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Self-blood pressure monitoring in an urban, ethnically diverse population: A randomized clinical trial utilizing the electronic health record

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Abstract

Background—Hypertension is a leading risk factor for cardiovascular disease. While control rates have improved over time, racial/ethnic disparities in hypertension control persist. Self-blood pressure monitoring (SBPM), by itself, has been shown to be an effective tool in predominantly white populations, but less studied in minority, urban communities. These types of minimally intensive approaches are important to test in all populations, especially those experiencing related health disparities, for broad implementation with limited resources.

Methods and Results—The New York City Health Department in partnership with community clinic networks implemented a randomized clinical trial (n=900, 450 per arm) to investigate the effectiveness of SBPM in medically underserved, and largely black and Hispanic participants. Intervention participants received a home blood pressure (BP) monitor and training on use, while control participants received usual care. After 9 months, systolic BP decreased (intervention: 14.7 mm Hg, control: 14.1 mm Hg; p=0.70). Similar results were observed when incorporating longitudinal data and calculating a mean slope over time. Control was achieved in 38.9% of

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Clinical Trials Registration

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intervention and 39.1% of control participants at the end of follow-up; the time-to-event experience of achieving BP control in the intervention vs. control were not different from each other (logrank p-value=0.91).

Conclusions—SBPM was not shown to improve control over usual care in this largely minority, urban population. The patient population in this study, which included a high proportion of Hispanics and uninsured persons is understudied. Results indicate these groups may have additional meaningful barriers to achieving BP control beyond access to the monitor itself.

Keywords

hypertension; blood pressure measurement/monitoring; lifestyle; population; clinical trial

Introduction

Hypertension (HTN) is a major risk factor for cardiovascular disease (CVD), and yet nationally, only 69% of all individuals with HTN treated with anti-hypertensive medications meet treatment targets.[1] HTN control has been shown to be lower in non-Hispanic blacks compared to non-Hispanic whites, while results are mixed in Hispanic populations vs. whites.[2-4] CVD risk increases with even small increases in blood pressure (BP), thus establishing treatment and control of HTN as a significant public health priority.

Approaches to disease management aimed at increasing HTN control include the use of self-blood pressure monitoring (SBPM).[5] Although the precise mechanism through which it enhances control is not clearly defined, it is hypothesized that SBPM is effective because it increases patient awareness leading to healthier behaviors, and/or induces healthcare providers to advance therapy more actively.[6-10] National interest in SBPM is increasing, as demonstrated by the recent release of an action guide developed by the Centers for Disease Control and Prevention (CDC) to support the Million Hearts initiative.[11]

SBPM has been shown to be an effective tool in reducing BP and improving HTN control, especially when enhanced with additional, non-treatment related supports such as educational materials or calls from nurses or pharmacists; however, the bulk of the literature on SBPM has focused on whites only.[12, 13] Studies evaluating the effectiveness of SBPM in different racial and ethnic minority groups in urban, low income populations are few. A review by the Agency for Healthcare Research and Quality (AHRQ) on the effectiveness of SBPM was conducted contemporaneously with this study, and cited that small samples of race/ethnic subgroups in reviewed studies precluded any specific conclusions for these groups.[14]

In 2006, the New York City Health Department implemented an SBPM program in 19 clinics in medically underserved neighborhoods where the majority (86%) of participants were black or Hispanic. Enrolled participants with uncontrolled HTN received BP monitors and training on how to use them. Evaluation of this program using a pre-post study design showed that fifty percent of participants achieved BP control at the end of 9 months.[15] The desire to corroborate these results using a more rigorous study design (i.e., presence of a control group) led to the conduct of a randomized clinical trial by the Health Department

and clinical partners in 2010-11. The objective of the study was to assess if SBPM alone was effective in reducing elevated BP and in increasing HTN control in black and Hispanic patients from low income neighborhoods. Additionally, this study highlights the electronic health record (EHR) as a valuable tool for translational research.

