

# Economics of Non-Communicable Diseases in Indonesia

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# Overview and purpose

Non-communicable diseases (NCDs) have been established as a clear threat not only to human health, but also to development and economic growth. Developed by the World Economic Forum, *The Economics of Non-Communicable Diseases in Indonesia* provides new data on the economic burden of NCDs in Indonesia and puts it in perspective by comparing this burden to that of India and China.

With this new addition to the series on the Economics of NCDs, the World Economic Forum aims to advance the understanding of the expected economic output loss at the country level, particularly in countries in economic and epidemiological transition. This document also seeks to stimulate discussion on the extensive impact of NCDs on Indonesian families, businesses and society.

The evidence presented here provides a starting point to reorient the dialogue on investing in healthy living and NCD prevention in Indonesia towards the view that a healthy population is an important factor for sustainable growth.

Focusing on Indonesia, this document includes:

1. A snapshot of the prevalence of NCDs and risk factors in Indonesia
2. Estimates of lost economic output due to NCDs, focusing on the negative effects of NCDs on the labour supply
3. Comparison of the economic burden of NCDs in Indonesia, India and China



# NCDs and prevalence of risk factors in Indonesia

## NCD burden

Over the past decades, Indonesia has made phenomenal progress. Per capita income has been increasing at a blistering pace, up to around \$3,000 per capita in 2010. At the same time, fertility has dropped dramatically, while life expectancy has increased steadily. From an individual perspective, these developments are clearly welcome.

However, they also imply an increasing threat of NCDs to Indonesia's population health and well-being. This threat is being realized through two pathways. First, the continuous drop in fertility and mortality has led to an ageing of the society. Second, the economic growth has been accompanied by rapid urbanization and the transition to occupations requiring less physical activity. This has led to a steady increase in the prevalence of modifiable NCD risk factors such as tobacco use, harmful alcohol use, poor diet and sedentary lifestyles (see Table 1).

All of these factors act to raise the risk of susceptibility to NCDs such as cardiovascular disease and chronic obstructive pulmonary disease.

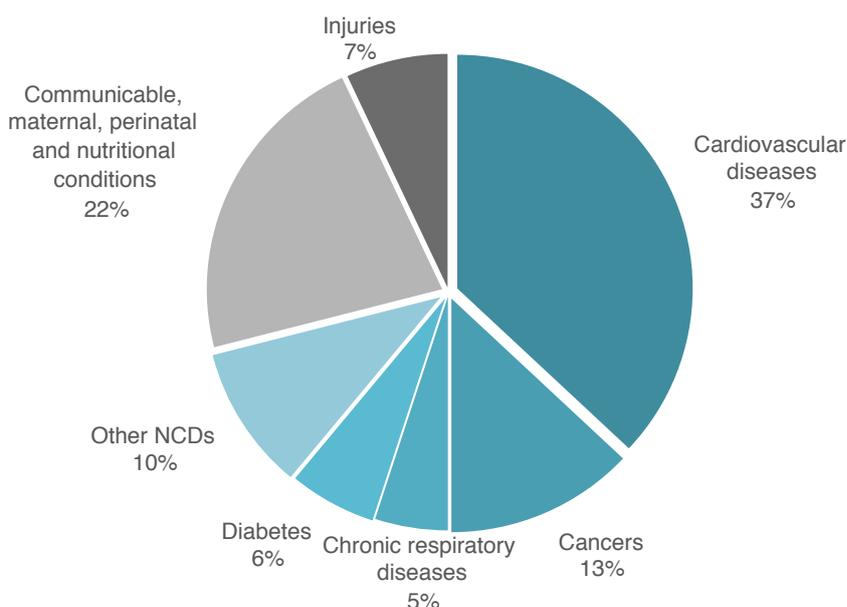
**Table 1:** Adult NCD risk factors of Indonesia

	Males	Females	Total
Current tobacco smoking (2011)	67%	3%	35%
Total alcohol per capita consumption, in litres of pure alcohol (2010)	1.1	0.1	0.6
Raised blood pressure (2008)	29.1%	26.6%	27.8%
Obesity (2008)	2.6%	6.9%	4.8%

Source: World Health Organization, 2014

Indonesia is undergoing an epidemiological transition, with the disease burden shifting from communicable disease and early life mortality to NCDs, increases in life expectancy and increases in median age at death. According to estimates from the World Health Organization (WHO), the proportional mortality due to NCDs has increased from 50.7% in 2004 to 71% in 2014 (see Figure 1).

