

SPECIAL COMMUNICATION

The Global Burden of Chronic Diseases

Overcoming Impediments to Prevention and Control

Derek Yach, MBChB, MPH

Corinna Hawkes, PhD

C. Linn Gould, MS, MPH

Karen J. Hofman, MD

CHRONIC DISEASES ARE THE largest cause of death in the world (FIGURE 1), led by cardiovascular disease (17 million deaths in 2002, mainly from ischemic heart disease and stroke) and followed by cancer (7 million deaths), chronic lung diseases (4 million), and diabetes mellitus (almost 1 million).¹ These leading diseases share key risk factors: tobacco use, unhealthful diets, lack of physical activity, and alcohol use (TABLE).² The current burden of chronic diseases reflects past exposure to these risk factors, and the future burden will be largely determined by current exposures.

The global prevalence of all the leading chronic diseases is increasing, with the majority occurring in developing countries and projected to increase substantially over the next 2 decades (Figure 1).³ Cardiovascular disease is already the leading cause of mortality in developing countries (FIGURE 2).¹ Between 1990 and 2020, mortality from ischemic heart disease in developing countries is expected to increase by 120% for women and 137% for men.⁴ Predictions for the next 2 decades include a near tripling of ischemic heart disease and stroke mortality in Latin America, the Middle East, and sub-Saharan Africa. The global number of individuals with diabetes in 2000 was estimated to be 171 million (2.8% of the world's population), a figure projected to increase in 2030 to 366 million (6.5%), 298 million of whom

Chronic diseases are the largest cause of death in the world. In 2002, the leading chronic diseases—cardiovascular disease, cancer, chronic respiratory disease, and diabetes—caused 29 million deaths worldwide. Despite growing evidence of epidemiological and economic impact, the global response to the problem remains inadequate. Stakeholders include governments, the World Health Organization and other United Nations bodies, academic and research groups, nongovernmental organizations, and the private sector. Lack of financial support retards capacity development for prevention, treatment, and research in most developing countries. Reasons for this include that up-to-date evidence related to the nature of the burden of chronic diseases is not in the hands of decision makers and strong beliefs persist that chronic diseases afflict only the affluent and the elderly, that they arise solely from freely acquired risks, and that their control is ineffective and too expensive and should wait until infectious diseases are addressed. The influence of global economic factors on chronic disease risks impedes progress, as does the orientation of health systems toward acute care. We identify 3 policy levers to address these impediments: elevating chronic diseases on the health agenda of key policymakers, providing them with better evidence about risk factor control, and persuading them of the need for health systems change. A more concerted, strategic, and multisectoral policy approach, underpinned by solid research, is essential to help reverse the negative trends in the global incidence of chronic disease.

JAMA. 2004;291:2616-2622

www.jama.com

will live in developing countries.⁵ Cancer incidence increased 19% between 1990 and 2000, mainly in developing countries.⁶ Death and disability due to chronic obstructive pulmonary disease are increasing across most regions.⁷ Risks for chronic disease are also escalating. Smoking prevalence and obesity levels among adolescents in developing countries have risen over the past decade and portend rapid increases in chronic diseases.^{8,9}

Numerous developing countries and countries in transition have witnessed a rapid deterioration of their chronic disease risk and mortality profiles.² In

the world's most populous country, China, age-specific death rates from circulatory disease increased between 200% and 300% in those aged 35 through 44 years between 1986 and 1999, and by more than 100% in those aged 45 through 54 years.¹⁰ During the same period, cancer death rates in-

Author Affiliations: World Health Organization, Geneva, Switzerland (Drs Yach, Hawkes, and Gould) and Fogarty International Center/US National Institutes of Health, Washington, DC (Dr Hofman). Linn Gould is now at Erda Environmental Services, Inc, Seattle, Wash.

Correspondence: Derek Yach, MBChB, MPH, World Health Organization, 20, Avenue Appia, CH-1211 Geneva 27 Switzerland (yachd@who.int).

GLOBAL BURDEN OF CHRONIC DISEASES

creased between 100% and 200% in those aged 35 through 44 years and between 100% and 160% in those aged 45 through 54 years.

Chronic diseases have not simply displaced acute infectious ones in developing countries. Rather, such countries now experience a polarized and protracted double burden of disease.¹¹ India, the second most populous country, has the highest number of diabetics in the world and annual coronary deaths are expected to reach 2 million by 2010.¹² At the same time, around 2.5 million children in India die from infections such as pneumonia, diarrhea, and malaria every year. In South Africa, infectious diseases account for 28% of years of lives lost while chronic diseases account for 25%.¹³

