and discovered that patients were
14 generally welcoming to this approach provided that reassurances and action strategies were
15 in place should high readings be returned. Further, Liew et al (5) demonstrated that receipt
16 of text messages resulted in behaviours equivalent to conventional (direct 1:1 telephone)
17 reminder systems, thus supporting the use of interactive text message feedback both from
18 Florence and the healthcare professionals reviewing the readings.
19
20
21

22 To improve satisfaction with this technology among patients it is important that they are
23 positive about this method of service provision in addition to achieving good clinical
24 outcomes. This paper reports the findings of a service evaluation undertaken in primary care
25 to determine the acceptability and levels of patient satisfaction with the use of a simple
26 telehealth intervention for monitoring BP. (6)
27
28

29 **Method.**

30
31 This paper describes the feedback obtained as part of a service evaluation of the
32 implementation of an innovative simple telehealth strategy for managing hypertension.
33 Information about the service design, recruitment, patient characteristics and results with
34 regards to management of BP are described elsewhere. (6) The telehealth strategy used
35 was innovative as it employed the use of home electronic BP measurements and mobile
36 phones so that patients could text their BP results to a secure server ('Florence') for
37 automatic assessment and immediate response according to the level of BP received and
38 personalised, human review of results at least weekly, by the patient's usual primary
39 healthcare team for advice on further management and changes (e.g. to medication) that are
40 required. Patients were enrolled to use Florence for 3 months, or a shorter period if they
41 became, or were found to be, normotensive. Data collection continued for six months after
42 enrolment onto the programme.
43
44
45

46 Information on patient satisfaction, ease of use of Florence and acceptability of this
47 management strategy was obtained using a variety of means. Patients received two
48 questions monthly (week 4, 8 and 12) via text throughout their time using the system. These
49 were 'It is easy to use the Florence system to record my blood pressure' and 'I am satisfied
50 with the feedback from my GP about my blood pressure as a result of using the system'.
51 Patients were required to respond using a 5 point Likert scale (1 = strongly disagree, 2 =
52 disagree, 3 = neither disagree/agree, 4 = agree, 5 = strongly agree). At week 13 patients
53 were texted a further question to answer using a satisfaction score of one to five, 'how
54 satisfied are you with your experience of using the Florence system to manage your blood
55 pressure?'
56
57
58
59
60

1
2
3 At least two patients per practice were contacted by telephone by practice staff to complete
4 a cross-sectional questionnaire survey which, using a Likert scale as above and a selection
5 of attitude statements, enquired about the patients' attitudes towards and satisfaction with
6 using Florence. Attitude statements included 'The Florence (text messaging) system is easy
7 to use', 'I am satisfied with the feedback from by GP about my blood pressure as a result of
8 using the Florence system', 'I find the advice/information I receive from Florence to be useful'
9 and 'I prefer to send daily BP readings via Florence rather than having to go to my doctor's
10 surgery to get my BP checked monthly'. Patients were selected by convenience sampling as
11 some patients were not contactable by telephone. Only one questionnaire was administered
12 to each patient but this data was collected at various time points after enrolment to Florence
13 so they provide an overview of patient satisfaction at all stages of the programme.
14
15

16
17 When patients stopped using Florence they were contacted by telephone by practice staff to
18 enquire about their reasons for stopping and/or any problems encountered, their
19 experiences of using Florence and the likelihood that they would get involved in a similar
20 project in the future should one be available for other health conditions. Patients had to
21 respond to the same attitude statements detailed above. They were also asked to describe
22 an problems encountered and to provide any further comments where they felt this to be
23 appropriate and this supplementary information was recorded as free text. Length of time of
24 using Florence was noted so that an average usage could be calculated.
25
26

27
28 Nine months after the start of the programme, an educational event was held for patients to
29 learn about more about telehealth technology and its wider application. Discussion groups
30 were held during this event for patients to provide feedback about their experiences of being
31 involved in the intervention. Non-attendees were able to remotely provide feedback. The
32 discussion groups were semi-structured and patients were asked questions about using
33 telehealth in general, ease of use of the technology in this specific programme and
34 satisfaction with seeing healthcare professionals less frequently given the closer monitoring
35 using telehealth.
36

37
38 Feedback from practice staff was a dynamic process. Comments from practice staff over the
39 course of the programme were noted. During data collection, patients that appeared to be
40 clinically interesting (e.g. many readings in the middle of the night) were flagged and
41 practices were asked to provide case studies on these patients. Further, practices provided
42 case studies of patients they felt had particularly benefitted from being involved in the
43 programme.
44

45
46 Patient feedback obtained via the Likert scales was summarised descriptively and average
47 scores were calculated. An overview of the patient experience of using Florence obtained
48 through free text feedback on the questionnaires, written and verbal feedback from practice
49 staff and during the discussion groups was summarised according to topics as they
50 emerged.
51

52 **Results.**

53
54 This service evaluation analysed data from 124 patients intervention patients. At the point of
55 final data collection, the six month follow up period was not complete for five patients. Fifty-
56 one patients stopped using the programme at three months, as per the protocol and an
57 addition 37 patients continued using Florence after the three month programme period had
58
59
60

1
2
3 ended. Of these 37 patients, 19 continued to submit BP readings to Florence six months
4 post recruitment.
5

6 In total, 95 patients were sent the monthly questions via Florence, of which, 76% responded
7 to at least one question. Nine of these patients stopped using Florence before completing
8 three months so did not get sent week 12 and 13 questions. Sixty-three patients provided
9 feedback via the questionnaire administered by practice staff over the telephone. Average
10 time between recruitment and administration of the questionnaire among these patients was
11 5.2 months (range 1 to 9 months). Twenty-four people participated in discussion groups. (7)
12
13

14 Feedback obtained using the telephone questionnaire at various time points during the data
15 collection period was collected from 64 patients. Another 82 questionnaires were completed
16 by patients who were contacted after leaving the programme. Forty of these patients left the
17 programme by choice and 42 left because their BP was found to be, or became, controlled
18 within the normotensive range. Of the 40 patients who were classified as leaving the
19 programme by choice, 17 left because they had completed the allocated three months, four
20 because they were unable to devote the required time or were not in the country to
21 undertake the programme, three left due to struggling to use or having limited access to a
22 mobile phone, two patients preferred review by the doctor face-to-face, two patients left their
23 GP practice, two felt unable to relax enough to take their own BP themselves, one patient
24 only wanted to use it short term, one could not access Florence, one misunderstood that the
25 programme should have continued and one was advised by secondary care to have their BP
26 monitored at the hospital. Of the remaining six patients two patients reported that they did
27 not want to continue with the programme anymore but gave no specific reasons and no
28 explanation was provided for four patients.
29
30
31

32 **Patients found Florence easy to use**

33 The statement 'It is easy to use the Florence system to record my blood pressure' was
34 posed on a number of occasions using a five-point Likert scale (1 = strongly disagree, 3 =
35 neither disagree/agree, 5 = strongly agree), and at each stage, results were favourable.
36 Average scores out of a maximum of 5.00, from the text questions on months one, two and
37 three of the programme were 4.49, 4.77 and 4.78, respectively, see Figure 1. In response to
38 the attitude statement 'The Florence (text messaging) system is easy to use', an average
39 score of 4.79 (median 5.00) was obtained from the telephone questionnaire during the
40 programme period (see Table 1) and, among patients who left the programme a score of
41 4.31 (median 5.00) was obtained from those leaving through choice and 4.73 (median 5.00)
42 from those who left due to being normotensive. Further, a number of patients offered the free
43 text feedback that the system was 'easy to use' and they had 'no problems' implementing it
44 and the feedback from discussion groups was that it 'seemed to be easy to use'. (7)
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60

Table 1: Spread of responses to Likert statements from cross-sectional survey administered by telephone

	Strongly disagree	Disagree	Neither disagree/ agree	Agree	Strongly agree	Average	Missing data
The Florence system is easy to use	1	0	2	5	55	4.79	3
I am satisfied with the feedback from my GP about my blood pressure	1	2	1	17	41	4.53	4
'I prefer to send daily BP readings via Florence rather than having to go to my doctors surgery to get my BP checked monthly	2	3	11	11	35	4.19	4

Patients were satisfied with the feedback they obtained through Florence

The statement 'I am satisfied with the feedback from my GP about my BP as a result of using the Florence system' was also asked multiple times using a five-point Likert scale. Again, results were positive. Average scores out of a maximum of 5.00, from the text questions during months one, two and three of the programme were 4.04 (median 5.00), 4.07 (median 5.00) and 4.05 (median 5.00), respectively, see Figure 1. An average score of 4.53 (median 5.00) was obtained from the telephone questionnaire administered during the programme period (see Table 1) and, among patients who left the programme, a score of 4.54 (median 5.00) was obtained from those who left through choice and 4.14 (median 5.00) from those who left due to being normotensive.

This level of satisfaction does not appear to be one-sided. An indication that simple telehealth was also satisfactory to healthcare professionals and promoted efficiencies in care is highlighted by the following: '[A doctor involves recalls that she] had just finished texting her instructions to a patient informing him that he would need a prescription following his blood pressure result – she took the prescription out to reception within five minutes of sending the message, and he was already standing there waiting for the prescription, having jumped into his car and driving to collect it!'

