

The Global Burden of Cardiovascular Diseases: A Challenge to Improve

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Abstract There are many challenges that need to be overcome to address the global cardiovascular disease epidemic. They include (1) lack of multisectoral action to support reduction of behavioral risk factors and their determinants, (2) weak public health and health care system capacity for forging an accelerated national response, and (3) inefficient use of limited resources. To make progress, countries need to develop and implement multisectoral national action plans guided by the global action plan for prevention and control of noncommunicable diseases, strengthen surveillance and monitoring systems, and set national targets consistent with global voluntary targets, which are to be attained by 2025. In addition, a set of cost-effective preventive and curative interventions need to be prioritized. Further, resources need to be generated and capacity developed to ensure sustainable country-wide implementation of the prioritized interventions. According to WHO estimates, the implementation of a core set of very cost-effective interventions for prevention and control of cardiovascular disease requires about 4 % of current health spending in lower income countries, 2 % in lower middle income countries, and less than 1 % in upper middle income and high income countries.

Keywords Cardiovascular diseases · Global action plan · Multisectoral action · Global targets · Global burden · Public health challenge

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Introduction

Noncommunicable diseases including cardiovascular diseases are major global public health challenges of the 21st century. They were responsible for an estimated 36 million deaths, or 63 % of all deaths that occurred globally in 2008 [1–3]. Cardiovascular diseases, including heart attacks and strokes, are responsible for 17.3 million deaths, accounting for nearly one-half of noncommunicable disease deaths [1–5]. About 80 % of the cardiovascular burden is borne by low- and middle-income countries. Cardiovascular diseases are not solely public health problems, but major barriers to sustainable development [2, 5, 6, 7••]. Over the period 2011–2025, the cumulative lost output in low- and middle-income countries associated with cardiovascular diseases is projected to be US\$ 3.76 trillion [8].

Key Challenges

The cardiovascular epidemic is growing steadily even in low income countries, which are still grappling with other public health priorities such as communicable diseases, maternal and infant mortality, and violence and injuries. Social determinants and behavioral risk factors, tobacco use, unhealthy diet, physical inactivity, and harmful use of alcohol are the major forces that drive the cardiovascular epidemic [2, 6, 7••]. Their control requires action that extends beyond the jurisdiction of the health sector. Herein lies one of the formidable challenges in addressing the cardiovascular epidemic (Fig. 1).

Further, improved life expectancy worldwide increases the duration of exposure of populations to behavioral risk factors. The prevalence of tobacco use, unhealthy diet, physical inactivity, and harmful use of alcohol are rising in most low- and middle-income countries. Overweight and obesity are increasing worldwide because of consumption of unhealthy diets and

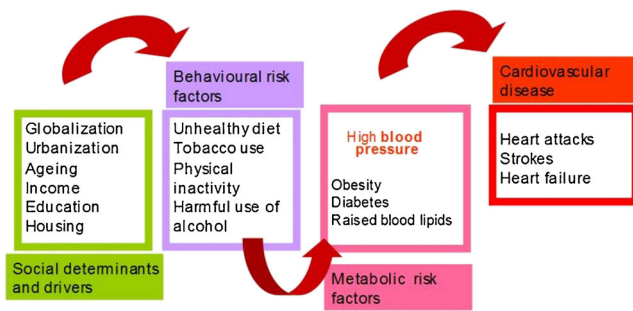


Fig. 1 Major risk factors and determinants of cardiovascular disease. (Adapted from: World Health Organization. A global brief on high blood pressure (hypertension); preventing heart attacks, strokes and kidney failure. World Health Organization: 2013). [33]

increasing physical inactivity. It is projected that 1.5 billion people will be overweight by 2015 [2, 5]. If overweight/obesity trends are not controlled, the prevalence of diabetes and hypertension will inevitably increase worsening the global cardiovascular epidemic. The rising obesity trends in the developed world may even threaten to reverse the declining cardiovascular mortality trends in high income countries. These trends together with the increased cardiovascular risk associated with ageing also make the prevention and control of cardiovascular diseases a challenging task.

The probability of dying from cardiovascular disease prematurely is higher in low and middle income countries compared with high income countries [5]. Premature deaths due to cardiovascular disease negatively impact on productivity and poverty alleviation efforts [6, 7•]. Poverty increases the vulnerability of exposure to behavioral risk factors. For example lower socioeconomic groups with low health literacy are the targets of advertising campaigns of tobacco companies. Poverty also limits the choice of healthy foods such as fruits and vegetables and low fat meat and dairy products. Those who are less well-to-do also have limited access to health services preventing early detection of raised cardiovascular risk. As a result the poor, present late to health systems with heart attacks, strokes, and their complications. The resulting catastrophic expenditure often entrench them in poverty. In addition, it is important to note that cardiovascular diseases such as rheumatic heart disease [9] and Chagas cardiomyopathy [10] are directly linked to poverty, uneven distribution of wealth, and social determinants. They can only be addressed if health interventions are implemented hand in hand with poverty alleviation efforts. These links between cardiovascular disease and poverty pose significant challenges to national efforts for containing the cardiovascular disease epidemic.