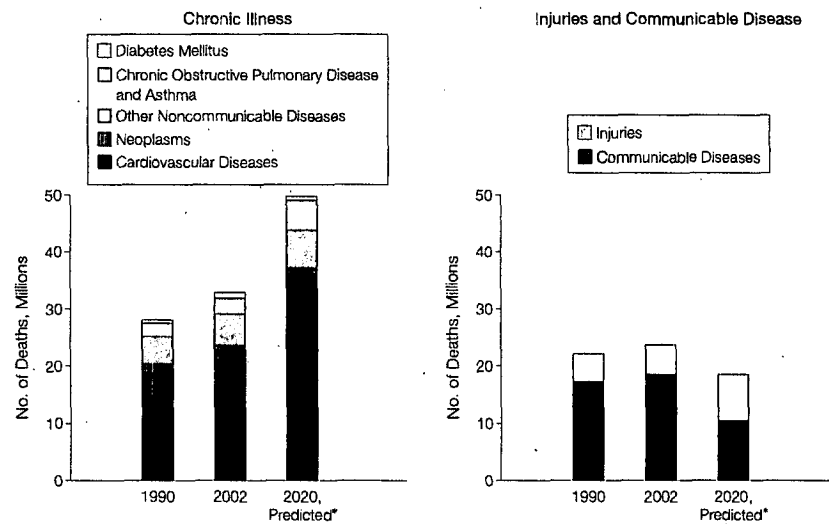
The increased burden of chronic diseases in countries that also have a high infectious disease burden is straining their health services. In all countries, it is also leading to growing economic costs, best documented with respect to tobacco-related diseases,⁸ with increasing evidence emerging for cardiovascular disease,⁴ diabetes,¹⁴ and obesity.¹⁵ Many developed nations have focused considerable efforts on addressing the burden of chronic diseases. In contrast, the rising burden of chronic diseases on developing countries has received inadequate attention.¹⁶

The rates and potential risks of chronic disease, vis-à-vis policy decisions, can be described conceptually. For example, as economic development occurs, tobacco use and obesity (and presumably other risk behaviors) increase.^{9,17} Eventually uptake of risk factors leads to onset of disease. Mortality and morbidity from chronic disease subsequently decline along with continued economic development. Thus far, only the Organisation for Economic Co-operation and Development countries have achieved these declines,⁴ which have been associated with consumption behavior, while declining mortality from chronic diseases is associated with very high levels of social and economic development. Thus, in the absence of policy actions, con-

sumption of tobacco, alcohol, and foods high in fat and sugar increases along with gross national product, followed by associated increases in chronic dis-

eases decades later. This contrasts with infectious diseases, which generally decline with economic growth.¹⁸ Chronic disease risk rates do not begin to fall un-

Figure 1. Global Mortality From Chronic Diseases



Source derived from data in the World Health Report 2003¹ and Murray and Lopez.³
*The 2020 projections were estimated by Murray and Lopez.³

Table. Contribution of 10 Selected Risk Factors to Burden of Disease by Level of Development and Mortality*

Risk Factor	Percentage of Mortality Attributable to Risk Factors		
	Developing Countries†		Developed Countries (Population: 1.4 Billion)†
	High Mortality (Population: 2.3 Billion)	Low Mortality (Population: 2.4 Billion)	
Underweight	14.9	3.1	...
Unsafe sex	10.2	...	0.8
Unsafe water, sanitation and hygiene	5.5	1.7	...
Indoor smoke from solid fuels	3.7	1.9	...
Zinc deficiency	3.2	...	...
Iron deficiency	3.1	1.8	0.7
Vitamin A deficiency	3.0	...	...
Blood pressure	2.5	5.0	10.9
Tobacco	2.0	4.0	12.2
Cholesterol	1.9	2.1	7.6
Alcohol	...	6.2	9.2
Overweight	...	2.7	7.4
Low fruit and vegetable intake	...	1.9	3.9
Physical inactivity	...	...	3.3
Illicit drugs	...	...	...

Ellipses indicates that it is not a top-10 mortality risk factor.
*Based on *The World Health Report 2003*.²
†Developed countries include the United States, Japan, and Australia; low-mortality developing countries include China, Brazil, and Thailand; and high-mortality developing countries include India, Mali, and Nigeria.

GLOBAL BURDEN OF CHRONIC DISEASES

til high levels of wealth and literacy are reached, whereupon governments are more likely to respond to public health concerns and use a broad range of policy instruments to influence consumption trends. The global challenge policymakers face is how to implement policies now that support continued economic development while simultaneously reducing the rates of increase of chronic diseases.

KEY PLAYERS' POLICY RESPONSES TO THE GLOBAL BURDEN OF CHRONIC DISEASES

Although many key groups have responded to the infectious disease burdens of developing nations, they have not responded to the expanded chronic disease burden.

Heads of State

Heads of state of the G8 countries recognized health as a global challenge at their Summit in 2000, acknowledging that health is the "key to prosperity" and that "poor health drives poverty."¹⁹ The G8 leaders agreed to

mobilize resources, ultimately leading to the establishment of the Global Fund for HIV/AIDS, Tuberculosis, and Malaria.²⁰ No subsequent commitment has yet been made for chronic diseases.

