


Chronic Diseases 1

Preventing chronic diseases: how many lives can we save?

Kathleen Strong, Colin Mathers, Stephen Leeder, Robert Beaglehole

Lancet 2005; 366: 1578–82

See [Comment](#) pages 1512 and 1514

Published online

October 5, 2005

DOI:10.1016/S0140-6736(05)67341-2

This is the first in a [Series](#) of four papers about chronic diseases.

Department of Chronic Diseases and Health Promotion (K Strong PhD, R Beaglehole DSc) and Department of Measurement and Health Information Systems (C Mathers PhD), WHO, 20 Avenue Appia, CH-1211 Geneva 27, Switzerland; and Australian Health Policy Institute, College of Health Sciences, The University of Sydney, Australia (Prof S Leeder PhD)

Correspondence to: Kathleen Strong strongk@who.int

35 million people will die in 2005 from heart disease, stroke, cancer, and other chronic diseases. Only 20% of these deaths will be in high-income countries—while 80% will occur in low-income and middle-income countries. The death rates from these potentially preventable diseases are higher in low-income and middle-income countries than in high-income countries, especially among adults aged 30–69 years. The impact on men and women is similar. We propose a new goal for reducing deaths from chronic disease to focus prevention and control efforts among those concerned about international health. This goal—to reduce chronic disease death rates by an additional 2% annually—would avert 36 million deaths by 2015. An additional benefit will be a gain of about 500 million years of life over the 10 years from 2006 to 2015. Most of these averted deaths and life-years gained will be in low-income and middle-income countries, and just under half will be in people younger than 70 years. We base the global goal on worldwide projections of deaths by cause for 2005 and 2015. The data are presented for the world, selected countries, and World Bank income groups.

Introduction

The neglected epidemic

An appreciation of the rising global burden of chronic, noncommunicable diseases has been developing for more than 20 years.^{1–4} Physicians and health managers have applied effective measures, including behavioural interventions and pharmaceutical treatment, in the prevention and management of chronic diseases, but these are neither widely used nor equitably distributed. Further, a widening gap exists between the reality of the chronic disease burden worldwide and the response of national governments, civil society, and international agencies to this burden. In this paper, we review the mortality and chronic disease burden as estimated for 2005 and projected to 2015. We respond to the gap between information and action by proposing a global goal for prevention of chronic diseases. The global goal is designed to rally partners from all sectors of society to avoid needless suffering and death.

Methods

Projections of mortality for 2005 and 2015

WHO provides consistent estimates of deaths by age, sex, and cause for all member countries based on a systematic review and analysis of available evidence from surveys, censuses, sample registration systems, population laboratories, and vital registration on levels and trends in child and adult mortality. The most recent regional and global estimates for mortality by cause are for the year 2002.⁵ More information on how these estimates were made is available online.⁶

WHO has prepared updated projections of future trends for mortality between 2002 and 2015 using methods similar to those applied in the original Global Burden of Disease study.⁷ The data inputs for the projection models take into account the greater

number of countries reporting death registration data to WHO, especially low-income and middle-income countries and the updated projections for the HIV/AIDS and smoking epidemics. For the projections reported here, historical death registration data for 107 countries between 1950 and 2002 were used to model the relation between death rates for all major causes (excluding HIV/AIDS) and three variables: (1) average income per capita, measured as gross domestic product (GDP) per person; (2) the average number of years of schooling in adults; and (3) time, a proxy measure for the effect of technological change on health status. Death rates were then projected using World Bank projections of GDP per person, WHO projections of average years of schooling, and smoking intensity based on historical patterns of tobacco use,^{8,9} and further adjusted for recent trends in tobacco consumption. Separate projections for HIV/AIDS mortality were prepared by UNAIDS and WHO, and tuberculosis mortality projections were modified for the interaction between HIV and tuberculosis. Further information on the projection methods can be found online.¹⁰

Observed historical relations between indicators of development and mortality patterns, together with explicit assumptions about future trends in development indicators, smoking intensity, and body-mass index, were used to produce “business as usual” projections. The results depend on the assumption that future mortality trends in low-income and middle-income countries will generally have the same relation to economic and social development as has applied in high-income countries recently.

