Patients’ Perspectives of a Multifaceted Intervention With a Focus on Technology
A Qualitative Analysis
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Background—Few studies have investigated the effectiveness of multifaceted interventions from the perspective of participants. We conducted qualitative interviews to understand patients’ experiences with a multifaceted blood pressure (BP) control intervention involving interactive voice response technology, home BP monitoring, and pharmacist-led BP management. In the randomized study, the intervention resulted in clinically significant decreases in BP.

Methods and Results—We used insights generated from in-depth interviews from all study participants randomly assigned to the multifaceted intervention or usual care (n=146) to create a model explaining the observed improvements in health behavior and clinical outcomes. The data were analyzed using qualitative content analysis methods and consultative and reflexive team analysis. Six explanatory factors emerged from the patients’ interviews: (1) improved relationships with medical personnel; (2) increased knowledge of hypertension; (3) increased participation in their health care and personal empowerment; (4) greater understanding of the impact of health behavior on BP; (5) high satisfaction with technology used in the intervention; and, for some patients, (6) increased health care utilization. Eighty-six percent of the intervention patients and 62% of the usual care patients stated that study participation had a positive effect on them. Of those expressing a positive effect, 68% (intervention) and 55% (usual care) reached their systolic BP goal.

Conclusions—Establishing bidirectional conversations between patients and providers is a key element of successful hypertension management. Home BP monitoring coupled with interactive voice response technology reporting facilitates such conversations. (Circ Cardiovasc Qual Outcomes. 2010;3:668-674.)

Key Words: hypertension ■ qualitative ■ trials

Hypertension is a major risk factor for cardiovascular morbidity and mortality, yet only 50% of hypertensive patients have blood pressure (BP) controlled to guideline-recommended levels.1 Multifaceted interventions incorporating telehealth technologies such as the Internet, telephonic interactive voice response (IVR), and electronic home monitors can improve BP control.2–10 However, few studies have investigated the effectiveness of multifaceted interventions from the perspective of participants.

There are many potential reasons for the effectiveness of a multifaceted intervention. Pawson11 has noted that multifaceted interventions by definition have more than one component and the success of the intervention depends on the efficacy of each step in the chain of events as well as the cumulative success of the entire sequence of events. Engaging patients to participate fully in multifaceted interventions is important to the success of the intervention. Further, determining how patients make choices about participating is critical to understanding why interventions achieve the results they do and to reshaping them to achieve better results.11 Thus, evaluations must take into account a variety of factors at individual and organizational levels.12,13 The Medical Research Council’s framework for evaluating multifaceted interventions has highlighted the importance of going beyond evaluating overall effectiveness to studying component processes in greater depth.12

Accordingly, the purpose of this study was to gather in-depth understanding of the experience of participating in a multifaceted hypertension intervention, with a focus on technology. We used a qualitative approach to understand patients’ experiences with various components of the study, including the impact of home BP monitoring and the IVR technology, to create a theoretical model to improve hypertension care. Better understanding of how participants expe-
Hypertension is one of the major causes of cardiovascular morbidity and mortality, and the majority of hypertension patients do not have blood pressure (BP) controlled to guideline-recommended levels.

Studies have demonstrated the effectiveness of multifaceted interventions to improve blood pressure control, facilitated by telehealth technologies. Few studies have investigated the effectiveness of multifaceted interventions from the perspective of participants.

**WHAT THE STUDY ADDS**

- Patients identified 6 themes that contributed to successful blood pressure reduction: (1) improved relationships with medical personnel; (2) increased knowledge of hypertension; (3) increased participation in their health care and personal empowerment; (4) greater understanding of the impact of health behavior on BP; (5) the effect of technology, including the BP cuffs and the interactive voice response system; and (6) the effects of the study on the patients’ health care utilization.
- We propose a new model to improve uncontrolled BP that uses interactive voice response to facilitate bidirectional conversations between patients and health care providers.
- This proposed model of care delivery moves away from traditional episode based care to a patient-centered model where care delivered is responsive to patient needs, and is consistent with the chronic nature of hypertension.

