The world has experienced a public-health miracle in the past half century, as cleaner water, new health technologies, better diet and a host of other improvements have sharply reduced mortality and extended life expectancy in poor countries by as much as 20 years. A substantial portion of those gains has been realized through improvements in infant and child survival. However, the increase in income that was both a cause and effect of this miracle brought with it a new and ironic threat: a steep rise in non-communicable diseases (NCDs) like heart ailments and cancer.

These diseases, linked to aging populations and greater affluence, have replaced infectious diseases and malnutrition as the dominant causes of ill health and death in much of the world. As urbanization and population aging progress in low- and middle-income countries, NCDs will increasingly come to the forefront, causing incalculable misery, straining government budgets and undermining productivity.

China and India, home to more than a third of the world’s population, are, by virtue of sheer size and pace of growth, leaders in this transition. If NCDs are not addressed head-on, they could materially impinge on economic growth and undermine these countries’ prospects for achieving Western levels of prosperity.

**FIRST, SOME FACTS**

NCDs are typically chronic in nature and develop over long periods. Four of them – cardiovascular diseases, cancer, chronic respiratory diseases and diabetes – are the main targets for global action. One big reason is that they
share a set of modifiable risk factors: unhealthy diet, physical inactivity, smoking, excessive use of alcohol and failure to detect and control intermediate risk factors like high blood pressure, high cholesterol, high blood sugar and excess weight. The big four already account for 78 percent of all deaths in China and 42 percent of all deaths in India. Arguably more important (since everybody dies of something), they cause 44 percent and
22 percent of disability-adjusted life-years in China and India, respectively. DALYs – the combination of years lived with serious illness and those lost due to premature death – are a standard measure of the direct health burden of a disease.

It is worth noting, too, that other chronic health conditions also take a hefty toll in both countries; musculoskeletal disorders such as arthritis, as well as serious mental disorders are major contributors to disability. Indeed, in 2010, musculoskeletal conditions represented four of the top 10 causes of disability in China (as measured by years lived with disability) and accounted for more DALYs than diabetes or cancer in India. In that same year, mental health conditions accounted for seven of the top 20 causes of disability in China and six of the top 20 in India.

Some NCDs lead to others and create clusters of co-morbid conditions. (For example, diabetes can lead to kidney failure and blindness.) Mental health conditions are often co-morbid with each other (anxiety and depression, for instance), as well as with other NCDs (like cancer and diabetes).

Taken as a whole, NCDs already account for a significant share of deaths and more DALYs in India than do communicable diseases. And in China, which has reduced the number of deaths from diarrhea, pneumonia and bronchitis in children under age 5 by 90 percent since 1990 and cut deaths from tuberculosis and meningitis by 73 percent and 76 percent, respectively, NCDs are responsible for seven times more DALYs than are communicable diseases.

The strides that India has made against infectious diseases has initiated its epidemiological transition. However, malnutrition and a lack of commitment to improving the health of women and children help sustain India’s “triple burden” of disease. That is, India must contend with a rising burden of NCDs without having resolved major challenges in infectious disease or injuries. More than 70 percent of the country’s women and children suffer from malnutrition. This is occurring at the same time that NCDs are affecting women of all ages. Just one example: the age-adjusted incidence of cervical cancer in India, at 22 cases per 100,000 women, far
exceeds the global average of 14. India, with 17 percent of the world’s population, registers nearly 30 percent of cervical-cancer deaths.

To be sure, China is hardly perfect on this score, especially when it comes to girls’ health. Indeed, for most of this century, China and India were the only large countries in the world where, among children under 5, girls were more likely to die than boys. Cultural preference for male children in China and India has led to female infanticide, as well as a host of other discriminatory practices affecting the girls who are allowed to survive — everything from poorer nutrition to poorer access to health care. Recent data indicate improvements in China. Still, its rate of female child deaths — at 13.1 deaths per 1,000 live births — is more than twice the rate in high-income countries.

