

Economics of Non-Communicable Diseases in India Executive Summary

An executive summary of a report by the World Economic Forum
and the Harvard School of Public Health

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For the full report and references, please consult
<http://www.weforum.org/issues/healthy-living>.

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1. Overview and Purpose

Non-communicable diseases (NCDs) – cardiovascular diseases (CVDs), chronic respiratory diseases, diabetes and cancer – are a major threat to human health, economic growth and national development.

An emerging economy and population superpower, India faces a human and economic threat posed by NCDs. This report provides, to the global and national debates, an account of the economic impact of NCDs to the Indian economy, and an assessment of the return on investment (ROI) of specific interventions to address that burden.

The evidence is compelling. India stands to incur a cost of \$4.58 trillion between 2012 and 2030 due to NCDs and mental health conditions. Of this amount, CVDs (\$2.17 trillion) and mental health conditions (\$1.03 trillion) will account for the majority of the economic loss.

However, these losses are not inevitable: options exist for action that policy-makers can take today to significantly reduce these costs.

Primary prevention of NCDs, built upon robust early screening and a strong healthcare infrastructure, is a promising path for reaping favourable returns on investment in the Indian context. Interventions that focus on screening (in the case of hypertension), vaccination (in the case of human papillomavirus [HPV]) and reduced tobacco use were assessed as promising in terms of feasibility of achieving a 15% ROI. An intervention to improve care for depressive and anxiety disorders through collaborative stepped care, which leverages an existing healthcare infrastructure and employed lay health counsellors to deliver care, also presents a promising approach to addressing common mental health conditions in India.

NCD prevention and control are a worthwhile focus for India to invest its resources. A critical part of this focus will be collaboration among the public sector, private sector and civil society to combat NCDs.

The following additional features will be important for reducing the impact of NCDs:

- Robust mechanisms for data collection, data sharing and knowledge transfer
- Consistent monitoring and evaluation that targets both health and economic outcomes
- Clearing houses in which people can share and learn what works and what doesn't in various contexts
- Enlightened leadership highlighting the importance of multistakeholder collaboration for healthy living

With this report, the World Economic Forum and the Harvard School of Public Health aim to highlight current activities, as well as gaps, in addressing NCDs in India.

This report also seeks to stimulate discussion on the extensive impact of NCDs on Indian families, businesses and society. The evidence presented here provides a starting point to reorient the dialogue about investing in healthy living and NCD prevention in India, with the view that a healthy population is an important factor for sustainable growth. This is particularly important considering that India is Asia's third-largest economy, and on track to become the most populous country in the world.

The purpose of this document is to give an overview of six subject areas concerning the current landscape for NCDs in India:

1. A snapshot of the prevalence of NCDs and risk factors
2. Estimates of lost economic output due to NCDs, focusing on the negative effects of NCDs on labour supply and capital accumulation
3. A summary of the business community's concerns regarding the impact of NCDs
4. A selection of current programmes and policies being implemented in India to address NCDs and promote healthy living
5. The cost of 12 interventions, and an analysis of the health returns necessary for these interventions to deliver worthwhile returns (15% or above)
6. Guidance for programme managers in the form of a data collection checklist for ROI calculations

For the full report content and references, please consult: <http://www.weforum.org/issues/healthy-living>.

2. Background

Impact of NCDs on Economic Growth

Empirical research has established a strong relationship between economic growth and health. Ill health affects economic growth in several ways, including early retirement, negative expectations regarding employment and reduced productivity. These factors may contribute to lowering labour supply and increasing the ratio of dependents to workers.

Disease burden also increases expenditures for the health system, individuals and households. By increasing public health expenditures to treat NCDs, and reducing the amount of household taxable income by pushing ill people out of the workforce, NCDs may reduce the net availability of government resources. As a result, governments may increase tax rates to meet rising health expenditures. Doing so depresses aggregate demand, further limiting the growth potential of the economy and reducing the public sector's ability to invest in strategic areas, such as the development of physical capital and the workforce (people's skills and capacities that may be put to productive use). Treating NCDs and mental health conditions may require an ever-growing share of resources, increasing demand on the health system and thus reducing a government's ability to target other development goals, such as poverty reduction or education improvements (Ryan & Wilden, 2011).

The Indian Response

Despite the growing economic burden that NCDs represent, prevention and treatment of these conditions have long been largely underfunded and, until recently, did not occupy a central place on the global development agenda. During the 2011 High-Level Meeting (HLM) of the United Nations (UN) General Assembly, India recognized NCDs as a development issue and announced two programmes to address this challenge: the National Programme for Prevention and Control of Cancer, Diabetes, Cardiovascular Diseases and Stroke (NPCDCS) and the National Programme for Health Care of Elderly (NPHCE) (UN, 2011).

The 2011 HLM and events since then have emphasized that, if left unattended, the public health toll of NCDs could mean all but a curtailing of future economic development. At the level of the individual, NCDs can lead to poverty; and, poverty to NCDs. In the absence of a comprehensive and widely available health insurance system in low- and middle-income countries (LMICs), payment for healthcare services often entails substantial, poverty-driving out-of-pocket (OOP) spending. India's low medical insurance coverage is well documented, and OOP expenditures for healthcare are substantially higher than in other South Asian countries.



