

## Five insights from the Global Burden of Disease Study 2019



GBD 2019 Viewpoint Collaborators\*

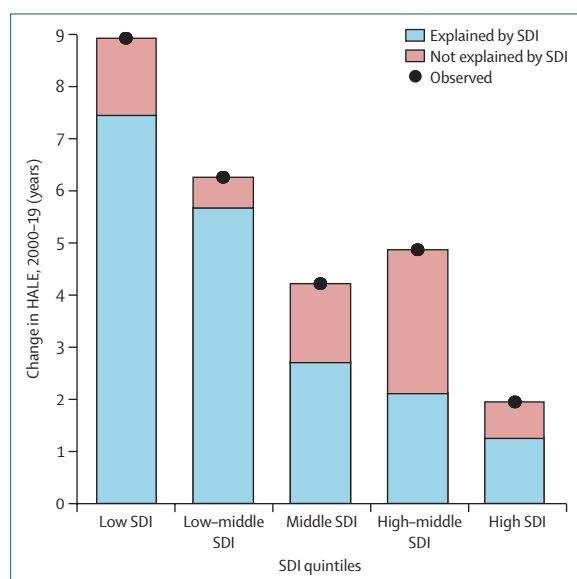
The Global Burden of Diseases, Injuries, and Risk Factors Study (GBD) 2019 provides a rules-based synthesis of the available evidence on levels and trends in health outcomes, a diverse set of risk factors, and health system responses. GBD 2019 covered 204 countries and territories, as well as first administrative level disaggregations for 22 countries, from 1990 to 2019. Because GBD is highly standardised and comprehensive, spanning both fatal and non-fatal outcomes, and uses a mutually exclusive and collectively exhaustive list of hierarchical disease and injury causes, the study provides a powerful basis for detailed and broad insights on global health trends and emerging challenges. GBD 2019 incorporates data from 281 586 sources and provides more than 3·5 billion estimates of health outcome and health system measures of interest for global, national, and subnational policy dialogue. All GBD estimates are publicly available and adhere to the Guidelines on Accurate and Transparent Health Estimate Reporting. From this vast amount of information, five key insights that are important for health, social, and economic development strategies have been distilled. These insights are subject to the many limitations outlined in each of the component GBD capstone papers.

### Double down on catch-up development

In the Global Burden of Diseases, Injuries, and Risk Factors Study (GBD), a population's social and economic development status for each location-year is tracked on the basis of the Socio-demographic Index (SDI), which combines information on gross domestic product per capita, average years of schooling among individuals aged older than 25 years, and the total fertility rate among females under the age of 25 years (as a widely available inverse proxy for the status of girls and women in society).<sup>1</sup> SDI ranges from 0 to 100. Since 1950, global SDI has increased monotonically from 35 to 65. The average pace of progress accelerated from 1950 to 1980 and has stayed at around 0·5 units per year since then. For the 15% of countries with the fastest rate of increase, SDI has

improved on average by 0·9 units per year since 1980, but it has improved by less than a third of this rate (0·3 units per year) for the bottom 15% of countries. Social and economic development can take centuries. Given what was reported from 1950 to 2019, the average country would take about 184 years to progress from an SDI of 0 to an SDI of 100; whereas, countries in the bottom 15% would take 357 years and those in the top 15% would take 110 years. From 1950 to 2000, the pace of improvement in SDI was positively correlated with the level of SDI, whereby high and high-middle SDI countries developed faster than did low and low-middle SDI countries. Since 2000, the correlation has become progressively more negative and is now around -0·5. In other words, since the Millennium Declaration,<sup>2</sup> low and low-middle SDI countries have had larger annual increases in SDI than have high and high-middle SDI countries. The inequality in SDI between countries, measured with the standard deviation of SDI, has been decreasing since 2000, showing catch-up development.

Social and economic development, measured with SDI, is highly correlated with health outcomes.<sup>3</sup> Figure 1 shows the increase in healthy life expectancy from 2000 to 2019, divided by what could be expected on the basis of SDI change alone and what is unexplained by SDI. These changes unexplained by SDI are likely to be explained by some combination of new technologies, prioritisation of societal resources for health, and the emergence of public health challenges, such as the HIV epidemic or alcohol consumption in eastern Europe and central Asia. Given the overwhelming impact of SDI on health progress, doubling down on policies and strategies that stimulate economic growth, expand access to primary and secondary schooling, and improve the status of women should be our collective priority. The catch-up social and economic development that has been clearly evident since the Millennium Declaration provides some optimism that maintaining focus on low SDI countries, and low SDI communities within countries, is not only possible but can also be expected to have profound health benefits. Further



**Figure 1: Change in HALE disaggregated by SDI quintiles, 2000-19**  
SDI quintiles as assessed in 2019. Expected change in HALE related to change in SDI is based on fitting spline functions to the relationship between age-specific mortality and SDI, and age-specific years lived with disability per capita and SDI. HALE=healthy life expectancy. SDI=Socio-demographic Index.