The mortality projections were also used as the basis for projections of the global burden of disease from 2002 to the year 2015 by use of methods similar to those of Murray and Lopez.⁷ The burden of disease is quantified in terms of disability-adjusted

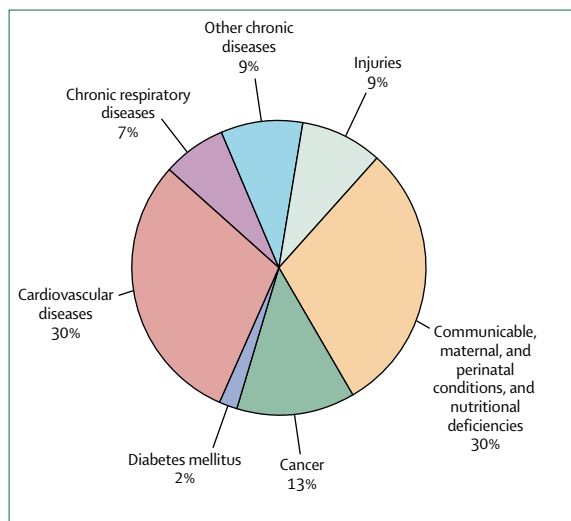


Figure 1: Projected global distribution of total deaths (58 million) by major cause, 2005

life years (DALYs). One DALY can be thought of as one lost year of healthy life and the burden of disease as a measurement of the gap between the current health of a population and an ideal situation where everyone in the population lives into old age in full health.

A global goal

Projected annual rates of change in age-and-sex-specific death rates for all chronic disease causes were calculated for the mortality projections from 2005 to 2015 and then adjusted by subtraction of an additional 2% per year. Death rates for years 2006 to 2015 were then recomputed using the adjusted annual trends for age-sex-specific rates. The final death rates for chronic diseases in 2015, assuming that the global goal is achieved, are substantially lower than the base projections, since the additional 2% annual declines are cumulative. Population numbers, were the global goal to apply, were projected using the new death rates.

Years of life gained under the global goal scenario were estimated by calculating total years of life lost (without discounting or age weights) for each year between 2005 and 2015 under the global goal scenario and subtracting these from the years of life lost under the base projections scenario.

Results

Global mortality and burden of disease

We estimate that, globally, about 58 million people will die in 2005. This value is projected to rise to 64 million in 2015. Figure 1 shows the distribution of these deaths across three major cause groups: communicable, maternal, perinatal conditions, and nutritional deficiencies (group 1), chronic, non-communicable, diseases (group 2) and injuries (group 3). At a more detailed cause group level, cardiovascular disease is the leading single cause of death worldwide.

The table shows the projected number of chronic disease deaths and age-specific death rates for persons for 2005 and 2015. Just over 15 million chronic disease deaths will occur in people under 70 years in 2005, rising to 17 million in 2015. Half of these deaths will be in women. The age-specific death rates between 2005 and 2015 are generally projected to remain the same or decline slightly between 2005 and 2015 (table). However, ageing populations will result in an overall increase in chronic disease death rates for all ages combined.

In 2005, all chronic diseases account for 72% of the total global burden of disease in the population aged 30 years and older. The total lost years of healthy life due to chronic diseases, as measured by DALYs, are greater in adults aged 30–59 years than for ages 60 years and older, although the DALY rates increase with age. More than 80% of the burden of chronic diseases occurs in people under the age of 70 years. Cardiovascular disease alone accounts for 20% of global total DALYs in those older than 30 years. Projected DALY rates for 2015 are similar to those for 2005 for the older age groups but are higher for all ages combined, reflecting global population ageing. Selected country-level projections taken from a WHO publication¹¹ show that chronic disease rates are higher in the Russian Federation and low-income and middle-income countries than in Canada or the UK (figure 2).

Mortality and DALYs by World Bank income group

When countries are grouped by per-person income,¹² chronic diseases are projected to be the leading cause of death in all income groups in 2015 (figure 3). This is already the case in all but low-income countries for 2005.

