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Community Based Cardiovascular Health Interventions in Vulnerable Populations: A Systematic Review

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Abstract

Background—Although cardiovascular health has been improving for many Americans, this is not true of those in “vulnerable populations.” To address this growing disparity communities and researchers have worked for decades, and as a result of their work a growing body of literature supports the use of community engagement as a component of successful interventions. However, little literature synthesizes community-based interventions that address this disparity among a wide range of vulnerable populations.

Objective—This paper provides a critical review of community-based cardiovascular disease (CVD) interventions to improve cardiovascular health behaviors and factors among vulnerable populations based on the American Heart Association’s 7 metrics of ideal cardiovascular health.

Methods—In February 2011, four databases (PubMed, PsychInfo, CINAHL, and Scopus) were searched using the following keywords: vulnerable populations OR healthcare disparities AND cardiovascular disease AND clinical trials OR public health practice AND English.

Results—This search strategy resulted in the retrieval of 7,120 abstracts. Each abstract was reviewed by at least two authors and eligibility for the systematic review was confirmed after reading the full article. Thirty two studies met eligibility criteria. Education was the most common intervention (41%), followed by counseling or support (38%), and exercise classes (28%). Half of the interventions were multi-component. Health care providers were the most frequent interventionists. Interventions aimed at decreasing blood pressure were the most promising while behavior change interventions were the most challenging. Almost all of the interventions were at the individual level, and were proof of concept or efficacy trials.

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Conclusions—This analysis provides a step towards understanding the current literature on cardiovascular interventions for vulnerable population. The next step should be integrating the identified successful interventions into larger health systems and/or social policies.

Keywords

Cardiovascular Diseases; Intervention Studies; Healthcare Disparities; Review

Cardiovascular disease (CVD) is especially prevalent among vulnerable populations. This health disparity is true across all vulnerable populations from ethnic minority¹, to low-income²⁻⁴, to income poor neighborhoods^{5,6} and high risk geographic regions in the United States (US)^{7,8}. Corresponding disparities also exist for CVD risk factors, such as obesity, hypertension, smoking and sedentary lifestyles¹⁻³. Further, despite US prioritization of addressing the health needs of these vulnerable populations^{1,9}, cardiovascular disparities in the US have generally worsened over the past three decades^{4,10}. Reasons for this disparity in CVD include, but are not limited to, fewer socioeconomic resources¹¹, limited English proficiency¹² and differences in quality of care for vulnerable populations¹³⁻¹⁷ even when health access is accounted for^{12,13,17}.

Davis and colleagues¹⁸ conducted a systematic review of health care interventions from 1995 to 2006, focusing specifically on cardiovascular health in racial/ethnic minority populations. They concluded that high-quality research specifically addressing reduction of cardiovascular racial and ethnic disparities is virtually nonexistent. Their review however, did not include interventions that were exclusively community focused, such as faith- and school based programs, which have increasingly been shown to produce positive effects in improving physical activity, weight loss, and blood pressure (BP) control. Furthermore, the review only focused on racial/ethnic minority populations, one segment of the population who may be disproportionately vulnerable to CVD. Therefore, the purpose of this paper was to conduct a systematic review of community based cardiovascular health interventions in vulnerable populations.

Reviewing the existing literature is especially important with the Affordable Health Care Act providing access to individuals from more vulnerable populations. Improving access however, is not sufficient to reduce cardiovascular disparities as it is critical to determine what approaches work well for specific populations. This review adds to the analysis by Davis and colleagues¹⁸ by analyzing interventions with a community-based component. Further, this review includes research with vulnerable low-income populations irrespective of race or ethnicity.

Vulnerable populations are defined in various ways. Vulnerability can be broadly defined as, “the susceptibility to harm¹⁹ (p. 1220).” The literature is often defined by the way vulnerability is identified, most often as people who are from rural, poor, racial or ethnic minority or special groups such as veterans, uninsured without health insurance, disabled, homeless, or the elderly with numerous coexisting chronic illnesses¹⁹. Additionally, vulnerability is often measured using broad dichotomies- i.e. a population of vulnerable/non-vulnerable people. However, evolving conceptualizations of vulnerability view it as a

multidimensional construct, resulting from numerous individual as well as community level factors²⁰, and this is the viewpoint guiding the inclusion of studies in this paper.

