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Effects of a Community Population Health Initiative on Blood Pressure Control in Latinos.

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ORIGINAL RESEARCH

Effects of a Community Population Health Initiative on Blood Pressure Control in Latinos

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***Background*—**Hypertension remains one of the most important, modifiable cardiovascular risk factors. Yet, the largest minority ethnic group (Hispanics/Latinos) often have different health outcomes and behavior, making hypertension management more difficult. We explored the effects of an American Heart Association–sponsored population health intervention aimed at modifying behavior of Latinos living in Texas.

***Methods and Results*—**We enrolled 8071 patients, and 5714 (65.7%) completed the 90-day program (58.5 years ±11.7; 59% female) from July 2016 to June 2018. Navigators identified patients with risk factors; initial and final blood pressure (BP) readings were performed in the physician's office; and interim home measurements were recorded telephonically. The intervention incorporated home BP monitoring, fitness and nutritional counseling, and regular follow-up. Primary outcomes were change in systolic BP and health-related quality of life. Using a univariate paired-samples pre–post design, we found an average 5.5% (7.6-mm Hg) improvement in systolic BP (139.1 versus 131.5, t=10.32, $P<0.001$). Quality of life measured by the European quality of life 5-dimension visual analog scale improved from 0.79 to 0.82 (t=31.03, $P<0.001$). After multivariate regression analyses, improvements in quality of life and overall body mass index were significantly associated with reductions in systolic BP.

***Conclusions*—**A noninvasive, population health initiative that encourages routine engagement in patients' own BP control was associated with improvements in systolic BP and quality of life for this largely Latino community. **(*J Am Heart Assoc*. 2018;7: e010282. DOI: 10.1161/JAHA.118.010282.)**

Key Words: blood pressure measurement/monitoring • ethnicity • hypertension • population

Hypertension remains a major but modifiable risk factor for cardiovascular disease (CVD) and stroke in the United States. It is estimated that the hypertension prevalence rates based on current guidelines affect 46% of the population, or nearly 115 million adults in the United States alone.[1] The American Heart Association (AHA) established strategic impact goals aimed at reducing CVD and stroke deaths by 20% by the year 2020.[2] The strategy introduced a concept for cardiovascular health that is characterized by 7 metrics known as "Life's Simple 7."[3] These metrics focus on the patient's self-engagement in monitoring their health and key measures and emphasizes 4 health behaviors and 3 health factors, including blood pressure (BP) reduction.

Cardiovascular health has been shown to have ethnic and racial variation due to genetic, culture, nutritional, socioeconomic, and other factors.[4,5] Hispanic and Latino people (Latinos) compose the largest minority ethnic group in the country and the fastest growing population in the United States and will account for nearly a fifth of the total US population by 2020.[6] Understanding the cardiovascular health of Latinos is a key concern for ambulatory population health. Although Latinos have lower overall rates of heart disease than non-Latinos, CVD is still the leading cause of death since these patients seek treatment less often for cardiovascular issues[7] and are 40% less likely to achieve BP control.[8]

Community-based programs have begun to explore the use of ambulatory and home-based BP monitoring (HBPM) to reach specific populations.[9–11] Although most hypertension diagnosis and monitoring has typically been carried out in office settings, recent studies have shown that HBPM can be equally as or more effective in diagnosing and managing hypertension.[12–14] Patient self-engagement and self-management of their condition is associated with overall better physical,

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Clinical Perspective

What Is New?

- Most hypertension guidelines suggest incorporating out-of-office measurements, yet little evidence exists about the effectiveness in overall systolic blood pressure improvement.
- The inclusion of home blood pressure monitoring and lifestyle interventions was associated with a 5.5% positive change in systolic blood pressure for a largely Latino population.

What Are the Clinical Implications?

- Patients who present with controlled hypertension can benefit from the inclusion of home blood pressure monitoring to provide additional data points for medication management.

emotional, and social health outcomes.[15] Patient-reported measures via HBPM have also been shown to provide more effective management of hypertension specifically when combined with intensive therapeutic lifestyle interventions such as fitness and nutritional counseling.[16]

Nevertheless, recent systematic reviews have noted significant variability and contradictory findings relative to the efficacy of HBPM and lifestyle interventions for CVD.[17] In this study, we explore the effects of a community-based HBPM intervention targeted to a Latino population.