**Methods**

**Study Design and Sample**

This was a qualitative study of 146 patients who were participants in the “Improving Blood Pressure in Colorado” study. The patients were enrolled from the Denver Veterans Affairs (VA) Medical Center (n=87) and the Denver Health Medical Center (n=59), a municipal safety net hospital. The trial investigated the use of a pharmacist-led, multifaceted intervention to improve BP control. Patients were eligible to participate in the study if they had uncontrolled hypertension at the screening visit and were >17 years of age. Patients performed home BP monitoring and reported their results through an IVR telephone system on a weekly basis. The IVR system averaged the reported BP measurements and provided feedback to the patient about their level of control. In addition, patients could request a call from the pharmacist, connect to the pharmacy refill line or the nurse line or listen to educational messages. The IVR system also delivered reminder calls to patients if they did not report BP measurements to the IVR system after 11 days. The pharmacists received reports on home measurements and interacted with the patient through telephone visits to achieve BP goals. Patients in both arms received a National Heart, Lung, and Blood Institute educational booklet on hypertension as well as comprehensive education on hypertension (eg, diet, exercise). Of the 78 patients in the intervention group, 46 were from the VA and 32 were from Denver Health. Of the 68 usual care patients, 41 were from the VA and 27 were from Denver Health.

During the last study visit, each patient was interviewed about his or her experience with the study to gather in-depth understanding of the phenomena of participation in a multifaceted intervention. Because of issues such as illiteracy, cultural barriers, and prior experience with low response rates with surveys, we chose to conduct qualitative interviews to explain the findings of the multifaceted intervention. We choose questions that addressed each component of the patients’ overall experience during the study and the effect of the study on the patients’ visits with their primary care provider (PCP). In fulfillment of the theoretical sampling strategies of qualitative analysis, the data were collected via in-person, semistructured, open-ended interviews. To support the patient’s comfort with the environment and the interviewer and to elicit candid feedback, the interview was the last item in the final study visit. Patients were asked if they would participate in the qualitative interview, which took place after obtaining verbal consent to audiotape the conversation. Patients had signed an informed consent to participate in the qualitative study as part of participation in the randomized, controlled trial. Sixteen questions were developed by the research team with input from a qualitative methodologist who had not participated in the study. Questions for the intervention group assessed patients’ experience with the following: (1) specific details regarding taking their BP readings at home and any issues they experienced; (2) utilization of the IVR system to include details of the various components of the system and any problems; (3) details about taking their medications and any difficulties; (4) working with the study pharmacists and the effects on their BPs, medication adherence and overall health; and (5) the effects of participation in the BP study on their health behavior and utilization of health care. Questions for usual group patients only addressed taking medications and the effect of the study on their health behavior.

The first author (A.L.-K.) and trained research assistants conducted and audiotaped the qualitative interviews, which ranged from 40 to 60 minutes. The audiotapes were then transcribed verbatim. This study was approved as part of the randomized controlled trial by the Colorado Multiple Institutional Review Board.

**Data Analysis**

This study used an iterative, inductive toolkit of analytic strategies, drawing primarily on qualitative content analysis, and consultative and reflexive team analysis. One hundred forty-six interviews were audiotaped and transcribed verbatim. Transcripts were analyzed independently by the first author and one of the research assistants using qualitative content analysis methods. Analysis began with repeated readings to achieve immersion followed by initial coding using an emergent rather than an a priori approach to emphasize respondent perspectives and deemphasize team member speculations. Words, sentences, and paragraphs were treated as coding units or “meaning units.”

After initial coding was completed, the analysts compared and reconciled codes before applying the resulting shared set of codes to the transcripts and jointly identifying emergent themes through intersubjective agreement. These themes were then presented to a senior qualitative consultant for review. Throughout the analysis, findings were continually checked and compared with the rest of the data in order to determine new codes, themes, or patterns. The preliminary results of the analysis process were reviewed by members of the multidisciplinary research team, composed of members with clinical, methodological, and public health backgrounds, to assess their evocativeness, thoroughness, and comprehensiveness. The senior qualitative consultant completed a final review for analytic rigor. Accountability was supported by confirming patient reported use of the IVR system among those randomly assigned to the intervention. An additional evaluation investigated if there was any association between participants’ self-report of a positive impact of the intervention and achieving BP goals. SAS 9.1 statistical software was used for these analyses.
Comorbidities

