Title: Usability and acceptability of a home blood pressure telemonitoring device in community dwelling seniors with hypertension: A qualitative study

Authors:

Lauren Albrecht, PhD Candidate, Department of Pediatrics, 5-147 Edmonton Clinic Health Academy, University of Alberta, Edmonton, Alberta, Canada, T6G 1C9. Email: lauren.albrecht@ualberta.ca, PH: 780-492-9682

Peter W. Wood, Research Associate, Department of Medicine, University of Alberta, 5-112 Clinical Sciences Building, 11350-83 Avenue, Edmonton, Alberta, Canada, T6G 2G3

Miriam Fradette, Research Associate, Department of Medicine, University of Alberta, 5-112 Clinical Sciences Building, 11350-83 Avenue, Edmonton, Alberta, Canada, T6G 2G3

Finlay A. McAlister, Professor, Department of Medicine, University of Alberta, 5-134C Clinical Sciences Building, 11350-83 Avenue, Edmonton, Alberta, Canada, T6G 2G3

Doreen Rabi, Associate Professor, Departments of Medicine, Community Health and Cardiac Sciences, University of Calgary, 3e21 3280 Hospital Dr. NW, Calgary AB T2N 4N1

Pierre Boulanger, Professor, Department of Computing Science, University of Alberta, 4-11 Athabasca Hall, Edmonton, Alberta, Canada, T6G 2E8

Raj Padwal, Professor, Department of Medicine, University of Alberta, 5-134A Clinical Sciences Building, 11350-83 Avenue, Edmonton, Alberta, Canada, T6G 2G3
Abstract

**Background:** Hypertension is a major cause of cardiovascular disease in older individuals. To ensure that blood pressure (BP) levels are in the optimal range, accurate BP monitoring is required. Contemporary hypertension clinical practice guidelines strongly endorse use of home BP measurement as a preferred method of BP monitoring for individuals with hypertension. The benefits of home BP monitoring may be optimized when measurements are telemonitored to care providers; however, this may be challenging for older individuals with less technological capabilities. The purpose of this qualitative study was to examine usability and acceptability of a home BP telemonitoring system with seniors.

**Methods:** A qualitative descriptive study was conducted. Following a 1-week period of device use, an individual, semi-structured interview was conducted. Interview audio recordings were anonymized, de-identified, and transcribed verbatim. Thematic analysis was conducted on interview transcripts.

**Results:** Seven seniors participated in usability testing of the home BP telemonitoring system. Participants were female (n=4) and male (n=3) with a mean age of 86 years (range 70 – 95 years). Overall, eight main themes were identified from the interviews: 1) positive features of the device; 2) difficulties or problems with device; 3) device was simple to use; 4) comments about wireless capability and components; 5) would recommend device to someone else; 6) would use device in future; 7) suggestions for improving the device; and, 8) assistance to use device. Additional sub-themes were also identified.

**Conclusions:** Overall, the home blood pressure telemonitoring device had very good usability and acceptability with community dwelling seniors with hypertension. To enhance
long-term use, a few improvements were noted that may mitigate some of the relatively minor challenges encountered by the target population.

**Keywords** - blood pressure; telemonitoring; elderly; qualitative
Background

Population aging is occurring in countries across the world, such that by 2050, nearly 25% of the global population is expected to be over the age of 60 [1]. Advanced aged is often complicated by cardiovascular morbidity, which frequently leads to disability and death [2]. Hypertension is a major cause of cardiovascular disease in older individuals [3,4], but seniors also derive greater benefit from treatment of elevated blood pressure (BP) compared to younger patients [5,6]. The management of hypertension in seniors can be challenging and must balance the risk of serious treatment-related complications (including hypotension, postural dizziness, syncope, falls and metabolic side effects [3,7-9]) against the well-established cardiovascular benefits associated with BP lowering.