Methods

Study Design and Setting

This study was designed to identify primarily Latino patients with CVD risk factors and to encourage home BP readings to engage these patients actively in maintaining their own health. This research was a population-based prospective cohort study, and we utilized a pre–post study design to assess changes in systolic BP (SBP) over time (90 days of active engagement). The intervention incorporated lifestyle interventions, routine follow-up from patient navigators, and HBPM. The intervention was modeled after the AHA "Check. Change. Control." program.[18] The initiative, called the Voelcker Hypertension Impact Project, was funded by the Max and Minnie Tomerlin Voelcker Fund and organized by the AHA SouthWest Affiliate. It was designed to explore whether a noninvasive, ambulatory, quality-improvement program could encourage patient engagement and effect change in controlling individual hypertension for the Latino population specifically. The intervention used HBPM, multiple fitness and nutritional counseling sessions, and routine follow-up by patient navigators in a coordinated community population health initiative. The study was conducted in San Antonio, Texas (the seventh largest city in the United States, with >56% Hispanic population). All patients were enrolled from 1 of 3 participating clinics in the University Health System, a county-owned academic medical center in San Antonio. Institutional review board approval was obtained from the University of Texas Health Science Center at Houston.

Intervention

Nonclinical patient navigators provided patient screening, consent, education, coaching, and follow-up. Navigators are especially trained personnel who assist patients with the process of care and are especially useful for overcoming barriers and reducing disparities related to language or cultural gaps.[19] Eligibility criteria included adult Latino patients with risk factors, including elevated, stage 1, or stage 2 hypertension (>120/80 mm Hg). To complete the program, the patient study duration required 90 consecutive days and a minimum of 3 interim measurements. The first and final BP readings were performed entirely in the clinic by the provider. During the interim, home BP measurements were obtained by navigators during follow-up phone calls with patients (about 30% of all measurements) or follow-up visits by the patients to the clinic.

Approximately 26% of the patients received BP cuffs through the program (SmartHeart automatic arm digital monitor; Veridian Healthcare). The remainder either were given prescriptions to purchase the same monitor or stated they had an existing digital arm cuff. All cuffs had to be for the arm, and wrist monitor measurements were not permitted. Patients were instructed to perform at least 2 repeated measurements and to record all readings on paper for subsequent follow-up with the navigator. Other specific instructions to reduce measurement errors were provided, including guidance on how to utilize monitoring devices, proper arm and sitting position, timing, inflation techniques, and the need for repeated measurements.[20]

During the office visit, brief (<5 minutes) nutritional and fitness counseling was provided by the patient navigator and the nurse. Nutritional patient resources were provided for the DASH (Dietary Approaches to Stop Hypertension) diet, as well as fitness, activity, and local wellness programs. The intervention focused primarily on engaging patients in monitoring their own BP and encouraging active participation in their own cardiovascular health.

Variables and Data Sources

The data, analytic methods, and study materials will not be made available to other researchers for purposes of reproducing the results or replicating the procedure.

The primary dependent variable was the change in SBP reading between the first and last measurements. We also

captured change in diastolic BP and quality of life (QOL), using the European QOL 5-dimension (EQ-5D) visual analog scale.

Other variables included height and weight (to calculate body mass index [BMI]; kg/m^2), demographics (age, sex, race, ethnicity), and medical history (prior stroke, diabetes mellitus, and heart failure). Medication compliance was measured as binary (1=yes, on antihypertensive medication; 0=no). Most clinical data were extracted from electronic health records, including demographics, medications, medical history, and BP measurements. A separate database was maintained to track the fitness and nutritional counseling activities by patient and date.

