

Chronic Diseases 3



Responding to the threat of chronic diseases in India

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At the present stage of India's health transition, chronic diseases contribute to an estimated 53% of deaths and 44% of disability-adjusted life-years lost. Cardiovascular diseases and diabetes are highly prevalent in urban areas. Tobacco-related cancers account for a large proportion of all cancers. Tobacco consumption, in diverse smoked and smokeless forms, is common, especially among the poor and rural population segments. Hypertension and dyslipidaemia, although common, are inadequately detected and treated. Demographic and socioeconomic factors are hastening the health transition, with sharp escalation of chronic disease burdens expected over the next 20 years. A national cancer control programme, initiated in 1975, has established 13 registries and increased the capacity for treatment. A comprehensive law for tobacco control was enacted in 2003. An integrated national programme for the prevention and control of cardiovascular diseases and diabetes is under development. There is a need to increase resource allocation, coordinate multisectoral policy interventions, and enhance the engagement of the health system in activities related to chronic disease prevention and control.

Burden of chronic diseases: the rising tide

India is experiencing a rapid health transition, with large and rising burdens of chronic diseases, which are estimated to account for 53% of all deaths and 44% of disability-adjusted life-years (DALYs) lost in 2005 (figure 1). Earlier estimates, from the Global Burden of Disease Study, projected that the number of deaths attributable to chronic diseases would rise from 3.78 million in 1990 (40.4% of all deaths) to 7.63 million in 2020 (66.7% of all deaths).¹

Many of these deaths occur at relatively early ages. Compared with all other countries, India suffers the highest loss in potentially productive years of life, due to deaths from cardiovascular disease in people aged 35–64 years (9.2 million years lost in 2000). By 2030, this loss is expected to rise to 17.9 million years—940% greater than the corresponding loss in the USA, which has a population a third the size of India's.²

The burden of cardiovascular disease is rising in India. The estimated prevalence of coronary heart disease is around 3–4% in rural areas and 8–10% in urban areas among adults older than 20 years, representing a two-fold rise in rural areas and a six-fold rise in urban areas over the past four decades. About 29.8 million people were estimated to have coronary heart disease in India in 2003; 14.1 million in urban areas and 15.7 million in rural areas.³ The prevalence of stroke is thought to be 203 per 100 000 population among people older than 20 years.⁴

Data on cancer mortality are available from six centres across the country, which are part of the National Cancer Registry Programme of the Indian Council of Medical Research (ICMR). About 800 000 new cases of cancer are estimated to occur every year. The age-adjusted incidence rates in men vary from 44 per 100 000 in rural Maharashtra to 121 per 100 000 in Delhi.⁵ The major cancers in men are mostly tobacco-related (lung, oral cavity, larynx, oesophagus, and pharynx). In women, the

leading cancer sites include those related to tobacco (oral cavity, oesophagus, and lung), and cervix, breast, and ovary cancer. India has the largest number of oral cancers in the world, due to the widespread habit of chewing tobacco.

India also has the largest number of people with diabetes in the world, with an estimated 19.3 million in 1995 and projected 57.2 million in 2025.⁶ The prevalence of type 2 diabetes in urban Indian adults has been reported to have increased from less than 3.0% in 1970 to about 12.0% in 2000.⁷ On the basis of recent surveys, the ICMR estimates the prevalence of diabetes in adults to be 3.8% in rural areas and 11.8% in urban areas.

The prevalence of hypertension has been reported to range between 20–40% in urban adults and 12–17%

