

STATE-OF-THE-ART REVIEW

Expanding the Role of Nurses to Improve Hypertension Care and Control Globally



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Abstract

The role of the nurse in improving hypertension control has expanded over the past 50 years, complementing and supplementing that of the physician. Nurses' involvement began with measuring and monitoring blood pressure (BP) and patient education and has expanded to become one of the most effective strategies to improve BP control. Today the roles of nurses and nurse practitioners (NPs) in hypertension management involve all aspects of care, including (1) detection, referral, and follow up; (2) diagnostics and medication management; (3) patient education, counseling, and skill building; (4) coordination of care; (5) clinic or office management; (6) population health management; and (7) performance measurement and quality improvement. The patient-centered, multidisciplinary team is a key feature of effective care models that have been found to improve care processes and control rates. In addition to their clinical roles, nurses lead clinic and community-based research to improve the hypertension quality gap and ethnic disparities by holistically examining social, cultural, economic, and behavioral determinants of hypertension outcomes and designing culturally sensitive interventions to address these determinants.

KEY WORDS hypertension, nurse, team-based care, quality

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INTRODUCTION

Hypertension is a global public health issue, and it is estimated that by 2025 more than 1.5 billion individuals worldwide will have hypertension, accounting for up to 50% of heart disease risk and 75% of stroke risk.¹ Lowering blood pressure (BP) through lifestyle modification, antihypertensive medications, or both can substantially reduce an individual's risk for subsequent cardiovascular disease (CVD) and stroke.² Even a moderate reduction in systolic BP (SBP) of 10 mm Hg or diastolic blood pressure (DBP) of 5 mm Hg has been found to decrease

average risk of mortality from coronary heart disease and stroke by 22% and 41%, respectively.³

Despite clear benefits of hypertension treatment to reduce CVD morbidity and mortality, a large proportion of diagnosed and undiagnosed patients with hypertension are not receiving optimal care. In the United States, despite decades of national public and professional education, among those with hypertension, approximately 25% are unaware and almost 30% are not engaged hypertension care.⁴ Among the 45% with diagnosed hypertension and in care, BP control is achieved in only 64% overall, and rates remain as low as 39% among

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Mexican American men.^{4,5} Although control rates overall have increased over the past 10 years, ethnic disparities in care and control remain, with Mexican Americans less likely to be in hypertension care and African Americans, Hispanics, and Mexican Americans achieving lower control rates compared with whites.⁵ The difference in hypertension outcomes achieved with current practices and outcomes possible using hypertension care best practices is known as the quality gap, and this gap is at least partly responsible for the loss of thousands of lives each year.⁶ Expanding the role of nurses is one of the most effective strategies to improve BP control. This paper reviews the expanding roles of nurses in diverse practice settings and in team-based care and provides examples of nurse-led research aimed at reducing hypertension health disparities.⁷⁻¹¹

BACKGROUND

The role of nurses has been recognized for nearly 50 years in public and professional education to improve hypertension control promoted by the US National High Blood Pressure Education Program's Joint National Committee reports and other publications.^{2,12} Nurses' involvement began with measuring and monitoring BP and patient education. The role expanded in the 1960s and early 1970s to supplement and complement that of the physician as the number of newly identified patients grew after Veterans Administration and Hypertension Detection and Follow-up Program studies demonstrating the benefits of controlling hypertension.^{13,14} Subsequently, with evidence-based protocols to guide practice nurses and training programs, such as those provided by the American Heart Association, nurses gained the skills to assess patients' health status, adjust medications, and address barriers to hypertension care and control, thus becoming more involved in the assessment and management of hypertension. The establishment of nurse-run clinics was a further expansion of the nurse's role.¹⁵ Today around the globe, particularly in underserved low- and middle-income countries, as the numbers of people with hypertension and attention to non-communicable diseases increase, the role of nurses continues to expand. The role increasingly focuses on advanced practice nurses, known as nurse practitioners (NPs), who have legal authority to prescribe antihypertensive and other medications and practice independently or in teams, which requires attention to the legal scope of nursing practice.

TEAM-BASED HYPERTENSION MANAGEMENT

A key feature of the most effective hypertension care models is a multidisciplinary team that collaborates in delivering hypertension care services.¹⁶ A team-based approach is patient centered, with care tailored to meet patients' needs. It is often implemented as part of a multi-faceted approach, with systems support for clinical decision making (eg, treatment algorithms), communication, and patient self-management. Team-based hypertension care includes the patient, the patient's primary care provider, and other professionals such as nurses, pharmacists, physician assistants, dietitians, social workers, and community health workers. These professionals complement the activities of the primary care provider by providing process support and sharing the responsibilities of hypertension care, which include medication management, active patient follow-up, and adherence and self-management support. Team-based hypertension care has been reported to increase the proportion of individuals remaining in care with controlled BP and reduced SBP and DBP.⁷⁻¹¹ Randomized controlled trials (RCTs) and meta-analyses of RCTs of team-based hypertension care involving nurse or pharmacist intervention demonstrated reductions in SBP and DBP and greater achievement of BP goals when compared with usual care.⁶⁻⁹ Similarly, a systematic review of 52 studies of team-based primary care for patients with primary hypertension found reductions in SBP and DBP and greater achievement of BP goals when compared with usual care, although team-based approaches varied greatly across studies.¹¹ Nonetheless, the important findings on the impact of team-related factors on BP outcomes were identified: (1) Larger improvements in BP outcomes were found when team members could make changes to medications independent of the primary care provider or provide medication recommendations and make changes with primary care provider's approval compared with providing only adherence support and information on medication and hypertension. (2) Improvement in the proportion of patients with controlled BP was similar for studies in both health care and community settings.¹¹ A systematic review of studies, including 8 RCTs, examining the effect of community health workers in team-based hypertension care found improvements in BP control, appointment keeping, and hypertension medication adherence.¹⁷

Team-based care aims to achieve effective control of hypertension and reduce the consequences of uncontrolled hypertension. Delineation of individual team member roles based on knowledge, skill set, and availability, as well as patients' needs, allows the primary provider to delegate routine matters to the team, thereby permitting more time to manage complex and critical issues facing patients with hypertension. Specific roles of nurses in team-based hypertension care are delineated next.

