

India: Towards Universal Health Coverage 3



Chronic diseases and injuries in India

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Chronic diseases (eg, cardiovascular diseases, mental health disorders, diabetes, and cancer) and injuries are the leading causes of death and disability in India, and we project pronounced increases in their contribution to the burden of disease during the next 25 years. Most chronic diseases are equally prevalent in poor and rural populations and often occur together. Although a wide range of cost-effective primary and secondary prevention strategies are available, their coverage is generally low, especially in poor and rural populations. Much of the care for chronic diseases and injuries is provided in the private sector and can be very expensive. Sufficient evidence exists to warrant immediate action to scale up interventions for chronic diseases and injuries through private and public sectors; improved public health and primary health-care systems are essential for the implementation of cost-effective interventions. We strongly advocate the need to strengthen social and policy frameworks to enable the implementation of interventions such as taxation on bidis (small hand-rolled cigarettes), smokeless tobacco, and locally brewed alcohols. We also advocate the integration of national programmes for various chronic diseases and injuries with one another and with national health agendas. India has already passed the early stages of a chronic disease and injury epidemic; in view of the implications for future disease burden and the demographic transition that is in progress in India, the rate at which effective prevention and control is implemented should be substantially increased. The emerging agenda of chronic diseases and injuries should be a political priority and central to national consciousness, if universal health care is to be achieved.

Introduction

The first two reports^{1,2} in this Series on health care for all in India focused on unfinished priority public health agendas, notably maternal and child health, nutrition, and infectious diseases. In this report, we concentrate on chronic diseases and injuries, which are emerging public health priorities in India. Chronic diseases and injuries are a large and heterogeneous group of disorders and to address them all in this report will not be possible. We therefore focus on and discuss risk factors for diseases and health disorders that account for at least 1% of the national burden of disease.³ On the basis of this burden-of-disease threshold and the availability of cost-effective interventions, we have identified several groups of chronic diseases that often occur together and that have similar health-system interventions. These groups are cardiovascular, respiratory, and metabolic disorders (diabetes, coronary heart disease, stroke, and chronic obstructive pulmonary disease); sensory loss disorders (cataracts, adult-onset hearing loss, and refractory impairments); breast, cervical, and lung cancer; mental health disorders (schizophrenia, depression, and alcohol misuse); and injuries (road traffic injuries and suicides). Some chronic infectious diseases, notably HIV/AIDS, are addressed elsewhere in the Series.¹ Therefore, in this report we discuss most of the major chronic diseases and injuries in India.

We try to address two questions. First, what are the current and forecasted burdens of and associated risk factors for chronic diseases and injuries? Second, what are the cost-effective interventions for prevention and treatment of these disorders? A previous *Lancet* Series

draw attention to the burden of chronic diseases and the availability of cost-effective interventions in 23 low-income and middle-income countries.^{4,5} We have based our analyses on three WHO data sources (panel 1), and have supplemented these with relevant microstudies or regional data sources when relevant. We then assess the

Key messages

- Chronic diseases (including cardiovascular and respiratory diseases, mental disorders, diabetes, and cancers) and injuries are the leading causes of death and disability in India—their burden will continue to increase during the next 25 years as a consequence of the rapidly ageing population in India.
- Most chronic diseases are common and often occur as comorbidities.
- Risk factors for chronic diseases are highly prevalent among the Indian population.
- Although a wide range of cost-effective prevention strategies are available, implementation is generally low, especially among people who are poor and those living in rural areas.
- Most health care is provided by the private sector, which often causes high out-of-pocket health expenditure that leads to debt and impoverishment.
- Immediate action to scale up cost-effective interventions for chronic diseases and injuries is needed; public health-care systems need to be strengthened to allow these interventions to be effectively implemented.
- Strong public policy commitments to control chronic diseases and injuries need to be implemented more robustly.

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This is the third in a Series of seven papers on India: towards universal health coverage

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Panel 1: Methods and limitations of data sources

Global Burden of Disease (GBD)

The GBD study provides an analytic framework to quantify the worldwide contribution of diseases, injuries, and risk factors to mortality and loss of health by use of disability adjusted life years (DALYs). An update for 2004, done by WHO, provides the latest data but acknowledges the uncertainty in estimates for India and other countries for which death registration data are incomplete.³ Disease burden estimates are being updated with new mortality data but are not yet available. Methods and data sources for the GBD estimates are reported elsewhere.^{3,6} Updated estimates for causes of death in India were based on information from the Medical Certificate of Cause of Death Database for urban India, the Annual Survey of Causes of Death for rural areas of India, and India-specific information about 16 causes of death from WHO technical programmes and the Joint UN Programme on HIV/AIDS (UNAIDS).⁴ For incidence, prevalence, and severity of diseases, estimates for India were extrapolated from regional estimates based on available data and epidemiological studies from the south Asia region;³ most available studies for the region came from India. Although uncertainty exists regarding the 2004 GBD estimates for India (webappendix pp 1–3), they provide useful information about the burdens of different diseases and the importance of disability, mortality, and age distributions. A set of models was used to project future health trends for baseline, optimistic, and pessimistic scenarios, based largely on projections of economic and social development.^{3,7}

World Health Survey (WHS)

In 2003, the WHS⁸ was implemented as a household survey in India. Samples were taken from data obtained during the 2001 Indian census by use of a stratified, multistage cluster design to allow each household and respondent to be assigned a known non-zero probability of selection. The survey was done in the states of Assam, Karnataka, Maharashtra, Rajasthan, Uttar Pradesh, and West Bengal. The individual response rate was 92.8%. The questionnaire related to tobacco use, alcohol use, physical activity, exposure to indoor air pollution, and chronic disorders (asthma, angina, arthritis, depression, and diabetes). In addition to self-reported diagnosis of a disorder, a set of symptomatic questions for each illness were also asked, except for diabetes (for which no internationally accepted set of symptoms exist). Responses to the symptomatic questions were combined with results from a separate diagnostic item probability study to create an algorithm for the presence or absence of each disease. For diabetes, the self-report of a diagnosis was used alone. Economic status was derived indirectly from a set of known predictors of income (eg, age and education of the head of the household) and indicators of economic status (eg, consumer goods, such as type of drinking water, and household amenities, such as whether the house has a toilet).⁹

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WHO-CHOosing Interventions that are Cost Effective (CHOICE)

WHO-CHOICE¹⁰ assesses how much disease burden can be averted with implementation of effective intervention strategies, and evaluates their cost. Effectiveness is assessed by comparison of the total number of healthy years lived (or DALYs averted) during the lifetime of a defined population—in this case the population in India—with and without intervention (modelled for 10 years); an intervention's effect is expressed in terms of percentage change in one or more epidemiological rates (eg, incidence or case fatality). All health-system resources required to initiate and maintain public health interventions for 10 years are identified and priced in local currency (INR for the year 2005). The extent to which local Indian data were used to populate cost-effectiveness models is shown in webappendix p 9. Both costs and effects are discounted by 3% to account for preference for short-term use of resources; like GBD estimates, DALYs are also age-weighted. Because there is no universally agreed set of cost-effectiveness threshold values, in this report we define any intervention that averts one DALY for less than US\$100 (INR4500) as extremely cost effective, and an intervention that averts one DALY for less than \$1000 (INR45 000; one and a half times India's GDP per person in 2005 [INR31 445]) as a cost-effective use of resources. Because of potential imprecision in the epidemiological data used, expected effect sizes, and exact resource needs, we use broad categories of cost-effectiveness to summarise our findings and to distinguish between better and worse uses of public funds.

health-system responses to chronic diseases and injuries, and propose actions that need to be implemented to integrate this emerging public health agenda within a health system for the provision of universal health care.

Mortality and burden of disease

Of the estimated 10.3 million deaths that occurred in India in 2004, 1.1 million (11%) were due to injuries and 5.2 million (50%) were due to chronic diseases (figure 1; webappendix pp 4–7).³ The chronic diseases discussed in this report caused an estimated 3.6 million (35%) deaths.