Age-specific death rates are projected to decline in all income groups, which largely reflects projected economic growth over the next decade. However, the rate of decline is lower for chronic diseases (group 2)

	Deaths (millions)		DALYs (millions)		Deaths per 100000		DALYs per 100000	
	2005	2015	2005	2015	2005	2015	2005	2015
0–29 years	1.7	1.5	220	219	48	40	6320	5994
30–59 years	7	8	305	349	311	297	13304	13375
60–69 years	7	8	101	125	1911	1695	27965	26396
≥70 years	20	24	99	116	6467	6469	32457	31614
All ages	35	41	725	808	549	577	11262	11380

Table: Projected global deaths and burden of disease (DALYs) due to chronic diseases by age, 2005 and 2015

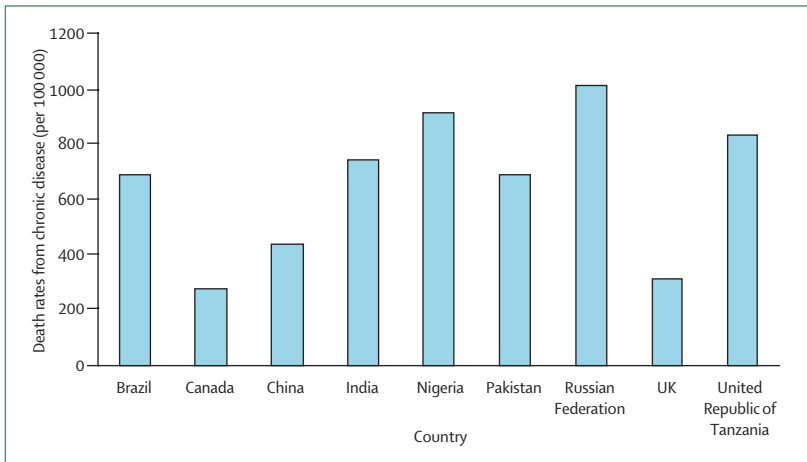


Figure 2: Age-standardised death rates from chronic disease (per 100 000) by country for ages 30-69 years, estimates for 2005 Standardised to WHO World Standard Population.

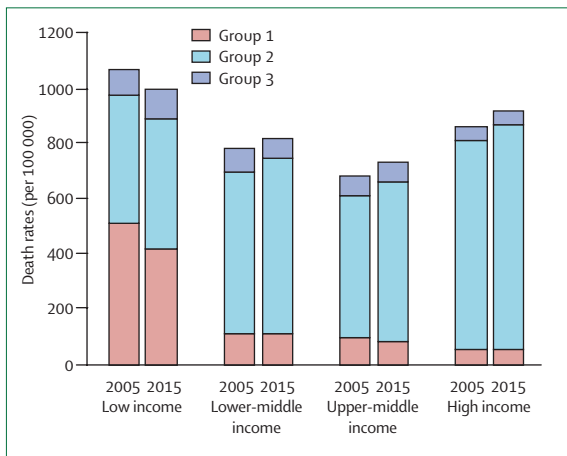


Figure 3: Projected crude death rates per 100 000 by World Bank income groups for all ages, 2005 and 2015 Group 1 combines communicable diseases, perinatal and maternal conditions, and nutritional deficiencies. Group 2 is chronic, noncommunicable diseases. Group 3 is injuries.

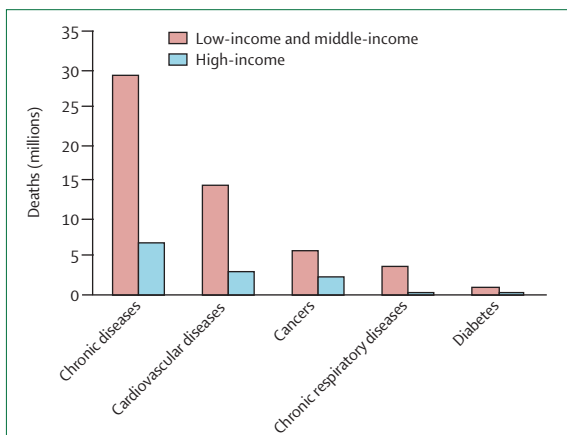


Figure 4: Cumulative number of deaths averted by an additional 2% annual reduction in death rates from chronic disease from 2006 to 2015, by combined World Bank income groups

than for group 1 causes other than HIV/AIDS. Because chronic disease death rates rise with age, and populations are ageing, the overall death rates for chronic diseases are set to increase in all income groups (figure 3). By 2015, overall deaths due to chronic diseases will exceed those due to group 1 for all income groups.

