

# Can we prevent cardiovascular diseases in low- and middle-income countries?

Claude Lenfant<sup>1</sup>

**Abstract** Ischaemic heart disease, the largest cause of death worldwide, is rapidly becoming a major threat in low- and middle-income countries. Experience in a variety of populations has demonstrated that lowering certain risk factors, such as hypertension and hypercholesterolaemia, reduces illness and deaths from cardiovascular diseases. A dual approach is recommended: screening and intervening in cases of relatively high risk, while fostering population-wide preventive activities. This is both feasible and affordable. Now is the time to make such efforts.

**Keywords** Cardiovascular diseases/prevention and control/drug therapy; Myocardial ischemia/mortality; Risk factors; Primary prevention; Developing countries (*source: MeSH*).

**Mots clés** Cardiovasculaires, Maladies/prévention et contrôle/chimiothérapie; Ischémie myocardique/mortalité; Facteur risque; Prévention; Pays en développement (*source: INSERM*).

**Palabras clave** Enfermedades cardiovasculares/prevenición y control/quimioterapia; Isquemia miocárdica/mortalidad; Factores de riesgo; Prevención primaria; Países en desarrollo (*fuentes: BIREME*).

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*Voir page 982 le résumé en français. En la página 982 figura un resumen en español.*

Currently, ischaemic heart disease is responsible for more deaths and a greater burden of disease than any other cause in the established market economies. Worldwide, ischaemic heart disease is the largest cause of death, and is fifth largest in terms of disease burden (1, 2). By 2020, the low- and middle-income countries will also have ischaemic heart disease as the most frequent cause of death and greatest disease burden. Some of the reasons for this are positive: they include reductions in other causes of death such as acute infectious diseases, improvements in sanitation and nutrition, family planning programmes resulting in improved maternal and child health, and increased longevity. Other reasons are not so positive. With the adoption of a Western lifestyle there is likely to be greater exposure to risk factors such as high blood pressure, diets high in saturated fat, leading to elevated serum cholesterol levels, and physical inactivity (2, 3). These kinds of changes have been seen in migration studies (4, 5). Importantly, cigarette smoking is already a major problem in many low- and middle-income countries. Increased longevity need not inevitably lead to the expected larger burden from cardiovascular disease, but reversing the incipient epidemic will require a number of actions.

Observational studies have shown that the risk factors for cardiovascular disease are the same in different populations (3, 6–10). Hypertension, hypercholesterolaemia, cigarette smoking, and diabetes all increase the risks of cardiovascular disease in the many populations in which they have been studied. The relative importance of these risk factors may vary across populations (6), but they have adverse consequences, even if to a different extent. Similarly, the absolute risk of developing cardiovascular disease may vary among populations and among subgroups within a population (3, 6). But the risk factors still operate among the low-risk groups, as they do among those at high risk (6).

Many large-scale, well-designed clinical trials of risk factor reduction have shown that lowering certain risk factors reduces illness and deaths from cardiovascular diseases. Particularly persuasive have been the trials of drugs for lowering lipid levels and blood pressure (11, 12). They have been conducted in a variety of populations, at various levels of risk, and in people with and without known end-organ damage. The latter is important, because it establishes the potential for early population-based intervention to prevent the occurrence of overt disease. Because of the consistency of findings among studies in different populations, there is every reason to believe that lowering risk factors or preventing their rise in low- and middle-income countries will produce the same sorts of relative reductions, or at least a slowing

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of progression, in cardiovascular disease that have been seen in clinical trials primarily conducted in the established market economies.

The dual approach of screening and intervening in cases of relatively high risk of cardiovascular disease and of fostering population-wide preventive activities (13, 14) is as appropriate in low- and middle-income countries as in the established market economies. Importantly, after promotion of a heart-healthy diet, prevention and treatment of weight gain, and facilitation of a physically active lifestyle, the pharmacological interventions that have been most clearly shown to work are often the cheapest. Thus, for hypertension, diuretics and beta-blockers are the first lines of treatment (14). For lipid-level lowering, the HMG-reductase inhibitors have been expensive, but the earlier ones are coming off patent and will be more affordable. In secondary prevention, aspirin clearly reduces cardiovascular mortality and morbidity and is cheap (15). Other drug classes proven to save lives and reduce morbidity, such as angiotensin-converting-enzyme inhibitors (16), are currently expensive. But at least one of these is coming off patent and the prices should come down.