Mortality rates for people with age-specific chronic diseases are estimated to be higher in India than in high-income countries. In 2004, the overall age-standardised mortality rates for chronic diseases were 769 per 100 000 men (56% higher than in high-income countries in 2004) and 602 per 100 000 women (100% higher than in high-income countries in 2004). Cardiovascular diseases, especially coronary heart disease, are major contributors to the higher death rates in India, because Indians are more likely to develop coronary heart disease and have an earlier age of disease onset than are people in high-income countries, and because the case-fatality rate in India is higher than in

See Online for webappendix

high-income countries.^{11–13} Three-quarters of all road traffic injuries occur in individuals aged 15–45 years, and predominantly in men.¹⁴ Suicide is the fourth most common cause of death in women aged 15–59 years, and the tenth most common cause among women of all ages. In the global burden of disease (GBD) analysis (panel 1), WHO estimated that more than 200 000 deaths from road traffic injury (2% of total deaths and 17% of injury deaths) and about 190 000 suicides (2% of total deaths) occurred in 2004.³ However, these numbers could be underestimates; results of subnational population-based studies, in which verbal autopsy methods were used, suggest that injury deaths constituted a higher proportion of total deaths.^{15–17} The discrepancies between estimates are because different data sources and methods were used. Additionally, for every death, nearly 20–30 people are likely to be admitted to hospital and 50–100 receive emergency care.¹⁸ When assessed by use of disability-adjusted life years (DALYs), unipolar depressive disorders and chronic obstructive pulmonary disease (COPD) were in the top ten causes of disease burden in India. Almost 60% of the disease burden in India is borne by people aged 15 years and older and, in this age group, chronic diseases make up 62% and injuries make up 16% of the total disease burden (figure 2; webappendix pp 4–7).

Burden attributable to risk

Mortality and disease burden attributable to nine risk factors for chronic diseases have been quantified for India by use of the GBD methods for comparative risk assessment.^{6,19} Relative risks for coronary heart disease and stroke mortality associated with total serum cholesterol concentrations were revised on the basis of results of a meta-analysis of 61 cohorts with 900 000 participants from Europe and North America.²⁰ Prevalence distributions for systolic blood pressure, total serum cholesterol, body-mass index, and alcohol consumption for India were revised with data from the WHO Global Infobase²¹ and from an update of 2004 estimates of alcohol consumption.²² Prevalence distributions and risks for suboptimum fasting blood glucose were based on a regional analysis.²³ Figure 3 shows that tobacco use (including tobacco chewing), high blood glucose concentration, alcohol misuse, high blood pressure, abnormal serum cholesterol concentrations, and overweight and obesity caused a substantial burden of disease in India in 2004 (see webappendix p 8 for details of the attributable deaths and DALYs for the risk factors).

Projections

We have updated previously reported projections of mortality rates from 2002 to 2030^{3,7,24} using the GBD estimates for 2004, projections of deaths associated with HIV/AIDS,²⁵ and forecasts of economic growth by region.²⁶ In India, the number of deaths due to communicable diseases and to maternal, perinatal, and nutritional causes is predicted to decrease between 2004 and 2030 (figure 4).¹⁹

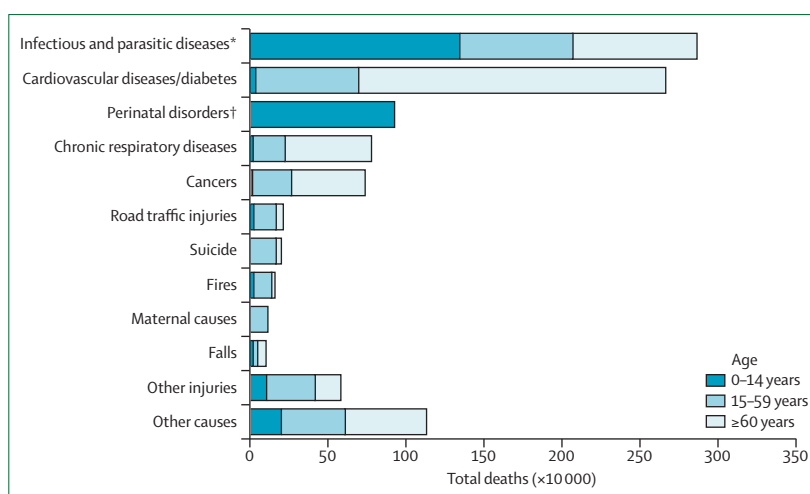


Figure 1: Estimated number of deaths due to selected diseases and injuries in India in 2004

Data are provided in the webappendix pp 4–7. *Includes acute respiratory infections. †Includes disorders arising in the perinatal period (eg, prematurity, birth trauma, and neonatal infections), but not all deaths occurring in the neonatal period (first 28 days).

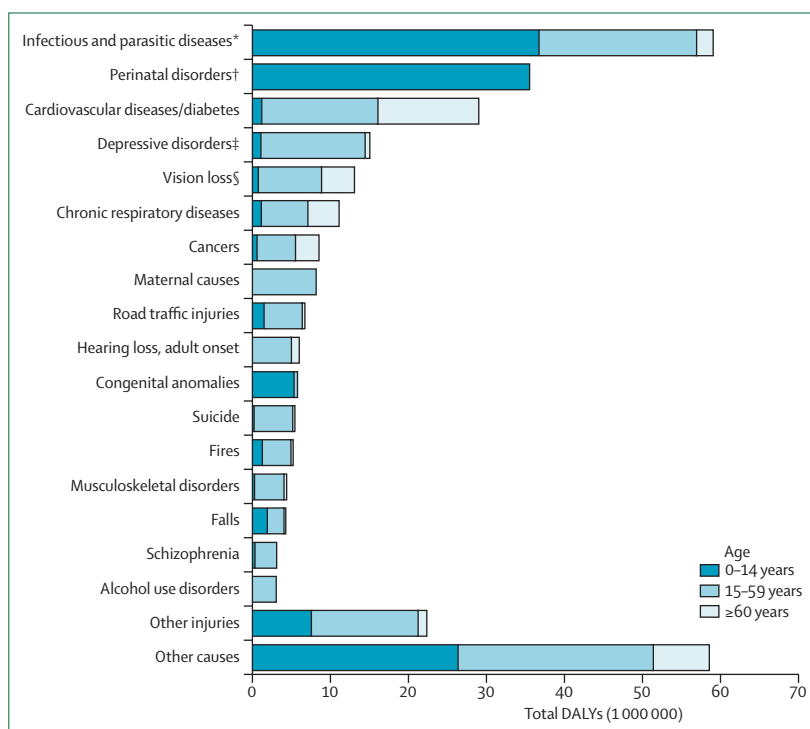


Figure 2: Estimated burden of selected diseases and injuries in India in 2004

Data are provided in the webappendix pp 4–7. DALYs=disability-adjusted life years. *Includes acute respiratory infections. †Includes disorders arising in the perinatal period (eg, prematurity, birth trauma, and neonatal infections) but not all deaths occurring in the neonatal period (first 28 days). ‡Unipolar major depression and dysthymia. §Vision loss due to glaucoma, cataracts, macular degeneration, and uncorrected refractive errors (vision loss due to infectious causes and injury are included in relevant cause categories).

As India's population ages during the next 25 years, the total number of deaths will increase substantially; this increase will be largely attributable to chronic diseases. Deaths caused by cancer are projected to increase from 730 000 in 2004 to 1.5 million in 2030, and those

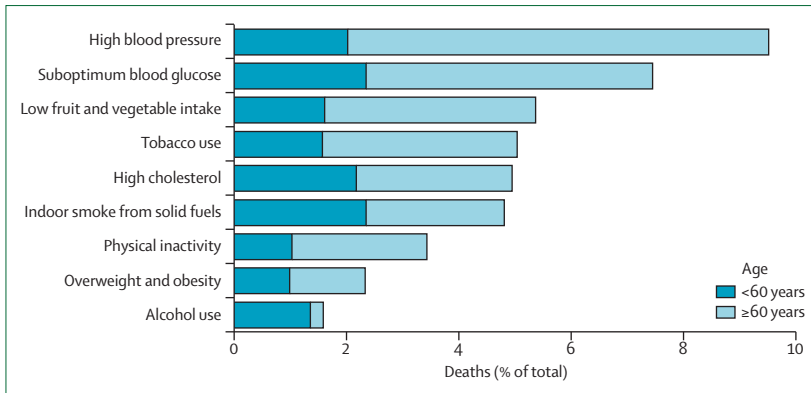


Figure 3: Estimates of deaths attributable to nine chronic disease risk factors
Data are provided in the webappendix p 8.

