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BLOOD PRESSURE MONITORING AND MANAGEMENT (J COCKCROFT, SECTION EDITOR)

Hypertension in Developing Countries: A Major Challenge for the Future

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Abstract

Purpose of Review Outline recent epidemiologic data regarding hypertension in developing countries, distinguish differences from developed countries, and identify challenges in management and future perspectives.

Recent Findings Increased sugar intake, air and noise pollution, and low birth weight are emerging hypertension risk factors. The major challenges in management are difficulties in accurate diagnosis of hypertension and adequate blood pressure control.

Summary In contrast to developed countries, hypertension prevalence rates are on the rise in developing countries with no improvement in awareness or control rates. The increasing burden of hypertension is largely attributable to behavioral factors, urbanization, unhealthy diet, obesity, social stress, and inactivity. Health authorities, medical societies, and drug industry can collaborate to improve hypertension control through education programs, public awareness campaigns, legislation to limit salt intake, encourage generic drugs, development and dissemination of national guidelines, and involving nurses and pharmacists in hypertension management. More epidemiologic data are needed in the future to identify reasons behind increased prevalence and poor blood pressure control and examine trends in prevalence, awareness, treatment, and control. National programs for better hypertension control based on local culture, economic characteristics, and available resources in the population are needed. The role of new tools for hypertension management should be tested in developing world.

Keywords Developing countries · Blood pressure control · Guidelines · Drug adherence · Risk factors

Introduction

While trends in hypertension prevalence are on the decline in Western industrial countries with improvement in awareness, treatment, and control rates, high hypertension prevalence rates did not change or on the rise in the developing world. Systolic blood pressure (SBP) falls in high-income countries between 1980 and 2008, and it rose in developing countries [1••]. Reasons for increasing prevalence include aging of the population, since aging is a risk factor for hypertension. Other causes are urbanization with associated changes in lifestyle and dietary habits [2, 3•], increasing prevalence of obesity, diabetes, and metabolic syndrome [4] and lack of physical exercise. The increasing urbanization is one of the main reasons for the rise of prevalence of hypertension. The levels of hypertension in developing countries are higher in urban than in rural settings. People in developing countries are progressively shifting toward a Western style diet with more animal products, refined grains, fat, salt, and sugars and less fibers [5, 6]. Additional hypertension risk factors in some developing countries as a consequence of overcrowding and industrialization are air and noise pollution [7•, 8–11]. Low birth weight which is associated with future development of hypertension is common in many developing countries [12]. Furthermore, limited financial resources and inadequate health services compounded with medical illiteracy are barriers for improving hypertension prevention and control.

In this review, I will try to outline the following: (1) what is special about hypertension in developing countries; (2) what are the major challenges in its management; and (3) what do we need for the future?

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What Is Special About Hypertension in Developing Countries?

High Prevalence and Low Awareness, Treatment, and Control Rates

In a systematic analysis of population-based studies from 135 populations from 968,419 adults in 90 countries, Mills et al. [13•] reported a prevalence rate of hypertension in 2010 of 28.5% in high-income countries and 31.5% in low- and middle-income countries.

The prevalence of hypertension decreased by 2.6% in high-income countries but increased by 7.7% in low- and middle-income countries from 2000 to 2010. The proportions of awareness, treatment, and control of hypertension were much lower in low- and middle-income countries than in high-income countries. Over the past decades, hypertension awareness, treatment, and control increased substantially in high-income countries, whereas there was less improvement in low- and middle-income countries [13•].

In a Prospective Urban Rural Epidemiology (PURE) study [14••] where prevalence, awareness, treatment, and control of hypertension in rural and urban communities were examined in high-, middle-, and low-income countries, the treatment rate was 31.7% in low-income compared with 46.7% in high-income countries. New WHO data for Ghana and South Africa show that less than 10% of people with hypertension had access to effective treatment [15]. The treatment rates in most Western countries was between 50 and 80% [16], while far less in developing countries, e.g., Indonesia 25% [17] and China 22% [18]. The control rates varied from 5.3% in China and 10.1% in India [19].

Hypertension Risk Factors

The current increasing burden of hypertension is largely attributable to behavioral factors such as unhealthy diet (excessive salt and alcohol consumption, low fruit and vegetable consumption), physical inactivity, and obesity. Urbanization which is rapidly increasing worldwide is associated with hypertension because of changes in dietary habits, social stress, and physical inactivity. Insufficient physical activity in adults was reported in 32% of Egyptians and 49% in Iraq (WHO Statistics 2016). Overweight and obesity levels are particularly high among women in Mexico, Egypt, and South Africa [20••]. Siervo et al. [21•] found that meat, animal fat, and milk consumption were directly associated with obesity and hypertension prevalence. Consumption of high sodium content foods is increasing in developing countries [22].

