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Trial Design: Blood Pressure Control and Weight Gain Prevention in Prehypertensive and Hypertensive Smokers: The Treatment & Prevention Study

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Abstract

Background—Cigarette smokers with elevated blood pressure (BP) are at substantially higher risk for cardiovascular events compared to normotensive smokers. Although smoking cessation should be a primary treatment goal for these patients, increases in body weight accompanying smoking abstinence may further increase BP. Intervention strategies that facilitate smoking cessation and modify adverse changes in body weight and BP are needed.

Methods—We describe an ongoing multi-site, two-phase, five-year randomized clinical trial. Participants are cigarette smokers with Prehypertension or Stage I Hypertension. In the first phase, participants receive a smoking cessation intervention combining behavioral counseling and nicotine replacement in an open-label fashion. In the second phase, participants who successfully quit smoking are randomly assigned to one of three lifestyle interventions: 1) weight gain prevention, 2) blood pressure control, or 3) usual lifestyle. Participants are followed for one year to assess changes in blood pressure, body weight, dietary intake, and physical activity.

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Conclusions—Results from the proposed study will provide important insights into the efficacy of various approaches to lifestyle modification in smokers at increased risk for cardiovascular events.

Keywords

Blood pressure; hypertension; cigarette smoking; body weight; lifestyle modification; cardiovascular disease

Background

Cigarette smoking and hypertension (HTN) are two of the leading causes of cardiovascular morbidity and mortality [1, 2]. Independently, smoking and HTN each carry at least a 2-to 3-fold increase in risk for cardiovascular events [2–4]. As concurrent risk factors, however, smoking and HTN act synergistically and increase risk in a multiplicative rather than additive fashion [4–6].

Quitting smoking is unquestionably among the most important steps patients with elevated blood pressure (BP) can take to promote their cardiovascular health. Unfortunately, smoking cessation is often associated with clinically significant weight gain. Although the average cessation-induced weight gain is approximately 3–7 kg [7–11], many former smokers experience substantially larger increases in body weight. Several studies have documented significant elevations in BP and increases in the prevalence of HTN following smoking cessation [12–15], which appear to be largely due to postcessation weight gain [15]. Consequently, although smoking cessation is associated with numerous health benefits for those with HTN, weight gain associated with quitting may lead to increases in BP, conferring additional cardiovascular risk.

Minimizing postcessation weight gain in patients with elevated BP could help to reduce exacerbations of high BP and motivate patients to remain abstinent. Initial attempts at behavioral and pharmacologic approaches to preventing postcessation weight gain met with limited success [16–18]. Subsequent trials, however, demonstrated that long-term reductions in postcessation weight gain can be sustained [19–20], at least in weight conscious smokers. Recently, Spring et al. [21] found that delaying weight control efforts until after smoking cessation was established was a particularly effective strategy. Collectively, these studies suggest that attempts to simultaneously change several complex behaviors related to smoking and body weight can be very difficult for many individuals, and that addressing them one at a time may be the most promising approach.

Given the combined risks associated with smoking and elevated BP and the fact that modifying one risk factor (smoking) may adversely affect the other (BP), interventions targeting multiple risk factors in this patient population are needed. The purpose of the current investigation is to evaluate whether BP and body weight can be maintained or even improved in patients with prehypertension and hypertension who quit smoking by making lifestyle changes to modify dietary intake and increase physical activity.

Design

The present study is a multi-center (University of Iowa, Iowa City, IA; University of Tennessee Health Sciences Center, Memphis, TN; Mayo Clinic, Rochester, MN) five year, randomized clinical trial involving two phases. The first phase utilizes a single-group open label design with participants receiving a smoking cessation intervention. Because the primary goals of the study are to improve BP control and reduce weight gain following smoking cessation, only participants who successfully quit smoking following the cessation program are randomized to treatment conditions for the second phase of the investigation.^a The second phase is a three-group randomized clinical trial designed to evaluate the long-term efficacy of two approaches to lifestyle modification among smokers with elevated BP who have recently stopped smoking. For this phase, participants are randomized to one of three interventions (Blood Pressure Control [BPC], Weight Gain Prevention [WGP], or Usual Lifestyle [UL]). The primary aim of the trial is to evaluate the long-term impact of the two experimental interventions on BP and body weight at 12-month follow-up. A graph depicting the study flow is presented in Figure 1.