3. NCDs and Prevalence of Risk Factors in India

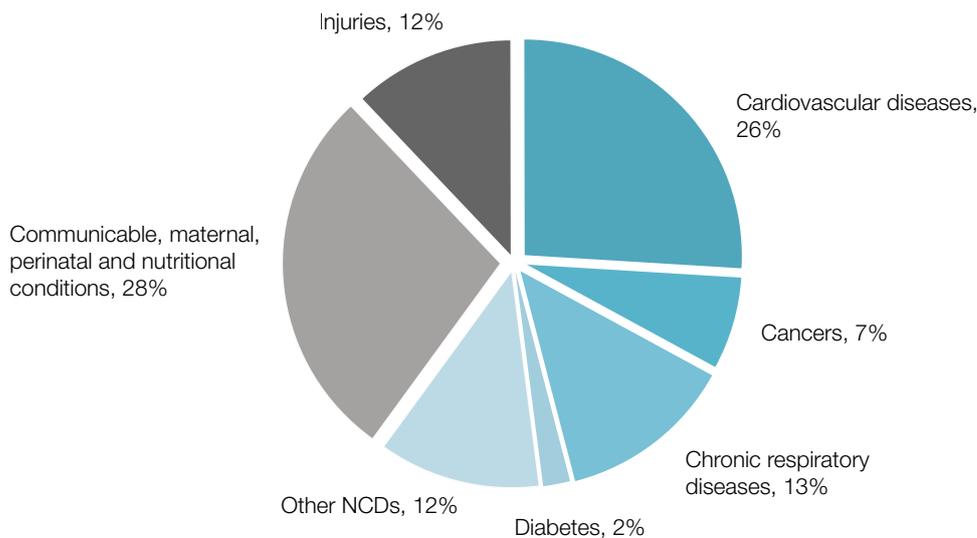
NCD Burden in India

India's high burden of communicable disease and classic "diseases of poverty" often dominate the healthcare debate. Data show, however, that NCDs also pose considerable risk to its population's health.

An estimated 60% of all deaths in India are due to non-communicable diseases (Figure 1) (WHO, 2014).

In 2010, non-communicable diseases accounted for more disability-adjusted life years (DALYs) in India than communicable diseases (approximately 235 million and 222 million DALYs, respectively) (IHME, 2013). Data from 2004 indicate that NCDs accounted for 40% of all hospital stays and roughly 35% of all recorded outpatient visits (Engelgau, Karan & Mahal, 2012). The impact of NCDs is felt not just in reduced health, but also in reduced productivity: a World Health Organization (WHO) study estimated that India will have lost \$237 billion in 2006-2015 from premature deaths due to heart disease, stroke and diabetes (WHO, 2005).

Figure 1: Causes of Death in India, 2012 (% of total)



Total deaths: 9,816,000

Source: WHO, 2014. *Noncommunicable Diseases Country Profiles 2014*

The most prevalent NCDs in India today are cardiovascular diseases, chronic respiratory diseases, cancer and diabetes. Diabetes is of particular concern; in 2012, more than 63 million people in India were living with type 2 diabetes (the most common type), earning the country the title of "diabetes capital of the world". The International Diabetes Federation (IDF) estimates that 33% of adults with diabetes in India are undiagnosed, preventing proper management of the disease (IDF, 2012; Mayo Clinic, 2013).

Mental health conditions in India, including depression, schizophrenia and bipolar disorder, also contribute heavily to its NCD burden. Estimates suggest that as many as 20 million Indians suffer from mental health conditions (National Human Rights Commission of India, 2008). Despite this number, India has only 0.25 psychiatric beds per 10,000 people; one psychiatrist per 500,000; and one psychiatric nurse per 2 million (WHO, 2005).

Prevalence of Risk Factors

NCDs are caused, in part, by underlying, modifiable risk factors, including tobacco use, harmful use of alcohol, lack of physical activity and poor diet. Among these, tobacco use is by far the most prevalent; nearly 60% of men and over 10% of women aged 15–49 report some form of tobacco use (IIPS, 2007). It is a risk factor for CVD, chronic obstructive pulmonary disease (COPD), tuberculosis and many forms of cancer; in fact, tobacco-related cancers constitute about 40% of all male cancers in India (IIPS, 2007). It is also estimated that about 10.6 million people in India are dependent users of alcohol, and therefore at heightened risk for CVD, cancer and diseases of the liver (WHO, 2008a). Meanwhile, rates of obesity, a major risk factor for CVD and diabetes, have been steadily climbing in India; an estimated 15% of females and 12% of males are either overweight or obese (IIPS, 2007). Research suggests that if Indians could adequately address these risk factors, NCD-related premature deaths would decline by 40–50% (Taylor, 2010).

Effects of Globalization and Urbanization on Risk Factors and NCDs

Globalization and urbanization are current and future drivers of NCDs (Popkin, Adair & Ng, 2012; Popkin 1998; Popkin, 1999; Allender et al., 2010; Arokiasamy & Yadav, 2013). These trends, coupled with rapid economic growth, have

impacted the country's nutritional transition, which is apparent at all levels of food processing, preparation and consumption. This transition has played out differently in urban versus rural areas. The availability of high-calorie foods is greater in urban than in rural areas, contributing to the greater burden of obesity and diabetes in cities. Other urban-rural differences exist in physical activity, which appears to be declining more in India's cities than in rural regions.

India is poised to experience significant urban growth over the next 35 years (UN, 2012). This suggests that more individuals will encounter urban risk factors for NCDs, which could contribute to an increase in disease burden and related economic losses.

NCDs in an Ageing India

Demographic changes are also driving the rise in NCDs. Due to falling fertility rates and longer life expectancies, the share of India's population aged 50 and older is projected to increase significantly, from about 16% today (roughly 190 million) to more than 31%, or approximately 506 million, over the next 35 years (United Nations Population Division, 2012). NCDs represent the main cause of mortality and morbidity among older people in both developed and developing countries, and in India in particular (Dey et al., 2012). Given the growth in share of India's elderly population, the NCD burden is also likely to increase.