Overcoming Challenges

If progress is to be made, the constraints which impede the prevention and control of cardiovascular diseases, need to be

systematically addressed. The gap between available and required resources for tackling the cardiovascular epidemic in low and middle income countries is considerable, and on current trends, set only to grow. If bilateral and multilateral assistance to support national efforts is to improve, advocacy efforts are needed to improve the understanding of development agencies of the importance of mainstreaming prevention and control of cardiovascular diseases, in the development agenda.

In addressing the cardiovascular epidemic neither care nor prevention can be neglected. Neglect of care leads to unnecessary premature death, suffering and poverty, and neglecting prevention leads to further growth of the epidemic and increasing demands on the health care systems, which have to cater to the needs of people who develop cardiovascular disease. Practically all countries need to invest more on population wide prevention approaches to reduce exposure of populations to cardiovascular risk factors. A few countries still only pay lip-service to tobacco control. For example, despite the adoption of the Framework Convention on Tobacco control [11], almost a decade ago there are several countries which have not even ratified the convention. Similarly although the global strategy for diet, physical activity, and health [12] was adopted by the World Health Assembly in 2004, only a handful of countries have implemented policy measures in agriculture, trade, transport, and finance ministries to make healthy food and physical activity choices available and affordable to people.

To make progress, all countries need to adopt comprehensive public health programs engaging the whole of government. Behavioral risk factors as well as their social and political determinants need to be tackled through action in multiple sectors including health, education, agriculture, sports, transport, communication, energy, urban planning, environment, labor, employment, industry and trade, finance, and social and economic development [6, 7•]. Multisectoral national plans based on a health in all policies approach is required to operationalize appropriate action across relevant sectors. Such multisectoral national plans either are not developed or implemented in many low and middle income countries.

Further, to ensure primordial and primary prevention a life course approach needs to be adopted. This includes giving due consideration to maternal health including avoiding exposure to tobacco and alcohol during pregnancy, breast feeding in infancy, healthy behaviors in child and adolescence, and healthy ageing. In order to operationalize this approach efforts to address cardiovascular diseases need to be incorporated alongside maternal and child health programs and care of the elderly in a range of settings (eg, schools, work places, communities).

Making progress in controlling the cardiovascular epidemic also entails leadership and decisive action of Governments and increased and sustained human, financial, and technical

resources. Activities of certain transnational cooperations that promote tobacco, alcohol, and consumption of obesogenic food are harmful to the health of people. They spend millions of dollars on advertising campaigns to increase the uptake of their products. The skills and capacity of public health authorities at the local, provincial, and national levels require strengthening so that they are competent to take appropriate action to counteract the health damaging activities of these powerful entities.

Health systems that organize their services around the principle of universal coverage and promote actions at the primary care level are required for effective prevention and control of cardiovascular diseases [13, 14•]. Although tertiary care services, coronary care units, and stroke units have a specific role to play for management of cardiovascular disease, they are not by themselves, sustainable and cost-effective solutions which address the cardiovascular epidemic, particularly in low and middle income countries [6]. Health systems in most countries, particularly at the primary care level, remain too weak to cater to early detection of cardiovascular risk and the long-term care of people with established cardiovascular diseases [2, 15–17]. To rectify this, gaps across all components of the health system need to be rectified, including:

- Governance: unregulated private sector, preventive curative imbalance.
- Financing: lack of equitable financing and inefficient use of resources.
- Workforce: inadequate capacity and weak contractual/managerial arrangements.
- Service provision: limited access and fragmented referral systems.
- Medicines and technologies: inadequate access and irrational use.
- Information: lack of monitoring and institutionalization of information systems.

Vital registration, surveillance and monitoring systems to track death rates, exposure to risk factors, social and economic determinants of health, and health system responses are critical for establishing baselines and measuring progress. National health information systems need to be developed and strengthened to serve these wide-ranging needs.