It is more difficult to conduct intervention studies showing that prevention of risk factors prevents the occurrence of cardiovascular disease, as the sample sizes become huge. Nevertheless, trials of lipid-level lowering in people with serum cholesterol levels considered to be “normal,” at least in the context of Western societies, have demonstrated reduction in coronary heart disease (17). Prevention of hypertension by means of dietary salt reduction and weight loss has been successfully accomplished, over the short term, in clinical trials (18). Diets high in fruits, vegetables, and low-fat dairy products are extremely effective in lowering blood pressure, again, in the short term (19).

In view of these successes, the prevention or reduction of risk factors deserves priority. This is an especially important concept for populations experiencing a rise in risk factors due to the epidemiological transition. Many countries do not yet have a high incidence of cardiovascular disease and may not want or be able to devote the medical and economic resources to treating something that is not yet an overwhelming problem. They may be inclined not to pursue interventions for several reasons: first, because of insufficient evidence that it is cost-effective; second, because the benefit if it occurs is likely to do so in the distant future; third, because it is assumed that the number of people

that would have to be treated to prevent an event is too large. With respect to the third, it is true that, given similar relative benefits, the absolute benefit achieved is a function of the absolute risk of disease; in other words, the populations with the highest risk gain the most from risk reduction. However, if the development of risk factors can be prevented by relatively inexpensive population-based measures, then the costs of dealing with specific existing risk factors can be reduced. Thus, promotion of diets that limit the intake of saturated fats and sodium, efforts to prevent people from starting smoking, and efforts to encourage life-long physical activity, can all be done on a population-wide basis. Though accomplished in a nation with an established economy, the example from North Karelia in Finland shows what can be done on a population basis (20). Importantly, in addition to being less expensive than intervening for individuals, such efforts carry a low likelihood of adverse effects, and thus it is reasonable to pursue them in populations that are still at low absolute risk of developing cardiovascular disease. The high “number needed to treat” should not be a factor that discourages these population-based efforts.

Over the past 30 years, mortality from cardiovascular diseases has fallen considerably in countries with established market economies (21). The reasons for the declines in mortality, at least for coronary artery disease, are most likely to be a combination of prevention and better treatment, with different studies ascribing slightly different percentages to each (22, 23). It would be a shame if the low- and middle-income countries went through the same rise in cardiovascular disease experienced by the wealthier ones although steps can be taken to reduce it. As noted, many of these steps, whether they are population-based prevention or treatment with proven agents, are affordable, particularly those involving public education and lifestyle changes. The challenge is for policy-makers to develop the political will to establish cardiovascular disease prevention and education programmes.

In summary, numerous observational and intervention studies of prevention and treatment of cardiovascular disease provide valid information for low- and middle-income countries. Many of the approaches are affordable. Now is the time for these efforts to be made — before the expected cardiovascular disease epidemic becomes too great and puts impossible strains on the limited budgets of these countries. ■

## Résumé

### La prévention des maladies cardio-vasculaires est-elle possible dans les pays à revenu faible ou moyen ?

Les cardiopathies ischémiques, principale cause de décès dans le monde, constituent une menace en aggravation rapide dans les pays à revenu faible ou moyen. Des expériences menées dans diverses populations ont montré qu'en réduisant certains facteurs de risque, comme l'hypertension et l'hypercholestérolémie, on peut limiter les maladies et les décès dus aux maladies cardio-

vasculaires. Une double approche est recommandée : dépistage et intervention dans les cas à risque relativement élevé, et promotion d'activités de prévention à l'échelle de la population. Cette approche est à la fois réalisable et d'un coût abordable. Il est maintenant temps de passer à l'action.