To ensure that BP levels are in the optimal range, accurate BP monitoring is required. Contemporary hypertension clinical practice guidelines strongly endorse use of home BP measurement as a preferred method of BP monitoring for individuals with hypertension [10]. The benefits of home BP monitoring may be optimized when measurements are telemoitored to care providers [11,12]. BP telemonitoring involves the electronic and secure transmission of BP readings in real-time to a central electronic health care portal and summarized BP data are presented to patients and providers. Through process automation and protocolization, BP telemonitoring can ensure that home BP monitoring is performed in a guideline-concordant manner, ensuring the proper frequency and timing of BP measurement [12]. Telemonitoring theoretically could eliminate the need for an in-person clinic visit, thereby increasing health care delivery efficiency, minimizing costs and making more efficient use of provider and patient time [12]. A meta-analysis of 23 RCTs (7037 patients) reported that home BP telemonitoring reduced BP by 5/3 mmHg compared to usual care (p<0.0001 for both systolic and diastolic BP) [13]. This
is a clinically important reduction in BP, as a 5mmHg reduction can decrease risk of total cardiovascular disease by 17%, stroke by 18% and myocardial infarction by 15% [14,15].

Adoption of telemonitoring will only occur if the process and technology are deemed useable and acceptable by patients and caregivers. Use of home BP telemonitoring may be particularly challenging in seniors, who, by virtue of being less technologically literate, may have greater difficulty using a telemonitoring system. Therefore, the purpose of this qualitative study, embedded within an ongoing randomized controlled trial examining the clinical and cost-effectiveness of telemonitoring in community-dwelling seniors with hypertension [16], was to examine usability and acceptability of a home BP telemonitoring system within this particular patient population.

**Methods**

A qualitative descriptive study was conducted [17,18] embedded within a randomized controlled trial comparing BP telemonitoring plus pharmacist case management versus usual care to optimize BP control in seniors residing in supportive living. A protocol paper has been published [16]; the most updated protocol can be found on clinicaltrials.gov (NCT02721667). The University of Alberta Research Ethics Board approved the study.

**Study population**

Participants were community-dwelling seniors (age 65 years and older) with hypertension residing in a supportive living residence. The target sample size for this qualitative study was 5-8 participants based on prior research demonstrating that the first 5 users typically identify 70% of severe usability problems and the first 8, 85% - beyond this, a higher sample size has low incremental yield as data saturation has been reached [19].

**Data collection**
Participating seniors were instructed to use the home BP telemonitoring device and perform all measurements according to recommended techniques for home BP measurement. Four measurements were taken daily (i.e., 2 x AM, 2 x PM) for 1 week [10]. Following this period of device use, participants completed an individual, semi-structured interview (Appendix A) to obtain usability and acceptability information, probe participants’ responses, and to give participants freedom to respond and illustrate concepts in an open-ended fashion [20]. Interviews were conducted in-person and were audio recorded. Audio recordings were anonymized, de-identified, and transcribed verbatim.

Telemonitoring system

The custom built TECHNOMED telemonitoring system consists of five components: 1) a commercially available, Bluetooth enabled oscillometric blood pressure monitor (A&D Medical); 2) a data transmission hub (Lamprey Networks Inc.); 3) a web portal interface (Telemed Diagnostic Management Inc.); 4) an android based interface for hub programming (Advanced Man Machine Interface Laboratory, University of Alberta); and, in patients with no existing internet access, 5) a selectively deployed (based on home internet availability) SIM based internet hotspot. Prior to operation, the system is set-up by connecting the hub to the internet (hotspot or home internet), assigning a patient ID using the android app, and creating a patient profile on the web portal.

Blood pressure measurements

Once set up, the patient is instructed to follow the 7-day series BP protocol initiated by performing a measurement using the A&D device. This measurement is sent to the web portal via the Bluetooth connected hub (Figure 1). The data are summarized in a variety of formats including individual readings, averages (mean of all readings minus the first day), and graphed
values to depict temporal trends. The case manager uses these data to adjust the patient’s blood pressure medication (up-titrate if BP is too high, down-titrate if BP too low, or leave unchanged if BP is in the optimal range).