Study Participants

The study sample will consist of 1267 of adult male and female smokers with elevated BP who smoke at least five cigarettes per day. Patients are eligible if their BP is in the Prehypertensive or Stage I Hypertensive range [22]. Patients currently taking antihypertensive medications are eligible for participation, provided their BP is adequately controlled. For all patients receiving pharmacologic treatment for HTN, data are recorded regarding medication, dose, and frequency so that these can be adjusted for in the analyses. A list of inclusion and exclusion criteria is presented in Table 1.

Procedures

Participants are recruited from the community via mass mailings, television, radio, and newspaper advertisements, as well as referrals from several primary care practices. For the latter, procedures have been implemented in several practices for systematically assessing tobacco use among all patients and referring cigarette smokers to available resources to assist with cessation, including study enrollment.

Potential participants receive a detailed description of the study during the initial baseline visit, at which time informed consent is obtained. BP is assessed to ensure that participants meet study eligibility requirements. BP readings within the target range must be obtained on two separate occasions prior to enrollment. Because nicotine replacement therapy is provided during the smoking cessation phase of the study (see below) and is not FDA-approved for use during pregnancy, any female participant who has the potential to be pregnant receives a urine pregnancy test.

^aThose who are unsuccessful at quitting smoking are given the option of recycling through the cessation intervention a second time or exiting the study.

Considering that participants may receive an intervention involving moderate levels of physical activity (approximately 3–6 METS), exclusionary criteria are included to ensure that the intervention does not increase the risk of a cardiac event. As such, a detailed medical history is obtained. Participants who are not receiving regular care from a provider also undergo a brief physical examination from a physician or nurse practitioner prior to entry into the study. The brief examination includes a general survey of the participant with an examination of the skin and extremities. An examination of the participant's head and neck and cardiopulmonary system is also performed including percussion and auscultation of the chest and lungs and palpation of the thyroid gland. In addition, participants are questioned about recent symptoms provoked by moderate intensity physical activity (e.g., walking, cycling at a moderate speed, general housework) using the Physical Activity Readiness Questionnaire (PAR-Q) [23] and the Rose Angina Questionnaire [24].

Smoking Cessation Intervention

The smoking cessation intervention consists of 3–4 sessions of one-on-one behavioral counseling. The behavioral intervention follows the framework outlined by Hatsukami and Lando [25] and involves 4 primary steps: (1) preparing to quit, (2) going through the quitting process, (3) maintaining short-term smoking abstinence, and (4) relapse prevention and long-term maintenance. Sessions are scheduled prior to the initial quit date, approximately 24 hours after the quit attempt, and 1- and 3-weeks following the participant's quit date. Follow-up phone calls are also conducted to provide continuing support and assistance. In addition, participants are provided with 6 weeks of transdermal nicotine to assist with their cessation efforts. The initial patch dose is tailored to participants' smoking rates based on the following algorithm: >20 cigarettes/d (21 mg), 10–19 cigarettes/d (14 mg), 5–9 cigarettes/d (7 mg). Participants initially placed on the 21 mg patch use the following dosing schedule: 21 mg for two weeks, 14 mg for two weeks, 7 mg for two weeks, and then off. Participants initially placed on the 14 mg patch use the following dosing schedule: 14 mg for two weeks, 7 mg for four weeks, and then off. If a participant is initially placed on the 7 mg patch, the following dosing schedule is used: 7 mg for six weeks and then off.

