Hypertension 3

Hypertension in developing countries

M Mohsen Ibrahim, Albertino Damasceno

Data from different national and regional surveys show that hypertension is common in developing countries, particularly in urban areas, and that rates of awareness, treatment, and control are low. Several hypertension risk factors seem to be more common in developing countries than in developed regions. Findings from serial surveys show an increasing prevalence of hypertension in developing countries, possibly caused by urbanisation, ageing of population, changes to dietary habits, and social stress. High illiteracy rates, poor access to health facilities, bad dietary habits, poverty, and high costs of drugs contribute to poor blood pressure control. The health system in many developing countries is inadequate because of low funds, poor infrastructure, and inexperience. Priority is given to acute disorders, child and maternal health care, and control of communicable diseases. Governments, together with medical societies and non-governmental organisations, should support and promote preventive programmes aiming to increase public awareness, educate physicians, and reduce salt intake. Regulations for the food industry and the production and availability of generic drugs should be reinforced.

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This is the third in a **Series** of three papers about hypertension

Department of Cardiology, Cairo University, Cairo, Egypt (Prof M M Ibrahim MD)**; and Faculty of Medicine, Eduardo Mondlane University, Maputo, Mozambique** (Prof A Damasceno PhD)

Correspondence to:
Prof M Mohsen Ibrahim, Egyptian Hypertension Society, Garden City, Cairo 11519, Egypt
ehs@link.net

Introduction

Almost three-quarters of people with hypertension (639 million people) live in developing countries with limited health resources and where people have a very low awareness of hypertension and poor blood pressure control.[1,2] The proportion of people with hypertension who have their hypertension under control (the control rate) in some countries such as rural Ecuador is as low as 0·3%.[3] Furthermore, the prevalence of hypertension is increasing and is predicted to grow by more than 500 million by 2025.[4,5] In South Africa, the risk of death from high blood pressure has increased by 25% in less than a decade.[6] In India, prevalence of hypertension has increased by 30 times in urban populations over 25 years, and by 10 times in rural populations over 36 years.[7] Serial surveys done in Tanzania with the same methods in 1987 and 1998 showed an increase in prevalence of hypertension from 25·4% to 41·1% in males and from 27·2% to 38·7% in females for rural and urban populations.[8] This high prevalence of hypertension and poor hypertension control are important factors in the rising epidemic of cardiovascular disease in developing countries. Deaths from stroke in the Middle East and north Africa will nearly double by 2030.[9] Between 1990 and 2020 mortality from ischaemic heart disease in developing countries is expected to increase by 120% for women and 137% for men.[10] Two-thirds of all strokes and half of all coronary disease can be attributed to non-optimum blood pressure.[11]

Reasons for the increasing prevalence and poor hypertension control need to be defined, and approaches to prevent and improve control should be identified. Explanation for regional and substantial rural–urban differences in prevalence might provide clues to the drivers of increasing hypertension prevalence.

We briefly summarise the magnitude of the hypertension problem in developing countries by providing data about hypertension prevalence, awareness, and treatment and control rates from population and regional surveys. We examine some of the known hypertension risk factors contributing to the rising epidemic of hypertension in many developing countries, particularly demographic, dietary, lifestyle, and genetic factors. We outline difficulties in hypertension control and suggest ways to achieve better control rates with cost-effective and affordable approaches, and we identify areas for future activities and clinical research.

Magnitude of hypertension

The World Bank (2010) defines countries with gross national income per head of US$12 195 or less as developing countries. More than 80% of the world population lives in developing countries, where most of the worldwide burden of hypertension occurs. By 2025, almost three-quarters of people with hypertension will be living in developing countries.[4] As late as 1940, hypertension was almost non-existent in non-developed populations—eg, a prevalence of 1·8% was reported in Ethiopian rural villages at this time.[12] A survey done in Egypt in the 1950s in rural Qalyub showed that 3·8% of people had hypertension.[13] Hypertension in areas where it was once rare is emerging as a serious health disorder. Prevalence has risen throughout the past four decades to a rate similar to and sometimes exceeding that in many