<table>
<thead>
<tr>
<th>Demographics</th>
<th>Intervention (n=78)</th>
<th>Usual Care (n=68)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sex</td>
<td>Male 64 (82)</td>
<td>55 (81)</td>
</tr>
<tr>
<td></td>
<td>Female 14 (18)</td>
<td>13 (19)</td>
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<tr>
<td>Mean age, y (SD)</td>
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<td>61.0(11.5)</td>
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<tr>
<td>Race</td>
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<tr>
<td></td>
<td>Nonwhite 37 (47)</td>
<td>33 (49)</td>
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<tr>
<td>Ethnicity</td>
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<td>23 (34)</td>
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<tr>
<td></td>
<td>Non-Hispanic 59 (76)</td>
<td>44 (65)</td>
</tr>
<tr>
<td>DMCKD</td>
<td>45 (58)</td>
<td>50 (74)</td>
</tr>
<tr>
<td>CAD</td>
<td>14 (18)</td>
<td>11 (16)</td>
</tr>
<tr>
<td>Prior MI</td>
<td>11 (14)</td>
<td>8 (12)</td>
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<tr>
<td>Prior PCI</td>
<td>5 (6)</td>
<td>7 (10)</td>
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<tr>
<td>Prior CABG</td>
<td>4 (5)</td>
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<tr>
<td>Hyperlipidemia</td>
<td>54 (69)</td>
<td>50 (74)</td>
</tr>
<tr>
<td>Stroke history</td>
<td>12 (15)</td>
<td>8 (12)</td>
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DMCKD indicates diabetes mellitus/chronic kidney disease; CAD, coronary artery disease; MI, myocardial infarction; PCI, percutaneous coronary intervention; and CABG, coronary artery bypass grafting.

Data are expressed as n (%) or mean±SD unless otherwise noted.

Results

Participants

Baseline characteristics were comparable between the 2 groups, except usual care patients were more likely to have diabetes or chronic kidney disease (74% versus 58%; \( P=0.045 \)) (Table). Most of the participants were male (81.5%), and the overall racial makeup was 52% non-Hispanic white, 23% Hispanic, 19% African American, and 4% Native American. The majority of the study participants were 50 years and older (87%). Four of the 32 intervention patients interviewed at Denver Health and 3 of the 46 intervention patients interviewed at the VA had not used the IVR system and we have included their interviews in the analysis.

Experiences

Participants reported a range of intervention effects, from no effect to significant effect, on their health behavior and control of hypertension. A significant majority (75%) of study participants indicated that they experienced a positive effect from the study, such as building a relationship with the medical personnel, feeling empowered to engage in bidirectional conversation with their health care provider or participating more in their health care, improving their health behavior, and increasing their health care knowledge. Eighty-six percent of the intervention group and 62% of the usual care patients indicated they experienced a positive effect. A higher percentage of women (82%) than men (73%) found the study had a positive effect. More African American (89%) participants than Hispanic (71%) and non-Hispanic white (74%) participants indicated a positive effect. There was no difference in the percent of patients experiencing a positive effect between the 2 study sites, a notable result given the difference in study populations and health care systems. The VA is predominately comprised of older men who are enrolled in the Veterans Affairs Health Care System; Denver Health is a local safety net hospital that cares for many of the indigent population of Denver, Colorado.

Of the 37 study participants who did not report a positive experience, most (70%) were usual care patients who indicated that the study had no effect on their BP. The remaining 11 (30%) who did not report a positive experience were intervention patients who indicated that they had not worked with the study pharmacist. Two participants had negative comments about the study. One participant, who never used the IVR system, did not like being contacted when he did not report his BP measurements. Another patient was fearful the pharmacist would replace his PCP and the study would “get this doctor in trouble because my blood pressure’s been up.” However, he noted improving his medication adherence had resulted in a positive effect: “… it proved it right there in my readings this morning. It’s working.” Some patients also mentioned personal issues that the intervention was unable to address such as financial problems, pharmacy rules, and transportation issues that could be barriers in their ability to improve their medication adherence. When asked, “What makes it difficult to take your medicines?” 2 patients responded: “If the water was shut off” and “Just when I can’t afford them.”

Of those who had positive experiences, the data suggest 6 main themes related to the successful reduction of BP. These themes were (1) improved relationships with medical personnel; (2) increased knowledge of hypertension; (3) increased participation in their health care and personal empowerment; (4) greater understanding of the impact of health behavior on BP; (5) high satisfaction with technology, including the BP cuffs and the IVR system; and (6) the effects of the study on the patients’ health care utilization. Each is discussed in more detail.