4. Economic Burden of NCDs in India

The global burden of NCDs is expected to increase due to two related demographic phenomena (Bloom et al., 2011): global population growth, and an increasing older population. The latter has important implications for the burden of disease because the older age group is the most affected by illness. Studies have highlighted the potential growth in chronic disease in developing nations and its impact on population health (Kearney et al., 2005). In emerging economies like India, which rely on rapid economic transformation to reduce poverty and improve population welfare, potential threats to development are particularly important to understand.

One way of estimating the magnitude of health's effect on growth is to construct a macroeconomic model that incorporates health alongside conventional factors of production, including capital and labour. WHO's EPIC model is used to estimate the economic burden of non-communicable diseases, accounting for two channels through which health affects the level and growth rate of income per capita. The first has to do with the diversion of savings from capital investment to healthcare consumption due to NCD treatment, while the second involves the reduction in labour supply owing to NCD mortality.

Table 1 shows the results from scaling up each disease in the EPIC model to the five WHO condition categories of diabetes, cardiovascular diseases, respiratory diseases, cancer and mental health. The scaling factors reflect India's burden of disease, according to WHO (2008b). The total losses associated with physical NCDs and mental health conditions are \$3.55 trillion and \$1.03 trillion, respectively, summing to a staggering \$4.58 trillion in lost economic output in 2012-2030.

Table 1: Economic Burden of NCDs in India, 2012-2030*

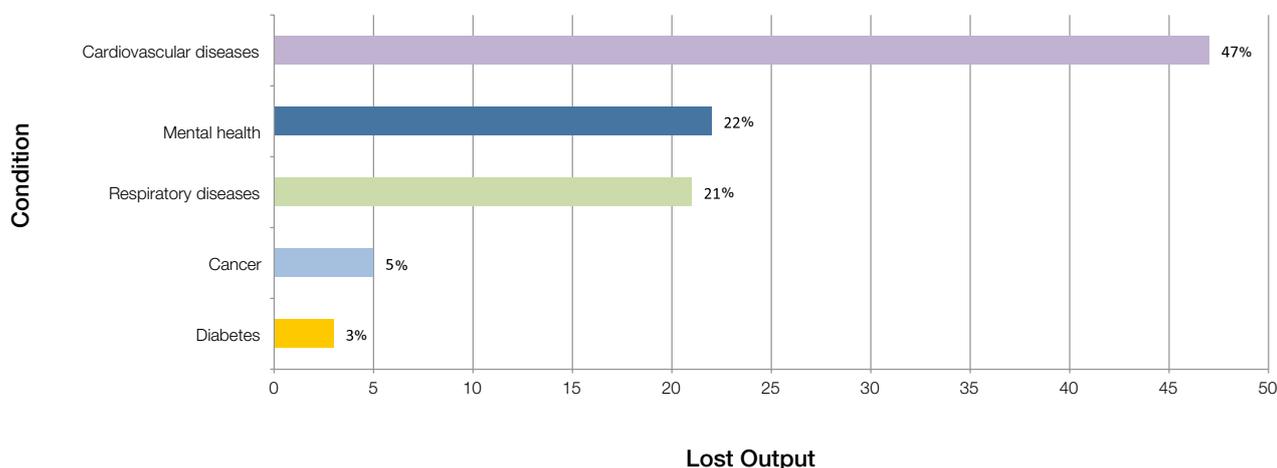
NCD category	Economic loss (in trillions of 2010 dollars)
Diabetes	0.15
Cardiovascular diseases	2.17
Respiratory diseases	0.98
Cancer	0.25
Total NCDs, excluding mental health conditions	3.55
Mental health conditions	1.03
Overall total	4.58

* Based on EPIC model.
Source: Authors

Cardiovascular diseases and mental health conditions: leading the way in economic losses

Figure 2 shows the contribution of each disease category to total loss of economic output. Mental health conditions and cardiovascular diseases are the largest categories, followed by respiratory diseases. The losses attributable to diabetes and cancer are somewhat small in comparison, which may be due in part to co-morbidities with other categories of NCDs.

Figure 2: Contribution (%) of Each Disease to Lost Economic Output for India, 2012-2030