Search strategy and selection criteria

We searched Medline for English language articles about hypertension in developing countries, published between 2001 and 2012, with the key terms “hypertension”, “developing countries”, “prevalence”, “treatment”, “control”, “risk factors”, and “salt”. We also searched references cited in reviews and original-research articles, the WHO internet database for yearly reports and regular publications, and the World Bank database.

developed countries—eg, hypertension prevalence in Venezuelan men is 45·2%.[4] Prevalence of hypertension varies between and within developing regions.[4,5,14–25] Table 1 shows data from hypertension surveys undertaken after 1990 that defined hypertension as blood pressure of 140/90 mm Hg or higher. Many of these surveys were regional, multisite, or done in a health-care facility without a nationwide representative sample. Figure 1 shows the prevalence of hypertension in several developing countries with national surveys.

In all developing countries surveyed, apart from Nigeria, hypertension was more prevalent in urban and semi-urban regions than in rural areas (figure 2). The difference in prevalence depends on the country's extent of urbanisation.[35] Prevalence in men and women did not differ uniformly.

We could not establish conclusive temporal trends in high blood pressure prevalence from available data because few countries have been surveyed repeatedly with the same methods; however, data from China,[28] India,[36] Tanzania,[32] Mauritius,[37] and Turkey[26] are available. Apart from Mauritius, the prevalence of hypertension increased in serial surveys in all these countries (table 2).

Between the years 1980 and 2008, the prevalence of hypertension decreased worldwide from 33% to 29% in men and from 29% to 25% in women.[38] The largest decrease in systolic blood pressure was in high-income North America, whereas systolic blood pressure rose in east and southeast Africa in both sexes and in west Africa in women. Prevalence in Middle Eastern and north African countries did not change. Systolic blood pressure is highest in low-income and middle-income countries.[38]

Table 3 shows the rates of hypertension awareness, treatment, and control in several developing countries.[5,20–25,32] Women generally have higher rates of hypertension awareness, treatment, and control than do men. The highest reported rates of awareness and treatment are from Cuba and the lowest rates are in Mozambique.

Pereira and colleagues[39] systematically reviewed quantitative differences in prevalence, awareness, treatment, and control of hypertension between developed and developing countries, adjusting for age. They reported no significant differences in mean prevalence, awareness, treatment, and control of hypertension between developed and developing countries, apart from a higher prevalence in men in developed countries (figure 3). However, most of the reviewed studies (69%) covered only one region within one country, and did not survey a nationally representative group. Furthermore, because of differences in methods between surveys, the differences in reported estimates do not necessarily show true differences in susceptibility.

	Countries
Very low (<10%)	Bangladesh (rural); Cameroon (rural); Ethiopia (rural); India (rural); Iran (rural); Nigeria (rural); Sudan
Low (<20%)	Cameroon (urban); Congo (urban); Democratic Republic of the Congo; Eritrea; Ethiopia; north India (rural); Iran; Liberia; Nepal; Nigeria (urban)
Intermediate (20–30%)	China; Costa Rica; Cuba; Egypt; Ethiopia (urban); Ghana; Jamaica; Pakistan; Senegal; South Africa; Thailand; The Gambia; Turkey; Uganda (rural); Vietnam
High (>30%)	Algeria; Brazil; Chile; Ecuador; Ghana (urban); north India (urban); Mexico; Mozambique; Tanzania; Zimbabwe
Very high (>40%)	Burkina Faso; Paraguay; Seychelles; Venezuela

Compiled from survey data (1990–2011).[4,5,14–25]

