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Review Article

Community-Based Participatory Research Approaches for Hypertension Control and Prevention in Churches

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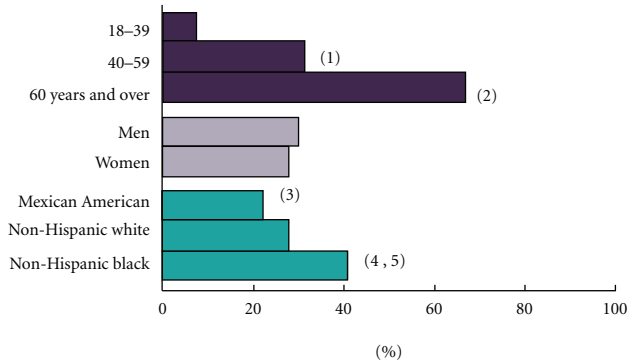
Hypertension (HTN) is a highly prevalent risk factor for cardiovascular (CV), cerebrovascular, and renal diseases and disproportionately affects African Americans (AAs). It has been shown that promoting the adoption of healthy lifestyles, ones that involve best practices of diet and exercise and abundant expert support, can, in a healthcare setting, reduce the incidence of hypertension in those who are at high risk. In this paper, we will examine whether similar programs are effective in the AA church-community-based participatory research settings, outside of the healthcare arena. If successful, these church-based approaches may be applied successfully to reduce the incidence and consequences of hypertension in large communities with potentially huge impact on public health.

1. Introduction

Hypertension (HTN) is one of the most common diseases facing the American public today with elevated blood pressure (BP) representing the number 1 attributable risk for death worldwide [1–3]. The National Health and Nutrition Examination Survey (NHANES) data indicate that the age-standardized prevalence of HTN increased from 24.4% to 28.9% ($P < .001$) between surveys conducted in 1989–1991 and 1999–2004 [4]. An aging population, growing rates of obesity, high-sodium diets, and a sedentary lifestyle all are thought to contribute to this increase [5]. Nationally, HTN is the largest treatable contributor to stroke and the second largest contributor to coronary artery disease (CAD). It is also the second leading cause of end-stage renal disease and contributes significantly to congestive heart failure [6]. HTN increases the risk of stroke, heart attack, heart failure, and kidney disease [1, 3], and though it is a modifiable risk factor for all the aforementioned diseases, however, no significant change in HTN prevalence is seen from 1999 to 2006 [7, 8]. In 2005-2006, approximately 29% of the US population over the age of 18 was hypertensive (almost equal prevalence between male and female), with the definition of HTN being systolic BP (SBP) $\geq$140 mm Hg and/or diastolic BP (DBP) $\geq$90 mm Hg, or taking medications for HTN [3, 7, 8].

The prevalence of HTN increased with age from 7% among those aged 18–39 years to 67% among those aged 60 years and older [7]. Furthermore, during this time period, pre-HTN, defined as SBP between 120–139 mm Hg and DBP between 80–89 mm Hg emerged as is an independent risk factor for cardiovascular disease (CVD) [9] and is associated with an increase in all-cause and CV mortality [10–14]. Currently an estimated 37% of adult Americans have pre-HTN, including 41,900,000 men and 27,800,000 women [14, 15]. People with pre-HTN are more likely to have obesity, hypercholesterolemia, and type 2 diabetes than those without it [16]. Pre-HTN is associated with a decreased life expectancy, increased hospitalizations, and increased health care costs and serves as a precursor to HTN [17–19].