Health outcomes observed as a result of this approach to defining vulnerability would need to consider both individual and community level factors in order to identify health disparity patterns. Consequently, interventions that extend beyond a single risk factor to target multiple risk factors would likely be more efficacious²⁰. In 2010, the American Heart Association (AHA), the leading voluntary health organization in CVDs and stroke, changed its focus from reducing the burden of CVD to promoting cardiovascular health²¹. It defined ideal cardiovascular health as the simultaneous presence of ideal health behaviors (nonsmoking, body mass index <25 kg/m², physical activity at goal levels, and a diet consistent with current guideline recommendations) and ideal health factors (untreated total cholesterol <200mg/dL, untreated blood pressure <120/80 mm Hg, and fasting blood glucose <100 mg/dL). These 7 metrics, selected by the AHA, will assist in determining the changing prevalence of cardiovascular health status and define achievement of the impact goal. In this paper, we used the AHA's 7 metrics to provide a critical review of the effect of community-based CVD interventions on improving cardiovascular health behaviors and factors of vulnerable populations in community settings.

Methods

We conducted a systematic literature search with librarian consultation in PubMed, PsychInfo, CINAHL, and Scopus. These included terms such as vulnerable populations OR healthcare disparities AND cardiovascular disease AND clinical trials OR public health practice AND English. See Appendix 1 for all search terms used. This search strategy resulted in the retrieval of 7,120 abstracts. Each abstract was reviewed by at least two authors (BW, SS, TN, YC, LS) and eligibility for the systematic review was confirmed after reading the full article (see Figure 1). At least one author read each article in full prior to determining eligibility and justified the exclusion of articles to the group. Articles were included in the systematic review if the title and abstract described a community-focused intervention targeting a vulnerable population and described a CVD or at least one of the following AHA defined cardiovascular metrics: blood pressure, smoking, physical activity, body mass index, diet, cholesterol, and fasting blood glucose. To be included, the article had to be published between January, 2006 and March, 2011 and describe statistical testing on at least one of the AHA metrics. Vulnerable populations include racial and ethnic minorities, those of low socioeconomic status or low literacy, and individuals who reside in geographic isolation or poverty. Studies were excluded if they were not in English, were published prior to 2006, or if individuals were described as vulnerable due solely to physical health characteristics, such as age or health status.

Results

Thirty two (32) studies met eligibility criteria including 16 randomized controlled trials (RCT)^{22–37}, 9 quasi-experimental studies^{38–46}, and 7 single-group pretest/posttest investigations^{47–53}. All but seven^{23–25,29, 30, 38,43} represented unique study samples. Vulnerable (i.e., susceptible to harm) populations studied included Asian/Asian

American^{25,30,38–40,41,43,50}, African/African American^{26,29,32,34,42,47,50–52}, Latino/Hispanic American^{23,24,31,36,48}, as well as low-income or populations from socially disadvantaged neighborhoods^{27,28,33,35,37,41,44,45,46}, rural settings³⁷, or neighborhoods with elevated mortality rates⁴⁶. Two investigations^{25,29} were with adolescents and the remainder with adult populations. Most studies were conducted in the United States with the remainder completed in South Africa²⁶, Guatemala³⁴, China³⁹, Norway⁴¹, Pakistan⁴⁴, Sweden⁴⁵, the Netherlands^{28,46}, or Australia²⁷. Sample sizes varied widely from as few as 16⁵² to more than 110,000³⁹.

Education was the most common intervention^{23,24,34,35,37–39,43,44,47,49,50} comprising about 38% of the studies reviewed followed by counseling or support^{35,38,39,41–43,46,47,53} constituting 28% of the reviewed studies. Seven (22%) of the investigations included both education and counseling or support^{34,35,38,43,47,48,51}. Nine (28%) of the education investigations were RCTs^{23,24,27,29,30,33–35,37}. Exercise classes were also included as the main strategy or in combination with others in approximately 19% of the investigations^{39,45,46,41,47,52} in this sample. None of the exercise studies were RCTs. Less frequently employed interventions included community improvements^{41,44,46,50}, meditation^{25,29}, health care provider training^{34,39}, food provision^{26,36} or storytelling^{32,42}. Five of the studies with less frequently employed interventions were RCTs^{25,26,29,32,36}. About 31% of the investigations included more than one component^{38,39,41–46,50,51}.

Health care providers were the most frequent interventionists^{26,28,30,33–35,38,43,45,46,51,52} followed by public health or community professionals^{25,27,29,41,44,50,51}, community health workers^{23,24,31,36,47} or pre-licensure health students or research staff^{37,40,42}. The interventionist was the patient for one study³². One investigation did not report who implemented the intervention³⁹.

