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Cardiovascular Health Disparities:

A Systematic Review of Health Care Interventions

Andrew M. Davis, Lisa M. Vinci, Tochi M. Okwuosa, Ayana R. Chase, and Elbert S. Huang
The University of Chicago

Abstract

Racial and ethnic disparities in cardiovascular health care are well documented. Promising approaches to disparity reduction are increasingly described in literature published since 1995, but reports are fragmented by risk, condition, population, and setting. The authors conducted a systematic review of clinically oriented studies in communities of color that addressed hypertension, hyperlipidemia, physical inactivity, tobacco, and two major cardiovascular conditions, coronary artery disease and heart failure. Virtually no literature specifically addressed disparity reduction. The greatest focus has been African American populations, with relatively little work in Hispanic, Asian, and Native American populations. The authors found 62 interventions, 27 addressing hypertension, 9 lipids, 18 tobacco use, 8 physical inactivity, and 7 heart failure. Only 1 study specifically addressed postmyocardial infarction care. Data supporting the value of registries, multidisciplinary teams, and community outreach were found across several conditions. Interventions addressing care transitions, using telephonic outreach, and promoting medication access and adherence merit further exploration.

Keywords

cardiovascular disease; health disparities; interventions; quality improvement

Communities of color bear a disproportionate burden of ill health in the United States, with little improvement in overall mortality differentials during the past 40 years (R. S. Levine et al. 2001; Satcher et al. 2005). Cardiovascular disease accounts for 1.4 million deaths overall each year in the United States (Thom et al. 2006) and is the leading contributor to these differentials, with African Americans having two to three times the likelihood of dying from cardiovascular disease compared to whites at any given age (Mensah and Brown 2007).

These differentials in cardiovascular outcomes are thought to be partially attributable to disparities in cardiovascular disease prevention and treatment. Disparities in treatment are defined by the Institute of Medicine as ethnic/racial differences in treatment that are not justified by the underlying health conditions or treatment preferences of patients (Committee on Understanding and Eliminating Racial and Ethnic Disparities in Health Care: Institute of Medicine 2002). Notable ethnic/racial disparities have been described in the diagnosis, management, and outcomes of many cardiac risk factors and conditions. Considerably less research has evaluated interventions designed to reduce those disparities. Fortunately, there is a growing literature describing interventions designed to improve care in communities of color. This later body of work may not directly address disparities reduction; however, interventions that are found to improve the health of patients of color may still prove valuable given the current situation in which African Americans and Hispanics receive poorer quality of care

compared to whites for a broad range of core measures of health care quality (Agency for Healthcare Research and Quality 2006, fig. H1).

In the following section of this review, we briefly describe the disparities landscape for traditional vascular risk factors (hypertension, hyperlipidemia, physical inactivity, tobacco use) and for two cardiovascular conditions (coronary artery disease and heart failure [HF]) to provide the context for a systematic review of extant interventions.

Disparities in Vascular Risk Factors

It is important to realize that vascular risk factors vary in distribution by race, ethnicity, gender, and education, and this variation should influence the design and targeting of disparities reduction interventions (table 1). Hypertension in African Americans has earlier onset and greater prevalence, is harder to control, and is associated with far more end-organ damage (Bosworth et al. 2006; Gadegbeku, Lea, and Jamerson 2005). Fully half of the cardiovascular mortality disparity between whites and African Americans may be due to hypertension (Hicks et al. 2005; M. D. Wong et al. 2002), with African Americans having five times as many potentially preventable hospitalizations for hypertension compared to whites (Russo, Andrews, and Coffey 2006). Hypertension is also a great public health concern among other communities of color (Glover 2005; Ong et al. 2007; W. Wang et al. 2006).

Disparities in the prevalence and management of lipid abnormalities are also well described (Ma et al. 2005; Persell et al. 2005; Trivedi et al. 2005; M. L. Williams et al. 2002; Woodard, Kressin, and Petersen 2004). African Americans have lower rates of medication adherence and control relative to whites (Benner et al. 2002; L. T. Clark et al. 2006; Kaplan et al. 2004; M. L. Williams et al. 2002) even when insurance coverage is the same (Trivedi et al. 2006). Mexican Americans are less likely to be aware of or to be treated for dyslipidemia (Hertz, Unger, and Ferrario 2006).

Patterns of disparities in tobacco dependence differ from that of hypertension and hyperlipidemia. The prevalence of tobacco use in African Americans and whites is similar, with lower prevalence among Hispanic and Asian populations, but with smoking rates approaching 40%-50% in some populations of Native Americans and Alaskan natives. African Americans and Hispanics are less likely to be offered assistance with cessation (Houston et al. 2005; Lopez-Quintero, Crum, and Neumark 2006) and more likely to suffer higher rates of tobacco-related morbidity, including higher rates of lung cancer.

Physical inactivity is most prevalent in Hispanic and African American populations, especially among females. Differential rates of inactivity begin to manifest in childhood and widen during adolescence (Kimm et al. 2002), with pregnancy, tobacco use, and greater degrees of obesity further associated with inactivity (Genkinger et al. 2006). Overviews of correlates of physical inactivity in underserved populations have recently been published (Coble and Rhodes 2006; Yancey, Ory, and Davis 2006).

Differentials in Coronary Disease Procedures and Therapies

Differentials in the prevalence of cardiovascular conditions across racial and ethnic groups (table 2) might be attributed mainly to risk factor variation (Hozawa et al. 2007). However, the breadth and degree of racial and ethnic variations in access, management, and outcomes of established cardiovascular disease goes beyond that which can be explained by risk factor variation alone (Kindig and Thompson 2003; Mayberry, Mili, and Ofili 2000). Procedural differentials have been documented for nearly every area of cardiac diagnosis and care (Allison et al. 1996; Gauri et al. 2006; Hannan et al. 1999; Mickelson, Blum, and Geraci 1997; Peterson et al. 1994; Peterson et al. 1997; Pezzin, Keyl, and Green 2007; Schulman et al. 1999; K. A.

Williams and Pokharna 2001;Yarzebski et al. 2004). Differentials in care persist even when the clinical appropriateness of the cardiac procedure (Epstein et al. 2003;Rathore et al. 2004;Vaccarino et al. 2005), socioeconomic status, and/or insurance are accounted for in analyses. As a related issue, communities of color tend to lag behind as new therapies are introduced (NCHS 2006;Sonel et al. 2005). Patient preference probably explains relatively little of the differentials in cardiac care (Gordon, Paterniti, and Wray 2004;Groeneveld et al. 2006;Kressin et al. 2004;Redberg 2005;Whittle et al. 1997).

Differences in residence and access to higher quality specialists (Ayanian et al. 2002; Fiscella and Franks 2006; Grimshaw et al. 2005; Konety, Vaughan Sarrazin, and Rosenthal 2005; LaVeist et al. 2003; Mehta et al. 2006) and health care organizations (Angelelli, Grabowski, and Mor 2006; Bach et al. 2004; Barnato et al. 2005; Doescher et al. 2001; Kressin 2005; Liu et al. 2006; Tonne et al. 2005; D. R. Williams and Collins 2001) are likely contributors to cardiac disparities. African Americans and Hispanics appear to receive vascular care at health care organizations that perform a lower volume of procedures and have higher risk-adjusted mortality after coronary artery bypass graft surgery (Trivedi, Sequist, and Ayanian 2006) and acute myocardial infarction (MI; Skinner et al. 2005).

Mortality and morbidity gaps appear to widen further in studies that look at longterm cardiovascular outcomes after hospitalizations or procedures (Bhandari et al. 2005; Chen et al. 2005; Horner et al. 2003; Konety, Vaughan Sarrazin, and Rosenthal 2005; Skinner et al. 2005; Spertus et al. 2005). This may be due, in part, to the fact that African Americans and Hispanics are 10%-40% less likely to receive outpatient secondary prevention therapies for cardiovascular disease (Ajani et al. 2006; Brown, Shepard, et al. 2005; Rathore et al. 2004; E. C. Schneider, Zaslavsky, and Epstein 2002; Virnig et al. 2002). Financial barriers are also much more likely in African American and Hispanic cardiac patients and are strongly associated with persistent angina and rehospitalization (Rahimi et al. 2007).

Disparities in HF

HF is the leading cause of medical admission in the Medicare population, and HF admission occurs significantly more in African Americans than whites, though the higher prevalence in African Americans is less clearly attributable to race once hypertension and other risk factors are controlled for (Brown, Haldeman, et al. 2005; He et al. 2001). Mortality after HF admission appears to be equal or lower in African Americans relative to whites (Agoston et al. 2004; Deswal et al. 2004; Thomas et al. 2005). However, once advanced left ventricular dysfunction develops, mortality in African Americans may be greater (Dries et al. 1999), and functional limitation in survivors appears relatively greater in African Americans (Vaccarino et al. 2002).

Nationally, inpatient quality of HF care appears similar between blacks and whites in some (Lafata et al. 2004; Rathore et al. 2003) but not all studies (Ahmed et al. 2003; Ayanian et al. 1999). When considering disparities in HF care, it is important to realize that the current understanding of the optimal treatment for HF for communities of color is evolving (Dries et al. 2002; Kahn and Sankar 2006; A. L. Taylor et al. 2004; Yancy et al. 2001).

New Contribution

The overall impression left by the preceding literature is that disparities in the quality of cardiovascular care exist, and they may partially explain disparities in cardiovascular outcomes. Disparities in cardiovascular care for communities of color have been attributed to factors such as limited access to care, limited health literacy, and education (Daumit et al. 1999; Fiscella and Franks 2004; Parker, Ratzan, and Lurie 2003; Sudore et al. 2006), delays in seeking cardiac care (Moser et al. 2006), inadequate cultural competency of providers (T.

Fisher et al. 2007 [this issue]; R. L. Johnson et al. 2004; S. L. Taylor and Lurie 2004), provider stereotyping of communities of color (van Ryn et al. 2006), mistrust of the health care system by patients of color (Armstrong et al. 2006; Call et al. 2006; Jacobs et al. 2006; Price et al. 2005; Ranjit et al. 2007), and racism of providers (Fiscella and Williams 2004; Wyatt et al. 2003). Such factors are thought to operate synergistically (Mehta et al. 2006; D. R. Williams 2005).

While the preceding discussion might temper expectations of success, there is, in fact, a great deal of research that has been devoted to evaluating cardiovascular interventions for communities of color in the past decade, and some of this work has begun to bear fruit. The results of these interventions are often scattered in the cardiology, prevention, public health, and general medicine literature and typically are limited to a single cardiac risk factor or condition. A comprehensive review that brings together these interventions may help to identify flaws in the design of current studies, illustrate what risk factors and conditions have received limited attention, identify interventions that have shown particular promise, and provide direction for future research.

We set out to conduct such a review and bring together interventions addressing risk factor control (i.e., hypertension, hyperlipidemia, physical inactivity, tobacco use) and management of representative cardiovascular conditions (i.e., coronary artery disease and HF). We consider interventions specifically designed to reduce racial/ethnic disparities in care but also consider interventions designed simply to improve care in populations of color. We organize interventions by risk factors/conditions but also by the target of intervention (e.g., patient vs. provider/health care organization) using the conceptual model described earlier in the supplement (Chin et al. 2007 [this issue]).

Method of Literature Search, Quality Rating, and Abstraction

We searched multiple electronic databases (MEDLINE, the Cochrane Register of Controlled Trials, EMBASE, EPOC, Research and Developments Resource Base in CME, CINAHL) for evaluation studies of interventions published from 1995 to 2006 and designed to improve delivery of care addressing hypertension, lipid abnormalities, tobacco use, sedentary behavior, coronary artery disease, and HF for adult patients of color. Patients of communities of color were either the focus of studies, representing more than 50% of study subjects, or subgroups of larger trials, where data for ethnic/racial subgroups were specifically described. We required that interventions be based in North America and have a connection with a health care setting.