Global Response and Milestones

The global strategy for prevention and control of noncommunicable diseases was adopted by WHO Member States (WHA 53.14), in May 2000 [18]. Since then the World Health Assembly has endorsed several other important public health instruments for strengthening addressing cardiovascular diseases. These include the first global public health treaty,

the Framework Convention on Tobacco Control [11]; the global strategy for diet physical activity and health [12], and the global strategy for reducing the harmful use of alcohol [19]. The Political Declaration of the high-level meeting of the United Nations General Assembly on the Prevention and Control of Non-communicable Diseases adopted in September 2011 was a historical milestone in the global fight against noncommunicable diseases [6]. It has provided considerable impetus for moving the global agenda forward on cardiovascular diseases by recognizing and highlighting the public health, socioeconomic and development threats posed by these diseases.

On May 27, 2013 the WHA endorsed (WHA66.10) the Global Action Plan for the prevention and control of NCD for the period 2013–2020 [7••]. World Health Assembly resolution 66.10 also requested the WHO Director-General to work together with other United Nations funds, programs, and agencies on a division of tasks and responsibilities for United Nations funds, programs and agencies and other international organizations. This work will be concluded before the end of 2013. Currently, WHO is in the process of completing the work on the terms of reference for the United Nations interagency taskforce on prevention and control of noncommunicable diseases.

On July 22, 2013, a resolution adopted by ECOSOC [20], decided that the United Nations Interagency Task Force on the prevention and control of noncommunicable Diseases will coordinate the activities of the relevant United Nations funds, programs, and specialized agencies to support the realization of the commitments made by Heads of State and Government in the UN Political Declaration, in particular through the implementation of the World Health Organization Global Action Plan 2013–2020. The ECOSOC resolution urged all members of the existing United Nations Ad Hoc Interagency Task Force on Tobacco Control and other United Nations agencies, to contribute, within their respective mandates, as appropriate, to the activities of the United Nations Interagency Task Force on the prevention and control of noncommunicable diseases.

The global action plan for prevention and control of noncommunicable disease 2013–2020 provides a road map to operationalize the commitments of Heads of State and Government included in the Political Declaration [6, 7••]. The action plan articulates the need to make strategic and programmatic links between NCD programs, poverty alleviation, sustainable development/sustainable cities, food security, and climate change. It is underpinned by a global monitoring framework consisting of 25 indicators and 9 global voluntary targets (Table 1). The 6 objectives of the action plan are: (1) to strengthen advocacy and international cooperation and to raise the priority accorded to prevention and control of noncommunicable diseases at global, regional and national levels and in the development agenda; (2) to strengthen capacity, leadership, governance, multisectoral action and partnerships to accelerate country response for prevention and

Table 1 The 9 voluntary global targets for prevention and control of noncommunicable diseases to be achieved by 2025 [7••]

	Target
Premature mortality from noncommunicable disease	(1) A 25 % relative reduction in the overall mortality from cardiovascular diseases, cancer, diabetes, or chronic respiratory diseases
Harmful use of alcohol	(2) At least 10 % relative reduction in the harmful use of alcohol, as appropriate, within the national context
Physical inactivity	(3) A 10 % relative reduction in prevalence of insufficient physical activity
Salt/sodium intake	(4) A 30 % relative reduction in mean population intake of salt/sodium
Tobacco use	(5) A 30 % relative reduction in prevalence of current tobacco use in persons aged 15+ yrs
Raised blood pressure	(6) A 25 % relative reduction in the prevalence of raised blood pressure or contain the prevalence of raised blood pressure, according to national circumstances
Diabetes and obesity	(7) Halt the rise in diabetes and obesity
Drug therapy to prevent heart attacks and strokes	(8) At least 50 % of eligible people receive drug therapy and counseling (including glycemic control) to prevent heart attacks and strokes
Essential noncommunicable disease medicines and basic technologies to treat major noncommunicable diseases	(9) An 80 % availability of the affordable basic technologies and essential medicines, including generics, required to treat major NCD in both public and private facilities

control of noncommunicable diseases; (3) to reduce exposure to modifiable risk factors through creation of health promoting environments; (4) to strengthen and reorient health systems to address prevention and control of noncommunicable diseases through people-centered primary care and universal health coverage; (5) to promote and support national capacity for quality research and development for prevention and control of noncommunicable diseases; and (6) to monitor trends and determinants of noncommunicable diseases and evaluate progress in their prevention and control. Actions are proposed under each of these objectives for Member States, international partners, United Nations Funds, Agencies and programs and the World Health Organization.

In September 2011, the Political Declaration of the UN high-level meeting also called upon the World Health Organization, as the lead United Nations specialized agency for health, to work together with the United Nations family, international financial institutions, development banks and other key international organizations in a coordinated manner, to support national efforts to prevent and control noncommunicable diseases. Currently, the World Health Organization is in the process of developing the terms of reference of the global coordination mechanism to facilitate international cooperation to support national efforts for prevention and control of noncommunicable diseases.

