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Improving Hypertension Control and Patient Engagement Using Digital Tools

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ABSTRACT

Hypertension is present in 30% of the adult US population and is a major contributor to cardiovascular disease. The established office-based approach yields only 50% blood pressure control rates and low levels of patient engagement. Available home technology now provides accurate, reliable data that can be transmitted directly to the electronic medical record. We evaluated blood pressure control in 156 patients with uncontrolled hypertension enrolled into a home-based digital-medicine blood pressure program and compared them with 400 patients (matched to age, sex, body mass index, and blood pressure) in a usual-care group after 90 days. Digital-medicine patients completed questionnaires online, were asked to submit at least one blood pressure reading/week, and received medication management and lifestyle recommendations via a clinical pharmacist and a health coach. Blood pressure units were commercially available that transmitted data directly to the electronic medical record. Digital-medicine patients averaged 4.2 blood pressure readings per week. At 90 days, 71% of digital-medicine vs 31% of usual-care patients had achieved target blood pressure control. Mean decrease in systolic/diastolic blood pressure was 14/5 mm Hg in digital medicine, vs 4/2 mm Hg in usual care ($P < .001$). Excess sodium consumption decreased from 32% to 8% in the digital-medicine group ($P = .004$). Mean patient activation increased from 41.9 to 44.1 ($P = .008$), and the percentage of patients with low patient activation decreased from 15% to 6% ($P = .03$) in the digital-medicine group. A digital hypertension program is feasible and associated with significant improvement in blood pressure control rates and lifestyle change. Utilization of a virtual health intervention using connected devices improves patient activation and is well accepted by patients.

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Hypertension is a major contributor to cardiovascular disease and is the leading risk factor contributing to the global disease burden, representing approximately 10% of all global health care spending.[1,2] Despite effective pharmacologic and nonpharmacologic therapies, the current office-based approach produces suboptimal results in which approximately half of the 80 million US adults with hypertension remain uncontrolled.[3,4] Several factors account for these poor outcomes, including the use of suboptimal doses of medications, lack of patient engagement, and limited resources and time to educate and provide lifestyle recommendations.[5] Although many types of interventions have been tested, recent systematic reviews conclude that what is needed is a reorganization of clinical practice and empowerment of nonphysician practitioners to adjust antihypertensive therapy.[6]

Home blood pressure monitoring addresses several limitations of traditional office-based care, including a larger sample of biologic data, reducing misclassification due to white-coat or masked hypertension, and an ability to take more timely action and course-correct therapy.[3] Current technology is accurate and easy to use, and home-based blood pressure measurements better predict cardiovascular

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risk than office measurements.[7] Moreover, home blood pressure monitoring avoids the inconvenience of an office-based encounter and in and of itself, enhances patient engagement, which independently plays an important role in medication and lifestyle adherence.[7-10]

We sought to evaluate the effectiveness of a remote, home-based telemonitoring program in a clinical setting using commercially available technologies, on blood pressure control and patient engagement in patients with uncontrolled hypertension.

CLINICAL SIGNIFICANCE

- Hypertension can be safely and effectively managed using a digital health platform, achieving better blood pressure control than traditional office-based care.
- A digital platform for managing chronic disease is well accepted by patients and enhances patient engagement.
- Factors in the patient domain including health literacy, patient activation, social isolation, and medication affordability play a significant role in chronic disease control and should be considered in population health management strategies.

METHODS

We identified adult patients with the diagnosis of hypertension at the Ochsner Health System who had elevated blood pressure (systolic pressure > 140 mm Hg or diastolic pressure > 90 mm Hg) at each of the 3 most recent physician visits within the previous 18 months. Patients meeting these requirements were enrolled by their physician during an office encounter or through an offer letter by their physician. Patients were required to possess a smartphone as well as purchase a wireless blood pressure unit from a list of preselected vendors based on the smartphone's operating system. For Android phones the vendor option was Withings (Withings, Inc, Cambridge, Mass); for Apple iPhones the options included Withings and iHealth (Mountain View, Calif). The electronic medical record (Epic Systems Corporation, Verona, Wis) provided a direct interface to Withings regardless of operating system, as well as a secure interface to Apple HealthKit (Apple Inc, Cupertino, Calif), thus providing an array of device options for units that interfaced with HealthKit. Patients also were required to have an active account in the patient portal (Epic MyChart, Epic Systems Corporation), which was free; if patients did not have an active account, they were given the opportunity to sign up for one.

Program details, questionnaires, and electronic consent to participate took place online through MyChart. Questionnaires assessed factors related to hypertension and chronic disease management, including dietary sodium and alcohol consumption, depression, medication adherence, patient activation, physical activity, health literacy, social circumstances (eg, medication affordability, number living in home), and screening for obstructive sleep apnea.[5] Additional clinical data were obtained from the electronic medical record, including serum sodium, potassium, creatinine, estimated glomerular filtration rate, thyroid function tests, and body mass index (BMI). These data were used to create a patient phenotype that assisted in the design of the intervention process.

Patients were asked to take no less than one blood pressure reading per week, but were encouraged to take 3-4 per week. If the care team had not received a blood pressure reading for 8 days, patients would receive an automated text alerting them that a blood pressure measurement was needed. Blood pressure units were purchased and initial training and setup was provided at the Ochsner O Bar, a patient-facing service that provides information, training, and tech support for patients interested in apps, wearables, and connected home devices.[11]

A second group of patients who met eligibility criteria but whose physician was not participating in the program were followed. Of these, 400 patients were matched to the digital-medicine group according to age, sex, BMI, and initial blood pressure, and were followed as a usual-care group over time. Usual-care patients received routine care through their primary care physician and averaged 0.8 visits over 90 days.

Doctoral pharmacists and health coaches participated in the intervention that included education, drug management, and lifestyle recommendations as per hypertension guidelines.[12,13] Each pharmacist received training in hypertension management as well as use of the custom tools within the electronic medical record created to facilitate optimal management. Pharmacists and health coaches were also educated about the importance of patient engagement and methods used to enhance engagement and lifestyle change.

We developed a health capability score composed of 4 patient domain factors impacting chronic disease outcomes: social isolation, capabilities to process and understand health information (health literacy), engagement in their disease process (patient activation), and economic barriers impacting treatment plans (medication affordability). One point was assigned to any deficiency in each component, with a higher score indicating decreasing health capability.

Interventions

Pharmacists contacted patients by phone and discussed the screening results as well as treatment options for improving blood pressure control. Patients were encouraged to be an active participant in their hypertension management and worked with the pharmacist to co-create the treatment plan by choosing among various lifestyle and medication options. Patients were also directed to a dedicated hypertension Web site that offered further educational and lifestyle materials including custom videos and downloadable handouts.

Those who screened positive for depression or obstructive sleep apnea were referred to their physician or to the