For the MEDLINE search, we used prespecified Medical Subject Headings (MeSH) and keywords to identify evaluation studies (Evaluation Studies, Clinical Trials [PT]) designed to address health care delivery (Health Services Accessibility, Delivery of Health Care, Integrated; Quality of Health Care) among communities of color (African Continental Ancestry Group; African Americans; Hispanic Americans; Mexican Americans; Indians, North American; Inuits; Asian Americans). This common search was systematically combined with searches using MeSH terms for each of the cardiac conditions—heart failure (Heart Failure, Congestive) and coronary artery disease (Myocardial Ischemia, Coronary Arteriosclerosis, Myocardial Revascularization, Coronary Artery Bypass)—and their related risk factors of smoking cessation (Tobacco Use Cessation, Smoking Cessation), sedentary behavior (Exercise), hypertension (Hypertension), and hyperlipidemia (Cholesterol). This generated six separate electronic searches. The details of non-MEDLINE searches are available by request.

We supplemented the search with a hand search of the past 2 years of issues from selected journals with a high likelihood of publishing interventions related to cardiovascular health (*Academic Medicine*, *American Journal of Preventive Medicine*, *Archives of Pediatrics and*

Adolescent Health, Circulation, Ethnicity & Disease, Health Services Research, Journal of the American Medical Association, Journal of General Internal Medicine, Journal of Health Care for the Poor and Underserved, Journal of Transcultural Nursing, Medical Care, Milbank Quarterly, and New England Journal of Medicine). The hand search also included an examination of reference lists from initially identified trials and recent review articles on the topic of health disparities. The hand search was coordinated among all five authors.

We excluded reported interventions that were not connected to health care organizations, such as schools and churches, but did include community interventions with nurses and community health workers when they incorporated some degree of formal medical collaboration. We integrated multiple study designs including time series studies, before/after studies, nontraditional comparison studies, and controlled trials. The results of the initial electronic search and hand search for all six conditions identified 5,943 articles. Two authors independently reviewed the identified articles for possible inclusion; disagreements were resolved by consensus. A total of 382 studies met our initial inclusion criteria based on information in abstracts. After further review of full-length manuscripts, 62 studies were identified that met all inclusion criteria.

Data abstraction was conducted by four of the reviewers. All reviewers were given formal instruction on data abstraction. Using an abstraction form adapted from Zaza and colleagues (2000), we collected information on intervention characteristics, patient demographics, outcomes, results, and study duration. For each search we focused on specific processes of care of interest and documented baseline and follow-up. Studies were also rated on their quality, using a scale of study quality developed by Downs and Black (1998), intended for use with randomized and nonrandomized intervention studies. We utilized the first 26 criteria for this scale, which gave a maximum score of 27.

Results

Interventions to Reduce Racial and Ethnic Disparities

Interventions can be grouped in a number of different ways, including by mechanism, clinical setting, scope of intervention, specific vascular disease or risk factor, racial or ethnic group, and methodological parameters and quality (Committee on Quality Health Care in America: Institute of Medicine 2001; Horner et al. 2004; Kressin 2005; Matson Koffman et al. 2005; D. R. Williams and Neighbors 2001).

We grouped interventions by the vascular risk or condition they address and by the predominant target of the intervention: patient and family, provider and health care organizations, or multitarget interventions. We found 62 interventions in all, 27 addressing hypertension, 9 hyperlipidemia, 18 tobacco use, 8 physical inactivity, 1 post-MI care, and 7 HF, with some interventions addressing multiple targets (see figure 1).

Hypertension Results

Patient and family interventions in hypertension—Of the 27 intervention studies concerning hypertension (table 3), 9 were focused on the behavior of patients or families, and these addressed nonpharmacologic approaches to hypertension including salt restriction (5), diet (2), exercise (1), and stress reduction (1), with some studies addressing multiple approaches. The Trial of Nonpharmacologic Interventions in the Elderly (TONE) evaluated the impact of a 4-month educational program led by a dietician among patients with hypertension under fair control on one medication. The intervention led to improvements in blood pressure (BP) with a reduction in the proportion of patients with average BP more than

150/90 mm Hg (59% of the intervention group compared to 73% of the control group; Appel et al. 2001).

The Trials of Hypertension Prevention (TOHP) studies of the 1990s explored multidisciplinary interventions on the diet and behavior of patients with diastolic BP of 80-89, with the involvement of dietitians, psychologists, and health counselors. Salt restriction, weight loss, and stress reduction were emphasized. At 36 months systolic pressure fell about 2 to 3 points in the diet and salt intervention groups (salt restriction alone, weight loss alone, and both combined). The incidence of formally diagnosed hypertension (>140/90) was significantly lower in the intervention groups (Stevens et al. 1993; TOHP 1992; TOHP2 1997), but in a later phase in a single center, only 21% of participants were able to achieve the target salt reduction (Kumanyika et al. 2005).

The Dietary Approaches to Stop Hypertension (DASH) diet held sodium and weight constant while testing a low-fat diet rich in fruits and vegetables in a hypertensive population (Appel et al. 1997). This intervention diet resulted in a daily intake of potassium nearly 3 g higher than in the control diet. This combination study diet was significantly more effective in the study's 275 African American patients than for other ethnic/racial groups, reducing systolic BP by nearly 6.8 mm Hg (Svetkey et al. 1999). In a subsequent DASH-Sodium subgroup analysis, salt restriction was found to be especially effective in African American women (Bray et al. 2004). The PREMIER trial has been reported in several articles (Appel et al. 2003; Elmer et al. 2006; Svetkey et al. 2005) and compared a comprehensive lifestyle approach to established risk factors (weight, salt, alcohol, and exercise) to an intervention that added DASH diet counseling. It is important to note that the DASH diet was prepared in a research kitchen, while the PREMIER trial diet was prepared by patients in their homes. The PREMIER intervention marginally affected BP, with optimal BP achieved in 30% of those who received counseling that addressed established risk factors compared to 35% of those receiving this counseling plus the DASH diet counseling. Ard and colleagues studied a 1,000 kcal diet based on culturally targeted (T. Fisher et al. 2007) recipes, recipes that might appeal to the practices of African Americans, and found a 4-point fall in systolic pressure after 8 weeks (Ard, Rosati, and Oddone 2000), while a food card, audiotape, and group class approach did not significantly improve either BP or lipids (Kumanyika et al. 1999). Programmed telephone messages designed to improve hypertension knowledge and medication adherence also had no effect (Walker 2000).

R. H. Schneider and colleagues (1995) compared the effect of transcendental meditation in 127 African Americans with hypertension receiving care at an urban community health center. After a 3-month intervention, systolic BP fell about 5 points, and meditation patients had reduced requirements for BP medication relative to those in two control groups, one receiving progressive muscle relaxation and another receiving simple health education. Other studies have not supported an association between stress reduction and BP control (TOHP 1992).

Kokkinos and colleagues (1995) compared a program of moderate-intensity exercise combined with BP medication and a program of BP medication alone in 46 African American men followed for 16 weeks and demonstrated a 5-point improvement in diastolic BP.

In summary, for patient and family interventions, (1) sodium restriction yields important benefits, especially in African Americans, at least with use of study diets; (2) less evidence is available for the benefits of exercise, weight loss, and psychosocial interventions.

Provider and care delivery interventions in hypertension—Provider and care delivery interventions for hypertension have received more research attention than patient interventions. We found 18 interventions, many with overlapping multidisciplinary approaches

in their design, including community-level components. The studies explored patient outreach (4), clinic reorganization (3), nurse interventions alone or in collaboration with community health workers (8), and pharmacist interventions (4). General clinic outreach produced mixed results. A postcard strategy was unsuccessful in encouraging follow-up appointments in an urban walk-in clinic (Ahluwalia, McNagny, and Kanuru 1996). By contrast, enhanced tracking and follow-up services by community health workers in 421 low-income patients (79% African American) improved clinic attendance from 47% to 65% compared to usual care (Krieger et al. 1999). Fedder and colleagues (2003) demonstrated a 50% reduction in emergency room visits after employing community health workers to work with a group of diabetic hypertensive patients. A small subgroup analysis in African Americans found a 9.6-mm Hg BP reduction associated with a home telephonic BP monitoring service that generated weekly electronic reports to the primary care physician and patient (Rogers et al. 2001).

Among health care organization interventions, chart-based reminders failed to improve physician adherence to hypertension guidelines in a Veterans Administration setting (Sanders and Satyavolu 2002), while overall organizational change in a clinic's approach to hypertension appeared to produce significant improvements in BP control in two other studies. In the first clinic reorganization study, a clinicwide program focused on improving the quality of care processes in cardiovascular disease was successful in an academic family practice clinic in the southeastern United States, for both white and African American patients (Jenkins et al. 2006). Likewise, a multidisciplinary intervention in the hypertension clinic of an urban public hospital provided individual therapeutic tailoring with doctors, pharmacists, nurses, and nutritionists. At 6 months 58% of patients achieved target BP, but sustaining the intervention proved challenging in this "safety-net" setting, with nearly a quarter of patients lost to follow-up (Tao et al. 2003).

Eight interventions that utilized nursing personnel in care management had generally successful results (Artinian, Washington, and Templin 2001; Becker et al. 2005; Dennison et al. 2007; Haskell et al. 2006; Hill et al. 1999; Hill et al. 2003; Lenz et al. 2004; D. M. Levine et al. 2003; Tobe et al. 2006) with several of these combining nursing and community health personnel (Becker et al. 2005; Dennison et al. 2007; Hill et al. 1999; Hill et al. 2003; D. M. Levine et al. 2003). In a small pilot study of African American patients, a nurse telemonitoring program was compared to nurse-managed community-based monitoring with both interventions associated with 10-25-mm Hg improvements relative to usual care (Artinian, Washington, and Templin 2001). In a study addressing a Hispanic population, primary care patients were randomly assigned to either a nurse practitioner- or physician-managed practice in New York City. Equal outcomes in health status, physiologic measures, and patient satisfaction occurred for 2 years (Lenz et al. 2004). Hill and colleagues performed two studies specifically focused on urban, young African American men with hypertension. The first found no significant differences in BP control at 12 months (Hill et al. 1999). The second tested a nurse practitioner/community health worker/physician approach in 309 men followed for 4 years and showed a modest but significant improvement in BP control and a more robust improvement in left ventricular mass (Dennison et al. 2007; Hill et al. 2003). Nurses working with indigenous community health workers were also effective in improving BP control in one community academic health center partnership (D. M. Levine et al. 2003). A recent study used homecare nurses and predefined hypertension medication algorithms in 95 Canadian First Nation patients with both hypertension and diabetes. Systolic BP fell 24 points, though albumin excretion was not improved (Tobe et al. 2006).

Becker and colleagues (2005) and Haskell and colleagues (2006) both evaluated interventions designed to modify multiple cardiac risk factors. Becker and colleagues evaluated an intervention that deployed a nurse practitioner/community health worker in an attempt to address multiple cardiac risk factors in African American families with a history of premature

coronary disease. Compared to enhanced primary care, community-based care resulted in a twofold better low-density lipoprotein (LDL) reduction and BP control and thus a substantial reduction in global coronary heart disease risk (Becker et al. 2005). Finally, Haskell and colleagues evaluated a multitarget intervention delivered by nurses and dieticians to a medically underserved, predominantly Hispanic population and demonstrated better BP and lipid control compared to a usual-care control population (Haskell et al. 2006).