## Resumen

### ¿Podemos prevenir las enfermedades cardiovasculares en los países de ingresos bajos y medios?

La cardiopatía isquémica, principal causa de defunción en todo el mundo, se está convirtiendo rápidamente en una gran amenaza para los países de ingresos bajos y medios. La experiencia acumulada en diversas poblaciones ha demostrado que la reducción de determinados factores de riesgo, como la hipertensión y la hipercolesterolemia, reduce la morbilidad y la mortalidad

por trastornos cardiovasculares. Se recomienda un doble enfoque: cribado e intervención en los casos de riesgo relativamente alto, y fomento de las actividades preventivas a nivel poblacional. Este planteamiento es al mismo tiempo viable y asequible. Es hora de emprender ese tipo de actividades.

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## Round Table Discussion

### Prevention is both moral and cost-effective

Anthony Mbewu<sup>1</sup>

Lenfant presents a lucid and compelling argument for cardiovascular disease (CVD) prevention in developing countries (1). The case he makes is particularly strong for so-called middle-income countries, such as South Africa, that currently experience a “triple burden” of pre-transitional and post-transitional diseases. According to the *The world health report 1999*, CVD accounted for 28.5% of all deaths in low- and middle-income countries in 1998 (2). In South Africa in 1996 over 22% of all deaths were due to stroke and heart disease, and 19% were due to injury caused by violence and accidents. South Africa’s per capita gross domestic product of US\$ 3450 places it in the higher echelons of middle-income countries, and its demographic profile is typical of such countries. Half its population are under 18 years of age and are thus exposed to the “globalization of risk factors” that is occurring.

Rapid liberalization and opening up of the economy lowers trade barriers to both regional and global partners. This can speed up the development of human and economic potential, but brings with it disadvantages such as easier access to tobacco products, diets higher in salt and sugar, and the more sedentary lifestyles associated with obesity and type II diabetes mellitus. Many of these influences are known as determinants — socioeconomic and behavioural patterns in which the classical risk factors for CVD emerge. Their spread and adoption is of course augmented by the global media and information technology revolution taking place in most of the countries of the world.

The relatively young populations of middle-income countries are thus exposed to these changing determinants and risk factors for longer periods of time, resulting in CVD at relatively young ages. For example, in South Africa stroke in 1995 accounted for 4.8% and 2.3% of deaths in women and men respectively in the 35–39 year-old age group, and these proportions rose with increasing age (3). In 1990, 46.7% of the deaths attributable to CVD in the developing countries occurred below the age of 70 years, in contrast to 22.8% of such deaths below that age in the high-income industrial countries (4).

The relative youth of CVD victims in developing countries has a profound economic impact, in terms not only of lost productivity (5) but of caring for the orphans they leave behind. Prevention of such deaths is a moral imperative and probably a more

cost-effective option than treating CVD after it is established. Responding to the urgent need to test this hypothesis in emerging nations, a number of projects are being planned by the Initiative on Cardiovascular Health in Developing Countries (ICH) organized by WHO and the Global Forum for Health Research.

In addition, pregnant women in developing countries are exposed to deficits in nutritional and environmental resources that could result in fetal “programming” (6) leading to hyperinsulinaemia, hypertension, and central obesity in their children later in life, particularly as they are exposed to the increasingly prevalent determinants and risk factors we have mentioned. Preventive cardiologists and public health specialists have grown to recognize the importance of “primordial” prevention measures aimed at determinants of CVD affecting children as well as adults, and of community-based interventions (7). Such interventions are obviously more important in countries whose demographic profile is weighted towards younger people.