Table 1: **Prevalence of hypertension in developing countries**

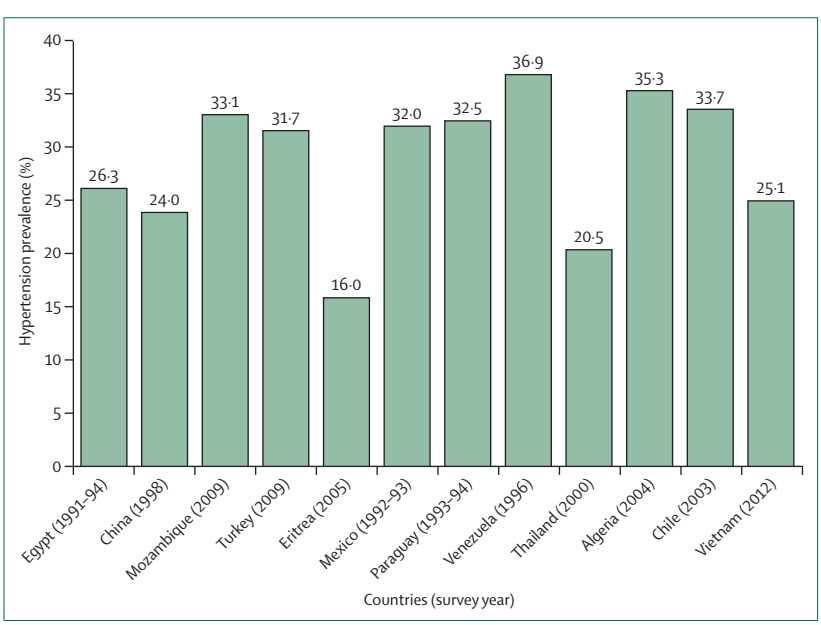

Figure 1: **Prevalence of hypertension in developing countries with national surveys**
Data are from references 4, 5, 21, and 24–27.

Hypertension risk factors

Underlying risk factors leading to hypertension can help to explain why some populations are at a greater risk of developing hypertension than are others. Risk factors can be of genetic, behavioural, or environmental origin or be the result of a medical disorder. They can be reversible, irreversible, or associated with other predisposing disorders (panel).[40–51]

Hypertension is mainly related to environmental and lifestyle factors rather than to genetically defined racial differences. Substantial differences in the prevalence of hypertension between people of African and European origin are greatly reduced after adjustment for socioeconomic status.[52] In children of African descent living in the UK, blood pressure results were either lower than or similar to those of their white UK counterparts.[53] In adults, blood pressure results were higher in people of African descent than in white people.[53] The findings clearly favour environmental factors or an interaction between environmental and genetic factors rather than genetic factors alone. Genetic predisposition might be permissive rather than determinative, with the addition of biosocial factors such as weight gain, high salt intake,

anxiety, psychosocial stress, and excess alcohol consumption necessary to cause disease.[54]

Genetic factors seem to play an important part in salt sensitivity, which is common in black people. Single gene mutations promote salt retention through a defect in renal sodium handling.[55] Many more common variants associated with blood pressure remain to be discovered.

In many but not all societies, dark skin colour is associated with high blood pressure. Burt and colleagues[56] reported that the prevalence of high blood pressure is two times greater in black people than in white people. However, Mosley and colleagues[57] documented a non-linear relation between skin pigmentation (measured by reflectance spectrophotometry) and blood pressure in Egyptian women. Nubian Egyptians, who live in south Egypt and are of a different ethnic origin and have darker skin than do non-Nubian people, had blood pressure similar to their non-Nubian counterparts.[57] The Egyptian Nubian population has physical characteristics similar to those of other black Africans. This finding provides strong evidence that high blood pressure does not inevitably occur in black-skinned populations residing in a multi-ethnic society. Keil and colleagues[58] reported no association between skin colour and the incidence of hypertension after controlling for education or other measures of social class. Skin colour is associated with environmental factors known to affect blood pressure, such as body mass, sodium–potassium excretion ratio, poverty, education, and access to health services.[59]

Diet and excess salt intake

The controversy surrounding the effect of salt intake on blood pressure has been inflamed by the publication of important and contradictory studies.[60,61] Irrespective of this controversy, influential and prestigious regulating organisations, such as the European Union and the US Institute of Medicine, chose to aim to reduce salt intake.