The consequences of neglecting in utero and early-childhood health are bound to dog both countries for many decades to come. The Barker Hypothesis — that adverse experiences during gestation and early life set an individual up for a variety of health problems including cardiovascular disease and diabetes — is particularly important in this context. The threat of NCDs thus looms even larger in China and India than one would project from the experience of the advanced industrialized countries, where early-childhood development has been a priority for policymakers.

UNDERSTANDING THE DRIVERS

Both modifiable and non-modifiable factors are driving health in China and India. The primary non-modifiable risk factor in both is aging — a reality that certainly seems better than the alternative. The primary modifiable risk factors in these countries are changes in what people eat, the extent to which they are physically active, and their consumption of alcohol and tobacco. Meanwhile, urbanization, while not a direct driver of NCDs, is spurring riskier lifestyles.

• AGING

In China, reductions in births per female and health-driven increases in longevity have led to rapid aging of the overall population. India is on a similar path, although it is about two decades behind in the demographic cycle. Life expectancy in China is currently 75 years, and is projected to rise to 80 by 2050. Life expectancy in India is 66 years, and likely to reach 73 by 2050. Fertility has dropped by about two-thirds in China since 1950, and by half in India in the same period. As a result, the share of individuals 60 or older is projected to increase substantially by mid-century, from approximately 15 percent in China today (200 million people) to 33 percent in 2050 (about 450 million people), and from about 8 percent in India (roughly 100 million people) to over 18 percent (290 million people). Meanwhile, the number of people who are very old (and thus very expensive to treat when they fall ill)
will rise accordingly. The share of people 80 or older will triple (to 7 percent) in China and double (to 2 percent) in India.

While aging alone increases the risk of NCDs, it is important to note that China and India are also experiencing a substantial and rising burden of early-age NCD deaths. Around 60 percent of NCD deaths in India and 35 percent in China involve people under the age of 70, in contrast to fewer than 30 percent in much of Western Europe. In addition, 23 percent of male NCD deaths in China and 38 percent in India are of men younger than 60. For women, these figures are 17 percent and 32 percent, respectively.

**Behavioral Changes**

Tobacco use, harmful alcohol use, poor diet and sedentary lifestyles and occupations have all risen steadily over the past 30 years in both China and India.

Overall, India fares better than China in terms of modifiable NCD risk factors, partly because India’s population is younger and poorer than China’s. India has a lower prevalence of most risk behaviors, particularly smoking and physical inactivity, as well as a lower prevalence of biomarkers for future disease such as high blood pressure and cholesterol. Tobacco is used at alarming rates in both countries, however. China is home to the world’s largest number of smokers, while India is home to the world’s largest number of smokeless (chewing) tobacco users.

Tobacco, of course, causes serious health problems, ranging from respiratory diseases to cancer. In fact, smoking is the third largest cause of ill health (as measured by DALYs) in both China and India. While cigarette consumption rose sharply among Chinese men from 1952 to 1996, it has since stabilized (albeit, at a high rate). But many of the consequences – cancer and chronic respiratory diseases – do not show up for many years; hence the incidence of smoking-related NCDs is on a slow (but certain) fuse in China.

In India, tobacco consumption takes many forms. Beedi smoking accounts for about half of Indian tobacco consumption. A beedi (sometimes spelled bidi) is tobacco, often flavored, rolled in a leaf and smoked without a filter. Beedis may be more harmful than conventional cigarettes, because they deliver more nicotine, carbon monoxide and tar. Indians consume tobacco in other forms as well, including flavored chewing tobacco called gutkha. Data from India’s National Family Health Survey show that among those aged 15 to 49, 57 percent of men and 11 percent of

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**PORTION OF POPULATION WITH NCD RISK FACTORS IN INDIA AND CHINA, 2011**