Methods

The study design was a randomized clinical trial conducted in a large heath center network (six sites) and two small, independent community health centers (one site each), for a total of eight clinic sites. These sites treat populations that are medically underserved; the large network which included six sites and one of the smaller centers were federally qualified health centers (FQHC). The design and implementation of this study incorporated aspects of participatory action research[16] in that it was a collaborative effort between the Health Department and community clinic networks. The healthcare networks were using the same EHR, eClinicalWorks, and receiving technical assistance on systems changes from Health Department staff. All eClinicalWorks practices have BP quality and decision support measures that allow for monitoring of their patient populations. The trial consisted of two study arms: an intervention arm where participants received automatic home BP monitors with modems capable of transmitting (or “uploading”) home BP readings via phone line to a secure database for evaluation, and a control arm where participants received usual care. The DOHMH collaborated with iMetrikus/Numera to provide a mechanism for uploading and collecting the participants’ home readings.

The target sample size for enrollment was 996, or 498 participants in each arm. This would have allowed for the detection of a 3.3 mm Hg (SD: 17 mm Hg) difference in systolic BP between intervention and control arms after 9 months at 80% power, and 99.8% power to detect BP control over time using time-to-event analysis, both accounting for study participant attrition (13.6% over 9 months). The original study design sought to recruit Hispanics, non-Hispanic blacks, and non-Hispanic whites evenly (33% of study sample of each race/ethnicity) using stratified, block randomization. With even distribution of study arms across three race/ethnic groups (n=165 per arm, per race/ethnicity), a difference of 5.7 mm Hg in systolic BP would be detectable within race/ethnic group; detection of BP control over time using time-to-event analysis was powered at 80%. In the planning process, study sites were selected based on having sufficient information technology (IT) infrastructure and provider interest which limited the demographics of the final recruited sample. The percentage of Hispanics was 62%, blacks 28%, and whites 10%. Between race/ethnic comparisons (e.g., Hispanic vs. white) were not performed given limited sample size.

Participant Recruitment and Randomization with the Electronic Health Record

Participants needed to meet all eligibility criteria: a) age 18 years or older; b) diagnosis of HTN for at least 6 months; c) last visit BP uncontrolled (systolic BP ≥ 140 mm Hg or diastolic BP ≥ 90 mm Hg; for those with diabetes or chronic kidney disease [CKD]: systolic BP ≥ 130 mm Hg or diastolic BP ≥ 80 mm Hg); d) not currently measuring BP at home; e) access to a land [telephone] line; f) Hispanic, black or white; g) capacity to use the home monitor and record readings as determined by the provider; and h) current visit BP

uncontrolled. Criteria ‘a’ through‘c’ were built into the EHR, such that only those who met those criteria were approached and screened for the study. All other criteria were assessed by a smartform, as described below.

Participants’ eligibility was determined and participants were automatically randomized into the intervention or control group by a smartform, a software tool residing within the EHR. The study smartform was developed by Health Department staff in collaboration with the EHR vendor for use in this study. The smartform is a tool that provides a method of query-able structured data collection and performs basic study logic and calculations. While some providers had used similar smartforms in the past to collect patient histories for depression/smoking, providers and non-provider/nursing staff at participating clinics did receive some training to become familiar and comfortable with the new smartform and the workflow that it entailed.

Patients were enrolled from June 7, 2010 thru October 7, 2011. A typical screening workflow proceeded in the following manner. After the vital signs were taken by the medical assistant, the smartform was opened and pre-populated with the study protocol and relevant patient information (eligibility criteria a-c listed above). If the patient met the initial eligibility criteria, the nurse continued the screening by asking the first 5 questions on the smartform (screenshot of smartform is included in the Supplementary Appendix online; included assessment of whether the patient was willing to be screened, and eligibility criteria d-f). If the patient was still eligible, when the patient saw the provider, the provider would answer the next three questions on the form (eligibility criteria g-h; and verification of CKD or diabetes diagnoses). If all three answers were yes, the patient was sent back to the nurse to complete enrollment including obtaining consent, randomization by answering “yes” to the last question, and training if in the intervention arm. The information from the smartform was passed to an integrated study protocol EHR module responsible for enrolling a randomized and balanced cohort of patients for each race/ethnicity for each control/intervention arm. All patients screened and enrolled in the study were tracked in a master study participants table within the EHR database, which prevented duplicate enrollments and facilitated study data collection efforts throughout the program. The screening and consent process was adapted to fit each clinic setting to minimize changes to workflow.