SPECIFIC ROLES OF NURSES IN TEAM-BASED HYPERTENSION CARE

The roles of nurses and NPs in hypertension management involve all aspects of care, including (1) detection, referral, and follow up; (2) diagnostics and medication management; (3) patient education, counseling, and skill building; (4) coordination of care; (5) clinic or office management; (6) population health management; and (7) performance measurement and quality improvement.^{12,18}

Detection, Referral, and Follow-up. Nurses routinely measure BP in most health care settings using BP measurement best practices as part of initial and ongoing assessments of each patient.¹⁹ In addition, nurses lead BP screening and verification initiatives in community, work site, church, school, and other settings. Once BP is measured and recorded, the nurse analyzes data to determine if the readings are in the normal or hypertensive range per site protocol. A system to flag records can help ensure that uncontrolled hypertension is recognized and treated. In addition, nurses assess the patient's level of cardiovascular risk. There are a number of tools, such as Framingham Cardiovascular Disease Risk Score,²⁰ Pooled Cohort Equations,²¹ QRISK2,²² and Reynolds Risk Score,^{23,24} that are helpful in guiding health care providers as they assess cardiovascular risk; these tools also can be used in patient education efforts.²⁵ It may be necessary to refer the patient to urgent care depending on BP levels and symptoms or to specialist evaluation for persistent uncontrolled BP despite intervention or for abnormal renal or vascular findings.²⁶ Nurses play an important role in implementing referrals and educating patients regarding the purpose and importance of referral.

Follow-up between visits via telephone, mail, or digital strategies can be effective to reinforce goals of entering and remaining in care and engaging in treatment and can enhance provider–patient relationship. It is essential to follow up on missed

appointments to maintain contact with the patient and to reinforce the importance of achieving BP goals. Nurses often are the first health professionals to detect hypertension and therefore have a key role in communicating with patients and other health professionals to enforce treatment guidelines through development and appropriate revision of the patient's treatment plan.

Diagnostics and Medication Management. Nurses or NPs are also responsible for the diagnostic and pharmacological aspects of hypertension management. Using well-defined protocols based on national treatment guidelines, NPs prescribe and titrate medications to achieve BP control.^{2,27,28} As discussed earlier, nurse-led hypertension management has been demonstrated to result in greater rates of BP control than those achieved with standard care. These improved outcomes have resulted from nurses placing a greater number of patients on medications, altering drug regimens more often in response to inadequate BP control, and placing a higher proportion of patients on multiple drug regimens to achieve greater control.^{8,9} In addition to management of hypertension, nurses have been shown to effectively manage other cardiovascular risk factors, such as diabetes²⁹ and dyslipidemia.^{30,31}

Patient Education, Counseling, and Skill Building. In the majority of hypertension care settings, nurses provide the education, counseling, and skill building necessary to ensure that patients are undertaking lifestyle changes that may favorably influence BP.^{32,33} Nurses actively engage patients in care using a combination of strategies to prevent, recognize, and respond to adherence problems and thereby maximize long-term adherence and BP control.^{34,35} They also use effective, evidence-based strategies to promote BP control; these strategies are identified in [Table 1](#) and are clustered under the following general approaches: identify knowledge, attitudes, beliefs, and experiences; educate about conditions and treatment; individualize the regimen; provide reinforcement; promote social support; and collaborate with other professionals.¹⁸ It is important to consider that patient education is a means to an end. That is, knowledge is necessary but insufficient to bring about desired behaviors without development of skills and multiple other reinforcing factors. The ultimate goal is for the patient to have the necessary skills and resources, including knowledge, to follow treatment recommendations and achieve and sustain BP control.

Table 1. Strategies to Promote Blood Pressure Control¹⁸

Identify knowledge, attitudes, beliefs, and experience

- ◆ Assess patient's understanding and acceptance of the diagnosis and expectations of being in care.
- ◆ Assess cultural beliefs and practices that may influence care and adherence.
- ◆ Discuss patient's concerns and clarify misunderstandings.

Educate about conditions and treatment

- ◆ Inform patient of blood pressure (BP) level.
- ◆ Establish with patients a goal BP.
- ◆ Inform patient about recommended treatment, providing specific oral and written information.
- ◆ Elicit concerns and questions and provide opportunities for patient to state-specific behaviors to carry out treatment recommendations.
- ◆ Emphasize need to continue treatment, that patient cannot tell if BP is elevated, and that control does not mean cure.
- ◆ Teach self-monitoring skills.