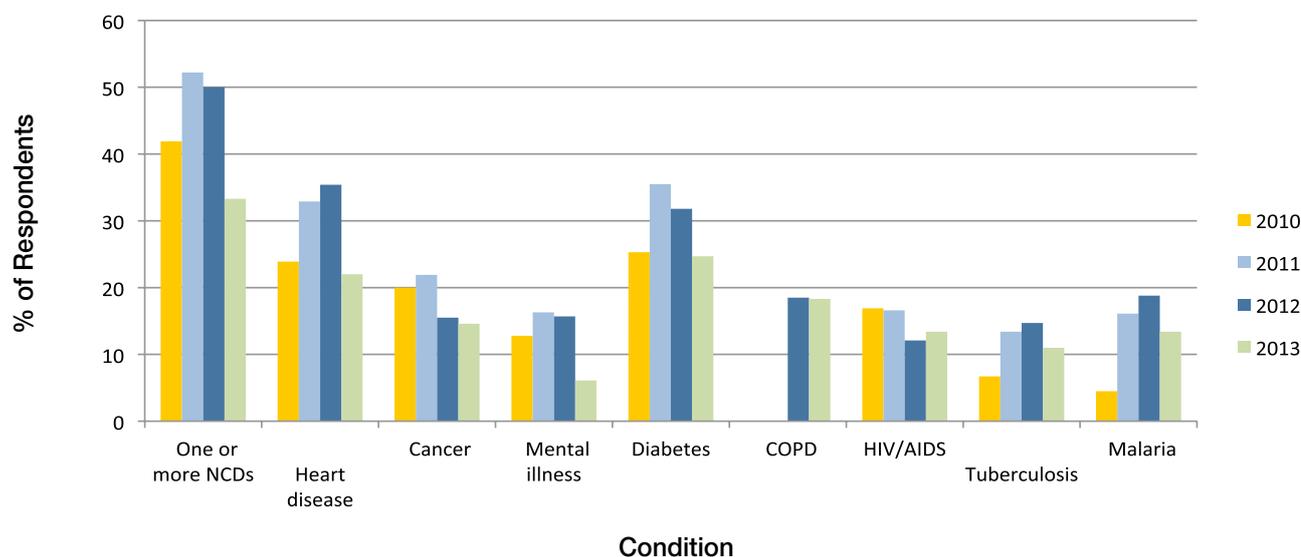
Source: Authors

5. NCD Concerns in India's Business Community

India's business community has a natural concern with non-communicable diseases: the potential negative impact of NCDs on output, revenue and profitability threaten business performance and economic growth. NCDs can impede workforce productivity by elevating rates of absenteeism, diminishing the energy and focus of workers, and depleting critical workplace skills. Rising costs of health and life insurance may also be a concern. In addition, India's business community is likely to be concerned with the impact of NCDs on the size and purchasing power of their current and prospective customer bases.

Providing evidence of this development, Indian business leaders responding to the Forum's annual Executive Opinion Survey (EOS) reported that NCDs would have a "somewhat serious to serious impact" on their companies in the next five years (Figure 3).¹ The results showed that concerns with the five-year impact of one or more NCDs were quite sizeable: at least one-third (42% in 2010, 33% in 2013) and as many as one-half (52% in 2011, 50% in 2012) reported somewhat serious to serious concerns, with levels running higher among those business leaders perceiving their country's health systems to be of low quality and not widely accessible (World Economic Forum, 2014).

Figure 3: Expectations of NCDs Seriously Impacting Business



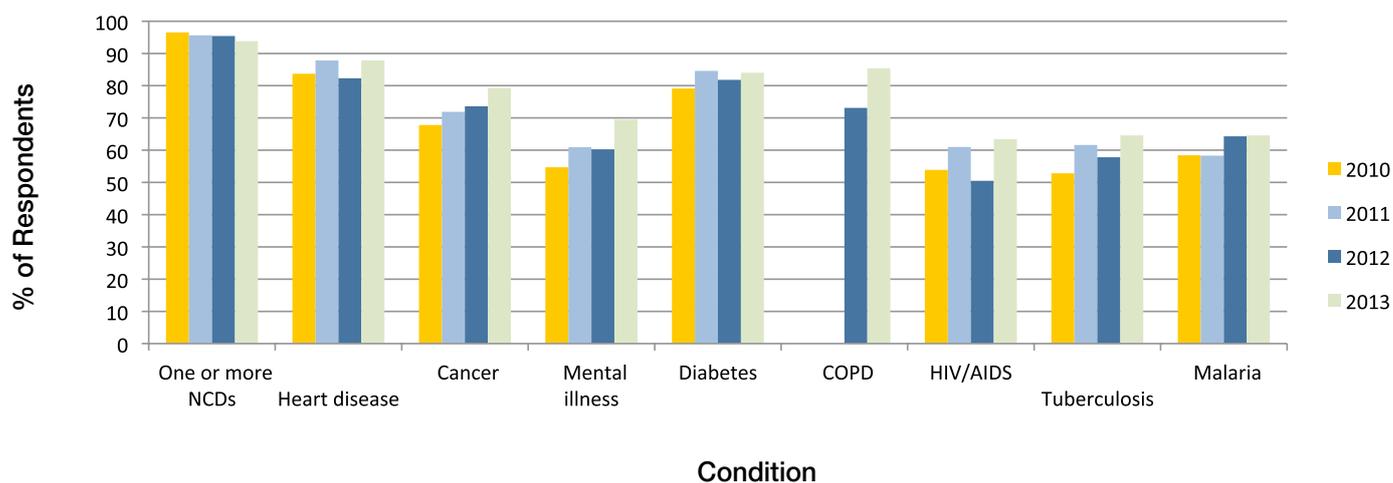
Source: World Economic Forum, 2014

Figure 4 shows the results of respondents reporting that NCDs would have at least a "moderate impact" on their companies in the next five years.² In relation to this threshold, the results indicate nearly universal concern among executives (94-97% of respondents annually in the period 2010-2013) over the five-year impact of one or more NCDs, with the highest levels of concern for heart disease and diabetes (World Economic Forum, 2014).

¹ "Somewhat serious to serious" includes responses of 1 or 2 on a scale ranging from 1 (= a serious impact) to 7 (= no impact at all).

² "Moderate" includes responses of 1 through 5 on a scale ranging from 1 (= a serious impact) to 7 (= no impact at all).

Figure 4: Expectations of NCDs at least Moderately Impacting Business



Source:World Economic Forum, 2014

Businesses may be interested in mitigating negative impacts of NCDs through workplace health programmes aimed at prevention, early detection, treatment and care.

Table 2 reports the prevalence of workplace policies and programmes related to NCD prevention and support by year for 2010-2012.³ The policies and programmes pertain to (1) smoking, (2) alcohol-free workplaces, (3) exercise, (4) mental health and (5) physical health. For all years, smoke-free workplace policies are highly prevalent among the Indian respondents' companies, followed by alcohol-free workplace policies. Least common are policies and programmes related to mental health and exercise (World Economic Forum, 2014).

³ The policy/programme questions changed between the 2010 and 2011 EOS, and the 2012 EOS. Nevertheless, the 2012 EOS data for India suggest that company health policies and programmes are met with a high level of employee engagement, participation and compliance.