Similarly, the G77, representing heads of state from approximately 130 developing countries, recently discussed global health issues.²¹ Their focus was communicable diseases although they did support the Framework Convention on Tobacco Control—a reversal for many G77 members, who previously feared reduced tobacco consumption would negatively affect their farmers.²¹ The G77 have also expressed concerns that efforts to reduce sugar consumption might harm their economies.²²

Health Ministries

The capacity of 185 countries to prevent and treat chronic diseases was recently assessed by the World Health Organization (WHO).²³ Although there was a high level of awareness about chronic diseases among health ministry officials, this was not supported by comprehensive policies and budgets to develop

integrated approaches to their prevention, surveillance, and control. Thirty-nine percent of countries reviewed had budget lines for chronic diseases. Only a few developing countries have committed significant resources to chronic disease control.²³

World Health Organization

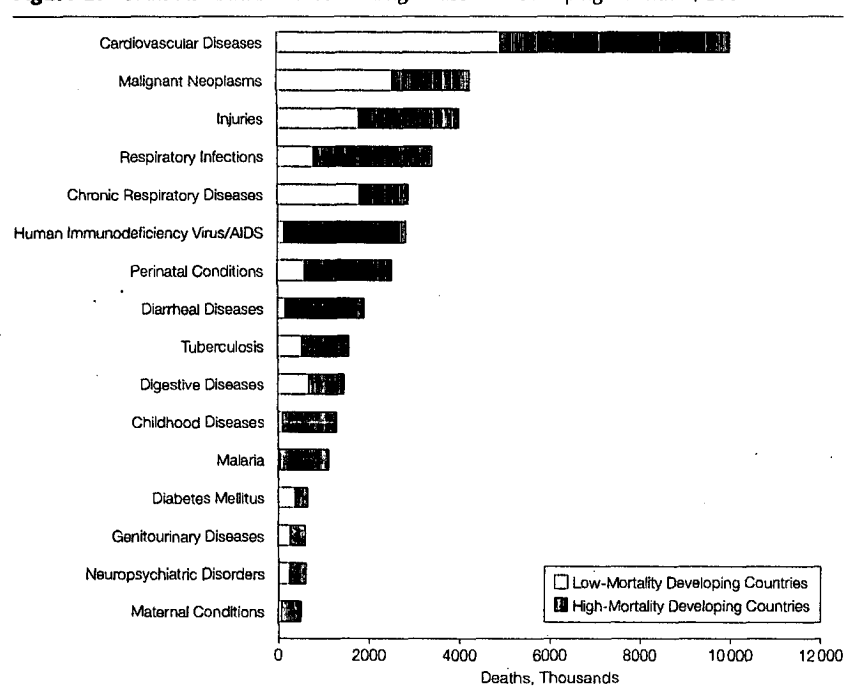
Many of WHO's functions are directly related to chronic disease control. WHO member states first requested action on chronic diseases in 1956 when India proposed a resolution on cardiovascular disease and hypertension at the Ninth World Health Assembly.²⁴ Subsequently, member states from both developed and developing countries have demanded action on chronic diseases, including the global strategy on "Prevention and Control of Non-communicable Diseases" in 2000²⁵ and a resolution and subsequent strategy on "Diet, Physical Activity and Health" in 2002-2004.²⁶ The landmark resolution on the Framework Convention on Tobacco Control in 2003²⁷ was the first time WHO used its constitutional treaty-making right to address a global public health threat.

With the important exception of tobacco control, WHO's financial resources for chronic disease control are small. WHO Headquarters spends only \$0.50 on chronic diseases (all noncommunicable diseases except for mental health) per death per person compared with \$7.50 for leading communicable diseases.²⁸

Academic Health Centers and Research Institutions

Schools of public health in the United States train thousands of health professionals from developing countries who return home as potential future public health leaders. A survey of the core requirements of the curricula of members of the Association of Schools of Public Health indicates that international health course work does not yet reflect the current global burden of chronic diseases.²⁹ Although Johns Hopkins, University of North Carolina, and Yale now address obesity in their nutrition courses and Yale teaches chronic diseases and has

Figure 2. Deaths Attributable to 16 Leading Causes in Developing Countries, 2001



a international tobacco seminar in its introductory global health course, the primary focus remains on infectious diseases and primary health care.

International committees convened by the Global Forum on Health Research recommend that greater support be given to chronic disease research specific to developing countries.³⁰ Yet the exponential growth of funding over the past decades has not been proportionally allocated to the growing burden of chronic disease.³¹ Most research support focuses on infectious diseases.^{32,33} A recent review showed that total health research funds spent on chronic diseases was only 7.4% in Cuba, 2.3% in Kazakhstan, and 14.4% in the Philippines.³⁴

Nevertheless, there are efforts to focus more research on chronic diseases. The Fogarty International Center has begun to allocate one third of its resources to chronic disease research and training programs in the developing world.³⁵ Research funding agencies in India, Mexico, and South Africa are devoting increasing budgetary resources to chronic diseases.³⁶⁻³⁸ Important insights into policies needed to strengthen research capability for chronic diseases in developing nations can be gained from experiences in tropical disease research and training over the past 3 decades.³⁹

Donors

Although official development assistance for health has increased in the past 5 years, these trends have been almost entirely absorbed by human immunodeficiency virus (HIV)/AIDS in sub-Saharan Africa (Catherine M. Michaud, MD, PhD, written communication, October 2003). Bilateral aid agencies rarely prioritize chronic disease or related risk factors.⁴⁰ Official Overseas Development Aid to the health sector in 2002 reached \$2.9 billion, of which 0.1% was officially allocated to chronic diseases (including mental health; Catherine M. Michaud, MD, PhD, written communication, March 2004). The true figure may be higher since about 30% of Overseas Development Aid to health goes to basic health services, of

which a proportion would benefit chronic disease control.