In summary, prevention, both for individuals and for populations, is likely to be the most effective and affordable way to limit the increase in CVD in developing countries, but much more research is needed. ■

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### Prevention of cardiovascular disease is possible but a major challenge

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There are three points I wish to raise in response to the statement by Lenfant (1). The first is that

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cardiovascular diseases (CVD) are already leading causes of mortality and morbidity in many low-income and middle-income countries. For lack of action, the situation is getting worse in these countries and the level of cardiovascular risk factors is now high. Today, more than 80% of smokers live in poorer countries, partly because of inadequate tobacco control initiatives (2). While tobacco consumption is falling in most industrialized countries, it is increasing in developing ones by about 3.4% per annum. Overall, smoking prevalence among men in developing countries is about 48%. In terms of other cardiovascular risk factors, studies also clearly show that high blood pressure and glucose intolerance are at least as prevalent in poorer populations as they are in richer ones. Action to prevent these diseases and their determinants is therefore long overdue.

The second point is about the strategies for CVD prevention in low-income and middle-income countries. Lenfant rightly states that since the risk factors for CVD are the same in different populations, reducing them can be expected to slow down the rise of CVD. There is no controversy over the importance of tackling risk factors. As stated in the global strategy for the prevention and control of noncommunicable diseases, which was endorsed by the World Health Assembly in 2000, health promotion and disease prevention are the most important components of reducing the burden of premature mortality and disability due to CVD. This is seen as the most feasible approach, particularly in low-income populations experiencing a rise in risk factors due to the epidemiological transition (3).

I agree that there is no reason to doubt that strategies for CVD prevention which have worked in established economies would work in developing ones too. However, the main challenge is in implementing these strategies through community-based action and health system interventions. It is not enough to recognize the need and increase the commitment of policy-makers. Considerable constraints have to be overcome before the successful work of developed countries can be fully translatable. It is because of these constraints that many countries in which CVD is a leading cause of premature death have failed to take comprehensive action or establish effective prevention programmes.

Health care systems are unable or ill-prepared to provide the services needed to prevent CVD. In many developing countries, there is no clear strategy for health or appropriate approach to delivering health services in the context of limited resources. Reforming and reorganizing health systems to respond more effectively to the needs of chronic diseases represents a huge challenge. A broader health agenda is needed, with greater emphasis on population health and on assessing the social and economic determinants of a healthy population.

Primary prevention of CVD is based on lifestyle interventions requiring the joint work of many sectors. Failure to initiate effective programmes is reinforced in many countries by neglect

of intersectoral approaches and lack of ways to influence government policies that have a major bearing on health. Human resources are another major part of the challenge. At the moment not enough health professionals in developing countries have training and experience in public health and noncommunicable disease prevention.

My third and last point is about Lenfant's emphasis on screening and pharmacological interventions. The decline in CVD mortality in industrialized countries is attributed to a combination of prevention and improved care, and there is no doubt that secondary prevention is another effective approach to controlling the rising epidemic. But where resources are scarce there is often a need to strike a balance between preventing disease and providing the services for identifying and treating it. Where poverty is extreme, secondary prevention will have to be limited to interventions that are known to be highly cost-effective and affordable. There is a pressing need for research to evaluate the impact of these interventions on risk factor levels and cardiovascular outcomes in low- and middle-income countries. WHO is currently launching an initiative to work out sustainable strategies for integrating secondary prevention into existing health care infrastructure. The aim is to build national capacity to meet health service needs related to CVD prevention. ■

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## Neglecting cardiovascular disease is unaffordable

K. Srinath Reddy<sup>1</sup>

The emergence and acceleration of cardiovascular disease (CVD) epidemics in low- and middle-income countries is explained by demographic shifts and lifestyle changes propelled by urbanization, industrialization, and globalization. Low birth weight and ethnic diversity in gene–environment interactions may magnify the impact of these changes (1–3).

While the determinants of the health transition in low- and middle-income countries are similar to those in the high-income countries, their dynamics are different. The compressed time frame of the

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transition in poorer countries imposes a double burden of communicable and noncommunicable diseases. Urbanization occurring in prospering economies differs in important respects from that which occurs in settings of poverty and international debt, which restrict resources for public health responses. Organized efforts at prevention began in high-income countries when the epidemic had peaked, and they often accelerated a secular downswing, while the efforts in low- and middle-income countries are starting when the epidemic is still on its upswing. Strategies to control CVD must be based on recognition of these similarities and differences. Principles of prevention must be based on the evidence gathered in high-income countries, but the interventions must be context-specific and resource-sensitive.