The four pharmacist interventions varied in the degree to which pharmacists were involved in care. In addition to the study by Tao et al. discussed in the clinic reorganization section, a second study had pharmacy staff join residents in an internal medicine continuity clinic where they assessed side effects, patient beliefs, adherence, drug coverage, and hypertension knowledge. The authors demonstrated a 12-point drop in the intervention group, compared to 2 points in the control clinics (Erickson, Slaughter, and Halapy 1997). Vivian et al. reported a study from a Philadelphia Veterans Affairs program in which a pharmacist provided monthly counseling, drug changes, and dose adjustments. At the end of 6 months, 81% in the intervention group were controlled to <140/90 mm Hg compared to 30% of the physician usual-care group (Vivian 2002). Finally, a small study involving African American renal transplant patients demonstrated markedly better BP control when the clinical pharmacist was assigned to perform medication reviews and troubleshooting interactions and to provide recommendations (Chisholm et al. 2002).

In summary, (1) general clinic reorganization interventions appeared to produce promising results on BP control but were very few in number; (2) nurse-led interventions were common and produced beneficial effects on BP control; (3) pharmacist and community health worker interventions were generally effective, but the total number and size of studies were both small.

Hyperlipidemia Results

Patient and family interventions in lipids—Lipid interventions were the subject of nine studies, four of which focused on the patient and/or the family and five of which focused on the provider and/or the health care organization (table 4). Of the lipid interventions focused on the patient and/or family, two tested moderate-intensity aerobic exercise, one in African American men (Kokkinos et al. 1998) and another in 389 Mexican American women (Poston et al. 2001). Neither showed effects on lipid primary end points; attrition was high in the latter study, especially in younger and less educated women. Another trial explored diet in conjunction with increased activity. This randomized modified crossover trial of a 1,000 kcal diet with culturally tailored recipes and exercise attitude modification in African American patients demonstrated a modest drop in cholesterol from 199 to 185 mg/dL, with little change for controls (Ard, Rosati, and Oddone 2000). The remaining trial compared full instruction on cardiovascular nutrition to a self-help group and showed significant improvements in LDL cholesterol in both groups (Kumanyika et al. 1999).

Provider and health care organization interventions in lipids—Overall, five studies were identified, and these studies had mixed results. The first intervention asked primary care physicians to give 5- to 10-min dietary counseling sessions with referral to a local dietitian if the LDL cholesterol remained elevated and showed only modest short-term effects on cholesterol levels (Keyserling et al. 1997). In the second, a pharmacist intervention assessed a cardiovascular risk reduction program in a Native American population in New Mexico and demonstrated a statistically significant but clinically modest gain in HDL (Burden et al. 2002). The three remaining studies were multitarget cardiovascular risk factor interventions, all of which have been mentioned earlier in the section on hypertension, that successfully improved lipid levels (Becker et al. 2005; Haskell et al. 2006; Jenkins et al. 2006). The first intervention involved clinic reorganization (Jenkins et al. 2006), while the latter two involved

nurses and or community health workers in care management (Becker et al. 2005; Haskell et al. 2006).

In summary, interventions designed to improve lipid levels in communities of color have had mixed results; however, several interventions intended to bring about overall improvements in cardiovascular risk factors via health care organization-level interventions or care management with nurses have successfully improved lipid levels.

Tobacco Results

In contrast to the literature on lipid lowering, studies specifically addressing tobacco use by communities of color were relatively common and of higher quality, with 13 of the 18 studies we identified being randomized controlled trials (table 5). Twelve of the studies evaluated interventions targeted at patients, all of which included counseling by a health care provider or health educator. Three studies targeted primarily health care provider behavior, and 3 studies were multicomponent, targeting both the patient and provider. In 14 studies African Americans made up the majority of the participants. Only 1 study had significant numbers of Hispanic participants, and only 1 study included Native Americans, despite their markedly higher prevalence of tobacco use relative to other racial and ethnic groups (table 1).

Studies varied in their approach to validating the presence of tobacco cessation and in their duration of follow-up. Studies with more scientifically rigorous (biochemically validated) and longer term (6 or 12 months) definitions of tobacco cessation tended to show smaller benefits in comparison to studies reporting shorter term and self-reported rates of tobacco cessation.

Patient and family interventions in tobacco—In this category of tobacco cessation interventions, two randomized double-blind placebo-controlled trials by Ahluwalia and colleagues explored the value of tobacco cessation medication use in African Americans (Ahluwalia, McNaghy, and Clark 1998; Ahluwalia et al. 2002). The most effective intervention identified was a combination of eight counseling sessions combined with sustained-release bupropion and resulted in a cessation rate of 21% at 6 months (Ahluwalia et al. 2002). Participants in the transdermal nicotine patch study received written material and extensive education on proper use of the patch. Quit rates at 6 months were 17% for the patch group and 11.7% for the placebo group, though after adjustment for baseline differences these were not significantly different (Ahluwalia, McNaghy, and Clark 1998). Pharmacologic interventions, especially when combined with counseling, appear to be the most effective interventions.

Apart from pharmacologic interventions, investigators have attempted to evaluate interventions that are linked to the community. Becker and colleagues evaluated a multicomponent community-based intervention to decrease cardiovascular risk of siblings of African American patients with premature cardiovascular disease (Becker et al. 2005). This complex study used a specialized community-based nonclinic site staffed by a nurse practitioner. Cessation medications were provided at no cost, as were written educational materials. At 1 year there was a 16% decrease in smoking in the intervention group and a 7% decrease in the control group.

Cessation interventions designed to be culturally competent have had mixed results. A study of hospitalized African American smokers, which included physician-delivered stage-specific advice, individualized counseling, self-help material tailored to African American smokers, and telephone follow-up, resulted in a significant advance in readiness to quit stage, but cessation rates were not reported (Davies et al. 2005). Nevid and Javier studied 93 Hispanic smokers, with the intervention group receiving a complex intervention involving two hour-long weekly group sessions led by Hispanic mental health workers, a culturally targeted video, and an assigned “buddy.” At 12 months the quit rates were the same in both groups, about 8%

(Nevid and Javier 1997). McBride and colleagues assessed the effectiveness of adding information on a genetic biomarker linked to higher cancer risk in patients of African ancestry to culturally targeted cessation advice but found that this did not influence quit rates (McBride et al. 2002).

By contrast, Lipkus, Lyna, and Rimer (1999) evaluated a series of three interventions on quit rates and showed higher quit rates when health care provider prompts were combined with culturally targeted print materials. Royce and colleagues tested an intervention that included 2-3 hr of training in tobacco cessation for physicians and patient enrollment in a culturally targeted cessation program. This program used video and a series of incentive programs to encourage cessation and resulted in a 7-month quit rate of 21% (Royce et al. 1995). More recently, Nollen and associates completed a large study of African American light smokers that explored the value of a culturally targeted health educational intervention compared with motivational interviewing, with and without nicotine gum. Overall cotinine-verified quit rate was 15% at 6 months. Health education emphasizing the addictive nature of nicotine, health consequences of smoking, and concrete approaches to a quit plan and triggers were more than twice as effective as motivational interviewing. Low-income subjects had a reduced chance of success, with nicotine gum showing only a nonsignificant trend toward benefit (Nollen et al. 2006).

Finally, several interventions have specifically targeted young mothers and pregnant women with the added goal of improving the health of their children. One study evaluated an intervention targeted at mothers of young children. The intervention group received a motivational message from a health care provider, a quit smoking guide, and a 10-min motivational interview with a nurse or study coordinator. Self-reported abstinence rates at 1 year were 14% in the intervention group and 7% in the control group (Curry et al. 2003). Two additional studies looked at smoking cessation interventions targeted at pregnant women. A smoking cessation program embedded in a complex multidisciplinary program to decrease rates of low birth weight and preterm labor showed no significant difference in rates of quitting compared to usual care (Klerman et al. 2001). Another program that involved counseling, a self-help guide, a booster postcard, and an incentive contest targeted at pregnant African American and Hispanic women attending a Women, Infants, and Children Clinic showed a significant difference in abstinence rates at 6 weeks postpartum (25% intervention group vs. 12% control group; Lillington et al. 1995). Attempts were made to verify salivary cotinine levels but patient follow-up was poor. Women who continue to smoke despite being pregnant or having young children may be especially refractory to interventions aimed at cessation.

Provider and health care organization interventions in tobacco—Three studies of interventions to reduce tobacco use were directed primarily at individual providers; these focused interventions were largely ineffective. A randomized study by Allen, Pederson, and Leonard (1998) of an educational program for physician trainees designed to promote recognition and treatment of tobacco use in an urban public hospital clinic showed no significant improvement in quit rates, as verified by cotinine levels at 12 months. Another study that provided attendings and trainees with written materials and lectures did not improve rates of cessation counseling (Gemson et al. 1995). A study of adding smoking status as a vital sign increased the rates at which physician trainees asked about smoking, advised patients to quit, and arranged follow-up, but not their rate of offering advice on cessation techniques (Ahluwalia et al. 1999).

Compared to provider interventions, the multicomponent, clinicwide tobacco cessation programs had slightly more promising results, although this was not uniform across studies. Manfredi and colleagues evaluated a tobacco cessation program set in public health clinics in Chicago that consisted of provider-delivered advice and a signed contract, waiting room posters

with a cessation message, a written booklet, and a patient-specific follow-up letter with or without a 15-min motivational counseling session. Quit rates at 5 to 8 weeks were 14.5% in the intervention clinics and 7.7% in the usual-care clinics (Manfredi et al. 1999). E. Fisher and colleagues evaluated a tobacco cessation program in the two federally qualified health centers in Saint Louis. The multicomponent program consisted of using smoking as a vital sign, electronic tracking of smokers, providing appropriate stage of quitting materials, training of and feedback to provider teams, medication cost reimbursement, and use of neighborhood resources. The clinic that offered the smoking cessation program showed increased documentation of smoking status and readiness to quit, though quit rates were not reported (E. Fisher et al. 2005). K. M. Johnson and colleagues studied the Doctors Helping Smokers program, which was implemented in two urban clinics serving Native Americans (K. M. Johnson et al. 1997). The program included screening all patients for tobacco use, alerts attached to charts, clinician-delivered smoking cessation messages, reinforcement delivered by staff, and phone follow-up by an outreach worker. Cotinine-verified 12-month quit rates were low and the same in both groups (6.7%).

In summary, (1) patient-directed pharmacologic interventions for smoking cessation have been shown in African Americans to be effective especially when combined with counseling; the same interventions have been less frequently studied in other minority groups. (2) Culturally targeted health education interventions have had mixed results, with heterogeneity in the study populations and interventions limiting the conclusions that can be drawn. (3) Clinicwide tobacco cessation programs may be more effective compared to isolated provider-targeted education programs.

Physical Inactivity Results

Eight studies described interventions to increase physical activity in communities of color (table 6). Of these studies, five included significant representation of African Americans (Banks-Wallace and Conn 2005; Gemson et al. 1995; Newton and Perri 2004; Rimmer et al. 2002; Yanek et al. 2001), two of Mexican Americans/Hispanics (Lorig, Ritter, and Gonzalez 2003; Poston et al. 2001), one of Alaskan Native/American Indians (Witmer et al. 2004), and one of Asian Americans (Gemson et al. 1995). Three of the eight studies were randomized controlled trials (Lorig, Ritter, and Gonzalez 2003; Poston et al. 2001; Yanek et al. 2001), and three were small pilot studies (Banks-Wallace and Conn 2005; Newton and Perri 2004; Witmer et al. 2004).

A variety of interventions utilized community-level components, including church-based interventions, home-based phone counseling and mail interventions, community-based group sessions utilizing motivational interviewing techniques (some incorporated cultural targeting), physician training in counseling, physician-assisted standard patient counseling, and self-motivation-based interventions. Most of the studies consisted of women only, with the exception of the studies by Newton and Lorig, which each had about 20% male subjects.