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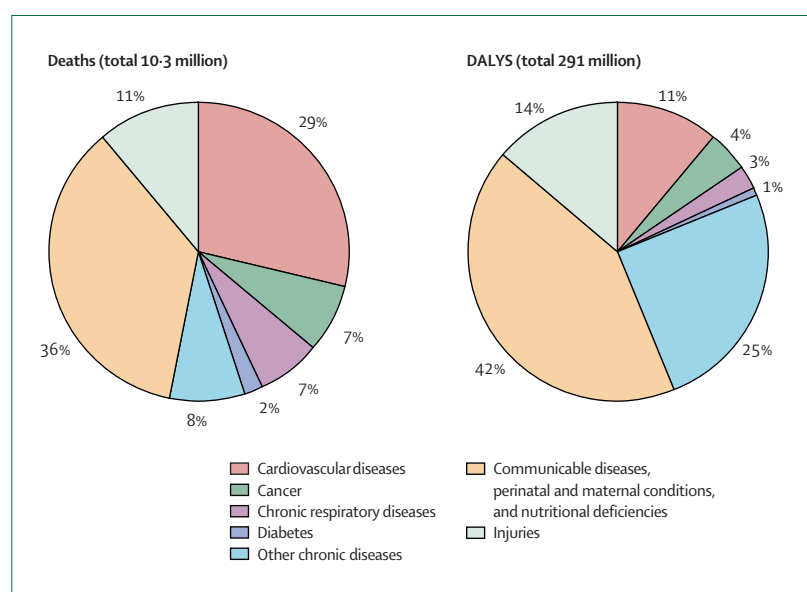


Figure 1: Estimated proportions of total deaths and DALYs lost by cause in India (all ages, 2005)

among rural adults.⁸ The number of people with hypertension is expected to increase from 118·2 million in 2000 to 213·5 million in 2025, with nearly equal numbers of men and women.⁹

Risk factor levels: grim portents

These advancing epidemics are propelled by demographic, economic, and social factors, of which urbanisation, industrialisation, and globalisation, are the main determinants. The Indian economy is growing at 7% per year. With increasing life expectancy, the proportion of the population older than 35 years is expected to rise from 28% in 1981 to 42% in 2021.¹⁰ The proportion of people in urban residence, presently around 30%, is expected to rise to about 43% in 2021. During the decade 1991–2001, the population grew by 18% in the rural areas and 31% in urban regions.¹¹ Urbanisation and industrialisation are changing the patterns of living in ways that increase behavioural and biological risk factor levels in the population. Substantial variations exist between different regions, but risk levels are rising across the country, most notably in urban areas of demographically and economically more advanced states of India.

An excess risk of death from coronary disease has been observed in men and women of south-Asian origin, by comparison with other ethnic groups, and there is a progressive rise in risk from rural to urban to migrant environments.^{12,13} The increased risk of cardiovascular problems noted in Indian migrants is a portent of the further rise in risk that Indians are likely to experience alongside the developmental transition of their country.

A high frequency of diabetes, central obesity, and other features of the metabolic syndrome (especially the characteristic dyslipidaemia of reduced HDL cholesterol and raised triglycerides) have been reported in migrant and urban Indian population groups.^{14,15} Comparisons between migrant and non-migrant groups and rural and urban populations have also highlighted the importance of conventional risk factors like smoking, blood pressure, plasma cholesterol, and body-mass index (BMI).^{10,12} The INTERHEART study¹⁶ found that the cluster of nine coronary risk factors identified in the global population was also applicable to south Asians as a group.

Nationally representative distribution data are available for a few risk factors. Several community-based surveys, done in different parts of India at different times, have contributed to a patchwork profile of risk in segments of the population, but there have been very few multicentre studies with standardised methodology. In the past few years, two surveillance systems have been established to provide risk factor data from different parts of the country, using WHO's STEPS methodology.¹⁷ In 2002, ICMR, with technical assistance from WHO, established a community-based surveillance system involving five

centres. During 2000–04, another WHO-assisted project established a sentinel surveillance system for cardiovascular risk factors and events in ten large industries across the country, involving the employees and their family members.