Individualize the regimen

- ◆ Actively engage patients in their own care by promoting shared decision making, with emphasis on social and cultural factors, including health literacy.
- ◆ Include patient in decision making.
- ◆ Simplify the regimen.
- ◆ Incorporate treatment into patient's daily lifestyle.
- ◆ Set, with the patient, realistic short-term objectives for specific components of the treatment plan.
- ◆ Encourage discussion of side effects and concerns.
- ◆ Encourage self-monitoring of BP.
- ◆ Prioritize critical aspects of the regimen.
- ◆ Implement treatment plan in steps.
- ◆ Modify dosages or change medications to reduce side effects.
- ◆ Minimize cost of therapy.
- ◆ Indicate you will ask about adherence at next visit.
- ◆ When weight loss is established as a treatment goal, discourage quick weight loss regimens, fasting, or unscientific methods, because these are associated with weight cycling, which may increase cardiovascular morbidity and mortality.

Provide follow-up and reinforcement

- ◆ Provide feedback regarding BP level.
- ◆ Ask about behaviors to achieve BP control.
- ◆ Give positive feedback for behavioral and BP improvement.
- ◆ Hold exit interviews to clarify regimen.
- ◆ Make appointment for next visit before patient leaves the office.
- ◆ Use appointment reminders and contact patients to confirm appointments.
- ◆ Schedule more frequent visits to counsel nonadherent patients.
- ◆ Contact and follow up with patients who missed appointments.
- ◆ Consider clinician-patient contracts.
- ◆ Consider home visits.
- ◆ Establish regular, structured follow-up mechanisms and reminder systems to monitor patients' progress both in the office and remotely.
- ◆ Provide the most appropriate evidence-based tools and resources designed to maximize self-management (including health behavior change, lifestyle modification, etc.).

Promote social support

- ◆ Educate family members to be part of the BP control process and provide daily reinforcement.
- ◆ Suggest small-group activities to enhance mutual support and motivation.

Collaborate with other professionals

- ◆ Draw on complementary skills and knowledge of nurses, pharmacists, community health workers, dietitians, optometrists, dentists, and physician assistants.
- ◆ Facilitate communication and care coordination among various team members, patient, family, and caregivers.
- ◆ Assure awareness and effective use of evidence-based diagnosis and treatment guidelines by all team members.
- ◆ Follow a single, personalized plan of care based on individual patient's characteristics and needs.
- ◆ Refer patients for more intensive counseling or specialty evaluation.

Identify knowledge, attitudes, beliefs, and experiences. A classic framework is useful in guiding nurses and other professionals to provide patient education, counseling, and skill building and facilitate patients' attainment of the following 4 critical behaviors, which are necessary to achieve and sustain long-term BP control: (1) Make the decision to control BP; (2) follow treatment recommendations (eg, medication taking and lifestyle changes) as prescribed; (3) monitor progress toward the BP goal; and (4) resolve barriers that prevent reaching the goal.³⁶ The premise of this evidence-based framework is that active participation by the patient as the decision maker and problem solver with the nurse or other health professional functioning as advisor or guide favors successful management of hypertension. The patient's understanding and acceptance of the diagnosis and expectations of being in care are assessed, patient concerns addressed, and misunderstandings clarified.

Educate about conditions and treatment. Adequate knowledge of hypertension, consequences of uncontrolled hypertension, and treatment regimen is essential to achieve BP control. It has been found that patients who receive education and counseling on hypertension management exhibit increased adherence.^{34,35} Nurses practice patient-centered care, engaging the patient in shared decision making and establishing mutually agreed on BP goals. Patients must always be informed of BP and related diagnostic testing values. This provides an ideal opportunity to assess patient knowledge, educate, establish clear goals, and discuss progress toward goals with the patient. Nurses emphasize the need to continue treatment even when BP control has been achieved (ie, *control* does not mean *cure*). Nurses also play a key role in educating patients regarding the necessary self-monitoring skills (eg, home BP monitoring). In addition to patient education and skill building, effective communication and a trustful relationship between the patient and nurse are of paramount importance to achieve sustained BP control.

Individualize the regimen. Successful education and counseling to promote adherence to treatment regimen and BP control requires that nurses and other health professionals individualize care to maximize patients' motivation to control their hypertension by remaining in care, maintaining a healthy lifestyle, taking prescribed medication, and monitoring progress toward goals. Nurse efforts to individualize the regimen should focus on social and cultural factors, including health literacy, self-care

behaviors, and skills necessary to hypertension control as well as patient response to the treatment regimen.³⁶ Nurses assist patients to incorporate the treatment regimen into his or her daily lifestyle, which is required for long-term sustainability. Nurses work with patients to mutually develop realistic, outcomes-oriented goals and strategies for attaining the goals. Equally important, nurses follow up with patients often to assess progress toward goals and, if necessary, to revise strategies for attaining goals.

Nurses are trained to provide counseling regarding lifestyle modification, which is recommended for all hypertensive patients with lifestyle risk factors (eg, obesity, physical inactivity, high-sodium diet, and alcohol consumption).^{32,33} Weight loss, which may be the most successful nonpharmacological technique for lowering BP, requires behavior change in both diet and physical activity patterns. Such nonpharmacological approaches include helping patients to initiate or maintain an aerobic exercise program and limit sodium intake and alcohol consumption to 1 to 2 drinks per day. In addition, many hypertensive patients present with multiple risk factors for cardiovascular disease. Nurses also provide education and counseling for smoking cessation and lipid reduction to help patients further lower their risk of cardiovascular disease. Modifying lifestyle behaviors requires many clinical interventions: assessment of an individual's baseline behaviors; education about how to make the appropriate changes; counseling to develop strategies such as setting short-term goals and self-monitoring that will ensure the achievement and maintenance of the changes; working with patients to identify and resolve barriers to adherence and BP control; and reinforcement of progress toward behavior change goals.