After randomization, participants in both arms were asked to return to the clinic as per their regularly scheduled visits. Intervention arm participants received BP monitors, educational materials on HTN, and a tote bag. They were trained on how to use their monitors, record their BP, and upload their home readings (transmitting them electronically to the secured database), and were encouraged to share their BP readings with their doctors. Control arm participants received usual care, and as an incentive, a BP monitor at the end of study follow-up. The planned follow-up period was 9 months, longer than the majority of previous studies on SBPM[13] to demonstrate persistence and maintenance of improvement over time. The Institutional Review Board of each participating institution approved this study; informed consent from the patient was required to participate in the trial.

Data and Variable Definitions

Clinic data for analysis was pulled from the EHRs in all clinic sites with the assistance of Health Department staff and the clinic IT staff in September and October 2012. Data included demographic characteristics (age at baseline, sex, race/ethnicity, nativity, body mass index [BMI], primary insurance [self-pay, Medicare, other]), systolic and diastolic BP at each clinic visit, and mean number of clinic visits (defined as having a clinic BP reading in the EHR). Clinic BP values were those BP readings that were taken at the start of the clinic visit as a part of vital signs measurements, and were pulled from this field in the EHR. Given the applied design of this trial, a clinic visit specifically for the study was not required. Nativity was defined as U.S. born or foreign born; those born in Puerto Rico were categorized as U.S. born since they are more likely to have health insurance, [17] potentially owing to their U.S. citizenship status. Relevant comorbidities (diabetes diagnosis, CKD diagnosis, personal history of heart disease and of stroke) were assessed using corresponding International Classification of Disease (ninth edition, ICD-09) codes for each condition (diabetes: 250; CKD: 585; heart disease: 393-398, 402, 404-429; stroke: 430-438 (but not 435)).

Outcomes assessed were change in systolic and diastolic BP from baseline to follow-up, the slope of BP over the follow-up period including all available BP measurements, and achievement of BP control. Control was defined as systolic BP <140 mm Hg and diastolic BP <90 mm Hg (<130/80 for those with diabetes or CKD). Because participants were not asked to come back specifically for this study but according to the clinic's regular schedule of follow-up visits for patients with HTN, the window for a follow-up visit was defined as a range of 7-10 months. Follow-up was enumerated in two ways. First, any participant who had at least one BP measurement during the 10 month follow-up time was enumerated as having at least one follow-up visit, and was included in analyses of change in BP slope and in the time-to-event (achieving BP control) analyses. Second, a participant who had at least one visit in the 7-10 month interval was included in analyses of change in baseline to follow-up BP comparisons; the first value in the 7-10 month interval was used. Specific participant flow is described in the Results below.

Analytic Methods

Participant characteristics at baseline were compared between the intervention and control groups, and stratified by race/ethnicity to verify comparability of the two study arms. Differences were assessed using t-test and the Wilcoxon Rank Sum test for normal and non-normal continuous variables respectively, and the chi-square test and Fisher's exact test for categorical variables.