Quiet alarming is the fact that the prevalence of childhood hypertension has been increasing; it currently occurs at a rate of 1–2% in developed countries and at a rate of 5–10% in developing countries [23]. Among a total of 2166 school-aged children in western Turkey, prevalence of hypertension was 15.1% and obesity was 18% [24].

Emerging Hypertension Risk Factors

Sugar and Hypertension

There is now an emerging but inconclusive body of evidence that added sugar, particularly those in soft drinks, may have a direct effect on blood pressure independent of obesity [25]. A recent review of 12 studies with 407,707 participants [26] showed that sugar-sweetened soft drink consumption was associated with increased blood pressure. Brown et al. [27•] reported in a cross-sectional study associations of sugar-sweetened beverages (SSBs), diet beverages, and sugar with blood pressure. Sugars containing fructose may play a major role in the development of hypertension, obesity, and metabolic syndrome [28].

The global consumption of sugar and animal products has increased steadily in the last five decades and highly populated, emerging economies have assumed a key role [29]. India, East Asia, and Latin America continue to drive growth in world sugar consumption [29]. The WHO has recommended limiting the consumption of added sugar to less than 10% of total energy intake [30]. The American Heart Association has further lowered the upper limit of added sugar intake to around 6% [31].

Air Pollution

Air pollution, both outdoor and indoor, is considered a major health problem in developing countries. Rapid urbanization associated with unplanned growth of cities in many developing countries is accompanied by environmental risks as a result of overcrowding and industrial development, both leading to air pollution. Sustained exposure to ambient and household air pollution has deleterious effects on cardiovascular systems and associated with hypertension [7•].

East Asian countries, due to their rapidly developing economies and dense pollution, are exposed to very high levels of air pollution. Dong et al. [9] found an association between long-term air pollution and increased blood pressure and hypertension in Chinese; however, the association was only statistically significant in men. In a cross-sectional survey of both oil-/gas-polluted and non-polluted communities in the Niger Delta region of Nigeria, Ezejimofor et al. [8] found that participants living in oil-polluted areas were almost five times as likely to have developed hypertension.

An association was found between exposure to indoor air pollution during pregnancy and low birth weight [7•].

Noise Pollution

Another byproduct of overcrowding, urbanization, and industrialization in developing countries is the increased levels of noise exposure. Noise exposure is independently associated with hypertension. In a cross-sectional study conducted in Brazil, DeSouza et al. [11] found an association between occupational noise exposure and hypertension, among petrochemical workers at Rio de Janeiro. Cumulative noise exposure was found to be associated with hypertension among steel workers in China [10]. Elevated risk of hypertension was shown in subjects exposed to high levels of noise for longer duration and with cumulative noise exposure of 85 dB and above [11].

Low Birth Weight

In developing countries, infant weight is lower than in developed countries. The highest proportion of low birth weight babies in the world is in South Asia [32]. The percentage of low birth weight among new born according to WHO statistics was 32 in Pakistan, 32.3 in Sudan, and 45 in Yemen [33]. There is an increased relationship of birth weight and adult hypertension [34]. Low birth weight has a tendency to cause adult high blood pressure in South Asian region [12].

Inadequate Health Services

At least half of the world population still lacks access to essential health services. In many developing countries, medical health insurance is non-existent. Low- and middle-income countries face many competing priorities for investment and end up committing less financial resources to health. The USA spends US $ 8362 per capita on health, whereas Eritrea spends 12 US $ [35]. In poorer countries, most health care costs must be paid by patients out of pocket according to recent WHO statistics 2016 [33]. The out-of-pocket expenditure as percentage of total health expenditure was 63% in Afghanistan, 75.5% in Sudan, 56.3% in Pakistan, and 55.7% in Egypt. The health workforce was quite limited in developing countries. The number of physicians per 10,000 population was 2.1 in Djibouti, 2.7 in Afghanistan, 3.0 in Yemen, and 8.4 in Egypt [33].

Major Challenges in Management of Hypertension

Accurate Diagnosis of Hypertension

There have been widespread and well-documented difficulties in the ability to take an accurate and reproducible blood pressure measurement. A major contributing factor to the rising tide of hypertension in African countries is the lack of a simple, reliable, and accurate device for measuring blood pressure [36].