<table>
<thead>
<tr>
<th>RISK FACTORS</th>
<th>CHINA MEN</th>
<th>CHINA WOMEN</th>
<th>CHINA TOTAL</th>
<th>INDIA MEN</th>
<th>INDIA WOMEN</th>
<th>INDIA TOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Daily tobacco smoking</td>
<td>49.3%</td>
<td>2.1%</td>
<td>26.3%</td>
<td>25.1%</td>
<td>2.0%</td>
<td>13.9%</td>
</tr>
<tr>
<td>Smokeless tobacco use</td>
<td>0.7%</td>
<td>0.0%</td>
<td>0.4%</td>
<td>32.9%</td>
<td>18.4%</td>
<td>25.9%</td>
</tr>
<tr>
<td>Overweight (BMI&gt;25kg/m²)</td>
<td>25.5%</td>
<td>25.4%</td>
<td>25.4%</td>
<td>9.9%</td>
<td>12.2%</td>
<td>11.0%</td>
</tr>
<tr>
<td>Obese (BMI&gt;30kg/m²)</td>
<td>4.7%</td>
<td>6.7%</td>
<td>5.7%</td>
<td>1.3%</td>
<td>2.4%</td>
<td>1.9%</td>
</tr>
<tr>
<td>Physical inactivity</td>
<td>29.3%</td>
<td>32.0%</td>
<td>30.6%</td>
<td>10.8%</td>
<td>17.3%</td>
<td>14.0%</td>
</tr>
<tr>
<td>Raised cholesterol</td>
<td>31.8%</td>
<td>35.3%</td>
<td>33.5%</td>
<td>25.8%</td>
<td>28.3%</td>
<td>27.1%</td>
</tr>
<tr>
<td>Raised blood glucose</td>
<td>9.5%</td>
<td>9.3%</td>
<td>9.4%</td>
<td>10.0%</td>
<td>10.0%</td>
<td>10.0%</td>
</tr>
<tr>
<td>Harmful use of alcohol</td>
<td>6.9%</td>
<td>0.2%</td>
<td>3.8%</td>
<td>3.5%</td>
<td>0.4%</td>
<td>2.0%</td>
</tr>
<tr>
<td>Raised blood pressure</td>
<td>40.1%</td>
<td>36.2%</td>
<td>38.2%</td>
<td>33.2%</td>
<td>31.7%</td>
<td>32.5%</td>
</tr>
</tbody>
</table>

**Source:** World Health Organization, Global Adult Tobacco Survey 2008-2010

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women use tobacco in some form.

Excessive alcohol consumption, sharply on the rise in China, has been linked to cardiovascular diseases, cancer, mental disorders and diseases of the liver. Chinese adults drink 12 times as much as they did in 1952, while close to 7 percent of men exhibit alcohol-linked risk factors for NCDs. The comparable number for India is 3.5 percent. (Use by women remains relatively low in both countries.)

As we know all too well, lack of physical activity and unbalanced, high-calorie diets promote weight gain. In China, the big culprits on the diet front are increased consumption of meat and oil; in India, the belt-busting honor goes to sugar and dairy fat. Roughly 25 percent of both men and women in China are overweight or obese, while 15 percent of women and 12 percent of men in India are. Obesity is, of course, a risk factor for cardiovascular disease and diabetes and can exacerbate symptoms of chronic obstructive pulmonary disease, like emphysema and bronchitis.

**URBANIZATION**

The aforementioned behavioral changes are related to two major societal changes: increased income and urbanization. Urbanization, in particular, plays an important role in the rise of NCDs. First, the availability of high-calorie processed foods is greater in urban areas than in rural ones, contributing to the greater burden of obesity and diabetes in cities. Urbanization has also ushered in a dramatic shift in physical activity. The transition from work that requires heavy physical labor, like agricultural jobs, to work that requires less energy expenditure (like desk-based jobs in customer-service call centers) has contributed to declines in physical activity.