The prevalence of tobacco use, in myriad smoked and smokeless forms, has been estimated in the National Sample Survey and the National Family Health Survey (figure 2).¹⁸ In the Indian component of the Global Youth Tobacco Survey (2000–04), 25·1% of the students aged 13–15 years reported that they had ever used tobacco, whereas current use was reported by 17·5%.¹⁹ A national survey in 2002, reported that the overall prevalence of current tobacco use in men and boys aged 12–60 years was 55·8%, ranging from 21·6% in those aged 12–18 years to 71·5% in the 51–60 year age group.²⁰

Many cross-sectional surveys, as well as the industrial surveillance project, recorded a high urban prevalence of central obesity and overweight (especially when the lower thresholds recommended by WHO for Asian people are used). Though the prevalence of obesity (BMI ≥ 30) is usually lower than that observed in the western population, the overweight category (BMI ≥ 25) includes almost a third to half the population in every survey. Women and men are equally affected.^{21,22} Small birth size, with rebound obesity in early childhood, predicted diabetes and glucose intolerance in adulthood, in an Indian cohort.²³

The few available standardised studies of physical activity revealed low levels in urban areas (compared with rural) and in the upper-income and middle-income groups (compared with low-income). Low levels of physical activity have been reported in 61–66% of men and 51–75% of women, in urban surveys.^{22,24}

Most surveys have also shown higher mean concentrations of plasma cholesterol in urban population groups (4·6–5·2 mmol/L) compared with rural groups (4·3–4·6 mmol/L), with a low mean concentration of HDL cholesterol.²⁵ The ICMR surveillance project observed that the prevalence of dyslipidaemia (ratio of total cholesterol to HDL cholesterol $\geq 4·5$) was 37·5% in individuals aged 15–64 years. Even in a relatively young

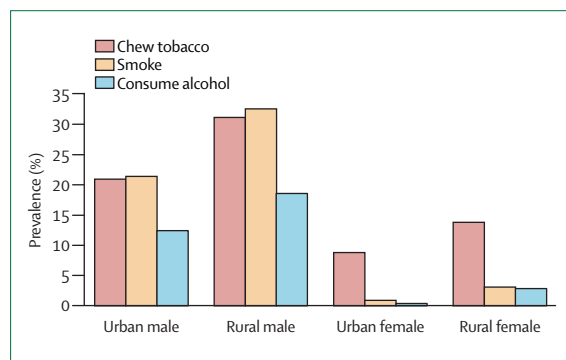


Figure 2: Prevalence of tobacco chewing, smoking, and alcohol habits in men and women older than 15 years in rural and urban India (1998–99)¹⁸

industrial population (20–59 years), 62.0% had dyslipidaemia.²⁶ Levels of awareness, treatment, and adequate control are low for hypertension, diabetes, and dyslipidaemia, especially in rural areas.^{26,27}

With advancing health transition, the poor are increasingly affected by chronic diseases and their risk factors. Low levels of education and income now predict not only higher levels of tobacco consumption, but also increased risk of coronary heart disease.^{19,28} Since India's daily consumption of fruits and vegetables is 130 g per person per day, poor people may also have deficiencies of protective phytonutrients. Urban slums in Delhi have high rates of diabetes and dyslipidaemia.²⁹ Lack of awareness of risk factors and diseases, and inadequate access to health care, increase the risk of early death or severe disability in such disadvantaged groups.

The policy response: current scenario

The advancing epidemics of chronic diseases require a comprehensive policy response that caters to the varied needs of population-based prevention and essential clinical care. The health systems are presently geared to provide prioritised care for communicable diseases and services related to maternal and child health. The agenda of health promotion and chronic disease prevention has not yet been adequately incorporated. Clinical services, too, are not currently designed to provide the required level of care for these diseases in primary and secondary health-care settings.

As in other developing countries, public health advocacy has been mostly devoted to communicable diseases, nutritional deficiencies, population stabilisation, and recently to HIV/AIDS. Clinical health-care providers, on the other hand, were more focused on developing advanced health-care facilities for treatment of established chronic diseases. Policymakers have been impeded, until recently, by inadequacy of data on the burdens of chronic diseases. Perceptions that these diseases mainly affect the rich, who can purchase private health care, also prevented public sector resources from flowing into chronic disease prevention and control. The limited health budgets were not ready to take on the additional costs of treating chronic diseases at state expense. The huge expenditure that the state and society are incurring on the tertiary care of advanced chronic diseases has only been recently recognised. The cost of treating three tobacco-related diseases (cancers, coronary heart disease, and chronic obstructive pulmonary disease) was an estimated US\$7.2 billion in the year 2002–03.¹⁹

