Comprehensive Approach for Hypertension Control in Low-Income Populations: Rationale and Study Design for the Hypertension Control Program in Argentina

Katherine T. Mills, PhD, Adolfo Rubinstein, MD, PhD, Vilma Irazola, MD, MSc, Jing Chen, MD, MSc, Andrea Beratarrechea, MD, PhD, Rosana Poggio, MD, MSc, Jacquelyn Dolan, BS, Federico Augustovski, MD, PhD, Lizheng Shi, PhD, Marie Krousel-Wood, MD, MSPH, Lydia A. Bazzano, MD, PhD and Jiang He, MD, PhD

Abstract: Although the efficacy and effectiveness of lifestyle modifications and antihypertensive pharmaceutical treatment for the prevention and control of hypertension and concomitant cardiovascular disease have been demonstrated in randomized controlled trials, this scientific knowledge has not been fully applied in the general population, especially in low-income communities. This article summarizes interventions to improve hypertension management and describes the rationale and study design for a cluster randomized trial testing whether a comprehensive intervention program within a national public primary care system will improve hypertension control among uninsured hypertensive men and women and their families. We will recruit 1,890 adults from 18 clinics within a public primary care network in Argentina. Clinic patients with uncontrolled hypertension, their spouses and hypertensive family members will be enrolled. The comprehensive intervention program targets the primary care system through health care provider education, a home-based intervention among patients and their families (home delivery of antihypertensive medication, self-monitoring of blood pressure [BP], health education for medication adherence and lifestyle modification) conducted by community health workers and a mobile health intervention. The primary outcome is net change in systolic BP from baseline to month 18 between intervention and control groups among hypertensive study participants. The secondary outcomes are net change in diastolic BP, BP control and cost-effectiveness of the intervention. This study will generate urgently needed data on effective, practical and sustainable intervention programs aimed at controlling hypertension and concomitant cardiovascular disease in underserved populations in low- and middle-income countries.

Key Indexing Terms: Hypertension; Cluster randomized trial; Medication adherence; Lifestyle Modification; Blood pressure control. **[Am J Med Sci 2014;348(2):139–145.]**

HYPERTENSION IN LOW- AND MIDDLE-INCOME COUNTRIES

Hypertension is a global public health challenge because of its high prevalence and concomitant increase in risk of cardiovascular disease (CVD).[1,2] It was estimated that 26.4% of the world adult population in 2000 had hypertension and 29.2% were projected to have hypertension by 2025.[1] Hypertension is a leading global risk factor for CVD and premature death.[2] Approximately 80% of the attributable burden of hypertension is in low- and middle-income countries (LMICs).[2] In these countries, the prevalence of hypertension continues to be high and is increasing while the proportion of hypertensive patients who are aware, treated and controlled are unacceptably low.[3] Hypertension detection, treatment and control in these countries are often burdened with strained health care systems, limited financial resources and lack of prioritization of chronic disease care.[3]

Latin America has the highest estimated prevalence of hypertension in the world.[1] The Cardiovascular Risk Factor Multiple Evaluation in Latin America study reported the highest prevalence of hypertension (29.0%) in Buenos Aires, Argentina.[4] In addition, 35.9% of Argentines with hypertension were unaware of their status, and only 18.0% were treated and controlled.[4] Hypertension explained 37.0% of all coronary heart disease and stroke events in Argentina in 2005.[5]

The hypertension control rate is even lower in underserved populations in Argentina. For example, even though antihypertensive drugs are delivered free of charge at public primary care clinics under the Remediar+Redes program, only 57% of uninsured hypertensive patients were treated. In those treated, almost 75% of patients received medication for $\leq$4 months per year, and only 11.8% received it for $\geq$9 months per year.[6]

LIFESTYLE MODIFICATION AND ANTIHYPERTENSIVE MEDICATIONS

Randomized clinical trials have demonstrated that lifestyle modification and antihypertensive medications lower blood pressure (BP) and risk of CVD.[7,8] Proven, effective lifestyle interventions exist for the prevention and treatment of hypertension, including weight loss, decreased sodium intake, increased physical activity, reduced excessive alcohol intake, increased potassium intake and consumption of a healthy diet rich in fruits, vegetables and low-fat dairy products with reduced saturated and total fat.[7] Randomized controlled trials have demonstrated that treatment with any commonly used antihypertensive medication regimen reduces the risk of major CVD events and total mortality.[8] Although the efficacy and effectiveness of lifestyle modifications and antihypertensive

From the Departments of Epidemiology (KTM, JC, JD, MK-W, LAB, JH) and Global Health Systems and Development (LS), Tulane University School of Public Health and Tropical Medicine, New Orleans, Louisiana; Department of Medicine (JC, MK-W, JH), Tulane University School of Medicine, New Orleans, Louisiana; Center for Health Research (MK-W), Ochsner Health System, New Orleans, Louisiana; and Institute for Clinical Effectiveness and Health Policy (AR, VI, AB, RP, FA), Buenos Aires, Argentina.

Support to the Hypertension Control Program in Argentina is provided by the National Heart, Lung, and Blood Institute, the National Institutes of Health Grant U01HL114197 under the Global Alliance for Chronic Diseases programme.

The authors have no conflicts of interest to disclose.

Correspondence: Jiang He, MD, PhD, Department of Epidemiology, Tulane University School of Public Health and Tropical Medicine, 1440 Canal Street, SL-18, New Orleans, LA 70112 (E-mail: jhe@tulane.edu).

medications on the prevention of hypertension and consequent CVD risk have been demonstrated in randomized controlled trials, this scientific knowledge has not been fully applied in the general population, especially in LMICs.[9] Therefore, there is an urgent need to implement innovative strategies to improve hypertension treatment and control in LMICs.