Data from the China Health and Nutrition Survey show that changes in occupation are the greatest sources of overall declines in physical activity for Chinese men in the past two decades. Furthermore, the urban population relies on motorized transport much more than the rural population does. In cities, rapid growth and lack of planning have resulted in a dearth of secure sidewalks and green spaces, and economic growth in cities has made technology – and, by extension, sedentary recreation such as television viewing and video game playing – more accessible. In both countries, air pollution (indoor and outdoor) is also a significant risk factor for NCDs.

India, somewhat behind China in this regard, is poised to experience significant urban growth over the coming decades. This suggests that more individuals will encounter urban risk factors, compounding the NCD burden and related economic losses.

**THE NCD-DEVELOPMENT NEXUS**

NCDs are not just a personal (and familial) burden, but also a societal one. The relationship between health and economic growth is well established. While the traditional view has always been that countries get healthier as they grow richer, research conducted over the past two decades has elucidated the pathway that runs the other way – from health to economic development.

According to the Disease Control Priorities Project, reductions in adult mortality were responsible for approximately 11 percent of economic growth in low- and middle-income

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**DEATHS IN CHINA AND INDIA ATTRIBUTED TO SELECTED RISK FACTORS, 1990 AND 2010**

<table>
<thead>
<tr>
<th>RISK FACTORS</th>
<th>CHINA 1990</th>
<th>CHINA 2010</th>
<th>INDIA 1990</th>
<th>INDIA 2010</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tobacco smoking</td>
<td>12.75%</td>
<td>16.44%</td>
<td>7.65%</td>
<td>10.14%</td>
</tr>
<tr>
<td>Alcohol use</td>
<td>4.44%</td>
<td>4.62%</td>
<td>2.54%</td>
<td>3.52%</td>
</tr>
<tr>
<td>High blood pressure</td>
<td>16.60%</td>
<td>24.60%</td>
<td>6.85%</td>
<td>10.79%</td>
</tr>
<tr>
<td>High BMI</td>
<td>1.67%</td>
<td>4.37%</td>
<td>0.50%</td>
<td>1.53%</td>
</tr>
<tr>
<td>High sodium</td>
<td>7.06%</td>
<td>10.18%</td>
<td>2.43%</td>
<td>3.84%</td>
</tr>
<tr>
<td>Physical inactivity</td>
<td>Not measured</td>
<td>5.97%</td>
<td>Not measured</td>
<td>4.39%</td>
</tr>
</tbody>
</table>

**SOURCE:** Institute for Health Metrics and Evaluation
countries from 1970 to 2000. This reflects the higher productivity of healthier workers, higher savings rates in healthier populations and the fact that healthy populations are magnets for foreign direct investment along with the trade and technology that go with it. In emerging economies, this relationship is especially important, as the countries are seeking to sustain rapid economic development against the headwinds of NCDs.

NCDs affect growth in multiple ways. Most obviously, they reduce the supply of labor and redirect resources from productive investments to health care consumption, draining public and private budgets while shrinking the tax base. Moreover, chronic disease reduces the productivity of workers on the job, raising business costs and reducing competitiveness. In surveys, executives around the world have expressed concern that one or more NCDs would affect their businesses in the next five years. Indeed, the concerns of Chinese and Indian executives about NCDs are greater than their worries about HIV, tuberculosis and malaria.

**ADDING UP THE BILL**

There are three main techniques for estimating the economic impact of disease. The cost-of-illness (human-capital) approach combines direct costs like medical care and travel costs with indirect ones like the value of production lost from reduced work hours. The value-of-statistical-life approach is based on the application of “willingness-to-pay” methods, in which the estimate follows from how much people would be willing to pay – say, by installing smoke alarms – to avoid the chance of dying.

Value-of-statistical-life models thus complement cost-of-illness estimates, because they capture the value of non-market production and consumption, non-labor income, leisure time and any premiums attached to
the avoidance of pain and suffering – although they do not include health care costs that are paid by the government. The third approach is to construct a macroeconomic growth model that incorporates health alongside technology and other factors of production, like physical capital and labor.