Very Cost Effective Interventions for Attaining Global Voluntary Targets

The overarching target global voluntary target is a 25 % relative reduction in the overall mortality from cardiovascular diseases, cancer, diabetes, or chronic respiratory diseases by

2025. Action to prevent premature deaths from cardiovascular disease has the potential to make the largest contribution to reducing the premature mortality target on noncommunicable diseases. Very cost-effective interventions are available for attaining the global voluntary targets (Table 2) on tobacco use, harmful use of alcohol, physical inactivity, salt intake, hypertension, diabetes, obesity, and prevention of heart attacks and strokes through an absolute risk approach [7••].

Targets on Behavioral Risk Factors, Hypertension, Diabetes, and Obesity

In the case of tobacco control, they include, tobacco tax increases; dissemination of information about the health risks of smoking; restrictions on smoking in public places and workplaces and comprehensive bans on advertising and promotion [6, 11, 21–23].

The cost of implementing tobacco control measures is low. Total financial resources required to implement 4 population based demand reduction measures (smoke-free policies, raise tobacco taxes, package warnings, advertising bans) in low- and middle-income countries is US\$ 0.11 per head of population [24•]. The median cost per capita ranges from as little as US\$ 0.05 in low-income countries to US\$ 0.15 in upper-middle income countries [24•].

Cost effective interventions are also available to reduce the harmful use of alcohol [7••, 25, 26]. They include : regulating availability of alcoholic beverages, including minimum legal purchase age, restrictions on outlet density and on time of sale; increasing excise taxes on alcoholic beverages; restricting exposure to marketing of alcoholic beverages through effective marketing regulations or comprehensive advertising bans; drink-driving countermeasures including random breath

Table 2 Very cost-effective* policy measures and interventions for prevention and control of cardiovascular diseases [7••]

Tobacco use
<ul style="list-style-type: none"> • Reduce affordability of tobacco products by increasing tobacco excise taxes • Create, by law, completely smoke-free environments in all indoor workplaces, public places and public transport • Warn people of the dangers of tobacco and tobacco smoke through effective health warnings and mass media campaigns³ • Ban all forms of tobacco advertising, promotion and sponsorship
Harmful use of alcohol
<ul style="list-style-type: none"> • Regulating commercial and public availability of alcohol • Restricting or banning alcohol advertising and promotions • Using pricing policies such as excise tax increases on alcoholic beverages
Unhealthy diet and physical inactivity
<ul style="list-style-type: none"> • Reduce salt intake • Replace trans fats with unsaturated fats • Implement public awareness programs on diet and physical activity
Health system interventions
<ul style="list-style-type: none"> • Drug therapy (including glycemic control for diabetes mellitus and control of hypertension using a total risk approach) and counseling to individuals who have had a heart attack or stroke and to persons with high risk (≥ 30 %) of a fatal and nonfatal cardiovascular event in the next 10 years* • Acetylsalicylic acid for acute myocardial infarction* • Drug therapy (including glycemic control for diabetes mellitus and control of hypertension using a total risk approach) and counseling to individuals who have had a heart attack or stroke, and to persons with moderate risk (≥ 20 %) of a fatal and nonfatal cardiovascular event in the next 10 yrs • Secondary prevention of rheumatic fever and rheumatic heart disease • Acetylsalicylic acid, atenolol and thrombolytic therapy (streptokinase) for acute myocardial infarction • Treatment of congestive cardiac failure with ACE inhibitor, beta-blocker, and diuretic • Cardiac rehabilitation postmyocardial infarction • Anticoagulation for medium- and high-risk nonvalvular atrial fibrillation and for mitral stenosis with atrial fibrillation • Low-dose acetylsalicylic acid for ischemic stroke • Care of acute stroke and rehabilitation in stroke unit

*Very cost-effective (ie, generate an extra year of healthy life for a cost that falls below the average annual income or gross domestic product per person)

testing; treatment of alcohol use disorders, and brief interventions for hazardous and harmful drinking and educational and information campaigns to support these measures.

Many interventions are also available for modifying the diet to prevent cardiovascular diseases [6, 12, 27–29]. They include reducing the energy intake from total fats to less than 30 % of total energy intake; shifting fat consumption away from saturated fats to unsaturated fats and toward elimination of trans-fatty acids; limiting intake of free sugars and sodium consumption and increased consumption of

fruits, legumes, whole grains and nuts. Increased taxation on less healthy foods and decreased taxation, price subsidies or production incentives for healthy foods also have been demonstrated to be effective in promoting a healthy diet [7••].