Private investment in global health far exceeds government assistance, but most target infectious diseases and humanitarian needs. There has been modest support for tobacco control from the UN Foundation, the Rockefeller Foundation, and the Soros Foundations,^{41,42} but this is now declining. The Bill and Melinda Gates Foundation does not include chronic diseases in its portfolio.⁴³ Although several US foundations support innovative domestic chronic disease research and training programs, they provide little support for such programs internationally.

World Bank and Regional Development Banks

Although the World Bank recognizes the increasing burden of chronic diseases on the poor,⁴⁴ it has no comprehensive chronic disease policy. Over the last 5 years, it provided \$4.25 billion in loans to countries for health sector work, about 2.5% of which was allocated to "noncommunicable disease prevention and control" programs, all in eastern Europe (Catherine M. Michaud, MD, PhD, written communication, March 2004).

The lack of an integrated approach to chronic diseases is reflected by the Bank's Poverty Strategy Reduction Papers, which are intended to guide investment priorities to reduce poverty in the poorest countries in the world. However, the Poverty Strategy Reduction Papers present no strategies to address chronic diseases, and in particular smoking.⁴⁵

The Regional Development Banks have policies on health, but only the Asian Development Bank includes chronic diseases.⁴⁶ This policy has been met by minimal spending commitments. A review carried out for the Asian Development Bank in 1999 recommends that subsidies for chronic diseases would be better spent on the prevention and treatment of communicable diseases.⁴⁷ The rationale was that the cost of treating chronic disease is most likely to accrue to individuals and, as such, should be left to the private market.

Global Nongovernmental Organizations

Nationally, nongovernmental organizations (NGOs) are reported to play a variety of roles in chronic disease control, but their precise roles and effectiveness are not well known.²³ Internationally, NGOs proved critical in the development of the Framework Convention on Tobacco Control.¹⁶ Nongovernmental organizations have a wide geographic spread and have the ability to build capacity. Yet overall, there has been no concerted effort on chronic diseases by NGOs. Nongovernmental organizations concerned with diet and nutrition in developed countries have not built capacity in developing countries. International consumer group input is inadequate. Initiatives such as "sustainable development" and "corporate social responsibility" have not been applied to chronic diseases.

Health and Development Initiatives

United Nations health and development reports play a major role in setting priorities for global health. Persistent problems that hinder development, such as infant and maternal mortality, malnutrition, and HIV/AIDS have received priority in the poorest countries. But the emphasis on communicable diseases has excluded consideration of chronic diseases in low-middle and middle income countries. The Millennium Development Goals are illustrative in this respect. Millennium Development Goal 6 is to "Combat HIV/AIDS, malaria and other diseases."⁴⁸ Although the *other diseases* category theoretically includes chronic diseases, in practice, they are ignored. The UN Population Fund does not mention chronic diseases in its strategy on population and development⁴⁹ and UN Children's Fund's recent goal-setting program, "A World Fit for Children" does not include risk factors for chronic conditions among the 25 action points proposed to "promote healthy lives" despite strong evidence to the contrary.⁵⁰

GLOBAL BURDEN OF CHRONIC DISEASES

Reasons for Neglect: Impediments to Control Global Chronic Diseases

In most developing countries inadequate financing and lack of manpower to address chronic diseases have been major impediments to chronic disease control. Other impediments are the failure to provide key decision makers with up-to-date evidence on the burden of chronic diseases; a lack of understanding of the economic factors that influence chronic disease risks; and the current orientation of health systems toward acute care.

Up-to-Date Evidence Is Not in the Hands of Key Decision Makers

Many key decision makers still believe that chronic diseases afflict only the affluent and the elderly and arise only from freely acquired risks and that their control is ineffective and too expensive and should wait until infectious diseases are addressed.

These beliefs are based on a misunderstanding of the chronic disease burden. In developed countries, the relationship between socioeconomic inequalities and many chronic diseases and their risk factors are well described.⁵¹ Although the disease burden is more variable in developing countries, the poorest populations, particularly in rapidly growing cities, in many cases already exhibit the highest risks for tobacco use, alcohol use, and physical activity, with evidence emerging for obesity.⁵²⁻⁵⁴ This will lead to a higher burden of chronic diseases over the long-term. Poverty also leads to greater comorbidity and decreased access to quality medical care.