Duration of follow-up was most often 2–12 months but there were investigations in which the intervention and assessment occurred on a single day^{42,49} as well as those with a duration beyond 12 months^{36,39,41,44,46,47}. Community settings were also variable but most frequently included clinics^{23,24,28,31,32,33,37,42,45} or homes^{25–29,32,34,38,43} as well as various other community sites^{25,29,35,36,39,41,42,44,46,49}.

The following sections describe the 32 selected articles based on their focus on one or more of the following AHA measures: blood pressure, smoking, physical activity, body mass index, diet, fasting blood glucose, or cholesterol. Statistical significance was determined using a level of significance of $\alpha = 0.05$.

Blood Pressure

Twenty investigations tested blood pressure (BP) as an outcome measure^{22–26,28,29,31–36,38–43,51}; 13 of these were RCTs^{22–26,28,29,31–36}. Thirteen of these investigations did not require eligible participants to have baseline blood pressures of at least 140/90 or be on blood pressure medications^{22,24,25,28,29,31,33,35,36,39,41,42,51}.

Studies with a BP of at least 140/90 not required

These studies had a range of foci, from adolescents^{25,29}, to African American males⁴², to CVD prevention or risk reduction trials^{31,36,39} to physical activity/diet^{33,35,41}, to diabetes mellitus^{22,51}. The remaining investigations required a cardiovascular risk factor that could include one of several such as diabetes or high cholesterol, as well as hypertension^{24,28}. Significant reductions were observed in systolic blood pressure (SBP) in 62% of the blood pressure studies in this group^{25,29,31,35,36,39,41,51}. Significant diastolic blood pressure (DBP) reductions were observed^{25,29,35,39,51} in 38% of the studies. Five investigations were RCTs^{25,29,31,35,36} and two were non-randomized controlled trials^{39,41} in which significant BP differences were observed between groups. One investigation did not include a comparison group⁵¹. Interventions, interventionists and duration of follow-up were varied across studies.

BP reductions in two investigations^{39,41} were significant only if sex was accounted for in the analyses. Jenum and colleagues⁴¹ had nearly equivalent numbers of men (43%) and women (57%) in their 3-year community risk reduction trial in Norway. While both sexes significantly reduced their SBP, effects for men were moderated by age, that is, these reductions were only present among men older than 50 years of age. Significant reductions were consistent for women of all ages though of greater magnitude for those older than 50 years. In contrast, Chen and colleagues³⁹ observed in their 9-year CVD risk reduction trial among Chinese factory workers, that significant BP reductions depended upon whether participants were urban or rural residents. Among all urban residents, DBP reductions were greater in the treatment group relative to the control group, a finding observed in men and women. Significant SBP reductions were also observed but only among urban participants who were normotensive at baseline. Amongst rural participants however, greater BP reductions were limited to SBP and noted only for women.

Studies with a BP of 140/90 required

Seven investigations required study participants to have a diagnosis of hypertension to be eligible^{23,26,32,34,38,40,43}. Half of these were RCTs^{23,26,32,34}. No study in this group had a follow-up duration of 12 months or longer. In three investigations participants in the treatment groups were more likely to have significant SBP^{26,32,34} or DBP³² reductions. BP reductions for two studies^{32,34} were limited to participants with uncontrolled BP (treated or untreated) at baseline.

Houston and colleagues³² used a storytelling intervention with African Americans achieving significant SBP and DBP reductions for participants with uncontrolled BP (Stage 2 hypertension defined by JNC 7) at baseline. Pezzin et al³⁴ investigated two home-based interventions that differed in intensity with African Americans from a home health agency. BP control was achieved for participants with JNC Stage 2 hypertension at baseline but not the overall group. These reductions were limited to SBP and observed for the augmented intervention relative to usual care.

In summary, 20 investigations included BP as an outcome measure (see Tables 1, 2, and 3). In more than half of these studies, BP greater than 140/90 (treated or untreated) was not

required for study participation. Significant BP reductions were more frequently noted in this group compared to the group requiring a hypertension diagnosis. In some studies, statistically significant BP reductions were dependent on residence, sex, or BP severity. See Tables 1, 2, and 3.

Other Cardiovascular risk Factors (body mass index, physical activity, diet, fasting blood glucose, cholesterol, and smoking)

Twenty one studies measured aspects of weight management behaviors, including changes in body mass index (BMI), physical activity and/or diet^{15,16,18–20,22,23,25,27,29,31–33,38,40,44–48,50}. Interventions included education^{15,16,19,25,27,29,31,32,38,40,44–48,50}, counseling^{15,16,19,23,25,27,32,38,46–48}, exercise classes^{25,33,40,44–47}, improved community based primary care services^{31,20}, the provision of healthful food¹⁸, and structural improvements in the community^{33,45}. Most included interventions targeted at minorities, but several targeted low income and underserved communities that did not have a predominance of minority residents^{19,25,27,31,33,38}.