With regard to unhealthy diet the global target is focused on salt consumption and aims at a 30 % relative reduction in mean population intake of salt/sodium [7••]. Dietary salt intake contributes to the causation of high blood pressure. The salt intake in many countries is between 9 and 12 g/day [30–32]. Many scientific studies have consistently demonstrated that a modest reduction in salt intake lowers blood pressure in people with high blood pressure, normal blood pressure, in all age groups, and in all ethnic groups [15, 33]. Studies have shown that a reduction in salt intake is one of the most cost-effective interventions to reduce heart disease and stroke worldwide at the population level [7••, 30–32]. It has been estimated that if salt consumption is reduced to the recommended levels (less than 5 g per day), up to 2.5 million cardiovascular deaths could be prevented each year [33]. Several countries have used both legislative and voluntary salt reduction strategies effectively for reducing dietary sodium [34].

Effective interventions are also available to eliminate trans-fatty acids from the diet in order to reduce cardiovascular risk. They include raising awareness about adverse effects of trans-fatty acids; nutrition recommendations; mandatory regulation of food standards; voluntary or mandatory labeling of trans-fatty acid content of foods, and voluntary reformulation by industry [7••, 35]. The reduction in marketing of foods and nonalcoholic beverages high in salt, fats and sugar to children is a key evidence based action for primordial and primary prevention of cardiovascular diseases [36].

Many developed countries have implemented effective interventions to promote physical activity. They include; media campaigns to promote physical activity; public policies to encourage physical activity, across sectors such as transport, education, sport and urban design; school-based interventions to improve knowledge, attitudes, and behavior related to physical activity and workplace and community health promotion programs [7••, 12].

All the interventions to promote healthy diet and physical activity alluded to above will contribute to attaining the targets on diabetes, obesity and hypertension. The global voluntary target is to halt the rise in diabetes and obesity by 2025. Similarly they will contribute to attaining the global voluntary target for hypertension, which is a 25 % relative reduction in the prevalence of raised blood pressure among people aged 18 years and above or contain the prevalence of raised blood pressure among people aged 18 years and above, according to national circumstances.

Targets to Prevent Heart Attacks and Strokes and Access to Basic Medicines and Technologies

In addition to population wide interventions alluded to above, improved access to individual interventions through a primary health care approach offers the greatest potential for reducing rising health care costs and mortality due to cardiovascular diseases [7••, 13, 14•, 15, 16].

To prevent heart attacks, strokes and cardiac failure individual interventions can be targeted to those at high absolute risk of cardiovascular disease or those with single risk-factor levels above traditional thresholds, such as hypertension, hypercholesterolemia, and hyperglycemia [7••, 15, 16, 21]. The former approach is much more cost-effective, than the latter and has the potential to substantially reduce cardiovascular events [37–39]. As such the World Health Organization has recommended the total risk approach for addressing these risk factors since 2002 [15, 40]. The major cardiovascular risk factors hypertension, hypercholesterolemia, and hyperglycemia/diabetes are so closely linked to one another in relation to health outcomes that it makes no technical or logistic sense to separate their management into vertical programs in primary care. To target those at high absolute risk of cardiovascular disease, primary care needs to be strengthened for cardiovascular risk assessment and management. Simplified implementation tools which can be used for implementing integrated programs for hypertension and diabetes in primary care even by non physician health workers have been developed by the World Health Organization [16, 41, 42].

There are 2 very cost-effective interventions for prevention and treatment of cardiovascular diseases that can be implemented in primary care in all countries [7••, 24•]. First, is treatment of people at medium to high cardiovascular risk including those with established cardiovascular disease. Second is providing acetylsalicylic acid treatment for acute myocardial infarction. Although it is feasible to deliver both interventions in primary care in all countries, currently, there are major gaps in access to these essential primary care interventions [17]. The annual cost per head of population for implementing these 2 interventions falls below US \$1 in low income countries and less than US\$1.50 in lower middle income countries and US\$ 2.50 in upper middle income countries [24•].

The global voluntary target for prevention of heart attacks and strokes is related to the first intervention to prevent heart attacks and strokes, alluded to above. The target is at least 50 % of eligible people with high cardiovascular risk to receive drug therapy and counseling (including glycemic control). The eligible people are defined as people 40 years and older with a 10-year cardiovascular risk >30 %, including those with existing cardiovascular disease [7••].

Action to attain the global voluntary target to improve access to basic technologies and medicines will support the

implementation of essential interventions through a primary care approach [7••]. The target is 80 % availability of the affordable basic technologies and essential medicines, including generics, required to treat major noncommunicable diseases in both public and private facilities [7••].

Priorities for National Action

Countries are at different levels of socioeconomic development, at varying stages of epidemiologic transition, and at different starting points in terms of addressing cardiovascular diseases. The global NCD action plan provides evidence based guidance and direction for policy making, priority setting and a framework for development of multisectoral national action plans.