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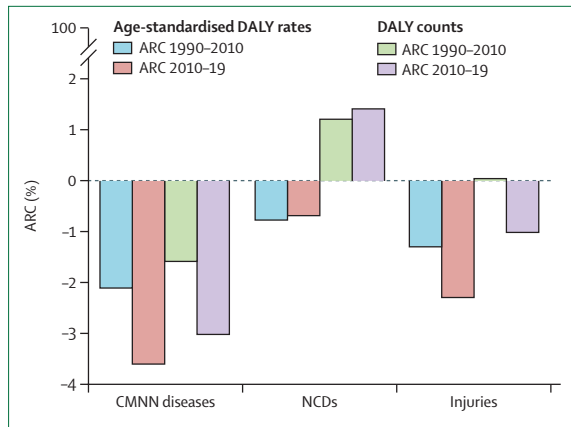
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For GBD Compare see  
<https://vizhub.healthdata.org/gbd-compare/>

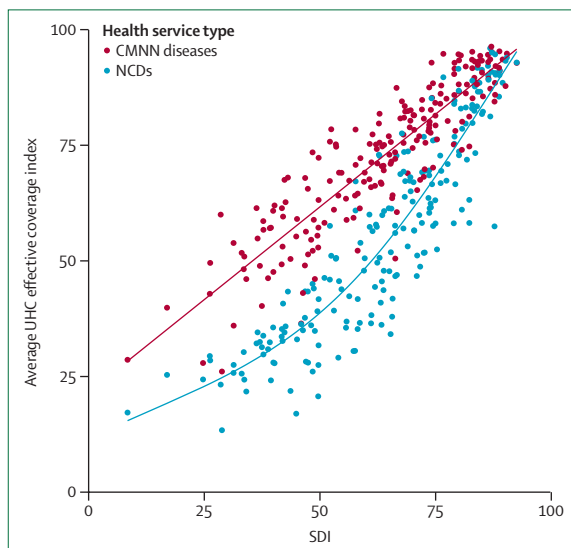
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For more on the Guidelines on  
Accurate and Transparent  
Health Estimate Reporting see  
Statement Lancet 2016;  
388: e19-23



**Figure 2: Global ARC for age-standardised DALY rates and DALY counts, 1990–2010 and 2010–19**

Results are shown for three broad cause groups: CMNN diseases, NCDs, and injuries. ARC=annualised rate of change. CMNN=communicable, maternal, neonatal, and nutritional. DALY=disability-adjusted life-year. NCDs=non-communicable diseases.



**Figure 3: Relationships of UHC effective coverage in 204 countries and territories for health services targeting CMNN diseases and NCDs versus SDI, 2019**

CMNN=communicable, maternal, neonatal, and nutritional. NCDs=non-communicable diseases. SDI=Socio-demographic Index. UHC=universal health coverage.

improvements in health can also contribute to economic growth; higher educational attainment, because healthy children can learn more effectively; and greater female empowerment, as more women have access to reproductive health services, all of which create the potential for further health gains that expand SDI improvement.

### The Millennium Development Goal health agenda has been working

Since around 2000, the global health community, including donors, has focused on reducing mortality of children and

mothers, and the burden from three target conditions: tuberculosis, HIV, and malaria.<sup>2,4,5</sup> Development Assistance for Health increased profoundly until 2010, but has since stagnated.<sup>6</sup> The share of this assistance allocated to the Millennium Development Goal agenda has remained constant, even with the expanded Sustainable Development Goal health agenda in place since 2015. This concerted focus on communicable, maternal, neonatal, and nutritional (CMNN) diseases has led to faster progress in combatting these causes than has been reported for non-communicable diseases (NCDs) and injuries (figure 2). Reductions in rates of age-standardised disability-adjusted life-years (DALYs) since 1990 have been largest for CMNN diseases and progress has been the fastest in the past decade,<sup>7</sup> even considering the stagnation in Development Assistance for Health since 2010. Despite population growth, particularly in countries with the lowest SDI, the absolute number of DALYs from CMNN causes has also decreased. By contrast, age-standardised DALY rates for NCDs have barely reduced; in fact, population growth and ageing have resulted in a steady increase in the number of DALYs due to these causes. Age-standardised DALY rates for injuries have decreased, but at rates well below those of CMNN diseases.

### Health systems need to be more agile to adapt to the rapid shift to NCDs and disabilities

Countries in the low-middle and middle SDI quintiles have had rapid transitions from disease burden dominated by CMNN causes to burden dominated by NCDs and injuries. The low-middle quintile increased from 37.8% of total DALYs caused by NCDs and injuries in 1990 to 66.0% in 2019, with a similar pattern in the middle quintile as well.<sup>7</sup> The GBD assessment of universal health coverage (UHC) allows disaggregation of coverage into interventions for CMNN diseases and NCDs (figure 3).<sup>8</sup> Although coverage of CMNN diseases increases almost linearly with higher SDI, coverage of NCD intervention lags behind. Countries with rapid transitions have burden profiles dominated by NCDs, yet their health systems are struggling to deliver effective interventions for these diseases. As countries' health profiles shift to NCDs, there is a middle-SDI quintile gap that emerges, in which the most important interventions for improving health in these countries have low coverage. Despite this gap, most policy discussion, including WHO engagement with countries, is firmly focused on the agenda for CMNN diseases, ignoring the epidemiological heterogeneity of countries with low and middle SDI. The legacy focus on CMNN causes, and a failure to purposefully anticipate the inevitable shift to NCDs, is evident even in discussions on UHC. For example, the official UN UHC service indicator (3.8.1) does not include the coverage of any intervention targeting NCDs.<sup>9</sup>