Improved Relationships With Medical Personnel

Thirty-two percent of the intervention patients reported that the multifaceted intervention created relationships that made them feel cared about and encouraged them to become more active participants in their health care. Some intervention patients spent more time with the study personnel because they contacted the study pharmacists with questions or their home BPs warranted pharmacist intervention. Many of these patients attributed improved medication adherence and BP reduction to their positive relationships with the pharmacist. They felt that this positive relationship was unusual in routine clinical practice. In the words of one participant who was initially frustrated with the technology but was very appreciative of the support and concern that he received from the study pharmacist, “Oh, it was great, you got me spoiled there for a minute; it was like somebody really cared for … my high blood pressure…”

Increased Knowledge of Hypertension

Though all study patients enrolled in the intervention had uncontrolled hypertension, most had limited knowledge about
its causes and/or consequences, as well as comprehension of the medical therapies used to treat it. The relationships that developed between some of the patients and the study personnel supported a level of comfort and trust, which allowed give-and-take in the educational process about BP. Seventy-eight percent of the intervention group indicated that their overall awareness of BP increased, including the definition of systolic and diastolic numbers, the ramifications of too much salt and lack of exercise, and the overall importance of BP on their health. As one participant put it, “... when they take my blood pressure I didn’t know what the numbers meant at all and now I know what they mean so that’s helped me a lot because you know they check my blood pressure, ok, I don’t know if it’s normal. It’s high, it’s low, so I started asking question and now I know what it means so that helped me a lot.” More African Americans participants (85%) in the study shared that their knowledge of BP increased from participation in the study, compared with 68% of both Hispanic and non-Hispanic white counterparts. Interestingly, 60% of participants in the usual care group also indicated that the study increased their knowledge of BP. Comments from some in this group suggest that the personal interaction and the educational information they were provided with at enrollment gave them the impetus to lose weight, exercise, and adhere to their prescribed medications.

Increased Participation in Health Care and Personal Empowerment

Almost half of the participants (47%) from the intervention arm said they became active participants in their health care by exercising more, eating healthier, and taking their home BP measurements to their PCP visits. In addition, 27% of the intervention patients expressed that the knowledge and experience they gained from the study empowered them to increase their interactions and communications with their PCPs. The knowledge and information (ie, home BP measurements) they brought to the PCP visit facilitated a bidirectional conversation that supported their self care as well as assisted their physicians in the management of their hypertension. As one patient said, “So it’s made me have a two-way street with my PCP.” Interestingly, patients from both study arms reported increased confidence in their ability to change their beliefs and behaviors. A minority (10%) of usual care patients also indicated that the added knowledge and understanding of the dynamics of hypertension increased their personal confidence about the disease, which led to better communication with their PCPs. In the words of one such usual care patient, “Well, after reading the book that you gave me, I realized that things weren’t looking, ... good for me ‘cause I have an aneurysm in my brain that is inoperable and I realized after reading that I could blow my head off and I started going to my doctor every two weeks to get the blood pressure under control, and I started losing weight, going on a diet. I started walking, I started eating healthier and I’ve lost quite a few pounds.”

Among the intervention group, 59% of African Americans, 37.5% of Hispanics, and 44% of non-Hispanic whites indicated they increased their participation in their health care. However, despite increasing participation in their health care, racial differences trended in the opposite direction in terms of empowerment. Although 29% of non-Hispanic whites reported that they were more empowered to interact with their health care providers as a result of the study, only 25% of Hispanics, and 24% of African Americans reported that they felt more empowered to interact with their PCP as a result of the study. Comparison between the 2 sites indicate that 24% of the patients from the VA but only 12% of Denver Health patients became empowered to interact more with their PCP as a result of the study.

Six participants indicated that fear was either a motivator or an inhibitor of participation in their health care. These patients were fearful of learning that they had a serious problem, afraid to learn how high their BP was, afraid of their physician, and/or fearful of losing their job if they took too much time off to go to the doctor. One man explained how Colorado is a no-fault state and that he could be fired for missing work due to his surgeries. Another explained that he was afraid of his doctor and therefore, “I do exactly what she says.” For such participants, the support and tools (eg, education about BP management and observing the consequences of appropriate health behavior from home BP measurement) provided by the study were helpful in addressing and thus partially alleviating these fears.