Prevention must aim at risk reduction across the lifespan and be guided by the following facts. First, risk operates across a continuum for most variables. Second, many more events arise from the “moderate” middle of the distribution than from the “high-risk” tail. Third, risk is multiplied when risk factors coexist, which they often do. Fourth, the majority of CVD events occur in persons with modest levels of multiple risk factors rather than in those with a high level of a single risk factor. Fifth, “comprehensive” or “absolute” CVD risk is the best guide for individual interventions, while “population-attributable risk” should guide mass interventions, maximizing benefits by bringing about modest distributional shifts. Sixth, a synergistically complementary blend of cost-effective “population-wide” and “high-risk” interventions must extend from primary prevention in children to secondary prevention in older adults (4–6).

Community empowerment through education (mass and targeted) and policy change (to provide an enabling environment) are essential for health promotion in populations at all stages of health transition. Populations at high risk need, in addition, strategies and services for early detection and effective control of risk. Opportunistic screening (for tobacco use, being overweight, and high blood pressure) and targeted screening (for diabetes and dyslipidaemia) must be followed by risk stratification and management. In the case of manifest CVD, the following practices should be promoted for acute care: recognition and response by the community, along with resuscitation skills; use of chest pain algorithms and cost-effective interventions such as aspirin in primary care; rational pharmacotherapy in secondary care; and rational use of diagnostics and interventions in tertiary care. Chronic care must effectively integrate secondary prevention into primary care, improve the management of left ventricular dysfunction in secondary care, and promote rational use of high technology in tertiary care. The centre of gravity for chronic care must shift closer to the community through the promotion of self-care and the provision of care by family

members, community health workers, and other non-physicians.

Health systems need to be reoriented to include the expanded mandate of chronic disease control. Access to life-saving drugs and technologies must be promoted through public–private partnerships. Surveillance and delivery systems need to be established through the synergy of public, private, and voluntary agencies.

The challenge facing low- and middle-income countries is to move quickly to mitigate the burden of CVD in midlife. This can be done by applying existing knowledge to catalyse the convergence of an empowered community, an enlightened policy, and an energetic medical profession for CVD prevention. The question is not whether poorer countries can afford to invest in CVD prevention but whether they can afford not to. ■

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## Health-related lifestyles are the key Pekka Puska<sup>1</sup>

Claude Lenfant (1) makes a number of important points. Noncommunicable diseases (NCDs) are becoming the main cause of death and disease in the developing world. Thus the greatest health gains are achieved in preventing major NCDs, especially cardiovascular diseases (CVDs). Furthermore, these diseases and their risk factors tend in most countries to accumulate in lower socioeconomic segments of the population, thus greatly contributing to inequities in health.

Is prevention of CVDs possible in low- and middle-income countries? A good reason for thinking so is that the main factors behind the CVDs seem to be the same in different parts of the world, even if their

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cultural backgrounds and relative importance vary. Tobacco use, unhealthy nutrition, and physical inactivity seem to be major factors in most populations.

Thus the main question is what strategies for preventive interventions are most feasible, effective, and cost-effective. As Lenfant comments, the information varies. A US analysis emphasizes treatment interventions (2). Finnish analyses, supported by a very recent US study, indicate that the role of general lifestyle changes has been crucial (3, 4).

Ideally, we should prevent the risk factors in childhood through adoption of healthy lifestyles. This should be a key objective in all countries, but will only improve public health after 20–40 years. In the meantime we can greatly improve public health by reducing risk factors that have already developed — in both developing and developed countries.

Although the efficacy of several drug treatments has been clearly demonstrated in developed countries, the feasibility of widespread drug use is restricted by the considerable costs involved, and for other reasons. Promotion of healthy lifestyles, when possible, is much cheaper. In real life a balanced combination of these strategies is needed. Certain drugs have their place, but general lifestyle changes can and should be vigorously promoted. In low- and middle-income countries heavy emphasis should be put on the latter strategy, using policy measures and other actions that cost very little.