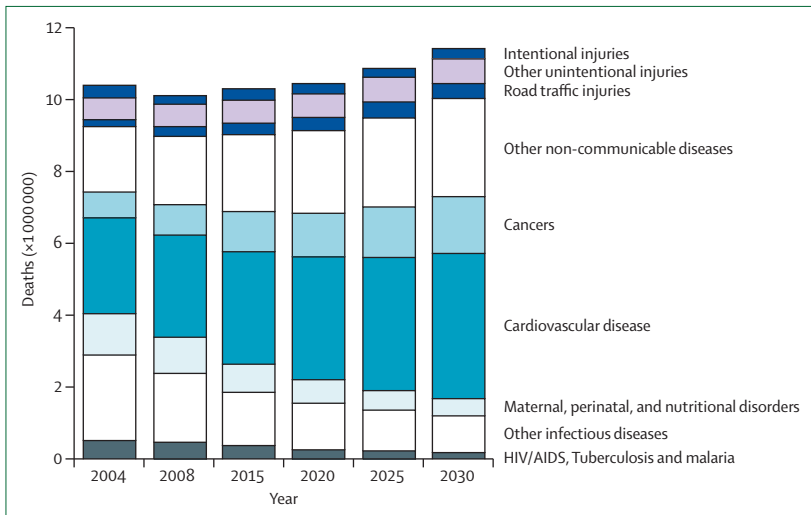


Figure 4: Projected deaths by cause in India

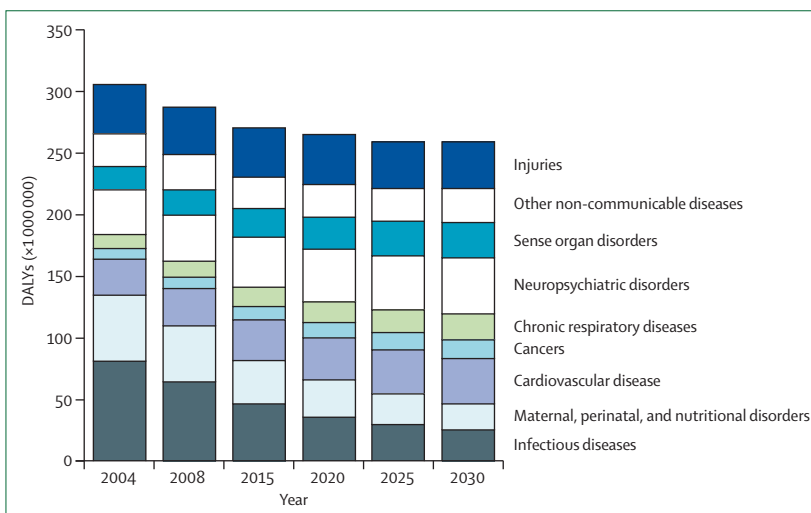


Figure 5: Projected burden of disease by cause in India
DALYs=disability-adjusted life years.

	Number of respondents	Insufficient physical activity	Daily smokers	Heavy drinkers*
Sex				
Male	5137	10.4% (1.6)	36.7% (1.5)	2.5% (0.5)
Female	4586	14.8% (1.3)	7.4% (1)	0.1% (0)
Residence				
Urban	996	14.7% (1.3)	10.9% (0.7)	1.2% (0.3)
Rural	8727	12.2% (1.4)	23.7% (0.9)	1.4% (0.3)
Income quintile				
Q1, low	1746	10.9% (1.3)	32.3% (2.3)	2.0% (0.5)
Q2	2109	11.1% (1.8)	30.2% (1.9)	1.4% (0.4)
Q3	2141	10.8% (1.5)	24.0% (1.7)	0.8% (0.2)
Q4	1977	14.1% (2.3)	13.2% (1.5)	1.1% (0.4)
Q5, high	1547	16.2% (2.1)	11.6% (1.5)	1.8% (0.9)
Missing	204
Age (years)				
18-29	3622	10.2% (1.6)	11.3% (1.4)	0.7% (0.4)
30-44	2686	9.6% (1.2)	25.8% (1.5)	2.0% (0.3)
45-59	2021	12.8% (2.1)	34.5% (2.5)	1.3% (0.4)
60-69	895	18.1% (2.3)	26.7% (1.8)	2.3% (1.1)
70-79	391	29.9% (4)	40.2% (4.5)	1.1% (0.6)
≥80	105	49.9% (6.7)	22.2% (5.1)	1.2% (0.9)
Missing	4
Total	9723	12.4% (1.3)	22.4% (0.8)	1.3% (0.3)

Data are percentage (SE), unless otherwise indicated. Data from the World Health Surveys.⁹ *Five or more standard drinks on 2 or more days in the previous week.

Table 1: Prevalence of selected risk factors for chronic diseases

attributable to cardiovascular causes from 2.7 million in 2004 to 4.0 million in 2030. Overall, our projections suggest that chronic diseases will account for slightly less than three-quarters of all deaths in India by 2030. Between 2004 and 2030, injury-related deaths are estimated to increase by 30%; most of which will be attributable to road traffic injuries and suicides. In India, the number of years of life lost because of coronary heart disease deaths before the age of 60 years will increase from 7.1 million in 2004 to 17.9 million in 2030, which means that, by 2030, more life years will be lost as a result of this disease in India than is projected for China, Russia, and the USA combined.³

We estimate that the total number of DALYs lost in India will decrease from 305 million in 2004 to 256 million in 2030, an overall reduction of about 16%. Because India's population is projected to increase by 30% over the same period, this reduction in the number of DALYs lost represents a substantial reduction in global disease burden per person. For most communicable, maternal, and perinatal causes of disease in India, population growth, population ageing, and changing disease risks will reduce the total number of DALYs lost. For chronic diseases, population-ageing-associated increases in the number of DALYs lost will be tempered by a reduction in age-specific incidence rates due to improved

socioeconomic conditions (which result in better access to health care and reduced disease risk). Despite the effect of improved socioeconomic conditions, our projections suggest that, for the Indian population aged 45 years and older, the number of DALYs lost because of chronic diseases per 1000 people will increase from 278 in 2004 to 307 in 2030 (figure 5). The health of people in India aged 45 years or older will, therefore, continue to deteriorate, largely because of ageing within this population group.²⁷ In 2030, unipolar depressive disorders, ischaemic heart disease, COPD, and road traffic injuries are projected to be the four leading causes of loss of DALYs in India.

Causes

Health behaviours

Our analyses of the World Health Survey data⁸ show that more than 20% of the Indian population smoke daily. Twice as many people living in rural areas smoke every day compared with the urban population (table 1) and, compared with the richest quintile, about three times as many people in the poorest quintile smoke daily (32.3% vs 11.6%). Data from the Indian Migration Study²⁸ show that men in urban areas are twice as likely to have low physical activity compared with those in rural areas. The increasing use of tobacco by young people is of great concern; data from a study²⁹ suggest that tobacco use among students from lower grades in urban schools seems to be increasing, signalling a worrying trend that needs to be investigated. About 2.5% of men in the population report that they drink heavily (five or more standard drinks on at least 2 days in the previous week). 12.4% of the population does not do sufficient physical activity, and the proportion increases with age. 7.3% of the population are overweight and 1.2% of the population are obese. Physical inactivity and obesity are most common among individuals in the upper-income quintiles, urban residents, and elderly people. The overall levels of these risk behaviours reported in the World Health Survey might be underestimates, as suggested by an Indian study estimating that up to 35% of a rural population and 56% of an urban population did not engage in sufficient physical activity.³⁰ Whether these discrepancies arise from differences in survey samples, measurement strategies, or study design is unclear.