As can be seen in Tables 1 through 3, twelve studies reported BMI data; five studies found a statistically significant reduction in BMI, and no differences in BMI were found in the RCTs between groups. Similarly, 4 of 13 studies found statistically significant improvements in physical activity, including one which found increased physical activity at 6 but not 12 weeks post intervention⁴¹. Among the 6 investigations including fasting blood glucose as an outcome, only Stein and colleagues³⁶ observed significant between-group results among children in Guatemala. Children who were fed azole, a nutritional supplement, between 36 and 72 months of age had significantly lower fasting blood glucose levels, an effect noted in both sexes. Of the 7 studies that included total cholesterol as an outcome measure, only Steinhardt et al.⁵² observed significant reductions. Eleven studies reported dietary outcomes with inconsistent findings, all but one³³ relying on self-report. Tables 1 through 3 present dietary results relevant to the AHA dietary score, including consumption of sodium, fruits and vegetables, and fiber. Studies also found reduced consumption of fats and cholesterol^{23,24,27,51}, increased intake of potassium, calcium and magnesium²³, and improved overall dietary patterns^{23,24,31}.

Six investigations included smoking status as an outcome^{24,30,31,39,47,50}. Five studies followed participants for one year or more to see if smoking rates decreased^{30,31,39,47,50} and another followed participants for four months²⁴. Only Chen and colleagues³⁹ found a significant decrease in smoking prevalence post-intervention and this finding was limited to rural-residing males only.

Effective interventions

Intervention effects on blood pressure did not appear to be more effective for one group over another. All racial and ethnic minorities as well as low-income groups were represented. Overall, these interventions seem to be more effective for reducing systolic versus diastolic blood pressure however, there is more potential variability for systolic blood pressure. Notably, more than half of these interventions were tested in RCTs. Research that examined

intervention effects on BMI and physical activity appeared to be more efficacious for low-income or individuals living in socially disadvantaged communities again, regardless of race or ethnicity. We found that studies including BMI as an outcome measure may be more effective for men whereas studies including physical activity may be more effective for women. There were no studies for which BMI or physical activity improved more for women or men, respectively. In contrast, dietary interventions were effective across vulnerable populations studied.

Due to the heterogeneity of the interventions, it is difficult to state which interventions are more effective. Similarly, no one vulnerable group appeared to benefit more from one type of intervention over another in regards to the AHA measures reviewed. Even so, there was a pattern for successful education and support interventions in that there was often initially a more intensive phase that was either individual or group based followed by a less intensive phase that often included individual telephone support or support groups. Again, this approach appeared to be no more effective for one vulnerable group over another but effective for each.

Discussion

We conducted a systematic review of community-focused cardiovascular interventions targeting vulnerable populations. Blood pressure interventions were the most promising while behavior change interventions (such as those targeting increased physical activity or decreased smoking) were the most challenging. Education interventions were the most common type of intervention although almost half of interventions were multi-component. Almost all of the interventions were at the individual level. Finally, differential effects of interventions were observed with some results that were moderated by age, sex, education or residence.

As behavior change is so difficult, many have suggested the need to intervene at the community or even societal levels^{20,54,55} such as increased neighborhood walkability⁵⁶ or decreased access to sodas for children⁵⁷. This review found only sparse data addressing data that focused on integration into current health care practice or social policy, and all of the studies were proof of concept or efficacy trials. For those that were successful, it remains to be seen whether they can be translated into a larger clinical or societal population.

Strengths of the review include a systematic search of comprehensive databases with a standard extraction tool and multiple authors. Focus on the seven areas targeted for ideal cardiovascular health was another advantage. However, our search did not yield enough studies that included fasting blood glucose, one of the target areas, as an outcome measure. Our review was also limited by the selection of studies published in English as well as possible publication bias. Further, the heterogeneity of the studies prevented us from conducting a meta-analysis.

Future research should target other vulnerable groups such as the homeless or military veterans. Whenever possible, study duration should extend beyond 12 months. When considering physical activity and exercise, research designs should be RCTs, a design absent

from physical activities studies in this review. Finally, it is important to consider carefully whether the comprehensive assessments themselves may lead to improved results. The attention given for these assessments may have more of an impact among vulnerable groups that may lack even minimal attention in “usual care” groups.