**Figure 1:** Cause of death in Indonesia, 2012 (% of total)



Source: World Health Organization, 2014

## Prevalence

The most prevalent NCDs in Indonesia today are cardiovascular diseases, cancers, chronic respiratory diseases and diabetes. In 2012, non-communicable diseases accounted for more disability-adjusted life years (DALYs) than communicable ones – approximately 476 million and 240 million DALYs, respectively (WHO, 2014).

Diabetes is of particular concern – by 2030, the number of people with diabetes will nearly double, from 7.6 million in 2013 to 11.8 million. With an annual growth in diabetes prevalence of 6%, this far exceeds the country's overall annual population growth rate (Blueprint for Change Program, 2013).

Mental health conditions, including depression, schizophrenia and bipolar disorder, also contribute heavily to the country's NCD burden. Neuropsychiatric disorders are estimated to account for 10.7% of the total burden of disease in Indonesia (WHO, 2011).

However, Indonesia is still in the midst of this transition with communicable, maternal, perinatal and nutritional conditions accounting for 22% of total deaths, compared to just 5% in China. As the trend of increasing NCD burden is expected to continue, inaction is not an option.



# Economic burden of NCDs in Indonesia, 2012-2030

While gathering further evidence to add to our understanding of the consequences of NCDs for individual health remains a priority, there is less evidence on the impact of NCDs on wider society, such as their effect on economic growth. There are many channels through which the consequences of NCDs are expected to manifest, including the diversion of household or individual consumption expenditure or savings into healthcare, and reductions in labour supply and productivity.

In this analysis, we provide a framework for modelling the impact of NCDs on economic growth through labour supply and productivity, and for quantifying the losses associated with these diseases. This framework constitutes a tool for evaluating the economic costs associated with NCDs and, as a result, provides an evidence base for policy decisions in relation to interventions targeted at NCDs.

## EPIC model to assess the economic output loss for Indonesia

The economic burden of NCDs is analysed using an updated and corrected version of the World Health Organization (WHO) EPIC model, which allows us to quantify the impact of NCDs on aggregate output. EPIC is based on an augmented Solow economic growth model in which the growth path of national income (GDP) is assumed to depend on technological progress, capital accumulation and changes in (effective) labour supply.

The Solow model has been a workhorse framework used to understand aggregate income growth and differences in macroeconomic performance since the 1950s. EPIC captures NCDs' impact on aggregate output through the labour supply channel. Specifically, NCDs mortality directly reduce labour supply by reducing the number of working-age individuals.

The reduction in the size of the labour force then translates into a loss in aggregate output through the usual Solow production function. Notice that NCD mortality for people who are not in the labour force (retirees, children, etc.) will not affect aggregate output (in contrast to per capita output). Hence, the input data needs to differentiate between the disease burdens in different groups.

Economic output in each year is modelled according to the production function approach described above, and forecasts for population structure and NCD prevalence. Then, aggregate income is simulated over the period of interest in two scenarios:

*Status quo scenario:* Economic output is modelled for each year, taking the NCD prevalence forecasts as given. This is the case without implementation of interventions that would reduce the mortality rate of a disease further than projected.

*Counterfactual scenario:* The case assumes complete elimination of the specified disease with zero cost of the intervention.

The economic burden of a specified disease is then calculated as the undiscounted cumulative difference in projected annual GDP between the two scenarios described above.