More than 80% of the Indian population use solid fuel for cooking. Use of solid fuel is more than three times more common in the poorest quintile (99.7% of households) than in the richest quintile (29.6% of households) of the population; indoor air pollution from use of solid fuel for cooking affects only a quarter of urban households but nearly 90% of rural households.

Social determinants

More than 20% of the population have at least one chronic disease and more than 10% have more than one. Chronic diseases are widespread in people who are

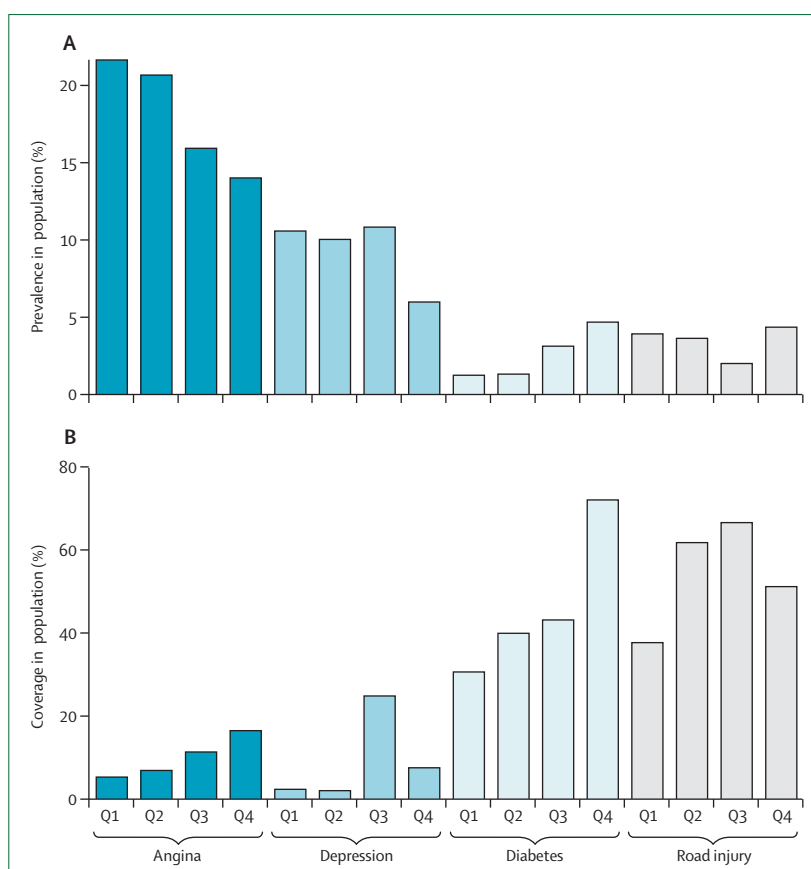


Figure 6: Burden of chronic disease and injuries and intervention coverage among different socioeconomic groups in India

(A) Burden of disease (prevalence estimated from symptom-based algorithm and self-reported diagnosis). (B) Intervention coverage. Q1=poorest quintile. Q4=richest quintile.

younger than 45 years and in poorer populations (figure 6; webappendix p 10).

Whereas socioeconomic development tends to be associated with healthy behaviours,³¹ rapidly improving socioeconomic status in India is associated with a reduction of physical activity and increased rates of obesity and diabetes.³²⁻³⁴ The emerging pattern in India is therefore characterised by an initial uptake of harmful health behaviours in the early phase of socioeconomic development. Such behaviours include increased consumption of energy-dense foods and reduced physical activity, increased exposure to risk factors for road traffic injury such as driving above the speed limit, after intake of alcohol, or without appropriate safety precautions like wearing seat belts or motorcycle helmets. After the early phase of socioeconomic development, increased health literacy and public awareness of chronic diseases will lead to richer people adopting healthier lifestyles more quickly than less educated and poorer population groups.^{33,34}

Our analyses do not account for the role of distal social or structural determinants or early life determinants in the development of chronic diseases. Early life

	Extremely cost effective (<INR4400 [US\$100] per DALY averted)	Cost effective (INR4400–44 000 [\$ 100–1000] per DALY averted)	Less cost effective (>INR44 000 [\$1000] per DALY averted)
Population-wide interventions	Prevention and control of tobacco and alcohol use (through measures to reduce advertising, availability, and affordability of products, especially bidis and locally brewed alcohols); dietary salt reduction programme; screening for refractory error and provision of glasses	Screening for hearing loss and provision of hearing aids; road traffic injury prevention (enforcement of speed limits, drink-driving law, motorcycle helmet use, and seat belt use)	Bicycle helmet use by children
Primary-care interventions	Preventive drug treatment for high blood pressure (systolic blood pressure >160 mm Hg)	Preventive drug treatment for high cholesterol; preventive combination therapy for individuals at high risk of a CVD event; flu vaccination (for people aged >60 years) and smoking cessation programmes for people with COPD; brief interventions for alcohol misusers; depression treatment	..
Secondary-care and tertiary-care interventions	Treatment of stage I breast cancer (lumpectomy and radiotherapy); extensive breast cancer programme (treatment of all stages and biannual screening for women aged 50–70 years)	Treatment of acute MI with aspirin or streptokinase; treatment of post-acute MI with aspirin, ACE-inhibitors, β blockers, or statins; treatment of post-acute ischaemic stroke with aspirin, statins, or blood-pressure-lowering drugs; treatment of CHF with ACE-inhibitors or β blockers; extracapsular cataract extraction with posterior chamber lens implant	Treatment of acute MI with ACE-inhibitors or β blockers; organised stroke unit care; treatment of severe COPD disease and exacerbations; intracapsular cataract extraction by use of aphakic glasses; schizophrenia treatment

This table only includes interventions for which cost-effectiveness estimates have been calculated. DALY=disability-adjusted life years. CVD=cardiovascular disease. COPD=chronic obstructive pulmonary disease. MI=myocardial infarction. ACE=angiotensin-converting enzyme. CHF=congestive heart failure.

Table 2: Intervention strategies categorised by level of health system and cost-effectiveness

For more on WHO-CHOosing Interventions that are Cost Effective (CHOICE) see <http://www.who.int/choice>

determinants affect diabetes, hypertension, and chronic diseases—eg, prenatal and infant food supplementation seems to improve adult outcomes³⁵ but policy-relevant evidence from India is scarce. However, evidence exists that distal social and structural determinants strongly affect the burden of chronic diseases and injuries.³⁶ We discuss two specific examples here. First, rapid motorisation, along with the heterogeneous composition of road traffic and infrastructural deficiencies, is directly linked to the increased number of road traffic injuries: more than half of total road deaths in 2007 were in Andhra Pradesh, Maharashtra, Tamil Nadu, and Karnataka, which account for 27% of India's population but 37% of its motor vehicles.³⁷ Pedestrians, motorcyclists, and bicyclists are the most vulnerable road users. Second, a large number of suicides among farmers has been linked to a combination of factors, such as drought, increased competition from cheap food imports, and large-scale mechanised agricultural practices, which make local small-scale agriculture economically unviable and restrict access to formal credit for marginalised farmers.^{38,39} Powerlessness, as experienced by these farmers, or women entrapped in violent marriages, is a major social determinant of suicide.⁴⁰

Cost-effectiveness of interventions

We estimated the cost-effectiveness of interventions relating to five categories of disease and injury: cardiovascular and respiratory diseases, sensory loss disorders, mental health disorders, cancer, and road traffic injuries. The cost-effectiveness of intervention strategies for each of these categories is summarised in table 2 (for detailed results, see webappendix pp 11–14). The main

data source for these estimates is the WHO-CHOosing Interventions that are Cost Effective (CHOICE) project,¹⁰ which has generated internally consistent and therefore comparable cost-effectiveness results for a wide range of leading contributors to the GBD (panel 1). Use of generic drugs, when available, is assumed for all drug-based interventions.