Greater Understanding of the Impact of Health Behavior on BP

Some of the patients (36%) were able to translate their behaviors such as eating too much salt or medication nonadherence to home BP readings. A few subjects said specific issues such as forgetting to take their BP measurements and/or difficulty finding time to perform home BP measurement impeded their ability to comply with study requirements. As one participant said, “I think taking my BP regularly really made me show that I did need to take the medication and that was somewhat motivating, ... even though I didn’t cheat or fudge on it, on taking the medication ... I often thought ... I don’t think this might be doing anything ... so it did show that the medication was important.”

Fifty-nine percent of African Americans in the intervention group indicated that they were able to implement the information they received into improved understanding of their health behavior, whereas only 37.5% of Hispanics and 24% of non-Hispanic whites did so.

Satisfaction With IVR Technology and Home BP Monitoring

The technology used in the study consisted of an electronic BP cuff and an IVR telephone system. Overwhelmingly (94%), the patients reported having no problems with taking their BP at home. In fact, a couple of the patients informed study personnel that they “enjoyed” taking their BP at home. Similarly, a significant majority of patients (90%) found the IVR system very user-friendly and supported their efforts to lower their BP and address other issues such as talking with a nurse or contacting quit-smoking lines and exercise programs. Participants particularly noted the ease of contacting the study pharmacist, refilling their prescriptions, and the reminder calls. As one participant said, “the fact is, if they
[the IVR] hadn’t called a lot of times I probably wouldn’t have done as well as I did.”

Despite the overall satisfaction with the technology, some patients became frustrated when the system was unavailable and they could not report their BP results. A few subjects reported other issues with the system, such as having difficulty pushing the buttons on their cell phones and the system was cumbersome initially. One participant indicated that the phone system was not an issue for the first few months, but after a while it became tedious. He suggested that a web site would be easier and more convenient. Two patients were concerned about the cost of the minutes on their cell phones. Ultimately, most patients said the system was successful in helping them attain their BP goals. A couple of the patients even enjoyed something akin to a “relationship” with the IVR system that supported their goal of reducing their BP levels. “She [the IVR] would say you reached your goal congratulations, and I was elated to hear that so I worked that much harder the next time so I could hear those words again.”

Health Care Utilization
Overall, the intervention had mixed effects on health care utilization beyond the study. Some patients reported that the intervention controlled their hypertension with appropriate medication adjustments, and this resulted in fewer urgent care visits. Others realized they needed to be more concerned about their hypertension and consequently increased their visits with their primary care provider. Health care utilization was a minor issue for most of the study participants. Only 15% of the intervention patients and 10% of the usual care patients said the study had any effect on their health care utilization.

When considering the generalizability of this intervention, a couple of patients shared their beliefs of the potential positive effects of this type of program on the medical system and specific populations such as the Latino community.

“Great program. Should expand it because … the Latin community, we just naturally eat bad and could use more help like this.”

“I really do think it’s a good program.” “Really, I think it could make a huge difference in problems with compliance. I think that kind of personalization would really help. And it would take a lot of pressure off the medical system itself.”

Association Between Program Impact and BP Control
An additional analysis assessed the association between participants’ report of a positive impact of the program and achieving BP goals. In the intervention group, most of the patients (86%) shared that the study had a positive effect and of those patients; the majority (68%) reached their systolic BP goal. Among intervention patients who reached their systolic goal, most (89%) felt the study had a positive effect. In the usual care group, 62% indicated they experienced a positive effect from participating in the study and of these patients 55% reached their systolic BP goal. Overall, 50% of the usual care patients reached their systolic BP goal. As one might expect, it appears from this comparison that those participants who had a positive experience with the program also had a positive impact on their BP. As one participant said, “…you’re going to save a lot of lives and it’s going to prevent a lot of strokes and heart attacks ‘cause … they don’t seem to realize and neither did I until I got more education about blood pressure … how important this is to monitor your blood pressure…. And … I think it’s going to help diabetes people … I’ve noticed my [A1C] level dropped some too with the blood pressure…”