Statistical Analysis

Continuous variables are presented as mean±SD. Categorical data are presented as percentages. Chi-square analyses were used to assess differences between groups of categorical data. Student *t* tests were used to examine univariate differences between continuous variables. Baseline characteristics were compared between compliant and noncompliant participants (those who did not complete the intervention), using *t* tests and chi-square tests. Multivariate linear regression examined changes in SBP, controlling for the demographic and patient baseline conditions. We modeled the dependent variable (improvement in within-participant SBP) as a positive number in the regression model, defined as baseline SBP minus follow-up SBP. We assessed for multicollinearity between the variables using Pearson correlation for continuous variables or Spearman correlation in the case of binary variables. Using a cutoff of >0.7, we did not find evidence of significant collinearity between any of the variables. Statistical significance was defined as $P<0.05$. SPSS Statistics v25 (IBM Corp) was utilized to perform all data analyses.

Results

The study enrolled 8071 patients from July 2016 to June 2018 (24 months), and 5714 (65.7%) completed the program. The average age for patients who completed the intervention was 58.5±11.7 years (range: 18–97 years), including 3353 women (58.7%), and 4069 patients (71.2%) identified as Latino. Approximately 60% of the patients had a history of diabetes mellitus, and 75% had a BMI greater than normal ranges (ie, BMI >25), with a mean of 33.4 (considered obese class I). The mean intervention time for participants was 98.1 days.

Before study initiation, no participants were adhering to the AHA Life's Simple 7 recommendations (including BP management, diet, BP, fitness, and activity). The majority (92.3%) were already placed on antihypertensive medication before enrollment in the study and remained on medications during the intervention. Unless complications were reported in the interim, patients did not return to the physician's office until the completion of the program; therefore, changes to medication were minimal. Only 110 patients (1.9%) had any change in dosage recorded during the program. Of those patients on medications, the majority had 1 primary medication for hypertension management including calcium channel blocker in 30%, angiotensin-converting enzyme inhibitors in 60%, and angiotensin II receptor blockers in 10%. The results from interim measurements provided additional information for physicians to monitor medication concordance and improve BP management following the program's completion. Table 1 summarizes the patient baseline characteristics.

There were minor differences in the demographics and baseline characteristics between those who did and did not complete the program, including higher rates of stroke, diabetes mellitus, prior heart failure, and baseline antihypertensive medications in patients who completed the program. Most patients dropped out of the program between the second and third BP readings. For compliant participants, we had full compliance for all readings during the program, largely because of proactive follow-up by the patient navigator.

There was a significant 5.5% improvement in mean SBP from 139.1 mm Hg at baseline to a final reading of 131.5 mm Hg (7.6 mm Hg, $t=10.32$, $P<0.001$). There was a similar 6% improvement in diastolic BP. Average EQ-5D score increased from 0.79 to 0.82 ($t=31.03$, $P<0.001$). Table 2

Table 1. Patient Characteristics

Variable	Compliant	Noncompliant	*P* Value
Patients, n	5714	2357	
Age, y, mean (SD)	58.5 (11.7)	57.14 (12.41)	0.001
Sex, female, n (%)	3353 (58.7)	1350 (57.3)	0.245
Body mass index, mean (SD)	33.4 (9.6)	33.7 (10.1)	0.112
Hispanic or Latino ethnicity, n (%)	4069 (71.2)	1697 (72.0)	0.010
Race, n (%)			
White	4720 (82.6)	1968 (83.5)	<0.001
Black	571 (10.0)	276 (11.7)	
All others	423 (7.4)	113 (4.8)	
Baseline characteristics, n (%)			
Diabetes mellitus	3539 (61.9)	1335 (56.7)	<0.001
Prior stroke	466 (8.1)	157 (6.6)	<0.001
Prior heart failure	692 (12.1)	207 (8.7)	<0.001
Antihypertensive medication	5277 (92.3)	2086 (88.6)	<0.001

summarizes the outcome differences between the initial and final readings for those who completed the program.

For patients who completed the intervention, there was a reduction in within-participant mean SBP at each reading across this consistent sample. The box plot in Figure shows trend reduction in participants' SBP over 5 measurements during the 90-day period.

There was no significant difference between sexes for either outcome variable. With the dependent variable (improvement in within-participant SBP) measured as a positive number, we fit a multivariate regression model. After controlling for patient baseline and demographic factors, only BMI and change in QOL persisted as significant factors in SBP change in the final model (R^2=0.092, P<0.001). Higher BMI and greater improvement in QOL were factors positively associated with improved SBP. Age, race, sex, ethnicity, medication compliance, and prior medical history were not significantly associated with reductions in SBP after controls. Table 3 shows the regression results.