Table 2: NCD Prevention and Support: Prevalence of Company Policies and Programmes, Already Established (% of Respondents)

Policy/programme	2010	2011	2012	Moderate or substantial compliance/uptake of programmes, 2012
Smoke-free	91.6	87.8	82.4	87.6
Alcohol-free	77.1	75.2	72.4	88.2
Incentives for exercise	38.3	39.4	46.7	63.3
Prevention, screening and support – mental health	52.6	50.4	58.0	79.3
Prevention, screening and support – physical health	73.7	65.1	63.7	81.5

Source:World Economic Forum, 2014

6. Addressing NCDs in India: The Costs and Returns of Interventions

Through the analysis of the costs and returns of 12 specific interventions implemented in India, this section explores what it would take for these interventions to deliver unambiguously attractive social returns on investment.

The methodology for this analysis included the following:

1. Identifying NCD-related interventions in India
2. Seeking data on these interventions to evaluate the feasibility of conducting economic analyses, including information on target population for the intervention, delivery costs, benefits (in terms of health outcomes and other outcomes, such as productivity and financial risk protection), time frame of the costs and benefits, and monitoring and evaluation
3. Screening the interventions according to the inclusion criteria
4. Conducting economic analysis

Drawing on reviews of literature, expert opinions and site visits, this initial assessment identified 33 interventions across different diseases, risk factors, life stages and settings. Of these interventions, 12 met the inclusion criteria. The process of determining which interventions to include in the analysis was heavily data driven. It relied on availability of data on an intervention's costs or benefits, or both.

Evaluating the interventions against these criteria, the research team categorized them into one of three categories:

1. Interventions with data: These interventions (category A) had data on at least one side of the equation (i.e. costs or benefits). For interventions with data on impact but not on costs, the research team sought to calculate the programme cost that would yield a favourable ROI, defined as a 15% return. Conversely, for interventions with data on cost but not on impact (e.g. an intervention in its early stages or one lacking impact measurement), the research team sought to calculate the minimum health impact that an intervention would have to produce to achieve a 15% return on the initial investment. Twelve interventions fell in this category (Table 3).
2. Interventions without data on costs and benefits, but with descriptive information: Although promising as approaches to healthy living in India, these interventions did not have data on costs or benefits due to their early stage, lack of monitoring and evaluation, or data inaccessibility. However, they did have robust information on operations, which could be helpful to programme planners. Details on these interventions are included in Appendix D of the full report.
3. Interventions left out of the report: These emergent interventions did not have enough information available to describe or conduct economic analyses, and were thus left out of the report. (Appendix C has the full list of 33 interventions, including those in this category.)



Table 3: Overview of the 12 Interventions Included in Category A

<p>1. National Programme for Prevention and Control of Cancer, Diabetes, Cardiovascular Diseases and Stroke (NPCDCS): national plans and state-level experience in Karnataka</p> <p>Health conditions: cancer, CVD, diabetes</p> <p>Settings: community, health system, policy</p>	<p>In 2008, the Government of India announced the establishment of the NPCDCS, for implementation in seven states. By focusing on the risk factors for diabetes and hypertension, the programme aims to detect these conditions at the opportune time (i.e. before serious complications set in). The NPCDCS involves training of health personnel and, through this, aims to build capacity of the existing system to recognize and treat NCDs and their risk factors (Directorate General of Health Services, 2010).</p>
<p>2. Dietary salt reduction</p> <p>Health conditions: hypertension, CVD</p> <p>Settings: community, health system</p>	<p>Of all major NCDs, CVDs are associated with the highest burden of morbidity and mortality in India, accounting for nearly 10% of all DALYs and more than 20% of all deaths in 2010 (IHME, 2013). Several wealthy nations have implemented stronger regulations on salt content in food products, and have subsequently seen lower rates of CVDs. No such restrictions are in place in India (Webster et al., 2011).</p>
<p>3. Health systems strengthening project: state-level experience in Tamil Nadu</p> <p>Health conditions: cervical cancer, hypertension, CVD</p> <p>Settings: community, health system</p>	<p>In 2007-2010, the Government of Tamil Nadu piloted two programmes aimed at prevention and control of CVDs, and early detection and control of cervical cancer. The health systems strengthening project has four main components: (1) increase access to health services by the poor, disadvantaged and tribal groups; (2) develop and pilot test interventions to address health challenges, specifically NCDs; (3) improve health outcomes, access and quality of service delivery through strengthened oversight of the public sector and engagement with the non-governmental sector; and (4) increase effectiveness of public-sector hospital services (World Bank, 2013a).</p>
<p>4. HPV vaccination: public policy for prevention of cervical cancer</p> <p>Health condition: cancer</p> <p>Settings: health system, school, policy</p>	<p>A viable low-cost approach to cervical cancer prevention in India is vaccination for HPV, the leading cause of this cancer (Farooqui & Zodpey, 2012). Presently two vaccines are licensed in India: Cervarix and Gardasil. The public sector does not currently provide the vaccine, and the private-sector cost for the series of three doses, at INR 7500 or \$126, is prohibitive for most women. As of May 2013, the two companies that make the HPV vaccine have pledged to cut the price for the world's poorest countries to less than \$5 per dose (McNeil, 2013).</p>
<p>5. Tobacco taxation: public policy response to prevent tobacco use</p> <p>Health conditions: CVD, chronic renal disease (CRD), cancer</p> <p>Setting: policy</p>	<p>Tobacco taxation is one recommended measure to help countries implement the Framework Convention for Tobacco Control (FCTC) and reduce demand for tobacco products (WHO, 2013a).</p>
<p>6. Tobacco regulation: enforcement of a complete smoking ban in public places</p> <p>Health conditions: CVD, CRD, cancer</p> <p>Setting: policy</p>	<p>In response to the ratification of the WHO FCTC in 2004, India passed a public smoking ban. Enforcement of such a ban would help reduce second-hand smoke, also known as environmental tobacco smoke, in the public setting (Goel et al., 2014; Donaldson et al., 2011). A ban on public smoking improves air quality for non-smokers and concomitantly promotes tobacco cessation among smokers (Singh et al., 2011). In turn, this legislative intervention can reduce disease, such as CVD, cancer and stroke, and death in the population.</p>
<p>7. Mobilizing Youth for Tobacco-Related Initiatives (MYTRI): school-based programme to prevent tobacco use</p> <p>Health conditions: CVD, CRD, cancer</p> <p>Settings: school</p>	<p>This school-based intervention programme to prevent tobacco use was carried out in Delhi and Chennai in 2004-2006. MYTRI involved more than 14,000 students aged 10-16 in 32 schools in a group-randomized trial design (Perry et al., 2009; Brown et al., 2012).</p>
<p>8. Kidney Help Trust of Chennai: community-based programme to address diabetes and hypertension, and prevent chronic kidney disease</p> <p>Health conditions: kidney disease, diabetes</p> <p>Settings: community, health system</p>	<p>Although renal disease is not one of the core diseases in WHO's <i>Global Action Plan for the Prevention and Control of Noncommunicable Diseases 2013-2020</i>, it is recognized as a key co-morbidity and a costly consequence, in both human and economic terms, of poorly managed diabetes and hypertension. Because most Indians cannot afford renal replacement therapy, the Kidney Help Trust of Chennai, under the direction of M.K. Mani, chief nephrologist at Apollo Hospitals, Chennai, launched a low-cost, community-level prevention programme in the surrounding villages. The programme serves a population of 25,000 in rural areas (Mani, 2005).</p>