Because there are entrenched health disparities in CVD among vulnerable populations, it is essential to understand what can improve them. This analysis is a step towards this understanding as it synthesizes the current literature. The next step should be integrating the identified successful interventions into larger health systems and/or social policies.

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Figure 1.
Systematic Literature Search Results

Summary Table 1

Randomized Controlled Trials

1 st Author	Intervention	Interventionist	Follow- up	Smoking	BMI	Physical Activity (moderate or vigorous)	Healthy Diet (4–5 components of healthy diet score)	Total cholesterol	Blood pressure	Fasting blood glucose
<i>Urban Poor</i>										
Eakin ²⁷	i. Telephone counseling over 12 months ii. mailed workbook w/info on physical activity & healthy eating w/pedometer; used 5 A's approach ^a (n=434; 315 @ f/u)	Bachelor's or master's prepared w/degrees in public health or allied health	18 months			0 ^b ; significant within-group differences, both groups	@ 18 mos: +total & saturated fat of > 1%, ~ 2g/day > fiber; fruit (~1/4 svg/day; ~ ½ svg for vegetables at 12 mo; 0 ^b @ 18 mos			
El Fakiri ²⁸	i. Interdisciplinary CVD Risk Management team tailored tx plan reevaluated q3mon; 3 risk assessments at 3, 6, & 9 mo (BP, lipids, glucose & HbA1c) (n=275; 108 @ f/u)	General practitioner; practice nurse(team leader), peer health educator	12 months		0 ^b			0 ^b ; significant within-group differences, both groups	0 ^b	0 ^b
Keyserling ³³	i. 2 Individualized face-to-face education over 6 mo + 3 Group-based education + 3 phone education [INTENSIVE PHASE] ii. 1 Individualized face-to-face education+ phone education over 7 mos. [MAINTENANCE PHASE] (n=236; 106 @ f/u)	Community Health Advisor	1 year			0 ^b by accelerometer; + for self-report for moderate & vigorous by s	+ fruit/vegetable intake by serum carotenoid levels;			
Samuel- Hodge ³⁵	i. Group based education over 16wks by RN trained in motivational interviewing ii. Dietary session, taste- testing, and food demonstrations iii. Program incentives (n= 143; 126 @ f/u)	Registered nurse	5 months		0 ^b ; + for decreased body weight	+ moderate intensity; 0 ^b for vigorous		0 ^b	+ SBP (↓6.5 mm Hg for tx grp vs 0.4mm Hg for control & DBP (↓4.1 mm Hg for tx grp vs 1.3 mm Hg for control	
<i>Rural Poor</i>										
Stein ³⁶	Children 7 yrs in Guatemala were given atole, a dietary supplement from maize, dry skin milk, and sugar fortified with micronutrients 2x/day × 8 years (1969–1977). (n=1455 of 1856 alive)	Trained field workers	Participants in intervention from were resurveyed 2002–2004		+ for males (24.3 for tx grp vs 25.1 for control); 0 ^b for females			0 ^b	0 ^b for SBP overall; + SBP (–4.2 mm Hg)for exposure at 24–60 mo for males; 0 ^b for DBP	+ for exposure at 36–72 mo
Tessaro ³⁷	1X Video Education on healthy eating and received magnet and wheel with correct portion sizes of various foods and recipe	Health professional student-specific discipline not indicated	3 months				0 ^b for fruit/vegetable & fat intake			