EPIC has been used to directly model the impact of five NCDs: ischemic heart disease, cerebrovascular disease, diabetes, chronic obstructive pulmonary disease (COPD) and breast cancer. To obtain estimates for all NCDs, we scaled up the results presented in the model to reflect the four leading physical NCD domains (all cardiovascular diseases, diabetes, chronic respiratory disease and cancers).



The scaling is implemented by calculating the proportion of total morbidity in a particular domain (e.g. cancer) that is accounted for by the relevant disease in EPIC (e.g. breast cancer). The morbidity contribution of the EPIC disease to the NCD domain is calculated using the ratio of DALYs for that disease relative to the NCD domain. DALY estimates are taken from the latest WHO Global Burden of Disease (GBD) study (2013).

Furthermore, the burden of mental health is constructed using the ratio of the DALYs associated with the four physical NCD domains to the DALYs associated with mental health. We plan to expand the framework to provide direct estimates of the economic burden associated with all relevant NCDs in a later updated version of the EPIC model.

### Data sources

The disease-specific mortality projections and the population projection for Indonesia are based on WHO Global Burden of Disease estimates through 2030. Labour projections are based on International Labour Organization estimates of labour force participation rates. Data on economic variables were obtained from Abegunde and Stanciole (2006), the World Development Indicators & Global Development Finance database, the International Monetary Fund's World Economic Outlook database, and the Penn World Tables.

### Expected economic output loss for Indonesia: \$4.47 trillion lost due to NCDs (\$17,863 per capita)<sup>1</sup> from 2012 through 2030

Table 2 presents the model estimates for the NCD burden in Indonesia in 2010 US\$. The first two columns show the WHO disease domains and the diseases addressed in the EPIC model, respectively. The third column shows the output of EPIC for individual diseases. The fourth column shows the scaling factors calculated from the associated DALYs. The last column presents the scaled value of the disease burden in each of the five WHO-defined domains.

<sup>1</sup> Per capita losses are calculated based on the population in 2012

**Table 2:** Scaling of EPIC output for 2012-2030 to match the five WHO NCD domains for Indonesia

WHO disease	EPIC disease	EPIC raw output	Disease scaling factor	Total output loss Scaled raw output in 2010 US\$ trillions
Diabetes	Diabetes	0.2	Diabetes/1.00	<b>0.20</b>
Cardiovascular disease	Ischemic heart disease	0.9	(IHD+CBD)/0.77	<b>1.77</b>
	Cerebrovascular disease	0.46		
Respiratory disease	COPD	0.45	COPD/0.547	<b>0.82</b>
Cancer	Breast cancer	0.07	Breast cancer/0.1	<b>0.70</b>
<b>Total physical</b>				<b>3.49</b>
<b>Mental illness</b>			(Total physical)x(0.28)	<b>0.98</b>
<b>Overall total</b>				<b>4.47</b>