<p>9. Indian Diabetes Prevention Programme (IDPP)</p> <p>Health condition: diabetes</p> <p>Setting: health system, community</p>	<p>IDPP presents a model for reducing morbidity and mortality from diabetes in an Indian context. In a randomized controlled trial (RCT) conducted over three years in Chennai, the IDPP identified more than 500 Indian adults aged 35-55 who had impaired glucose tolerance, a prediabetic state of hyperglycaemia. The four study arms were (1) a control arm, in which participants were given “standard healthcare advice”; 2) a lifestyle modification (LSM) arm, in which participants were advised on changes in exercise and diet based on their occupations and leisure activities, on an ongoing basis; 3) an arm in which participants were given metformin, a common anti-diabetes drug; and 4) an arm in which participants were given both LSM advice and metformin (Ramachandran et al., 2007).</p>
<p>10. Stepped Care Intervention for Depressive and Anxiety Disorders (MANAS) in Goa</p> <p>Health condition: mental health</p> <p>Setting: health system</p>	<p>From 2007 to 2009, researchers carried out an RCT in 24 primary care facilities in Goa to assess adequate care for patients suffering from mental disorders. Facilities in the treatment group used a collaborative stepped care (CSC) model of treatment, with trained lay health workers acting as case managers and overseeing all non-drug treatment in close collaboration with physicians (Patel et al., 2010).</p>
<p>11. WHO best buys: combination drug therapy for CVD</p> <p>Health condition: CVD</p> <p>Setting: health system</p>	<p>Before the UN's 2011 High-Level Meeting on the Prevention and Control of Non-Communicable Diseases, WHO identified a set of best buy interventions that are considered highly cost-effective, feasible and appropriate for control of NCDs within the constraints of LMICs' health systems. Though these best buys cover a range of NCDs, WHO recommends that India should specifically consider adopting interventions that target CVD. These include a multi-drug therapy recommended to treat people with medium-to-high risk of developing heart attacks and strokes, and treatment of heart attacks with aspirin (WHO & World Economic Forum, 2011).</p>
<p>12. Bangalore Baptist Hospital (BBH): community-level intervention for CVD prevention and management</p> <p>Health conditions: diabetes, hypertension, harmful use of alcohol</p> <p>Settings: community, technology</p>	<p>The Community Health Department of BBH focuses on approximately 35,000 people living in 50 villages around Bangalore, with a combination of four broad categories of activity: promoting health and preventing disease, strengthening government services and programmes, improving access to primary care, and developing the community. To reach these people with high-quality care, BBH, in conjunction with Mobiatrics LLC, piloted a model that combines community health workers with mobile technology to address diabetes and CVD in the community. BBH's model challenges the status quo; instead of trying to bring the villagers into the clinic, it brings healthcare to villagers, where they live and work (Cafiero, 2013).</p>

Calculating ROI

In general terms, ROI depends on the costs and associated net benefits of an investment, with appropriate adjustments for the time frame within which costs are incurred and benefits realized. As a practical matter, though, quantifying the value of any healthcare intervention is difficult and complex, and has significant data requirements. This is particularly true of interventions involving NCDs, because benefits may be realized over the course of a lifetime rather than in the short term. With this in mind, the economics of NCD interventions were analysed in terms of ROI: how will future benefits compare with initial “investments” in health, i.e. the costs of prevention, screening and treatment? Although this model requires many assumptions and represents a great simplification of the dynamic costs and benefits of any health intervention over time, it is nevertheless a useful tool and starting point from which to begin to compare different programmes and estimate future benefits.

To compare costs and benefits of a health programme, health benefits must be translated into monetary terms. The valuation of one DALY equalling one to three times the value a country's per-capita GDP, as proposed by WHO's Commission on Macroeconomics and Health, serves this purpose (WHO, 2001). In order to maintain a conservative estimate, the valuation of one DALY equalling one time the per-capita GDP was used in the analyses for this report (also keeping in mind that India's per-capita GDP is likely to increase in the future). Because these benefits will not be realized until far in the future, the standard discount rate of 3% has been applied to adjust them to their present value, accounting for the economic preference of a sum of money today over that same sum of money in the future.

Data on current interventions are limited; for many of them, data are only available for costs and not for benefits. Therefore, the ROI equation was modified to calculate the health benefit, in DALYs averted, that a programme must achieve to reap a favourable return on the initial investment. For the purposes of this report, a favourable return was defined as 15%, which is substantial but not unrealistic in an investment context.