**Figure 1: System flow chart for Technomed telemonitoring BP system**

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**Data analysis**

Interview transcripts were managed and analyzed using NVivo data management software [21]. Thematic analysis was used to break interview text into small units for a detailed, nuanced account of the data [22-24]. Thematic analysis was guided by the hybrid approach of inductive and deductive coding and theme development described by Fereday & Muir-Cochrane (2006) [25]. Deductive coding of the interview transcripts were done first using the semi-structured interview guide as a framework; smaller units of data that emerged inductively were coded for increased granularity and specificity.

**Results**

*Sample Demographics*
Seven seniors participated in usability testing of the home BP telemonitoring system from November 2016 to June 2017. Participants were female (n=4) and male (n=3) with a mean age of 86 years (range 70 – 95 years). Additional demographics are summarized in Table 1. The mean baseline home systolic blood pressure of the seven participants was 131 mmHg (range 99-181) and mean diastolic was 71 mmHg (range 47-125).

### Table 1: Participant demographics

<table>
<thead>
<tr>
<th>Participant number</th>
<th>Sex</th>
<th>Age (years)</th>
<th>Partnered/single</th>
<th>Caregiver providing assistance (Y/N)</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>male</td>
<td>89</td>
<td>single</td>
<td>no</td>
<td>N/A</td>
</tr>
<tr>
<td>2</td>
<td>female</td>
<td>89</td>
<td>single</td>
<td>no</td>
<td>N/A</td>
</tr>
<tr>
<td>3</td>
<td>female</td>
<td>70</td>
<td>single</td>
<td>no</td>
<td>Reported visual impairment.</td>
</tr>
<tr>
<td>4</td>
<td>male</td>
<td>86</td>
<td>partnered</td>
<td>yes</td>
<td>Reported hearing impairment.</td>
</tr>
<tr>
<td>5</td>
<td>female</td>
<td>91</td>
<td>single</td>
<td>no</td>
<td>Reported mild dementia</td>
</tr>
<tr>
<td>6</td>
<td>female</td>
<td>80</td>
<td>partnered, lived alone</td>
<td>no</td>
<td>N/A</td>
</tr>
<tr>
<td>7</td>
<td>male</td>
<td>95</td>
<td>single</td>
<td>no</td>
<td>N/A</td>
</tr>
</tbody>
</table>

**Themes**

Overall, eight main themes were identified (Table 2). Two main themes were further classified into sub-themes (Table 3) for increased granularity and specificity.

### Table 2: Main themes

<table>
<thead>
<tr>
<th>Main Themes</th>
<th>Number of Interviews Theme is Referenced</th>
<th>Number of Overall References for Theme</th>
</tr>
</thead>
<tbody>
<tr>
<td>Positive features of the device*</td>
<td>7</td>
<td>35</td>
</tr>
<tr>
<td>Difficulties or problems with device*</td>
<td>7</td>
<td>28</td>
</tr>
<tr>
<td>Device was simple to use</td>
<td>6</td>
<td>16</td>
</tr>
<tr>
<td>Comments about wireless capability and components</td>
<td>6</td>
<td>8</td>
</tr>
<tr>
<td>Would recommend device to someone else</td>
<td>7</td>
<td>8</td>
</tr>
<tr>
<td>Would use device in future</td>
<td>6</td>
<td>6</td>
</tr>
<tr>
<td>Suggestions for improving the device</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>Assistance to use device</td>
<td>1</td>
<td>1</td>
</tr>
</tbody>
</table>
Table 3: Main themes with sub-themes