Source: Authors

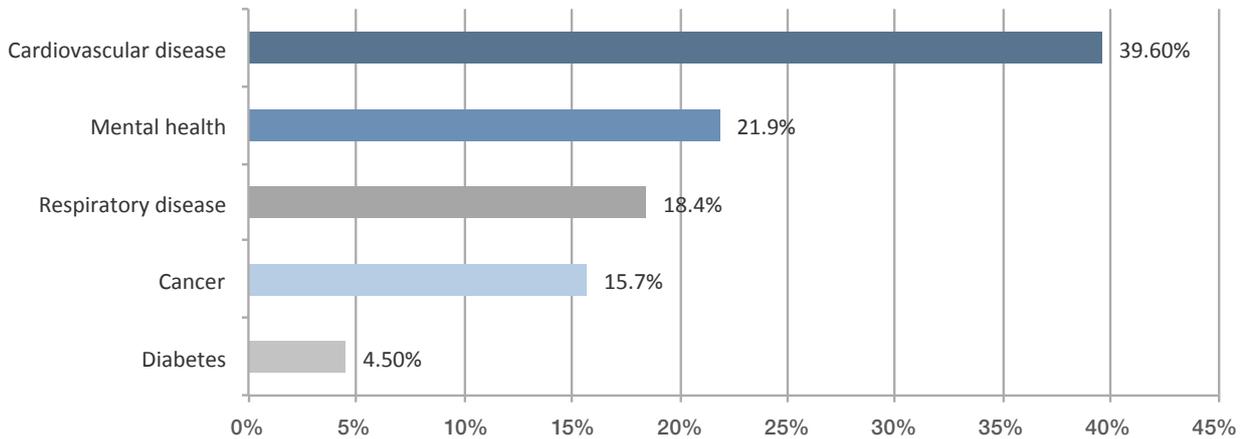


**The costs associated with NCDs in Indonesia are substantial.** According to our calculations, the five domains of NCDs (cardiovascular disease, cancer, chronic obstructive pulmonary disease, diabetes and mental health conditions) will cost Indonesia \$4.47 trillion (or \$17,863 per capita)<sup>2</sup> from 2012 through 2030.

**The burden varies substantially between diseases.** As we can see from Figure 2, cardiovascular disease alone accounts for 39.6% of the total loss of GDP output and is followed by mental health conditions (21.9%) and respiratory diseases (18.4%). Cancer contributes another 15.7% to the total loss, and diabetes accounts for the remaining 4.5%.