Lifestyle Interventions

The lifestyle interventions chosen for the present study were originally developed for the Trials of Nonpharmacologic Interventions in the Elderly (TONE) study. TONE examined the efficacy of several lifestyle interventions (weight loss, sodium restriction, and weight loss + sodium restriction) relative to usual care at reducing BP among older adults with HTN [26]. All three active treatment conditions were associated with positive outcomes. However, each produced slightly different results depending upon the nature of the lifestyle modification that was targeted. Weight loss among overweight participants in the two weight reduction groups averaged 3.5–4.5 kg compared to a loss of 0.9 kg among those not assigned to a weight loss intervention. Overall, the Weight Loss only intervention was associated with slightly greater weight losses than the Weight Loss + Sodium Restriction condition [27]. The effect of the interventions on BP, however, was slightly different. The two interventions that targeted sodium restriction were associated with better BP control

than those that did not address sodium. The most beneficial impact on BP was observed among those assigned to the combined Weight Loss + Sodium Restriction condition. Collectively, these results suggest that the mechanisms through which weight loss and sodium restriction affect BP may differ [27].

Intervention Format

The BPC and WGP interventions consist of five individual and 12 weekly group sessions lasting 30–60 minutes each. Group sessions address a variety of proven strategies for modifying diet and physical activity including nutrition education, behavioral skills training, problem solving, relapse prevention, and physical activity promotion. Individual sessions focus on reviewing participants' success with meeting dietary, physical activity, and weight goals, and problem solving strategies for increasing adherence and success. Consequently, these sessions provide more specific, personalized instruction tailored to the needs of each individual participant. In order to reduce participant burden and the number of required study visits, individual sessions are scheduled immediately prior to or following the group sessions. Attendance at the individual and group sessions is tracked as an indicator of treatment adherence.

Because the TONE intervention was originally designed for older adults, it was necessary to modify the physical activity component of the intervention in order to make it inclusive for all adults. A variety of different topics related to physical activity promotion are addressed including educating participants about the benefits of physical activity, overcoming barriers to getting active, initiating and maintaining regular physical activity, safety issues, goal setting, choosing appropriate activities, and monitoring intensity level. Participants are encouraged to select activities that are moderate in intensity level (e.g., brisk walking, gardening) but are given considerable flexibility in terms of the specific types of moderate activity in which they choose to engage. This approach was chosen over a more standardized and “prescribed” exercise plan in order to enhance acceptability among participants and increase the generalizability of results.

Blood Pressure Control (BPC) Intervention

The intervention for those assigned to the BPC condition is patterned after the TONE WL +SR protocol. The rationale for addressing weight gain prevention in the BPC intervention is based on the well-documented relationships between smoking, dietary intake, body weight, and BP [16, 28–29]. The goal of the intervention is to limit cessation-induced weight gain in order to improve BP control. Results from several studies indicate that the weight gain that occurs following smoking cessation is due primarily to increases in energy intake, although the loss of the acute increases in energy expenditure associated with repeated nicotine administration throughout the day also may play a role [28, 30–31]. Therefore, the intervention is aimed at reducing the positive energy balance that occurs after quitting smoking by limiting postcessation increases in energy intake and promoting increased energy expenditure through physical activity.

In addition to promoting weight control, the BPC intervention targets a variety of nutritional recommendations designed to lower BP including sodium restriction (1500 mg/day) [32–

33]. In addition, the BPC intervention incorporates the nutritional recommendations that are included in the DASH (Dietary Approaches to Stopping Hypertension) diet plan [34], which was not part of the original TONE intervention. The DASH diet is rich in fruits, vegetables, and low-fat dairy products, and includes whole grains, poultry, fish, and nuts. It also emphasizes reduced consumption of red meat, sweets, and sweetened beverages. Nutritionally, the plan produces a diet that is considerably higher in potassium, magnesium, calcium, fiber, and protein than is typically consumed in the U.S. and lower in dietary fat and cholesterol [34].

Weight Gain Prevention (WGP) Intervention

The WGP intervention used in this study is derived from the TONE Weight Loss condition. As with the BPC intervention, the emphasis is on helping participants improve their weight control after quitting smoking rather than targeting weight loss. Unlike the BPC condition, however, the focus is strictly on weight control and does not address other dietary modifications (e.g., reduced sodium intake) that may affect blood pressure.

Usual Lifestyle (UL) Condition

To determine the relative effectiveness of the BPC and WGP interventions, results will be compared to participants assigned to a UL condition. Participants in this group will receive self-help books designed to help patients manage their body weight [35] and BP [36]. However, they do not receive any additional instructions for making lifestyle changes other than they would normally receive from their primary care provider.