<table>
<thead>
<tr>
<th>Themes</th>
<th>Number of Interviews Theme is Referenced</th>
<th>Number of Overall References for Theme</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Main theme: Positive features of the device</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sub-theme 1: General positive comments about device</td>
<td>6</td>
<td>15</td>
</tr>
<tr>
<td>Sub-theme 2: Specific positives about device</td>
<td>7</td>
<td>20</td>
</tr>
<tr>
<td>Sub-theme 2a: Cuff was appropriate</td>
<td>6</td>
<td>12</td>
</tr>
<tr>
<td>Sub-theme 2b: Start button worked well</td>
<td>6</td>
<td>7</td>
</tr>
<tr>
<td>Sub-theme 2c: Display screen worked well</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>Sub-theme 2d: No bruising after device use</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td><strong>Main theme: Difficulties or problems with device</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sub-theme 1: No difficulties or problems with device</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Sub-theme 2: General difficulties or problems with device</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Sub-theme 3: Specific difficulties or problems with device</td>
<td>7</td>
<td>25</td>
</tr>
<tr>
<td>Sub-theme 3a: Issues positioning and securing cuff</td>
<td>5</td>
<td>8</td>
</tr>
<tr>
<td>Sub-theme 3b: Cuff too large for arm</td>
<td>3</td>
<td>8</td>
</tr>
<tr>
<td>Sub-theme 3c: Knowing/remembering when to take blood pressure measurements</td>
<td>3</td>
<td>7</td>
</tr>
<tr>
<td>Sub-theme 3d: Error messages on display screen</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>Sub-theme 3e: Battery issues</td>
<td>1</td>
<td>2</td>
</tr>
</tbody>
</table>

*contains sub-themes

**Theme descriptions**

**Positive features of the device.** The interview guide included questions to ascertain the positive features of the device and elicit what worked for participants. A range of answers were given. These fell into 2 sub-themes: 1) general positive comments about device, 2) specific positive features of the device.

For the first sub-theme, six participants described the device in general positive terms, including stating it “worked well” and “was a very good set-up”. All participants provided specific feedback on positive features of the device (sub-theme 2). These fell into four sub-
categories: 1) cuff was appropriate tightness; 2) start button worked well; 3) display screen worked well; and, 4) no bruising after device use. These sub-categories are described in detail in table 4.

Table 4: Specific positive features of the device

<table>
<thead>
<tr>
<th>Sub-category</th>
<th>Description</th>
<th>Supporting quote from interview</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cuff was appropriate tightness</td>
<td>All participants described the cuff as appropriate tightness. It only caused minimal pain for a short duration (i.e., when cuff was fully inflated), similar to other blood pressure cuffs they had used in the past.</td>
<td>“P: No, I think it was just right. [I: Good, okay] ‘Cause it didn’t bother me that much. But it bothered me a little bit. [Laughing]” - Participant 5</td>
</tr>
<tr>
<td>Start button worked well</td>
<td>Six participants noted that the start button was large enough to locate, easy to press to activate reading, and did not stick.</td>
<td>“But, yeah. So, other than that, it’s… it’s easy to use. The start and - and the stop. And - I mean, it’s quite simple.” - Participant 6</td>
</tr>
<tr>
<td>Display screen worked well</td>
<td>Three participants described the display screen as large enough and easy to read, even for participants with visual impairments.</td>
<td>“P: Um… well, I - ah, I mean you know, it’s um, it’s got a… like, I’m legally blind. [I: Okay] And - and so I - I have about 12 percent vision. So I mean, for me, like it - [stammers] it’s ah - the - it’s quite clear on the - on the screen and that.” - Participant 3</td>
</tr>
<tr>
<td>No bruising after device use</td>
<td>One participant noted that they had no bruising after using the device.</td>
<td></td>
</tr>
</tbody>
</table>

**Difficulties or problems with the device.** The interview guide included questions to ascertain whether there were any difficulties or problems using the device. A range of answers were given. These fell into 3 sub-themes: 1) no difficulties or problems with device; 2) general difficulties or problems with device; and, 3) specific difficulties or problems with the device.
For the first sub-theme, two participants indicated that there were no difficulties or problems using the device in response to a general question. For the second sub-theme, one participant indicated that using the device was “a little bit awkward” but that once you practice a few times, it works well. However, all seven participants identified specific difficulties or issues with the device (sub-theme 3). These concerns fell into five sub-categories: 1) issues positioning and securing cuff; 2) cuff too large for arm; 3) knowing/remembering when to take blood pressure measurements; 4) error messages on display screen; and, 5) battery issues. These sub-categories are described in detail in table 5.