The extent to which patients are able to adhere to treatment recommendations is a major issue in BP control and depends on many factors. Review of adherence in randomized controlled trials on cardiovascular disease prevention strategies identified the following successful approaches: signed agreements, behavioral skill training, self-monitoring, telephone or mail contact, spouse or other key person support, self-efficacy enhancement, contingency contracting, exercise prescriptions, external cognitive aids, persuasive communication, nurse-managed clinics, and work- or school-based programs.^{34,35} Improving patient and primary provider adherence to evidence-based guidelines is a multilevel challenge—the patient, the provider, the health

care setting and system, and the societal health care system. Multiple strategies are required beginning with patient and provider education, counseling, and skill building.³⁷

Another important aspect of individualizing the regimen to promote BP control involves assessing potential barriers to BP control. Nurses are motivated and trained to assess and address common barriers to BP control. Barriers may include knowledge deficits, limited access to health care or pharmacy, inadequate communication with clinicians, cost of care and medications, complexity of the regimen, adverse effects of medication, transportation to and from the visit, work schedule, inconvenient clinic or office location or difficulty scheduling appointments, child or elder care, or other competing life demands.^{38–40} After identification of barriers, nurses work with patients and collaborating health professionals to minimize or eliminate the barriers, thereby promoting BP control.

Provide reinforcement. It is important to work with individual patients to ensure that they understand what is necessary to achieve treatment goals and that they participate in treatment decisions. Nurse responsiveness to patient concerns, along with joint problem solving to prevent or minimize barriers to care and treatment as well as provide reinforcement and support, is crucial. Provision of reminders, outreach, and follow-up services are beneficial. Follow-up on missed visits and between visits via phone or digital methods can be effective to reinforce goals and enhance the provider–patient relationship. Success in implementing the treatment regimen to achieve BP control requires frequent monitoring of BP, modification of treatment regimen, and interaction with the patient. These roles require training and dedicated time to provide the education and counseling necessary to build skills for and reinforce successful behavior change.

Promote social support. Nurses also effectively educate family members and friends to participate in the BP control process. Family members can play a fundamental role providing daily reinforcement of the patient's efforts to achieve BP control. If the patient desires greater family participation, family members should be encouraged to attend and participate in clinic visits. In addition, some patients may benefit from small group activities (eg, clinic support groups or group visits) to enhance social support and motivation.

Collaborate with other professionals. In planning care, nurses work in conjunction with the patient and members of the hypertension management

team to achieve and sustain BP control. Achieving and sustaining BP goals over time requires continuous educational and behavioral strategies, an individualized regimen, and reinforcement so that patients have the knowledge, skills, motivation, and resources to carry out treatment recommendations. Successful BP control requires that patients know what behaviors are necessary and develop skills in problem identification and problem solving to address barriers. Strategies to help patients develop these skills need to be adapted so that they are culturally salient and feasible for staff to implement.

Coordination of Care. Long-term maintenance of hypertension control requires continual monitoring of BP, refilling of prescriptions, provision of counseling and reinforcement of behavior change efforts, and titration of therapy as indicated. Each patient's management must be individualized, with costs minimized. Patients often see different providers at several settings for various health problems, fill prescriptions in more than 1 pharmacy, receive inconsistent messages, and experience interruption of therapy and inadequate communication among providers. Nurses are skilled at building and maintaining both informal and formal collaborative linkages among providers, resources, and services within and external to their practice setting. Further, nurses assist patients in understanding complex treatment regimen and navigating through the challenging and highly complex health care structure and systems.

Manage the Clinic or Office. Nurses often are in the position of managing or planning for the initiation of a hypertension clinic.⁴¹ Nurses often direct or coordinate the efforts of other team members who are working within the clinic or providing direct consultation. To enhance consistency and quality of care and to facilitate adherence to treatment guidelines, decision support systems (electronic and paper) such as flow sheets, treatment algorithms, and feedback reminders may be developed. In addition, it may be the responsibility of the nurse to hire, supervise, and train the community health workers to deliver appropriate intervention strategies and other staff, such as office assistants and receptionists, to measure BP, schedule appointments, make reminder telephone calls, obtain laboratory results, and enter data to support evaluation of clinical outcomes. Nurses influence utilization of resources, including appropriate length of visits and caseload size, as well as optimizing reimbursement for services in the hypertension clinic setting.

It is imperative that all health professionals who measure BP use correct measurement technique.¹⁹ In addition to ensuring proper BP measurement technique among staff, nurses often are responsible for ensuring that BP measurement equipment is properly calibrated and functioning.

Population Health Management. The paradigm shift from care of 1 patient at a time, either in the dyad of 1 physician with 1 patient or, more recently, the team approach, to the responsibility to care for large numbers of patients has occurred in the past decade. New models of managing care promoted by health systems and governments have focused on measuring and reimbursing improved outcomes and controlling costs of care.

Improving health for populations of people to reduce risk factors, morbidity, and mortality calls for integration of public health and prevention principles with traditional medical care. Hypertension is a prominent condition being targeted because of its prevalence and the benefits of controlling it. Public advocacy to improve health of large numbers of people and sensible policy making requires evidence of effective interventions. The evidence justifying expanded roles for nurses in hypertension care and control is abundant.