Cardiovascular and respiratory diseases and risk factors

We assessed the costs and effects of a range of interventions for cardiovascular disease and its risk factors (high blood pressure, high body-mass index, suboptimum blood glucose concentrations, high cholesterol concentrations, and tobacco use). These interventions include both population-focused and individual-focused primary prevention efforts (eg, tobacco control, reduced dietary salt intake, hypertension-lowering and cholesterol-lowering drugs, and combination drug treatment for individuals at high risk of an event associated with cardiovascular disease), and secondary prevention and management of ischaemic heart disease and stroke.^{41–44} India-specific results relating to the effect of interventions for two further important risk factors—unhealthy diet and physical inactivity—are reported elsewhere as part of a Series on chronic diseases.⁴⁵

Several secondary prevention strategies are well below the cost-effectiveness threshold of US\$1000 (INR45000) per DALY averted, such as the use of aspirin, angiotensin-converting-enzyme inhibitors, and β blockers for people with post-acute coronary heart disease and ischaemic stroke. Treatment of congestive heart failure with angiotensin-converting-enzyme inhibitors and β blockers is also cost effective. For a

similar or even reduced cost per DALY averted, population-wide health gains can be increased with the use of a combination of hypertension-lowering and cholesterol-lowering drugs in people at high risk of events associated with cardiovascular disease. The results of a randomised controlled trial⁴⁶ of people in India with at least one risk factor for cardiovascular disease showed similar adherence rates when a 12-week combination treatment was compared with other drug regimens. Compared with patients who received the alternative drug regimens, for those who received the combination treatment the results suggested a likely reduction of 50% in events associated with cardiovascular disease if treatment continued for 5 years.⁴⁶ These findings lend support to existing evidence that combination treatment is feasible and effective. Scale up of the provision of combination drug treatment to 50% of high-risk individuals in India is expected to avert 5·8 million deaths over 10 years, at a yearly cost of less than \$1 per person.⁴⁷

Among the most cost-effective interventions (<\$100 per DALY averted) that could be undertaken are population-based efforts to promote reductions in key risk factors such as salt intake or tobacco use, which have been projected to avert millions of deaths (3·1 million in 10 years) for a very small investment (<\$0·25 per person per year) if undertaken on a large enough scale.⁴⁸ In terms of tobacco control, attention should be focused on efforts to reduce the consumption of bidis (small hand-rolled cigarettes), which account for more than 70% of smoked tobacco in India (about 1 trillion sticks per year). Bidis are at least as harmful as cigarettes and their consumption is inversely responsive to increase in price,⁴⁹ but are taxed at a much lower rate (\$0·22–0·44 per 1000 sticks) than are cigarettes (\$19–49 per 1000 sticks) and at least half of all consumption is not taxed (panel 2).⁶⁰

Tobacco prevention programmes affect health outcomes other than cardiovascular disease, particularly reducing incidence of lung cancer and COPD. For the treatment of COPD, which is also caused by indoor air pollution, we adapted a WHO-CHOICE model and intervention set used for a priority-setting exercise in Mexico.⁴³ Results indicate that smoking cessation programmes and yearly influenza vaccination for patients with COPD who are aged 60 years or older are two cost-effective strategies that could be pursued in India (although absolute health gains achieved in the population are small).

WHO-CHOICE results for the management of diabetes are not available. However, in their cost-effectiveness analysis, Chow and colleagues⁶¹ assessed the use of metformin for prevention of type 2 adult-onset diabetes and estimated that the burden of diabetes could be reduced by roughly 400 000 DALYs, at a cost of less than \$130 per DALY averted. In an Indian randomised trial,⁶² both lifestyle modification and use of metformin were equally cost-effective (about \$1000 per case avoided) in preventing the onset of type 2 diabetes. There is also strong evidence that type 2 diabetes can be

prevented by weight loss through dietary changes and physical activity.⁶³ Moreover, efforts to prevent diabetes help to prevent cardiovascular disease by control of other risk factors.

Sensory loss disorders

We assessed the health-effect and cost of screening (and providing hearing aids) for people with hearing impairment, plus two strategies for doing population-wide cataract surgery.^{64,65} Identification of cases—through passive or active screening in schools or the community—and subsequent fitting of hearing aids is estimated to cost between \$330–440 per DALY averted. For cataracts, extracapsular extraction with posterior chamber lens implants is estimated to be more cost effective (<\$220 per DALY averted) than is intracapsular extraction by use of aphakic glasses (\$1040 per DALY averted). A WHO-CHOICE analysis⁶⁶ suggests that to screen school children for refractive error and to provide glasses when necessary would be a highly cost-effective strategy (<\$100 per DALY averted). Models for the scale up of such interventions exist and are discussed in panel 3.

Mental health disorders

Building on an earlier WHO-CHOICE analysis,⁷¹ we analysed interventions for alcohol misuse as a risk factor for disease, including psychosocial treatment in primary care (\$490 per DALY averted) and pricing policies aimed at increasing excise taxation or reducing the untaxed consumption (<\$22 per DALY averted). On the basis of an estimate of unrecorded consumption of 1·7 L of pure alcohol per person per year,⁷² we calculate that 3 billion L of illicit alcohol is produced and consumed per year in India, which is why taxation enforcement strategies for illegally produced alcohol are expected to be as effective as increased taxation of legal alcohol.

Clinical interventions for mental health disorders include antipsychotic drugs for schizophrenia (with or without psychosocial support and care), and antidepressant drugs or psychosocial treatment for depression (on an episodic or long-term basis). Methods and assumptions underlying these analyses are reported elsewhere.^{73,74} Because of the high prevalence of depression, treatment at a meaningful population coverage (50%) is expensive, but is nevertheless a cost-effective strategy (<\$440 per DALY averted). Compared with depression, community-based care and treatment of people with schizophrenia is more expensive to treat (per patient) and not as cost effective—combination treatment with a cheap, generically produced antipsychotic drug (risperidone) and six to eight individualised psychosocial sessions costs roughly \$2200 per DALY averted.

Cancer

Although no form of cancer meets the inclusion criterion of 1% of national disease burden, we recognise the need for enhanced efforts to prevent and control common

Panel 2: Bidis

Bidis are unfiltered tobacco flakes hand-rolled in a tendu leaf and held together by a cotton thread. Bidis, along with smokeless tobacco, account for 81% of the Indian tobacco market.⁵⁰ Their popularity stems from their low cost and from the misperception that they are herbal and therefore less harmful than cigarettes.^{49,51} Several studies indicate that bidi smokers have an increased risk of mortality, cardiovascular diseases, lung diseases, and cancer compared with people who do not smoke.⁵²⁻⁵⁷ The Bombay Cohort Study,⁵⁸ for example, showed that bidi smokers are at increased risk of smoking-related death (odds ratio 1.64, 95% CI 1.47–1.81) compared with cigarette smokers (OR: 1.37, 1.23–1.53), and also showed a dose-response relation between mortality and the number of bidis smoked. The INTERHEART Study,⁵⁵ a case-control study of 12 461 people with acute myocardial infarction (AMI) and 14 637 healthy individuals from 52 countries, showed nearly a three-times increase (2.89, 2.11–3.96) in risk of AMI for individuals who smoke bidis compared with those who do not smoke; cigarette smoking was associated with similarly high risks of AMI.⁵⁵ Jha and colleagues⁵² also showed that smoking of bidis increases the risk of mortality for several chronic diseases including respiratory, vascular, and neoplastic diseases. Despite the high prevalence of⁵⁹ and increased risks associated with bidi smoking, regulatory policies in India seem to favour bidis. Manufacturers who produce less than 2 million bidis a year do not have to pay excise tax; even for those who exceed this limit the taxes are negligible. In view of the adverse health consequences of bidi smoking, regulatory and taxation measures against bidis are needed. Part of the tax revenue can be used to provide free education to the children of parents involved in bidi manufacturing industries and for helping bidi workers retrain and establish new occupations. Public health activists argue that the bidi industry should be accountable to international standards of trade that would protect the welfare of their workers⁴⁹—bidi manufacturers are predominantly women working from their own homes without employment rights or health and safety regulations.