'Self-care' that suits the patient rather than the surgery

A key benefit highlighted by patients and fed back by practices was the flexibility proffered by the Florence system. BP readings could be taken and submitted at any time of the day or night. This assisted patients who may be at risk of 'white coat' hypertension. (8) One man, who exited the Florence system due to his BP becoming controlled, stated that home BP readings were beneficial as he was 'less stressed, more disciplined' and he 'learned how BP was affected by...work and was much lower at weekends - he could then tell how to look after his BP better'. Similarly, one patient 'was delighted by the fact that he could communicate with his GP without the necessity of travelling to the surgery...he often had to tackle rush hour traffic...to attend...his appointment and felt that he was not in a sufficiently relaxed state to have his BP taken when he'd completed that battle'. The theme of being more 'relaxed' or 'less anxious' when taking home BP and submitting them to Florence was repeated by a number of patients.

Further, Florence also suited patients whose lifestyles conflict with attending GP surgeries. For example one patient who 'doesn't get up until the afternoon' sent in multiple readings in the middle of the night. Elderly patients who rely on others to transport them to the GP surgery were 'delighted not to have the inconvenience of attending surgery for the blood pressures to be taken'. Carers benefited from this flexibility also; 'a 59 year old male who lives with and cares for his 84 year old father...he felt very happy and felt that someone is looking after him...without him coming to the surgery...he hadn't been into the surgery [for over six months] and rarely comes in due to caring full time for his father'.

Florence provided reassurance for patients with uncertain diagnoses of hypertension

Although patients without confirmed hypertension did not meet our 'specific' inclusion criteria for this project, this was a service evaluation and these patients were recruited for clinically appropriate reasons and gained significant benefit from being involved. For example, 25 patients with high clinic systolic BP readings at recruitment used Florence and discovered they had normal home readings, without making any changes to their medication. These patients could be reassured and discharged from the system. This reassurance was welcomed by some of the patients who reported that 'no treatment needed – reassuring...long term monitoring gives a better picture', 'reassuring to monitor in home environment' and 'reassured no problem'. Such use of Florence represents an extension to the current National Institute for Health and Clinical Excellence (NICE) recommendations for 24 hour ambulatory or home monitoring of BP to determine a diagnosis of hypertension. (8)

Reinforces care and advice from primary healthcare team

Florence was noted to reinforce health messages from the primary healthcare team and lead to control of hypertension among patients who had previously been difficult to manage. Someone in the discussion group fed back 'my partner was struggling with his blood pressure, and telehealth has made a world of difference'. (7) Patients specifically commented on liking 'to see BP reading and be aware that it is normal'. Another discussion group member commented that telehealth 'helped me to learn to live with the disease and become more involved in monitoring my own health'. (7) The enhanced involvement and knowledge about BP readings and the significance of the result obtained, promoted by the training and accompanying literature for the programme, lead to a new attitude of compliance with management of their hypertension among certain patients. For example, one patient who had previously stopped his own medication had been strongly counselled about the dangers of his uncontrolled BP continued to have significant hypertension. He

1
2
3 joined the Florence system and gained better control of his BP, practice staff reported that
4 'he could take his BP at home, where the readings would be done in a less stressful
5 situation...the process has helped his understanding of his condition...it does seem to be a
6 combination of the nurse's firm advice, and Florence's routine readings that have combined
7 to stabilise his condition'. A similar situation was noted in another patient 'the system has
8 highlighted just how high her BP actually is'. The intensive nature of Florence made one
9 patient feel 'he had a strong support from his GP and that it was a really worthwhile
10 illustration of the quality of NHS service'.
11
12

13 A few patients fed back that being involved in the programme prompted them to find out
14 more about 'blood pressure', educated them about the relevance and interpretation of the
15 BP values and highlighted the importance of good BP control. '[A 25 year old male] found
16 the scheme helped him to understand more about the importance of keeping his BP under
17 control especially with regards to his ongoing kidney problems'. 'A 73 yr old male...on the
18 whole felt that [being involved in the programme] had helped him to understand his BP and
19 control a bit better.' '[A 60 year old female] found that using this system helped her
20 considerably as she was more relaxed plus she found the accompanying literature very
21 helpful and it prompted her to research further about hypertension on the internet, therefore
22 increasing her understanding.' However, one individual highlighted that despite improved
23 understanding, patients remain free to exert their autonomy 'once information became
24 knowledge I understood my disease. Then I had a choice: should I do something about it or
25 not – it was my choice'.
26
27
28

29 Florence also helped to promote more comprehensive management of high risk patients,
30 such as 'a 25 year old male...noted to have proteinuria at his new patient check
31 and...BP...145/84mmHg. Over time he was noted to have persisting proteinuria with mid
32 stream urine samples negative for infection. He had a history of gout and associated anti-
33 inflammatory drug use. [Blood tests revealed] creatinine 275, urea 11.7 and eGFR 25 [so he
34 was diagnosed with] CKD Stage 4. Following referral to nephrology he was found to have
35 small kidneys and signs of longstanding CKD...he was advised that he needed good BP
36 control and was invited to join the Florence programme...He was not on any BP medication
37 at baseline (the new patient check) but was started on amlodipine by nephrology soon
38 afterwards. Having previously not self-monitored his BP, while involved in this programme he
39 monitored it twice per week and found the texts useful as they reminded him to take his BP'.
40
41
42

43 **Florence was a companion to patients**

44 An unexpected role that Florence was found to fulfil was of companionship to the patients it
45 serves. 'A 67 year old lady was very happy with using Florence – she said that when she
46 finished using the system she missed the contact and felt that she had "lost a friend"'. Other
47 indicators of this role of Florence was from a patient who reported 'that using the system
48 gave her a sense of comfort to have the feedback from the GP to reassure her that she was
49 managing her condition very well' and another who reported that 'getting texts from Flo has
50 given him a break in his daily routine, as it feels that he has someone to talk to'.
51
52

53 **Few problems were encountered**

54 Problems using the simple telehealth system were identified among only a few patients.
55 Among patients who chose to leave the programme by choice, six had problems sending or
56 receiving text messages using Florence and one reported having a problem taking their own
57 BP, but this was due to them being 'too anxious'. Among the six patients who had problems
58
59
60

1
2
3 sending or receiving text messages, one patient was texting in words, not numbers, got
4 frustrated as submissions were not recognised and left the programme, one reported not
5 being 'a technical person', two patients required other family members to text in readings,
6 one reported not being able to access the Florence system and the final patient only had
7 problems returning messages from survey questions, rather than BP readings. Among
8 patients who left the programme with controlled BP, four reported problems sending or
9 receiving text messages using Florence and one had a problem taking their own BP due the
10 resultant effects of having a previous stroke. Of the four patients who reported problems
11 sending or receiving text messages, two had problems initially transferring readings but after
12 further advice had no problems thereafter, one patient reported having incongruous
13 responses after submitting readings and one patient reported a problem but gave no
14 explanation. Another patient also reported getting conflicting advice, they were 'told by
15 phone that BP's okay but had to contact surgery regarding medication'.

16
17
18
19 Some patients fed back that multiple messages a day prompting them to submit readings
20 and providing advice was a little excessive. However, this was balanced by another patient
21 who stated that they 'felt at first that taking BP each day was a bit much but soon realised
22 the benefits and could not fault it'.

23
24
25 Focus group discussions among patients also highlighted that this type of service would not
26 be suitable for all patients, especially those with limited cognitive abilities. They also
27 suggested that older people may not manage to use a mobile phone or other equipment,
28 however, this is not a universal problem as patients up to the age of 86 years used the
29 system.

30 31 **Simple telehealth and the future**

32 Among the 40 patients who left the programme by choice, an average score of 3.71 (median
33 4.00) out of 5.00 was obtained in response to the statement 'I would be interested in using
34 this type of programme in the future for this or another type of health problem'. A score of
35 4.54 (median 5.00) was obtained (from a five-point Likert scale where 1 = strongly disagree
36 and 5 = strongly agree) in relation to the same question among the 42 patients who left the
37 programme with controlled BP.

38
39
40 Further evidence of a positive attitude towards future use of a similar programme was
41 obtained when patients were asked to respond to the statement 'I prefer to send daily BP
42 readings via Florence rather than having to go to my doctors surgery to get my BP checked
43 monthly', an average score of 4.19 (median 5.00) was obtained (see Table 1).

44
45
46 Positive attitudes among patients for utility of simple telehealth in the future were underlined
47 by feedback from the discussion groups. This highlighted the areas in which patients felt that
48 telehealthcare may be of value in the future. Such uses include monitoring of other chronic
49 conditions such as renal, heart, respiratory conditions and diabetes and certain 'medium
50 term afflictions' (e.g. pre-eclampsia). However, patients also saw a role for telehealthcare as
51 prompting service particularly for those with learning disabilities, dementia and carers,
52 assisting patients to remember to take medications, fluids and food and managing patients
53 pre-operatively. Finally, patients imagined this type of intervention could help the 'well' to
54 stay that way by monitoring health parameters to prevent illness.