Randomization

Participants who are abstinent from tobacco for at least two continuous weeks at the end of the smoking cessation phase are enrolled into the second phase of the study, which is comprised of a three-group randomized clinical trial. Prior to randomization, participants have their vital signs assessed and their medical histories updated and receive an electrocardiogram (ECG) to screen for occult CHD. Eligibility for physical activity is assessed a second time using the PAR-Q [23] and Rose Angina Questionnaire [24]. Randomization is performed based on a 1:1:1 ratio within blocks that are randomly chosen to be of size 3, 6, or 9 to ensure that treatment assignment is balanced across groups over the enrollment period.

Measures

Blood Pressure

Systolic and diastolic BP is measured following the methods recommended by the Seventh Report of the Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure (JNC 7) [22]. Participants are assessed in a quiet location while seated with their backs supported and their arms bared and supported at heart level. Measurements are obtained following a 5-minute rest using an automated oscillometric BP monitor. A total of 3 measurements are obtained at each assessment, 2 minutes apart. Two sets of 3 BP assessments are taken at each data collection visit for a total of 6 measurements.

Height, Weight, Body Composition, and Waist Circumference

Height is measured in stocking feet using a vertical stadiometer. Body weight is measured by a digital scale. Participants are measured with their shoes and heavy outer garments removed. Body composition (percent body fat) is assessed via bioelectrical impedance analysis (BIA). Waist circumference is measured in centimeters at the level of the umbilicus using a fiberglass measuring tape.

Smoking Status

Smoking status is assessed using both prolonged and 7-day point prevalence abstinence criteria [37]. Prolonged abstinence refers to sustained abstinence following an initial grace period [37], defined for purposes of this study as the two weeks immediately following participants' quit date. Point prevalence abstinence refers to smoking at a particular point in time, with no correction for previous or subsequent smoking status. Self-reports of point prevalent smoking status are verified by measuring expired-air CO, with levels of 10 parts-per-million (ppm) used to validate abstinence. Participants that produce CO values above the cut-off yet still claim to be a nonsmoker are given a salivary cotinine test to provide a confirming/disconfirming assessment based on a cut-off of 15 ng/ml [38].

Dietary Intake

Percent of energy intake from fat is assessed using the National Cancer Institute (NCI) Fat Screener [39]. The Fat Screener is a brief survey that assesses respondents' consumption of 15 different food groups that have been determined to be most predictive of overall dietary fat intake. Fruit and vegetable intake is assessed using the All Day version of the NCI Fruit and Vegetable Screener [40]. The Fruit and Vegetable Screener assesses both the frequency of consumption and portion size for 10 types of fruits and vegetables. Both screeners provide valid estimates of dietary intake compared to data obtained via 24-hour recall.

Urinary Chloride Excretion

Because the BPC intervention targets reductions in sodium intake, it is important to include a measure of dietary sodium to assess adherence. This is accomplished by measuring urinary chloride excretion. The vast majority of sodium in the diet is ingested in the form of sodium chloride [41]. Because urinary sodium and urinary chloride levels are very highly correlated (typically in the range of $r = 0.9$) [41–44], chloride levels provide a good index of dietary sodium intake. Overnight urinary chloride levels are assessed using chloride titrator sticks [41, 43–45]. Chloride titrators correlate very highly with measures of urinary sodium excretion [41, 45–46], and discriminate well among patients consuming diets containing different levels of sodium intake [41, 46].

Participants are instructed to collect overnight urine samples each morning and throughout the preceding night and to place the titrator stick in the sample for a period of 20 minutes. Each test strip has a capillary column containing silver dichromate that forms silver chloride when reacting with chloride ions. After the column becomes saturated, a moisture sensitive signal appears at the top. A line appears on the column providing a value ranging from 0.0 to 10.0. Readings are converted to chloride levels using a calibration table [43, 46].

Participants are instructed to measure overnight urinary chloride levels for 5 consecutive days at each timepoint [45].