The strength of evidence for salt intake as a factor in blood pressure is much greater than that of other lifestyle factors.[62] Several studies have shown that migration from isolated low-salt societies to an urban environment with an increased salt intake is associated with a rise in blood pressure.[63,64] Extent of salt consumption and the main sources of salt intake are difficult to measure accurately and vary widely in the developing countries where measurements were possible. Brown and colleagues[65] reviewed the urinary sodium excretion rate in several countries. The lowest mean urinary sodium excretion rates were reported in Ghana and in urban and rural Cameroon. The highest mean excretion rates were reported in north China. In Turkey, daily salt intake was about 18 g per person according to the SALTURK study,[66] and in an urban south Indian population, mean daily salt intake was 8·5 g per person, which was correlated with risk of hypertension.[67] Blood pressure response to

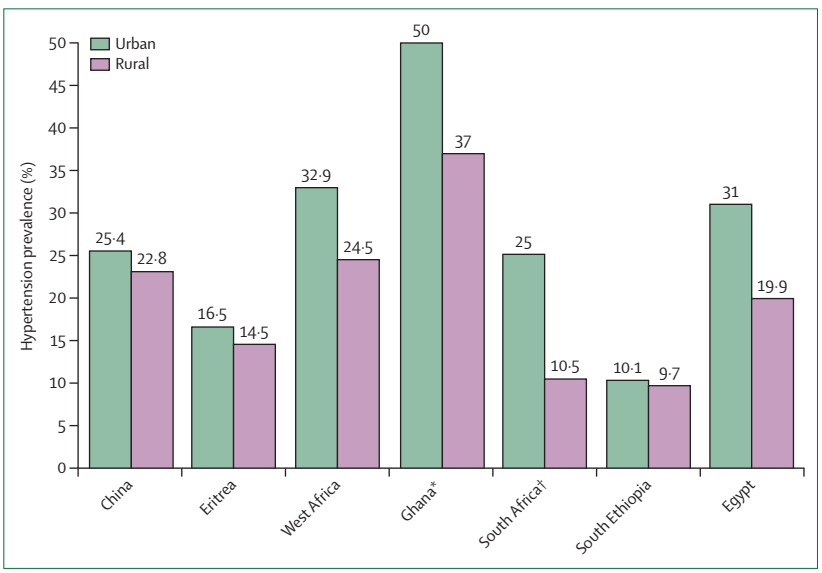

Figure 2: **Differences in prevalence between urban and rural regions**
Data are from references 28–34. Prevalence is given to 1 decimal place when known, and as a whole number when more accurate values are not available. *Prevalence in people aged 65 years and older only. †Prevalence in the Zulu people of South Africa only.

	Timeframe	Change in prevalence
China	1992–94 to 1998	22·7% to 24%
India	1988 to 2003	6·6% to 36·4%
Tanzania	1987 to 1998	25·4% to 41·1% (men); 27·2% to 38·7% (women)
Turkey	2003 to 2007	28·9% to 31·7%
Sub-Saharan Africa*	1998 to 2003	54% to 78%
Mauritius†	1987 to 1992	15% to 12% (men); 12% to 11% (women)

Data extracted from references 26, 28, 32, 36, and 37. *Data are for adults aged ≥55 years only. †Hypertension defined as 160/95 mm Hg.

Table 2: **Changes in hypertension prevalence in selected countries over time**

	Awareness (%)	Treatment (%)	Control (%)
Egypt (national)	37·5	23·9	8
Tanzania (urban and rural)	20·0	10·0	1·0
South Africa (national)	26·0 (men); 51·0 (women)	21 (men); 36 (women)	10 (men); 8 (women)
Ghana (urban)	39·0	18·0	4·0
Ghana (semi-urban and rural)	22·0	11·3	2·8
China (national)	44·2	28·2	8·1
Mozambique (national)	10·6 (men); 18·4 (women)	3·5 (men); 11·2 (women)	1·0 (men); 4·8 (women)
Vietnam	48·4	29·6	10·7

Data extracted from references 5, 20–25, and 32. Percentages are given to 1 decimal place when known, and as a whole number when more accurate values are not available. Awareness is the proportion of people with hypertension who are aware of their high blood pressure status. Treatment is the proportion of people with hypertension who are being treated for hypertension. Control is the proportion of people with hypertension who have their hypertension under control.