An encouraging development in recent years is an increasing demand for technical assistance in the area of noncommunicable diseases. An analysis of 144 WHO Country Cooperation Strategies demonstrates a demand for technical assistance to support national efforts to address NCDs in 136 of them (comparable with 134 requests to address health system strengthening, 119 for communicable diseases, and 119 for emergency preparedness and response) [41, 42].

In a capacity assessment survey conducted by WHO in 2013, among responding countries (178) only 50 %, had an operational multisectoral national noncommunicable diseases action plan, which is in conformity with the global NCD action plan. Only 56 % had an operational noncommunicable diseases unit within the Ministry of Health. The percentage of countries with an operational policy, strategy or action plan to reduce physical inactivity, promote healthy diet and reduce harmful use of alcohol were 56 %, 60 %, and 52 %, respectively. By mid 2013 only 24 countries had implemented a complete indoor smoking ban and/or a complete tobacco advertising promotion and sponsorship ban. Only about half the countries had government approved evidence based national guidelines or protocols for management of noncommunicable diseases through a primary health care approach. Clearly, the gaps in capacity evident from these data need to be addressed as a matter of priority.

As alluded to above, a public health strategy to address cardiovascular diseases need to go beyond a narrow medical model. Government needs to provide leadership for multisectoral collaboration and action, including whole-of-government approaches across all relevant sectors incorporating a systematic consideration of wider health concerns in the routine policy processes of non-health sectors. To operationalize cross-sectoral action countries need to develop and implement multisectoral national action plans guided by the global action plan for prevention and control of noncommunicable diseases. Further, mechanisms need to be

established for facilitating, supporting and monitoring cross sectoral collaboration and action.

The time bound global targets and the monitoring framework of the global action plan provide a platform to facilitate accountability of stakeholders. Countries need to set national targets consistent with global targets to suit their contexts and prioritize action to attain them by 2025. National information systems need to be established for accurate vital registration, surveillance of risk factors and monitoring the process and impact of implementing national action plans.

Most importantly, available resources need to be used effectively and efficiently by giving priority to country wide implementation of a core set of very cost-effective preventive and curative interventions. Implementation of a core set of very cost-effective interventions for prevention and control of cardiovascular disease require about 4 % of current health spending in lower income countries, 2 % in lower middle income countries, and less than 1 % in upper middle income and high income countries [24]. A combination of domestic and foreign revenues and traditional and innovative financing needs to be mobilized to make this a reality in low and middle income countries.

Equity should be a central concern and access to these interventions should be based on the need rather than the ability to pay. The key focus should be on reducing exposure of populations to behavioral risk factors and early detection and equitable care. Implementation of a core set of interventions has the potential to shift the cardiovascular risk profile of the population to a healthy distribution and reduce cardiovascular events and preventable mortality [7•, 9–13, 14•, 24•].

Strengthening national capacity should be a priority. Shortage of trained human resources (doctors, nurses, paramedical and health care workers) is a major limitation in many countries. National workforce development to address cardiovascular diseases, require attention to a wide range of expertise; policy analysis and development, legislative and regulatory functions, surveillance, prevention and promotion, disease management, operational research, multisectoral action, and program coordination including partnership/coalition building.

Priority should also be given to strengthening and reorienting health systems. First, they need to move away from excessive and inappropriate use of high cost technologies, medicines and costly invasive procedures. Second, the health financing policy needs to be revised to address equity issues and to move toward universal coverage. Third, resources need to be more effectively used by investing in the delivery of cost-effective, high impact interventions. Finally, primary care facilities need to be strengthened to deliver good quality care by a skilled and motivated health workforce.

The building and coordinating of results-oriented collaborative efforts and alliances with the civil society and the

private sector have the potential to support national efforts for prevention and control of cardiovascular diseases. Such partnerships with the private sector should include mechanisms to enable the private sector to exercise its cooperate social responsibility while safeguarding public health from potential conflicts of interest. In the assessment of global capacity for prevention and control of noncommunicable diseases conducted by WHO in 2013, 84 % of WHO Member States reported having partnerships or collaborations for implementing key activities [2]. They included collaboration among health-care teams, patients, families, communities, municipalities, and other relevant partners. New partnerships and collaborations need to be forged to address functional gaps, which are barriers to prevention and control of cardiovascular diseases. They include advocacy and awareness-raising, multisectoral action, financing and resource mobilization including innovative financing, capacity strengthening, product development/innovation and product access to support procurement of essential health commodities.