55
56
57 Not only did patients see scope for this type of service provision in the future, feedback
58 indicated that the lessons learned through the use of this system will be taken into the future
59
60

1
2
3 by individual patients. For example, one man 'is continuing to take his own blood pressure at
4 home with a machine he has purchased and will continue to monitor himself accordingly so
5 that he can bring the results into surgery on his review appointment'.
6

7 8 **Discussion**

9
10 This service evaluation demonstrates that patients found this simple telehealth strategy for
11 managing hypertension easy to use, convenient and acceptable. Patients liked feeling
12 increased levels of support and Florence had a role as a companion, in promoting patients to
13 educate themselves further and providing reassurance about normotension in cases of white
14 coat hypertension. As previously found (3), the skills and knowledge gained by patients from
15 using Florence has led some patients to commence longer term health behaviours such as
16 self-directed ongoing monitoring and purchase of their own home machines.
17

18
19 The problems encountered with using the system were relatively minor and many could be
20 eliminated by careful recruitment of patients (ensuring dexterity to use BP machine and
21 mobile phone and access to equipment needed), through thorough counselling about what
22 they will be expected to do (one patient reported it feeling 'awkward' initially but was 'fine
23 when got used to it') and what they should expect to receive from the system before
24 embarking on the programme and/or tailor the number of requests more precisely to the
25 needs of the patient. For example, if, clinically, only once weekly readings are required then
26 Florence can be 'instructed' to only send prompts at this regularity. Such down regulation in
27 the frequency of prompts from Florence is expected to occur in all patients using the system
28 as hypertension becomes controlled. Discussion groups raised the concern that 'older
29 people won't want to change, maybe they wouldn't manage the mobile phone or other
30 equipment, they would need a lot of teaching about it so they were able to use it. If there
31 wasn't confidence in being able to use the equipment, it would make them feel worse'. (7)
32 However, this concern did not affect the majority of Florence users as only three patients
33 could not manage the mobile phone enough to continue with the programme. In line with
34 previous experience (3), this management approach just does not seem to suit some
35 patients' preferences, who would rather see a doctor and/or are concerned about using
36 home BP machines or mobile phones. However this only appears to apply to a small
37 minority of patients.
38
39
40

41
42 The results presented are from a pragmatic service evaluation. They are therefore valuable
43 as they reflect patient experience in the actual clinical setting when the programme is
44 delivered by the patients' usual clinical staff. However data was thus not obtained
45 systematically nor until the point of data saturation. Further, the number of patients included
46 was not derived through calculation of required sample size but determined by the maximum
47 number of patients that could be recruited in the given time period. Data regarding the
48 number of patients approached to join the programme and thus how many declined is not
49 available. The same question may have been asked of the same patient on multiple
50 occasions and at varying time points throughout their use of the programme. Data is also
51 missing from some patients who could not be contacted or if practice staff did not have
52 capacity to contact all patients involved to obtain feedback. The effect on the data of this
53 missing information is likely to be minimal as patients were not systematically excluded from
54 providing feedback and the feedback from practice staff in all ten participating practices
55 ensured that overall patient experience was summarised. Predominantly, patient feedback
56 was very positive. This finding may be due to the wording of the statements associated with
57
58
59
60

1
2
3 the Likert scales which were all framed in a positive way, for example 'The Florence (text
4 messaging) system is easy to use' and 'I find the advice/information I receive from Florence
5 to be useful'. However, patients had opportunity to disagree with these statements using the
6 Likert scale and it could be argued that using both positive and negative statements may
7 lead to confusion in giving responses. When thinking about other possible anomalous
8 causes of the positive results found it is important to consider the risk of missing opposing
9 views. It was clear if and when patients stopped using Florence as there were no further
10 readings submitted to the server. If submissions of readings appeared to have ceased,
11 practice staff were requested to contact the patient to establish if they were still using
12 Florence and, if not, they completed the telephone questionnaire to find out the reasons why
13 not and establish if any problems had been encountered. Of the 124 patients enrolled on the
14 programme, 82 completed questionnaires upon cessation of their use of Florence. Of the
15 remaining patients, 19 were still submitting BP readings to Florence after six months had
16 elapsed since their enrolment. Therefore it is unlikely that any significant negativity about the
17 programme was missed unless dissatisfied patients were regularly using the programme and
18 not feeding this dissatisfaction back to the team.
19
20
21

22
23 In line with the findings of McManus et al(9) and Jones et al (10), intervention patients were
24 supportive of home or self-monitoring in the future and, once the programme had finished,
25 some wished to continue using Florence. Generally there was no evidence that undertaking
26 home readings increased anxiety. Only one patient specifically reported that they withdrew
27 from the programme as she 'would have preferred to send BP readings in monthly...[as daily
28 readings] made her feel anxious [as] she knew each day when she got up she had to text in'.
29 This is in accordance with the findings of previous studies investigating home BP readings
30 by Little et al in 2002 (11), McManus et al in 2005 (9) and Ovaisi et al in 2011(12) which all
31 found good levels of acceptability of home readings among patients and no evidence of
32 detrimental effects of increased anxiety. In general, patients in this service evaluation found
33 home readings to be beneficial as they were more relaxed and less anxious than they would
34 be in the GP surgery. It may be for this reason that the patients investigated by Jones et al
35 (10) felt that home readings were more 'natural'.
36
37

38
39 Patient concordance with jointly agreed management strategies between the patient and
40 their responsible health professional is essential in maximising the health benefits obtained.
41 Therefore ease of use of any intervention needs to be high to minimise barriers to use. This
42 evaluation identified that this simple telehealth intervention was generally found to be easy to
43 use, a finding which is supported by Clarke et al(13), who undertook a systematic review of
44 telemonitoring and structured telephone support programmes for patients with chronic heart
45 failure. They reported generally high patient acceptance, satisfaction and ease of use scores
46 among the studies they examined.
47

48
49 Utilising this simple telehealth strategy has benefits over patients taking home readings and
50 reporting them to the GP for two reasons: BP readings are transmitted and recorded in real
51 time, therefore there is no scope for missing or lost results at GP review; and one recent
52 study of home BP readings among stroke patients identified that even though all patients
53 understood the importance of having a high BP reading, when one was obtained, they did
54 not all seek help or direction from their primary care team.(12) The simple health strategy
55 used in this service evaluation eliminates this barrier to seeking appropriate care as all
56 results that are sent to Florence are reviewed on the dedicated server by the primary
57 healthcare team at regular intervals. Further, due to the at least weekly review of BP
58
59
60

1
2
3 readings by the patients' usual primary care team, any persistently suboptimal readings that
4 have not been recognised by the patient will be detected more quickly than they will have
5 been had the patient been asked to record their blood pressure at home and return after a
6 month or so.
7

8
9 In agreement with a previous systematic review of telemonitoring for heart failure(14), which
10 concluded that telemonitoring was generally 'favourable compared with usual care', this
11 service evaluation indicates that patients feel the same about simple telehealth monitoring of
12 hypertension. The flexibility, control and education that Florence provides were well received
13 and appear to have empowered patients who had previously been uncontrolled and/or non-
14 compliant with usual care.
15

16
17 When used in clinical practice, there should be scope to continue using Florence for
18 prolonged periods even after normotension is reached, albeit with readings at reduced
19 intervals. Not only would this ensure enduring control it may help to allay patients' concerns
20 that arose during the discussion groups about 'slipping through the net' due to lack of face-
21 to-face contact. Some patients within this service evaluation, and those who were
22 interviewed by Jones et al (10) following a similar intervention, were keen to continue self-
23 monitoring in the same way. The number of BP readings requested by Florence each week
24 or month can be adjusted down accordingly in these situations.
25

26
27 In summary, there is a clear need for new and improved clinically driven strategies for
28 hypertension control in primary care to prevent morbidity and mortality. This pragmatic
29 service evaluation indicates that simple telehealth strategies may not only be effective in
30 doing this in actual clinical practice but do so in a way that is easy, flexible, affordable,
31 acceptable and, in many cases preferable, when compared with usual care. Not only does
32 simple telehealth deliver a service that patients appreciated and believed in, it appeared to
33 become a companion to some patients. Our results indicate that careful selection and
34 counselling of patients is required at recruitment onto such a programme to ensure that they
35 understand and agree with the nature and frequency of the processes involved and that they
36 are physically and cognitively able to operate the simple equipment.
37
38

39 40 **Funding**

41
42 Funded by Health Foundation.
43

44 **Competing Interests**

45
46 All authors have completed the Unified Competing Interest form at
47 www.icmje.org/coi_disclosure.pdf (available on request from the corresponding author) and
48 declare that (1) EC, KM and RC have support from NHS Stoke on Trent for the submitted
49 work; (2) EC, KM and RC have no relationships with Mediaburst Limited that might have an
50 interest in the submitted work in the previous 3 years (3) their spouses, partners, or children
51 have no financial relationships that may be relevant to the submitted work; and (4) EC, KM
52 and RC have no non-financial interests that may be relevant to the submitted work.
53
54
55
56
57
58
59
60

Contributorship

EC designed data collection tools, inputted and analysed data and drafted and revised the original paper. RC lead the programme of work and oversaw the processes of data collection, analysis and reporting, she also devised and revised this paper. KM collected data and revised the draft paper. EC, RC and KM are responsible for the overall content as guarantor(s). JB, CC, JD, MD, PO, DS and DW were all involved in running the programme and for data collection.

Data Sharing

No additional unpublished data is available. A linked paper has been submitted containing the design, recruitment, patient characteristics and results of the programme described.