In African Americans (AAs), HTN is more common, more severe, develops at an earlier age, and leads to more clinical sequelae than in age-matched non-Hispanic whites (Figure 1) [3, 6]. As a result, among hypertensive AAs, the stroke mortality rate is 80% higher, CAD mortality rate is 50% higher, and HTN-related end-stage renal disease rate is 320% higher than for the general population [7]. This high-CVD-risk group, hypertensive AAs, now totals greater than 9 million American adults, and with the increasing age, health disparities, and weight of society as a whole, this number will continue to rise [2, 7]. The objective of this



(1) Statistically significant difference between ages 18–39 and 40–59 years
(2) Statistically significant difference between ages 40–59 and 60 years and over
(3) Statistically significant difference between the non-Hispanic white and Mexican-American populations
(4) Statistically significant difference between the non-Hispanic white and non-Hispanic black populations
(5) Statistically significant difference between the non-Hispanic black and Mexican-American populations

Figure 1: Age-specific and age-adjusted prevalence of hypertension in adults: United States, 2005-2006.

paper is to provide review of hypertension control programs focusing on life style and diet modifications. In addition, we also provide details on DASH (dietary approaches to stop hypertension) diet program and its implication in the community settings.

2. Role of Diet and Lifestyle Modification in HTN Prevention and Treatment

The magnitude of HTN, including pre-HTN, in terms of population size, the severe consequences of uncontrolled HTN, and the personal and economic costs to individuals and to the nation's health care system demand that national nutrition policy regarding HTN management promote strategies that have been proven to be effective, safe, and feasible. Such approaches are typically associated with concomitant benefits such as extended life expectancy, enhanced quality of life, and improvements in multiple risk factors. Joint National Committee-7 (JNC-7) guidelines direct physicians to prescribe lifestyle modification to all patients with BP classified as pre-HTN or greater [8]. The recommendations for lifestyle treatment include losing weight if overweight, reducing sodium intake, increasing physical activity, limiting alcohol intake, and eating a healthy dietary pattern such as the dietary approaches to stop hypertension (DASH) pattern [20–24]. The successful NIH-funded DASH feeding study (details below) showed greater improvement in BP (greater effect in AAs than other groups) than a diet high in fruits and vegetables only [20]. Moreover, adherence to the DASH-style diet is associated with a lower risk of CAD, stroke and recently showed lowering in the incidence of heart failure [25–27]. Subsequently, the DASH-Sodium trial (details below) found that additional sodium restriction resulted in even greater BP reduction [27–31]. The DASH diet has also been shown to reduce low-density lipoprotein (LDL) cholesterol levels [23]. The DASH diet is now widely promoted by the National Heart, Lung, and Blood Institute (NHLBI) for the prevention and treatment of hypertension [8] and is included as an example of a healthy eating pattern in the 2005 Dietary Guidelines for Americans [32].

Ideally, this dietary pattern would be a key intervention for AA with HTN. As >10 years of accumulateddata have now proven, the dietary pattern exemplified by the DASH diet meets all of these criteria, particularly for AA, and is the obvious "best practice" among dietary modifications for reducing HTN and CVD risk in this population. In the original efficacy study of DASH, the effect on BP of the DASH diet was more pronounced in AA participants as compared to white participants (6.8 versus 3 mm Hg, $P < .05$) [21]. The subsequent clinic-based community trial called PREMIER (details below) tested the DASH dietary pattern plus established lifestyle modifications for BP control [33–39]. In PREMIER study, the DASH dietary pattern plus established lifestyle recommendations decreased BP by 4.3 mm Hg, whereas an advice only intervention group had a reduction of 2.6 mm Hg only ($P < .001$) [30–33]. However, the impact of the established plus DASH intervention in AA was less than what might be expected given prior efficacy studies. This was particularly true for AA women, where there was no significant difference in BP reduction compared to the advice-only intervention [33–36, 39].

3. Community-Based Health Promotion (CBHP) Programs

Enough available clinical evidence suggests that DASH diet [20–22] with intensive lifestyle modification (PREMIER)—is an effective preventive intervention for HTN prevention and treatment [8, 20–22, 33–39]. Delivery of these lifestyle interventions through CBHP programs has emerged as the important next step [40–43]. For example, during the past decade numerous intervention studies have shown the ability of small portions of lifestyle programs to reduce risk factors for CVD in both clinical and community settings [12, 40–46], and several frameworks for evaluating these CBHP programs have been proposed [41]. Churches and other faith-based organizations have, for a number of reasons, become increasingly popular settings in which to conduct health promotion programs and research studies [47–51]. Most AAs attend church or other organized religious venues, making these settings ideal for reaching and recruiting potential participants for public health programs. The historical Bible belt also continues to thrive; data for states such as Missouri and Kansas indicate that >90% of adults (majority of AAs) report some religious affiliation [47]. Also, the number of "mega-churches" (churches with ≥2000 members), is increasing nationally, with ∼1200 mega-churches listed in 2005 by the Faith Communities Today Project [51, 52]. Faith-based settings are good for effectiveness trials, because AAs are more likely to identify themselves as being religious [47].