According to the recent Healthcare Trends and Forecasts survey,⁴² population health management (56%) ranked highest among 3 key areas of value-based priorities in 2014 by health professionals. Population health management requires a variety of skills, including care coordination, decision making, and project management, and is needed in communities where disparities in chronic conditions exist. By mapping health care services to the needs of the population, nurses and NPs formulate an overall health care strategy that improves hypertension care quality and reduces health disparities. Nurses can implement technology to identify and analyze these populations' most pressing health needs and, in collaboration with other health care team members, design appropriate interventions to preempt or satisfy these needs.

Performance Measurement and Quality Improvement. The universal need to measure and improve the hypertension care processes and outcomes is well established, and often it is the nurse in the hypertension care setting who has responsibility for leading these efforts. Efforts to improve suboptimal hypertension care have included the use of performance measures, which are a standardized, validated approach to assess whether correct health care processes are being performed and desired

patient outcomes are being achieved. Hypertension quality improvement strategies, including audit and feedback on performance, provider education, patient education, self-management support, patient reminder systems (for follow-up appointments, blood pressure checks, and self-management), and care delivery system changes, have been demonstrated to reduce blood pressure and improve blood pressure.^{6,28,43} In addition, multicomponent and multi-level strategies to improve the organization and delivery of hypertension care at the local community, health care delivery system, and national levels and have been found to improve blood pressure control.^{44–}

⁴⁶ With the expanding evolution of health information technologies, strategies such as electronic health records, registry databases, telehealth, digital health (“eHealth”), and the use of mobile computing and communication technologies (“mHealth”) are increasingly deployed by nurses and other members of the care team as tools to facilitate improvements in health behaviors and hypertension control.^{47–54}

Hypertension care teams are using these tools to enable appointment scheduling, reminders, and follow-up; tracking BP control trends and large-scale queries to support population health management strategies with identification of undiagnosed or undertreated hypertension; assessing frequency of clinic visits, emergency room visits, and hospitalizations; facilitating and monitoring medication prescriptions and refills; monitoring and promoting self-management behaviors, including medication adherence, diet, and physical activity; and provision of decision support for antihypertensive medication titration using evidence-based protocols and treatment algorithms. They show promise as adjunctive strategies to improve hypertension care and control.^{6,28,43}

EXEMPLARS OF NURSE-LED RESEARCH TO REDUCE THE HYPERTENSION QUALITY GAP AND ETHNIC DISPARITIES

In addition to their traditional clinical roles, nurses have been involved in the conduct of clinic- and community-based research to improve the hypertension quality gap and ethnic disparities in hypertension outcomes dating as far back as 1950.⁵⁵ In the 21st century, nurses are leading research teams to examine social, cultural, economic, and behavioral determinants of hypertension outcomes. The following studies are exemplars of nurses' roles in leading research to improve hypertension care and control.

The Comprehensive High Blood Pressure Care and Control in Young Urban Black Men Study^{39,56,57} was a nurse-led 5-year RCT of hypertensive urban African-American men (N = 309) that evaluated the effectiveness of a more intensive comprehensive educational-behavioral-pharmacological intervention by an NP–community health worker–physician (NP/CHW/MD) team and a less intensive education and referral intervention in controlling BP and minimizing progression of left ventricular hypertrophy (LVH) and renal insufficiency. At the 36-month follow-up, the more intensive intervention led to a lower BP and decreased progression of LVH. At 5 years, LVH prevalence in the more intensive group was lower compared with the less intensive group (37% vs 56%, $P = 0.02$). However, between-group significant difference in BP control (more intensive 44%, less intensive 31%, $P = 0.05$) at 3 years was not sustained to the 5-year follow-up period. By using a multifaceted, individually tailored, multidisciplinary team approach with free medications, this study demonstrated that it was possible to recruit and retain a cohort of inner-city young African-American men with hypertension, improve BP control, and reduced barriers to BP control.

With respect to international studies, the HiHi Study^{38,58} was a cross-sectional descriptive study (N = 403) of periurban black South Africans that examined determinants of hypertension care control to identify opportunities to improve hypertension outcomes and quality of care. Using the PRECEDE-PROCEED Model⁵⁹ as the guiding framework, it was observed that significant and interrelated predictors of lower SBP and DBP or BP control were fewer antihypertensive medications, better compliance to hypertension recommendations, younger age, female sex, higher education, and moderate alcohol consumption.^{38,58} Hence, interventions at the patient, provider, and system level were identified as important areas to address to improve hypertension care and control in primary health care settings in South Africa.

The COACH trial³⁰ was an RCT evaluating the effectiveness of a comprehensive program of CVD risk reduction delivered by NP/CHW teams versus enhanced usual care to improve lipids, BP, and glycated hemoglobin in primarily low-income patients in urban community health centers (N = 525). The NP/CHW intervention included aggressive pharmacological management, tailored low-literacy educational materials, and behavioral counseling for lifestyle modification and problem solving to address barriers to adherence and control. A

significantly greater improvement in SBP (difference = 6.2 mm Hg), DBP (difference = 3.1 mm Hg), and perceptions of the quality of chronic illness care compared with the enhanced usual care group was observed.

Commodore-Mensah et al^{60,61} conducted a cross-sectional epidemiological study (N = 253) to examine the association between acculturation and CVD risk factors, including hypertension, in the growing African immigrant population in the United States, which is often studied as a homogeneous group with the dominant African-American population. Hypertension diagnosis, treatment, and control were 40%, 53%, and 50%, respectively, and prevalence of overweight and obesity was 88%. African immigrants who identified equally with the US society and their African culture (integrationists) were more likely to have controlled BP than those who identified more with their African culture (traditionalists) (68% vs 25%; $P = 0.011$). This study examined disparities in CVD risk from an ethnic perspective rather than a racial perspective⁶² to inform the implementation of culturally tailored public health interventions in this ethnic minority population.