Table 3: **Differences in the awareness, treatment, and control of hypertension between and within countries**

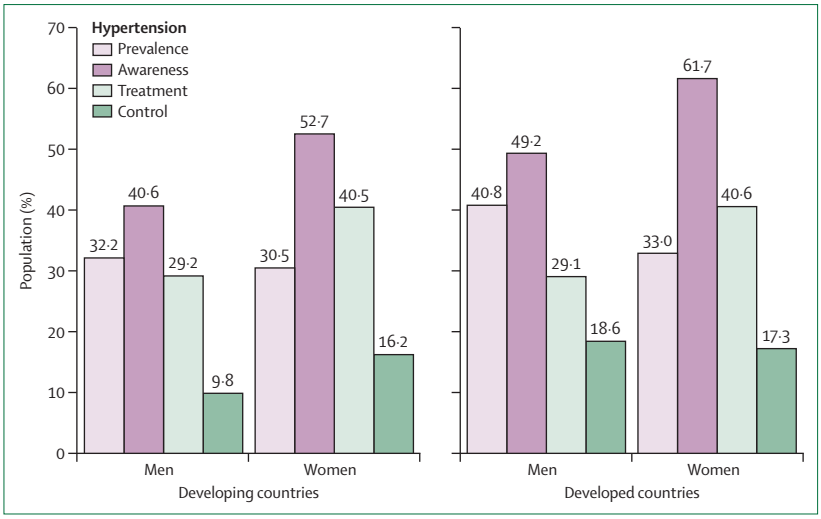

Figure 3: **Differences in measures of hypertension between men and women in developed and developing countries**

Data are from Pereira and colleagues.[39] Prevalence is the proportion of the total population who have hypertension. Awareness is the proportion of people with hypertension who are aware of their high blood pressure status. Treatment is the proportion of people with hypertension who are being treated for hypertension. Control is the proportion of people with hypertension who have their hypertension under control.

changes in sodium intake (salt sensitivity) is affected by genetic factors, age, body mass, associated disease, and ethnic factors.[55] In the Chinese population, variations in blood pressure response to salt intake are affected almost equally by genetic and environmental factors.[68]

Food sources of sodium vary between developed and developing countries.[65] In European and North American diets, an estimated 75% of sodium intake comes from processed and restaurant-prepared foods. In Asian countries and many African countries, the salt added in cooking and present in sauces and seasonings represents the main source of sodium in the diet. In the Chinese Health and Nutrition Survey (2002), 72% of sodium was from salt added during cooking and 8% from soy sauce.[69] Bread can be an important source of salt in diet. In Turkey, average daily bread consumption is 400 g per person, which accounts for 7·28 g/day of salt intake.[70] In some settings, bread is produced on an industrial scale, so control of salt content is possible. However, in most African cities bread comes from many small producers, making successful control measures much more difficult to implement.

The association between high fructose intake and systolic blood pressure is graded.[71] Sugar consumption has risen substantially in Middle Eastern developing countries, to an average of 30–40 kg/year per person.[72]

Between 1970 and the end of 1990s, nutrition in many developing countries changed radically.[73] Changes in the composition of diet followed the introduction of food processing and the fast-food industry. Diets have become richer in calories, salt, sugar, and fat, which has increased the prevalence of obesity, metabolic syndrome, and hypertension in many developing countries.

Panel: **Underlying factors that increase or are associated with high blood pressure**

Non-modifiable factors

- Age
- Genetic predisposition[40]
- Family history
- Susceptible ethnic origin
- Dark skin colour
- Low birthweight

Modifiable factors (environmental or lifestyle)

- Overweight and obesity
- Excess visceral (abdominal) fat
- Excess salt intake
- Low potassium intake
- Unhealthy diet,[41] particularly excess calories, fats, and fructose
- Excess alcohol
- Sedentary occupation
- Reduced physical activity
- Psychological stress
- Urban living
- Smoking
- Vitamin D deficiency[42]
- Low folic-acid intake[43]