Over the past 20 years, policies related to tobacco control have been strengthened, culminating in the Indian Parliament unanimously enacting a comprehensive national law for tobacco control in April, 2003 (panel 1). India has also ratified the WHO Framework Convention on Tobacco Control. Many factors cumulatively contributed to the emergence of this

Panel 1: Key provisions of the Indian Tobacco Control Act, 2003

- Ban on smoking in public places
- Ban on direct and indirect advertisement of cigarettes and other tobacco products in print, electronic and outdoor media (ban on tobacco use in films to be implemented from October, 2005)
- Ban on sales to and by people younger than 18 years
- Tobacco products cannot be sold near educational institutions
- Mandatory depiction of statutory health warning (in one or more Indian languages) and pictorial warning, on all tobacco products
- Product regulation: tar and nicotine levels to be declared on tobacco product packages

national consensus: increasing knowledge of the health, environmental, and developmental damages caused by tobacco; growing global support for tobacco control; WHO's catalytic role in developing policies and programmes for effective action; national research on tobacco-related burdens; vigorous advocacy by Indian civil society groups; decisive interventions by the Indian judiciary and increasing policymaker support across the political spectrum. Implementation of the national law, however, needs to gather strength, through effective mobilisation of central and state level enforcement agencies and community groups.

India is the world's second largest producer as well as consumer of tobacco. As a source of excise revenue, export earnings, and employment, tobacco occupies an important place in the Indian economy. The strong measures initiated by the Government of India for tobacco control have overcome fierce resistance from the tobacco industry. In this respect, India becomes an excellent role model for other developing countries.

The policy framework needed to implement the WHO Global Strategy on Diet, Physical Activity and Health is still evolving. Although several nutrition programmes exist for correction of nutritional deficiencies, especially among vulnerable groups, they do not incorporate the dietary elements needed for prevention of chronic disease. Coordinated multi-sectoral initiatives, recommended by the Global Strategy, have not yet been designed. However, efforts have recently been initiated to address these needs. A multi-stakeholder national consultation was held in April, 2005, at the behest of the Indian Health Ministry, to identify action pathways and partnerships for implementing the Global Strategy in the context of India.

Recently the Health Ministry has decided to initiate an integrated national programme for prevention and control of diabetes and cardiovascular diseases (including stroke) and is now developing models. Some state governments, such as Tamil Nadu and Kerala, have identified chronic disease prevention and control as a high priority. The former has incorporated this component into its recently launched statewide health-systems project, which is supported by the World Bank.

Existing chronic disease prevention and control programmes

Although several national programmes for prevention and control of communicable diseases exist, there are very few such programmes for chronic diseases. The National Cancer Control Programme was the first programme dedicated to a chronic disease. The National Blindness Control Programme has helped to reduce the backlog of cataract operations through wide coverage (about 4.3 million cataract operations per year at the moment). The National Programme on Speech and Hearing provides services related to prevention and control of deafness. The other programmes relevant to chronic diseases are National Iodine Deficiency Disorders Control Programme and National Mental Health Programme.

New programmes that are being initiated this year are likely to have a substantial effect on chronic diseases. The National Rural Health Mission is a country-wide programme for upscaling rural health services, and can be designed to include key elements of health promotion and chronic disease prevention. Special outpatient services for elderly people in all hospitals and two National Institutes of Ageing are also proposed.

In general, most national health programmes have been structured around a technological response and focused on specific targets. The need for multi-component interventions, affecting several behaviours, posed difficulties in designing programmes related to chronic diseases. However, the fact that programmes for population stabilisation and HIV prevention also have major behaviour modification components should open the way for programmes related to chronic disease.

India was one of the first countries to develop a National Cancer Control Programme. Cancer control received early recognition because of strong advocacy from health professionals, emotive appeal to people, and the realisation that the disease affected the poor in large numbers. The programme, which was started in 1975, was initially focused on setting up ten regional cancer centres and procuring cobalt therapy units. It was reformulated in 1984 (panel 2).