For instance, WHO has long recommended a set of actions that can greatly reduce tobacco use, thereby directly preventing diseases that will otherwise occur, particularly in low-income groups. Some of these measures, like tax increases, cost nothing and can actually even increase public revenues. Thus the idea that controlling noncommunicable disease always favours the rich more than the poor is misleading. For instance, *The world health report 2000* states that “Doubling the pace of reduction of NCD damage, in contrast [to infectious disease control], world preferentially benefit the well-off as well as costing considerably more”(5) but in some instances, such as raising tobacco taxes, this is clearly not the case.

Most low- and middle-income countries have a double burden of disease: a heavy communicable disease burden and an increasing noncommunicable one as well. Concentrating only on infectious disease control will lead to higher health care costs in the future. Thus the prevention of CVDs and other major NCDs that often have common risk factors must not be neglected. It is the most crucial question of global public health for the future.

Some have suggested that middle-income countries should take the lead in CVD prevention, making inexpensive population-wide measures their priority, encouraging low-income countries to follow suit. At the same time, specific programmes should be considered, including simple community-based demonstration projects and feasible risk factor treatment measures in primary health care. Some of

these measures are spelt out in WHO’s recent NCD strategy paper (6) and a World Health Assembly resolution adopted last year (7). ■

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## Primary prevention must have priority Robert Beaglehole<sup>1</sup>

I agree with Lenfant (1) that there is great potential for the prevention of cardiovascular disease (CVD) in low- and middle-income countries. My main concern is the lack of a sense of the urgency of this challenge. The developing epidemics of CVD in low- and middle-income countries will result in a public health catastrophe unless we take serious action now. I want to emphasize three points.

First, we could do much more to prevent the epidemics of CVD in wealthy countries. We are not applying fully the information and experience gained over the last 50 years of CVD research. Even in the USA, which has seen one of the greatest declines in CVD mortality rates over the last three decades, CVD remains the leading cause of death and is responsible for untold economic and social costs. This is not due to lack of knowledge; it is due to the lack of application of appropriate evidence-based strategies.

The successes in the USA and elsewhere in partially controlling these epidemics have come from the application of the high-risk-based and, to a lesser extent, population-based strategies of primary prevention. This is the model that Lenfant recommends for low- and middle-income countries. However, because this approach relies heavily on individual screening and the long-term management of people who are at high risk, it is not a viable solution to the

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problem of how to prevent the epidemics in most of the world. This approach does nothing to stem the rising flow of high-risk people, all too apparent in the new epidemic of obesity in the USA. The only rational approach to CVD prevention in all countries is one that gives the greatest priority to population-based primary prevention. Where resources are scarce, and this applies to most of the world, this strategy should be the only one adopted.

My second point is that we know enough about the causes of the CVD epidemics to act now. Of course there is room for more research, though I don't think much useful and widely applicable information will come from further research on new risk factors or on the genetic determinants of CVD. With appropriate analyses of epidemiological data and in the absence of the three or four standard risk factors, CVD is extremely rare (2). The goal should be to achieve an ideal population risk factor profile through the population-wide approach to

primary prevention based on appropriate economic, legislative, social, and environmental programmes.

The third point is that despite all the research conducted in wealthy countries, we know little about the occurrence of CVD in poorer countries. We cannot even be sure if age-specific CVD rates are rising in much of the world and, if so, for what reasons. How much of the projected burden of CVD will be due to ageing and how much to changing population risk factor profiles? This fundamental question will only be answered when we have suitable and sustainable surveillance systems in sentinel sites in low- and middle-income countries. ■

1. **Lenfant C.** Can we prevent cardiovascular diseases in low- and middle-income countries? *Bulletin of the World Health Organization*, 2001, **79**: 980–982.
2. **Stamler J et al.** Low risk-factor profile and long-term cardiovascular and non-cardiovascular mortality and life expectancy. Findings for 5 large cohorts of young adult and middle-aged men and women. *JAMA*, 1999, **282**: 2012–2018.