The 12 interventions mentioned had data available on costs. Table 4 shows the number of DALYs a programme must avert over the long-term time horizon of 30 years to attain this figure. For a detailed description of ROI calculation methods used here, as well as full equations and sensitivity analyses, see the full version of this report.

Assumptions and Caveats

When examining ROI results for individual programmes, it is important to remember that the calculations are based on several broad assumptions. In addition to the assumed discount rate and time horizon, the model is vastly simplified by assuming that recipients of programme benefits will not be subject to other health conditions not covered by the intervention in question.

Furthermore, the data underlying the analyses are often restricted to specific populations or geographies, and are

not necessarily representative nationally. In addition, the figures presented in Table 4 are based on programme implementation data to date, and do not make any assumptions about scaling up a programme over time. In reality, the costs of scaling up existing or pilot interventions could reduce the cost on a per-person basis due to economies of scale. Alternatively, the costs of scaling up interventions could also rise on a per-person basis if the hard-to-reach populations require substantial investment to bring about the desired health effects.

Results: Estimated Health Benefits Needed to Achieve a 15% ROI

The DALYs averted needed to produce a 15% ROI over 30 years for selected interventions are shown in Table 4. The calculations used in the table value one DALY at India's 2013 per-capita GDP (\$1,489.20) (World Bank, 2013b) and account for a 3% discount rate.

Table 4: Health Benefit Needed to Achieve a 15% ROI over a 30-Year Period

Intervention	Programme costs (in thousand 2013 \$)	Required number of DALYs averted
1. NPCDCS	4,100,000	7,685,027
<i>NPCDCS: Karnataka only</i>	373	699
2. 15% voluntary dietary salt reduction	33	63
3. Health systems strengthening project, Tamil Nadu		
<i>Cervical cancer screening</i>	363	681
<i>Hypertension screening</i>	360	675
4. HPV vaccination		
<i>70% coverage at \$10/dose</i>	17,390	32,595
<i>70% coverage at \$25/dose</i>	144,913	271,624
<i>70% coverage at \$50/dose</i>	365,180	684,491
5. Tobacco taxation: increased rate on cigarettes and bidis	72	136
6. Tobacco regulation: Gujarat public smoking ban		
<i>Partial ban</i>	64	120
<i>Complete ban</i>	4,391	8,230
7. MYTRI	211	395
8. Kidney Help Trust of Chennai	8	15
9. IDPP (cost for 100 patients over three years)		
<i>LSM</i>	25	47
<i>Metformin</i>	25	46
<i>LSM + metformin</i>	30	57
10. MANAS	2	3
11. Best buys for CVD: four-drug regimen for primary and secondary treatment		
<i>Low-end estimate (confidence interval [CI] 95%): \$15.29/patient</i>	1,529	2,866
<i>Average estimate (CI 95%): \$56.74/patient</i>	5,674	10,635
<i>High-end estimate (CI 95%): \$104.46/patient</i>	10,446	19,580
12. BBH: community health	100	187

Source: Authors

What Do these Results Indicate?

The results in Table 4 suggest that a favourable ROI is within reach for some interventions. Data from programme evaluations can indicate if the benefit needed to achieve a 15% return is reasonably within reach, given what is known about programme performance. Mental healthcare, using a CSC model, stands out as an intervention that is likely to yield handsome returns. Programmes that target primary prevention also have the potential to deliver above-average returns. From the interventions included in Table 3, the following are judged as able to provide a high ROI (at least 15%):

Health systems strengthening project, Tamil Nadu: hypertension screening.

The programme successfully treated approximately 16,014 patients each year for hypertension (Ray & Varghese, 2010). WHO estimates that India has a prevalence of 35.2% for hypertension among adults aged 25 and older (WHO, 2013b). In 2010, India's population aged 25 and older was estimated at 612,827,772 (United Nations Population Division, 2012), implying that about 215,715,376 individuals in this age group were living with hypertension. The IHME (2013) estimates that 23,804,500 DALYs were lost to high blood pressure among adults in this age group in India in 2010, averaging to about 0.11 DALYs lost per case of hypertension, per year. Assuming that all 16,014 patients have successful blood pressure control due to the programme and thus avert illness caused by hypertension, this would result in a benefit of approximately 1,767 DALYs averted, which is well in excess of the threshold needed to achieve a 15% ROI.

HPV vaccination. Based on predictions of averted cervical cancer cases and cervical cancer deaths, as extrapolated from the IHME (2013), Goldie et al. (2008) estimate a total of 531,789 DALYs averted for their total proposed vaccine rollout scenario in India. This is well above the averted DALYs called for in the model at \$10/dose (32,595 DALYs averted for 15% ROI) and \$25/dose (271,624), but below the threshold for \$50/dose (684,491). The latest figures from the GAVI Alliance (GAVI) state that the current lowest public-sector price for HPV vaccines in developing countries is \$13/dose; GAVI can deliver the vaccines for as low as \$4.50 a dose (GAVI, 2013). While GAVI currently does not offer HPV-vaccine support in India, and a large-scale vaccination campaign there may prove costly in terms of public education (due to the recent controversy over PATH HPV vaccine trials), delivering vaccines at a cost low enough to fulfil a 15% ROI still seems highly feasible.

Tobacco taxation. Patel et al. (2011) estimate that increased taxation on cigarettes would cost approximately \$72,480 per million people per year,⁴ and would avert an additional

811 DALYs per million people, above and beyond the DALYs averted via the current taxation scenario. Patel et al. also estimate that an increased rate of taxation for bidis would not incur any additional costs above current taxation rates, and would avert an additional 1,304 DALYs per million people per year. Both of these figures are well above the 136 DALYs needed to yield a 15% ROI, suggesting that increased rates of tobacco taxation may be a feasible and cost-effective strategy for averting DALYs, especially because increasing rates would incur no marginal costs above currently existing taxation practices.