Chronic diseases in developing countries are not just diseases of the elderly, since cardiovascular disease accounts for as many deaths in young and middle-aged adults as HIV/AIDS.¹ Also, in developing countries chronic diseases affect a much higher proportion of people during their prime working years than in developed countries. Male deaths during middle age could create a significant cohort of widows, which increases the likelihood that women will live out their final years in poverty.⁴

Many decision makers mistakenly believe that chronic diseases arise only as a result of the irresponsibility of the individuals who contract them, with the perception that "smoking is a free choice with health consequences."⁵⁵ Yet age and uptake of smoking in developing countries are showing a trend toward early teenage years,⁸ the stage of life when the addictiveness of tobacco belies freedom of choice. Tobacco marketing is often targeted specifically at children,⁵⁶ alcohol advertisements shape young peoples' perceptions and encourage pro-drink attitudes,⁵⁷ and food marketing works its way "into the skin" of children and adolescents.⁵⁸ There will always be a tension between the role of individuals vs the role of government, but it is clear that governments (and industry) must take some responsibility.⁵⁹

Chronic disease control is not necessarily expensive or ineffective. For example, a recent review of tobacco control in Brazil, South Africa, Thailand, Poland, Bangladesh, and Canada showed that tobacco prevalence can be reduced cost-effectively in high-, middle-, and low-income countries.⁶⁰ Several clinical and public health interventions have the potential to reduce the burden of disease from cardiovascular disease, diabetes, and hypertension significantly and at low cost.² There is, however, an urgent need to develop best practices for obesity control.

The belief that scarce resources should not be used for chronic diseases until infectious diseases are addressed is also fallacious. Several infectious agents cause cancers⁶; tobacco increases deaths from tuberculosis in already infected populations,⁶¹ and antiretroviral regimens in HIV-infected patients increase the risk of heart disease.⁶² Better tobacco control would reduce tuberculosis mortality, and new vaccines could reduce the prevalence of cervical cancer and perhaps other cancers.

Economic Factors Influence Chronic Disease Risks

At a macroeconomic level, it is often assumed that global economic development increases income and subse-

quently improves all aspects of health in developing countries. Yet, although greater economic investment and higher incomes among some groups have eased some of the health challenges in developing countries, chronic diseases have been exacerbated.⁴

Important drivers here are urbanization, trade, foreign investment, and promotional marketing. More open conditions for trade and foreign investment can bring economic benefits, but also encourage unhealthy behavior risks.⁶³ Several of the world's top 100 nonfinancial transnational corporations ranked by foreign assets in 2000 are associated with chronic disease risk factors, including tobacco, food, and automobile companies.⁶⁴ These companies all invest heavily in marketing their products,⁵⁶⁻⁵⁸ which, if unregulated, encourages acquisition of the risk factors for chronic diseases.

Lobbyists for tobacco, sugar, and other food interests have diverted attention from the need to address consumption patterns that drive chronic diseases, and their views have become the accepted position of many policymakers.⁶⁵ Some companies and their trade associations have actively tried to thwart introduction of regulations and effective advocacy in advancing tobacco control.⁶⁶ Sugar lobbyists have been effective in having their messages that "sugar doesn't harm health—but less sugar consumption harms their economies" accepted by some governments despite evidence to the contrary.⁶⁷

Health Systems Are Not Oriented Toward Managing Chronic Diseases

Acute problems, such as certain infectious diseases and maternal and child care, have been the principal focus of health care systems.⁶⁸ Although infectious diseases continue to be a threat in many developing countries, their health systems now must address a double burden of chronic and acute conditions.

The chronic disease management model is more complex than that required for acute problems, such as

many infectious diseases.⁶⁸ It entails multiple causes over a lifetime and a more horizontal and integrated approach, with patient, family, and the community being active participants.

Chronic care has tended to screen high-risk individuals with a high probability of contracting chronic diseases. Yet for chronic diseases, most risk factors are widely distributed in the population, with all individuals at risk but differing in the extent of their risk.⁶⁹ Prevention and treatment therefore requires a sustained, multisectoral commitment well beyond the traditional health sector. This model is also required for communicable diseases such as HIV/AIDS, since antiretroviral therapy must be taken for life.⁷⁰

TOWARD THE FUTURE—LEVERING LONG-TERM CHANGE

The rising global burden of chronic diseases needs stronger leadership by policy makers, advocates, and health professionals.

Placing Chronic Diseases Higher on the Political and Health Agenda

Decision makers need to be fully informed with the up-to-date evidence about the burden and impacts of chronic diseases. Clearer messages on chronic diseases are needed and the advocacy base expanded. Gaps in our knowledge about chronic disease control should be tackled using a "grand challenges initiative."⁷¹

Controlling Risk Factors for Chronic Diseases

The negative impacts of global economic development can be ameliorated through multisectoral action to tackle chronic diseases upstream. Policy leaders need to encourage transnational corporations to improve health while also making a profit by putting in place new business models, such as those being developed by Unilever (Paulus Verschuen and Harry Jongeneelan, written communication, May 13, 2004) and Novo Nordisk SA.⁷² They should also encourage the creation of

codes and incentives for healthy foreign investment in developing countries and incorporating chronic diseases into accountability initiatives such as the UN Global Compact.⁷³

The role of government is critical to the development and implementation of well grounded risk-factor control programs such as the WHO's Framework Convention on Tobacco Control, which also has implications for food policies.⁷⁴ Age-specific death rates from the leading chronic diseases in Organization for Economic Co-operation and Development countries have declined as a result of governmental and civil society action against tobacco use, emphasis on maintaining healthful lifestyles, and access to treatments.⁴ Over the last decade, increased longevity has been accompanied by a compression of morbidity: in the United States, disability rates in people older than 65 years have decreased 2% a year while mortality rates have declined by 1%.⁷⁵

Governments can play a role by altering economic incentives for business and individuals. Expanding markets for fruit and vegetables will allow developing countries to gain from increased export earnings and consumption. Raising the tobacco excise tax to levels that will reduce consumption effectively⁷⁶ will increase government revenue and reduce the burden of disease.