The British Hypertension Society Guidelines—NICE [37]—recommend that a diagnosis of hypertension should be confirmed using 24 h ABPM as a gold standard rather than be based solely on measurements of blood pressure taken in the clinic. The recent Australian Guidelines [38••] recommend ambulatory and/or home monitoring should be offered to confirm the blood pressure level if clinic blood pressure is ≥ 140/90 mmHg, or hypertension is suspected. The Canadian Guidelines (2017) recommended automated office blood pressure measurement for hypertension diagnosis [39•].

The WHL and WHO have advocated the use of automated blood pressure devices especially in low-resource settings as a partial solution to improve the accuracy of blood pressure assessment [40, 41].

Improving Blood Pressure Control

Prevalence of uncontrolled hypertension is high and increasing in low- and middle-income countries. Current control rates are very low, as low as 2% in Africa [42].

Barriers to treatment and control of hypertension among hypertensive patients were examined in a community-based cross-sectional study in Nepal [43]. Reasons for poor adherence to drugs include the silent nature of hypertension, long duration of therapy, complicated drug regimen, too many tablets, frequent dosing, drug cost, feeling of no immediate benefit with lack of motivation and drug side effects, and fear of potential harm. Avoiding or reducing the dose of medications deliberately was observed among Dutch, British, American, Brazilian, and Thai [44]. In Malaysia, patients are reluctant to visit physicians for the second time because of their denial of their condition [45]. Attaei et al. analyzed the availability, costs, and affordability of blood pressure-lowering medicines with data recorded in 20 countries participating in the PURE study [46••]. A large proportion of communities in low- and middle-income countries do not have access to more than one blood pressure-lowering medicine and, when available, they are often not affordable.

Measures to Improve Hypertension Control

Patients, physicians, health authorities, and medical societies should collaborate to improve blood pressure control.

Measures to improve BP control
Patients
• Home: BP measurement and self BP monitoring

- Education: improving adherence to treatment and lifestyle

Physicians

- Patients education and motivation
- Drug prescription:
  - Affordable drugs: generic, off-patent
  - Minimize frequency of dosing and number of tables
  - Single-pill combination: enabling once-daily dosing
- Encourage more frequent office visits

Health authorities

- Health insurance
- Provide list of essential drugs
- Promote generic policies
- Salt legislations: food industry and restaurants
- Sponsor education programs jointly with medical societies
- Provide opportunistic BP screening
- Hypertension clinics
- Involve nurses and pharmacists in patient management

Medical societies

- Develop and disseminate national hypertension guidelines
- Physician, nurse, and pharmacist education
- Specialized hypertension clinics
- Public and patient awareness programs through the internet, social media, and telemedicine
- Establish blood pressure checking stations in malls, metro stations, etc.

Role of Patients

Self-blood pressure monitoring and home blood pressure measurement together with patient education proved effective in improving hypertension control. Meta-analyses of randomized trials have demonstrated improved hypertension control and lower mean diastolic and systolic blood pressure with home monitor use [47•, 48]. Recent guidelines recommend home blood pressure monitoring. Home blood pressure management significantly lowers blood pressure when compared to usual care in high-income countries [49]. A clinical trial in Mexico and Honduras documented that individuals using a blood pressure monitoring combined with automated interactive voice response messages had SBP levels lower on average than that of control groups [50].

Among patients with hypertension at high risk of cardiovascular disease, self-monitoring with self-titration antihypertensive medications compared with usual care resulted in lower SBP at 12 months [51•].

Role of Physicians

Physicians play a central role in improving patients' adherence to medication through patients' education and motivation, prescription of affordable drugs, minimizing frequency of dosing, and number of tablets. Single-pill combination and once-daily dosing proved effective in improving compliance to drug therapy. Blood pressure monitoring through more frequent office visits may help to maintain patient enthusiasm and adherence to medication.

Physicians should prescribe generic medicines, if possible, rather than more expensive brand-name medications [52].

Role of Health Authorities

Health authorities in developing countries have the responsibility of providing nationwide health insurance which is lacking in the majority of poor countries, to develop a list of essential drugs, promote generic policies, establish legislation to limit salt content in processed foods and restaurants, sponsor education programs for physicians and nurses, encourage opportunistic blood pressure screening, and help establishment of specialized hypertension clinics. Health authorities can share in multicomponent intervention programs. Low-income patients in Argentina with uncontrolled hypertension who participated in a community health worker-led multicomponent intervention experienced a greater decrease in systolic and diastolic blood pressure than did patients who received usual care [53]. Health authorities should ensure access to affordable blood pressure-lowering medicines.