There are still other reasons to use church settings to conduct health promotion programs. Religious affiliation and church attendance improve physical and psychological

Table 1: Church-based participatory research interventions through African American churches.

Study (ref)	Design	Outcomes	Intervention	Results
Project Joy [64] $n = 529$ AA women from 16 churches	Randomization at church level-1-year followup	SBP, body weight, waist circumference, dietary energy and total fat, sodium intake	Spiritually based, behavior modification, program or self-help behavior modification	Intervention group improved: SBP (−1.6 mm Hg), weight loss (−1.1 lbs), waist circumference (−0.66 inches), dietary energy (−177 kcal), dietary total fat (−8 g), sodium intake (−145 mg) No change in self-help group
Baltimore Church High Blood Pressure Program (CHBPP) [54, 55] $n = 187$, 184 AA and 3 white women from black churches in Baltimore, MD	Randomized into those taking anti-hypertensive's than those without −8 wk counseling and exercising session −2 years	BP and body weight	Church-based weight loss program for blood pressure control among black women: eight weekly 2-h diet counseling/exercise sessions.	Final SBP was <140 mm Hg for 74% of participants, versus 52% initially. Final DBP was <90 mm Hg in 92% versus 65% initially Mean weight loss was 6 lb in both groups: −18 to +7 lb in the Rx group and −31 to +3 lb in the no Rx group
Church-based education [56]. An outreach program for African Americans with hypertension $N = 97$ from AA churches	Outreach demonstration study	Knowledge, social support and BP	Registered nurses (RNs) were trained as church health educators The intervention's content included the bases of HTN and HTN management strategies, and was taught in eight 1-hr sessions.	Significant increase in knowledge scores from pre to post1 and post2. Education, age and number of years with high BP explained 49% of the variance associated with high BP knowledge. SBP/DBP and mean arterial BP significantly decreased from pre to post1 and post2 relationships were found between social support and DBP, and social support and mean arterial BP
Lighten Up: a church-based lifestyle program [57, 58] $n = 381$, 66% AA and 83% women	Partnership with christian church communities	BP and weight church counselors with experts were interventionists.	Total 10 wks-8 educational sessions, combining study of scripture and health messages, followup at 10 weeks and 1-yr.	Significant reductions in BP and weight (at 10 wks), which sustained throughout the year. 70% participants attended 50% or more sessions. Whites had greater reductions in risk factors than did AA
Church-based Cholesterol Education Program [70, 71] $N = 348$ from six churches with predominantly black members	Randomization at church level −6 months	Cholesterol and BP reduction	6-week nutrition education class of 1 hour each week about techniques to lower blood cholesterol and BP. Information about cholesterol was also mailed to them. Church members selected as educationalists	Significant difference in the mean SBP was seen; 137.4 ± 22 SD for education group and 129.5 ± 18 SD for usual care group ($P < .001$) Education group had 23.4 mg per dl decrease in the mean cholesterol level

HTN: hypertension; SBP: systolic blood pressure; DBP: diastolic blood pressure; Rx: treatment; SD: standard deviation, wk: week; hr: hour.

Table 2: Population-based DASH interventions to prevent or treat HTN in AA adults.