Using the principles of community-based participatory research, the Self-Help Intervention Program for High Blood Pressure Care (SHIP-HBP)^{63,64} was a 15-month trial that consisted of 6-week behavioral education followed by home telemonitoring of BP and bilingual nurse telephone counseling for 12 months among Korean immigrants (N = 359). The research team adapted and translated evidence-based hypertension treatment guidelines and behavioral recommendations into more culturally relevant education materials for first-generation Korean immigrants. The intervention resulted in a sharp increase in BP control rates, which was sustained over 12 months. At baseline, BP control was achieved in only 30% of the sample. After the initial education period (approximately 3 months), BP control was achieved in 73% of the participants, and this level of control continuously improved over a 12-month follow-up period (83.2%, $P < 0.001$).

CONCLUSIONS

Nurses have been involved in hypertension care and control for as long as the field has been formally addressed by professional societies, voluntary non-profit organizations, and governments, approximately 50 years. The roles initially involved

assisting in office evaluation by measuring BP and educating patients. As nurses' skills evolved through on-the-job or graduate training, their roles in hypertension evolved to include physical assessment, medication and lifestyle prescription, and greater independent practice. Nurse-led clinics and team models of care and research have evolved and contributed to increasing the number of patients

receiving high-quality hypertension care and control. Nurses have assumed leadership roles in the conduct of research to improve hypertension care quality and reduce ethnic disparities by holistically examining social, cultural, economic, and behavioral determinants of hypertension outcomes and designing culturally sensitive interventions geared at addressing these factors.

REFERENCES

- Kearney PM, Whelton M, Reynolds K, Muntner P, Whelton PK, He J. Global burden of hypertension: analysis of worldwide data. *Lancet* 2005;365:217–23.
- James PA, Oparil S, Carter BL, et al. 2014 evidence-based guideline for the management of high blood pressure in adults: report from the panel members appointed to the eighth joint national committee (JNC 8). *JAMA* 2014;311:507–20.
- Law MR, Morris JK, Wald NJ. Use of blood pressure lowering drugs in the prevention of cardiovascular disease: meta-analysis of 147 randomised trials in the context of expectations from prospective epidemiological studies. *BMJ* 2009;338:b1665.
- Guo F, He D, Zhang W, Walton RG. Trends in prevalence, awareness, management, and control of hypertension among United States adults, 1999 to 2010. *J Am Coll Cardiol* 2012;60:599–606.
- Gillespie CD, Hurvitz KA. Centers for Disease Control and Prevention (CDC). Prevalence of hypertension and controlled hypertension—United States, 2007–2010. *MMWR Surveill Summ* 2013;62(Suppl 3):144–8.
- Walsh JM, McDonald KM, Shojania KG, et al. Quality improvement strategies for hypertension management: a systematic review. *Med Care* 2006;44:646–57.
- Carter BL, Bosworth HB, Green BB. The hypertension team: the role of the pharmacist, nurse, and teamwork in hypertension therapy. *J Clin Hypertens (Greenwich)* 2012;14:51–65.
- Clark CE, Smith LF, Taylor RS, Campbell JL. Nurse led interventions to improve control of blood pressure in people with hypertension: systematic review and meta-analysis. *BMJ* 2010;341:c3995.
- Shaw RJ, McDuffie JR, Hendrix CC, et al. Effects of nurse-managed protocols in the outpatient management of adults with chronic conditions: a systematic review and meta-analysis. *Ann Intern Med* 2014;161:113–21.
- Santschi V, Chioloro A, Colosimo AL, et al. Improving blood pressure control through pharmacist interventions: a meta-analysis of randomized controlled trials. *J Am Heart Assoc* 2014;3:e000718.
- Proia KK, Thota AB, Njie GJ, et al. Team-based care and improved blood pressure control: a community guide systematic review. *Am J Prev Med* 2014;47:86–99.
- Miller NH, Hill MN. Nursing clinics in the management of hypertension. In: Oparil S, Weber M, eds. *Hypertension*. 2nd ed. Philadelphia, PA: Saunders; 2005.
- Perry HM Jr, Bingham S, Horney A, et al. Antihypertensive efficacy of treatment regimens used in veterans administration hypertension clinics. Department of Veterans Affairs Cooperative Study Group on Antihypertensive Agents. *Hypertension* 1998;31:771–9.
- Five-year findings of the hypertension detection and follow-up program. I. Reduction in mortality of persons with high blood pressure, including mild hypertension. Hypertension detection and follow-up program cooperative group. 1979. *JAMA* 1997;277:157–66.
- Barkauskas VH, Pohl JM, Tanner C, Onifade TJ, Pilon B. Quality of care in nurse-managed health centers. *Nurs Adm Q* 2011;35:34–43.
- Brush JE Jr, Handberg EM, Biga C, et al. 2015 ACC health policy statement on cardiovascular team-based care and the role of advanced practice providers. *J Am Coll Cardiol* 2015;65:2118–36.
- Brownstein JN, Chowdhury FM, Norris SL, et al. Effectiveness of community health workers in the care of people with hypertension. *Am J Prev Med* 2007;32:435–47.
- Dennison CR, Hill MN. Multidisciplinary management of hypertension and the role of the nurse. In: Lip G, Hall JE, eds. *Comprehensive Hypertension*. Philadelphia, PA: Mosby; 2007:1147–55.
- Pickering TG, Hall JE, Appel LJ, et al. Recommendations for blood pressure measurement in humans and experimental animals: Part 1: Blood pressure measurement in humans: a statement for professionals from the Subcommittee of Professional and Public Education of the American Heart Association Council on High Blood Pressure Research. *Circulation* 2005;111:697–716.
- D'Agostino RBS, Vasan RS, Pencina MJ, et al. General cardiovascular risk profile for use in primary care: the Framingham Heart Study. *Circulation* 2008;117:743–53.
- Goff DC Jr, Lloyd-Jones DM, Bennett G, et al. 2013 ACC/AHA guideline on the assessment of cardiovascular risk: a report of the American College of Cardiology/American Heart Association Task Force on Practice Guidelines. *Circulation* 2014;129:S49–73.
- Hippisley-Cox J, Coupland C, Vinogradova Y, Robson J, May M, Brindle P. Derivation and validation of QRISK, a new cardiovascular disease risk score for the United Kingdom: prospective open cohort study. *BMJ* 2007;335:136.
- Ridker PM, Paynter NP, Rifai N, Gaziano JM, Cook NR. C-reactive protein and parental history improve global cardiovascular risk prediction: the Reynolds risk score for men. *Circulation* 2008;118:2243–51. 4p following 2251.
- Ridker PM, Buring JE, Rifai N, Cook NR. Development and validation of improved algorithms for the assessment of global cardiovascular risk in women: the Reynolds risk score. *JAMA* 2007;297:611–9.
- Commodore-Mensah Y, Himmelfarb CR. Patient education strategies for hospitalized cardiovascular patients: a systematic review. *J Cardiovasc Nurs* 2012;27:154–74.
- Calhoun DA, Jones D, Textor S, et al. Resistant hypertension: Diagnosis, evaluation, and treatment: a scientific statement from the American Heart