All of the studies had an intervention period of at least 3 months (Witmer et al. 2004) with the average follow-up period ranging between 6 and 12 months. In most of the studies, there was a high drop-out rate with reduced follow-up rates (32%-67%), with only one study recording a low (12%) drop-out rate (Poston et al. 2001). Three studies (Lorig, Ritter, and Gonzalez 2003; Newton and Perri 2004; Yanek et al. 2001) used general activity assessments such as the 7-day Physical Activity Recall questionnaire, with the remainder assessing walking behavior by self-report or pedometer readings.

The effectiveness of interventions was mixed. Four studies (Banks-Wallace and Conn 2005; Gemson et al. 1995; Poston et al. 2001; Yanek et al. 2001) found marginal or no statistically significant impact. Some of the studies that did not show a statistical difference cited intergroup

contamination as a possible reason. For example, in the study conducted by Poston et al. (2001), the intervention group started off with statistically significant lower activity levels at baseline, suggesting randomization failure. Of note, interventions that incorporated culturally targeted and faith-based counseling themes did not appear to produce significant differences in physical activity in comparison to standard counseling methods (Newton and Perri 2004; Poston et al. 2001; Yanek et al. 2001). Physician education to improve exercise counseling was also ineffective (Gemson et al. 1995).

On the other hand, four studies demonstrated a positive effect on physical activity for patients of color (Lorig, Ritter, and Gonzalez 2003; Newton and Perri 2004; Rimmer et al. 2002; Witmer et al. 2004). Why these studies were successful while others were not is not entirely clear. Three of the interventions utilized nonphysician counselors in implementing behavioral education (Lorig, Ritter, and Gonzalez 2003; Newton and Perri 2004; Witmer et al. 2004); however, many of the previously described negative studies used similar intervention designs. The intervention by Lorig et al. is distinct in that the intervention was led by patient peers. That study is also notable for differences in patient behavior at the 1-year mark well after the intervention had ended at 6 weeks (Lorig, Ritter, and Gonzalez 2003). The study by Rimmer et al. (2002) evaluated a structured exercise training program in a majority African American population with chronic disease conditions and disabilities. All participants were able to adhere to the exercise program, and despite the patients' disabilities, there were no side effects related to exercise. The authors cited removal of cost and transportation barriers and close followup by a highly motivated staff as reasons for the strong adherence.

In summary, interventions designed to increase physical activity have had mixed results and have been marked by high drop-out rates. While some study results are particularly promising, there are too few studies in this area to draw definitive conclusions regarding the ideal intervention to increase physical activity in communities of color.

Acute and Postacute Coronary Artery Disease Results

We found no interventions that directly addressed the care of acute coronary disease. We found only one study of post-MI care (Schneiderman et al. 2004). In this study, investigators evaluated a psychosocial intervention that attempted to address depression and low perceived social support among patients who had had recent MIs. Patients were followed for a mean of 2.4 years. The investigators found that there was a significant reduction in the outcome, cardiac death or nonfatal MI, among white men, but no such benefit for men or women of color (Schneiderman et al. 2004).

In summary, there are no studies describing attempts to improve acute coronary heart disease care. The one study of post-MI care of depression and social support was not effective in communities of color.

HF Results

Overall, seven reports met the review's criteria of interventions to improve the quality of care for patients with HF (table 7). Most of these involved HF care management programs with multiple components including patient education, frequent phone follow-up, patient self-management skill development such as checking daily weights, and oversight by a cardiologist and/or the patient's primary care provider. A key educational message consistent in most of the interventions was the early recognition of symptoms and signs of fluid overload and prompt adjustment of diuretic dose.

Four of the randomized controlled trials used interventions with specialized nurses and frequent phone follow-up to reduce rates of admission for HF (Benatar et al. 2003; Naylor et al. 2004;

Rich et al. 1995; Sisk et al. 2006). Each of these interventions used nurse-led care management, patient education, and facilitated follow-up to identify early signs of fluid overload and implement medication changes, often over the phone. The four interventions varied in the exact nature of how vital signs of HF patients were ascertained and the extent to which other health care professionals were involved. Despite these differences, the interventions were largely successful in reducing rehospitalizations for HF. The study by Benatar and colleagues (2003) used transtelephonic home monitoring to measure such factors as weight and BP. Information was reviewed by trained nurses and adjustment of care plans were made by cardiologists and implemented by nurses. The study by Naylor and colleagues (2004), targeted at elderly patients, evaluated an advanced practice nurse-delivered program of education, frequent outpatient visits, and active assessment for early signs of volume overload. Rich and colleagues (1995) evaluated a multidisciplinary intervention that included intensive education and consultation with a geriatric cardiologist, dietician, and social worker. Patients were followed up with frequent home visits and telephone contacts. A recently published study by Sisk and colleagues (2006) evaluated a 12-month nurse-led program of dietary and medication counseling and education on the self-management of symptoms.

Two pre/postintervention studies evaluating nurse-led care management programs showed promising results. The first study was an evaluation of a nurse-led care management program for low-literacy patients that involved intensive education, frequent telephone follow-up, and telephone-based medication adjustment. The intervention group showed improvement in compliance with daily weights and the New York Heart Association class (DeWalt et al. 2004). The second study was conducted in a predominantly Latino population and evaluated an intervention also consisting of an educational component, care management by a nurse practitioner, and weekly follow-up. The intervention was associated with a marked reduction in hospitalization rates (O'Connell, Crawford, and Abrams 2001).

Apart from these nurse-led interventions, Artinian and colleagues (2003) evaluated a Web-based home-monitoring system that was designed to change self-care behaviors such as medication adherence, diet, and exercise. The study showed no significant difference in self-care behaviors, 6-min walk test, or functional class. Quality of life did improve in the monitoring group.

In summary, (1) HF care management programs have been found to decrease hospitalization rates; (2) successful care management programs have consisted of education, specialty nurse case management, frequent telephone follow-up with medication adjustment, and oversight by a specialist in HF and are best validated in patients with advanced HF; (3) the value of culturally tailored care and the importance of disease management in patients with mild to moderate HF remains to be demonstrated.

Discussion

In this systematic review, we describe cardiovascular interventions evaluated in populations of color since 1995. Despite thousands of studies bearing on the issue of cardiovascular racial and ethnic disparities, we found only 27 hypertension, 9 dyslipidemia, 18 tobacco use, 8 physical inactivity, 1 post-MI, and 7 HF studies formally testing interventions. Studies were often limited by small numbers, clinically modest gains, and short follow-up; demonstrations of sustainable improvement were decidedly the exception. Few interventions have been tested across the full range of cardiovascular conditions and spectrum of communities of color. Few interventions have been evaluated in multiple health care settings (Godfrey et al. 2003). Perhaps the most important limitation of the existing literature is that few studies have specifically tested interventions for their effectiveness in reducing ethnic/racial disparities in cardiovascular prevention and care. The vast majority of studies we identified during our

systematic review were studies of interventions that have been carried out in communities of color without a white subpopulation for comparison. Despite this limitation, the strengths and weaknesses of these interventions will provide valuable lessons for future efforts to reduce cardiovascular disparities. Future efforts should also incorporate findings from the quality of care interventions that have, as of yet, solely been conducted in populations with a white majority.

Lessons Learned from the Current Cardiovascular Intervention Literature

Several overarching lessons emerged from our review of interventions, crossing all cardiovascular risk factors and conditions. First, interventions have been inconsistently studied across risk factors and conditions. The most heavily studied areas have been hypertension and tobacco use; attention to these areas is appropriate given their relative health burden. The most striking deficiency in the current literature is in the area of interventions to address acute or postacute coronary artery disease management, where disparities in care have been very well documented. This deficiency may be a reflection of the fact that designing interventions for acute coronary syndromes may simply require far more resources and planning on a scale that is far larger than interventions for risk factor or chronic disease management. Specialty societies have begun important work in this area (Roe 2004). The Robert Wood Johnson Program, Expecting Success, is an example of a large-scale multihospital initiative that will specifically target disparities in acute coronary disease management (<http://www.expectingsuccess.org/index.html>).

A second lesson learned has to do with the ideal approach to improving the management of cardiovascular risk factors in primary care practice. Our review suggests that interventions in primary care should consider organization-level interventions, such as clinic reorganization, rather than provider-level interventions that attempt to change physician prescribing behaviors. While high-quality primary care may facilitate cardiac risk reduction and access to specialty care, our review has found relatively little support for physician-focused programs. Physician awareness of key prescribing messages (sodium-restricted diets for hypertension; bupropion and nicotine replacement for smoking; aspirin, beta blocker, and statins for dyslipidemia and coronary artery disease) is necessary but not sufficient for effective translation, especially in vulnerable populations. Sustaining adherence to BP and lipid medication may fundamentally depend on ensuring access to care and prescription medication (Briesacher, Limcangco, and Gaskin 2003; Burke, Dunbar-Jacob, and Hill 1997; McDowell, Coleman, and Ferner 2006; Rehman et al. 2005; Sabatine et al. 2005; Schore, Brown, and Lavin 2003).

Health care organization-level interventions, such as practice reorganization, as a strategy in improving cardiovascular care has so far shown modest effects in fostering prescribing and behavior change in primary care practice. Results from such interventions may be difficult to extricate from the attention and enthusiasm that triggered the reorganization in the first place and require careful study (de Lusignan et al. 2004; Elley et al. 2003). Ongoing research in the Prescription for Change program funded by the Robert Wood Johnson Foundation and the Agency for Healthcare Research and Quality is exploring the value of adapting three existing models (the chronic care model, Rogers' diffusion of innovation, and the Five A model) in ethnically diverse populations (Cifuentes et al. 2005). A robust set of "toolboxes" might be useful in allowing individual practices to adapt promising quality interventions to local patient populations and clinic organizational factors, something that has proved daunting even in fairly homogeneous patient populations (Shortell and Peck 2006; Solberg et al. 2000). Web-based updates in the prevalence of race- and ethnicity-specific risk factors (<http://www.prevent.org>; Satcher 2006) and the extent of health disparities (<http://www.qualitytools.ahrq.gov/disparitiesreport>) may help in the necessary business of setting prevention priorities for practices (Woolf and Stange 2006).

A third lesson learned has to do with the use of multidisciplinary health professional teams in improving cardiovascular risk factor and disease management among patients of color. Across the interventions in this review, management and outreach strategies involving nurses have shown relatively consistent effectiveness in communities of color and, by implication, may help to reduce health disparities. In our review, effectiveness of nursing interventions was best demonstrated for hypertension, HF, and several multitarget coronary artery disease prevention programs. This is consonant with other research suggesting that multicomponent nurse specialist-led intervention with physician collaboration appears most consistently effective in populations of color both in the United States and abroad (Denver et al. 2003) and in the general population (Salisbury and Fahey 2006).

In our review of interventions concerning communities of color, we found relatively few pharmacist-led interventions except in the areas of hypertension and hyperlipidemia (Fahey, Schroeder, and Ebrahim 2005), although they appeared to be relatively effective. In several studies excluded from this review because of inadequate representation by communities of color, pharmacist-led interventions have been found to improve lipid and BP levels (Lee, Grace, and Taylor 2006; Palmieri, Redline, and Morita 2005) and in one case have been found to reduce mortality rates in elderly patients (Wu et al. 2006). Such interventions deserve replication in communities of color in the United States.

Disease management has also been offered as a nurse- and sometimes pharmacist-based solution, given its potential to promote more systematic adherence to evidence-based guidelines and coordination of care between the inpatient and outpatient settings. However, this literature is heterogeneous in study population and intervention, has commonly involved managed care and for-profit settings, and has often had clinically modest effects, suggesting potential pitfalls in uncritically extrapolating this literature to disparities reduction (Ofman et al. 2004). An American Heart Association expert panel has recently published a taxonomy designed to improve the quality and comparability of disease management programs (Krumholz et al. 2006).