References

1. Aylett MJ. Ambulatory or self blood pressure measurement? Improving the diagnosis of hypertension. *Fam Pract*. 1994;11:197-200
2. Rickerby J. The role of home BP measurement in managing hypertension – an evidence based review. *J Hum Hypertens*. 2002;16: 469-72.
3. Rickerby J, Woodward J. Patients' experiences and opinions of home blood pressure measurement. *J Hum Hypertens*. 2003;17:495-503.
4. Bostock Y, Hanley J, McGown D, et al. *The acceptability to patients and professionals of remote blood pressure monitoring using mobile phones*. *Prim Health Care Res Dev*. 2009;10:299-308.
5. Liew SM, Tong SF, Lee VKM, et al. *Text messaging reminders to reduce non-attendance in chronic disease follow-up: a clinical trial*. *Br J Gen Pract*. 2009;59:916-20.
6. Cottrell E, Chambers R, O'Connell P. *Using simple telehealth in primary care to reduce blood pressure: a service evaluation*. 2012. [In Press - bmjopen-2012-001391.R1].
7. Stoke on Trent Community Health Voice. *Telehealthcare event on 27th January 2012*. Unpublished.
8. National Institute of Health and Clinical Excellence. *Hypertension: clinical management of primary hypertension in adults*. London: NICE; 2011.
9. McManus RJ, Mant J, Roalfe A, et al. *Targets and self monitoring in hypertension: randomised controlled trial and cost effectiveness analysis*. *BMJ*. 2005; doi:10.1136/bmj.38558.393669.E0.
10. Jones MI, Greenfield SM, Bray EP, et al. Patients' experiences of self-monitoring blood pressure and self-titration of medication: the TASMING2 trial qualitative study. *Br J Gen Pract*. 2012;62:e135-42: doi:10.3399/bjgp12X625201
11. Little P, Barnett J, Barnsley L, et al. *Comparison of acceptability of and preferences for different methods of measuring blood pressure in primary care*. *BMJ*. 2002;325:258-9.

1
2
3 12. Ovaisi S, Ibison J, Leontowitsch M, et al. *Stroke patients' perceptions of home blood*
4 *pressure monitoring: a qualitative study*. Br J Gen Pract. 2011; doi: 10.3399/bjgp11X593893.

5
6 13. Clark RA, Inglis SC, McAlister FA, et al. *Telemonitoring or structured telephone support*
7 *programmes for patients with chronic heart failure: systematic review and meta-analysis*.
8 BMJ. 2007; doi:10.1136/bmj.39156.536968.55.

9
10 14. Polisena J, Tran K, Cimon K, et al. *Home telemonitoring for congestive heart failure: a*
11 *systematic review and meta-analysis*. J Telemed Telecare. 2010;16:68-76.
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60

For peer review only

1
2
3
4
5
6
7
8 **A cross-sectional survey service evaluation and service evaluation of**
9 **simple telehealth in primary care: what do patients think?**

10 Elizabeth Cottrell, Kate McMillan, Ruth Chambers

11 E Cottrell, Arthritis Research UK Primary Care Centre, Primary Care Sciences, Keele
12 University, Staffordshire, ST5 5BG, UK

13 Dr E Cottrell NIHR Academic Clinical Fellow in GP Specialty Training

14 K McMillan, Furlong Medical Practice, Tunstall, Stoke on Trent, ST6 5UD

15 Dr K McMillan Foundation Year 2 Doctor, General Practice placement

16 R Chambers, NHS Stoke on Trent Clinical Commissioning Group, Herbert Minton Building,
17 79 London Road, Stoke on Trent ST4 7PZ

18 Dr R Chambers Clinical director of practice development & performance

19 Correspondence to: Dr E Cottrell e.cottrell@ephe.keele.ac.uk, Arthritis Research UK Primary
20 Care Centre, Primary Care Sciences, Keele University, Staffordshire, ST5 5BG, UK

Field Code Changed

Abstract

Objective. To determine the patient experience of using a simple telehealth strategy to manage hypertension in adults.

Design. As part of a pragmatic service evaluation, the acceptability of, satisfaction with and ease of use of a simple telehealth strategy was determined via text, [cross-sectional questionnaire survey administered by](#) telephone, case studies, discussion groups and informal feedback from practices. This simple telehealth approach required patients to take home blood pressure (BP) readings and text them to a secure server ('Florence') for immediate automatic analysis and individual healthcare professional review.

Participants. 124 intervention patients who used the Florence system.

Setting Ten volunteer GP practices in Stoke on Trent, UK, with poor health and high levels of material deprivation took part.

Results Patient satisfaction was high. In particular, patients found the system easy to use, were very satisfied about the feedback from their GP regarding their BP readings, found the advice sent via Florence useful and preferred to send BP readings using Florence rather than having to go to the practice monthly to get BP checked. Overall satisfaction with the system was 4.81/5.00 at week 13 of the programme. Other advantages of being enrolled with Florence were improved education about hypertension, a greater feeling of support and companionship and flexibility which allowed self-care to occur at a time that suited the patient rather than their practice.

Conclusions This simple telehealth strategy for managing hypertension in the community was met with high levels of patient satisfaction and feelings of control and support. This management approach should thus be considered for widespread implementation for clinical management of hypertension and other long term conditions involving monitoring of patients' bodily measurements and symptoms as a large number of meaningful readings can be obtained from many patients in a prompt, efficient, interactive and acceptable way.

Keywords. primary health care, hypertension, telehealth, patient experience, text message

Article Summary

Article Focus

- Home BP readings are a valuable source of information upon which clinical management decisions can be made and are acceptable to patients
- Although studies have shown that patients are receptive to the idea of simple telehealth strategies for managing BP and that they respond well to text messages, details of the patient experience when actually using simple telehealth in this way is lacking.

- This paper examines the experiences of and feedback from intervention patients who used an innovative interactive simple telehealth strategy to monitor and manage their hypertension.

Key messages

- Patients find that simple telehealth is a flexible, convenient, easy to use and acceptable means of them jointly managing their hypertension with a responsible health professional
- The interactive nature of such a simple telehealth strategy provides support and companionship for some patients and builds their confidence in their health and wellbeing
- Patients are supportive of wider use of this technology in the future for hypertension and other long term conditions.

Strengths and limitations of this study

- As this is a service evaluation, the results obtained accurately reflect actual use of the technology in the clinical setting
- Due to the fact this was a service evaluation, not all patients provided feedback using all the means employed and data collection did not continue until it reached saturation, therefore there may be some missing data

Introduction.

Hypertension is common and carries the risk of great morbidity and mortality. Current management strategies are not adequately controlling this significant problem and new and innovative means of diagnosing and managing hypertension are required. For the best part of the last century the concept of home BP readings to improve the accuracy of measurement and prevent inappropriate treatment of white coat hypertension has been recognised. However the early machines utilised were not reliable and useful readings were limited. (1) Twenty years ago, Aylett (1) outlined that patients became more actively involved in their care with self BP monitoring, compared with ambulatory BP monitoring. Ten years ago a literature review concluded that home BP measurements using automated devices are equivalent to ambulatory readings taken into health settings. (2) The programme evaluated here for patient acceptability and satisfaction brings these historic ideas about improving blood pressure management into the present day. Utilising an electronic sphygmomanometer, to obtain home BP readings, patients text their results into a secure server ('Florence') and receive immediate automated feedback regarding any required further actions, based upon the level of the reading. This is an innovative system that allows 'closed loop' management in the main, i.e. automatic responses, however individualised patient management is provided from the patient's own healthcare professional who reviews their BP recordings weekly, or more frequently if indicated. Clinically, this type of clinical management strategy has a number of benefits; it allows multiple readings, and thus meaningful averages to be calculated, from patients in their own environment, collected at any time of the day or night. Thus personal, social or occupational factors need not be barriers to accessing prompt and effective care for hypertension.

1
2
3
4
5
6
7 Florence had not been used in this healthcare setting prior to undertaking this programme,
8 although local pilot work for other conditions resulted in positive healthcare professional and
9 patient anecdotal feedback. However, previous work by other groups have suggested that
10 this innovative system was likely to be well accepted by patients. In 2003, when availability
11 of home electronic sphygmomanometers was relatively new, Rickerby et al (3) reported that
12 home BP measurements were easy to obtain with little or no formal training and are
13 acceptable for certain patients, particularly those who wish to accept responsibility for the
14 management of their hypertension as it facilitates more regular BP monitoring than could be
15 realistically possible if measurements were only obtained in the clinical setting. Bostock et al
16 (4) investigated the acceptability of the concept of remote management of BP using mobile
17 phones among healthcare professionals and patients and discovered that patients were
18 generally welcoming to this approach provided that reassurances and action strategies were
19 in place should high readings be returned. Further, Liew et al (5) demonstrated that receipt
20 of text messages resulted in behaviours equivalent to conventional (direct 1:1 telephone)
21 reminder systems, thus supporting the use of interactive text message feedback both from
22 Florence and the healthcare professionals reviewing the readings.