Other factors

- Dyslipidaemia
- Increased triglycerides[44]
- Hyperuricaemia[45]
- High gross national product per head[46]
- Increased arterial stiffness[47]
- Systemic proinflammatory state[48]
- Undernutrition in childhood[49]
- Sleep deprivation[50]
- Prescription drugs (eg, non-steroidal anti-inflammatory drugs)
- Long-term exposure to noise[51]

Urbanisation and socioeconomic status

Urbanisation is strongly correlated with an increase in hypertension prevalence,[35] and migration from rural to urban areas is also associated with increased blood pressure.[64] South Africans who have spent most of their life in urban areas are more likely to be hypertensive than are those from rural areas.[74] Mass migration from rural to urban and peri-urban areas probably accounts for the high prevalence of hypertension in black Africans living in urban areas. Urbanisation affects food consumption patterns, with increased consumption of fats, oils, and animal-based foodstuff. This diet change can increase bodyweight, which is an independent risk factor for the development of hypertension. In Cameroon, migration to urban areas is associated with high body-mass index, fasting blood sugar, and blood pressure.[75] Body-mass index—a powerful predictor of hypertension—is also

strongly associated with urbanisation[35] and might result from dietary changes, reduced physical activity in addition to increased psychological stress, and interruption of traditional family links.

Obesity

Body-mass index alone was the most powerful predictor of hypertension in the Nurses' Health Study II.[76] A stable linear relation between adiposity and blood pressure has been reported, independent of age and body-fat distribution across developed and developing countries.[77] In Chinese women from rural areas followed up for 28 months, the risk of progression to hypertension was associated with advancing age, body-mass index, salt intake, and low physical activity.[78]

The prevalence of childhood obesity has increased substantially throughout the past two decades. Abolfotouh and colleagues[79] reported that high blood pressure was significantly associated with overall obesity in Egyptian adolescents. Adolescents with high blood pressure were 3·5 times more likely to be overweight or obese compared with adolescents with normal blood pressure. Obesity tends to stay with individuals and populations—obese children become obese adults. This tendency, combined with continuing urbanisation, will cause the prevalence of obesity and hypertension in adults to escalate.

Hypertension control

A systematic review that compared hypertension prevalence in settings with different rates of economic development showed higher overall prevalence of controlled hypertension in the more affluent countries, although the proportion of controlled hypertension in people aware of their disorder and treated pharmacologically was not meaningfully lower in developing settings.[39] Conclusions from the STEPS (STEPwise approach to Suveillance) survey in Mozambique were similar,[21] suggesting that the big difference in terms of hypertension control between developed and developing countries is the extent of awareness, which is much lower in low-income regions. This difference in awareness might be predominantly attributable to the scarce human and material resources that characterise less affluent settings.

Most low-income countries do not have a national policy for the control of non-communicable diseases. Primary health-care systems have not adapted to cope with these new challenges. As a result, primary health-care units, mainly in sub-Saharan African countries, are often without the most basic equipment, such as a calibrated and functioning sphygmomanometer or a glucometer.[80]

Furthermore, health professionals and the general population have little knowledge about the importance, causes, and control of hypertension.

Another factor that contributes to poor awareness is that hypertension, as an asymptomatic disease, contrasts with the most common clinical situations faced daily by primary health-care workers in developing countries. Measurement of blood pressure is seen as a secondary task and is not systematically done. As a result, hypertension is not often diagnosed.

If patients are diagnosed with hypertension, a great proportion are lost to follow-up as a result of a poor relationship with their overburdened health professional, disorganised outpatient clinics with long waiting times, and the economic burden of purchasing drugs, which are generally paid for by the patients themselves.

Most of these countries have no national guidelines for diagnosis and treatment of hypertension. When they do, the local guidelines are merely a copy of the American or European guidelines, and have not been adjusted to meet the needs of the country.