Study (ref)	Study design and duration	Interventions/outcome	Community involvement and culturally relevant components	Results
Appel et al. PREMIER trial [33–39, 70]	Multicenter randomized-controlled trial: 18 months.	Three arms; (a) advice only, (b) comprehensive lifestyle intervention, and (c) comprehensive lifestyle intervention plus DASH diet. Established guidelines from JNC V (weight loss, limited sodium and alcohol intake, and increased physical activity	$N = 810$ diverse participants from 4 clinical centers across the US communities among free living US adults. Healthy men and women age ≥25 years with high-normal BP (SBP = 130–139, DBP = 85–89) or stage 1 HTN (SBP = 140–159, DBP = 90–99) but not taking BP medication	The prevalence of HTN decreased from a baseline of 38% to 17% in the established group ($P = .01$) and to 12% in the established plus DASH group ($P < .001$) compared with a decrease to 26% in the advice-only group. Less reduction in AA as compare to other groups
Rankins et al. DASH dinners for AA [44, 75]	Neighborhood health care center for study enrollment	1-2 hr weekly intervention × 8 wks. program included BP and weight monitoring brief nutrition education, meal service, recipe demonstrations, and taste-testing	$N = 82$ AA hypertensives list was obtained from medical records and recruited from AA communities. Dinners were based on DASH diet plan	BP was significantly lowered ($P < .05$) among participants who missed no more than 2 of 8 sessions
Bavikati VV [88] Effect of comprehensive therapeutic lifestyle changes on pre-HTN.	Community-based program of therapeutic lifestyle changes (TLC) for 6-months	TLC included exercise training, nutrition, weight management, stress management, and smoking cessation interventions	$N = 2,478$ ethnically diverse (AA $n = 448$, Caucasians $n = 1,881$) men ($n = 666$) and women ($n = 1,812$) with pre-HTN	SBP of 120 to 139 mm Hg ($n = 2,082$), decreased by 7 ±12 mm Hg ($P = .001$). DBP of 80 to 89 mm Hg ($n = 1,504$), decreased by 6 ±3 mm Hg ($P = .001$). No racial differences in BP reduction; women had greater BP reductions than men ($P = .001$)
Moore et al. [76]	12 months Internet-based nutrition education program	DASH for Health program to provide weekly articles about healthy nutrition via the Internet. Dietary advice was based on the DASH diet	$N = 2,834$ corporation employees and their families. Outcome measures were weight and BP reduction and lifestyle modification	In 26% who were remained in the study in the study, weight change at 12 months was −4.2 lbs, SBP fell 6.8 mm Hg at 12 months, DBP 2.1 mm Hg. On self-entered food surveys, ($n = 181$) at 12 months were eating significantly more fruits, more vegetables, and fewer grain products
Bertoni et al. (Un-published)	Randomized: 3 months	Intervention: 8 group and 2 individual sessions and emphasize the adoption of DASH diet pattern at breakfast, lunch, dinner, snacks, both at home and when dining out Control: standard DASH and high blood pressure informational handouts	Adoption of DASH eating pattern by African American adults with hypertension and prehypertension living in lower-income minority community	Results not available yet
Ard et al. [89]	Randomized: 4 years	Behavioral: DASH diet Behavioral: Intervention with no dietary component info	Develop modified DASH dietary pattern that is culturally appropriate for African-Americans	Study in progress, and results not yet available

health across religions and populations worldwide [37, 38]. Many religious organizations include health as part of their mission or ministry and often create health committees and participate in community outreach activities such as soup kitchens. Churches also provide an attractive venue to recruit and retain participants, because they tend to be stable institutions with members who attend church activities frequently over many years. The purpose of holding CBHP programs in churches is to reduce health disparities, especially in AAs [38, 39] which is consistent with the mission of AA churches to contribute to the social, economic, and political welfare of their congregants, and to the community at large [50, 51].