23
24 To improve satisfaction with this technology among patients it is important that they are
25 positive about this method of service provision in addition to achieving good clinical
26 outcomes. This paper reports the ~~qualitative~~ findings of a service evaluation undertaken in
27 primary care to determine the acceptability and levels of patient satisfaction with the use of a
28 simple telehealth intervention for monitoring BP. (6)

29 **Method.**

30
31 This paper describes the ~~qualitative~~ feedback obtained as part of a service evaluation of the
32 implementation of an innovative simple telehealth strategy for managing hypertension. ~~Information about the service the design, recruitment, patient characteristics and results of~~
33 ~~which on with regards to the~~ management of BP are described ~~in an accompanying~~
34 ~~paper elsewhere.~~ (6) The telehealth strategy used was innovative as it employed the use of
35 home electronic BP measurements and mobile phones so that patients could text their BP
36 results to a secure server ('Florence') for automatic assessment and immediate response
37 according to the level of BP received and personalised, human review of results at least
38 weekly, by the patient's usual primary healthcare team for advice on further management
39 and changes (e.g. to medication) that are required. Patients were enrolled to use Florence
40 for 3 months, or a shorter period if they became, or were found to be, normotensive. Data
41 collection continued for six months after enrolment onto the programme.

42
43
44 ~~Qualitative~~ information on patient satisfaction, ease of use of Florence and acceptability of
45 this management strategy was obtained using a variety of means. Patients received two
46 questions monthly (week 4, 8 and 12) via text throughout their time using the system. These
47 were 'It is easy to use the Florence system to record my blood pressure' and 'I am satisfied
48 with the feedback from my GP about my blood pressure as a result of using the system'.
49 Patients were required to respond using a 5 point Likert scale (1 = strongly disagree, 2 =
50 disagree, 3 = neither disagree/agree, 4 = agree, 5 = strongly agree). At week 13 patients
51 were texted a further question to answer using a satisfaction score of one to five, 'how
52 satisfied are you with your experience of using the Florence system to manage your blood
53 pressure?'

1
2
3
4
5
6
7 At least two patients per practice were contacted by telephone by practice staff to complete
8 a cross-sectional questionnaire survey which, using a Likert scale as above and a selection
9 of attitude statements, enquired about the patients' attitudes towards and satisfaction with
10 using Florence. Attitude statements included 'The Florence (text messaging) system is easy
11 to use', 'I am satisfied with the feedback from by GP about my blood pressure as a result of
12 using the Florence system', 'I find the advice/information I receive from Florence to be useful'
13 and 'I prefer to send daily BP readings via Florence rather than having to go to my doctor's
14 surgery to get my BP checked monthly'. Patients were selected by convenience sampling as
15 some patients were not contactable by telephone. Only one questionnaire was administered
16 to each patient but this data was collected at various time points after enrolment to Florence
17 so they provide an overview of patient satisfaction at all stages of the programme.

18
19 When patients stopped using Florence they were contacted by telephone by practice staff to
20 enquire about their reasons for stopping and/or any problems encountered, their
21 experiences of using Florence and the likelihood that they would get involved in a similar
22 project in the future should one be available for other health conditions. Patients had to
23 respond to the same attitude statements detailed above. They were also asked to describe
24 an problems encountered and to provide any further comments where they felt this to be
25 appropriate and this supplementary information was recorded as free text. Length of time of
26 using Florence was noted so that an average usage could be calculated.

27
28 Nine months after the start of the programme, an educational event was held for patients to
29 learn about more about telehealth technology and its wider application. Discussion groups
30 were held during this event for patients to provide feedback about their experiences of being
31 involved in the intervention. Non-attendees were able to remotely provide feedback. The
32 discussion groups were semi-structured and patients were asked questions about using
33 telehealth in general, ease of use of the technology in this specific programme and
34 satisfaction with seeing healthcare professionals less frequently given the closer monitoring
35 using telehealth.

36
37 Feedback from practice staff was a dynamic process. Comments from practice staff over the
38 course of the programme were noted. During data collection, patients that appeared to be
39 clinically interesting (e.g. many readings in the middle of the night) were flagged and
40 practices were asked to provide case studies on these patients. Further, practices provided
41 case studies of patients they felt had particularly benefitted from being involved in the
42 programme.

43
44 Patient feedback obtained via the Likert scales was summarised descriptively and average
45 scores were calculated. An overview of the patient experience of using Florence obtained
46 through free text feedback on the questionnaires, written and verbal feedback from practice
47 staff and during the discussion groups was summarised according to topics as they
48 emerged.

49 **Results.**

50
51 This service evaluation analysed data from 124 patients intervention patients. At the point of
52 final data collection, the six month follow up period was not complete for five patients. Fifty-
53 one patients stopped using the programme at three months, as per the protocol and an
54 addition 37 patients continued using Florence after the three month programme period had
55
56
57
58
59
60

ended. Of these 37 patients, 19 continued to submit BP readings to Florence six months post recruitment.

In total, 95 patients were sent the monthly questions via Florence, of which, 76% responded to at least one question. Nine of these patients stopped using Florence before completing three months so did not get sent week 12 and 13 questions. Sixty-three patients provided feedback via the questionnaire administered by practice staff over the telephone. Average time between recruitment and administration of the questionnaire among these patients was 5.2 months (range 1 to 9 months). Twenty-four people participated in discussion groups. (7)

Feedback obtained using the telephone questionnaire at various time points during the data collection period was collected from 64 patients. Another 82 questionnaires were completed by patients who were contacted after leaving the programme. Forty of these patients left the programme by choice and 42 left because their BP was found to be, or became, controlled within the normotensive range. Of the 40 patients who were classified as leaving the programme by choice, 17 left because they had completed the allocated three months, four because they were unable to devote the required time or were not in the country to undertake the programme, three left due to struggling to use or having limited access to a mobile phone, two patients preferred review by the doctor face-to-face, two patients left their GP practice, two felt unable to relax enough to take their own BP themselves, one patient only wanted to use it short term, one could not access Florence, one misunderstood that the programme should have continued and one was advised by secondary care to have their BP monitored at the hospital. Of the remaining six patients two patients reported that they did not want to continue with the programme anymore but gave no specific reasons and no explanation was provided for four patients.

Patients found Florence easy to use

The statement 'It is easy to use the Florence system to record my blood pressure' was posed on a number of occasions using a five-point Likert scale (1 = strongly disagree, 3 = neither disagree/agree, 5 = strongly agree), and at each stage, results were favourable. Average scores out of a maximum of 5.00, from the text questions on months one, two and three of the programme were 4.49, 4.77 and 4.78, respectively, see Figure 1. In response to the attitude statement 'The Florence (text messaging) system is easy to use', an average score of 4.79 (median 5.00) was obtained from the telephone questionnaire during the programme period (see Table 1) and, among patients who left the programme a score of 4.31 (median 5.00) was obtained from those leaving through choice and 4.74-73 (median 5.00) from those who left due to being normotensive. Further, a number of patients offered the free text feedback that the system was 'easy to use' and they had 'no problems' implementing it and the feedback from discussion groups was that it 'seemed to be easy to use'. (7)

Figure 1: Average patient satisfaction scores for feedback from GP/practice nurse, ease of use of the Florence system and the overall experience of using Florence (1 = strongly disagree, 3 = neither disagree/agree, 5 = strongly agree)

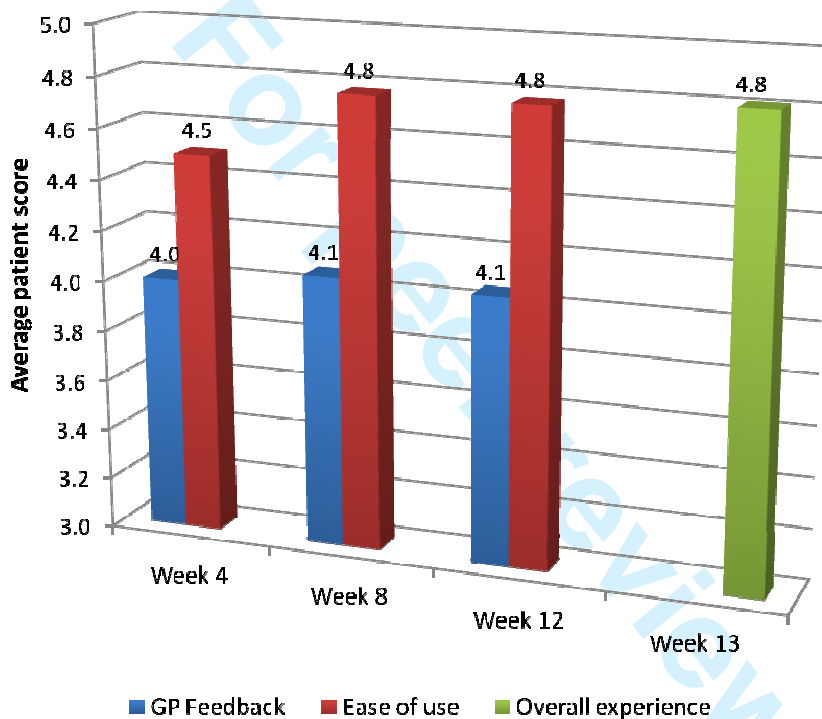


Table 1: Spread of responses to Likert statements from cross-sectional survey administered by telephone

	Strongly disagree	Disagree	Neither disagree/agree	Agree	Strongly agree	Average	Missing data
The Florence system is easy to use	1	0	2	5	55	4.79	3
I am satisfied with the feedback from my GP about my	1	2	1	17	41	4.53	4

<u>blood pressure</u>							
<u>'I prefer to send daily BP readings via Florence rather than having to go to my doctors surgery to get my BP checked monthly</u>	<u>2</u>	<u>3</u>	<u>11</u>	<u>11</u>	<u>35</u>	<u>4.19</u>	<u>4</u>

Patients were satisfied with the feedback they obtained through Florence

The statement 'I am satisfied with the feedback from my GP about my BP as a result of using the Florence system' was also asked multiple times using a five-point Likert scale. Again, results were positive. Average scores out of a maximum of 5.00, from the text questions during months one, two and three of the programme were 4.04 (median 5.00), 4.07 (median 5.00) and 4.05 (median 5.00), respectively, see Figure 1. An average score of 4.53 (median 5.00) was obtained from the telephone questionnaire administered during the programme period (see Table 1) and, among patients who left the programme, a score of 4.454 (median 5.00) was obtained from those who left through choice and 4.53-14 (median 5.00) from those who left due to being normotensive.