Physical Activity

Physical activity level is assessed using the International Physical Activity Questionnaire (IPAQ) [47]. The IPAQ is a 27-item, self-administered survey designed to assess physical activity patterns over the past 7 days. Respondents are asked to provide detailed information about all moderate and vigorous physical activity they engaged in during the past week across several domains including occupational activity, self-powered transportation, household and yard work, and sports and leisure activities. The amount of time spent in each type of activity is summed and multiplied by the metabolic equivalent (MET) level associated with that category [48]. The IPAQ has demonstrated good test-retest reliability [47]. Tests of both concurrent and criterion validity suggest levels that are comparable with other established self-report measures of physical activity [47].

Assessment of Predictor, Mediator, and Moderator Variables

Several potential moderators, mediators, and predictors of treatment outcome are also collected including demographics and measures of various components of social cognitive theory. Specifically, measures are included to assess self-efficacy and outcome expectations related to smoking cessation [49–50], weight control [51–52], and physical activity [53–54]. Attendance at the intervention sessions is also tracked as an indicator of treatment adherence. The data collection schedule is provided in Table 2.

Statistical Power

Because the study is specifically addressing post-cessation changes in weight and BP, only those that meet criteria for abstinence at the 1-year follow-up will be included in the primary analysis. Although the primary analyses will be performed using ANCOVA to adjust for baseline values, the sample-size calculations presented here are based on an analysis of change scores. In addition to adjusting each participant's follow-up score for his or her baseline score, the ANCOVA approach has the advantage of being unaffected by baseline differences. This approach also typically has greater statistical power to detect a treatment effect than analyzing change scores [55]. Therefore, the sample-size requirements reported below will provide similar or greater statistical power for analyses that are performed using an ANCOVA approach.

For detecting differences in BP, sample-size requirements were determined based on preliminary data from TONE [27]. In that trial, the mean change from baseline for the combined Weight Loss + Sodium Restriction intervention was -5.3 mmHg (SPB) and -3.4 mmHg (DBP). The pooled estimate of the standard deviation (SD) of SBP change from baseline was approximately 14.5 mmHg for SPB and 9.4 mmHg for DPB. Based on these assumed SD, Table 3 lists the sample-size required to provide statistical power of 80% to detect a range of differences between groups with respect to mean BP change from baseline using a two-tailed, $\alpha=0.05$ level test. Although a sample-size of approximately 120 per group would provide statistical power to detect group differences consistent with TONE, we

have chosen to propose slightly larger sample sizes ($n = 145$) in the event that the effect sizes associated with the experimental interventions are reduced in the present study.

For estimating effect sizes for body weight, we identified five studies from the literature that used similar methodologies to assess 12-month weight gain following smoking cessation. From these studies, the pooled estimate of the SD of weight change from baseline to 1-year was 4.2 kg. For the current investigation, the SD of weight change from baseline to 1-year was conservatively estimated at 5.0 kg. Based on this assumption, Table 4 provides the sample-size required to provide statistical power of 80% to detect a range of differences between groups with respect to mean weight change from baseline to 1-year. To be clinically meaningful, we determined that the mean difference between treatment groups should be 2.0 kg or larger. A sample-size of 145 participants per group will provide statistical power of 92% (two-sided, $\alpha = 0.05$ level test) to detect a difference between groups of this magnitude.

Anticipated Attrition

As noted above, approximately 435 randomized participants ($N = 145$ per group) that meet criteria for prolonged abstinence through one year will be required to provide adequate statistical power to detect anticipated group differences in primary and secondary endpoints. To achieve this sample size, several levels of ineligibility and attrition must be considered. Overall, we estimate that 1267 participants will need to be recruited into the study. Among those enrolled, we estimate that $N = 570$ (45%) will be abstinent at the end of the open label cessation phase and eligible for randomization based on our prior experience with the smoking cessation intervention. Of those randomized, we anticipate that 10% ($N = 57$) will discontinue study participation prior to 1-year and an additional 15% ($N = 78$) will relapse to smoking. These estimates are based on our previous experiences with the smoking cessation intervention and the retention rates that were observed in the original TONE study [27]. Therefore, as outlined in Figure 2, we anticipate that 1267 participants enrolled in the initial smoking cessation phase of the study will result in a sample-size of approximately 435 (145 per group).