1 st Author	Intervention	Interventionist	Follow- up	Smoking	BMI	Physical Activity (moderate or vigorous)	Healthy Diet (4-5 components of healthy diet score)	Total cholesterol	Blood pressure	Fasting blood glucose
	booklet tailored to what participants viewed in the video (n=395; 262 @ f/u) booklet tailored to what participants viewed in the video (n=395; 262 @ f/u)									
<i>African or African American</i>										
Barnes ²⁵	3 10-minute Breathing awareness meditation sessions at school & home in 3 months (n=66; 56 @ f/u)	High school classroom teachers	3 months						+SBP (120.5 mm Hg for tx grp vs 126.4 mm Hg for control) at school & at night (107.1 vs 112.2); 0 ^b DBP	
Charlton ²⁶	Provision of 6 food items to South African adults on meds for HTN with salt replacement, bread, margarine, stock cubes, soup mix & flavor enhancer and 500 ml of maas (fermented milk) for 8 weeks (n=83; 80 @ f/u)	1 dietician & a driver delivered food 3 x/wk	4 weeks		0 ^b	0 ^b	+for sodium; 0 ^b for fat intake		+SBP (-6.1 mm Hg); 0 ^b for DBP	
Gregoski ²⁹	i. Breathing awareness meditation (BAM) 10 min sessions at class & home on weekends 2x/d x 3mos ii. Life Skills Training (LST): wkly 50 min sessions x 3 mos (n=166; 164 @ f/u)	High school classroom teachers	3 months						+SBP @ school (120.8 mm Hg vs 124.9), night (109.2 mm Hg vs 112.5 mm Hg) & 24hr (116.6 mm Hg vs 119.4 mm Hg betw/BAM & LST, respectively; & BAM vs control; 0 ^b DBP	
Houston ³²	3 diffr DVDs of real patients talking about managing HTN (at 0,3,6 mos) (n=299; 230 @ f/u)	Audiovisual of patients telling stories	6 months						0 ^b overall; +SBP (-6.4 mm Hg) & DBP (-4.22 mm Hg) among patients w/uncontrolled high BP	
Pezzini ³⁴	i. Basic: Education using “5 A” model of self-management. Patients received booklet, monitor, log and advice to monitor bp. ii. Augmented: Trained HTN nurse and health educator visits and phone calls using 12 week protocol to improve pt self-management, medication adherence, health behaviors and communication with PCP (n=845; 635 @ f/u)	Home care nurse & for augmented, health educator also	3 months						0 ^b overall SBP/DBP; +augmented: i increased BP control for stage 2 pts (-8.3 mm Hg)	
<i>Hispanic American</i>										
Balcázar ²³	i. 6 curriculum based in-person education sessions in 3 weeks	3 promotoras (Community Health Workers)	4 months		0 ^b		+ Salt, cholesterol & fat intake	0 ^b	+ DBP (79.8 mm Hg for tx vs 75.5 mm Hg for control); 0 ^b SBP	0 ^b

1 st Author	Intervention	Interventionist	Follow- up	Smoking	BMI	Physical Activity (moderate or vigorous)	Healthy Diet (4-5 components of healthy diet score)	Total cholesterol	Blood pressure	Fasting blood glucose
	ii. Phone education over 4 weeks (n=328; 234 @ f/u)									
Balcázar ²⁴	i. 8 curriculum based in-person education sessions in 2 months ii. 3 Phone education sessions in 2 months (n=98; 98 @f/u)	3 promotoras (Community Health Workers)	9 weeks							0 ^b
Hayashi ³¹	i. 3 face-to face lifestyle counseling visits for nutrition and PA counseling at 1,2,6 mos (n=869; 645 @ f/u)	Community Health Workers	12 months	0 ^b	0 ^b			0 ^b	+SBP (−5.9 mm Hg for tx vs 3.7 mm Hg for control); 0 ^b for DBP overall; Significant DBP ↓ within- group	
Asian American										
Han ³⁰	telephone counseling: more intensive - biweekly vs less intensive: monthly × 12 months (n=445; 360 @ f/u)	Bilingual Nurse	12 months	0 ^b						
Kim ²²	psychobehavioral strategies using Transtheoretical Model to encourage 150 min moderate exercise/wk, 2 00–300 reduced dietary calories/day; phone counseling × 16 weeks (n=54; 43 @ f/u)	Nurse	16 months						0 ^b	0 ^b

^a 5As approach: assess, advise, agree, assist, and arrange-follow up SBP: systolic blood pressure DBP: diastolic blood pressure

⁺ Statistically significant between-group differences

0^b No statistically significant between-group differences

Table 2

Quasi-experimental

1 st Author	Intervention	Interventionist	Follow-up	No current smoking	BMI < 25 kg/m ²	Physical Activity (150+ min/week moderate or 75+ min/week vigorous, or combination)	Healthy Diet (4-5 components of healthy diet score)	Total cholesterol < 200 mg/dL	Blood pressure < 120/80 mmHg	Fasting blood glucose
<i>Urban Poor</i>										
Jennum ⁴¹	Comprehensive intervention of walking clubs in Norway, reminders to take stairs, biannual fitness tests, improved street lighting, salting ice over 3 years (n=1766; 888 @ f/u)	local political and lay leaders and health and welfare workers	3 years		+men (-0.42); 0 ^b women	+reduction; 9% net increase in activity		0 ^b	+SBP (men < 50 yrs: -3.79 mm Hg; 0 ^b > 50 yrs; women < 50 yrs: -2.49 mm Hg; > 50 yrs: -4.45 mm Hg)	
Nishtar ⁴⁴	i. 3 hour structured health education in Pakistan ii. 1-year radio campaign, iii. Training of health professionals (1 day workshop) (n=604; 592 @ f/u)	"An officer trained to deliver the message in the local language"	3 years	0 ^b		0 ^b moderate & vigorous	+vegetables (2 servings/day; 0 ^b fruits			
Wendel-Vos ⁴⁶	Community-based intervention in the Netherlands; dietary, physical activity, antismoking education, nutrition parties, debt assistance (people with debts taught to cook healthy meal on small budget, printed guides showing walking and cycling routes, daily TV guided aerobics program,	Dietician, expert on walks, health expert, welfare worker, sports teacher	5 years	0 ^b quit smoking overall; significant reduction for both groups		+walking for women (+2.2 hrs/wk)	0 ^b fat; Significant differences for low education for fat intake (-2.5 gm/day); significant within-group reductions both groups for fat intake			