This level of satisfaction does not appear to be one-sided. An indication that simple telehealth was also satisfactory to healthcare professionals and promoted efficiencies in care is highlighted by the following: '[A doctor involves recalls that she] had just finished texting her instructions to a patient informing him that he would need a prescription following his blood pressure result – she took the prescription out to reception within five minutes of sending the message, and he was already standing there waiting for the prescription, having jumped into his car and driving to collect it!'

'Self-care' that suits the patient rather than the surgery

A key benefit highlighted by patients and fed back by practices was the flexibility proffered by the Florence system. BP readings could be taken and submitted at any time of the day or night. This assisted patients who may be at risk of 'white coat' hypertension. (8) One man, who exited the Florence system due to his BP becoming controlled, stated that home BP readings were beneficial as he was 'less stressed, more disciplined' and he 'learned how BP was affected by...work and was much lower at weekends - he could then tell how to look after his BP better'. Similarly, one patient 'was delighted by the fact that he could communicate with his GP without the necessity of travelling to the surgery...he often had to tackle rush hour traffic...to attend...his appointment and felt that he was not in a sufficiently relaxed state to have his BP taken when he'd completed that battle'. The theme of being more 'relaxed' or 'less anxious' when taking home BP and submitting them to Florence was repeated by a number of patients.

Further, Florence also suited patients whose lifestyles conflict with attending GP surgeries. For example one patient who 'doesn't get up until the afternoon' sent in multiple readings in the middle of the night. Elderly patients who rely on others to transport them to the GP

1
2
3
4
5
6
7 surgery were 'delighted not to have the inconvenience of attending surgery for the blood
8 pressures to be taken'. Carers benefited from this flexibility also; 'a 59 year old male who
9 lives with and cares for his 84 year old father...he felt very happy and felt that someone is
10 looking after him...without him coming to the surgery...he hadn't been into the surgery [for
11 over six months] and rarely comes in due to caring full time for his father'.

12 **Florence provided reassurance for patients with uncertain diagnoses of hypertension**

13 Although patients without confirmed hypertension did not meet our 'specific' inclusion criteria
14 for this project, this was a service evaluation and these patients were recruited for clinically
15 appropriate reasons and gained significant benefit from being involved. For example, 25
16 patients with high clinic systolic BP readings at recruitment used Florence and discovered
17 they had normal home readings, without making any changes to their medication. These
18 patients could be reassured and discharged from the system. This reassurance was
19 welcomed by some of the patients who reported that 'no treatment needed –
20 reassuring...long term monitoring gives a better picture', 'reassuring to monitor in home
21 environment' and 'reassured no problem'. Such use of Florence represents an extension to
22 the current National Institute for Health and Clinical Excellence (NICE) recommendations for
23 24 hour ambulatory or home monitoring of BP to determine a diagnosis of hypertension. (8)
24

25 **Reinforces care and advice from primary healthcare team**

26 Florence was noted to reinforce health messages from the primary healthcare team and lead
27 to control of hypertension among patients who had previously been difficult to manage.
28 Someone in the discussion group fed back 'my partner was struggling with his blood
29 pressure, and telehealth has made a world of difference'. (7) Patients specifically
30 commented on liking 'to see BP reading and be aware that it is normal'. Another discussion
31 group member commented that telehealth 'helped me to learn to live with the disease and
32 become more involved in monitoring my own health'. (7) The enhanced involvement and
33 knowledge about BP readings and the significance of the result obtained, promoted by the
34 training and accompanying literature for the programme, lead to a new attitude of
35 compliance with management of their hypertension among certain patients. For example,
36 one patient who had previously stopped his own medication had been strongly counselled
37 about the dangers of his uncontrolled BP continued to have significant hypertension. He
38 joined the Florence system and gained better control of his BP, practice staff reported that
39 'he could take his BP at home, where the readings would be done in a less stressful
40 situation...the process has helped his understanding of his condition...it does seem to be a
41 combination of the nurse's firm advice, and Florence's routine readings that have combined
42 to stabilise his condition'. A similar situation was noted in another patient 'the system has
43 highlighted just how high her BP actually is'. The intensive nature of Florence made one
44 patient feel 'he had a strong support from his GP and that it was a really worthwhile
45 illustration of the quality of NHS service'.
46

47 A few patients fed back that being involved in the programme prompted them to find out
48 more about 'blood pressure', educated them about the relevance and interpretation of the
49 BP values and highlighted the importance of good BP control. '[A 25 year old male] found
50 the scheme helped him to understand more about the importance of keeping his BP under
51 control especially with regards to his ongoing kidney problems'. 'A 73 yr old male...on the
52 whole felt that [being involved in the programme] had helped him to understand his BP and
53 control a bit better.' '[A 60 year old female] found that using this system helped her
54 considerably as she was more relaxed plus she found the accompanying literature very
55
56
57
58
59
60

1
2
3
4
5
6
7 helpful and it prompted her to research further about hypertension on the internet, therefore
8 increasing her understanding.' However, one individual highlighted that despite improved
9 understanding, patients remain free to exert their autonomy 'once information became
10 knowledge I understood my disease. Then I had a choice: should I do something about it or
11 not – it was my choice'.

12
13 Florence also helped to promote more comprehensive management of high risk patients,
14 such as 'a 25 year old male...noted to have proteinuria at his new patient check
15 and...BP...145/84mmHg. Over time he was noted to have persisting proteinuria with mid
16 stream urine samples negative for infection. He had a history of gout and associated anti-
17 inflammatory drug use. [Blood tests revealed] creatinine 275, urea 11.7 and eGFR 25 [so he
18 was diagnosed with] CKD Stage 4. Following referral to nephrology he was found to have
19 small kidneys and signs of longstanding CKD...he was advised that he needed good BP
20 control and was invited to join the Florence programme...He was not on any BP medication
21 at baseline (the new patient check) but was started on amlodipine by nephrology soon
22 afterwards. Having previously not self-monitored his BP, while involved in this programme he
23 monitored it twice per week and found the texts useful as they reminded him to take his BP'.

24 **Florence was a companion to patients**

25 An unexpected role that Florence was found to fulfil was of companionship to the patients it
26 serves. 'A 67 year old lady was very happy with using Florence – she said that when she
27 finished using the system she missed the contact and felt that she had "lost a friend"'. Other
28 indicators of this role of Florence was from a patient who reported 'that using the system
29 gave her a sense of comfort to have the feedback from the GP to reassure her that she was
30 managing her condition very well' and another who reported that 'getting texts from Flo has
31 given him a break in his daily routine, as it feels that he has someone to talk to'.

32 **Few problems were encountered**

33 Problems using the simple telehealth system were identified among only a few patients.
34 Among patients who chose to leave the programme by choice, six had problems sending or
35 receiving text messages using Florence and one reported having a problem taking their own
36 BP, but this was due to them being 'too anxious'. Among the six patients who had problems
37 sending or receiving text messages, one patient was texting in words, not numbers, got
38 frustrated as submissions were not recognised and left the programme, one reported not
39 being 'a technical person', two patients required other family members to text in readings,
40 one reported not being able to access the Florence system and the final patient only had
41 problems returning messages from survey questions, rather than BP readings. Among
42 patients who left the programme with controlled BP, four reported problems sending or
43 receiving text messages using Florence and one had a problem taking their own BP due the
44 resultant effects of having a previous stroke. Of the four patients who reported problems
45 sending or receiving text messages, two had problems initially transferring readings but after
46 further advice had no problems thereafter, one patient reported having incongruous
47 responses after submitting readings and one patient reported a problem but gave no
48 explanation. Another patient also reported getting conflicting advice, they were 'told by
49 phone that BP's okay but had to contact surgery regarding medication'.

50
51
52 Some patients fed back that multiple messages a day prompting them to submit readings
53 and providing advice was a little excessive. However, this was balanced by another patient
54
55
56
57
58
59
60

1
2
3
4
5
6
7 who stated that they 'felt at first that taking BP each day was a bit much but soon realised
8 the benefits and could not fault it'.

9
10 Focus group discussions among patients also highlighted that this type of service would not
11 be suitable for all patients, especially those with limited cognitive abilities. They also
12 suggested that older people may not manage to use a mobile phone or other equipment,
13 however, this is not a universal problem as patients up to the age of 86 years used the
14 system.