Role of Nurses and Pharmacists

In developing countries, as the numbers of people with hypertension increase, the role of nurses continues to expand. They help measuring and monitoring blood pressure and patient education and paying reminder phone calls for drug intake and office appointments. Nurses lead blood pressure service in community, worksite, school, and other settings. Nurse-led hypertension management has been demonstrated to result in greater rates of blood pressure control than those achieved with standard care [54•].

Nurse-led clinics proved effective for hypertension care in rural and urban sub-Saharan Africa [55]. Patients followed by nurses were more likely to be prescribed blood pressure-lowering treatment and adhere to such medications. In Mexico, home-delivered health promotion by nurses on top of usual care was associated with lowering of blood pressure in the intervention group compared with the control groups [56].

Santschi et al. [57] reviewed the impact of pharmacist care on the management of cardiovascular disease risk factors among outpatients. Pharmacist care was associated with significant reduction in systolic/diastolic blood pressure.

A key feature of the most effective hypertension care models is a multi-disciplinary team that collaborates in delivering hypertension care services. RCTs of team-based hypertension care involving nurse or pharmacist intervention demonstrated reduction in SBP and DBP and greater achievement of blood pressure goals when compared with usual care [58].

Adherence Improving Interventions

Non-adherence to antihypertensive medication is common in developing countries [59•]. Approximately half of the patients start treatment for hypertension abandon treatment [60••, 61]. Educating the patient was found to be a key component of a cost-effective approach to improve adherence [62]. Reducing the number of daily doses appears to be effective in increasing adherence to blood pressure-lowering medication and should be tried as a first-line therapy [63].

Ensuring access and supply of inexpensive medicines is crucial since drug costs account for two thirds of the estimated resource needs. Promoting local manufacturing of generic products and price regulations to ensure availability of inexpensive medicines is required [64].

Generic drugs have helped to improve accessibility and affordability of antihypertensive therapy in developing countries [65•]. Developing countries should adopt laws permitting generic substitution, requiring the pharmacist to substitute a generic for a brand-name medication except when prescriber indicates "brand only." The use of generic medications influence adherence. Policies that promote generic medicines can generate large savings. In France, implementation of a general generic substitutions strategy saved nearly US $ 2 billion in 2008 alone [66].

Terline et al. performed a quality assessment of five commonly used antihypertensive generic drugs in ten Sub-Saharan African countries [65•] using standardized methods. In this study, one quarter of the available generic antihypertensive drugs was found to be of poor quality. In Rwanda, 20% of hypertensive medicines on the market were of substandard content and 70% were of insufficient stability [67].

The adoption of an essential medicine list into public policy could lead to lower medication costs and could serve as a starting point for the development of a national drug coverage system [68]. Each country is encouraged to prepare their own list of essential medicines.

Salt Reduction

Worldwide salt intakes are above recommendations [69•]. Strategies to reduce intake are required. Given the current food environment, educational efforts such as clinician counseling are useful, but a comprehensive public health approach is necessary to achieve meaningful reductions in sodium intake. Three-gram per day should become the long-term target for population salt intake.

Strategies for salt reduction are outlined by Cobb et al. [70] and these include: public education, mass media education campaigns coupled with voluntarily efforts by industry, and warning labels on high-salt packaged foods. National legislation reducing the addition of salt to food is a cost-effective policy. The International Society of Hypertension and the World Hypertension League have developed a policy statement calling for reducing dietary salt [71].

Hypertension Guidelines

The absence of specific national hypertension treatment guidelines based on country-specific circumstances adds to the challenges in hypertension management. What is prescribed in developed countries may not be applicable in developing countries. Many developing countries with limited resources cannot treat everyone with a blood pressure beyond the defined thresholds (≥ 140/90 mmHg). As resources for managing hypertension are limited, it is important that interventions are guided by cost-effectiveness and guidelines should include drug affordability as main management component.

The threshold of cardiovascular risk for deciding the start of drug treatment can be adjusted to suit the country context. Cost-effectiveness of an intervention depends on the gross domestic product per head for the country. WHO proposed different 10-year total cardiovascular risk threshold for intensive interventions based on countries resource level [72•]. The development of the Egyptian hypertension guidelines by the Egyptian Hypertension Society could serve as an example for developing countries [73]. Egyptian guidelines tried to adopt evidence-based recommendations to local economic, cultural, and lifestyle circumstances. The real threshold of hypertension must be considered as flexible, being higher or lower based on the total cardiovascular risk of each individual [74]. The WHO suggests performing cardiovascular risk stratification according to WHO/ISH risk prediction charts using a limited panel of data [75].

What Do We Need for the Future?