Discussion

We found that a targeted noninvasive intervention for Latinos, incorporating HBPM and lifestyle counseling, was associated with a reduction in mean SBP. We also observed an improvement in reported QOL scores during the program that were positively associated with SBP change. In addition, after controls for patient and demographic factors, individuals with greater BMI had the largest overall change. Cardiovascular health has been shown to have ethnic and racial variation, partially due to nutritional and cultural factors. Better understanding of the link between BMI and BP control is necessary, especially when focusing on the Latino community. More frequent interim BP measurements can be used to comprehensively augment patient medical management.

Other researchers have found similar results regarding the relationship of targeted quality-improvement strategies in BP control. In their review of 18 comparable interventional programs across the United States, Anderson and colleagues found that community interventions that include HBPM resulted in BP improvements.[21] Other quality-improvement strategies have also been shown to result in positive change.

Table 2. Quality Outcome by Phase

Measure	Initial	Final	*P* Value
Systolic BP	139.1 (18.5)	131.5 (15.1)	<0.001
Diastolic BP	76.8 (12.3)	72.2 (10.8)	<0.001
Quality of life	0.79 (0.16)	0.82 (0.14)	<0.001

Data shown as mean (SD). BP indicates blood pressure.

Walsh and colleagues conducted a systematic review of 54 previously published community quality-improvement programs and found a median reduction of 4.5 mm Hg in both SBP and diastolic BP. They concluded that interventions in which the physician care team is extended outside of the office and to others (eg, navigators, nurse educators) result in improvement in hypertension control.

Graarup and colleagues reported that involving patients in effective education and communication surrounding their condition results in improvement in patients' quality of care.[22] Similarly, Ivey and colleagues analyzed patients with both CVD and diabetes mellitus and concluded that getting patients involved in managing their own chronic conditions results in better patient-reported outcomes, including emotional, physical, and social health.[15] In contrast, Ryvicker and colleagues conducted a randomized trial of 587 patients and did not find that actively engaging the patient through similar mechanisms resulted in a positive SBP change.[11]

Most hypertension guidelines suggest incorporating out-of-office measurements, including those of the US Preventive Task Force on Hypertension, the European Society for Hypertension, and the World Hypertension League.[23–25] However, studies involving the inclusion of HBPM have also yielded conflicting results. Bosworth and colleagues conducted a randomized trial of telemonitored HBPM and found only moderate improvements in BP control.[26] Alternatively, in a 2-year study of older adults using nontelemonitored HBPM, Tzourio and colleagues reported that routine HBPM resulted in modest reductions of BP that improve significantly over time.[16] Band and colleagues suggest a comprehensive approach to managing hypertension, including active patient engagement and digital interventions such as HBPM.[12]

Legitimate concerns exist around the validity and accuracy of HBPM equipment and the patient's ability to monitor and record readings correctly.[20,27] Kronish and colleagues reported that the level of patients' experience and training around proper use is a common problem. They further established that the primary barriers to broader use of HBPM include "compliance with the correct test protocol, accuracy of tests results, out-of-pocket costs of home BP devices, and time needed to instruct patients on home BP monitoring problems."[28] They go on to report however that "white coat hypertension" offers compelling evidence to support the inclusion of repeated measurements outside the physician's office.[26] Celis and colleagues recommend that clinics adopt HBPM but conclude that it should not replace, but rather complement, in-office and ambulatory measurements based on concerns about the validity of readings.[29]

Lifestyle and nutritional counseling in the management of patients with hypertension is considered level I evidence for reducing cardiovascular risk.[30] However, including such counseling in clinic-based population health programs poses