<sup>2</sup> Per capita losses are calculated based on the population in 2012

**Figure 2:** Contribution of each disease to overall loss of GDP output, Indonesia 2012-2030

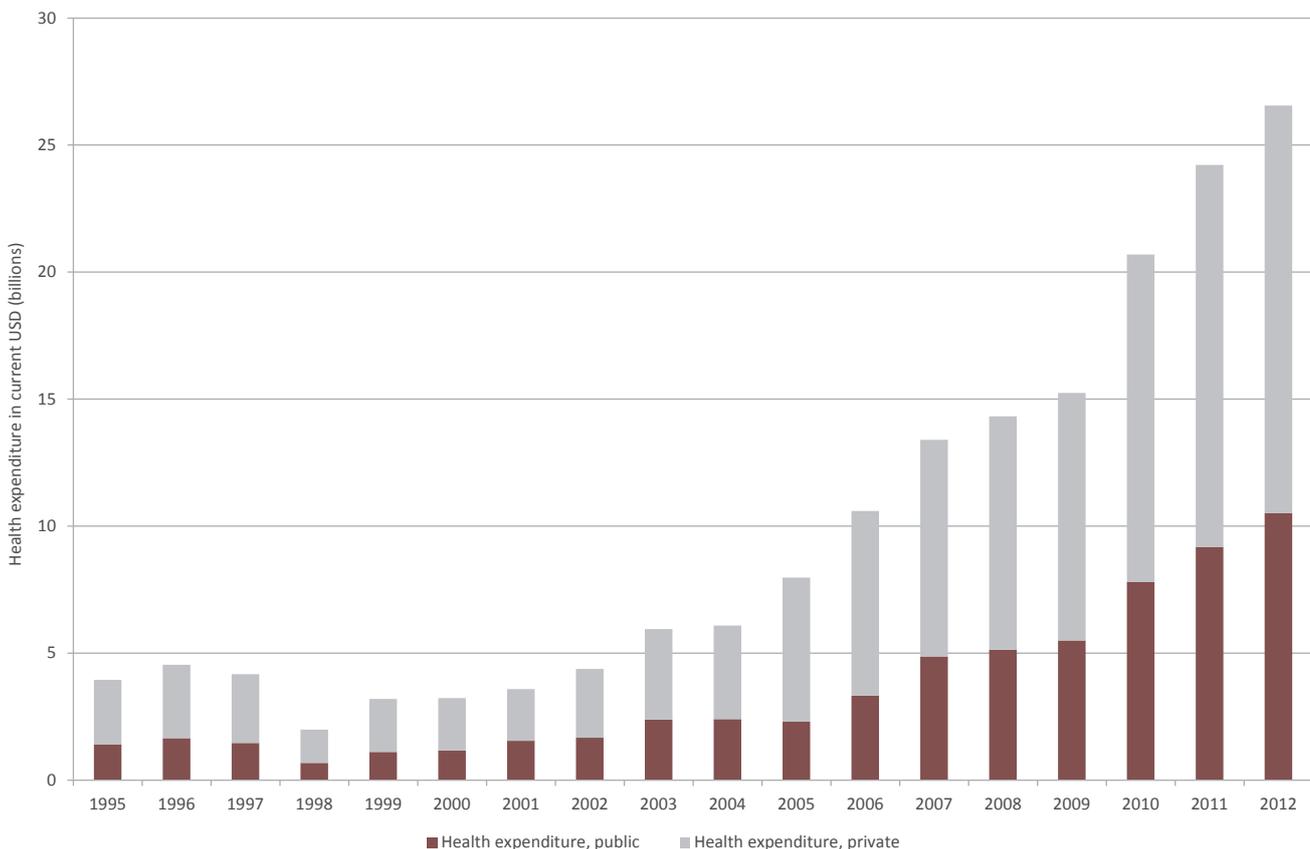


Source: Authors

A total cost estimate of \$4.47 trillion due to NCDs from 2012 through 2030 is a substantial amount by any measure: it is 5.1 times Indonesia's GDP in 2012, and almost 170 times Indonesia's total health expenditure in 2012<sup>3</sup> (see Figure 3).

<sup>3</sup> Data for total health expenditure is obtained from the Global Health Expenditure Database (GHED) of WHO, updated in 2014

**Figure 3:** Total health expenditure (current US\$), Indonesia 1995-2012



Source: Global Health Expenditure Database, World Health Organization, 2014

# Comparison between Indonesia, India and China

The NCD burden in Indonesia is more severe than among its neighbours. Figures 5-7 provide comparisons of the output lost due to NCDs between Indonesia, India and China.<sup>4</sup> Indonesia will suffer a larger total output loss than India (\$4.47 trillion versus \$4.32 trillion) during the period 2012-2030, with only one-fifth of India's population and one-half of its annual GDP.

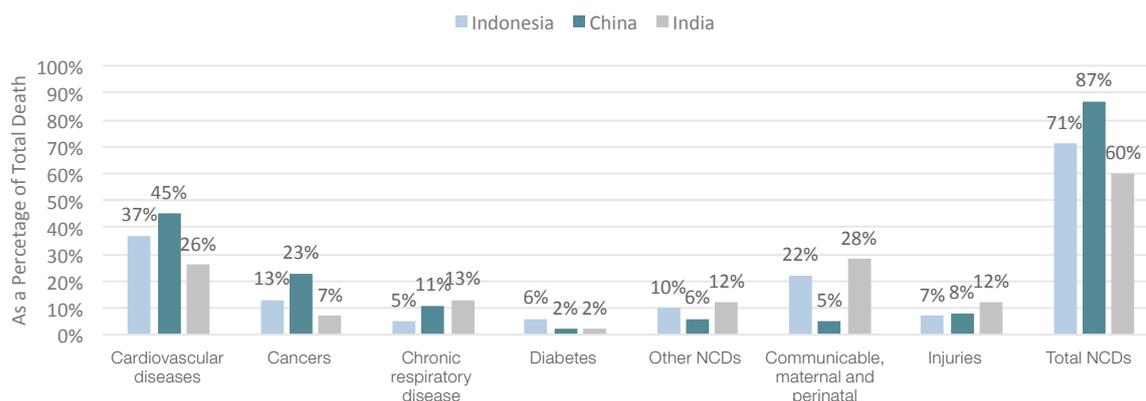
China has larger output losses than Indonesia at both the aggregate level (\$29.4 trillion versus \$4.47 trillion) and at the per capita level (\$21,794 versus \$17,863). However, taking the differences in economic development between these

two countries into account, Indonesia's NCD burden is much larger compared to baseline GDP.