More Epidemiologic Data

A substantial proportion of countries have little usable data on the hypertension prevalence, awareness, treatment, and control rates and determinants of hypertension and have weak surveillance systems. Improving country-level surveillance and monitoring must be a top priority in the fight against hypertension.

Little is currently known about how socioeconomic factors may influence the distribution of blood pressure and hypertension in these societies. The role of emerging dietary risk factors, e.g., sugar and fat intake and environmental pollution needs to be clarified in epidemiologic studies.

We need data about the cost-effectiveness of aggressive management of hypertension in developing countries and approaches to improve detection and adherence to treatment.

Development of National Programs

There are several hypertension strategies that hypertension organizations can use as templates [76, 77]. All strategies require adaptation to the national or regional circumstances based on cultures, values, health literacy, health care systems, and available resources.

Health authorities and drug industry in collaboration with national hypertension societies should develop national programs for hypertension control which include the following activities:

(1) Development and dissemination of national country- or region-specific hypertension guidelines and translating guidelines into clinical practice.
(2) Plan, sponsor, and execute public awareness programs through social media, internet, press, and T.V.
(3) Salt reduction campaign. Make healthy low-salt foods readily available and affordable.
(4) Prepare list of essential drugs and promote generic prescription.
(5) Specialized hypertension clinics providing free service for screening, diagnosis investigating, and monitoring hypertensive patients. Routine and opportunistic screening should be encouraged, with establishing blood pressure checking stations in malls and public places.

A successful blood pressure screening program [78] should include (1) training to accurately measure blood pressure; (2) use of accurate equipment (blood pressure devices)—semi-automated devices are recommended; (3) appropriate interpretations of blood pressure readings: e.g., blood pressure of 140–170/90–95 mmHg will require follow-up within a few weeks, if more than 180 mmHg, follow-up as soon as possible by a medical doctor; (4) follow-up instructions can be provided at blood pressure checking stations as posters or other forms of printed material. Routine opportunistic screening for hypertension in formal medical setting can significantly increase hypertension awareness in developing countries [79].

New Management Tools

The efficacy and cost-effectiveness of new hypertension management tools needs to be tested in developing countries. Examples of these new tools are the electronic health records, automated office blood pressure (AOBP) measurement, and telemedicine and home blood pressure tele-monitoring.

Although the introduction of a fully electronic health record system may seem far off in many countries, they are being introduced rapidly in others. In many developing countries, costs, available technology, lack of technical expertise, and computer skills of staff are limitations to the widespread use of electronic documentation.

Electronic medical records (EMR) improve the quality of care as a result of having health information immediately available at all times.

There is now sufficient evidence to consider replacing manual office blood pressure with AOBP in routine clinical practice [80]. AOBP has a greater accuracy and consistency than manual blood pressure. Recent hypertension guidelines recommend, when feasible, AOBP [40, 81] as the preferred electronic sphygmomanometer and should replace the manual blood pressure measurement.

Telemedicine and in particular home blood pressure telemonitoring (HBPT) represent a promising tool for improving blood pressure control. HBPT consists of automated blood pressure data transmission from the patient's home to the doctor's office or to a clinic [82•]. It is generally based on the use of electronic-automated upper arm or wrist blood pressure monitors storing blood pressure values obtained at patient's home. When data are received at the central telemedicine server, they are sorted and automatically analyzed. HBPT showed a clear benefit in terms of greater blood pressure reductions, but the overall costs were significantly high [83].

Expanding Financial Coverage for Health Care

This should have a priority on the agenda of health authorities in order to improve hypertension control in the coming years. Governments in low-resource settings should adopt new strategies to manage the increasing financial burden of hypertension and NCDs. Health care insurance or publically provided health care can improve hypertension control specially among the poor who cannot afford cost of drugs and medical care. Health insurance coverage was associated with improved outcomes of hypertension care in US settings [84•] and correlated with improvement in hypertension control in Taiwan [85].

Conclusion

Management of hypertension remains a major challenge for developing countries. Prevalence rates are on the rise, while treatment and control rates are not improving or even declining. Improvement is required in the following areas: (1) technique to measure blood pressure and reach accurate diagnosis of hypertension, (2) analysis of patients compliance and follow-up, (3) development and implementation of treatment guidelines, (4) continued physician, pharmacist, nurse, and patient education, (5) involvement of health authorities, medical societies, and drug industry, (6) salt reduction programs.

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Compliance with Ethical Standards

Conflict of Interest The author declares no conflicts of interest relevant to this manuscript.

Human and Animal Rights and Informed Consent This article does not contain any studies with human or animal subjects performed by any of the authors.

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