Potential Lessons from the General Population Intervention Literature for Specific Risk Factors and Conditions

Hypertension and diet—Hypertension remains a linchpin of efforts to reduce racial disparities in vascular disease (Yusuf 2006). Strategies to improve medication adherence have been recently reviewed, and assessing their usefulness in populations of color is a promising strategy (Hess et al. 2007; Kripalani, Yao, and Haynes 2007; T. J. Wang and Vasani 2005). Salt restriction and potassium supplementation may also have small but important benefits at the population level, especially in African American patients. Culturally targeted diets are likely to be of greater importance in the African American population. This is suggested by the lesser BP effects achieved by the PREMIER compared to DASH diets, which may well be attributed to the contrast between giving patients meals prepared in a research kitchen and teaching patients to follow a diet in their daily lives (Svetkey et al. 2005). In our review, the DASH and TONE studies as well as older literature (Brancati et al. 1996) suggest that potassium supplementation may be of value, especially in African American patients (Appel et al. 2006), with recent surveys suggesting that African Americans continue to consume more sodium and less potassium (Panel on Dietary Reference Intakes for Electrolytes and Water: Institute of Medicine 2004). While these dietary changes hold significant potential to reduce disparities in BP and thus cardiovascular disease (Cook et al. 2007; Erlinger et al. 2003), these changes may be difficult to achieve by individual patients without systemic changes in the available food supply (Dickinson et al. 2006; Kumanyika et al. 2005). Strategies to disseminate healthier culturally appealing food selection and preparation require further exploration (Pickering 2006).

Physical inactivity—Self-help or minimal assistance interventions are attractive because of their potential to influence broad segments of the population. Unfortunately, in our review, studies of self-help groups had higher drop-out rates and were at best modestly successful in increasing physical activity levels, compared with faith-based, culturally targeted, or physician-assisted counseling groups. Interventions directed at increasing the safety and acceptability of exercise in the community, interventions that target individuals across generations (Yancey, Ory, and Davis 2006), and programs addressing issues of “built environment” may hold greater promise for increasing physical activity (Mobley et al. 2006). Studies abroad have shown that primary care-delivered prescriptions for physical activity can increase patient activity and improve quality of life (Elley et al. 2003), but these studies have yet to be replicated in U.S. communities of color.

Coronary artery disease—Given the relative paucity of studies specifically examining coronary care for patients of color, studies of coronary artery disease quality improvement interventions in the general population offer important ideas for future interventions for patients of color (A. M. Clark et al. 2005). Adherence to protocol-driven care in acute coronary syndrome and acute MI within hospitals may help to enhance the quality of care for all patients (M. L. Williams, Hill, and Jackson 2006). A hospital-based discharge medicine program using statistical process control techniques was able to achieve appropriate cardiac medication-prescribing rates of more than 90% with an associated highly significant 21% reduction in 1-year mortality (Lappe et al. 2004). A computerized alert intervention incorporated academic detailing by inpatient pharmacists who responded to lab alerts of elevated troponins. This intervention increased the discharge provision of recommended secondary prevention medications (angiotensin-converting enzyme inhibitors, aspirin, beta blockers, and statins) in coronary artery disease patients (Bailey et al. 2007). A postoperative cardiac call from a nurse increased attendance to cardiac rehabilitation in Ontario from 50% to 78% (Harkness et al. 2005). Practice facilitators are health care professionals, often nurses with additional training, who assist primary care clinicians in research and quality improvement; they have shown great promise in Europe (Nagykaldi, Mold, and Aspy 2005). Given the significant degree of de facto segregation of cardiac care in the United States, disparities reduction strategies will need to benchmark, analyze, and address variations both within health care organizations (clinics, hospitals, and networks) and between health care organizations, looking for the clues and opportunities that better and worse performers can provide (Rumsfeld and Epstein 2006).

Limitations

Many of the studies we reviewed were of small sample size and confined to a single health care organization, limiting generalizability. Caution is warranted in drawing broad conclusions given the variability in the components of interventions and the intangibles of staff involvement and implementation. The review is retrospective, and publication bias in favor of successful interventions is likely, particularly given the complexity of modifying long-standing cardiac risk in vulnerable populations. Interventions that were exclusively community focused, such as faith- and school-based programs, were not addressed in this review, though some have rigorously shown positive effects in improving physical activity, weight loss, and BP control.

Conclusions

High-quality research specifically addressing reduction of cardiovascular racial and ethnic disparities is virtually nonexistent. Fortunately, there has been an accumulation of research addressing cardiac risk and conditions in vulnerable populations, and several broad themes have emerged. Interventions that have included organization-level interventions, such as multifactorial clinic reorganization and multidisciplinary teams, have had the most consistent success in improving the cardiovascular management of communities of color. Nurse-led

interventions have shown greater effectiveness in general and may be more affordable in urban and rural settings with poorer physician supply.

Building on this existing literature, greater attention to cardiovascular disparities is sorely needed and should inform ongoing national efforts to improve cardiovascular care. There are accelerating national efforts to improve the quality of care for chronic conditions in the general population through methods such as the chronic care model (Bodenheimer, Wagner, and Grumbach 2002; Cifuentes et al. 2005; Solberg et al. 2006) and pay for performance (Grossbart 2006), but whether these strategies will prove useful in reducing health disparities remains largely untested (Chien et al. 2007 [this issue]; Lavizzo-Mourey and Jung 2005). To truly fulfill the promise of modern cardiovascular care, quality improvement efforts need to identify vulnerable populations, consider and document the presence of disparities, and when found, assess the value of clearly defined interventions in reducing them. This need is most apparent for the acute management of coronary artery disease, between-visit education and adherence (Benatar et al. 2003; Rogers et al. 2001; Wu et al. 2006), and for coordination of care (Coleman et al. 2006), areas that have thus far received relatively little attention in communities of color. Our hope is that the information gathered in this review will inform researchers, policy makers, and clinicians as they strive to reduce disparities and improve the quality of care for all.

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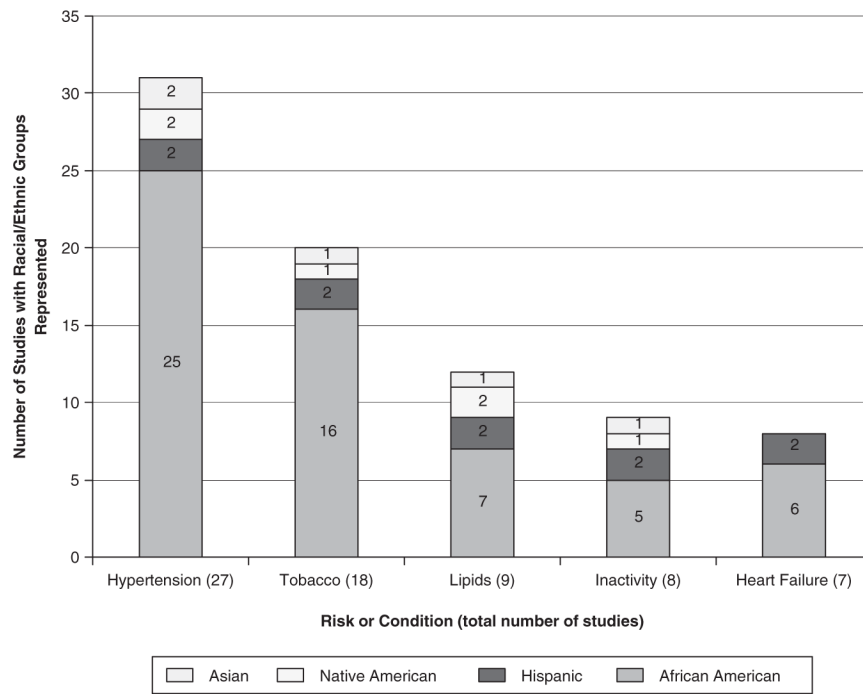


Figure 1.
Racial/Ethnic Representation in Studies

Table 1

Prevalence of Classical Vascular Risk Factors by Ethnicity/Race

Risk Factor	White	African American	Mexican American/ Hispanic	Native American	Asian Pacific Islander
Obesity (M/F) [*]	30/31	31/51	29/39	33	6
Hypertension for patients > 20 years of age (M/F) [*]	33/32	43/47	29/31	24	16
Prehypertension (F) [†]	40	32	43	39	—
Smoking prevalence (M/F) [*]	24/20	24/17	19/11	37/29	18/5
Diabetes: physician diagnosed (M/F) [*]	7/6	11/13	11/11	16	8
Prediabetes (M/F) [*]	34/22	23/21	38/23	—	—
Total cholesterol > 240 mg/dL (M/F) [*]	16/18	45/42	16/14/26	26/29	27
LDL cholesterol > 130 mg/dL (M/F) [*]	32/34	32/30	39/31	—	—
HDL cholesterol < 40 mg/dL (M/F) [*]	26/9	16/7	34/15	—	—
Physical inactivity (M/F) [‡]	18/22	27/34	33/40	24/32	20/24
Two or more cardiovascular risk factors [§]	35.5	48.7	39.6	46.7	25.9
Treatment of both hypertension and lipids, where both present [¶]	30.0	24.0	12.0	—	—
Control of both hypertension and lipids, where both present [¶]	11.0	6.5	0	—	—
Metabolic syndrome (M/F) [¶]	35/39	20/35	43/52	—	—

Note: F = female; HDL = high-density lipoprotein; LDL = low-density lipoprotein; M = male.

Source:

^{*} Rosamond et al. 2007[†] Hsia et al. 2007[‡] Kruger 2005[§] Hayes 2005[¶] N. D. Wong et al. 2006[¶] Park et al. 2003.

Table 2

Prevalence and Incidence of Vascular Conditions by Ethnicity/Race

Condition	White	African American	Mexican American/ Hispanic	Native American	Asian Pacific Islander
Cardiovascular disease, myocardial infarction or angina, %	6.2	6.2	6.9	11.2	4.7
Coronary heart disease > 20 years of age (M/F), %	9.4/6.0	7.1/7.8	5.6/5.3	7.6 (18+)	4.2 (18+)
Subclinical coronary artery calcification, % [‡]	70/45	52/37	57/35	59/42	—
Congestive heart failure (M/F), % [‡]	2.8/2.1	2.7/3.3	2.1/1.9	—	—
Stroke, years of potential life lost from stroke before age 75 [§]	173.7	475.3	195.5	202.6	187.4
Peripheral arterial disease in diabetes, % ^{//}	8.5	9.5	5.0	—	6.4
ESRD incidence (age- and sex-adjusted rates), per million [^]	262	1,009	—	537	364
Sudden cardiac death (M/F), per 100,000 ^{**}	205/138	207/141	119/147	133/77	112/67
Premature (<65 years of age) cardiovascular mortality, % of deaths from heart disease [^]	14.7	31.5	23.5	36.0	21.1

Note: ESRD = end-stage renal disease; F = female; M = male.

Source:

* Prevalence of heart disease 2007

[‡] Rosamond et al. 2007

[§] Bild et al. 2005

[§] Harris et al. 2005

^{//} Carnethon et al. 2005

^{//} U.S. Renal Data System 2006

^{**} Zheng 2002

[^] Oh 2004.