Table 5: Specific difficulties or problems with the device

<table>
<thead>
<tr>
<th>Sub-category</th>
<th>Description</th>
<th>Supporting quote from interview</th>
</tr>
</thead>
<tbody>
<tr>
<td>Issues positioning and securing cuff</td>
<td>Five participants found the cuff difficult to position and secure on the arm. This was largely an issue of having enough dexterity to pull the fabric tight and wrap it around the arm with only one hand. Participants indicated that while pulling and fastening, the cuff would slide back and forth and the participants were unsure if it was properly placed on the arm. Participants used the crook of the elbow as well as the dot on the cuff as helpful guides, but didn’t feel it was optimal.</td>
<td>“P: And so, then you - [stammers] you’re trying to tighten it. And then you put your - in the meantime, you’re struggling to try and get it… [I: I see, yeah] and so you think, “Okay, can I pull it with this? No, that’s not gonna work.” So… I don’t know how - and then, you raise your blood pressure trying to… I: [Laughing] I see, yes. P: To - to do that. [I: Kind of a catch-22]” – Participant 6</td>
</tr>
<tr>
<td>Cuff too large for arm</td>
<td>Three participants found the cuff was too large and the extra material was cumbersome to manage with a single hand while securing the cuff.</td>
<td>“P: Yes. And the thing just slithered around. So it was not a good fit. [I: Okay] It was a terrible fit. [I: It was -] A terrible choice. [I: Too baggy?] Oh, yeah. [I: Yeah] I should have had a small cuff. [I: Okay] They always use a small cuff on me at the… [chuckling] when I go to the doctor.” – Participant 2</td>
</tr>
<tr>
<td>Knowing/remembering when</td>
<td>Five participants expressed uncertainty about knowing or</td>
<td>“P: Yes, but that was - trying to figure out that it was the right time. [I: Uhum]</td>
</tr>
</tbody>
</table>


<table>
<thead>
<tr>
<th>to take blood pressure measurements</th>
<th>remembering when to take the blood pressure measurements. For one participant this meant forgetting to take two measurements at one time and for the other two participants, this meant taking readings at different times than directed.</th>
<th>You know, 10 to 12 hours apart. And I wasn’t right in getting that every time. [I: Uhum] I was a little bit… too short or too long, I’m not quite sure which.” – Participant 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Error messages on display screen.</td>
<td>Two participants experienced error messages on the display screen. When an error message appeared on the device, both participants attempted to take another blood pressure reading and repeated this process until it worked and a reading was displayed, which resulted in slight confusion.</td>
<td>“P: Ah, yeah. If I had an error message, I’d just… put - push the stop but - button, and push the Start again. I:Okay. And that worked? [P: Uhum] Okay. Well, that’s good. [P: Yeah] Was it a little bit frustrating? P:Ah… oh, I was beginning to wonder if I’m doing it right. [I: Yeah] Is there - is it my fault that it’s getting the error message? I don’t think so. But it might have been.” – Participant 7</td>
</tr>
<tr>
<td>Battery issues.</td>
<td>One participant experienced a battery issue with the device and did not know how to resolve it. Participant called study staff to resolve the issue, study staff replaced the battery, and the participant continued to use the device.</td>
<td></td>
</tr>
</tbody>
</table>

**Device was simple to use.** All seven participants felt that the device was simple and straightforward to use, as demonstrated by the following quote:

“I: So, did you find the device simple, to use? [P: Oh, yeah] Yeah?
P: Yeah, I did. Yes.
I: And there was noth - was there anything about it that maybe was a bit tricky at first?
P: No, not - ah, not really. If you just followed the instructions, ah… the - all you gotta do is push the button and it - it goes, you know. [I: Yeah [laughing]] You don’t have to figure it out. It’s not like you’re doing ah… puzzle or something like that. Ah… [I: Very true] No, not at all.”
- Participant 1

**Comments about wireless capability and components.** Six participants commented on the wireless technology aspect of the system. Overall, participants knew that study staff had
plugged in one or two peripheral devices to assist with the operation of the blood pressure device, but they did not know what the peripheral devices did, they did not touch these pieces during their week of using the device.