Owing to the multi-site nature of the study design, the strength of clustering and the degree of dependence was measured by the intra-cluster correlation coefficient (ICC). The ICCs showed some, albeit minor, statistically significant evidence of hierarchical clustering of individuals within sites (ICC=0.03, $p<0.001$ for systolic BP, 0.05, $p<0.001$for diastolic BP). Therefore, changes in systolic and diastolic BP were assessed by intervention group, by race/ethnicity, and by home upload status, and were compared using multi-level linear mixed models with one between subjects factor (intervention group – intervention vs.

control) and one within-subjects factor (time – baseline and follow-up) accounting for non-independence and correlation of the BP measurements within patients and hierarchical clustering of patients within clinic sites. The change in BP measurements from baseline to follow-up was directly measured by the group x time interaction term within each intervention group and then compared between the two intervention groups. Separate models were developed for systolic BP and diastolic BP. Several residual covariance structures were tested by using likelihood ratio test (LRT), the Akaike's Information Criterion (AIC) and Bayesian Information Criterion (BIC) measures and models with an unstructured correlation structure showed to be the best fitted models.

Since the clustering effect in our data was unintentional and not an explicit part of the study design, a secondary sensitivity analysis was conducted by using an alternative simpler approach of analysis of covariance on BP change (follow-up – baseline measurements) controlling for the baseline BP measurements ignoring the hierarchical site clustering effect. Separate models were developed for systolic BP and diastolic BP. This sensitivity analysis however, produced similar inferences to the mixed model approach for the level of statistical significance of change in BP between the study groups and thus for brevity, are not included in this report.

The slopes of BP over the follow-up period were calculated and compared using random coefficient models accounting for the longitudinal correlation of BP measurements within patients, overall and by race/ethnicity. Percent achieving control in the study period was assessed using time-to-event analysis, overall and by race/ethnicity. The comparison of interest was the time (months) that it took the intervention and control groups to achieving BP control for the first time. Differences in the time-to-event experience were compared using the Kaplan-Meier survival distribution function, survival curves, and log-rank tests.

To assess whether frequency of BP measurements at home impacted clinic results in the intervention group, intervention arm participants were additionally stratified by whether or not they uploaded their home readings. This pre-specified analysis was performed to determine best patterns of home BP monitor use. Intervention-uploaders were defined as intervention arm participants who uploaded (n=182); intervention-non-uploaders were defined as intervention arm participants who did not upload (n=224). Intervention-uploaders were stratified as measuring BP 2+ times/day (n=96) or <2 times/day (n=86); this cutoff was decided post hoc based on the distribution of the data.

All statistical analyses were conducted using SAS software version 9.2 (SAS Institute, Inc., Cary, North Carolina).

Results

Ninety-one percent (409) of intervention and 93% (419) of control participants had a baseline visit and at least one follow-up visit within 10 months, which meant they were included in the analysis of BP slope over time, and the time-to-event analysis. Seventy-three percent (329) in the intervention group and 74% (332) in the control group had a follow-up visit in the 7 to 10 months follow-up window only; analyses of change from baseline to

follow-up BP included only these individuals. A participant flow diagram, which also includes the breakdowns by race/ethnicity, is displayed in Figure 1. The median number of visits per participant was 5 (IQR: 3-8 visits) in both study arms. The majority of the study population was female (68%); Hispanic (63%); foreign born (51%); had diabetes (59%); and were self-pay/uninsured (69%). Characteristics of participants by interventions arm are displayed in Table 1. The intervention and control groups were similar with respect to age, sex, race/ethnicity, nativity, BMI, diabetes, CKD, personal history of heart disease and stroke, and primary insurance. Diastolic BP at baseline was slightly higher in the intervention vs. control group (83.9 ± 11.2 mm Hg vs. 82.3 ± 10.6 mm Hg, p=0.04). No significant differences were found between intervention arms by race/ethnicity (results not shown), other than a higher prevalence of diabetes among black participants in the intervention (60.4%) vs. control group (43.9%, p=0.02). Additionally, whites in the intervention group had a higher mean systolic BP at baseline compared to the white control group (157.7 ± 16.6 mm Hg vs. 150.8 ± 14.2 mm Hg, p=0.04).