- Association Professional Education Committee of the Council for High Blood Pressure Research. *Circulation* 2008;117:e510–26.
27. Williams B, Poulter NR, Brown MJ, et al. British Hypertension Society guidelines for hypertension management 2004 (BHS-IV): summary. *BMJ* 2004;328:634–40.
 28. Go AS, Bauman MA, Coleman King SM, et al. An effective approach to high blood pressure control: a science advisory from the American Heart Association, the American College of Cardiology, and the Centers for Disease Control and Prevention. *J Am Coll Cardiol* 2014;63:1230–8.
 29. Aubert RE, Herman WH, Waters J, et al. Nurse case management to improve glycemic control in diabetic patients in a health maintenance organization. A randomized, controlled trial. *Ann Intern Med* 1998;129:605–12.
 30. Allen JK, Dennison-Himmelfarb CR, Szanton SL, et al. Community outreach and cardiovascular health (COACH) trial: a randomized, controlled trial of nurse practitioner/community health worker cardiovascular disease risk reduction in urban community health centers. *Circ Cardiovasc Qual Outcomes* 2011;4:595–602.
 31. Hayman LL, Berra K, Fletcher BJ, Houston Miller N. The role of nurses in promoting cardiovascular health worldwide: the global cardiovascular nursing leadership forum. *J Am Coll Cardiol* 2015;66:864–6.
 32. Artinian NT, Fletcher GF, Mozaffarian D, et al. Interventions to promote physical activity and dietary lifestyle changes for cardiovascular risk factor reduction in adults: a scientific statement from the American Heart Association. *Circulation* 2010;122:406–41.
 33. Eckel RH, Jakicic JM, Ard JD, et al. 2013 AHA/ACC guideline on lifestyle management to reduce cardiovascular risk: a report of the American College of Cardiology/American Heart Association task force on practice guidelines. *J Am Coll Cardiol* 2014;63:2960–84.
 34. Gwadry-Sridhar FH, Manias E, Lal L, et al. Impact of interventions on medication adherence and blood pressure control in patients with essential hypertension: a systematic review by the ISPOR medication adherence and persistence special interest group. *Value Health* 2013;16:863–71.
 35. Nieuwlaat R, Wilczynski N, Navarro T, et al. Interventions for enhancing medication adherence. *Cochrane Database Syst Rev* 2014;11:CD000011.
 36. Patient behavior for blood pressure control. Guidelines for professionals. *JAMA* 1979;241:2534–7.
 37. Miller NH, Hill M, Kottke T, Ockene IS. The multilevel compliance challenge: recommendations for a call to action. A statement for healthcare professionals. *Circulation* 1997;95:1085–90.
 38. Dennison CR, Peer N, Steyn K, Levitt NS, Hill MN. Determinants of hypertension care and control among peri-urban black South Africans: the HiHi study. *Ethn Dis* 2007;17:484–91.
 39. Hill MN, Bone LR, Kim MT, Miller DJ, Dennison CR, Levine DM. Barriers to hypertension care and control in young urban black men. *Am J Hypertens* 1999;12:951–8.
 40. Ogedegbe G. Barriers to optimal hypertension control. *J Clin Hypertens (Greenwich)* 2008;10:644–6.
 41. Prevention of stroke by antihypertensive drug treatment in older persons with isolated systolic hypertension. final results of the Systolic Hypertension in the Elderly Program (SHEP). SHEP Cooperative Research Group. *JAMA* 1991;265:3255–64.
 42. The Healthcare Intelligence Network. Healthcare trends in 2014: putting money on population health, care coordination and integrated care delivery. Sea Girt, NJ: Healthcare Intelligence Network. Available at: <http://www.hin.com/library/HealthcareTrends2014.pdf>; 2013. Accessed December 21, 2015.
 43. Glynn LG, Murphy AW, Smith SM, Schroeder K, Fahey T. Interventions used to improve control of blood pressure in patients with hypertension. *Cochrane Database Syst Rev* 2010:CD005182.
 44. Jaffe MG, Lee GA, Young JD, Sidney S, Go AS. Improved blood pressure control associated with a large-scale hypertension program. *JAMA* 2013;310:699–705.
 45. Thomas KL, Shah BR, Elliot-Bynum S, et al. Check it, change it: a community-based, multifaceted intervention to improve blood pressure control. *Circ Cardiovasc Qual Outcomes* 2014;7:828–34.
 46. Million Hearts. Tools & protocols. Atlanta, GA: Centers for Disease Control and Prevention; 2015. Available at: <http://millionhearts.hhs.gov/tools-protocols/index.html>. Updated 2015. Accessed January 13, 2016.
 47. Agarwal R, Bills JE, Hecht TJ, Light RP. Role of home blood pressure monitoring in overcoming therapeutic inertia and improving hypertension control: a systematic review and meta-analysis. *Hypertension* 2011;57:29–38.
 48. Borden WB, Maddox TM, Tang F, et al. Impact of the 2014 expert panel recommendations for management of high blood pressure on contemporary cardiovascular practice: insights from the NCDR PINNACLE registry. *J Am Coll Cardiol* 2014;64:2196–203.
 49. Burke LE, Ma J, Azar KM, et al. Current science on consumer use of mobile health for cardiovascular disease prevention: a scientific statement from the American Heart Association. *Circulation* 2015;132:1157–213.
 50. Li JS, Barnett TA, Goodman E, Wasserman RC, Kemper AR; American Heart Association Atherosclerosis, Hypertension and Obesity in the Young Committee of the Council on Cardiovascular Disease in the Young, Council on Epidemiology and Prevention, and Council on Nutrition, Physical Activity and Metabolism. Approaches to the prevention and management of childhood obesity: the role of social networks and the use of social media and related electronic technologies: a scientific statement from the American Heart Association. *Circulation* 2013;127:260–7.
 51. Liu S, Dunford SD, Leung YW, et al. Reducing blood pressure with internet-based interventions: a meta-analysis. *Can J Cardiol* 2013;29:613–21.
 52. Omboni S, Gazzola T, Carabelli G, Parati G. Clinical usefulness and cost effectiveness of home blood pressure telemonitoring: meta-analysis of randomized controlled studies. *J Hypertens* 2013;31:455–67. discussion 467–8.
 53. Omboni S, Ferrari R. The role of telemedicine in hypertension management: focus on blood pressure telemonitoring. *Curr Hypertens Rep* 2015;17:535.
 54. Verberk WJ, Kessels AG, Thien T. Telecare is a valuable tool for hypertension management: a systematic review and meta-analysis. *Blood Press Monit* 2011;16:149–55.
 55. Frant R, Groen J. Prognosis of vascular hypertension; a 9 year follow-up study of 418 cases. *Arch Intern Med (Chic)* 1950;85:727–50.
 56. Hill MN, Han HR, Dennison CR, et al. Hypertension care and control in underserved urban African American men: behavioral and physiologic outcomes at 36 months. *Am J Hypertens* 2003;16:906–13.
 57. Dennison CR, Post WS, Kim MT, et al. Underserved urban African American men: hypertension trial outcomes and mortality during 5 years. *Am J Hypertens* 2007;20:164–71.
 58. Dennison CR, Peer N, Lombard CJ, et al. Cardiovascular risk and comorbid conditions among black South Africans with hypertension in public and private primary care settings: the HiHi study. *Ethn Dis* 2007;17:477–83.
 59. Green LW, Kreuter MW, eds. *Health Promotion Planning: An Educational*