During the period 2012-2030, the total NCD-related loss accruing in China is 3.57 times GDP in 2012, while the corresponding loss for Indonesia over the same time period is 5.10 times its GDP. Therefore, NCDs pose a large burden for Indonesia's economy in both absolute and relative terms.

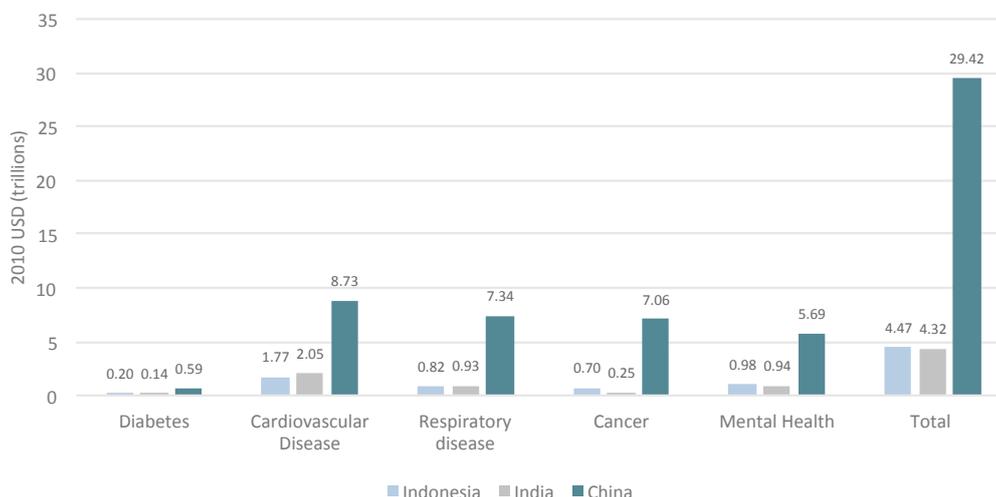
<sup>4</sup> The calculations for China and India follow from Bloom et al. (2014); notice that the values are different, since here we updated the results with a corrected version of WHO EPIC model (See Appendix for details of the corrections)

**Figure 4:** Proportional mortality due to NCDs in Indonesia, India and China, 2014 (% of total deaths, all ages, both sexes)