J Cardiovasc Nurs. Author manuscript; available in PMC 2015 July 01.

1 st Author	Intervention	Interventionist	Follow-up	No current smoking	BMI < 25 kg/m ²	Physical Activity (150+ min/week moderate or 75+ min/week vigorous, or combination)	Healthy Diet (4-5 components of healthy diet score)	Total cholesterol < 200 mg/dL	Blood pressure < 120/80 mmHG	Fasting blood glucose
	antismoking campaigns using billboards, posters, leaflets	billboards, posters, leaflets	< 5 years (n=3114; 3101 @ f/u)							Walton-Moss et al.
	antismoking campaigns using billboards, posters, leaflets	billboards, posters, leaflets	< 5 years (n=3114; 3101 @ f/u)							
	antismoking campaigns using billboards, posters, leaflets	billboards, posters, leaflets	< 5 years (n=3114; 3101 @ f/u)							
<i>African American</i>										
Hess ⁴²	One time documentation of BP and referral to HCP, model story, BP report card (n=94; 63 @ f/u)	Black Research Assistants	8-10 months						+SBP (tx: 133.4 mm Hg vs control: 146.7 mm Hg) +DBP (tx: 78.8 mm Hg vs control: 88.0 mm Hg)	
<i>Asian or Asian American</i>										
Chen ³⁹	Health network set-up; health education & promotion; health professional training for local practitioners & health workers; detection/management of HTN pts; disease & death surveillance × 9 years (n>110,000)	not reported	2 cohorts followed for 9 years	+for rural men (tx: 64.4% vs control: 70.3%)			+salt (-3.9 gm/day)		+overall urban DBP (-2.2 mm Hg; +SBP (-3.4 mm Hg rural women	
Chiang ⁴⁰	Culturally modified walking program × 8 weeks (modified Jitramontree's protocol) (n=137; 128 @ f/u)	Researcher or translator	8 weeks			0 ^b			0 ^b	
Kim ⁴³	i. Structured 2-hr psycho-behavioral education focusing on HBP self-help skills over 6-weeks ii. Home BP monitoring	Bilingual Nurse	15 months						0 ^b between education delivered face-to-face vs mail	

1 st Author	Intervention	Interventionist	Follow-up	No current smoking	BMI < 25 kg/m ²	Physical Activity (150+ min/week moderate or 75+ min/week vigorous, or combination)	Healthy Diet (4–5 components of healthy diet score)	Total cholesterol < 200 mg/dL	Blood pressure < 120/80 mmHG	Fasting blood glucose
	<p>with tele-transmission × 3 mos</p> <p>with tele-transmission × 3 mos</p> <p>with tele-transmission × 3 mos</p> <p>iii. Telephone counseling by bilingual nurse × 3 mos (n=445; 359 @ f/u)</p>									Walton-Moss et al.
Kim ³⁸	<p>i. Structured 2-hr psycho-behavioral education focusing on HBP self-help skills over 6-weeks</p> <p>ii. Home BP monitoring with tele-transmission × 6 mos</p> <p>iii. Telephone counseling by bilingual nurse × 6 mos (n=377)</p>	Bilingual Nurse	3 months						+HTN control if compliant vs noncompliant w/home BP monitoring	
<i>Middle Eastern Refugee</i>										
Sundquist ⁴⁵	<p>i. 28 Individual counseling sessions to strengthen self efficacy, empowerment and personal motivation × 6 mos</p> <p>ii. Group activities including</p>	Physiotherapist	6 months						+ relative aerobic capacity & % with acceptable fitness level	

[illegible]