Although no separate national programme has, as yet, been established for tobacco control, a National Tobacco Control Cell has been established in the central Health Ministry, with assistance from WHO. Its activities currently extend from supporting civil society initiatives for anti-tobacco education and advocacy to operation of tobacco cessation clinics in selected health-care facilities. A National Programme for Tobacco Control, linked with state-level programmes, has now become necessary for effective implementation of the Indian law and adherence to the WHO Framework Convention on Tobacco Control.

State-subsidised health care is available for treatment of chronic diseases. However, such clinical care facilities are mostly concentrated in large urban centres. There

has been a rapid growth of private tertiary-care hospitals, which cater to the urban affluent sections and are now vying to attract international medical tourism. Facilities for both acute and long-term care of chronic diseases are inadequate in rural primary-care settings, and even in secondary-care settings of smaller towns and cities. Essential drugs for treatment of cardiovascular disease and diabetes are available at lower than global prices, but are still too expensive for many people.

Action needed

The need to provide an effective public-health response to the growing challenge of chronic diseases in India can no longer be ignored without imperilling India's development. A comprehensive strategy must integrate actions to minimise exposure to risk factors at the population level, and reduce risk in individuals at high risk, to provide early, medium-term, and long-term effects.

Interventions that can prevent or reduce the risk of chronic diseases include: policy measures, such as those related to tobacco control, production and supply of healthy foods, regulation of unhealthy foods, and urban planning that promotes physical activity; empowerment of communities through health promotion programmes that can effectively enhance knowledge, motivation, and skills to foster awareness and adoption of healthy behaviours; early detection of individuals at high risk of developing a chronic disease and those with an early manifestation of disease, for imparting effective protection; secondary prevention in people who have developed chronic diseases; and provision of cost-effective and life-saving acute care.

Panel 2: National cancer control programme

Objectives

- Primary prevention of tobacco-related cancers
- Early diagnosis and treatment of cervical cancer
- Extension and strengthening of therapeutic services including pain relief, on a national scale, through regional cancer centres and medical and dental colleges

Schemes

- Financial assistance to voluntary organisations
- District cancer control scheme
- Financial assistance for Cobalt Unit installation
- Development of oncology wings in Government Medical College hospitals
- Assistance for regional research and treatment centres

Current status

- 205 cancer treatment centres; 22 regional cancer centres; 325 teletherapy units; 113 remote brachytherapy machines
- Availability of oral morphine tablets in registered medical institutions since 1991

While India is simultaneously experiencing several disease burdens due to old and new infections, nutritional deficiencies, chronic diseases, and injuries, individual interventions for clinical care are unlikely to be affordable on a large scale. Although community empowerment for health promotion is essential, health education alone would be insufficient in the absence of supportive environmental changes. Health messages on chronic disease prevention also have to compete for public attention with many other messages on polio, tuberculosis, HIV, family planning, and other health problems. In such a scenario, policy interventions related to tobacco, food supply, and urban design are likely to have a far greater and quicker effect on chronic disease prevention through their population-wide effect. WHO's stepwise approach to prevention and control provides practical pathways for staged implementation.³⁰

The initiatives taken for tobacco control must be consolidated, by establishing a national regulatory authority for tobacco control to steer the national programme. A national coordinating body, representing multiple stakeholder groups, should be set up to strengthen implementation. The existing food-based dietary guidelines should be revised to reflect the principles of chronic disease prevention and health promotion and, thereafter, widely disseminated in various Indian languages. Through amendments to the Prevention of Food Adulteration Act of 1954, limitations can be placed on the levels of salt, sugar, and saturated fats in manufactured food products. Food labelling also needs to be introduced to facilitate informed choice by consumers. Policies related to urban design and urban transport also need to be formulated to facilitate safe and pleasurable physical activity as a routine component of daily life.