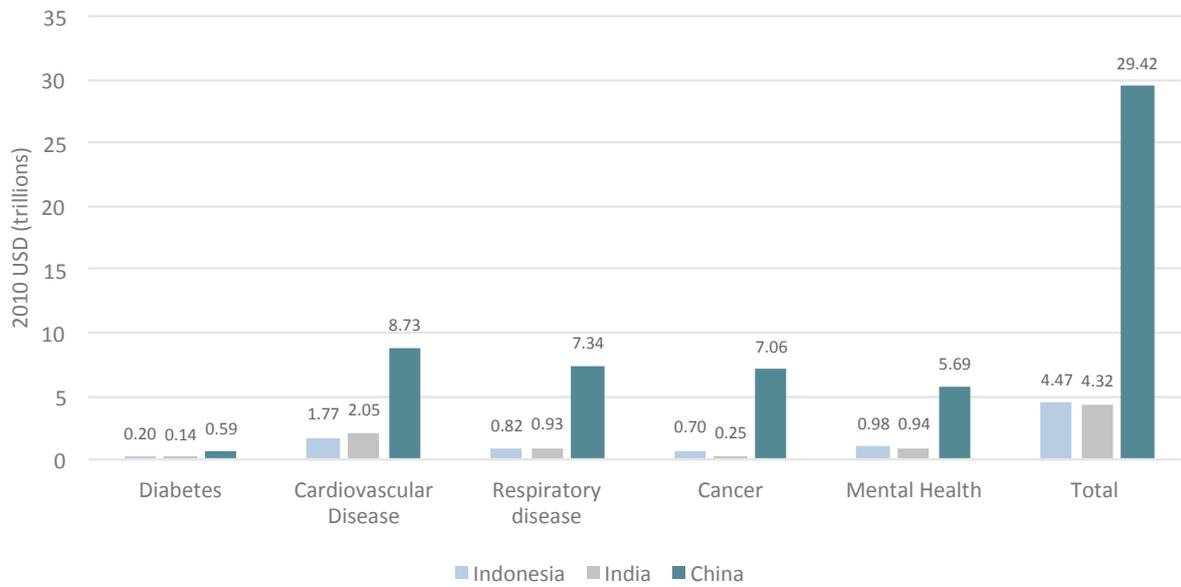
Source: World Health Organization, 2014

**Figure 5:** Comparison of lost output between Indonesia, India and China, 2012-2030 (2010 US\$ trillions)



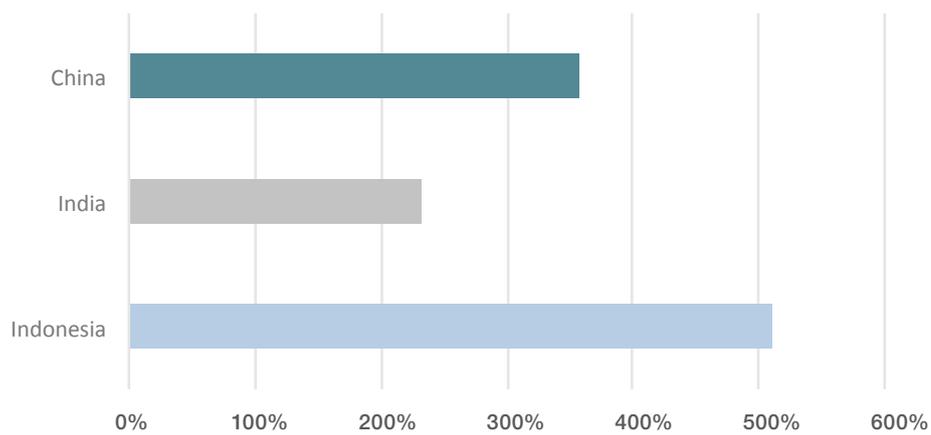
Source: Authors

**Figure 6:** Comparison of lost output per capita between Indonesia, India and China, 2012-2030 (2010 US\$)



Source: Authors

**Figure 7:** Comparison of lost output as a percentage of 2012 nominal GDP



Source: Authors



# Conclusion

**NCDs are extremely costly for Indonesia.** Our analysis estimates that the loss of labour due to NCDs will lead to a substantial reduction in the country's productive capacity that is much bigger than those of its neighbours in Asia. Relative to scenarios where interventions are taken to reduce NCD prevalence, Indonesia's economic development is likely to be significantly impeded by NCDs if the status quo scenario is maintained.

Moreover, the results presented here are likely to be underestimates of the total impact of NCDs on the Indonesian economy, as the EPIC model currently only models the effect on labour supply. But, as we discuss above, there are many other pathways through which we would expect NCDs to affect aggregate economic growth. Future updates to the EPIC model will include these additional channels.

NCDs are imposing a significant burden on Indonesia's economy that will only increase in the next two decades. There is a vast body of evidence on effective and cost-effective actions that governments, the private sector and civil society can implement to address the NCD burden (World Economic Forum/WHO, 2011).

**There are promising estimates of returns on investment (ROI) for interventions to reduce NCDs.** Investing in population health not only improves health, but also contributes to prosperity and provides both social and financial protection. The 2013 Lancet Commission on investing in health estimated that, between 2000 and 2011, about 24% of the growth in full income in low-income and middle-income countries resulted from the value of additional healthy life years gained. In South Asia, the annual value of the reduction in mortality was equivalent to 2.9% of the average income during the period 2000 to 2011, which is almost half the size of the value of the increase in GDP (Jamison, 2013).