Conclusions

The cardiovascular epidemic continues to grow particularly in low and middle income countries, which are particularly ill-equipped to launch a proper national response. The global action plan 2013-2020 provides a road map and a set of affordable actions, which can be implemented in all countries. Countries need to develop and implement multisectoral national plans, set national targets consistent with the global voluntary targets, prioritize the implementation of a core set of very cost-effective interventions and monitor progress in attaining the targets. To steer the future course of the global cardiovascular epidemic in the right direction, political commitment operationalized as results oriented action, international cooperation and due consideration of the socio-economic and development impacts of noncommunicable diseases in the post 2015 UN development agenda will be necessary.

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Compliance with Ethics Guidelines

Conflict of Interest S. Mendis and O. Chestnov declare that they have no conflict of interest.

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.

References

Papers of particular interest, published recently, have been highlighted as:

- Of importance
- Of major importance

1. Causes of death 2008 (online database), Geneva Switzerland: World Health Organization. Available at: http://www.who.int/healthinfo/global_burden_disease/cod_2008_sources_methods.pdf. Accessed November 13, 2013.
2. World Health Organization. Global Status Report on noncommunicable diseases 2010. Geneva: World Health Organization; 2010.
3. Global health risks: mortality and burden of disease attributable to selected major risks. Geneva, World Health Organization: 2009. Available at: http://www.who.int/healthinfo/global_burden_disease/GlobalHealthRisks_report_full.pdf. Accessed November 13, 2013.
4. Global atlas on prevention and control of cardiovascular diseases. Geneva, Switzerland: World Health Organization: 2011.
5. World Health Statistics. Part II Highlighted topics. Geneva, Switzerland: World Health Organization; 2012.
6. United Nations General Assembly resolution 66/2 Political Declaration of the high-level meeting of the General Assembly on the Prevention and Control of Non-communicable Diseases. Available at: http://www.who.int/nmh/events/un_ncd_summit2011/political_declaration_en.pdf. Accessed November 13, 2013.
7. World Health Assembly. Global Action Plan for the Prevention and Control of NCD 2013-2020, (WHA 66.10). Geneva, Switzerland: World Health Organization: 2013. *This publication provides a road map for operationalizing the commitments of the Political Declaration of the United Nations high level meeting on prevention and control of noncommunicable diseases 2011.*
8. World Health Organization and World Economic Forum. From Burden to “Best Buys”: Reducing the Economic Impact of Non-Communicable Diseases in Low- and Middle-Income Countries. Geneva, Switzerland: World Health Organization and World Economic Forum: 2011. Available at: www.who.int/nmh/publications/best_buys_summary. Accessed 13 November 2013.
9. World Health Organization. Rheumatic fever and rheumatic heart disease. WHO Technical Report 923: Geneva, Switzerland: 2001.
10. World Health Organization. Chagas disease. WHO Technical Report Series 905. Geneva, Switzerland: 2002. Available at: http://whqlibdoc.who.int/trs/WHO_TRS_905.pdf. Accessed November 13, 2013.
11. Conference of the Parties to the WHO Framework Convention on Tobacco Control. Geneva: World Health Organization: 2007. Available at: http://www.who.int/gb/fctc/PDF/cop2/FCTC_COP2_17P-en.pdf. Accessed November 13, 2013.
12. World Health Assembly. Global Strategy on Diet, Physical Activity and Health, (WHA 57.17). Geneva: World Health Organization; 2004.
13. World Health Report 2008. Primary health care - now more than ever. Geneva: World Health Organization; 2008.
14. World Health Report 2010. Health Systems financing: the path to universal coverage. Geneva: World Health Organization; 2010. *This publication provides information on the challenges and approaches to attaining universal health coverage.*
15. Prevention of cardiovascular disease: guidelines for assessment and management of total cardiovascular risk. Geneva, Switzerland: World Health Organization: 2007.
16. Package of Essential Noncommunicable (WHO-PEN) Disease interventions for primary health care in low resource settings. Geneva, Switzerland: World Health Organization: 2011.
17. Mendis S, Al Bashir I, Dissanayake L, et al. Gaps in capacity in primary care in low-resource settings for implementation of essential noncommunicable disease interventions. *Int J Hypertens.* 2012;2012:584041.
18. Global strategy for prevention and control of noncommunicable diseases, (WHA 53.14). Geneva, Switzerland: World Health Organization: 2000.
19. World Health Assembly. Global Strategy to reduce the harmful use of alcohol, WHA 63.13. Geneva: World Health Organization; 2010.
20. United Nations Economic and Social Council. United Nations Interagency task force on prevention and control of noncommunicable diseases. E/2013/L.23. Available at: http://www.who.int/nmh/events/2013/E.2013.L.23_tobacco.pdf. Accessed November 13, 2013.
21. Ortegon M, Lim S, Chisholm D, et al. Cost effectiveness of strategies to control cardiovascular disease, diabetes and tobacco use in sub-Saharan Africa and South East Asia: mathematical modeling study. *BMJ.* 2013;344:e607.
22. Jha P, Chaloupka FJ, Moore J, et al. Tobacco Addiction. In: Jamison DT, Breman JG, Measham AR, et al. editors. *Disease Control Priorities in Developing Countries*, 2nd edition. Washington DC: World Bank: 2006. 17) World Health Organization, WHO technical manual on tobacco tax administration. Geneva, Switzerland, 2010
23. International Tobacco Control Policy Evaluation Project: key findings. Waterloo: International Tobacco Control Project: 2010.
24. Scaling up action against noncommunicable disease: how much will it cost? Geneva, Switzerland: World Health Organization: 2011. Available at: http://whqlibdoc.who.int/publications/2011/9789241502313_eng.pdf. Accessed November 13, 2013. *This publication provides information on the cost of scaling up a set of very cost-effective, high impact interventions for prevention and control of noncommunicable diseases including cardiovascular diseases in all low and middle income countries.*
25. Anderson P, Chisholm D, Fuhr D. Effectiveness and cost-effectiveness of policies and programs to reduce the harm caused by alcohol. *Lancet.* 2009;373:2234–46.
26. Evidence for the effectiveness and cost-effectiveness of interventions to reduce alcohol-related harm. Copenhagen, Denmark: World Health Organization Regional Office for Europe: 2009.
27. Willett WC, Koplan JP, Nugent R, et al. Prevention of Chronic Disease by Means of Diet and Lifestyle Changes. In: Jamison DT, Breman JG, Measham AR, et al. editors. *Disease Control Priorities in Developing Countries*. World Bank: 2006.
28. Interventions on diet and physical activity: what works: summary report. Geneva, Switzerland: World Health Organization; 2009.
29. Cecchini M, Sassi F, Lauer JA, et al. Tackling unhealthy diets, physical inactivity, and obesity: health effects and cost-effectiveness. *Lancet.* 2010;376:1775–84.
30. Reducing salt intake in populations. Report of a WHO Forum and Technical Meeting, Geneva, Switzerland: World Health Organization; 2007.
31. World Health Organization Guideline: sodium intake for a adults and children. Geneva, Switzerland: World Health Organization; 2012.
32. Salt reduction and iodine fortification strategies in public health 2014. http://www.who.int/nutrition/publications/publichealth_saltreduc_iodine_fortification/en/. Accessed March 24, 2014.
33. A global brief on high blood pressure (hypertension): preventing heart attacks, strokes and kidney failure. Geneva, Switzerland; World Health Organization: 2013.
34. Webster JL, Dunford EK, Hawkes C, et al. Salt reduction initiatives around the world. *J Hypertens.* 2011;29:1043–50.