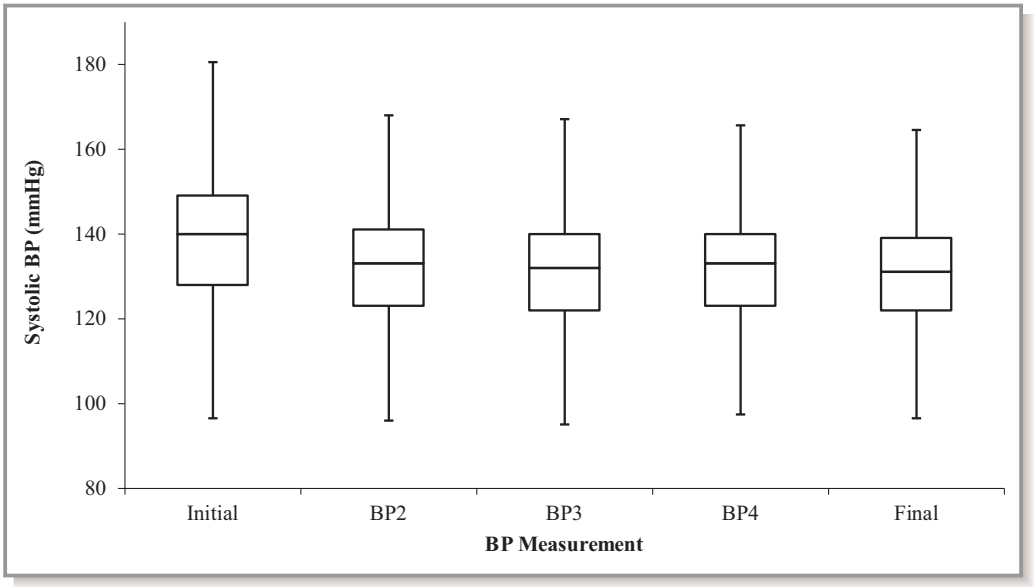

Figure. Mean systolic BP by measurement. BP indicates blood pressure.

administrative and personnel challenges that limit broader utilization.[31] Even if lifestyle counseling offers only minimal positive change without the addition of antihypertensive medication, most researchers recommend augmenting patient management with these components.[32,33]

Prior studies have pointed to evidence gaps in the diagnosis and treatment of CVD in the Latino community.[34] In this study, we conclude that regular patient engagement through their own HBPM, coupled with nutritional and fitness counseling sessions, results in improvement in SBP control for a Latino population.

Limitations and Future Research

First, this sample was not randomized, so it is possible that our findings are partially based on inherent sample characteristics or other factors for which we did not control. We attempted to adjust for confounders by including patient demographic and baseline characteristics in our models. Future studies would benefit from randomization. In addition, because this was a community intervention, we relied on home-based BP readings, largely based on patients' own equipment. There are control, quality, and accuracy concerns surrounding home readings, given equipment, timing, and human factors. We attempted to control for these concerns by doing all first and final readings in the clinic, providing cuffs to >25% of the patients, and instructing patients on appropriate use and positioning. Furthermore, because most patients came into the study already compliant with BP medications, this study does not address the impact of antihypertensive medication changes during the study. Finally, white coat or masked hypertension could affect measurement in the study. We are unable to determine whether these issues played a role, but the point of key analysis was each patient's change from baseline to final reading.

Given our findings, future research should examine other community-based programs across other racial and ethnic populations. Subsequent studies could explore BMI and QOL in more detail. We also recommend large-scale studies to positively confirm these findings across other regions.

Conclusion

A noninvasive population health intervention that extended hypertension management outside the physician's office and incorporated routine HBPM and lifestyle counseling was

Table 3. Regression Model Results

Variable	Δ SBP β (95% CI)	*P* Value
Age	0.045 (−0.001 to 0.091)	0.057
Sex	1.043 (−0.430 to 2.516)	0.165
Ethnicity	−0.992 (−2.671 to 0.686)	0.246
BMI	0.118 (0.055–0.182)	<0.001
Stroke	−2.199 (−4.984 to 0.585)	0.122
Diabetes mellitus	−0.284 (−1.854 to 1.286)	0.723
Heart failure	−2.212 (−4.484 to 0.060)	0.056
Medication	−2.405 (−4.939 to 0.129)	0.063
QOL change	0.315 (0.237–0.393)	<0.001

BMI indicates body mass index; CI, confidence interval; QOL, quality of life; SBP, systolic blood pressure.

effective at improving BP control and QOL for a Latino population.

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Disclosures

None.

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