The projections suggest that the largest relative increases in chronic disease death rates will be in high-income countries. However, it is clear from the high death rates projected for lower-income and upper middle-income countries for 2015 that these countries also need urgent interventions to control and prevent chronic diseases.

DALY rates for group 1 conditions are highest in low-income countries in 2005. This observation reflects the heavy toll that HIV/AIDS is taking in sub-Saharan African countries. However, by 2015, the DALY rates for chronic disease (group 2) are projected to be slightly higher than those for group 1 conditions in low-income countries, reflecting the decline of group 1 causes apart from HIV and tuberculosis, population ageing and a projected increase in tobacco use. In 2005, coronary heart disease and cerebrovascular disease combined are the main cause of deaths in all income groups and DALYs in all except low-income groups. This dominance is set to increase in 2015.

Potential achievements of the global chronic disease goal

Achieving the global chronic disease goal would result in an estimated 36 million fewer chronic disease deaths between 2005 and 2015 worldwide, of which 28 million would be averted in low-income and middle-income countries (figure 4). For people under the age of 70 years, achieving the global goal would result in 3 million fewer deaths in 2015 (figure 5). Averting these deaths would result in a gain of 115 million years of life globally in 2015. 500 million life-years would be saved cumulatively between 2005 and 2015 for those deaths averted under age 70, and almost 90% of these saved life-years would be in low-income and middle-income countries. This supports the overall goal of chronic disease prevention and control, which is to delay mortality from these diseases to older age groups and to promote healthy ageing of global populations.

Discussion

We present the mortality and burden of disease projections for chronic diseases using the WHO 2002 mortality estimates as a baseline. For regions with limited death registration data, such as the eastern Mediterranean region, sub-Saharan Africa, parts of Asia, and the Pacific, there is considerable uncertainty in estimates of deaths by cause. For some countries, only limited information on mortality is available from sources such as the Demographic and Health Surveys and from cause-specific mortality estimates for causes

such as HIV/AIDS, malaria, tuberculosis and vaccine-preventable diseases. The Global Burden of Disease approach included results for these regions based on the best possible assessment of the available evidence.¹³

The mortality and burden of disease projections are less firm than the base year assessments, and provide “business as usual” projections under specified assumptions. Furthermore, “business as usual” projections do not take account of trends in major risk factors apart from tobacco smoking and, to a limited extent, overweight and obesity in relation to diabetes mortality. If risk factor prevalence increases, rather than falls, in low-income and middle-income countries, then our projections of deaths and DALYs in those countries will be underestimates.

Currently, the serious consequences of chronic diseases and their risk factors are not recognised by the international health community, at least in terms of financial commitments by health and development agencies. Chronic diseases are often characterised as problems of affluent, ageing communities who have acquired them through indulging in the risk factors for disease (tobacco use, unhealthy diets, and physical inactivity). This view is inaccurate: chronic disease is a larger problem in low-income countries, especially among those who do not have the resources to pursue healthy choices easily. Furthermore, recent evidence, supported by data presented here, suggests that deaths from heart disease and lung cancer occur at earlier ages in low-income and middle-income countries where effective treatments are not widely available and prevention has not been made a priority.^{8,14}

Myths about chronic disease have serious consequences for the health and welfare of people in low-income and middle-income countries. The costs of chronic diseases in these countries are high and often borne by patients as out-of-pocket payments, contributing directly to family poverty.^{15,16} The cost of illness to national governments is also high.¹¹

Another more insidious myth about the chronic disease burden is that we can do nothing to prevent these conditions because they are caused by unhealthy behaviours that people choose to have. The reality could hardly be more different. Human behaviour is shaped by many factors, including environment and economic pressures, which with increasingly urbanised populations in low-income and middle-income countries may result in poor diet choices and limited physical activity. Fortunately, many of these diseases are amenable to successful intervention.¹⁷

The experience of high-income countries clearly shows what can be achieved with sustained interventions. Death rates from heart disease have fallen by up to 70% in the past three decades in Australia, Canada, Japan, the UK, and the USA. Between 1970 and 2000, 14 million deaths due to cardiovascular disease were averted in the USA alone. During the same period, the numbers of