MYTRI. Based on progression models for uptake of tobacco usage among Indian youth, Brown et al. (2012) predict that the programme (one cohort, one session) will prevent about 12 students (95% CI 10.97-13.12) from becoming established smokers by age 26. They also predict a conservative 4.52 DALYs averted per "prevented" smoker for a total of 54.24 DALYs averted per cohort.⁵ This is far less than the 395 DALYs averted per cohort the model requires for a 15% ROI. However, these results are very context-specific and speculative. Because the programme is targeted to secondary school students, expanding it to many populations of at-risk youth who are no longer in school is not possible. This is especially true in rural areas, where school enrolment rates are lower, but rates of tobacco use are higher.

MANAS. Buttorff et al. (2012) estimate that patients in public facilities averted an average of about 0.02 DALYs per year, over and above those averted by patients in "baseline" programmes", through alleviation of depression and anxiety symptoms.⁶ This benefit, multiplied by 823 patients in public facilities, results in 16 DALYs averted per year, which is well above the three called for in the ROI analysis to achieve a 15% ROI. As with the other interventions, these results are context-specific and, importantly, necessitate some pre-existing mental health delivery structure that can be improved upon, which does not exist in all populations.

⁴ This is also the estimated cost for current rates of taxation, so no additional cost is incurred in this model.

⁵ In their original report, the authors calculate benefits in quality-adjusted life years (QALYs) gained, an alternative measure to DALYs averted, which measure health benefits in terms of years of healthy life. For the purposes of our analysis, we value one QALY gained as equivalent to one DALY averted (a country's per-capita GDP value).

⁶ The original paper also uses QALYs gained rather than DALYs averted.

7. Principles for Measuring ROI and Collecting Data

Without knowing if a programme is delivering benefits that exceed the investment made in it, programme managers will have a difficult time making the case for continued investment in and scaling up of their programme.

Many potential interventions to address NCDs exist, and they can result in positive health and economic impacts. To guide programme managers in collecting data that will allow subsequent ROI analysis, several general principles should be considered:

1. Measure an intervention's economic costs.

Programme costs can typically be categorized as cost of materials, human resources and other overhead.

2. Measure an intervention's benefits.

The benefits include the change in health status, healthcare costs and increased productivity that result from a programme.

3. Set the time frame required to realize benefits.

As NCDs can take decades to develop, it is crucial to understand the time frame for benefits to accrue.

4. Establish a way to collect data for the specific programme.

Directly measured costs and benefits are the ideal, and randomizing individuals or groups to intervention and control groups is an excellent, though not always feasible, method of gaining a clear picture of the benefits attributable to the intervention.

5. Be careful about generalizing.

Good analyses will pay attention to uncertainties, quality of data, durability of the effects of the intervention and multiple outcomes.



8. ROI Data Collection Checklist

The following checklist can be used as an aid in designing and implementing NCD and healthy living programmes:

Checklist: ROI Data Collection

- 1. Identify the intervention's economic costs:
 - a. Cost of materials
 - b. Cost of personnel
 - c. Value of time of patients participating in the intervention
 - d. Other overhead
- 2. Identify the intervention's intended outcomes and benefits. Divide these into different categories that can be converted into a monetary benefit:
 - a. Health gains (e.g. cases of a disease, death rates, life expectancy, DALYs averted)
 - b. Medical care savings (costs of diagnosis, treatment and care)
 - c. Productivity savings (lost wages due to missed work)
- 3. Establish the time frame needed to achieve/see these outcomes.
- 4. Identify other indicators to measure along the way to the desired outcome (e.g. hypertension, prediabetes, cervical lesions), and the activities needed to achieve them (e.g. screening, education, distribution of testing strips). This will help in crafting programme activities that will lead to the desired outcome.
- 5. Identify a control group. If this is not possible, conduct a before-after study in the same group.
- 6. Collect baseline data to measure outcomes, pre-intervention.
- 7. Collect outcome data to measure those benefits attributable to the programme.
- 8. Exercise caution in generalizing results.



9. Conclusions and Final Message

NCDs are a large and growing challenge for India's future economic growth and its population's well-being. Business leaders and the government feel the threat of NCDs, and the country has already moved to address it via public policy initiatives (e.g. NPCDCS). As India moves to increase public health spending, more information is needed to guide decisions on resource allocation. **This summary document attempts to provide information on NCDs and related interventions, highlight areas for improvement, and identify where India gets a favourable ROI in healthy living.**

Primary prevention of NCDs, built upon a strong healthcare foundation and early screening, is an area for investment. Interventions that focus on screening (in the case of hypertension), vaccination (in the case of HPV) and prevention of tobacco use were assessed as promising in terms of feasibility of achieving a 15% ROI. This is in line with other studies that have deemed these interventions cost-effective. Because data show that returns can be particularly high for prevention programmes (whose benefits are seen in

the long run), **elected officials must take a concerted long-term view so that the economic benefits can be seized in the future.**

While school-based interventions have serious potential in India, the country must also consider other settings to deliver NCD and healthy-living interventions.

Expanding the focus to the community, through interventions such as those being delivered by the Kidney Help Trust of Chennai and BBH, is necessary to reach Indians where they live and work.

In conclusion, India is a heterogeneous country, and solutions to the challenge of NCDs must be tailored to the local context. A comprehensive set of solutions must be deployed by multiple stakeholders to put India on the path to achieving the nine global targets for prevention and control of non-communicable disease as laid out by the WHO Global Action Plan for the Prevention and Control of Noncommunicable Diseases 2013-2020.



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