The deficient procurement and distribution process of essential drugs for treatment of hypertension is also very common. As a result, these drugs are commonly out of stock, with the inevitable effects on compliance of patients and control of patients' blood pressure.[81] A potentially more important issue is that many of these drugs are counterfeit generic drugs bought without any process of quality control. Even if these generic drugs are not harmful, they are usually less efficient, which increases the proportion of patients whose blood pressure is not correctly controlled.[82]

Scarce resources and the projected importance of hypertension and its future effects should be an important stimulus for innovative solutions that should help to override the enormous difficulties of these deficient health systems.

The final objective of the control of hypertension is the reduction of incident cases of stroke and acute coronary ischaemic events. A cost-effective approach should be put in practice to achieve these goals in resource-limited settings. Eligibility for drug therapy should be restricted to patients who will really benefit from it, such as those at moderate or high risk. A more aggressive treatment should be given to patients at highest risk. Nevertheless, this approach will only reach a very small number of people and will not effectively reduce the burden of cardiovascular events. To reduce the number of strokes and acute coronary deaths, this strategy should be reinforced by a strong national public health campaign that should aim to reduce not only the prevalence of hypertension, but also all the other risk factors, such as diabetes; consumption of alcohol, salt, and tobacco; obesity; and low physical activity, at both the population and the individual level.

A cost-effective public measure for the control of hypertension is to reduce excessive salt intake. In a revision of 32 salt-reduction initiatives around the world,[83] none of the initiatives came from Africa. South Africa has announced the need to legally control the salt content in most processed food available for consumption, but it has still not been adopted in a continent in which most of the population are salt-sensitive.

Salt substitutes, once used for the control of sodium intake, were almost abandoned as a valid policy because of the risk of hyperkalaemia in older people and those with renal disease or who use drugs that act on the renin–angiotensin system.[84] Increased potassium intake or an improved ratio of sodium to potassium decreases blood pressure and has a beneficial effect on stroke incidence. The wide reintroduction of salt substitutes is again being tested with success in China[85] and some results show a positive effect on blood pressure and a reduction in end-organ damage.[86]

Street food is also very popular in most developing countries and accounts for a large proportion of the food intake, both of adults and children, in major cities. The microbiological quality and safety of the street food has been widely studied, but the contribution of street food to the total salt intake of the urban population is unknown and should be researched, although control will not be an easy task.

The three most important steps to increase hypertension control in developing countries at an individual level are to use primary health care as the key point of control, to have nurses as the main human resources for diagnosis and follow-up, and to adopt a global cardiovascular risk approach as a strategy for drug treatment.[87,88]

The control of hypertension together with the control of diabetes and other non-communicable diseases should be managed by primary care. Well trained nurses in several developing countries are able to run reliable chronic disease control programmes.[89] The progressive introduction of antiretroviral therapy is creating a large group of patients with chronic disease. In settings where a vertical infrastructure has been created for the control of HIV/AIDS, integration of hypertension or diabetes care with the HIV/AIDS human and material infrastructure has resulted in better control of all these disorders, particularly in South Africa and Cambodia.[90,91] This approach has resulted in an important decrease in the stigma that is still attached to HIV.

A global risk approach has been proposed by the most recent hypertension guidelines from WHO and the International Society of Hypertension and has been shown to have an economic benefit in several developing settings.[92,93] WHO has developed risk charts for different regions of the world that define the global risk of a cardiovascular event in the next 10 years on the basis of age, sex, systolic blood pressure, total cholesterol, the presence of diabetes, and tobacco consumption. Simpler risk charts were also proposed for developing countries where total cholesterol concentrations are generally assumed to be low, such as in sub-Saharan Africa.

In a study that analysed the distribution of total cardiovascular risk in eight low-income and middle-income countries, the proportion of the population with a cardiovascular risk higher than 20% was less than 10% in all populations studied.[94] Treatment of only patients who have a total cardiovascular risk higher than 20%, accompanied by a population-wide strategy to shift the cardiovascular risk distribution, seems to be the most cost-effective strategy for countries where the yearly total expenditure for health is less than $100 per citizen.

