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## The macroeconomic impact of non-communicable diseases in China and India: Estimates, projections, and comparisons

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## ABSTRACT

This study provides estimates of the macroeconomic impact of non-communicable diseases (NCDs) in China and India for the period 2012–2030. Our estimates are derived using the World Health Organization's EPIC model of economic growth, which focuses on the negative effects of NCDs on labor supply and capital accumulation. We present results for the five main NCDs (cardiovascular disease, cancer, chronic respiratory disease, diabetes, and mental health). Our undiscounted estimates indicate that the cost of the five main NCDs will total USD 23.03 trillion for China and USD 4.58 trillion for India (in 2010 USD). For both countries, the most costly domain is cardiovascular disease. Our analyses also reveal that the costs are much larger in China than in India mainly because of China's higher and steeper income trajectory, and to a lesser extent its older population. Rough calculations also indicate that WHO's best buys for addressing the challenge of NCDs are highly cost-beneficial.

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## Introduction

Previous research has documented the impact of non-communicable diseases (NCDs) worldwide, in terms of avoidable deaths (Marrero et al., 2012), disability (Murray et al., 2012a,b; Salomon et al., 2012), and economic impact (Abegunde et al., 2007; Bloom et al., 2011b,c). Studies have highlighted the potential increase in chronic disease in developing and emerging nations and the overall impact on population health that this could have (Kearney et al., 2005). In fact, NCDs are responsible for 65.5 percent of all mortality (Lozano et al., 2012), and account for 54 percent of healthy life years lost, as measured by Disability-Adjusted Life Years (DALYs) (Murray et al., 2012b). Differentials in health-related behaviors and outcomes represent an important component of disparities

between the economic well-being of populations, both across countries and over time (Bloom et al., 2004; Bloom, 2011a; Becker et al., 2005). A comparison of India and China offers a good example. The economies of both countries have undergone significant changes in terms of demographic and economic structure (Bloom et al., 2010); however, recent estimates suggest that health and disability may represent non-trivial impediments to further economic growth.

The global burden of non-communicable diseases is expected to increase as a result of two related demographic phenomena (Bloom, 2011a; Bloom et al., 2011b), first the rise in global population, and second the growth in the share of the older population. This is particularly the case for certain emerging nations, such as China and India. Currently 5.5 percent of India's population and 9.5 percent of China's is aged 65 or older; however, this will increase to 9.2 percent and 19.5 percent, respectively, by 2035 (United Nations Department of Economic and Social Affairs Population Division, 2013). This has important implications for the burden of disease because this age group is the most affected by illness (Bloom et al., 2011b; Dey et al., 2012; National Sample Survey Organisation, 2006). These trends have particularly impor-

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tant implications for emerging nations, which rely on rapid economic transformation to reduce poverty and improve population welfare.

Disease burden can impact economic growth and national income through a number of different pathways. For example, poor health is associated with early retirement (Dwyer and Mitchell, 1999), negative expectations regarding employment (McGarry, 2004), and reduced productivity (Lopez-Casasnovas et al., 2005). These factors may contribute to lowering labor supply and increasing the ratio of dependents to workers.

By increasing public health expenditure to treat NCDs, and reducing taxable household income by pushing ill people out of the workforce, NCDs may reduce the net availability of government resources. As a result, limited fiscal capacity could compel governments to increase tax rates to meet rising health expenditure, which in turn would depress aggregate demand and reduce the public sector's ability to invest in strategic areas. Increased health expenditure also impedes the accumulation of physical and human capital (for example, through reductions in investment in education), depressing the potential for economic growth. In addition, the types of conditions that affect the health of aging populations may require an ever-growing share of resources, thus reducing a government's ability to target poverty reduction.

Existing empirical research has established a strong relationship between economic growth and health, including in China and India (Bloom et al., 2010), which likely reflects causality running from health to economic growth (Bloom et al., 2004; Bloom and Fink, 2014; Bloom et al., 2014), as well as from the longer-understood effect of economic growth on improved health. The reframing of health as a benefits-generating investment emerged from the landmark 1993 World Development Report *Investing in Health*, as well as a multiplicity of academic and popular pieces, including the work of the Commission on Macroeconomics and Health (The World Bank, 1993; World Health Organization, 2001). The recent Lancet Commission on Investing in Health reviewed the progress made in the past twenty years and proposed a new agenda for investing in health. The hallmark of the 2013 Lancet Commission report is the concept of “grand convergence”—that, with the right investments, substantial gains in health which would dramatically reduce disparities can be achieved by 2035 (Jamison et al., 2013). Jamison and colleagues project that health disparities between low-, middle-, and high-income countries could be reduced and ten million lives saved by adopting a specified set of health and policy interventions. The earlier work on understanding health as an instrument of economic growth paved the way for an entire body of research on the economic impacts of health, which is the premise that provides the jumping-off point for this study.