Mean systolic and diastolic BP at baseline and follow-up, and changes in values are displayed in Table 2. Overall, systolic BP decreased 14.7 mm Hg (p<0.001) in the intervention group and 14.1 mm Hg (p<0.001) in the control group, with no significant difference between these decreases (p=0.70). When stratified by race/ethnicity, the difference in systolic BP decrease was significant in white participants only (p=0.01), and not in blacks (p=0.95) or Hispanics (p=0.56). Similar results were observed with diastolic BP values, with the only significant effect of the intervention being observed in whites. There was no difference in the slope over the follow-up period between the intervention and control groups (Table 2), but again, differences were apparent in the whites only.

BP control was achieved in 38.9% of intervention and 39.1% of control participants after 10 months, though the time-to-event experience of intervention vs. control were not different from each other (logrank p-value=0.91; Figure 2). Achieving BP control did not differ for intervention vs. control for any of the race/ethnic groups (logrank p-values: whites p=0.50, Blacks p=0.11, Hispanics p=0.64).

Home Data Results

Overall, those in the intervention group who uploaded their readings (uploaders) and those who did not upload their readings (non-uploaders) were similar to each other on key demographic characteristics, including age, sex, race/ethnicity, nativity, BMI, diabetes, CKD, history of CVD and insurance status. When considering uploaders only, uploaders who took BP measurements >2 times per day were more likely to achieve BP control in the clinic compared to uploaders who took BP measurements >2 times per day (log rank p-value = 0.02); and had a larger change systolic BP over time (decrease in uploaders: >2 times/day=1.06 mm Hg; <2 times/day=0.48 mm Hg, p=0.05). When comparing intervention – uploaders, intervention – non-uploaders, and control, there were no differences in achieving BP control (log rank p-value = 0.38) or in slope over time.

Discussion

Overall, the distribution of self BP monitors was not shown to be more effective in reducing BP over time or in improving BP control above and beyond usual care in this largely minority sample of NYC adults from medically underserved communities. The intervention was not found to be effective among Hispanic and black participants for any BP outcomes. It was effective among white participants in reducing BP compared to the control group, but not in achieving control over time. The participants in this study represent a unique subset of individuals typically understudied in the literature: predominantly Hispanic (~70%); foreign born (~60%); and uninsured or self-pay patients (~70%). While the recent studies include emerging information on predictors or correlates of BP control in Hispanics,[3, 4, 18, 19] to our knowledge, this is one of first randomized clinical trials to evaluate SBPM in an urban, medically underserved population. Consistent with the AHRQ review published January 2012 on the effectiveness of SBPM, we conclude that SBPM alone was not effective in our study sample under existing conditions.

In both the intervention and control groups, BP reductions corroborate the magnitude of BP reduction observed in the evaluation of the SBPM program, where we observed an 18.7 mm Hg reduction in systolic BP and a 8.5 mm Hg reduction in diastolic BP using a pre-post design (systolic BP 9.0 mm Hg reduction, diastolic BP 3.4 mm Hg reduction after adjustment for regression to the mean).[15] However in the current study, the magnitude of the effect in the intervention group was not greater than the effect observed in the control group. Because this study was randomized at the participant level and not the provider or practice level, providers may have been engaging with participants in both the intervention and control arms similarly with respect to activities around BP control. As a part of EHR implementation, the Health Department provided technical assistance and all eClinicalWorks practices had enhanced BP quality and decision support measures that allowed for monitoring of their patient populations. Further, the clinic network from which our largest percentage (85%) of participants came from additionally was able to achieve Level 3 status as a Patient Centered Medical Home (in part due to their participation in the current study). These activities included improvements in BP measurements through training of medical assistants on appropriate cuff sizes and increased education on BP generally among nurses. This may partially explain the large decrease observed in the control group as this may have impacted usual care. Additionally, it may be that simply enrolling in the study, with or without the BP monitor may have been a factor in some participants being able to lower their BP and achieve BP control.

The high percentage of uninsured participants bears implication on interpretation of the study results. Lack of insurance has been shown to be associated with lower rates of BP control[20, 21] owing in part to decreased regular access to BP medications, or lower access to BP monitoring.[21] Prior studies have demonstrated less use of a BP monitor in lower income groups,[22, 23] providing evidence that the cost of the monitor may be a meaningful barrier to use. Through our study design, participants had access to a BP monitor, but facilitated access to other resources related to BP management such as behavioral counseling above and beyond what is provided by the clinic staff or reduced cost medications, was not provided. Therefore in this patient population with a high prevalence of being uninsured,

supplying the BP monitor itself may not be sufficient to produce the anticipated benefits in BP outcomes.