**Would recommend device to someone else.** All participants indicated that they would recommend this device to someone else if they needed regular blood pressure monitoring.

**Would use device in future.** Six participants indicated a willingness to use this device in the future if their health required regular blood pressure monitoring.

**Suggestions for improving the device.** Two participants indicated that no improvements were needed for the blood pressure device. One participant suggested that a helpful improvement would be a signal from the device to indicate when to take a blood pressure measurement and another indicated that some form of feedback from the device to know whether the device was positioned and secured properly would be helpful. A third improvement would be decreased tightness of cuff if possible.

**Assistance to use device.** One participant required some assistance from their spouse to use the device. The spouse did not assist during the morning blood pressure readings, only the afternoon/evening readings. The spouse helped to secure and position the device for the participant because it was difficult to do so with one hand.

**Discussion**

The purpose of this qualitative study, conducted concurrently to the RCT, was to assess the usability and acceptability of the home BP telemonitoring device in community dwelling seniors with hypertension. Previous research has shown that 65% of the population aged 65 years and older would like to keep up-to-date with technological advancements, which includes health applications [26]; however, at present there is a dearth of information on the unique needs and
demands of seniors using medical devices at home [27]. In-line with previous research conducted by Ehmen and colleagues (2012), which concluded that mobile devices for measuring heart rate and ECG were well accepted by participants age 55 and older [27], we hypothesized that participating seniors in this study would rate the home BP telemonitoring device as user-friendly, acceptable, and useful for hypertension management. This was supported by the study findings. However, a few issues were identified, and potential solutions explored in order to optimize device functionality and successful future use.

One unique aspect of our study in comparison to prior studies is the advanced age of the participants (average 86 years). However, despite this difference, it is worth noting that our findings of high patient acceptability are consistent with the existing qualitative literature assessing patient views on BP telemonitoring systems [28-31]. Other studies have also included care providers in the qualitative assessment and have reported that while caregivers are generally supportive of the concept, they are concerned about the time required to view and act on telemonitored readings [30,31]. This underscores the need to develop systems and protocols that minimize provider time and replace (instead of adding to) existing workloads.

**User-friendliness of device**

In this study, all participants described the device as simple and straightforward to use; specifically, the start button was large enough and easy to engage, and the display screen was legible, even for patients with visual impairments. This demonstrates that the design of this home BP telemonitoring is suitable for overcoming age-related difficulties with mental processing capacity.

Conversely, all participants identified one or more difficulties related to using the device. Specific issues were noted regarding the design and application of the blood pressure cuff
component. For example, it was described as: too large, having cumbersome extra material when pulled tight, and difficult to place and secure with one hand. These concerns may be related to features of normal, age-related decline in psychomotor skills, including dexterity and hand-eye coordination [32]; however, it is critical to optimize design by addressing these concerns to overcome barriers to implementation and successful adoption of home telemonitoring technology.

Separate from the blood pressure cuff component, participants noted that error messages on the display screen were confusing, and one participant did not know how to manage the device when the batteries ran out. While these issues are seen as normal features, albeit limitations, of current technology, older adults are more affected by distracting context, including unfamiliar or unexpected error messages, making it challenging to perform concurrent tasks, including changing batteries at the same time as taking a blood pressure measurement [32]. These challenges are related to cognitive load and previous research has suggested that an initial facilitated learning experience supplemented with support material can be used to train seniors in proper use and functioning of the device and to practice any potential errors or issues that may arise [27].

An issue that arose that was peripheral to the blood pressure device itself was the lack of understanding of the wireless technology required to enable the telemonitoring aspect of this system. Six of seven participants had little awareness of this piece. Participants knew, in general, that the hub assists with the operation of the telemonitoring system, but they were not clear on specific functions and they did not touch or interfere with these components during their week of using the device. This finding is not surprising as consumers often lack understanding of the inner workings of commonly used technologies such as smartphones and computers but this lack
of knowledge does not preclude use of these devices. In fact, rather than having an intimate understanding of how the technology works, it is more important that users have access to assistance with troubleshooting if the device is not working properly. Thus, it is important that telemonitoring system vendors provide such assistance.