forms of cancer. WHO-CHOICE analyses have focused on three common types of cancer for which effective interventions exist and could be scaled up in developing countries: breast, cervical, and colorectal cancers. For breast cancer, the treatment of stage 1 disease (plus introduction of an extensive breast cancer programme that offers appropriate treatment at all stages) and biennial mammographic screening for women aged 50–70 years are the most cost-effective interventions, with a cost per DALY averted of less than \$100.⁷⁵ The most cost-effective intervention for cervical cancer is surgery (with or without adjuvant chemotherapy and radiotherapy); a vaccination programme with Papanicolaou screening or visual inspection with acetic acid screening at age 40 years is the next most cost-

Panel 3: Elimination of avoidable blindness in rural India

The Aravind Eye Hospital was founded in 1976 in Madurai, south India, by Govindappa Venkataswamy, an ophthalmologist, after he retired from government service. Because rural communities had restricted access to eye care, even when care was offered for free in district hospitals, Aravind Eye Hospital provided outreach screening services that, if necessary, arranged for a patient to be taken to hospital and given food, surgery, and drugs free of charge.^{67,68} In 2008, Aravind Eye Hospital, through its five base hospitals, organised 1643 eye camps in rural areas, screening 532 877 patients, including 167 707 school children. This effort resulted in 69 616 sight-restoring cataract surgeries and 3541 other surgeries and laser procedures. 73 388 spectacles were dispensed (5987 to children) to correct refractive error. To provide permanent rural eye care, Aravind Eye Hospital has recently established 30 permanent village-based vision centres for primary eye care, staffed by ophthalmic technicians with access to telemedicine; each centre covers a population of 50 000 people and less than 30% of those who come to these centres need to go to the base hospital for further examination or surgery. Standardised protocols have been developed for clinical procedures and administrative and outreach activities. To allow ophthalmologists to concentrate on making clinical decisions and treating patients, routine skill-based tasks, such as measurements of intraocular pressure, diagnostic tests, and counselling and preparing patients for surgery, are done by trained paramedical ophthalmic assistants. To maximise surgical output, surgeons focus only on the surgical procedure and paramedics take care of all preparations for surgery, record writing, and counselling of patients and their relatives.^{68,69} This task-shifting approach has enabled Aravind Eye Hospital to do 4% of the 5.4 million cataract surgeries done nationwide every year with less than 1% of the country's ophthalmic manpower.⁷⁰ The Aravind Eye Hospital model is now being adopted by eye care programmes across India and in other developing countries.

effective strategy.⁷⁶ The only cost-effective intervention for colorectal cancer is provision of treatment facilities; the introduction of screening programmes is not a cost-effective option.⁷⁷

Injuries

Interventions that are slightly less than the cost-effectiveness threshold of \$1000 per DALY averted include enforcement of speed limits (eg, with mobile hand-held cameras), drink-driving legislation and enforcement (through roadside breath-testing campaigns), and legislation to make the wearing of motorcycle helmets and seat belts mandatory.⁷⁸ Our analysis indicates that interventions should be combined to minimise costs and improve health outcomes. Other potentially useful interventions that have not undergone formal economic

assessment for use in India include the improvement of prehospital care (eg, early first aid and minimisation of the time taken to reach hospital after injury),⁷⁹ improvement of public transport, separation of motorised traffic from pedestrians and bicyclists, increase in the legal age of driving, restriction of the number of hours that a person can drive in a day, and the improvement of road and vehicle engineering, along with enforcement measures and educational programmes for each of these interventions.^{18,80–82} If all short-term and long-term methods are integrated and implemented, 60 000–70 000 deaths could be prevented by 2015 (a 50% reduction).⁸² Interventions that could prevent suicides include the restriction of access to organophosphorus compounds and drugs,⁸³ early recognition and management of mental health disorders such as depression,⁸⁴ and programmes for prevention of interpersonal violence.⁸³ No cost-effectiveness estimates are available to allow comparison of different interventions.

Package of cost-effective interventions

From an economic perspective, the interventions that are the most cost effective and feasible to implement should be prioritised. Most of the cost-effective interventions listed in table 2 require substantial strengthening of the Indian health-care system before major progress can be made. Population-wide interventions for reduction of tobacco consumption and alcohol misuse (specifically through taxation; panel 2), and number of road traffic injuries (through enforcement of drink-driving laws and speed limits) are the most feasible and cost effective and could be implemented first. Other interventions, such as detection and treatment of high blood pressure, combination drug treatment for prevention of cardiovascular disease, depression treatment, and influenza vaccination might be more feasible in urban settings where primary-care services are more developed than they are in rural areas.

Health system responses

Consensus is increasing among global health policy makers and researchers about the importance of addressing the emerging burden of chronic diseases in low-income and middle-income countries.⁸⁵ Several principles underpin it: strengthened public health and primary health-care systems are essential; population ageing will increase the absolute numbers of people with chronic diseases; the main causes of the major chronic diseases are well understood and are just as relevant in developing countries as they are in developed countries;^{34,86} many chronic diseases can be treated with inexpensive generic drugs and lifestyle modifications;⁸⁷ and if action is not taken now, the avoidable suffering and deaths will have an adverse effect on economic development.

On the basis of cost-effectiveness estimates, we recommend the implementation of interventions for tobacco control; reduction of dietary salt intake; and

reduction of cardiovascular risk factors through promotion of healthy diets and physical activity, and the use of a combination of aspirin and low-dose drugs that lower blood pressure and cholesterol in individuals at high risk of cardiovascular disease.^{5,45,47,48} Public health interventions, such as taxation of tobacco and alcohol or the provision of places to exercise, play a major part in the promotion of healthy lifestyles. However, specific interventions to change individuals' behaviour are also important, especially for people who already have chronic diseases.^{88,89} Strong evidence exists to support the benefit of behavioural interventions such as advice from a health-care professional to stop smoking,⁹⁰ and the promotion of physical activity in people with impaired glucose homeostasis.⁹¹

One trial of physical activity for prevention of diabetes has been done in India.⁸⁷ The recommended interventions, if properly applied, have great potential to reduce avoidable mortality and disability caused by chronic diseases. The consensus is dominated by tobacco-related diseases and cardiovascular disease but other major contributors to chronic suffering, disability, or death (eg, mental health disorders and injuries) will probably be included as progress is made. WHO has been promoting a public health approach for the prevention and control of road traffic injuries with a focus on reducing exposure to the risk of road accidents, reducing the severity of crashes, and improvement of trauma outcomes.¹⁸ In 2008, WHO launched a programme for mental and neurological diseases, mhGAP, to scale up health interventions for eight disorders (child and adolescent mental health disorders, epilepsy, depression, schizophrenia and other psychoses, alcohol misuse, illicit drug use, dementia, and suicidal behaviour).⁹²

Several models exist for the organisation of services for chronic diseases and injuries, but all rely on a strengthened primary health-care system⁹³ and improvement of prehospital and acute trauma-care services. Of particular relevance to India is the WHO Innovative Care for Chronic Conditions framework,⁸⁵ which stresses the importance of local communities in the mobilisation of new resources and of policy makers in the provision of consistent funding and leadership. This framework emphasises the role of the health-care system in provision of continuity of care, coordination of care services, monitoring and maintenance of standards, training clinical teams, equipping health facilities, use of health information systems to monitor and guide policy and practice, increasing patients' and families' self-care abilities, and active promotion of prevention programmes. However, the evidence is weak or inconsistent to support choice of a specific model.^{94,95}

Policies

India has made substantial progress in development of national policies that are backed by adequate resources to comprehensively address the burden of chronic diseases and injuries (table 3). However, most of these national

programmes have been “structured around a technological response and focused on specific targets” rather than having multicomponent interventions,¹⁰⁰ and their success has been variable. The National Mental Health Programme, for example, was initiated over a quarter of a century ago, making India among the first low-income countries to initiate such a scheme. However, the programme was poorly funded and covered only a few districts. Even in these districts, funds were underused and there are no data for the coverage that was achieved. Although the latest version of the National Mental Health Programme aims to substantially increase funding and expand coverage for a range of mental health care and promotion activities, its implementation in districts has been delayed.¹⁰¹ In view of India’s position as the world’s second largest tobacco producer, the fact that the Indian government supported the Indian Tobacco Control Act 2003, which substantially strengthens tobacco control and builds on India’s ratification of WHO’s framework convention on tobacco control, is remarkable.¹⁰² On Oct 2, 2008, the government passed a law that banned smoking in all public places. However, much more needs to be done to reduce the use of bidis and non-smoking forms of tobacco, especially in view of the evidence that raising tax on bidis from INR14 to INR98 per 1000 sticks would raise INR36.9 billion in revenue and could prevent

15.5 million current and future smokers from dying (panel 2).¹⁰³ Little progress has been made in the development of policies to reduce the amount of saturated and trans fats, salt, and sugar in processed foods, and improve public transport and urban design to increase the opportunities for cycling and walking. The National Programme for Prevention and Control of Diabetes, Cardiovascular Disease, and Stroke, launched in January, 2008, has completed its pilot phase in ten states and is now set to be extended to the whole country.