Nevertheless, CBHPs, even church-affiliated ones, face obstacles. One is that many of today's chronic diseases, including HTN, are complex and have multiple contributing risk factors. Hence, health promotion programs that address the multilevel nature of chronic diseases are also more complex and more difficult to conceptualize and implement. But they are also more likely to cause lasting behavioral changes [51], especially if the affiliation is strong. For example, church-affiliated CBHP programs can be classified into 1 of 3 categories: faith-based, faith-placed, and collaborative [52]. *Faith-based* programs emanate from existing committees or groups within the church (e.g., health ministries). *Faith-placed* programs work with churches, but originate outside the church [51]. *Collaborative* programs include partnerships between churches and outside groups. A literature review on church-affiliated CBHP programs from 1990 to 2005 showed that ∼25% of programs are faith-based, 40% are faith-placed, and 35% are collaborative [41]. The later programs, collaborative partnerships, were particularly recommended for efforts that are meant to be evaluated and their findings disseminated and were found to be more effective than the other two. This current project is developed as collaborative community-based participatory research (CBPR) health promotion faith-based program in 16 AA churches.

Table 3: Dash eating plan.

Food group	Daily servings	Serving sizes
Grains*	6–8	1 slice bread 1 oz dry cereal† 1/2 cup cooked rice, pasta, or cereal
Vegetables	4-5	1 cup raw leafy vegetable 1/2 cup cut-up raw or cooked vegetable 1/2 cup vegetable juice
Fruits	4-5	1 medium fruit 1/4 cup dried fruit 1/2 cup fresh, frozen, or canned fruit 1/2 cup fruit juice
Fat-free or low-fat milk and milk products	2-3	1 cup milk or yogurt 1.5 oz cheese
Lean meats, poultry, and fish	6 or less	1 oz cooked meats, poultry, or fish 1 egg
Nuts, seeds, and legumes	4-5 per week	1/3 cup or 1.5 oz nuts 2 Tbsp peanut butter 2 Tbsp or 1/2 oz seeds 1/2 cup cooked legumes (dry beans and peas)
Fats and oils	2-3	1 tsp soft margarine 1 tsp vegetable oil 1 Tbsp mayonnaise 2 Tbsp salad dressing
Sweets and added sugars	5 or less per week	1 Tbsp sugar 1 Tbsp jelly or jam 1/2 cup sorbet, gelatin 1 cup lemonade

*Whole grains are recommended for most grain servings as a good source of fiber and nutrients.
†Serving sizes vary between 1/2 cup and 1.25 cups, depending on cereal type. Check the product's nutrition facts label.

4. Health Disparities Related to HTN

AAs have a disproportionately higher incidence of HTN, but are less likely to benefit from clinical lifestyle modification program. Although behavior modification is an important step in the management of HTN, AA have consistently been less successful at achieving behavior modifications, as seen in PREMIER, Trials of Hypertension Prevention (TOPH), and the Hypertension Prevention Trial [33–39, 53, 54]. Despite clear efficacy, as in the DASH example, effectiveness has been difficult to achieve. This has been attributed to social and cultural barriers [55, 56] including different body-image ideals and food attitudes, to having fewer models for PA, and to normative views of overweight and obesity [55]. Thus, to successfully address health disparities, multiple sociocultural factors need to be addressed. Recruitment of participants into research is particularly challenging when working with AA or other racial/ethnic minority groups that traditionally have not been well served by health programs or research. Thus, an initial and vitally important step in recruiting participants is the establishment of trust and credibility within the AA community. Moreover, a church-affiliated, CBHP approach offers a way to make programs culturally appropriate by involving them in the development and implementation of these programs [57, 58]. Such programs can (a) foster dialogue and partnership to improve community health and (b) integrate the strengths and insights of all partners to address health disparities in a powerful way [48]. Fit body and Soul diabetes prevention program and HEALS (Healthy Eating and Living Spiritually) hypertension control program are some examples of strong community partnership and successful CBHP programs [59–61].

"Participatory Action Research" involves collaboration of the community and the researchers as colearners, and may be particularly suited to strategies for primary prevention

of HTN in well-defined communities [62, 63]. These approaches tend to be highly valued by local communities because they can ensure the cultural relevance and appropriateness of interventions. To evaluate current evidence for the effectiveness of such an approach, we reviewed two types of studies: (a) recent studies that adapted lifestyle interventions using a CBPR approach in AA churches (Table 1) and (b) a few reports from community based trials that focused on DASH or DASH lifestyle program for HTN prevention and treatment (Table 2) in AA or other community settings.