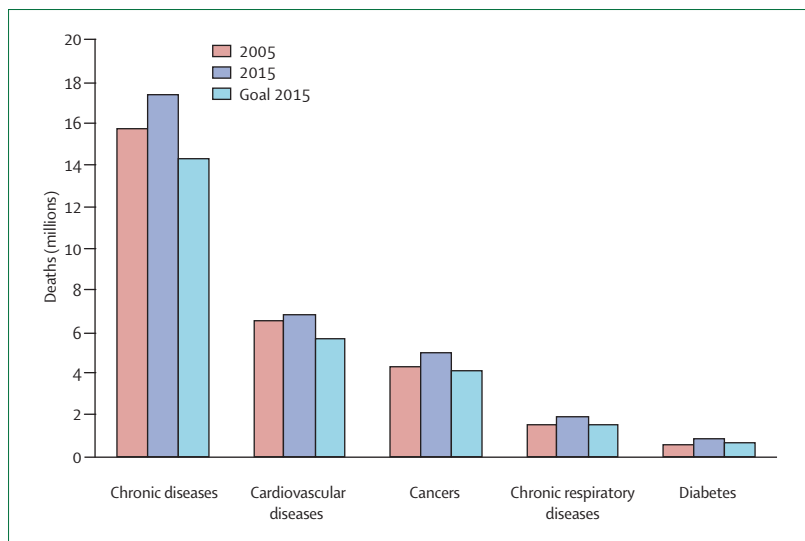


Figure 5: Chronic disease deaths (millions) projected from 2005 to 2015 with the global goal scenario for people younger than 70 years of age

deaths averted in Japan and the UK were 8 million and 3 million, respectively. These data correspond to a reduction in chronic disease death rates of 1–3% per year over a 30-year period. Estimates of the joint effects of the leading chronic disease risk factors (tobacco use, raised blood pressure, and poor diet) indicate that more than 30% of the burden of chronic diseases and more than 50% of deaths from chronic disease are attributable to a relatively small number of modifiable risks.¹⁸ In setting out the global goal, we have used a 2% reduction per year—one which has been typical of the decline in these disorders in committed high-income countries.

What could we hope to achieve by the year 2015? Meeting the global goal target would result in 36 million deaths from chronic disease averted during the next 10 years (2006–2015) and a gain of more than 500 million healthy life years over the next 10 years. Every death averted is a bonus, but the goal contains an additional, priceless asset: almost half of these averted deaths will be in men and women younger than 70 years. Extending these lives for the benefit of the individuals concerned, their families and communities is in itself the worthiest of goals.

How might this goal be achieved? There are three discrete but overlapping components to chronic disease prevention and management¹⁹ and these can be approached in a stepwise manner¹⁷ including: (1) individual interventions; (2) population-based interventions; and (3) macroeconomic interventions that align fiscal realities with health promotion. All three are needed to achieve the global goal of chronic disease prevention and control.

We have set out a proposal for the establishment of a global health goal that is both realistic and necessary in light of the serious threat posed by chronic diseases to global health. Any single organisation or group is

unlikely to have the resources needed to address the complex public health issues related to chronic diseases. New coalitions that extend beyond the confines of the traditional health portfolio will need to be built.²⁰ The reason for this lies in the very nature of the causal, modifiable risks of chronic diseases. These risks, including tobacco use, poor diet, and physical inactivity, derive from the structure and function of societies, especially with the process of rapid urbanisation. If health-promoting change is to occur, then the drivers of these risks need to be involved in defining the problem as well as the solution. Sectors of society such as business, labour, and non-governmental organisations not traditionally included in the development of health policy can be recruited for prevention efforts. The global goal that we offer is intended to challenge these sectors to become involved. Our vision for the future extends beyond measuring risk behaviour and counting the dead, and instead encourages all sectors of society to contribute to effective ways of reducing health risks and promoting longer, healthier lives.

Conflict of interest statement

We declare that we have no conflict of interest.