Finally, we suggest that one antihypertensive drug from each of the main groups—namely, a thiazide diuretic, a calcium-channel blocker, a β blocker, and an angiotensin-converting-enzyme inhibitor—plus a low-dose aspirin, a statin, and metformin should be widely distributed and used in accordance with strict guidelines for their sequential use. This approach might not be popular with doctors, but it is very effective at the primary health-care level when dispensed by educated nurses. It would also allow better planning of drug procurement and distribution.[95]

Special precaution should be taken with old β blockers, mainly atenolol, because they are associated with an increased risk of development of new-onset type 2 diabetes mellitus. This association is especially true when atenolol is used together with a thiazide diuretic.

Although generic drugs should be used in these settings, their quality should be scrutinised. In Africa and Asia, many patients are given counterfeit drugs, sometimes purchased freely by the government. Governments should make a special effort to supply basic drugs for treatment of hypertension at the primary health level at a fair price, which should increase compliance of the poorest patients.

Future directions

One of the major constraints of the global risk approach is the need to measure blood glucose and total cholesterol to assess risk. In most primary health-care centres in developing countries, measurement of total cholesterol is uncommon, and in some more peripheral areas even blood glucose assessment is not possible. A study of the NHANES (National Health and Nutrition Examination Survey) III population showed high agreement in risk characterisation between a non-laboratory-based risk prediction method and the classic laboratory-based risk charts.[96] Investigators used a history of diabetes as an entrance point for risk calculation. Simple and cheap risk assessment such as this method is important for resource-poor settings.

A new reliable, durable, and largely affordable sphygmomanometer that can be widely used at a primary health-care level is also urgently needed. A new solar device has been produced and tested and proved to be accurate,[97] but it is not widely accessible because the price is still above expectations.

Several studies from developing countries report successful initiatives. Probably the most striking example in developing countries is from Cuba.[98] Possibly because reduction of cardiovascular disease (particularly by detection and treatment of hypertension) was

classified as high priority, and allied with the strong family-doctor-based system and active diagnoses of cases, the Cuban system had the highest rate of controlled patients with hypertension ever reported in the world.[98]

Community leaders and health workers have worked successfully to control communicable diseases; they could now be trained to actively diagnose and control hypertension. Although some good examples of community participation have been described in Vietnam and Pakistan,[99,100] a broader assessment of the effect of community participation would be useful. The involvement of religious leaders in campaigns for behaviour modifications has already been successfully tested in African-American communities.[101,102] The approach, which includes active diagnosis of hypertension at the end of each religious service, could be effective. The use of mobile phones in developing countries is increasing greatly. In parallel, messages sent to mobile phones are becoming a new means to control diabetes, hypertension, and heart failure.[103–105] This method could be used to increase drug compliance of patients with hypertension in developing countries, but it still needs to be tested. Finally, active participation of all family members seems to be an important but rarely used way to change lifestyle risk factors and increase adherence to treatment.

Ministries of Health or national societies (where applicable) should develop hypertension guidelines designed specifically for resource-poor settings to replace the complex and largely impractical international guidelines developed for high-income countries. These guidelines should be based on the evidence that a cardiovascular risk approach that takes into account several risk factors is more cost-effective than one that uses only blood pressure thresholds to measure risk. Treatment to reduce blood pressure might need to be restricted to higher-risk individuals with moderate-to-severe hypertension. Thresholds for initiation of pharmacological therapy should be based on strong clinical evidence. Pharmacies, nurses, and community health workers should participate in hypertension control. International organisations can provide help and skilled workers to support risk-factor surveillance programmes, epidemiological studies, and interventions for disease prevention relevant to particular populations.

In summary, to manage hypertension, developing countries need a simple algorithm for screening, treatment, and follow-up; a reliable drug supply; free or subsidised drugs; health education about blood pressure and cardiovascular disease; community programmes aimed at increasing self-referral for risk assessment; improved health record systems (electronic records); a cost-effective drug distribution system; health information systems (eg, mortality surveillance); and targets for and monitoring of the effect of intervention programmes.

Contributors
MMI designed and structured the review, wrote the summary, background, aims, and sections on the magnitude of the problem and risk factors, and did the final revision of the manuscript. AD wrote the sections on control and future directions.

Conflicts of interest
We declare that we have no conflicts of interest.

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