India does not have a comprehensive injury prevention policy, programme, or plan of action. A national road safety policy has been announced, but in some states, such as Kerala and Maharashtra, road safety policies have been formulated but little progress has been made in implementation. The main focus of road safety efforts in India has been to change the behaviour of road users through isolated, sporadic, and non-systematic approaches (figure 7), whereas globally the approach has shifted to building safe vehicles and safe road environments through engineering, enforcement, and education. A comprehensive policy on suicide prevention is also absent, though recent initiatives, such as the Protection of Women from Domestic Violence Act (2005), and reforms in other sectors will probably have beneficial effects on suicide prevention.

	Policy or programme	Year of launch	Focus of activities
Cancer	National Cancer Control Programme	1975	Primary prevention of cancers by education, especially about the hazards of tobacco use and the necessity of genital hygiene for prevention of cervical cancer; secondary prevention (ie, early detection and diagnosis of cancers); strengthening of existing cancer treatment facilities; palliative care in terminal stages
Vision	National Programme for Control of Blindness	1976	To reduce the burden of blindness through identification and treatment of the blind; to develop eye care facilities in every district; to develop human resources for providing eye care services; to improve quality of service delivery; to secure participation of voluntary organisations
Mental health	National Mental Health Programme	1982	District mental health care; upgrade of mental hospitals; increasing specialist human resources; school mental health-care promotion; research; advocacy
Tobacco control	Indian Tobacco Control Act	2003	Increased taxes on tobacco products; smoking in public places ban (2008); pictorial warnings on tobacco products
Hearing	National Programme for Prevention and Control of Deafness	2007	Prevention of avoidable hearing loss caused by disease or injury; early identification, diagnosis, and treatment of ear problems causing hearing loss and deafness; treatment of deafness in people of all ages; promotion of intersectoral collaboration to improve the standard of care for people with hearing disorders; provision of equipment and training to ear care services
Cardiovascular disease and diabetes	National Programme for Prevention and Control of Diabetes, Cardiovascular Disease, and Stroke	2008	Risk reduction for prevention of diabetes, cardiovascular disease, and stroke; early diagnosis and appropriate management of diabetes, cardiovascular diseases, and stroke
Road traffic injury	Draft National Road Safety Policy (Sundar Committee Report ⁹⁶)	Under final stages of approval	The development of institutional mechanisms for promoting road safety; implementation of cost-effective interventions; prioritisation of most cost-effective interventions; promotion of research and information systems; development of standards, guidelines, and road safety education
	Draft National Road Transport Policy (Thangaraj committee report ⁹⁷), National Urban Transport Policy ⁹⁸	Under final stages of approval Recommended for approval	Includes road safety as an essential component to be integrated with transport development Focus on urban development, transport patterns and mobility, and control of noise and air pollution
All injuries	National Trauma Care Programme	11th plan	To strengthen trauma care in hospitals; increasing the number of ambulances on highways; training of doctors

All information is from the Planning Commission,⁹⁹ unless stated otherwise.

Table 3: National policies for chronic diseases and injuries in India

Overall, progress in development and implementation has varied between different strategies—as evidenced by our attempt to track the progress of strategies to control cardiovascular diseases and diabetes since an earlier call to action (panel 4).¹⁰⁰

Several barriers to policy development and implementation exist. First, the effect of macroeconomic policies on chronic diseases and injuries has not been assessed. For instance, the introduction of new and cheap motor vehicles and the reduction of import duties on processed foods might exacerbate the road traffic injury and chronic disease epidemics. Second, the role of civil society has not been adequately acknowledged. Community mobilisation, especially to target risk factors, is crucial in a country where civil society has played a part in shaping the political agenda. The actions taken by the community in tackling alcohol misuse by men¹⁰⁴ and the recent success of tobacco control policies are largely attributable to the active engagement of civil society.¹⁰⁰ Third, many of the health-care programmes are vertical and do not acknowledge the need for intersectoral action, and do not address the overlap that is necessary between programmes to strengthen the health-care system (eg, the National Rural Health Mission) and programmes to tackle chronic diseases and injuries.

Health care

Heterogeneity is the most striking aspect of the management of patients with chronic diseases and injuries in India: on the one hand some patients receive the best possible evidence-based treatment at tertiary hospitals, but on the other hand, some patients have poor access to basic care and their disorders are usually not detected or adequately treated.¹⁰⁵ Despite the substantial burden of chronic diseases and injuries, and the availability of cost-effective interventions, data from the World Health Survey show that a large proportion of the population receives no treatment for chronic disease—eg, 47.2% of patients with diabetes and 91.2% of those with angina receive treatment. Individuals in the poorer quartiles are between two and 20 times less likely to receive any treatment than are those in the richer quartiles (figure 6). Rural and economically disadvantaged populations have poor health outcomes.^{13,32,106,107} Inconsistent quality of care, an increase in treatment costs, an increase in inequity, and consumer exploitation lead to poor outcomes.^{13,108,109} The economic consequences of such poor quality of care are enormous. Data from the 1995–96 National Sample Survey Organisation's health survey¹¹⁰ suggest that episodes of hospital care for chronic diseases were almost twice as frequent as those for infectious diseases. Health expenditure among people from all socioeconomic groups was higher for chronic diseases than it was for infectious diseases, and more was spent on private sector services than on public sector services. Health-care expenditure on chronic diseases was 70% of the average monthly income for people in



Figure 7: Road signs in India

Examples of non-cost-effective strategies for prevention of road traffic injuries.

low-income groups and was 45% for those in the highest income group.^{111,112} In Goa, a survey of common health disorders in women (namely, anaemia, depression, and reproductive tract infections) suggested that catastrophic health expenditure was only associated with depression.¹¹³ In another study from Kerala, catastrophic health spending after acute coronary syndrome was as high as 92% among people in low-income groups (Harikrishnan S, Sree Chitra Tirunal Institute for Medical Sciences and Technology, personal communication). Nationally representative sample surveys estimate that the total direct cost for diabetes treatment is INR7000 per person per year, much of which is paid for by the patient; indirect costs are a further INR12800 per person per year.¹¹⁴ Because trauma care in the public sector is inadequate or inaccessible, injuries in people who are poor often result in death or disability.

In response to reduced central funding and restricted opportunities for states to raise more money for public funding of health services, Indian hospital services have become an investment opportunity for corporate and multinational enterprises and a strong health insurance market is emerging.¹⁰⁸ Although these trends are bringing new resources to strengthen and extend activities for the control of chronic diseases, without independent regulation and assessment, the vested interests of these corporate enterprises will probably determine both the

Panel 4: Progress made on recommendations made for action on cardiovascular diseases and diabetes in 2005¹⁰⁰

Tobacco control

- Ban on tobacco use in Indian films and television programmes (Aug 1, 2005).
- Ban on smoking in public places such as worksites, restaurants, bars, and all enclosed public spaces (Oct 2, 2008; further judicial review pending).

Production and supply of healthy foods (ie, fruits and vegetables)

- No substantial progress.