35. L'Abbé MR, Stender S, Skeaff M, et al. Approaches to removing trans fats from the food supply in industrialized and developing countries. *Eur J Clin Nutr.* 2009;63:S50–67.
36. World Health Assembly. Marketing of food and non-alcoholic beverages to children, (WHA63.14). Geneva, Switzerland: World Health Organization; 2010.
37. Mendis S, Chestnov O. Cost benefits and effectiveness of interventions for the prevention, treatment and control of cardiovascular disease and diabetes in Africa. *Prog Cardiovasc Dis.* 2013;56(3):314–21.
38. Ndindjock R, Gedeon J, Mendis S, et al. Potential impact of single-risk-factor versus total risk management for the prevention of cardiovascular events in Seychelles. *Bull World Health Organ.* 2011;89:286–95.
39. Mendis S, Johnston SC, Fan W, et al. Cardiovascular risk management and its impact on hypertension control in primary care in low-resource settings: a cluster-randomized trial. *Bull World Health Organ.* 2010;288:412–9.
40. World Health Report. Reducing Risks, Promoting Healthy Life. Geneva: World Health Organization; 2002. p. 2002.
41. WHO Country Cooperation Strategies Guide 2010. Geneva, Switzerland: World Health Organization; 2010. Available at: http://www.who.int/countryfocus/cooperation_strategy/en/. Accessed November 15, 2013.
42. Prevention and control of noncommunicable diseases: Guidelines for primary health care in low-resource settings: diagnosis and management of type 2 diabetes and management of asthma and chronic obstructive pulmonary disease, Geneva, Switzerland: World Health Organization; 2012. Available at: http://www.who.int/nmh/events/action_plan_indicators/en/. Accessed November 15, 2013.