Acceptability & usefulness of device

As proxies for acceptability and usefulness of the device, participants were asked if they would use the device in the future and/or recommend this device to a friend. All seven participants indicated that they would recommend this device to a friend in need of regular blood pressure monitoring. The majority (n=6) indicated a willingness to use this device in the future if their health status required regular blood pressure monitoring.

Recommendations for future developments

It is worthwhile noting two specific factors that may influence future, appropriate use of this home BP telemonitoring device. First, five of seven participants indicated some difficulty knowing when and how often to take measurements with the device. This could be addressed in both high-tech and low-tech approaches. For example, a high-tech solution could be a programmable device feature of either an audible signal, or visual aid when it is time to take blood pressure measurements. This is the advantage that smartphone connected strategies provide, however, these are not appropriate for populations with limited technology literacy. A low-tech solution could be to provide written, supporting information, like a daily calendar containing these details. For 5/7 of participants though, detailed instructions were provided as part of the ‘study pack’; this may indicate that the provided information is not formatted optimally to disseminate operational instruction. The high-tech improvement (i.e., a signal from
the device) was suggested by a participant during the interview and would likely be acceptable to users.

Second, a number of patients indicated uncertainty about whether or not they were using the device properly. Other than the potential for an error message on the display screen, the device did not have the capacity to provide patients with feedback as to whether the device was properly positioned and secured for optimal readings or if the readings were being properly transmitted through the wireless connection. This concern was noted by a participant when asked about suggestions for improvement. Additionally, there was no explanation of the error messages. When these warnings occurred, participants repeatedly attempted to take additional blood pressure readings until the error message disappeared. It could be worthwhile to explore whether real-time feedback could be incorporated into the machine, which could include a written message on the display, an auditory message (i.e., voice, beep, etc.) from the device, or a sensory message (squeeze, vibration, etc.) in the cuff. This functionality may be especially important for successful, long-term use as the majority of participants lived alone and did not have any caregiver assistance to use the device.

**Conclusion**

Overall, the home blood pressure telemonitoring device had very good usability and acceptability with community dwelling seniors with hypertension. This was illustrated by all participants indicating willingness to recommend this device to a friend and six of seven participants stating they would use this device in future. Additionally, all participants found the device to be simple and straightforward to use. To enhance long-term use, a few improvements were noted that may mitigate some of the relatively minor challenges encountered by the target population.
References


21. QSR International Pty Ltd. NVivo qualitative data analysis Software. version 11. 2015.


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Conflict of interest: RP is a Director of a start-up company, mmHg Inc., focusing on innovations in blood pressure measurement.

Appendix A: Semi-structured interview guide

Good morning/afternoon. Thank you for taking the time to meet with me. I would like to ask you several questions about your experience using the blood pressure monitoring device. I am recording our conversation to ensure that we have an accurate summary of your opinions. All the information we collect will be kept confidential. You may refuse to answer any questions or leave the interview at any time. Do you have any questions before we begin? Please feel free to ask questions at any time during the interview. Let’s get started;

1. Tell me about your experience using the blood pressure monitor over the past [length of time with device].
2. Was the blood pressure monitor simple to use?
3. Was there anything difficult about using it?
   Prompts: Tell me more. How was it difficult?
4. Did you ever encounter a problem when using the device?
5. Let’s walk through how you used the device to measure your blood pressure. Can you please explain to me as we go what you did at each step?
   Prompts: What is the first thing you did? What did you do next? Then what?
6. Did you need any additional help to use the blood pressure monitor?
   **Prompts:** Tell me more. For example, did you read the written instructions or ask for someone for help? When did you need help?

7. How did you feel about measuring your blood pressure at home with this device?
   **Prompts:** Did you like it? Did you dislike it? Why? Why not?

8. Would you use the blood pressure monitor in the future?
   **Prompt:** Why or why not?

9. Would you recommend this blood pressure monitor to someone else?
   **Prompt:** Why or why not?

10. Is there anything else you would like to tell me about your experience with this blood pressure monitor?
    Thank you for your thoughtful responses to my questions.