Statistical Analysis

Because the primary focus of the present study is on changes in body weight and BP following smoking cessation, the main statistical analyses will be for the three-group randomized clinical trial with the primary analyses restricted to participants that do not relapse to smoking. The primary efficacy endpoints are BP and body weight at one year. Analyses will also be conducted to assess changes in BP and body weight at six months. The primary analysis will be restricted to participants that have not relapsed to smoking and who provide follow-up data. Subsequent analysis will be performed based on all participants using multiple imputation procedures.

The primary analysis will be performed using ANCOVA to assess for treatment effects adjusting for the baseline value of the dependent variable, study site, and any baseline variables found to differ significantly between groups. In all cases, each of the two experimental groups will be compared to the UL group. Since there are two pair-wise

treatment comparisons of interest (BPC vs. UL; WGP vs. UL), we will utilize Fisher's least significant difference (LSD) approach to protect against inflation of the experiment-wise error rate. An initial omnibus test will be used to test the null hypotheses that all group means are equal. Rejection of the null hypothesis will result in subsequent pair-wise comparisons between treatment groups.

The present study will also allow us to assess the impact of smoking cessation and each of the lifestyle interventions on changes in dietary intake and physical activity level. These secondary endpoints will include servings of fruits and vegetables per day, dietary fat intake, overnight urinary chloride excretion, and self-reported physical activity. The analyses for the secondary endpoints will be similar to that for the primary endpoints, with groups compared using ANCOVA to assess for treatment effects adjusting for baseline values, study site, and baseline variables found to differ significantly between groups. In all cases, each of the two experimental groups will be compared to the UL group.

Although the study was not designed to evaluate different approaches to helping patients with elevated BP quit smoking, we will also examine group differences in smoking abstinence as an exploratory outcome in order to determine whether either of the interventions is more effective at preventing relapse to smoking. Both 7-day point-prevalence abstinence (based on self-report with biochemical verification) and prolonged abstinence will be considered. For the initial intention-to-treat analysis, participants with missing data at each endpoint will conservatively be considered to have relapsed to smoking. Subsequent analyses will utilize multiple imputation approaches to dealing with missing data.

Discussion

Cigarette smoking and HTN represent two of the most important risk factors for cardiovascular events. When they occur in combination, the associated risk is substantially greater. Cessation of tobacco use should be a top priority for patients with elevated BP. Weight gain that typically accompanies smoking cessation discourages many patients from attempting cessation. Furthermore, for patients who already have elevated BP, substantial weight gains after quitting smoking can lead to increased cardiovascular risk. There is a need to develop evidence-based lifestyle interventions to help cigarette smokers with HTN remain tobacco free, while also assisting them with weight control and dietary management.

The present study has the potential to increase our knowledge about how to most effectively help patients quit smoking while limiting increases in body weight and BP. Such information will also benefit smokers in other patient groups for whom significant weight gains are contraindicated, such as those with diabetes mellitus, hyperlipidemia, respiratory problems, or arthritis, and women at increased risk for breast cancer.

The study may also provide important insights regarding how we should approach modification of multiple lifestyle factors. Most empirically-supported lifestyle interventions were designed to address a single risk factor, such as tobacco use, physical inactivity, excessive alcohol intake, or body weight. In practice, these cardiovascular risk factors often

occur together in the same individual. Clinically, the approach has often been to focus either on one factor that is associated with the greatest risk or one which the patient is most amenable to changing. The few interventions that have been designed to simultaneously modify multiple risk factors have typically met with limited success. By addressing several lifestyle factors in a sequential fashion, we hope to obtain important information about how the modification of one risk factor may influence another, and how to best intervene with patients in need of making multiple lifestyle changes.

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Figure 1.
Design and Study Flow for Study of Lifestyle Approaches to Weight and Blood Pressure Control in Smokers with Prehypertension or Stage I Hypertension.

Figure 2.
Anticipated Attrition Over Course of Study.