Health System Realignment

Health systems should be realigned to accommodate diagnosis, secondary prevention, and primary prevention of chronic diseases. Governments need to support this transformation if they are to realize significant health gains. In an approach that has international applications, the United Kingdom Government Treasury has recommended a set of clear health targets and objectives for the nation based on scenarios.⁷⁷ The new financing opportunities for chronic infectious diseases like HIV/AIDS and tuberculosis create a chance to build integrated systems in the poorest countries. The potential for secondary prevention of cardiovascular disease and diabetes in developing countries has been high-

lighted by several academics^{4,16,68} but needs to be translated into action.

We are now at a critical juncture with respect to the global health agenda. Coordinated and focused emphasis on chronic disease is essential to address the enormity of the burden of those who now survive beyond childhood around the world.

Disclaimer: The views in this article represent the opinions of the authors and do not necessarily reflect the views or position of either the World Health Organization or the views or position of the US National Institutes of Health.

Acknowledgment: The authors would like to thank Dr Catherine Michaud for her analysis of Overseas Development Assistance for chronic diseases. Thanks also to Ian Neil from WHO and the anonymous reviewer for comments that helped strengthen the article.

REFERENCES

1. World Health Organization. *The World Health Report 2003—Shaping the Future*. Geneva, Switzerland: World Health Organization; 2003.
2. World Health Organization. *The World Health Report 2002—Reducing Risks, Promoting Healthy Life*. Geneva, Switzerland: World Health Organization; 2002.
3. Murray CJL, Lopez AD. *The Global Burden of Disease*. Boston, Mass: Harvard School of Public Health; 1996.
4. Leeder S, Raymond S, Greenberg H, Liu H, Esson K. *A Race Against Time: The Challenge of Cardiovascular Disease in Developing Economies*. New York, NY: Columbia University; 2004.
5. Wild S, Roglic G, Green A, Sicree R, King H. Global prevalence of diabetes: estimates for 2000 and projections for 2030. *Diabetes Care*. 2004;27:1047-1053.
6. Stewart BW, Kleihaus P, eds. *World Cancer Report*. Lyon, France: IARC Press; 2003.
7. World Health Organization. *WHO Strategy for Prevention and Control of Chronic Respiratory Diseases*. Geneva, Switzerland: World Health Organization; 2002.
8. Jha P, Chaloupka FJ. *Curbing the Epidemic: Governments and the Economics of Tobacco Control*. Washington, DC: International Bank for Reconstruction and Development/World Bank; 1999.
9. Popkin BM, Doak CM. The obesity epidemic is a worldwide phenomenon. *Nutr Rev*. 1998;56:106-114.
10. Bumgarner R. China: non-communicable disease issues and options revisited. *Soc Prev Med*. In press.
11. Frenk J, Bobadilla JL, Sepulveda J, Cervantes LM. Health Transition in middle-income countries: new challenges for health care. *H Policy Plann*. 1989;4:29-39.
12. Basnayar B, Rajapasha LC. Cardiovascular and infectious diseases in South Asia: the double whammy. *BMJ*. 2004;328:781.
13. Steyn K, Bradshaw D, Norman R, Laubscher R. *Determinants and Treatment of Hypertension in South Africa/Determinants of Hypertension and Its Treatment in South Africa During 1998: The First Demographic and Health Survey (draft)*. Tygerburg, South Africa: South Africa Medical Research Council; 2003.
14. International Diabetes Federation. *Diabetes Atlas*. 2nd ed. Brussels, Belgium: Internal Diabetes Federation; 2003.
15. Thompson D, Wolf AM. The medical-care cost burden of obesity. *Obes Rev*. 2001;2:189-197.
16. Beaglehole R, Yach D. Globalization and the prevention and control of non-communicable diseases:

GLOBAL BURDEN OF CHRONIC DISEASES

- the neglected chronic diseases of adults. *Lancet*. 2003; 362:903-908.
17. Yach D. Tobacco-induced diseases in South Africa. *Int J Epidemiol*. 1990;19:1122-1123.
 18. McKeown T. *The Origins of Human Disease*. Oxford, England: Basil Blackwell; 1988.
 19. *G8 Communiqué*. Okinawa 2000. Available at: <http://www.g8.utoronto.ca/summit/2000okinawa/finalcom.htm>. Accessed January 12, 2004.
 20. Sommet D'Evian 2003. 2003 G8 Summit. Available at: http://www.g8.fr/evian/english/navigation/2003_g8_summit/summit_documents/health_-_a_g8_action_plan.html. Accessed January 12, 2004.
 21. Group of seventy-seven. final communiqué: adopted by the thirty-fourth meeting of chairment/coordinators of the chapters of the Group of 77. Geneva, 26-27 June 2003 [press release]. Available at: <http://www.g77.org/news/pr062703.htm>. Accessed January 13, 2004.
 22. Fleck F. Rich and poor to clash over sugar in WHO's healthy diet plan. *BMJ*. 2004;328:730.
 23. Alwan A, MacLean D, Mandil A. *Assessment of National Capacity for Noncommunicable Disease Prevention and Control*. Geneva, Switzerland: World Health Organization; 2001.
 24. World Health Organization. Cardiovascular diseases and hypertension. In: Program of the 9th World Health Assembly. Geneva, Switzerland: World Health Organization; 1956. WHA9.3121.
 25. World Health Organization. Prevention and control of non-communicable diseases. Fifty-third World Health Assembly; May 20, 2000; Geneva, Switzerland. WHA53/17. Available at: http://www.who.int/gb/EB_WHA/PDF/WHA53/ResWHA53/17.pdf. Accessed January 13, 2004.
 26. World Health Organization. Integrated prevention of noncommunicable diseases: draft global strategy on diet, physical activity and health. World Health Organization, Geneva, Switzerland; 2003. Available at: http://www.who.int/gb/EB_WHA/PDF/EB113/eeb11344a1.pdf. Accessed January 13, 2004.
 27. Resolution: WHO Framework Convention on Tobacco Control. Fifty-sixth World Health Assembly; May 2003. WHA56.1. Available at: http://www.who.int/gb/EB_WHA/PDF/WHA56/ea56r1.pdf. Accessed January 13, 2004.
 28. Financial management report: expenditure on implementation of objectives in programme budget 2002-2003—all sources of funds, covering the period 1 January 2002-31 December 2002. Geneva, Switzerland: World Health Organization; 2003.
 29. Association of Schools of Public Health Web site. Available at: <http://www.asph.org/document.cfm?page=200>. Accessed March 28, 2004.
 30. *The 10/90 Report on Health Research 2001-2002*. Geneva, Switzerland: Global Forum for Health Research; 2002:89-94.
 31. *Monitoring Financial Flows for Health Research*. Geneva, Switzerland: Global Forum for Health Research; 2002.
 32. Wellcome Trust Web site. Available at: <http://www.wellcome.ac.uk/en/1/biosgintpopsuprem.html>. Accessed January 12, 2004.
 33. United Kingdom Medical Research Council Web site. Available at: <http://www.mrc.ac.uk>. Accessed January 12, 2004.
 34. Alano BP, Almarjo ES. Tracking funds flow for health R & D. Presented at: The Global Forum for Health Research Forum 7; December 2003; Geneva, Switzerland.
 35. Fogarty International Center Web site. Available at: <http://www.fic.nih.gov/>. Accessed January 12, 2004.
 36. Indian Council of Medical Research. Non-communicable diseases Web page. Available at: <http://www.icmr.nic.in/thrust/thrustncd.htm>. Accessed January 12, 2004.
 37. Instituto Nacional de Salud de Mexico Web site. Available at: <http://www.insp.mx>. Accessed January 12, 2004.
 38. South Africa Medical Research Council Web site. Available at: <http://www.mrc.ac.za>. Accessed January 12, 2004.
 39. Nchinda T. Research capacity strengthening in the South. *Soc Sci Med*. 2002;54:1699-1711.
 40. *Bilateral Aid Guide*. Geneva, Switzerland: World Health Organization, Dept of Government and Private Sector Relations; 2003.
 41. United Nations Foundation Project: building alliances and taking action to create a generation of tobacco-free children and youth—a WHO/UNICEF project supported by the United Nations Foundation. Geneva, Switzerland: WHO; 1999. Available at: http://www.who.int/tobacco/areas/training/un_foundation/en. Accessed March 30, 2004.
 42. Rockefeller Foundation launches a new program to support reducing the health burden of tobacco on the poor in developing countries. Press release (May 30, 2000). New York, Rockefeller Foundation, 2000. Available at: <http://www.rockfound.org/display.asp?context=1&Collection=4&DocID=54&Preview=0&ARCurrent=1>. Accessed March 30, 2004.
 43. Global Health Program fact sheet. Seattle, Wash: Bill and Melinda Gates Foundation, 2004. Available at: <http://www.gatesfoundation.org/MediaCenter/Publications/GlobalHealthFactSheet-021201.htm>. Accessed March 30, 2004.
 44. World Bank. Health, nutrition, and population sector strategy paper. Washington, DC: World Bank: Health Nutrition and Population Division; 1997.
 45. Dodd R, Hinshelwood E. *Poverty Reduction Strategy Papers—Their Significance for Health*. Geneva, Switzerland: World Health Organization; 2002.