Such multi-sectoral policies can only be implemented when other relevant government departments, civil society, and private sector act in concert with the departments of health at central and state levels. To enable this action, a broad based intersectoral coordinating group would need to be established at the Planning Commission of India.

Data obtained from simple and sustainable surveillance systems would help to guide future policy. The Integrated Disease Surveillance Programme, launched by the Government of India in 2004, incorporates key elements of chronic disease risk factor surveillance and has the potential to yield such nationally representative data.

Demonstration projects of health promotion and chronic disease risk reduction are in progress, in both community and industrial settings. School-based projects have evolved successful models of health promotion.³¹ Experience from these projects will strengthen the design and delivery of a national programme for chronic disease prevention and control.

This programme will also benefit from capacity enhancement in public health, which the government proposes to achieve by establishing a network of new and old schools of public health.

Cost-effective clinical interventions to reduce risk also need to be introduced in primary and secondary health-care settings. India has a strong pharmaceutical industry, which is able to provide many of the drugs needed for chronic disease management at low cost. Inexpensive drugs for treatment of individuals at high risk could be made widely available to the poor through the government health system, and to others through health insurance schemes.

Conclusion

As chronic disease epidemics gather pace in India and threaten harm to individuals, families, and the society at large, a comprehensive strategy for their prevention and control is needed. Some of the required elements are already in place, such as control programmes for tobacco use and cancer. These efforts need to be upscaled. In other areas, such as diet and physical activity, the process must move from contemplation to action. Health systems need to be reoriented to accommodate the needs of chronic disease prevention and control, by enhancing the skills of health-care providers and equipping health-care facilities to provide services related to health promotion, risk detection, and risk reduction.

Conflict of interest statement

We declare that we have no conflict of interest.

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References

- Murray CJL, Lopez AD. Global Health Statistics. Global Burden of Disease and Injury Series. Boston MA: Harvard School of Public Health, 1996.
- Leeder S, Raymond S, Greenberg H, Liu H, Esson K. A race against time. The challenge of cardiovascular disease in developing economies. New York: Columbia University, 2004.
- Gupta R. Rapid response to Ghaffar A, Reddy KS, Singhi M. Burden of non-communicable diseases in South Asia. *BMJ* 2004; **328**: 807–10. <http://bmj.bmjournals.com/cgi/eletters/328/7443/807> (accessed Aug 1, 2005).
- Anand K, Chowdhury D, Singh KB, Pandav CS, Kapoor SK. Estimation of mortality and morbidity due to strokes in India. *Neuroepidemiol* 2001; **20**: 208–11.
- National Cancer Registry Programme. Two year report of the population-based cancer registries 1997–1998. Incidence and distribution of cancer. New Delhi: Indian Council of Medical Research; 2002.
- King H, Aubert RE, Herman WH. Global burden of diabetes, 1995–2025: prevalence, numerical estimates, and projections. *Diabetes Care* 1998; **21**: 1414–31.
- Ramachandran A. Epidemiology of diabetes in India—three decades of research. *J Assoc Physicians India* 2005; **53**: 34–38.
- Gupta R. Trends in hypertension epidemiology in India. *J Hum Hypertens* 2004; **18**: 73–78.
- Kearney PM, Whelton M, Reynolds K, Muntner P, Whelton PK, He J. Global burden of hypertension: analysis of worldwide data. *Lancet* 2005; **365**: 217–23.
- Reddy KS. Cardiovascular disease in India. *World Health Stat Q* 1993; **46**: 101–07.