By enrolling those who are both uninsured and foreign born, we may have captured a population that is known to have additional barriers such as reduced communication with their provider or restrictions in access to other health resources. Further, it has been suggested that Hispanics are less likely than whites or non-Hispanic blacks to benefit from community interventions targeting hypertension owing in part to barriers to access to care and treatment, dietary patterns, acculturation levels, and communication barriers.[18] Thus it may be that the dissemination of SBPM in this population should be accompanied by additional support services which might include education, appropriate language support, and cultural tailoring for achieving BP control. This should be a topic of further study.

Few studies to date have explored patient-related patterns of home use, and the optimal schedule for readings using a home monitor.[24, 25] We collected and evaluated home data to address this limitation in the current literature, and found that those who were measuring their BP 2+ times/day vs. <2 times/day were more likely to achieve BP control. However our small sample size limits the conclusions that can be made from these results. Another interesting finding is that only one half of those who received monitors actually engaged in uploading information, even with the additional support provided through participation in this research study. In this current era of expanding the use of technology in medical care, much attention has been given to the idea of efficiently increasing provider reach to patients in between office visits through the remote uploading of patient information. Our study suggests that the practical realities of this strategy in populations such as ours should be carefully considered.

There are several strengths worth highlighting in our study design. The innovative use of the smartform to screen eligible patients and to randomize to treatment arms minimized bias on the part of the provider. To our knowledge, this is one of the first studies to utilize this mechanism. Further, the EHR enabled us to collect systematic, longitudinal data on all study participants, including detailed data on comorbidities such as diabetes, CKD, and a detailed assessment of past history of CVD through ICD codes in the EHR rather than self-report. Lastly, we leveraged existing electronic systems and relationships to maximize efficiency in study conduct; factors strongly indicated by national institutions for cardiovascular disease research.[26]

In terms of limitations, there may have been bias operating at the study site level. At the largest study site the BP-related quality improvements described above were being implemented, which may have influenced the control group. A second limitation was that medication data for our largest study site was irretrievable. Therefore any behaviors related to medication intensification by the providers or whether the medication intensification had an impact on the results were not assessed. Third, we were unable to assess whether participants understood their readings and/or incorporated self-monitoring into their daily routines. While we assessed this in the focus groups and embedded a question on BP readings in the EHR, both modalities yielded low compliance and are thus not reported on in the current manuscript. Fourth, any potential differences in the frequency of BP

measurements between the intervention and control groups could have led to differing probabilities of control by chance alone; however this seems to have had a minimal effect to current results. Lastly, the small sample size of whites in this study limit the conclusions that can be made in this race/ethnic subgroup, in addition to the significantly higher baseline systolic BP in whites in the intervention vs. control group.