We use the World Health Organization’s EPIC model, a macroeconomic model introduced by the economists Dele Abegunde and Anderson Stanciole, to estimate the economic burden of NCDs in China and India. This model takes account of two channels through which health affects the level and growth of income. The first estimates the consequences of the diversion of savings from investment to NCD treatment, while the second estimates the reduction in labor supply due to premature NCD mortality. Our calculations put the potential cumulative losses to China’s and India’s economies from 2012 to 2030 at $28 trillion and $6 trillion respectively.

In both countries, cardiovascular diseases and mental health conditions present the greatest economic threats, followed by respiratory diseases and cancer. China’s losses far exceed those of India’s because the impact of lost labor and physical capital is larger in higher-income countries.

**APPORTIONING THE PAIN**

The EPIC model permits estimates of the aggregate cost of NCDs, but does not explain how the burden is divided. The best evidence available suggests that most of it falls on the ill and their families. Michael M. Engelgau of the National Center for Chronic Disease Prevention and Health Promotion at the Centers for Disease Control and Prevention and his co-authors looked at household spending patterns in India, tracking the proportion of out-of-pocket spending attributable to NCDs in 1995 and 1996, and again in 2004. They found that the share of out-of-pocket spending rose from 32 percent to 47 percent, with richer households allocating a larger portion to NCD care than poorer households did, probably because wealthier households seek more or better care.

Engelgau and his co-authors also found that hospitalizations for NCDs were more likely to lead to catastrophic expenditures and put households at greater odds of falling into poverty than were hospitalizations for communicable diseases. This impoverishing power of chronic disease was seen across households of different income. Ye Li of Harbin Medical University and several colleagues report similar patterns in China. In spite of a higher rate of health insurance coverage in China than in India, out-of-pocket payments remain a barrier to care for many in China.

Recent data from the Longitudinal Aging Study of India shed further light on the relationship between aging and NCDs. Fully 87 percent of respondents reported getting
C H R O N I C D I S E A S E

money from family members to pay for medical treatment; this holds true across demographic groups and disease types. Since the older adults in the study were mostly dependent on kin networks to provide financial support, it is likely that at least some individuals’ ability to pay for treatment is tenuous and turned on family circumstances. An aging India, whose population is growing more susceptible to NCDs, is thus likely to put added economic stress on households, extended family networks and health care delivery systems.

Evidence from China suggests that in spite of the country’s efforts to reign in health care expenses and expand insurance coverage in recent years, personal finances are an impediment to adequate care for NCDs for many. One study concluded that rural patients discontinued treatment for NCDs at twice the rate of urban patients, due to the high cost of treatment.

T U R N I N G T H E T I D E

In May 2012, the member states of the World Health Organization agreed to seek a 25 percent reduction in mortality from NCDs among people aged 30 and 70 by 2025. WHO has also proposed actions that countries can take to achieve that goal. They range from policy changes (such as higher tobacco taxation) to health system efficiencies, such as screening for cervical cancer and increased access to essential medicines and technologies. WHO has also identified a set of “best buys” for NCD prevention and control – low-cost, high-impact actions to address NCD prevention, early detection and care in low- and middle-income countries.

• PREVENTION

From better maternal and neonatal health all the way to promoting healthy aging, there is ample opportunity for China and India to make strides against NCDs. Curbing tobacco tops the list. China, alas, has made little progress in promoting smoke-free environments to protect against secondary exposure. The only smoke-free spaces are on public transport; workplaces, restaurants and even health care facilities remain unprotected. In addition, smoking-cessation aids (like nicotine-replacement therapy) are not covered by health insurance. India has made some progress in the arena of smoke-free spaces, but enforcement is lax. And the country has yet to use higher taxation on beedis and smokeless tobacco as a deterrent to consumption.

On other fronts, China and India need to focus on expanding access to the human papillomavirus (HPV) vaccine and on improving diet. As China and India continue to grow and urbanize, they need to pay attention to providing environments for people to safely engage in physical activity – sidewalks and green spaces are just two of the possibilities. Finally, with terrible air quality in cities, China and India need to address sources ranging from vehicle emissions to industrial pollution.