Table 3

Hypertension

Reference	Design	Intervention	n, Follow-Up, Racial/Ethnic Composition	Setting	Results: Process and Patient Outcomes	Conclusion	Target	Quality Score
Ahluwalia 1996	RCT	Reminder postcards sent to hypertensive patients	n = 107, 6 months, 95% AA	Urban hospital-based walk-in clinic	45% in postcard group and 47% of controls followed up in 10 days (p = .93)	Follow-up in severe hypertensives was poor, and a mailed postcard reminder had no effect in a walk-in setting	Provider & care delivery	16
Appel 2001	RCT	TONE: reduced Na intervention; initial individual session with dietitian, 4-month intensive phase with weekly group meetings, 3-month extended phase with biweekly meetings, and a maintenance phase; periodic individual sessions	n = 681, 28 months, 23% AA in subgroup analysis	1 of 4 TONE Clinical Centers	Primary outcome: 59% of reduced Na vs. 73% controls had BP > 150/90 (relative hazard ratio = 0.68); in AAs, the relative hazard ratio was 0.56	A reduced Na intake is a broadly effective, nonpharmacologic therapy that can lower BP and control HTN in older individuals	Patient/family	20
Ard 2000	Randomized modified crossover	Diet and exercise program included 1,000 kcal diet, culturally sensitive recipes, and address of exercise attitudes	n = 56, 8 weeks, 100% AA	Academic health center	Average weight loss 14.8 lb; BMI: 37.8 to 35.3 (p < .01); total cholesterol: 199 to 185 (p < .01); SBP and DBP decreased by 4.3 (p < .01), and 2.4 (p < .05); control group: no significant change	A culturally sensitive diet and exercise intervention can reduce BMI, cholesterol, and BP	Patient/family	12
Artinian 2001	RCT	Nurse-managed HT plus usual care or nurse-managed CBM or usual care	n = 26, 3 months, 100% AA	Family community center in urban setting	HT and CBM group had significant drops (HT > CBM) in SBP and DBP at 3 months (p < .05); little change in	Nurse case management and home/community monitoring can reduce BP	Provider & care delivery	17

Reference	Design	Intervention	n, Follow-Up, Racial/Ethnic Composition	Setting	Results: Process and Patient Outcomes	Conclusion	Target	Quality Score
Becker 2005	RCT	Community-based multiple risk factor intervention on CV risk in black families with a history of premature coronary disease; CBC group received NP-led, community-based multicomponent education and management intervention compared to EPC	n = 364, 1 year, 100% AA	Primary care and nonclinical community sites	usual-care group CBC group was two times more likely to achieve goal levels of LDL cholesterol and BP compared with the EPC group (95% CI: 1.11 to 4.20 and 1.39 to 3.88, respectively)	Multifaceted NP-directed community-based intervention can improve HTN, lipids, and tobacco cessation rates in a high-risk population	Provider & care delivery	18
Chisolm 2002	RCT	Clinical pharmacist performing patient medication reviews, with emphasis on preventing or resolving medication-related problems and providing medication recommendations	n = 23, 1 year, 100% AA	Academic renal transplant clinic	Mean SBP significantly lower in the intervention group at second (138 vs. 169), third (136 vs. 165), and fourth (145 vs. 176) quarters of study ($p < .05$); mean DBP lower in intervention group at second (76 vs. 85) and fourth quarters of study ($p < .05$) Significant improvement in SBP 157 to 145 in intervention group only ($p = .001$); SF-36 physical functioning domain ($p = .03$) in intervention group without	Pharmacist medication review and instruction improved BP control in renal transplant patients	Provider & care delivery	21
Erickson 1997	RCT	Pharmacist preclinic counseling on HTN, drug and nondrug management, compliance, and recommendations to MD	n = 80, 5 months, 89% AA	Urban university-affiliated internal medicine clinic		Pharmacist education improved BP control in this setting	Provider & care delivery	19

Reference	Design	Intervention	n, Follow-Up, Racial/Ethnic Composition	Setting	Results: Process and Patient Outcomes	Conclusion	Target	Quality Score
Fedder 2003	Retrospective comparison study	CHW impact on health care utilization of patients with DM with/without HTN	n = 117, 1 year, 100% AA	Urban Medicaid population	change in HTN-specific scale At 2 years, ER admissions decreased 53% (p = .02)	CHW-implemented HTN treatment program decreased emergency room use	Provider & care delivery	10
Haskell 2006	RCT	Multifaceted disease management intervention using team case management	n = 148, 1 year, 89% minority (57% Hispanic, 11% Asian, 7% AA)	Urban community clinics serving low-income patients	Disease management produced clinically important decreases in selected risk factors compared with usual care, including systolic BP (p < .01) and LDL cholesterol (p < .03)	Disease management targeted at high-risk patients (24% had CAD, 64% had no health insurance) can improve HTN and lipids	Provider & care delivery	21
Hill 1999	RCT	Nurse-CHW special (SI) educational-behavioral intervention, individualized counseling, monthly phone calls, home visit	n = 204, 12 months, 100% AA	Home and outpatient clinic at academic medical center	No significant differences in BP control	Nurse and CHW care consisting of multifaceted intervention did not improve BP control	Provider & care delivery	18
Hill 2003; Dennison 2007	RCT	NP/CHW/MD educational-behavioral pharmacologic vs. less intensive education referral	n = 309, 36 months, 100% AA	Home and outpatient clinic at academic medical center	At 36 months, SBP/DBP: -7.5/-10.1 (more intensive) vs. +3.4/-3.7 (less intensive), p = .001 and p = .005, respectively; LVM lower 274 g (more intensive) vs. 311 g (less intensive) (p = .004)	Combined nurse, CHW, MD behavioral pharmacological intervention improved BP control	Provider & care delivery	21

Reference	Design	Intervention	n, Follow-Up, Racial/Ethnic Composition	Setting	Results: Process and Patient Outcomes	Conclusion	Target	Quality Score
Jenkins 2006	Pre/post study	General CV disease quality improvement	n = 2,860, 1 year 48% AA with subgroup analysis	Academic family practice clinic	Significant improvements occurred in BP control for all adults (OR = 1.44) and those with HTN (OR = 1.82); measures of total cholesterol (OR = 1.10) and HDL cholesterol (OR = 1.27) for all patients	Multifaceted intervention can improve process measures and CV outcomes	Provider & care delivery	17
Kokkinos 1995	RCT	Moderate-intensity exercise plus BP medication or BP medication alone	n = 46, 32 weeks, 100% AA	Not mentioned	At 16 weeks, mean DBP decreased in exercise group (88 to 83 mm Hg) and increased in nonexercise group (88 to 90 mm Hg) (<i>p</i> = .002)	Effectiveness of moderately intense exercise extends to patients with severe HTN	Patient/family	18
Krieger 1999	RCT	Enhanced tracking and follow-up services provided by CHW's to promote medical follow-up of persons with elevate BP	n = 421, 3 months, 79% AA	Urban community-based clinics	Follow-up visits were completed by 65.1% of intervention group vs. 46.7% of those in the usual-care group (<i>p</i> = .001)	Enhanced tracking and follow-up services by CHW improved compliance with follow-up visits	Provider & care delivery	17
Kumanyika 1999	RCT	Nutrition program using food cards, audiotapes, and four classes vs. cards and nutrition guide	n = 255, 1 year, 100% AA	Community-based clinic affiliated with an academic medical center	Trend toward improvement but no significant difference in lipids and BP	Intensive nutrition intervention may improve lipid and BP control	Patient/family	18
Lenz 2004	Comparative study, 2-year follow-up of RCT	NP-run or physician-run primary care practice	n = 406, 2 years, 93% Hispanic	Urban ambulatory primary care clinic	No statistically significant difference in SBP or DBP for NP vs. MD patients at 2-	No difference between care provided by NPs and MDs	Provider & care delivery	17

Reference	Design	Intervention	n, Follow-Up, Racial/Ethnic Composition	Setting	Results: Process and Patient Outcomes	Conclusion	Target	Quality Score
Levine 2003	RCT	Nurse-supervised indigenous CHWs deliver intervention with two different intensity levels to reduce BP	n = 817, 40 months, 100% AA	Urban community clinics	year follow-up Significant decrease in SBP/DBP in both levels of intervention ($p < 0.05$); significant increase in the percentage with controlled high BP	Nurse-supervised CHW intervention in urban setting improved BP control	Provider & care delivery	17
Rogers 2001	RCT	Home BP monitoring service and electronic reports provided weekly to the PCP and patient	n = 121, 11 weeks, 12.3% AA with subgroup analysis	University-affiliated primary care clinics	Among AA patients, MAP decreased by 9.6 mm Hg with home service and increased by 5.25 mm Hg in usual care ($p = .047$)	Telecommunication service was efficacious in reducing the mean arterial pressure of patients with established HTN	Provider & care delivery	19
Sanders 2002	RCT	Chart-based reminder system for patients with HTN and DM	n = 320, 55% AA	Primary care practice of a Veterans Affairs Medical Center	Only 33% of visits resulted in medication change, although BP greater than guideline in 93% of patients	Chart reminder failed to improve MD compliance with the clinical guideline for HTN management in diabetics	Provider & care delivery	17
Schneider 2005	RCT	TM vs. PMR vs. HE	n = 150, 1 year 100% AA	Urban community health center	TM group showed decreased BP 3-5 mm Hg and reduced BP medication relative to PMR ($p = .001$) and HE ($p = .09$) groups	A stress reduction approach, the Transcendental Meditation Program, may be useful as an adjunct in the treatment of HTN	Patient/family	18
Svetkey 1999; Bray 2004	RCT	DASH: randomized controlled feeding study of (1) a diet rich in fruits and vegetables or (2) combination diet	n = 459, 8 weeks, 60% AA, 6% other minorities	Four academic medical centers	Combination diet: lowered SBP in all subgroups ($p < .008$), lowered DBP ($p < .01$) in all but two	DASH combination diet may be an effective strategy for preventing and treating HTN in a broad cross-section of the population	Patient/family	21

Reference	Design	Intervention	n, Follow-Up, Racial/Ethnic Composition	Setting	Results: Process and Patient Outcomes	Conclusion	Target	Quality Score
Svetkey 2005; Appel 2003; Elmer 2006	RCT	rich in fruits, vegetables, and low-fat dairy foods and reduced in saturated fat, total fat, and cholesterol (the DASH combination diet); weight and salt intake were held constant PREMIER, comprehensive lifestyle on diet, weight, lipids, BP; advice only vs. weight, exercise, EtOH, Na+ (established), vs. est + DASH	n = 810, 18 months, 34% AA with subgroup analysis	Four clinical centers	subgroups; combination diet lowered SBP significantly more in AA (6.8 mm Hg) than whites (3.0 mm Hg)	DASH modest supplemental help to established interventions; less of an effect with home meal preparation; BP effects greater in patients > 50; AA males and white males most responsive, AA females least	Patient/family	22
Tao 2003	Pre/post study	Multidisciplinary HTN clinic; MDs, nurses, pharmacists, and nutritionists assessed and reinforced objectives tailored to individual needs	n = 50, 6 months, 94% AA	Public hospital-based clinic	18-month follow-up: diet and weight changed, BP marginally so; optimal BP 19% advice only, 30% in est, 35% in est + DASH	Multidisciplinary clinic can improve BP control in patients with resistant HTN, at least for the short term	Provider & care delivery	11
Tobe 2006	RCT	Home care nurse treatment using predefined HTN algorithm compared to RN home care visits (monitoring only) with MD treatment decisions	n = 95, 12 months, 100% Native American with DM and HTN	Home	SBP down 24 vs. 13.5 in control; albumin excretion no change	Home care nurse monitoring significantly improves SBP; algorithm-driven treatment by RNs provides additional DBP improvement	Provider & care delivery	21
TOHP Phase I and Phase II 1992, 1997; Kumanyika 2005	RCT	Telephone-delivered dietary and behavioral change program led by dietitians, psychologists, and health	n = 2,382, 36 months, 18% AA with subgroup analysis	Nine academic medical centers	At 36 months I > C (weight loss, 1.3/0.9 mm Hg; Na reduction, 1.2/0.7 mm Hg;	Through 48 months, the incidence of HTN (140/90) was significantly less in each active intervention group than the usual-care	Patient/family	18