INTERVENTIONS TO IMPROVE BP CONTROL

Barriers to hypertension control have been identified at the health care system, health care provider and patient levels. Lack of access to health care, medication costs and poor insurance coverage are major health care system-level barriers to hypertension prevention and control.[9] Additional barriers include multiple competing demands on physician time and lack of reimbursement for preventive counseling.[10] Provider-level barriers include lack of adherence to guidelines, willingness to accept elevated BP and failure to prioritize BP management among multiple chronic medical issues.[9] Surveys have identified many reasons for provider failure to adhere to published guidelines, including uncertainty that clinical BP levels are representative of patients' usual BP, hypertension not being a priority for the visit and patient nonadherence with medications already prescribed.[11] Patient-level barriers to BP control are primarily related to therapy adherence and include low perceived risks of high BP, low health literacy, lack of motivation, out-of-pocket medication costs and adverse side effects.[9,12] Adherence to antihypertensive medications is difficult because they are costly, prone to side effects and no benefit is immediately observed.[13] Because barriers to hypertension control exist at multiple levels (ie, health care system, provider and patient), a combination of effective interventions is needed to comprehensively address hypertension treatment and control.

Interventions to address the previously described barriers have been developed and tested in clinical trials conducted primarily in high-income countries. These interventions include physician education, family-based education, self-monitoring of BP, use of community health workers (CHWs) as part of the health care delivery team and mobile health interventions.[14–28] Interactive physician educational programs have resulted in improvements in professional practice and BP control. After implementation of a large-scale hypertension program consisting of physician education on the use of an evidence-based clinical practice guideline, the hypertension control rate in a large health care delivery system almost doubled from 43.6% in 2001 to 80.4% in 2009 (P for trend <0.001).[14] In a meta-analysis, physician education interventions specific to BP control have resulted in a median reduction in systolic BP of 3.3 mm Hg and diastolic BP of 0.6 mm Hg.[15]

BP-lowering trials with a patient education component in multi-factorial interventions have been successful in lowering BP and controlling hypertension. A systematic review of hypertension management interventions found a median reduction of 8.1 mm Hg for systolic BP and 3.8 mm Hg for diastolic BP, as well as median 19.2% and 17.0% increases in systolic and diastolic BP control, respectively, in studies with a patient education component.[15] Patient reminder strategies (encouraging patients to keep appointments or adhere to treatment) have been effective for improving BP control in hypertension.[15,16] In comparison to individual education, family-based education has the added advantages of providing social support and accountability and targets shared lifestyle changes, such as food preparation and leisure time activities. Social support has a positive impact on many chronic disease outcomes, including hypertension.[17] In addition, spouses of patients with hypertension are more likely to have high BP than spouses of normotensives,[18] so targeting interventions at the family could also lower BP of high-risk individuals who are not the primary patient.

Home BP monitoring is an effective tool in the management of hypertension. Compared with measurements in a physician's office or clinic, home BP monitoring minimizes the "white coat" effect and allows for frequent and multiple readings.[19] Because some physicians are hesitant to treat hypertension based on clinic measurements alone, home BP monitoring can provide additional BP measurements leading to better treatment decisions. Home BP monitoring using electronic cuffs has been shown to be more effective in reducing BP and reaching target BP goals than BP monitoring in a clinical setting alone.[20] A recent trial comparing home BP monitoring used for antihypertensive therapy adjustment to usual care found a 9.7 mm Hg greater reduction in systolic BP ($P < 0.001$), a 5.1 greater reduction in diastolic BP ($P < 0.001$) and an 18.2% greater control rate ($P = 0.005$) in the intervention group compared with usual care after 1 year.[21]

CHW can increase the capacity of an already overburdened health care system by using health care resources effectively and increasing the quality of care.[22] The addition of CHW to the clinical team is an example of organizational or team change, which addresses system-level barriers to hypertension prevention and control by simplifying the health care provider's tasks and transferring some responsibility for patient care to another team member (task shifting). Task shifting from physicians to other team members was an important component of a large-scale hypertension program in an integrated health care delivery system that was able to almost double hypertension control rates in 8 years because it addressed patient barriers by reducing appointment times, providing increased scheduling flexibility and decreasing health care costs.[14] Team change strategies have resulted in median reductions in systolic BP of 9.7 mm Hg and in diastolic BP of 4.2 mm Hg in a meta-analysis.[15] In addition, CHW may remove barriers to BP control and medication adherence because of cultural, educational and language differences between community members and the health care system.[23] A systematic review of randomized trials using CHW to implement BP control programs found significant improvement in 7 of 8 studies, primarily in poor, urban, minority communities.[24] Trials in LMICs have also shown reductions in BP using CHW-delivered programs.[25]

Mobile health (mHealth), which uses mobile telecommunication and multimedia technologies for health-related purposes, has great potential for supporting behavior change. For example, in a trial of mobile phone text messages coupled with BP telemonitoring in diabetic patients with uncontrolled systolic hypertension, daytime ambulatory systolic BP decreased by 9.1 mm Hg in the intervention group versus 1.5 mm Hg in the control group ($P < 0.005$).[26] A review of text messaging or e-mail interventions identified 16 randomized trials, of which 10 reported significant improvement in outcomes and 6 reported differences suggesting positive trends.[27] In addition, mHealth trials in LMICs have demonstrated some improvements in chronic disease management.[28]

Recent randomized trials have shown that a comprehensive intervention strategy is more effective in hypertension control than individual components. For example, in the Hypertension Improvement Project, the greatest BP control was seen in the group with physician and patient interventions.[29] Similarly, reviews examining the translation of guidelines into practice have demonstrated that isolated strategies are largely ineffective, whereas integration of multiple intervention strategies (even those that are ineffective in isolation) in the