- 11 Registrar General of India. Census 2001. <http://www.censusindia.net/results> (accessed Aug 1, 2005).
- 12 Bhatnagar D, Anand IS, Durrington PN, et al. Coronary risk factors in people from the Indian subcontinent living in west London and their siblings in India. *Lancet* 1995; **345**: 405–09.
- 13 Patel JV, Vyas A, Cruickshank JK, et al. Impact of migration on coronary heart disease risk factors: comparison of Gujaratis in Britain and their contemporaries in villages of origin in India. *Atherosclerosis* 2005; published online July 7. DOI:10.1016/j.atherosclerosis.2005.06.005.
- 14 McKeigue PM, Miller GJ, Marmot MG. Coronary heart disease in south Asians overseas: a review. *J Clin Epidemiol* 1989; **42**: 597–609.
- 15 Mohan V, Shanthirani S, Deepa R, Premalatha G, Sastry NG, Saroja R. Intra-urban differences in the prevalence of the metabolic syndrome in southern India—the Chennai Urban Population Study (CUPS No. 4). *Diabet Med* 2001; **18**: 280–87.
- 16 Yusuf S, Hawken S, Ounpuu S, et al. Effect of potentially modifiable risk factors associated with myocardial infarction in 52 countries (the INTERHEART study): case-control study. *Lancet* 2004; **364**: 937–52.
- 17 Surveillance of risk factors for noncommunicable diseases. The WHO STEPwise approach. Noncommunicable diseases and mental health. World Health Organization, Geneva, 2003. http://www.who.int/ncd_surveillance/steps/riskfactor/en/index.html (accessed Sept 19, 2005).
- 18 International Institute for Population Sciences. National Family Health Survey 1998–1999 (NFHS-2). Mumbai: IIPS, 2000.
- 19 Reddy KS, Gupta PC, eds. Tobacco control in India. New Delhi: Ministry of Health and Family Welfare, Government of India, 2004.
- 20 Srivastava A, Pal H, Dwivedi SN, Pandey A, Pande JN. National household survey of drug and alcohol abuse in India. New Delhi: Report accepted by the Ministry of Social Justice and Empowerment, Government of India and UN Office of Drug and Crime, Regional Office of South Asia, 2004.
- 21 Reddy KS, Prabhakaran D, Shah P, Shah B. Rural-urban differences in distribution of body mass index and waist-hip ratios in north Indian population samples. *Obes Rev* 2002; **3**: 197–202.
- 22 Gupta R, Gupta VP, Sarna M, Prakash H, Rastogi S, Gupta KD. Serial epidemiological surveys in an urban Indian population demonstrate increasing coronary risk factors among the lower socioeconomic status. *J Assoc Physicians India* 2003; **51**: 470–77.
- 23 Bhargava SK, Sachdev HS, Fall CH, et al. Relation of serial changes in childhood body-mass index to impaired glucose tolerance in young adulthood. *N Engl J Med* 2004; **350**: 865–75.
- 24 Vaz M, Bharathi AV. Practices and perceptions of physical activity in urban, employed, middle-class Indians. *Indian Heart J* 2000; **52**: 301–06.
- 25 Misra A, Luthra K, Vikram NK. Dyslipidemia in Asian Indians: determinants and significance. *J Assoc Physicians India* 2004; **52**: 137–42.
- 26 Prabhakaran D, Shah P, Chaturvedi V, Ramakrishnan L, Manhapra A, Reddy KS. Cardiovascular risk factor prevalence among men in a large industry of North India. *Natl Med J India* 2005; **18**: 59–65.
- 27 Deepa R, Shanthirani CS, Pradeepa R, Mohan V. Is the 'rule of halves' in hypertension still valid? Evidence from the Chennai Urban Population Study. *J Assoc Physicians India* 2003; **51**: 153–57.
- 28 Rastogi T, Reddy KS, Vaz M, et al. Diet and risk of ischemic heart disease in India. *Am J Clin Nutr* 2004; **79**: 582–92.
- 29 Misra A, Pandey RM, Devi JR, Sharma R, Vikram NK, Khanna N. High prevalence of diabetes, obesity and dyslipidaemia in urban slum population in northern India. *Int J Obes* 2001; **25**: 1722–29.
- 30 Epping-Jordan J E, Galea G, Tukuitoronga C, Beaglehole R. Preventing chronic diseases: Taking stepwise action. *Lancet* 2005; published online Oct 5. DOI:10.1016/S0140-6736(05)67342-4.
- 31 Reddy KS, Arora M, Perry CL, et al. Tobacco and alcohol use outcomes of a school based intervention in New Delhi. *Am J Health Behav* 2002; **26**: 173–81.