• EARLY DETECTION

Early detection could make a significant difference. For example, the International Diabetes Federation estimates that, in 2013, about half of China’s approximately 98 million cases of Type 2 diabetes and India’s 65 million cases went undiagnosed, making eventual treatment more expensive and prognosis more guarded. Pap smears can prevent cervical cancer at low cost. Likewise, early detection of hypertension and diabetes and treatment with lifestyle changes and cheap drugs can prevent strokes, heart attacks, kidney failure and blindness.

Of course, detection only matters if it leads to treatment and/or lifestyle changes. But preliminary results from a community-level intervention in India suggest that it does, indeed,
make a significant difference, most importantly by preventing the onset of renal failure.

• TREATMENT

For those who already have NCDs, access to treatment is crucial for minimizing the associated economic and personal costs. There are some straightforward, highly cost-effective options available, including aspirin for people who have had heart attacks. Access to essential medicines, including insulin, chemotherapy and other life-saving drugs, should also be expanded. Mental health care is an essential piece of the puzzle and both China and India have recently passed laws governing aspects of mental health. China’s law is aimed at expanding access to mental health services, while India’s is meant to protect the rights of those with mental illness and to integrate mental health care into general care at all levels.

• INFRASTRUCTURE

Institutional capacity is a crucial part of both preventing and controlling NCDs. And it is unclear whether either country has the capacity (measured by organization, personnel and budgets) to deliver – a problem that will become more pressing as their populations age. Health care professionals will not only have to integrate NCDs into their practices, but the system will also have to deal with issues such as dementia and visual-acuity problems at levels never before seen in these countries.

A WORK IN PROGRESS

While China and India have made notable headway in health over the past half century, they are facing daunting new demographic and epidemiological realities. Both have substantially lessened premature mortality from infectious diseases. But urbanization and greater affluence have led to NCD-inducing behavior in abundance. Risky activities are on the rise, even as air pollution is compounding the burden of chronic respiratory disease.

That said, minimizing the cost of NCDs through prevention and treatment is easier prescribed than applied. It has proved an uphill battle even in advanced industrialized countries, which acknowledged the issues earlier and have far greater resources at their disposal. Tackling NCDs in China and India will thus require a wide range of stakeholders to work together productively – government agencies and nonprofit organizations, of course, but also private interests. In fact, the cooperation of the private sector will be critical to dissemination of technologies to prevent, diagnose and treat NCDs, to market healthier products and to guide people toward food choices that are simultaneously healthy and palatable.

But with great challenges go great prizes. Thanks to societal aging, the cost of NCDs will be high no matter what; unless the issue is given top priority, it will be utterly staggering. The EPIC model predicts cumulative losses in output between 2012 and 2030 equal to twice the current GDP of China, and close to one-and-a-half times that of India. China and India – currently home to more than 2.5 billion people – simply cannot afford to sit back and watch that happen. Effective action would, of course, be costly, but far less costly than the alternative.

THE COST OF NCDS IN CHINA AND INDIA
ESTIMATED LOSS, 2012–30, $2010, TRILLIONS

<table>
<thead>
<tr>
<th></th>
<th>China</th>
<th>India</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diabetes</td>
<td>$0.49</td>
<td>$0.15</td>
</tr>
<tr>
<td>Cardiovascular disease</td>
<td>$8.25</td>
<td>$2.25</td>
</tr>
<tr>
<td>Respiratory disease</td>
<td>$5.71</td>
<td>$1.17</td>
</tr>
<tr>
<td>Cancer</td>
<td>$3.97</td>
<td>$0.31</td>
</tr>
<tr>
<td>Mental health</td>
<td>$9.43</td>
<td>$2.28</td>
</tr>
<tr>
<td>Total</td>
<td>$27.84</td>
<td>$6.15</td>
</tr>
</tbody>
</table>

source: NBER Working Paper No. 19335