Regulation of unhealthy foods

- No substantial progress but planning in process. Food Standards Regulatory Agency meetings held on food labelling and promotion of healthy eating.

Urban planning to promote physical activity

- No substantial progress but the number of civil society initiatives has increased—eg, the informal building of parks and walking trails in residential areas.

Community empowerment through health promotion programmes

- National Rural Health Mission aims to integrate health promotion activities of the National Programme for Prevention and Control of Diabetes, Cardiovascular Disease, and Stroke into its overall goals after a resolution of the Central Council for Health and Family Welfare (2009).

Health system strengthening aimed at early detection of individuals at high risk of developing a chronic disease and those with early stage disease

National public health standards (2006) have been developed for chronic disease care in primary care. The following guidelines are being or have been developed:

- Medical officers manual on prevention and control of cardiovascular disease, diabetes, and stroke.
- Health workers guide with a flip chart for community awareness.
- India-specific physical activity guidelines.
- www.healthy-india.org website established in 2008 to promote health-seeking behaviour and provide credible health information.

Effective secondary prevention for people with chronic disease

- Involvement of medical colleges and private practitioners in setting up pilot special clinics as part of the National Programme for Prevention and Control of Diabetes, Cardiovascular Disease, and Stroke.

Provision of cost-effective and life-saving acute care

- No substantial progress.

diseases that receive attention and the costs to individuals and the government.¹¹⁵ Primary prevention strategies will probably receive less attention than will secondary and tertiary models of hospital care, which are more profitable. Although no national or regional programme has successfully provided a continuum of care that is equitable and evidence-based, regional programmes for specific chronic diseases that increase coverage across all social groups are increasing in number (panel 3; panel 5). A core strategy for such programmes is to shift specific health-care tasks to less expensive community health workers and patient-led self-management; this strategy is especially important for the management of chronic diseases when many interventions are non-pharmacological, and long-term adherence is crucial. Strong evidence for such task-shifting now exists for a range of

Panel 5: Chunampet Rural Diabetes Prevention Project

In India, 50 million people have diabetes; this number is projected to increase to 87 million by 2030.¹¹⁶ The Madras Diabetes Research Foundation in Chennai, established by Viswanathan and Rema Mohan, set up an innovative new programme for prevention and management of diabetes in rural India—the Chunampet Rural Diabetes Prevention Project—with the support of the World Diabetes Foundation and the Indian Space Research Organisation. The project aims to prevent diabetes in 50 000 people in 42 villages around Chunampet in the Kanchipuram district of Tamil Nadu. Village health workers and a mobile telemedicine unit are used to screen for diabetes. A rural diabetes centre has been set up to provide basic care for people with diabetes, and to ensure community acceptance and project sustainability the project provides employment to men and women from local villages. Although diabetes screening is provided free of charge, about 60% of patients at the diabetes centre pay for their treatment, albeit at subsidised rates. Patients who cannot afford to pay are treated for free. Within 1 year of the project's implementation, over 90% of the entire adult population of the 42 villages (about 25 000 people) had been screened for diabetes, and the mean glycated haemoglobin concentrations among diabetic individuals decreased from 9.3% to 8.5%. By use of telemedicine, over 80% of diabetic individuals have been screened for complications of diabetes such as retinopathy, nephropathy, and diabetic foot disease. Those who need laser photocoagulation for advanced diabetic retinopathy or surgery for diabetic foot disease are brought to a tertiary referral diabetes centre in Chennai, and, depending on their socioeconomic status, are provided free or as subsidised treatment. The Chunampet Rural Diabetes project thus seems to be a good model for delivering preventive and therapeutic diabetes health care to rural areas.

chronic diseases including diabetes,¹¹⁷ schizophrenia,¹¹⁸ and depression,¹¹⁹ but none of these have been scaled up within the public health sector.

Setting priorities for action

The most important short-term and medium-term priorities for the control of the epidemic of chronic diseases and injuries are listed in panel 6. We acknowledge the limitations of our analyses, which heavily relied on global datasets with varying degrees of context-specific data from India. In particular, the GBD data are limited because of the absence of state and rural–urban differentiation. We have identified several key research priorities and health-information-system needs, some of which are already being addressed through the Integrated Disease Surveillance programme (panel 7).

By drawing attention to these priorities, we encourage policy makers to move towards a more efficient allocation of resources across the health sector. The identification and choice of efficient interventions are important for

Panel 6: Short-term and medium-term strategies for the control of chronic diseases and injuries

Short-term (2-year) strategies

- Implementation of all extremely cost-effective interventions listed in table 2
- Mandatory health-impact assessment of all macroeconomic policies
- Social-insurance-funded care for all chronic diseases and injuries for the poorest third of the population
- Implementation of recommendations for health information systems for chronic diseases

Medium-term (5-year) strategies

- Full integration of chronic disease and injury prevention and control programmes with the national health missions
- Comprehensive coverage of all chronic diseases and injuries by social-insurance and private-insurance policies
- Implementation of all remaining cost-effective interventions listed in table 2

Panel 7: Research and health-information needs for chronic diseases and injuries

Health-information-system needs

- Routine collection of data for chronic diseases and injuries (including related risk factors) in primary care and district hospitals and examination of longitudinal trends
- Monitoring the prevalence of chronic diseases and risk factors, and population coverage of cost-effective interventions through cohort and panel studies
- Improved registration and reporting of all causes of death
- Improved monitoring of clinical practice in hospitals and longitudinal assessment of the effect of quality improvement initiatives

Research needs

- Trials of chronic disease care packages delivered by non-specialist health workers in primary care
- Trials of population primary-prevention and health-promotion interventions to reduce the burden of chronic disease and injuries
- Trials to assess interventions to promote healthier individual choices and safe behaviours

renewed investment and scaling up in the health-care system. However, cost-effectiveness is not the only criterion for selection of interventions—other criteria are the equitable distribution of available resources and ensuring that the health needs of vulnerable populations are met. For example, although schizophrenia treatment is less cost-effective than many other assessed intervention strategies, it substantially alleviates the suffering of individuals and families faced with this severe and stigmatising mental health disorder.

Despite the need for local data of improved accuracy, sufficient evidence exists for us to call for immediate action to provide comprehensive and affordable care for chronic diseases and injuries, a goal which is only feasible though a large increase in public spending on health care in India.¹²⁰ Universal coverage can only be achieved by integration of the private sector into the national health-care system while the quality and accessibility of public services are strengthened.¹²¹ We need to scale up cost-effective interventions for chronic diseases and injuries through both private and public sectors, enforce robust regulations that restrict use of irrational drugs and biotechnologies,¹²² and use India's human resources and information technology to innovate new low-cost methods for delivery of interventions. Alongside these health-care reforms, we strongly advocate the need to strengthen the social and policy frameworks to enable the scale up of preventive interventions. For example, in India's rush to build roads for the rich who can afford cars, the needs of pedestrians, motorcyclists, and bicyclists have been ignored, placing hundreds of millions of people at risk of injury. Health-impact assessments should be mandatory for all macroeconomic policies. We strongly endorse the government's current

policies for tobacco, and propose increasing the taxes on bidis, smokeless tobacco, and all forms of alcohol (including locally brewed alcohols), to reduce the high consumption by poor people in rural areas. We support the integration of national programmes for various chronic diseases and injuries because they share many epidemiological features and health-care needs. Their planned integration within national health missions should also improve the current fragmented approach but will require careful assessment.

India's epidemic of chronic diseases and injuries has already passed its early stages; the demographic and epidemiological transitions that are in progress have important implications for individuals, families, communities, and the nation as a whole. The time to act is now. For universal health care to be achieved, the emerging agenda of chronic diseases and injuries should be a political priority and central to the national consciousness of India.

Contributors

VP was responsible for the conception, design, and initial draft of this report. CM did analyses of global burden of disease data. SC did analyses of the World Health Survey data. DC analysed the cost-effectiveness of interventions. All authors participated in drafting and commenting on all versions of the report.

Conflicts of interest

We declare that we have no conflicts of interest.

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