Acknowledgments

We thank the following for their helpful comments and suggestions, particularly with regard to the global goal for chronic disease prevention and control: Ruth Bonita, Debbie Bradshaw, Majid Ezzati, Joanne Epping-Jordan, Jane McElligott, Thomson Prentice, Serge Resnikoff, Anthony Rodgers, and Theo Vos. The first two authors would like to dedicate their contributions to this paper to the memory of Robert Ross Woodrow, who died on July 7, 2005, in Australia, after fighting cancer for over 10 years. He was 61 years old. This manuscript contains the views of its authors, and does not necessarily represent the decisions or the stated policy of WHO.

References

- 1 Omran AR. The epidemiologic transition: a theory of epidemiology of population change. *Milbank Mem Fund Q* 1971; **XLIX**: 509–38.
- 2 Bulatao RA. Mortality by cause, 1970–2015. In: Gribble JN, Preston SH, eds. *The epidemiological transition. Policy and planning for developing countries*. Washington DC: National Academy Press, 1993.
- 3 Murray CJL, Lopez AD. The global burden of disease. In: Murray CJL, Lopez AD, eds. *The global burden of disease, vol 1, global burden of disease and injury series*. Cambridge: Harvard University Press, 1996.
- 4 Rodgers A, Lawes C, MacMahon S. The global burden of cardiovascular disease conferred by raised blood pressure: benefits of reversal of blood pressure-related cardiovascular risk in East Asia. *J Hypertens* 2000; **18** (suppl): S3–S6.
- 5 World Health Organization. *World Health Report 2004: Changing History*. Geneva: World Health Organization (WHO) 2004.
- 6 WHO. *The world health report*. <http://www.who.org/whr> (accessed July 21, 2005).
- 7 Murray CJL, Inoue M, Lopez AD. Alternative projections of mortality and disability by cause 1990–2020: global burden of disease study. *Lancet* 1997; **349**: 1498–04.
- 8 Ezzati M, Lopez AD. Smoking and oral tobacco use. In: Ezzati M, Lopez AD, Rodgers A, Murray CJL, eds. *Comparative quantification of health risks: global and regional burden of disease attributable to selected major risk factors*. Geneva: WHO, 2004.
- 9 Shibuya K, Lopez AD. Statistical modelling and projections of lung cancer mortality in 4 industrialized countries. *Int J Cancer* 2005; published online May 19. DOI:10.1002/ijc.21078.
- 10 WHO. Burden of disease project. <http://www.who.int/evidence/bod> (accessed July 21, 2005).
- 11 WHO. *Preventing chronic disease: a vital investment*. Geneva: World Health Organization, 2005.
- 12 World Bank. *2003 world development indicators*. Washington DC: World Bank, 2003.
- 13 Murray CJL, Mathers CD, Salomon JA. Towards evidence-based public health. In Murray CJL, Evans D, eds. *Health systems performance assessment: debates, methods and empiricism*. Geneva: World Health Organization, 2003.
- 14 Leeder SR, Raymond SU, Greenberg H, Lui H, Esson K. *A race against time: the challenge of cardiovascular diseases in developing countries*. New York: Columbia University, 2004.
- 15 Narayan D, Chambers R, Shah M, Petesch P. *Voices of the poor crying out for change*. Oxford: Oxford University Press for World Bank, 2000.
- 16 Hulme D, Shepherd A. 2003, conceptualizing chronic poverty. *World Dev* 2003; **31**: 403–23.
- 17 Epping-Jordan JE, Galea G, Tukuitoronga C. Preventing chronic diseases: taking stepwise action. *Lancet* 2005; published online Oct 5. DOI:10.1016/S0140-6736(05)67342-4.
- 18 Ezzati M, Lopez AD. Potential health gains from reducing multiple risk factors. In: Ezzati M, Lopez AD, Rodgers A, Murray CJL, eds. *Comparative quantification of health risks: global and regional burden of disease attributable to selected major risk factors*. Geneva: World Health Organization, 2004.
- 19 Greenberg H, Raymond SU, Leeder SR. Cardiovascular disease and global health: Threat and opportunity. *Health Aff (Millwood)* 2005; published online Jan 25. DOI:10.1377/hlthaff.W5.31.
- 20 Raymond SU, Greenberg HM, Lui H, Leeder SR. Civil society confronts the challenge of chronic illness. *Development* 2004; **47**: 94–104.