5. Church-Based Behavioral Lifestyle

To generate Table, we identified a total of 76 studies published in 1990 or later using several web-based search engines (pub-med, midline, Cochrane, etc.). We closely examined only those ($n = 5$) that reported using a CBHP/CBPR or behavioral lifestyle intervention with BP as one of the outcome measures in the setting of an AA church. Some were led by church members and pastors, others by experts. They were conducted in a variety of geographic areas with sample sizes ranging from 39 to 251 [54–58, 64–71]. As shown in Table 1, a variety of health promotion and behavioral intervention strategies and techniques were shown to be effective at changing SIMPLE health behaviors of church members. Only a few were designed to rigorously test one strategy versus another or in combination with another [64, 65]. Outcomes varied and included BP reduction [54–58, 64, 70, 71], dietary change [54–56, 64–71], improved physical activity [65, 66], and weight loss [54–58, 64–69].

We found that certain overarching themes and core elements were necessary for CBHP programs to be implemented at any level (i) Some used church member volunteers as lay advisors/facilitators/peer educators to deliver intervention activities [64, 70, 71]. (ii) Some used registered nurses as interventionists [67]. (iii) The majority provided self-help materials that were culturally appropriate and/or individually tailored [54–58, 64–68, 70, 71]. (iv) Some included telephone counseling [65, 66]. These studies demonstrate that CBHP approaches can be effective in achieving simple health behavior changes in real world settings. However, none of these church-based studies used DASH diet with primary objective of prevention and treating HTN. Although several of these studies provide an effective model for partnering with AA churches [64–69], many were not successful in demonstrating significant lifestyle behavioral (BP, weight loss, and physical activity) changes [53, 64, 65]. Likely reasons for this include the fact that a proven lifestyle program was not used, the commitment of lay health counselors may not have been enough to sustain the program, and the interventions were led by church members without continuous support of experts [64]. Similarly, many other studies listed in Table 1 used similar approaches in their CBHP programs, which led to increased empowerment and community ownership of the health promotion program, and thus greater participation. However, several did not include a control group [65–69] and did not specify any theoretical framework. In some studies, change was evaluated only by self-report measures [64]. Also, long-term sustainability was generally not assessed or reported [65–67, 70, 71]. Thus, there is a dearth of literature on successful behavioral lifestyle programs with primary focus on HTN control in AA church settings. Last, many of these programs did not have an expert and church health counselor team working together as program interventionists (that we bring in this project), and this is one reason for the nonsustainability of the programs and for the limited commitment by church members [72, 73]. Also, none of these behavioral lifestyle programs were tailored towards reducing future risk of HTN in AA communities.

6. Community-Based Lifestyle Interventions Using DASH for HTN Control and Prevention

Some recent and relevant community interventions targeted toward HTN are shown in Table 2 [33–39, 44, 74]. These include targeted populations known to be at higher risk for HTN and CVD compared to the US population at large. Many included comparison groups. PREMIER trial (Table 2, Row 1) details given below showed the effectiveness of DASH plus lifestyle measures in free living adults in a clinical setting and in diverse and in an indigenous population [33–39, 74]. A small pilot CBPR study (Table 2, Row 2) was designed as a university-neighborhood health care center intervention to produce soul foods (DASH dinners) that met the nutrient criteria of the DASH diet plan [44, 75]. In this study, participants were low-income AA adults ($N = 82$) with poorly controlled BP. Six groups, each consisting of 12 to 15 participants taking antihypertensive medications, met for 1 to 2 hours per week for 8 weeks [44]. The intervention followed constructs of social cognitive theory and featured dinners based on the DASH diet plan. BP was significantly lowered ($P < .05$) among participants who missed no more than 2 of 8 sessions [44]. The DASH soul study was also developed following the same principles of the DASH diet, but targeting AA women with metabolic syndrome [75]. Though participants achieved goals, the sample was small, the duration was short, and sustainability of the program was not measured [44].