 46. Policy for the health sector. Manila, Philippines: Asian Development Bank; 1999. Available at: <http://www.adb.org/Documents/Policies/Health/health100.asp>. Accessed January 13, 2004.
 47. Ramesh A, Gertler P, Lagman A. *Economic Analysis of Health Sector Projects—A Review of Issues, Methods, and Approaches*. Manila, Philippines: Asian Development Bank; 1999:8.
 48. United Nations Development Programme (UNDP). Implementing the Millennium Declaration: Goal 6—Combat HIV/AIDS, malaria and other diseases. Available at: <http://www.undp.org/mdg/goal6.pdf>. Accessed January 13, 2004.
 49. United Nations Population Fund. *Summary of the ICPD Programmed of Action*. Available at: <http://www.unfpa.org/icpd/summary.htm>. Accessed January 13, 2004.
 50. United Nations General Assembly. Resolution S-27/2: a world fit for children. Adopted by the General Assembly October 11, 2002.
 51. Wilkinson RC, Marmot M. *Social Determinants of Health: The Solid Facts*. 2nd ed. Copenhagen: Denmark: World Health Organization Regional Office for Europe; 2003.
 52. Yach D. Chronic disorders: cardiovascular disease, cancer, and diabetes. In: Levy BS, Sidel VW, eds. *Social Justice and Public Health*. Oxford, England: Oxford University Press; in press.
 53. Pena M, Bacallao J, eds. Obesity among the poor: an emerging problem in Latin America and the Caribbean. In: *Obesity and Poverty: A New Public Health Challenge*. Washington, DC: Pan American Health Organization, 2000:3-10. Scientific publication 576.
 54. Jha P, Chaloupka FJ, eds. *Tobacco Control in Developing Countries*. New York, NY. Oxford University Press; 2000.
 55. A manipulated dichotomy in global health policy [editorial]. *Lancet*. 2000;355:1923.
 56. Wakefield M, Flay B, Nichter M, Giovino G. Role of the media in influencing trajectories of youth smoking. *Addiction*. 2003;98:79-103.
 57. Babor T, Caetano R, Casswell S, et al. *Alcohol: No Ordinary Commodity*. New York, NY. Oxford University Press; 2003.
 58. Hawkes C. Marketing activities of global soft drink and fast food companies in emerging markets: a review. In: *Globalization, Diets and Noncommunicable Diseases*. Geneva, Switzerland: World Health Organization; 2002.
 59. Marmot M. Evidence based policy or policy based evidence? *BMJ*. 2004;328:906-907.
 60. de Beyer J, Waverley Brigden L. *Tobacco Control Policy: Strategies, Successes and Setbacks*. Washington, DC: World Bank/Research for International Tobacco Control; 2003.
 61. Gajalakshmi V, Peto R, Kanaka TS, Jha P. Smoking and mortality from tuberculosis and other diseases in India. *Lancet*. 2003;362:507-515.
 62. Sklar P, Henry M. HIV infection and cardiovascular disease—is there really a link? *N Engl J Med*. 2003; 349:2065-2067.
 63. Bettcher DW, Yach D, Guindon GE. Global trade and health: key linkages and future challenges. *Bull World Health Organ*. 2000;78:521-534.
 64. United Nations Conference on Trade and Development (UNCTAD). *World Investment Report 2003*. New York, NY: UNCTAD; 2003.
 65. Brownell KD, Hagen KB. *Food Fight: The Inside Story of the Food Industry: America's Obesity Crisis, and What We Can Do About It*. Chicago, Ill: Contemporary Books; 2004.
 66. World Health Organization. *Tobacco Company Strategies to Undermine Tobacco Control Activities at the World Health Organization. Report of the Committee of Experts on Tobacco Industry Documents*. Geneva, Switzerland: World Health Organization; 2000:46;116.
 67. Mann J. Free sugars and human health: sufficient evidence for action? *Lancet*. 2004;363:1068-1070.
 68. World Health Organization. *Innovative Care for Chronic Conditions: Building Blocks for Action*. Geneva, Switzerland: World Health Organization; 2002.
 69. Rose G. Sick individuals and sick populations. *Int J Epidemiol*. 1985;14(1).
 70. World Health Organization/Joint United Nations Programme on HIV/AIDS (UNAIDS). Treating 3 million by 2005: making it happen: the WHO Strategy. Geneva, Switzerland: World Health Organization; 2003. Available at: <http://www.who.int/3by5/publications/documents/isbn9241591129/en/>. Accessed January 13, 2004.
 71. Varmus H, Klausner R, Zerhouni E, Acharya T, Daar AS, Singer PA. Grand Challenges in Global Health. *Science*. 2003;302:398-399. Available at: <http://www.grandchallengesgh.org/ArDisplay.aspx?ID=78&SecID=302>. Accessed January 13, 2004.
 72. Novo Nordisk's New Strategy: from fighting disease to improving health [translation]. *Mandag Morgen*. February 9, 2004.
 73. *Guide to the Global Compact: A Practical Understanding of the Vision and Nine Principles*. New York, NY: UN Global Compact; 2001.
 74. Yach D, Hawkes C, Epping-Jordan JE, Galbraith S. The World Health Organization's Framework Convention on Tobacco Control: implications for global epidemics of food-related deaths and disease. *J Public Health Policy*. 2003;24:274-290.
 75. Fries J. Measuring and monitoring success in compressing morbidity. *Ann Intern Med*. 2003;139(5 pt 2):455-459.
 76. Guindon GE, Tobin S, Yach D. Trends and affordability of cigarette prices: ample room for tax increases and related health gains. *Tob Control*. 2002; 11:35-43.
 77. Wanless D. *Securing Our Future Health: Taking a Long-term View*. London, England: HM Treasury; 2002.