The SBPM intervention was not found to be impactful on lowering BP beyond usual care in this study population composed primarily of Hispanics, foreign born individuals and those who lacked insurance, as has been observed in predominantly white populations. While SBPM may be effective in some populations, it did not appear to have a meaningful impact under the conditions of the current study. In settings where a number of quality improvement activities are occurring, any improvements that may be observed by the provision of a BP monitor by itself (i.e., low-level intervention) may not be observable. We view these results as a starting point for expanding current strategies on BP control in specific subgroups, as an example of collaborative applied clinical research, and as a model for efficient study design and methods utilizing the EHR.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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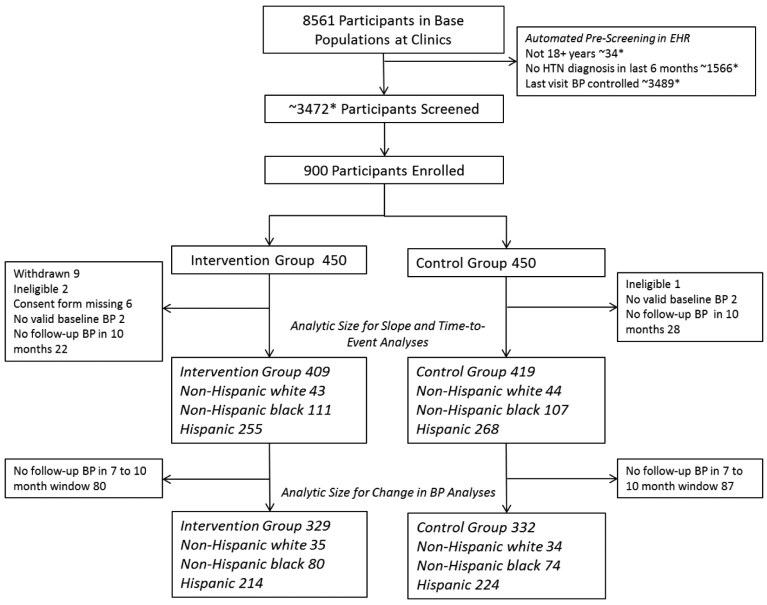
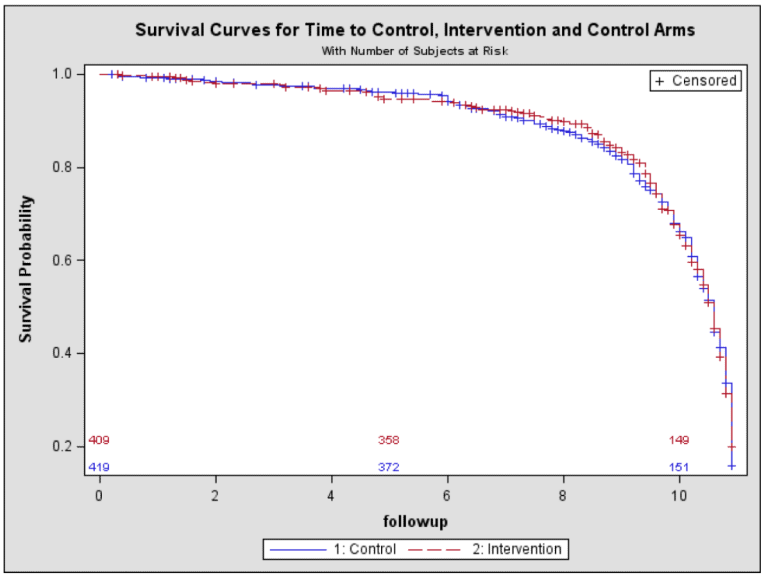


Figure 1.

Study Participant Flow Diagram

*Estimated values based on prior data pull. Final data was irretrievable.



Summary of the Number of Censored and Uncensored Values (Logrank=0.9064)					
Stratum	Group	Total	Achieved Blood Pressure Control*, n(%)	Censored	Percent Censored
1	Control	419	164 (39.1%)	255	60.86
2	Intervention	409	159 (38.9%)	250	61.12
Total		828	323	505	60.99

Figure 2.

Survival Curves for Time to Control, Intervention and Control Arms

*Blood pressure control defined as systolic blood pressure <140 and diastolic blood pressure <90 mm Hg; systolic blood pressure<130 and diastolic blood pressure <80 mm Hg for those with diabetes or kidney disease