A similar study among corporation employees and families was conducted where nutrition advice based on the DASH diet was provided over the internet (Table 2, Row 4-Appendix A) [76]. This single-armed study was followed for 12 months and showed weight and BP reduction, but only 26% percent of total study subjects were retained at the end of 12 months, and AA were not significantly represented in this study (only 2%) [76].

Limitations of the above-mentioned studies include short intervention durations, large numbers of non-responders, and inability to link self-reported lifestyle changes to health outcomes/indicators. Few studies included AA communities [76] or showed positive outcomes for all intermediate outcomes of interest (e.g., healthy eating behaviors and increased PA). Further, few studies assessed whether the interventions were effective among target populations in reducing and sustaining lower or other risk factors for

HTN. Finally, except one [44], none of these approaches were conducted in church-based or other faith-based settings.

Among published studies, most were done in populations with a disproportionately high incidence/prevalence of HTN, with their communities either initiating the study or collaborating with researchers. This finding is important and likely reflects the concern of leaders from these communities about HTN. Many researchers and collaborating communities are now breaking ground by implementing culturally relevant prevention programs in settings where many socioeconomic and environmental challenges exist. Although recent clinical trials have shown that DASH diet with lifestyle modification can prevent and treat HTN as well as delay the development of HTN [8, 20–22, 33–36], many of these clinical trials were conducted in resource-intensive clinical settings. There are few church-affiliated studies or programs led by church-based educators and counselors and supported by experts. We hereby present brief overview of DASH, DASH-sodium, and PREMIER studies.

7. Dietary Approaches to Stop Hypertension (DASH Study)

The DASH study, sponsored by the National Institutes of health (NIH), was a highly successful, multicenter controlled, outpatient feeding study that assessed the efficacy of three separate diet plans for 8 weeks in diverse study population [8, 20–22, 77]. The trial enrolled 459 adults with SBP of less than 160 mm Hg and DBP of 80–95 mm Hg. The three eating plans were (a) one that includes foods similar to what many Americans regularly eat, (b) a plan that includes foods similar to what many Americans regularly eat plus more fruits and vegetables, and (c) the DASH eating plan. A typical DASH diet includes fruits, vegetables, low-fat dairy products, whole grains, poultry, fish, and nuts, only small amounts of red meat, sweets, and sugar-containing beverages, and it contains decreased amounts of total and saturated fat and cholesterol (Table 3). The results were convincing. Subjects enrolled in both the plan that included more fruits and vegetables and the DASH eating plan had reduced BP, and DASH eating plan was more effective in reducing BP especially for those who had higher BP [20–22, 77]. The DASH diet lowered SBP by 5.5 mm Hg and DBP by 3 mm Hg over the control diet. DASH diet plan lowered BP substantially both in people with HTN and those without HTN, as compared to controlled typical diet in the US. The DASH diet was proven to reduce HTN, and the effect was greatest for AA, who showed higher BP reductions on the DASH diet as compared to other ethnic groups [77]. However, lower adherence to DASH diet in AA communities was seen that was attributable to mainly due to sociocultural reasons [78]. DASH now is recommended in national guidelines [8, 79, 80].

8. DASH-Sodium Study

Reducing the sodium chloride content of typical diets in the US lowers BP [81, 82], and guidelines recommend reducing the daily dietary sodium (Na) intake to 100 mmol (equivalent to 2.3 g of sodiumor 5.8 g of sodium chloride) or less [8]. DASH-Sodium trial studied the effect of different levels of dietary sodium, in conjunction with the DASH diet. DASH-Sodium trial studied the effect of different levels of dietary sodium, in conjunction with the DASH diet [28–30]. In a multicenter, randomized trial design, 412 participants were randomly assigned to eat either a control diet typical of intake in the US or the DASH diet. Within the assigned diet, participants ate foods with high (a target of 150 mmol per day with an energy intake of 2100 kcal), intermediate (a target of 100 mmol per day, reflecting the upper limit of the current national recommendations) and low (a target of 50 mmol per day, reflecting a level that we hypothesized might produce an additional lowering of BP) levels of sodium for 30 consecutive days each, in random order. The study showed that reducing the sodium intake from the high to the intermediate level reduced the SBP significantly by 2.1 mm Hg during the control diet and by 1.3 mm Hg during the DASH diet. Furthermore, reducing the sodium intake from the intermediate to the low level caused additional reductions of 4.6 mm Hg during the control diet and 1.7 mm Hg during the DASH diet. The effects of sodium were observed in participants with and in those without hypertension, AAs and those of other races, and women and men [28–30]. The DASH-Sodium study was the basis for PREMIER study described below.