Reference	Design	Intervention	n, Follow-Up, Racial/Ethnic Composition	Setting	Results: Process and Patient Outcomes	Conclusion	Target	Quality Score
Vivian 2002	RCT	<p>conselors focused reducing Na intake</p> <p>Monthly meetings with a clinical pharmacist who changed drugs, adjusted doses, provided drug counseling, compared to usual MD care</p> <p>Programmed telephone calls with HTN messages</p>	n = 56, 6 months, 77% AA	Veterans Affairs Medical Center	<p>combined, 1.1/0.6 mm Hg (p < .001), 21% Na reduction</p> <p>participants motivated and extensively counseled</p> <p>achieved the targeted level of Na excretion</p> <p>below 80 mmol/24 hr; no variation by race</p> <p>BP < 140/90 attained in 81% of intervention group and 30% in usual care; patient satisfaction and adherence similar</p>	<p>group (average relative risks, 0.78-0.82); modest results with highly motivated and extensively counseled individuals; Na reduction sufficient to help population will be difficult to achieve without food supply changes</p> <p>Monthly pharmacist meeting with medication changes and dose adjustment improve BP control</p>	Provider & care delivery	20
Walker 2000	RCT	<p>Programmed telephone calls with HTN messages</p>	n = 83, 3 months, 100% AA	Home and outpatient clinic at an academic medical center	<p>No significant improvements in HTN knowledge; SBP and DBP declined for both HTN and control (spiritual messages)</p>	<p>Programmed telephone calls do not improve HTN knowledge or medication adherence</p>	Patient/family	13

Note: AA = African American; BMI = body mass index; BP = blood pressure; C = control; CAD = coronary artery disease; CBC = community-based care; CBM = community-based monitoring; CHW = community health worker; CV = cardiovascular; DASH = Dietary Approaches to Stop Hypertension; DBP = diastolic blood pressure; DM = diabetes mellitus; EPC = enhanced primary care; ER = emergency room; HE = health education; HT = home telemonitoring; HTN = hypertension; I = intervention; LVM = left ventricular mass; MAP = mean arterial pressure; MD = medical doctor; Na = sodium; NP = nurse practitioner; PCP = primary care provider; PMR = progressive muscle relaxation; RCT = randomized controlled trial; RN = registered nurse; SBP = systolic blood pressure; SF = short form; TM = transcendental meditation; TOHP = Trials of Hypertension Prevention; TONE = Trial of Non-Pharmacologic Intervention in the Elderly.

Hyperlipidemia

Table 4

Reference	Design	Intervention	n, Follow-Up, Racial/Ethnic Composition	Setting	Results: Process and Patient Outcomes	Conclusion	Target	Quality Score
Ard 2000	Randomized modified crossover	Diet and exercise program included 1,000 kcal diet, culturally sensitive recipes, and address of exercise attitudes	n = 56, 8 weeks, 100% AA	Academic health center	Average weight loss 14.8 lb; BMI: 37.8 to 35.3 (p < .01); total cholesterol: 199 to 185 (p < .01); SBP and DBP decreased by 4.3 (p < .01) and 2.4 (p < .05); control group: no significant change	A culturally sensitive diet and exercise intervention can reduce BMI, cholesterol, and BP	Patient/family	12
Becker 2005	RCT	Community-based multiple risk factor intervention on CV risk in black families with a history of premature coronary disease; CBC group received NP-led, community-based multi-component education and management intervention compared to EPC	n = 364, 1 year, 100% AA	Primary care and nonclinical community sites	CBC group was two times more likely to achieve goal levels of LDL cholesterol and BP compared with the usual-care group (95% CI: 1.11 to 4.20 and 1.39 to 3.88, respectively)	Multifaceted NP-directed community-based intervention can improve HTN, lipids, and tobacco cessation rates in a high-risk population	Provider & care delivery	18
Burden 2002	Pre/post study	Pharmacist-led lipid reduction with initial 1-hr visit and follow-up every 6 weeks until stable, then every 6-12 months; dietician visit; exercise encouraged	n = 74, 8 months, 100% Native Americans	Clinic at an Indian Health Services Hospital	2.1 mg/dL increase in HDL (p = .01)	Pharmacist-directed lipid management resulted in modest improvement in HDL	Patient/family	12
Haskell 2006	RCT	Multifaceted disease management intervention	n = 148, 1 year, 89% minority (57%	Urban community clinics serving low-income patients	Disease management produced clinically	Disease management targeted at high-risk	Provider & care delivery	21

Reference	Design	Intervention	n, Follow-up, Racial/Ethnic Composition	Setting	Results: Process and Patient Outcomes	Conclusion	Target	Quality Score
Jenkins 2006	Pre/post study	using team case management	Hispanic, 11% Asian, 7% AA	Academic family practice clinic	important decreases in selected risk factors compared with usual care, including SBP ($p < .01$) and LDL cholesterol ($p < .03$)	patients (24% had CAD, 64% had no health insurance) can improve HTN and lipids	Provider & care delivery	17
Jenkins 2006	Pre/post study	General CV disease quality improvement	$n = 2,860$, 1 year, 48% AA with subgroup analysis	Academic family practice clinic	Significant improvements occurred in BP control for all adults (OR = 1.44) and those with HTN (OR = 1.82); measures of total cholesterol (OR = 1.10) and HDL cholesterol (OR = 1.27) for all patients	Multifaceted intervention can improve process measures and CV outcomes	Provider & care delivery	17
Keyserling 1997	RCT	90-min tutorial, brief dietary assessment, and three 5-10-min diet counseling sessions by the primary care clinician; dietitian referral if LDL remained high at 4-month follow-up; clinician prompt to consider meds based on LDL at 7-months	$n = 372$, 7 months, 40% AA, 11% Native American	21 rural and community health centers	5.3 mg/dL greater reduction in total cholesterol for intervention group averaged over 1 year; increased rate of lipid medication use	Dietary intervention had minimal effect on lipid control in this low-income group	Provider & care delivery	19
Kokkinos 1998	RCT	Moderate-intensity aerobic exercise for 20-50 min, 3 times/week for 16 weeks	$n = 36$, 16 weeks, 100% AA	Not mentioned	No change in lipids except HDL at 75% intensity ($p = .003$)	Low- to moderate-intensity aerobic exercise may not be enough to modify lipid	Provider & care delivery	17

Reference	Design	Intervention	n, Follow-Up, Racial/Ethnic Composition	Setting	Results: Process and Patient Outcomes	Conclusion	Target	Quality Score
Kumanyika 1999	RCT	CV nutrition program using food cards, audiotapes, and four classes vs. cards and nutrition guide Culturally appropriate intervention: weekly 90-min meetings using individual-oriented, culturally tailored behavioral techniques and reading materials; wait-list control group did not receive intervention but were assessed at baseline and 6 and 12 months	n = 255, 1 year, 100% AA	Community-based clinic affiliated with an academic medical center	Trend toward improvement but no significant difference in lipids and BP	profiles in patients with severe HTN, but increases in HDL suggest exercise intensity threshold Intensive nutrition intervention may improve lipid and BP control	Provider & care delivery	19
Poston 2001	RCT with block design	Culturally appropriate intervention: weekly 90-min meetings using individual-oriented, culturally tailored behavioral techniques and reading materials; wait-list control group did not receive intervention but were assessed at baseline and 6 and 12 months	n = 379, 12 months, 100% Mexican American women	Home and community centers	No difference in physical activity or cholesterol levels among the study participants; higher drop out rate in treatment group $p < .001$.	Culturally appropriate intervention consisting of weekly meetings, written materials, and behavioral techniques was not effective in increasing exercise or improving lipids in this challenging population	Patient/family	19

Note: AA = African American; BMI = body mass index; BP = blood pressure; CAD = coronary artery disease; CBC = community-based care; CV = cardiovascular; DBP = diastolic blood pressure; EPC = enhanced primary care; HTN = hypertension; NP = nurse practitioner; SBP = systolic blood pressure.

Table 5

Tobacco Cessation

Reference	Design	Intervention	n, Follow-Up, Racial/Ethnic Composition	Setting	Results: Process and Patient Outcomes	Conclusion	Target	Quality Score
Ahluwalia 1998	RCT	Nicotine transdermal patch plus counseling vs. placebo	n = 410, 6 months, 100% AA smokers	Large urban hospital-based clinic	6-month quit rates 17.1% with patch vs. 11.7% placebo; after adjustment, differences significant at 10 weeks ($p = .04$), but not at 6 months ($p = .14$)	Short-term quit rates are improved with the nicotine patch in AAs	Patient/family	23
Ahluwalia 1999	RCT	Smoking as a vital sign stamp	n = 2,595, 4 months, 100% AA	Adult urban walk-in clinic	78.4% intervention MDs vs. 45.6% control MDs asked about patient smoking; 39.9% intervention MDs advised quitting vs. 26.9% control MDs	Using smoking as a vital sign stamp; increased rates of asking, telling, and arranging follow-up for smoking cessation	Provider & care delivery	22
Allen 1998	RCT	Tobacco cessation training session for residents	n (residents) = 158, 30% Asian, 45% AA, n (patients) = 1,086, 1 year, 100% AA	Public hospital-based clinic	No difference in quit rates at 1 year	Short focused educational intervention for providers is not adequate to increase quit rates	Provider & care delivery	18
Becker 2005	RCT	Community-based multiple risk factor intervention on cardiovascular risk in black families with a history of premature coronary disease; CBS group received NP-led, community-based multicomponent education and management intervention	n = 364, 1 year, 100% AA	Primary care and nonclinical community sites	The CBS group was two times more likely to achieve goal levels of LDL cholesterol and BP compared with the usual-care group (95% CI: 1.11 to 4.20 and 1.39 to 3.88, respectively)	Multifaceted NP-directed community-based intervention can improve HTN, lipids, and tobacco cessation rates in a high-risk population	Provider & care delivery	18

Reference	Design	Intervention	n, Follow-Up, Racial/Ethnic Composition	Setting	Results: Process and Patient Outcomes	Conclusion	Target	Quality Score
Curry 2003	RCT	Motivational message from the child's clinician, a guide, a 10-min motivational interview with a nurse or study intervencionist, and up to three outreach phone counseling calls by intervencionist in 3 months	n = 303, 1 year, 63% AA	4 pediatric clinics serving an ethnically diverse low-income population	1-year abstinence rates: 13.5% intervention vs. 6.9% control, adjusted OR = 2.77	Pediatric clinic smoking cessation intervention has long-term benefits in socioeconomically disadvantaged sample of female smokers	Provider & care delivery	20
Davies 2005	RCT	Bedside counseling format with follow-up contact postdischarge	n = 248, 6 months, 100% AA	Incident-care hospital	40.0% intervention vs. 21.7% control patients progressed at least one stage in the trans-theoretical model of change ($p < .01$)	Although this intervention did not show significant impact on cessation rates, it did increase smokers' readiness to change their behavior	Provider & care delivery	18
Fisher 2005	Pre/post study	Multidisciplinary committees developed participatory approaches to system change and promoted systematic implementation of smoking cessation interventions	n = 2 FQHCs intervention clinic with two comparison clinics; 2,600 patients overall in intervention clinics, mostly AA	Community health clinics and community	Documentation of smoking status or readiness to quit increased from 2% to 94%; rates of advice to quit and providers offering assistance with quitting increased to 80%; quit rates not reported	Participatory, multidisciplinary approaches to systematically implement evidenced-based smoking cessation practices are effective in increasing documentation of smoking status and provision of advice	Provider & care delivery	20
Gemson 1995	Cluster RCT	Multifaceted physician education intervention targeted at use of preventive care processes	n = 229, 6 months, 35% AA, 44% Asian	Inner-city municipal hospitals	Improved nutrition and exercise counseling rates with intervention group MDs per patient report ($p < .05$); trend toward increased rates of tobacco cessation counseling	Complex physician education and improved clinical support program can increase provision of preventive care	Provider & care delivery	20