- and Ecological Approach. 4th ed. New York, NY: McGraw-Hill; 2005.
60. Commodore-Mensah Y, Hill M, Allen J, et al. Sex differences and cardiovascular disease risk of Ghanaian and Nigerian-born West African immigrants in the United States: The Afro-Cardiac Study. *J Am Heart Assoc* 2016;5(2):e002385.
 61. Commodore-Mensah Y, Sampah M, Berko C, et al. The Afro-Cardiac Study: cardiovascular disease risk and acculturation in West African immigrants in the United States: rationale and study design [e-pub ahead of print]. *J Immigr Minor Health* 2015.
 62. Commodore-Mensah Y, Dennison Himmelfarb CR, Agyemang C, Sumner AE. Cardiometabolic health in African immigrants to the United States: a call to re-examine research on African-descent populations. *Ethn Dis* 2015;25:373–80.
 63. Kim MT, Han HR, Hedlin H, et al. Teletransmitted monitoring of blood pressure and bilingual nurse counseling—sustained improvements in blood pressure control during 12 months in hypertensive Korean Americans. *J Clin Hypertens (Greenwich)* 2011;13:605–12.
 64. Kim MT, Han HR, Park HJ, Lee H, Kim KB. Constructing and testing a self-help intervention program for high blood pressure control in Korean American seniors—a pilot study. *J Cardiovasc Nurs* 2006;21:77–84.