Discussion
The objective of this study was to better understand patients’ experiences with a multifaceted intervention that required interactions between patients, health care providers, and the health care system. It also required explicit behaviors from participants, which necessitates the need to understand what was effective from the participant perspective. On the basis of the experiences shared by participants from both study arms, we propose a model to improve health behavior and clinical outcomes in patients with uncontrolled hypertension. As displayed in the Figure, the multifaceted intervention facilitates bidirectional conversations between patients and health care providers through the IVR system.9 The telehealth technology supports this process by providing patients with immediate feedback about home BP measurements and the opportunity to request follow-up calls from the pharmacist. Further, patients are able to see the benefits of diet, exercise, and/or medications through home BP monitoring, which reinforces the importance of these mediators to reduce BP. Health care providers are able to follow patients’ home BP measurements and can contact them as needed to reinforce medication adherence and make medication dose adjustments based on home BP measurements. The IVR reminder messages for those who have not entered home BP measurements recently further reinforces the importance of home BP monitoring and increases contacts between patients and the health care system. Consequently, patients feel cared for, feel they are an integral part of their health care, and are empowered to become active participants in their own health care, with regard to medication adherence, monitoring BP, and having the confidence to engage in bidirectional conversation with their health professionals.

The literature supports the individual components of our model that includes appropriate medication therapy, patient education, and addressing individuals’ needs for mutual working relationships with medical personnel for hypertension management.8,9,22–26 Previous studies have concluded that an organized system of regular follow-up, a stepped-care approach to a patient’s hypertension regimen,27 and integration of computer technology can improve BP control.28 However, the literature lacks a model that integrates these different components into an organized system that supports patient care on multiple levels, which is the foundation of our theoretical framework. In addition, there has been little research focusing on the participants’ perceptions of the different components of a hypertension intervention. The proposed model illustrates a process that addresses needs of the individual patient, health care providers, and the health care system. The IVR system aids in the education of the patients, serves as a repository of BP results, and is a...
cost-effective liaison between the health care provider and the patient. For patients, the IVR system provides a mechanism to receive feedback about their home BP measurements and to request pharmacist support, which empowers them to actively participate in their health care. For health care providers, they have more BP measurements on which to base clinical decisions about whether to intensify therapy, in contrast to usual clinical care, where BP measurements are only available when patients come in for a clinic visit. From the perspective of the health care system, this model of care delivery moves away from the traditional episode-based care to a more patient-centered model, where care delivered is responsive to patient needs (eg, when BP is elevated or when patients request a call from the pharmacist) and is consistent with the chronic nature of hypertension.

Key questions in intervention evaluation are whether the intervention is effective in everyday practice and whether the results vary between sites and among patients. This study was conducted as a practical clinical trial by selecting clinically relevant alternative interventions to compare, including a diverse population of study participants, and recruiting participants from heterogeneous practice settings. The feedback regarding the program from patients was similar across sites but some differences were also noted. We found that a higher percentage of African American patients compared with Hispanic and non-Hispanic white patients reported an increase in knowledge and participation in their health care but a lower percentage reported being more empowered to interact with their PCPs. These findings should be further explored in subsequent studies to potentially tailor interventions to specific patient populations.

Potential limitations of the study should be acknowledged. The results of this study are based on the people who enrolled in the study and may be subject to attribution bias. In addition, there is the possibility of a social desirability bias in which patients respond in a certain way to please the interviewer. The study results are based only on interview data and did not include any direct observations of the patients using the intervention components. Finally, there was a greater number of usual care patients with diabetes or chronic kidney disease, and we do not know if the presence of these comorbidities had a differential impact on achievement of BP goals between the 2 groups. In conclusion, the proposed theoretical model of a management system that includes IVR integrates patients and health care providers in the process of improving BP control. Patients are no longer on the sidelines of their care and are better able to see the direct consequences of their behaviors regarding diet, physical activity, and medication adherence. Health care professionals can develop a mutual working relationship with patients who are facilitated by technology. When appropriately integrated, we believe this model will support patients to adhere to mutually agreed-on medical regimens. The findings from this study can provide the framework for the development of subsequent multifaceted interventions to change patient and health care provider behavior as well as clinical outcomes of patients with hypertension. This model may also inform interventions for other chronic conditions, such as diabetes.

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References
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