9. The PREMIER Trial

The PREMIER study was conducted among 810 diverse participants from 4 clinical centers across the US [33–39, 74]. It established the effectiveness of a multifaceted behavioral intervention incorporating the efficacious DASH diet [8] among free-living US adults. This 18-months study consisted of 3 arms: (1) an "advice only" comparison group, (2) a behavioral intervention, termed "established" traditional lifestyle recommendations [79], and (3) a behavioral intervention, termed "established plus DASH" that implemented the same traditional recommendations plus the DASH diet [80]. During the first 12 weeks, there were 8 group sessions, one each week for 4 weeks, followed by a 2-week break during which individual sessions were held, then another group each week during weeks 7 through 10. There was another 2-week break for another individual visit. From weeks 13 through 24, another 6 group sessions were held (bringing the total to 14 group sessions). From months 7 until 18, the groups met monthly (bringing the total number of group sessions to 26), with individual sessions held quarterly. Each session included a topic on nutrition, PA and a behavior strategy, as well as a tasting experience focused on DASH related foods (or low fat foods for the non-DASH established arm) [33, 34]. There were significant weight changes between the comparison arm and behavioral arms at 6 months (mean change −1.1 kg versus −4.9 kg versus −5.8 kg, resp., $P < .001$ for difference between behavioral arms versus comparison, $P = .07$ for difference between behavioral arms). There were significant BP changes between behavioral arms versus the

comparison at 6 months. Among all participants, there was a mean SBP change of −3.7 mm Hg between the behavioral only arm versus comparison ($P < .001$), a mean SBP change of −4.3 mm Hg between the behavioral plus DASH arm versus comparison ($P < .001$). There was not a significant BP change between the behavioral arms at 6 months. However, when DASH was translated with lifestyle modifications in this PREMIER study, only modest BP lowering benefit were seen in AA and no immediate benefit was seen AA women, in particular [28, 29]. However, though AA women were hardest to lose weight, effect was seen eventually.

10. Economics of Altering Dietary Behavior

Food availability and the cost of healthier food options has been the subject of a fair bit of research in recent years. Briefly, studies have demonstrated that actual and perceived food availability, prices, and quality differ by type of retail outlet, geographic location, and socioeconomic status. In turn, segments of the population, for example, inner city AAs, face potential barriers to high-quality dietary nutrients [81–87]. Most of these studies have analyzed environments using cross-sectional survey methods or secondary data sets making their results difficult to interpret with respect to individuals' behaviors. In addition, many studies were limited to particular urban areas and homogeneous socioeconomic groups.

11. Conclusion and Future Recommendations

Despite more than 30 years of intense activity to improve control—and more recently prevention—high BP continues to be a major public health problem. Since the 1970s, community-based programs have been instrumental in raising awareness, increasing knowledge, and promoting changes in health behavior to improve blood pressure control. Faith-based initiatives for lifestyle change show promise in helping to promote healthy behaviors in AA communities. AA individuals are more likely to attend faith-based services than Whites from similar backgrounds. Because of their disproportionately greater risk of HTN, AAs are a logical target for high-risk research and AA churches make an ideal setting for such programs. While faith- and community-based strategies are getting more attention from policy makers, further research on the effect of faith- and other community-based strategies is needed to understand how to improve health and health care practices among patients who are often locked out of the traditional health care system. Lifestyle programs that have been used in clinic settings can be translated to a faith-based setting. Published reports of applications of the DASH or PREMIER lifestyle intervention in community-based church settings are generally lacking. Additional research is needed and this is a promising area for further research.

Conflict of Interests

The authors declare that there is no conflict of interests.

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