The joint World Economic Forum/Harvard School of Public Health report on the *Economics of Non-Communicable Diseases in India* (2014) calculated the ROI of 12 interventions ongoing in India. The interventions that focused on screening (for hypertension), vaccination (HPV) and reduced tobacco consumption were particularly promising in terms of the feasibility of achieving a 15% ROI. Other interventions that focused on reducing salt intake or improving care for depressive and anxiety disorders also presented promising ROI values.

Other assessments of the potential ROI of investing in population health published in 2015 also pointed to promising results ranging between 90% and 3,700% ROI (World Economic Forum, 2015).

One interesting example comes from the work of the Health Promotion Board of Singapore to reduce the intake of saturated fat through subsidies for meals eaten outside the home which had a higher composition of healthier oils. It is estimated that this intervention will have a ROI of more than 1,100% by 2020. The programme is estimated to replace 1,860 DALYs with healthy life years. This could result in a tremendous economic return for Singapore, estimated at S\$102 million by 2020. The ROI of more than 1,100% is especially impressive given the fact that some benefits, such as reduced healthcare costs, were not included in the analysis, resulting in a more conservative estimate.<sup>5</sup>

Kaiser Permanente, an integrated healthcare provider in the United States covering more than 9 million people, set up a programme to treat 350,000 high-risk patients with a medication bundle, including aspirin, a statin and an ACE inhibitor. In addition, partnerships with community-based health systems helped to further extend the programme to their patient populations. The programme has a direct cost of \$205,000 per 1,000 participating patients and prevents 19 heart attacks or strokes per 1,000 participating patients per year, which results in 147 fewer unhealthy years per 1,000 high-risk patients. Those additional healthy life years have a socio-economic value of \$7.8 million, giving a ROI of 3,700%.<sup>6</sup>

**Efficient allocation of resources.** Given the large disparities in the disease-specific burden as well as in the treatment costs associated with specific diseases, limited resources should be carefully allocated to both treatment and prevention initiatives, according to guidance from cost-effectiveness analysis and the national context.

All stakeholders can benefit from investing in maximizing healthy life years and help move the current landscape from "healthy as a cost" to "healthy as an investment", particularly when it comes to investing in the prevention of the largest killers of the decade: NCDs. Taking a holistic and systemic approach – in which all public and private stakeholders understand the full range of costs and benefits that can be incurred to their business, public policies and societies – will lead to a step-change in the health investment agenda.

<sup>5</sup> World Economic Forum, Maximizing Healthy Life Years: Investments that Pay Off, January 2015

<sup>6</sup> Ibid

# Appendix

## Corrections of the World Health Organization's EPIC model in 2015

Major problems:

- *Inconsistency of the definition of labour.* The original EPIC model fails to use a consistent definition of labour throughout the calculations (working population versus effective labour). Notice that effective labour is calculated as the product of working population and experience factors. The labour projection is the number in the working population rather than effective labour. And this number is used as the labour input for status quo economic projections. However, when calculating the effect of mortality, additional effective labour from the mortality decline is added to the pure number of the working population, which is not correct. Instead, in our updated version of the model, we modified the code by using “effective labour” rather than working population in all calculations.
- *Wrong update function for physical capital.* The function for calculating aggregate capital is not correct, it should be:

$$K_t = (1 - \delta)K_{t-1} + sY_{t-1} - xC_t$$

Instead of:

$$K_t = (1 - \delta)K_{t-1} + sY_t - xC_t$$

Here  $sY_{t-1}$  represents the savings at time period  $t-1$  that are invested to generate physical capital in the next time period  $t$ . This (coding) error results in savings always being set to zero, which implies that aggregate capital continually depreciates over time and is never augmented.

Minor problems:

- In the calculations, the treatment cost is always set as \$0.50 for all diseases and all countries.
- Morbidity is not factored into the model, despite being nominally present in the original EPIC programme.
- It is not possible to change the starting year for the analysis. Although the model allows for input of starting year, the starting year GDP value is always set to the value of 2005, which renders the calculation incorrect. Because 2005 is always taken as the base year, it is not possible to calculate losses for other periods, for example, 2012-2030, only periods starting from 2005.



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