Reference	Design	Intervention	n, Follow-Up, Racial/Ethnic Composition	Setting	Results: Process and Patient Outcomes	Conclusion	Target	Quality Score
Johnson 1997	Non-randomized controlled trial	DHS program: consisted of screening for tobacco use, culturally appropriate education material, provider- and staff-delivered counseling, and postcard follow-up	n = 601, 1 year, 100% Native Americans	4 urban Indian Health Clinics	Abstinence rates higher in intervention group (7.1 vs. 4.9%), though no difference in quit rates validated by cotinine levels (6.7 vs. 6.8)	The DHS program may increase tobacco cessation rates in Native American smokers	Patient/family	16
Klerman 2001	RCT	Augmented prenatal care, educational peer groups, longer and more frequent visits	n = 619 (46 smokers), mean intervention at week 11 of pregnancy, 100% AA	Medicaid-eligible OB clinic	50% quit rate in the intervention group vs. 27% in control group; not statically significant; small number of patients	Tobacco cessation counseling embedded in an augmented prenatal care program may improve quit rates	Patient/family	18
Lillington 1995	Pre/post study	Culturally specific counseling, self-help guide, booster postcard, and incentive contest	n = 555 pregnant women, 6-weeks postpartum, 53% AA and 43% Hispanic; four clinics (two intervention and two control)	4 women, infant, and children clinics	6 weeks postpartum abstinence rates: intervention vs. controls, 25% vs. 12%	Culturally specific counseling and materials resulted in significant quit rate in pregnant women	Patient/family	22
Lipkus 1999	RCT comparing three interventions	Provider prompting intervention vs. provider prompting intervention plus printed material vs. provider prompting intervention plus printed material plus telephone counseling	n = 160, 16 months, 100% AA	Community health clinic	21.8% of all participants quit; provider intervention vs. provider plus print material quit rate (32.7 vs. 13.2) ($p < .05$); no additional improvement with phone follow-up	Provider intervention plus print materials resulted in highest quit rate	Patient/family	20
Manfredi 1999	Pre/post study	Multicomponent motivational smoking	n = 1,747, 8 weeks, 76% AA	12 urban public health clinics	Quit rate in intervention vs. control group	This intervention, implemented by clinic personnel at	Patient/family	20

Reference	Design	Intervention	n, Follow-Up, Racial/Ethnic Composition	Setting	Results: Process and Patient Outcomes	Conclusion	Target	Quality Score
McBride 2002	RCT	cessation intervention Enhanced usual care of BF; self-help manual nicotine patches; BF arm got genotyping GST3 gene (GSTM1) and health educator calls	n = 557, 1 year, 100% AA	Inner-city community health clinic	(14.5 vs. 7.7%) ($p < .01$) Smoking cessation was greater for the BF arm than the enhanced usualcare arm (19 vs. 10%, respectively) ($p < .006$) at 6 months but not at 12 months Intervention vs. control validated posttreatment abstinence rates (21 vs. 6%, $p < .05$); no difference in abstinence rates at 12-month follow-up	routine visits, was effective Intervention showed short-term effectiveness when delivered as part of routine health care	Patient/family	23
Nevid 1997	RCT	Clinic-based group program with culturally specific videotape with smoking related vignettes; control group received group self-help session	n = 93, 1 year, 100% Hispanic	Not mentioned		Intervention resulted in short-term increase in abstinence rates; no long-term improvements	Patient/family	20
Nollen 2006	RCT	2 x 2 design: nicotine gum or placebo and health education counseling or motivational interviewing	n = 755, 6 months, 100% AA	Urban community medical clinic	Health education recipients more than twice as likely to quit smoking at 6 months vs. motivational interviewing recipients (OR = 2.17%, CI = 1.38 to 3.41); older age and higher BMI also associated with higher quit rates Rates of cessation and cutting back by 50%; 21% quit rate in intervention group; an additional 27% decreased cigarette intake by at least 50%	Knowledge of individual factors associated with quitting and directive, advice-oriented counseling may be effective facilitators in smoking cessation	Patient/family	21
Royce 1995	Pre/post study	Brief clinician advice combined with socioculturally appropriate smoking cessation materials	n = 153, 7 months, 100% AA	Primary care clinic		Clinician advice combined with culturally appropriate materials decreased daily cigarette usage and increased cessation rates	Patient/family	16

Reference	Design	Intervention	n, Follow-Up, Racial/Ethnic Composition	Setting	Results: Process and Patient Outcomes	Conclusion	Target	Quality Score
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Note: AA = African American; BF = biomarker feedback; BMI = body mass index; BP = blood pressure; CBC = community-based care; DHS = Doctors Helping Smokers; FQHC = federally qualified health center; HTN = hypertension; LDL = low-density lipoprotein; MD = medical doctor; NP = nurse practitioner; RCT = randomized controlled trial.

Physical Inactivity

Table 6

Reference	Design	Intervention	n, Follow-Up, Racial/Ethnic Composition	Setting	Results: Process and Patient Outcomes	Conclusion	Target	Quality Score
Banks-Wallace 2005	RCT	12-month intervention that included a 3-hr monthly group meeting (with behavioral counseling, some storytelling, and a 40-min interactive learning period) and a home-based walking component	n = 21, 6 months, 100% AA	Homes and community centers	At 6 months, mean steps/day increased by 37% from baseline in the entire group; this was only a trend toward statistical significance, probably related to small study size	Group intervention can have a positive impact on promoting walking in the African American population	Patient/family	10
Gemson 1995	Cluster RCT	Multifaceted physician education intervention targeted at use of preventive care processes	n = 229, 6 months, 35% AA, 44% Asian		Improved nutrition and exercise counseling rates with intervention group MDs per patient report ($p < .05$); trend toward increased rates of tobacco cessation counseling	Complex physician education and improved clinical support program can increase provision of preventive care	Provider & care delivery	20
Lorig 2003	RCT for initial 4 months; then crossover of all study subjects to intervention group	6-week peer-led intervention, audio exercise tape, illustrated booklet of the exercise routines, and audio relaxation tape	n = 551, 1 year, 50% Hispanic with cardiovascular risk factors	Community and home based	Improved health status, health behavior, and self-efficacy, as well as fewer emergency department visits ($p < .05$); at 1 year, the improvements maintained; significant improvement in physical activity at 4 months compared with baseline ($p < .001$); reduced number of ER visits at 4 months and 1 year	Peer-led education and exercise intervention reduced ER visits and increased physical activity	Patient/family	22
Newton 2004	RCT	Standard behavioral counseling group (SB), culturally sensitive counseling (CS) group, physician advice comparison group (PA)	n = 60, 6 months, 100% AA	Home-based exercise promotion program	All three programs led to increases in self-reported physical activity; CS and SB showed higher increases in cardiovascular fit	Differences in fitness level did not differ significantly among all adherence was the same for all groups	Provider & care delivery	22
Poston 2001	RCT with block design	Culturally appropriate intervention: weekly 90-min meetings	n = 379, 12 months, 100% Mexican	Home and community centers	No difference in physical activity among the study participants; higher	Culturally appropriate intervention consisting of	Patient/family	19

Note: AA = African American; ER = emergency room; MD = medical doctor; RCT = randomized controlled trial; SBI = standard behavioral intervention.

Congestive Heart Failure

Table 7

Reference	Design	Intervention	n, Follow-Up, Racial/Ethnic Composition	Setting	Results: Process and Patient Outcomes	Conclusion	Target	Quality Score
Artinian 2003	RCT	Intervention group received usual care plus a Med-e Monitor device with electronic medication reminders; included daily reminders/assessment of medications and symptoms, while monitoring daily weight and BP	n = 18, 3 months, 65% AA class II-III CHF	CHF clinic of a Veterans Affairs Medical Center	Trend toward improved monitoring of daily weight (85% vs. 70%) and BP (81% vs. 51%) in intervention group as compared to control group; QOL improved in intervention group at 3 months (p = .006)	E-monitoring improved QOL, with trend toward improved self-monitoring	Provider & care delivery	22
Benatar 2003	RCT	APN monitored recently discharged patients using transtelephonic home measuring (TTM) device to follow weight, BP, oxygenation, and heart rate or use of home nurse visits	n = 216, 12 months, 86% AA	Home	At 3 months, TTM group had fewer admissions at 13 vs. 24 for home visit group (p ≤ 0.001) and shorter lengths of stay at 49 vs. 105 days (p ≤ 0.001)	Cardiologist-guided computerized monitoring of patients with CHF reduces admission rates and length of stay	Provider & care delivery	22
DeWalt 2004	Pre/post study	Patient education combined with frequent phone follow-up; patients given electronic scale to use for daily weights	n = 25, 3 months, 60% AA with low literacy	University internal medicine clinic	Proportion of patients reporting daily weights from 32% at baseline to 100% at 12 weeks; mean improvement on the ML-wHF scale was 9.9 points over the 3-month trial (95% CI: 0.5 to 19.2); mean knowledge scores did not improve	E-monitoring improved QOL, with trend toward improved self-monitoring	Provider & care delivery	16
Naylor 2004	RCT	A 3-month APN-directed discharge planning and home follow-up protocol	n = 239, 1 year, 36% AA (data reported for subgroup of AA patients; personal communication)	Hospital and home follow-up	Intervention patients had lower total number of CHF-related admissions (7 vs. 9) (p < .04) and lower CHF-related admission costs	Cardiologist-guided computerized monitoring of patients with CHF reduces admission rates and length of stay	Provider & care delivery	24
O'Connell 2001	Pre/post study	Multidisciplinary case management program to reduce hospitalizations in indigent HF patients	n = 35, 1 year, 51% Hispanic	Academic teaching hospital-based clinic	Group A (2 hospital admissions/year); 91% reduction in admissions (p < .001); Group B (difficult to manage): 100% reduction in admissions (p = .002)	Multidisciplinary case management was effective in reducing readmissions in patients with HF	Patient/family	16
Rich 1995, 1996	RCT	Nurse-directed education program for patient and family, prescribed diet, social service consult, medication review, and intensive follow-up	n = 282, 90 days, 55% AA	Home	Intervention reduced HF admissions by 56.2% (p = .04) in subgroup; QOL improved in intervention group at 90 days (p = .001); 88% adherence intervention vs. 81% control (p = .003)	Nurse-directed intervention can improve QOL, improve medication compliance, and reduce readmissions for HF patients	Patient/family	22

Reference	Design	Intervention	n, Follow-Up, Racial/Ethnic Composition	Setting	Results: Process and Patient Outcomes	Conclusion	Target	Quality Score
Sisk 2006	RCT	RN-led case management including education, medication monitoring, and teaching of self-management skills coordinated with patient's primary MD	n = 406, 12 months, 46% AA, 33% Hispanic	Four urban hospital-based clinics	Nurse management group had fewer hospitalizations compared to controls (143 vs. 180) and better functioning (39.9 vs. 36.3) on MLwHF	Case management delivered by RNs working with patient's primary provider can improve outcomes	Patient/family	23

Note: AA = African American; APN = advanced practice nurse; BP = blood pressure; CHF = congestive heart failure; HF = heart failure; MD = medical doctor; MLwHF = Minnesota Living with Heart Failure scale; QOL = quality of life; RCT = randomized controlled trial; RN = registered nurse.