Table 1**Inclusion and Exclusion Criteria for Treatment and Prevention Study.**Inclusion Criteria:

1. Adult daily smoker (5+ cigarettes per day)
2. Prehypertension or Stage I HTN

Exclusionary Criteria:

1. Inability to understand consent procedures
2. History of unstable CVD including MI, stroke, and unstable angina in the past 3 months
3. Coronary artery bypass grafting or angioplasty/stent in the past three months
4. Cardiac dysrhythmia treated with anti-arrhythmia medication, except stable atrial fibrillation
5. Untreated hyperthyroidism or pheochromocytoma
6. History of congestive heart failure (NYHA Class III or IV)
7. ECG evidence of 2nd or 3rd degree AV block
8. Uncontrolled or Stage II HTN
9. History of severe liver or renal failure
10. Current substance abuse
11. Presence of an unstable psychiatric condition
12. Severe COPD
13. Symptomatic peripheral vascular disease
14. Pulmonary HTN with shortness of breath
15. Congenital or valvular heart disease with shortness of breath
16. Current use of a medication that may interfere with primary study endpoints or that may increase the risk of side effects from study medication that cannot be discontinued.
17. Current pregnancy or plans to become pregnant within the next year
18. Plans to move out of the area or travel extensively during the intervention
19. Lack of access to a telephone

Table 2

Data Collection Schedule for Study of Lifestyle Approaches to Blood Pressure and Weight Control among Smokers with Prehypertension or Stage I Hypertension.

Measure	Baseline	Post Cessation *	6 Month	12 Month
Demographics	X			
Height	X			
Weight	X	X	X	X
Percent Body Fat (BIA)	X	X	X	X
Waist circumference	X	X	X	X
Blood Pressure	X	X	X	X
Smoking Status	X	X	X	X
Psychosocial Measures [†]	X	X	X	X
Medical History	X			
Interval Medical History		X	X	X
Current Medications	X	X	X	X
Physical Examination	X [‡]	X		
ECG [§]		X		
Dietary Intake		X	X	X
Urinary Chloride Excretion		X	X	X
Physical Activity		X	X	X
Side Effects/Adverse Events		X	X	X

* For those who are abstinent following the smoking cessation intervention and prior to randomization to treatment conditions.

[†] Self-efficacy for behavior change, outcome expectations.

[‡] Physical examinations are conducted during screening phase among community-recruited patients not receiving regular medical care. All participants who quit smoking receive a physical examination prior to randomization.

[§] ECG administered to participants who successfully quit smoking during the first phase of the trial.

Table 3

Sample-size for Detecting Differences in Blood Pressure Change from Baseline.

Sample-size requirements for SBP			Sample-size requirements for DBP		
Group Difference (mmHg)	SD (mmHg)	N per Group*	Group Difference (mmHg)	SD (mmHg)	N per Group*
4.8	14.5	145	2.9	9.4	166
4.9	14.5	139	3.0	9.4	156
5.0	14.5	134	3.1	9.4	146
5.1	14.5	128	3.2	9.4	137
5.2	14.5	124	3.3	9.4	129
5.3 [†]	14.5	119	3.4 [†]	9.4	121
5.4	14.5	115	3.5	9.4	115
5.5	14.5	111	3.6	9.4	109
5.6	14.5	107	3.7	9.4	103
5.7	14.5	103	3.8	9.4	98
5.8	14.5	100	3.9	9.4	93

* Sample-size required to provide statistical power of 80% using a two-sided, alpha = 0.05 level test.

[†] A difference of this magnitude is consistent with the effect observed for the Weight Loss + Sodium Restriction intervention from the TONE trial.

Table 4

Sample-size for Detecting Differences in Weight Change from Baseline.

Group Difference (kg)	SD (kg)	Effect Size [*]	N per group [†]
1.5	5.0	0.30	176
1.6	5.0	0.32	155
1.7	5.0	0.34	137
1.8	5.0	0.36	123
1.9	5.0	0.38	110
2.0	5.0	0.40	100
2.1	5.0	0.42	90
2.2	5.0	0.44	83
2.3	5.0	0.46	76
2.4	5.0	0.48	70
2.5	5.0	0.50	64

^{*} Difference between groups divided by the common standard deviation.

[†] Sample-size required to provide statistical power of 80% using a two-sided, alpha = 0.05 level test.