Table 1

Study Participants Characteristics by Intervention Group

Characteristic	Intervention (n=409)	Control (n=419)	p-value
Age at Baseline, mean ± SD	61.3 ± 11.9	61.3 ± 12.2	0.98
Female Sex, n (%)	275 (67.2)	285 (68.0)	0.81
Race, n (%)			
Non-Hispanic White	43 (10.5)	44 (10.5)	0.87
Non-Hispanic Black	111 (27.1)	107 (25.5)	
Hispanic	255 (62.4)	268 (64.0)	
Country of Birth, n (%)*			
US Born	134 (35.9)	108 (37.4)	0.70
Foreign Born	239 (64.1)	181 (62.6)	
BMI, kg/m^2, n (%)			
Normal, 18.5-<25	57 (14.1)	48 (11.6)	0.51
Overweight, 25-<30	123 (30.4)	136 (32.9)	
Obese, 30+	225 (55.6)	230 (55.6)	
Diabetes Diagnosis, n (%)	255 (62.4)	235 (56.1)	0.07
Chronic Kidney Disease Diagnosis, n (%)	12 (2.9)	11 (2.6)	0.79
Personal History of Heart Disease, n (%)	115 (28.1)	138 (32.9)	0.13
Personal History of Stroke, n (%)	53 (13.0)	57 (13.6)	0.78
Primary Insurance, n (%)			
Self-Pay	283 (69.2)	289 (69.0)	0.84
Medicare	18 (4.4)	22 (5.3)	
Other	108 (26.4)	108 (25.8)	
Systolic BP at baseline, mean ± SD*	151.5 ± 16.4	152.1 ± 15.0	0.58
Diastolic BP at baseline, mean ± SD*	83.9 ± 11.2	82.3 ± 10.6	0.04
# of visits, median (25-75% IQR)	5 (3-8)	5 (3-8)	0.65

Abbreviations: SD – standard deviation, BP – blood pressure, IQR – interquartile range

*Values here are not adjusted for clustering and thus differ from BP mean change analyses displayed in Table 2

Table 2

Baseline and follow-up comparison and slopes of mean systolic and diastolic BPs between intervention and control groups, overall and by race/ethnicity

		Intervention				Control				P*	P**
		Baseline	Follow-up	Change	Slope Over Time	Baseline	Follow-up Mean ± SE	Change	Slope Over Time		
		Mean ± SE	Mean ± SE	Mean ± SE		Mean ± SE		Mean ± SE			
Overall	**Systolic BP**	150.7 ± 1.5	136.0 ± 1.6	−14.7 ± 1.1	−0.86	151.0 ± 1.5	137.0 ± 1.6	−14.1 ± 1.1	−1.02	0.70	0.25
	Diastolic BP	84.1 ± 1.0	78.4 ± 1.0	−5.8 ± 0.6	−0.38	82.5 ± 1.0	77.7 ± 1.0	−4.8 ± 0.6	−0.36	0.24	0.81
White	**Systolic BP**	157.4 ± 2.9	135.9 ± 3.7	−21.5 ± 3.6	−1.45	149.0 ± 2.9	140.9 ± 3.7	−8.1 ± 1.3	−0.39	0.01	0.01
	Diastolic BP	86.1 ± 2.4	77.8 ± 2.0	−8.3 ± 1.9	−0.59	81.1 ± 2.4	79.8 ± 2.0	−1.3 ± 1.9	0.02	0.01	0.001
Black	**Systolic BP**	152.7 ± 2.4	141.4 ± 2.5	−11.3 ± 2.3	−0.82	151.3 ± 2.4	140.3 ± 2.6	−11.1 ± 2.4	−0.83	0.95	0.97
	Diastolic BP	86.5 ± 1.1	83.3 ± 1.2	−3.2 ± 1.3	−0.19	84.7 ± 1.2	81.9 ± 1.2	−2.9 ± 1.3	−0.18	0.86	0.98
Hispanic	**Systolic BP**	148.7 ± 1.6	133.8 ± 1.7	−14.9 ± 1.4	−0.76	151.0 ± 1.5	135.1 ± 1.7	−16.0 ± 1.3	−1.14	0.56	0.03
	Diastolic BP	81.9 ± 0.7	75.6 ± 0.6	−6.3 ± 0.7	−0.41	81.1 ± 0.7	75.2 ± 0.6	−5.9 ± 0.7	−0.46	0.70	0.56

* p-value comparing change in intervention group to change in control group

** p-value comparing slope over time in intervention group to slope over time in control group