Summary Table 3

One-group pre-post

1 st Author	Intervention	Interventionist	Follow-up	No current smoking	BMI	Physical Activity (150+ min/week moderate or 75+ min/week vigorous, or combination)	Healthy Diet (4-5 components of healthy diet score)	Total cholesterol 200 mg/dL	Blood pressure <120/80 mmHG	Fasting blood glucose
<i>African Americans</i>										
Paschal ⁴⁷	Interactive, AA culturally sensitive, education classes × 3 mos (hypertension, nutrition, general health, anger management, parenting) & physical fitness classes 2 or more/week × 9 mos (walking, aerobics and calisthenics) (n=134; 74 @ f/u)	AA health professionals and nurses	9 months						+SBP (155.2 mm Hg to 135.7 mm Hg); 0 DBP	
Plescia ⁵⁰	i. LHA face-to-face education on PA, smoking, nutrition ii. Group-based PA iii. Community level intervention (farmers market and diabetes management program) (n=4730)	Lay health advocates and local organizations	5 years	0 overall + for women only (26.8% to 20.9%)		0 overall; + for women, college graduates (physical inactivity from 33% to 26.1%) or betw/ages 35-54 (physical inactivity from 30.3% to 20.8%)	0 overall; +fruits & vegetables (5 servings/ day; from 21.4% to 33.3% for subject w/ some college/ technical educ)			
Resnick ⁵¹	60 minute motivational, educational, and exercise sessions to strengthen self-efficacy and outcome expectations to improve adherence to exercise,	Nurse Practitioners, pharmacists and lay health educators	12 weeks			0	0 sodium & cholesterol intake		+SBP (140mm to 123mm Hg) & DBP (85.7mm)	

1 st Author	Intervention	Interventionist	Follow-up	No current smoking	BMI	Physical Activity (150+ min/week moderate or 75+ min/week vigorous, or combination)	Healthy Diet (4-5 components of healthy diet score)	Total cholesterol 200 mg/dL	Blood pressure <120/80 mmHG	Fasting blood glucose
	diet, and medication, 3x/week × 12 weeks (n=22) diet, and medication, 3x/week × 12 weeks (n=22) diet, and medication, 3x/week × 12 weeks (n=22)								to 67.8 mm Hg)	
Steinhardt ⁵²	4X weekly Diabetes Coaching Program consisting of resilience education and diabetes self-management, followed by eight biweekly support group meetings over 6 mos (n=16; 12 @ f/u)	Health Education Professor taught resilience portion of intervention and a PhD candidate in nutritional sciences	6 months		+ 32.8 to 32.1			+ 178 to 163	+ SBP (134 to 124) +DBP (82 to 76)	0
Hispanic American										
Harralson ⁴⁸	3 exercise classes per wk (salsa); educational modules 1x/wk after exercise class, both for 12 weeks for year 1 and 16 weeks for year 2 (n=225; 118 @ f/u)	not reported	12–16 weeks		+ for completers only (%BMI 30 from 50% to 39%)				0 SBP & DBP for completers	
Yancey ⁵³	Culturally sensitive health education using audiovisual fitness materials on physical activity and healthy food choices, 12 wks of 30min weekly training sessions and 4 bimonthly booster training sessions. 2 treatment arms- 12wk vs. 6week program (n=338; 126 @ f/u for 12 wk prog; n=52; 48 @ f/u for 6 wk program)	Audiovisual	1 year		+ (28.8 to 28.3) for 12 wk group only	+ for vigorous activity (mean of 1.6 to 1.9 in typical wk) for 6 wk group only 0 for walking for both 6 and 12 wk groups	+ fruit/veg intake increased by 0.5 servings/day for 12 wk group only			
Asian American										
Kim ⁴⁹	i. Structured 2-hr psycho-behavioral education	Bilingual Nurse	6 months						0 SBP & DBP	

1 st Author	Intervention	Interventionist	Follow-up	No current smoking	BMI	Physical Activity (150+ min/ week moderate or 75+ min/ week vigorous, or combination)	Healthy Diet (4-5 components of healthy diet score)	Total cholesterol 200 mg/dL	Blood pressure <120/80 mmHG	Fasting blood glucose
	focusing on HBP self-help skills over 6-weeks focusing on HBP self-help skills over 6-weeks focusing on HBP self-help skills over 6-weeks focusing on HBP self-help skills over 6-weeks ii. Home BP monitoring with tele-transmission × 6 mos iii. Telephone counseling by bilingual nurse × 6 mos (n=49; 31 @ f/u)									

^aFace, Arm, Speech, Time to call 911

⁰No statistically significant pre-post differences

⁺ Statistically significant pre-post differences