15 **Simple telehealth and the future**

16 Among the 40 patients who left the programme by choice, an average score of 3.71/
17 (median 4.00) out of 5.00 was obtained in response to the statement 'I would be interested in
18 using this type of programme in the future for this or another type of health problem'. A score
19 of 4.52-54 (median 5.00) was obtained (from a five-point Likert scale where 1 = strongly
20 disagree and 5 = strongly agree) in relation to the same question among the 42 patients who
21 left the programme with controlled BP.

22
23 Further evidence of a positive attitude towards future use of a similar programme was
24 obtained when patients were asked to respond to the statement 'I prefer to send daily BP
25 readings via Florence rather than having to go to my doctors surgery to get my BP checked
26 monthly', an average score of 4.19 (median 5.00) was obtained (see Table 1).

27
28 Positive attitudes among patients for utility of simple telehealth in the future were underlined
29 by feedback from the discussion groups. This highlighted the areas in which patients felt that
30 telehealthcare may be of value in the future. Such uses include monitoring of other chronic
31 conditions such as renal, heart, respiratory conditions and diabetes and certain 'medium
32 term afflictions' (e.g. pre-eclampsia). However, patients also saw a role for telehealthcare as
33 prompting service particularly for those with learning disabilities, dementia and carers,
34 assisting patients to remember to take medications, fluids and food and managing patients
35 pre-operatively. Finally, patients imagined this type of intervention could help the 'well' to
36 stay that way by monitoring health parameters to prevent illness.

37
38 Not only did patients see scope for this type of service provision in the future, feedback
39 indicated that the lessons learned through the use of this system will be taken into the future
40 by individual patients. For example, one man 'is continuing to take his own blood pressure at
41 home with a machine he has purchased and will continue to monitor himself accordingly so
42 that he can bring the results into surgery on his review appointment'.

43 **Discussion**

44
45 This service evaluation demonstrates that patients found this simple telehealth strategy for
46 managing hypertension easy to use, convenient and acceptable. Patients liked feeling
47 increased levels of support and Florence had a role as a companion, in promoting patients to
48 educate themselves further and providing reassurance about normotension in cases of white
49 coat hypertension. As previously found (3), the skills and knowledge gained by patients from
50 using Florence has led some patients to commence longer term health behaviours such as
51 self-directed ongoing monitoring and purchase of their own home machines.

52
53 The problems encountered with using the system were relatively minor and many could be
54 eliminated by careful recruitment of patients (ensuring dexterity to use BP machine and
55
56
57
58
59
60

1
2
3
4
5
6
7 mobile phone and access to equipment needed), through thorough counselling about what
8 they will be expected to do (one patient reported it feeling 'awkward' initially but was 'fine
9 when got used to it') and what they should expect to receive from the system before
10 embarking on the programme and/or tailor the number of requests more precisely to the
11 needs of the patient. For example, if, clinically, only once weekly readings are required then
12 Florence can be 'instructed' to only send prompts at this regularity. Such down regulation in
13 the frequency of prompts from Florence is expected to occur in all patients using the system
14 as hypertension becomes controlled. Discussion groups raised the concern that 'older
15 people won't want to change, maybe they wouldn't manage the mobile phone or other
16 equipment, they would need a lot of teaching about it so they were able to use it. If there
17 wasn't confidence in being able to use the equipment, it would make them feel worse'. (7)
18 However, this concern did not affect the majority of Florence users as only three patients
19 could not manage the mobile phone enough to continue with the programme. In line with
20 previous experience (3), this management approach just does not seem to suit some
21 patients' preferences, who would rather see a doctor and/or are concerned about using
22 home BP machines or mobile phones. However this only appears to apply to a small
23 minority of patients.

24
25 The results presented are from a pragmatic service evaluation. They are therefore valuable
26 as they reflect patient experience in the actual clinical setting when the programme is
27 delivered by the patients' usual clinical staff. However data was thus not obtained
28 systematically nor until the point of data saturation. Further, the number of patients included
29 was not derived through calculation of required sample size but determined by the maximum
30 number of patients that could be recruited in the given time period. Data regarding the
31 number of patients approached to join the programme and thus how many declined is not
32 available. The same question may have been asked of the same patient on multiple
33 occasions and at varying time points throughout their use of the programme. Data is also
34 missing from some patients who could not be contacted or if practice staff did not have
35 capacity to contact all patients involved to obtain feedback. The effect on the data of this
36 missing information is likely to be minimal as patients were not systematically excluded from
37 providing feedback and the feedback from practice staff in all ten participating practices
38 ensured that overall patient experience was summarised. Predominantly, patient feedback
39 was very positive. This finding may be due to the wording of the statements associated with
40 the Likert scales which were all framed in a positive way, for example 'The Florence (text
41 messaging) system is easy to use' and '-I find the advice/information I receive from Florence
42 to be useful'. However, patients had opportunity to disagree with these statements using the
43 Likert scale and it could be argued that using both positive and negative statements may
44 lead to confusion in giving responses. Thus it is important to consider the risk of missing
45 opposing views. It was clear if and when patients stopped using Florence as there were no
46 further readings submitted to the server. If submissions of readings appeared to have
47 ceased, practice staff were requested to contact the patient to establish if they were still
48 using Florence and, if not, they completed the telephone questionnaire to find out the
49 reasons why not and establish if any problems had been encountered. Of the 124 patients
50 enrolled on the programme, 82 completed questionnaires upon cessation of their use of
51 Florence. Of the remaining patients, 19 were still submitting BP readings to Florence after
52 six months had elapsed since their enrolment. Therefore it is unlikely that any significant
53
54
55
56
57
58
59
60

1
2
3
4
5
6
7 negativity about the programme was missed unless dissatisfied patients were regularly using
8 the programme and not feeding this dissatisfaction back to the team.

9
10 In line with the findings of McManus et al(9) and Jones et al (10), intervention patients were
11 supportive of home or self-monitoring in the future and, once the programme had finished,
12 some wished to continue using Florence. Generally there was no evidence that undertaking
13 home readings increased anxiety. Only one patient specifically reported that they withdrew
14 from the programme as she 'would have preferred to send BP readings in monthly...[as daily
15 readings] made her feel anxious [as] she knew each day when she got up she had to text in'.
16 This is in accordance with the findings of previous studies investigating home BP readings
17 by Little et al in 2002 (11), McManus et al in 2005 (9) and Ovaisi et al in 2011(12) which all
18 found good levels of acceptability of home readings among patients and no evidence of
19 detrimental effects of increased anxiety. In general, patients in this service evaluation found
20 home readings to be beneficial as they were more relaxed and less anxious than they would
21 be in the GP surgery. It may be for this reason that the patients investigated by Jones et al
22 (10) felt that home readings were more 'natural'.

23 Patient concordance with jointly agreed management strategies between the patient and
24 their responsible health professional is essential in maximising the health benefits obtained.
25 Therefore ease of use of any intervention needs to be high to minimise barriers to use. This
26 evaluation identified that this simple telehealth intervention was generally found to be easy to
27 use, a finding which is supported by Clarke et al(13), who undertook a systematic review of
28 telemonitoring and structured telephone support programmes for patients with chronic heart
29 failure. They reported generally high patient acceptance, satisfaction and ease of use scores
30 among the studies they examined.

31
32 Utilising this simple telehealth strategy has benefits over patients taking home readings and
33 reporting them to the GP for two reasons: BP readings are transmitted and recorded in real
34 time, therefore there is no scope for missing or lost results at GP review; and one recent
35 study of home BP readings among stroke patients identified that even though all patients
36 understood the importance of having a high BP reading, when one was obtained, they did
37 not all seek help or direction from their primary care team.(12) The simple health strategy
38 used in this service evaluation eliminates this barrier to seeking appropriate care as all
39 results that are sent to Florence are reviewed on the dedicated server by the primary
40 healthcare team at regular intervals. Further, due to the at least weekly review of BP
41 readings by the patients' usual primary care team, any persistently suboptimal readings that
42 have not been recognised by the patient will be detected more quickly than they will have
43 been had the patient been asked to record their blood pressure at home and return after a
44 month or so.

45
46 In agreement with a previous systematic review of telemonitoring for heart failure(14), which
47 concluded that telemonitoring was generally 'favourable compared with usual care', this
48 service evaluation indicates that patients feel the same about simple telehealth monitoring of
49 hypertension. The flexibility, control and education that Florence provides were well received
50 and appear to have empowered patients who had previously been uncontrolled and/or non-
51 compliant with usual care.

52
53 When used in clinical practice, there should be scope to continue using Florence for
54 prolonged periods even after normotension is reached, albeit with readings at reduced
55
56
57
58
59
60

1
2
3
4
5
6
7 intervals. Not only would this ensure enduring control it may help to allay patients' concerns
8 that arose during the discussion groups about 'slipping through the net' due to lack of face-
9 to-face contact. Some patients within this service evaluation, and those who were
10 interviewed by Jones et al (10) following a similar intervention, were keen to continue self-
11 monitoring in the same way. The number of BP readings requested by Florence each week
12 or month can be adjusted down accordingly in these situations.