One way of estimating the magnitude of the impact of health on economic growth is to construct a macroeconomic model that incorporates health alongside conventional factors of production, like labor and capital. Growth models have a long history in economics, dating back to Solow (1956), who described the process of economic growth as a function of the aggregates of capital and labor. In this study, we adopt the approach in Abegunde and Stanciole (2006), and Bloom et al. (2011b), and allow for two effects of health on national income: first, NCDs cause the diversion of savings from capital investment into non-productive health care; and second, NCD mortality results in the reduction of labor supply.

We present and compare estimates of the economic burden of NCDs calculated by applying WHO's macroeconomic model—EPIC (WHO Tool for Projecting the Economic Costs of Ill-Health)—to data for China and India over the time period 2012–2030. We assess the economic impact of four types of NCDs (cardiovascular disease, cancer, chronic respiratory disease, and diabetes), and also

construct estimates of the economic impact of mental health conditions. We describe the relative contribution of each to the total and identify the most important of these in terms of overall magnitude. These results allow us to assess the potential impact of NCDs on each economy over a 19-year period.

The rest of this paper is structured as follows. Section 2 supplies background on the nature and magnitude of NCDs and their risk factors in general, as well as in China and India in particular. Section 3 describes the model—specifically WHO's EPIC model—and data used in the analysis. Section 4 presents results from China and India, Section 5 discusses the results, and Section 6 offers conclusions and suggestions for further research.

## Background on NCDs, their prevalence in China and India, and relevant policy implications

The transition from infectious diseases to NCDs as the dominant cause of mortality is often attributed to the success of efforts in public health, medicine, and nutrition. However, India is still in the midst of this transition. As shown in Fig. 1, the burden of infectious disease remains high in India, with communicable, maternal, perinatal, and nutritional conditions accounting for 37 percent of all mortality, compared with just 7 percent in China. While China has made good progress with regard to infectious disease control, India continues to face a double burden of disease.

The epidemiological transition is often associated with a decrease in mortality due to a rise in the average age at death. However, Fig. 2 illustrates that both China and India experience a substantial burden of premature NCD deaths, defined as NCD deaths occurring before age 70. Around 60 percent of NCD deaths in India and 35 percent in China are premature, in contrast to less than 30 percent in much of Western Europe.

The development and progression of NCDs is determined by both modifiable and non-modifiable risk factors. Non-modifiable risk factors include age, sex, and genetic make-up. Although these risk factors cannot be the primary targets of interventions, they are important to consider as they influence the overall burden of disease. Nearly all NCDs increase in prevalence with age (Dey et al., 2012; Zhao et al., 2013). Due to rapid population aging alone, both China and India will be at increased risk for non-communicable diseases, even if other risk factors remain constant.

However, population aging is not the only risk factor that is driving China and India toward an increased burden of NCDs and NCD-related premature mortality. The prevalence of modifiable NCD risk factors, such as tobacco use, harmful alcohol use, poor diet, and sedentary lifestyles has risen steadily over the past 30 years in both countries. These behavioral trends are related to macro-level changes in society: increased income, urbanization, and the transition to occupations requiring less physical activity. In the context of China and India, air pollution—both indoor and outdoor—is also an important risk factor due to its role in cancer, chronic lung disease, and cardiovascular disease (Institute for Health Metrics and Evaluation, 2013a,b).

Table 1 presents a comparison of major NCD risk factors. Overall, India fares better than China in terms of modifiable NCD risk factors, with a lower prevalence of risk behaviors such as smoking and physical inactivity, as well as a lower prevalence of such NCD biomarkers as high blood pressure and raised cholesterol.

Tobacco use is a major risk factor for NCDs, and an area in which both China and India could act to improve public health. China is the world's largest producer and consumer of tobacco. Liu et al. (1998) note that cigarette smoking among Chinese men rose rapidly in the period 1952–1996 and has since stabilized. However, since there is a lag of several decades between the initiation of smoking and smoking-related morbidity and mortality, the full

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