13
14 In summary, there is a clear need for new and improved clinically driven strategies for
15 hypertension control in primary care to prevent morbidity and mortality. This pragmatic
16 service evaluation indicates that simple telehealth strategies may not only be effective in
17 doing this in actual clinical practice but do so in a way that is easy, flexible, affordable,
18 acceptable and, in many cases preferable, when compared with usual care. Not only does
19 simple telehealth deliver a service that patients appreciated and believed in, it appeared to
20 become a companion to some patients. Our results indicate that careful selection and
21 counselling of patients is required at recruitment onto such a programme to ensure that they
22 understand and agree with the nature and frequency of the processes involved and that they
23 are physically and cognitively able to operate the simple equipment.

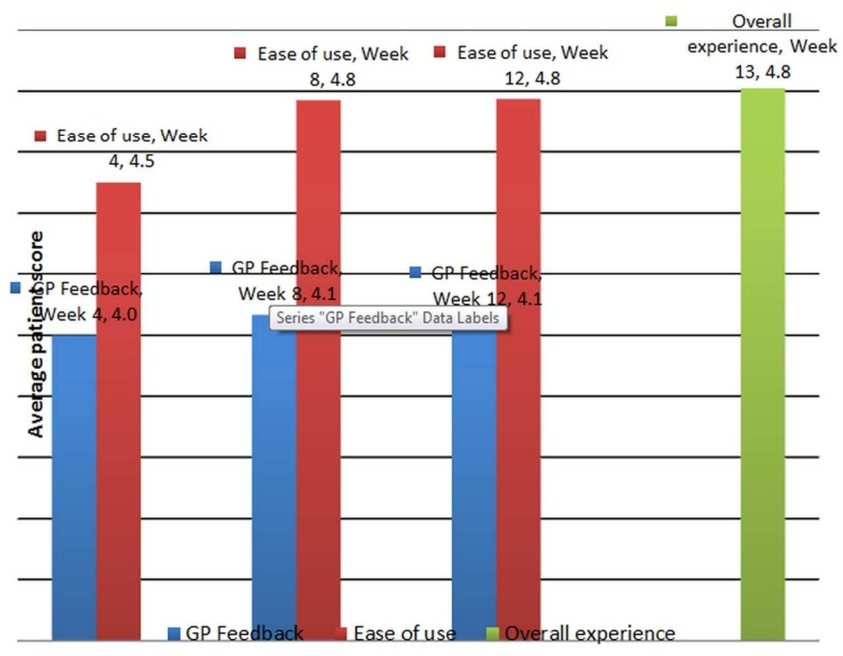
24 References

- 25 1. Aylett MJ. Ambulatory or self blood pressure measurement? Improving the diagnosis of
26 hypertension. *Fam Pract*. 1994;11:197-200
- 27 2. Rickerby J. The role of home BP measurement in managing hypertension – an evidence
28 based review. *J Hum Hypertens*. 2002;16: 469-72.
- 29 3. Rickerby J, Woodward J. Patients' experiences and opinions of home blood pressure
30 measurement. *J Hum Hypertens*. 2003;17:495-503.
- 31 4. Bostock Y, Hanley J, McGown D, Pinnock H, Padfield P, McKinstry B. *The acceptability to*
32 *patients and professionals of remote blood pressure monitoring using mobile phones*. *Prim*
33 *Health Care Res Dev*. 2009;10:299-308.
- 34 5. Liew SM, Tong SF, Lee VKM, Ng CJ, Leong KC, Teng CL. *Text messaging reminders to*
35 *reduce non-attendance in chronic disease follow-up: a clinical trial*. *Br J Gen Pract*.
36 2009;59:916-20.
- 37 6. Cottrell E, Chambers R, O'Connell P. *Using simple telehealth in primary care to reduce*
38 *blood pressure: a service evaluation*. 2012. [~~Unpublished—submitted alongside this paper~~
39 [Press - bmjopen-2012-001391.R1](#)].
- 40 7. Stoke on Trent Community Health Voice. *Telehealthcare event on 27th January 2012*.
41 Unpublished.
- 42 8. National Institute of Health and Clinical Excellence. *Hypertension: clinical management of*
43 *primary hypertension in adults*. London: NICE; 2011.
- 44 9. McManus RJ, Mant J, Roalfe A, Oakes RA, Bryan S, Pattison HM, Hobbs FDR. *Targets*
45 *and self monitoring in hypertension: randomised controlled trial and cost effectiveness*
46 *analysis*. *BMJ*. 2005; doi:10.1136/bmj.38558.393669.E0.
- 47
- 48
- 49
- 50
- 51
- 52
- 53
- 54
- 55
- 56
- 57
- 58
- 59
- 60

- 1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60
10. Jones MI, Greenfield SM, Bray EP, Baral-Grant S, Hobbs FDR, Holder R, Little P, Mant J, Virdee SK, Williams B, McManus RJ. Patients' experiences of self-monitoring blood pressure and self-titration of medication: the TASMINH2 trial qualitative study. *Br J Gen Pract.* 2012;62:e135-42: doi:10.3399/bjgp12X625201
11. Little P, Barnett J, Barnsley L, Marjoram J, Fitzgerald-Barron A, Mant D. *Comparison of acceptability of and preferences for different methods of measuring blood pressure in primary care.* *BMJ.* 2002;325:258-9.
12. Ovaisi S, Ibison J, Leontowitsch M, Cloud G, Oakeshott P, Kerry S. *Stroke patients' perceptions of home blood pressure monitoring: a qualitative study.* *Br J Gen Pract.* 2011; doi: 10.3399/bjgp11X593893.
13. Clark RA, Inglis SC, McAlister FA, Cleland JGF, Stewart S. *Telemonitoring or structured telephone support programmes for patients with chronic heart failure: systematic review and meta-analysis.* *BMJ.* 2007; doi:10.1136/bmj.39156.536968.55.
14. Polisena J, Tran K, Cimon K, Hutton B, McGill S, Palmer K, Scott RE. *Home telemonitoring for congestive heart failure: a systematic review and meta-analysis.* *J Telemed Telecare.* 2010;16:68-76.

1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60

Figure 1: Average patient satisfaction scores for feedback from GP/practice nurse, ease of use of the Florence system and the overall experience of using Florence (1 = strongly disagree, 3 = neither disagree/agree, 5 = strongly agree)



94x90mm (300 x 300 DPI)

only

STROBE Statement—Checklist of items that should be included in reports of *cross-sectional studies*

	Item No	Recommendation
Title and abstract	1 <input checked="" type="checkbox"/>	(a) Indicate the study's design with a commonly used term in the title or the abstract (b) Provide in the abstract an informative and balanced summary of what was done and what was found
Introduction		
Background/rationale	2 <input checked="" type="checkbox"/>	Explain the scientific background and rationale for the investigation being reported
Objectives	3 <input checked="" type="checkbox"/>	State specific objectives, including any prespecified hypotheses
Methods		
Study design	4 <input checked="" type="checkbox"/>	Present key elements of study design early in the paper
Setting	5 (in associated paper in print)	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection
Participants	6 (in associated paper in print)	(a) Give the eligibility criteria, and the sources and methods of selection of participants
Variables	7 (in associated paper in print)	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable
Data sources/ measurement	8* <input checked="" type="checkbox"/>	For each variable of interest, give sources of data and details of methods of assessment (measurement). [Describe comparability of assessment methods if there is more than one group]
Bias	9 <input checked="" type="checkbox"/> see limitations	Describe any efforts to address potential sources of bias
Study size	10 <input checked="" type="checkbox"/> see limitations	Explain how the study size was arrived at
Quantitative variables	11 <input checked="" type="checkbox"/>	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why
Statistical methods	12 <input checked="" type="checkbox"/>	(a) Describe all statistical methods, including those used to control for confounding (b) Describe any methods used to examine subgroups and interactions (c) Explain how missing data were addressed (d) If applicable, describe analytical methods taking account of sampling strategy (e) Describe any sensitivity analyses
Results		
Participants	13* Data not available	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed (b) Give reasons for non-participation at each stage (c) Consider use of a flow diagram
Descriptive data	14* (in associated paper in print) <input checked="" type="checkbox"/>	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders (b) Indicate number of participants with missing data for each variable of interest
Outcome data	15* <input checked="" type="checkbox"/>	Report numbers of outcome events or summary measures

1 2 3 4 5 6 7 8 9 10	Main results	16 <input checked="" type="checkbox"/> given average and median – given and table of results inserted	(a) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included <hr/> (b) Report category boundaries when continuous variables were categorized <hr/> (c) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period
11 12 13	Other analyses	17 n/a	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses
14	Discussion		
15 16	Key results	18 <input checked="" type="checkbox"/>	Summarise key results with reference to study objectives
17 18 19 20 21 22 23	Limitations	19 <input checked="" type="checkbox"/>	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias
24 25 26	Interpretation	20 <input checked="" type="checkbox"/>	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence
27 28 29 30	Generalisability	21 <input checked="" type="checkbox"/>	Discuss the generalisability (external validity) of the study results
31	Other information		
32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60	Funding	22 <input checked="" type="checkbox"/>	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based

*Give information separately for exposed and unexposed groups.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at <http://www.plosmedicine.org/>, Annals of Internal Medicine at <http://www.annals.org/>, and Epidemiology at <http://www.epidem.com/>). Information on the STROBE Initiative is available at www.strobe-statement.org.