A second challenge is emerging at high levels of development, in which most DALYs in high SDI countries

now arise not from premature mortality, but from loss of functional health. This shift is driven by a combination of ageing populations and stagnant age-specific rates of years lived with disability (YLDs) for the main sources of functional health loss, including musculoskeletal disorders, mental disorders, substance misuse, vision loss, and hearing loss. The proportion of global DALYs due to YLDs increased from 20·7% in 1990 to 33·9% in 2019.<sup>7</sup> Over the same period, the number of countries where YLDs exceeded years of life lost increased from one to 29 countries. This shift is mirrored in health expenditures in these high SDI nations. Musculoskeletal disorders were the largest health expenditure in the USA in 2016 at US\$380 billion,<sup>10</sup> which was greater than expenditure for either cardiovascular diseases or cancers. Health systems appear to be poorly prepared for this shift. Most policy discussion is focused on cardiovascular diseases and cancers.<sup>11–13</sup> The innovation pipeline for the main disabling conditions (musculoskeletal, mental, and neurological disorders) is poor.<sup>14–16</sup> Similarly, low investment in research into underlying causes and therapeutic innovations for key causes of functional health loss is exacerbating this widespread and unacceptable neglect. For example, the US National Institutes of Health budget on cardiovascular diseases and cancers is dramatically larger than its budget on musculoskeletal disorders (\$8·60 billion combined vs \$734 million in 2018).<sup>17</sup>

### Public health is failing to address the increase in crucial global risk factors

The potential to improve health by risk reduction is well reported in GBD 2019.<sup>18</sup> All risks quantified in GBD collectively account for 48% of global DALYs. Exposure to many risks highly correlated with SDI has been steadily decreasing as global SDI has increased, including household air pollution; child growth failure; and unsafe water, sanitation, and handwashing. Additionally, there have been notable decreases in exposure to smoking. Figure 4 shows the annualised rate of change in exposure from 2010 to 2019 for select risk factors ordered by global attributable DALYs. Among the 15 leading causes of attributable DALYs shown, high systolic blood pressure, high fasting plasma glucose, high body-mass index (BMI), ambient particulate matter pollution, alcohol use, and drug use stand out because rates of exposure are increasing by more than 0·5% per year.

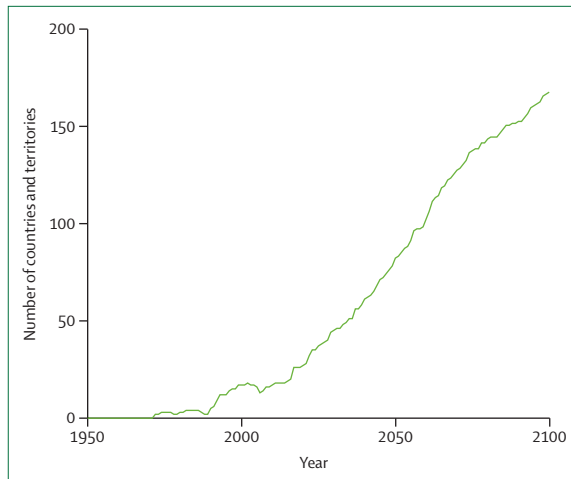
If public health action and public policy could stop or reverse the trends in exposure to these risks, the benefits would be huge. What lessons can be learned to improve health from humanity's collective failure to leverage knowledge on the harms associated with these risks? Simply providing information on the harms does not appear to be sufficient. The one major behavioural risk for adults is tobacco smoking, for which a cocktail of interventions built around strong commitment to government policy has had at least partial success. Smoking is down 1·2% per year globally since 2010,

	ARC
High SBP	0·51
Smoking	-1·20
Dietary risks	-0·28
High fasting plasma glucose	1·32
Low birthweight and short gestation	-0·21
High body-mass index	1·83
Ambient particulate matter pollution	1·47
High LDL cholesterol	-0·07
Alcohol use	0·52
Household air pollution from solid fuels	-3·54
Child growth failure	-1·96
Unsafe water, sanitation, and handwashing	-0·59
Kidney dysfunction	0·19
Occupational risks	-0·07
Drug use	0·53
Low temperature	-0·17
Low physical activity	0·36
Suboptimal breastfeeding	-0·40
High temperature	0·12
Intimate partner violence	0·40
Childhood sexual abuse and bullying	0·81

Figure 4: Global ARC in exposure for select risks, 2010–19

Risk factors are ordered by global attributable DALYs. Values are shaded by change in exposure, from dark blue (largest decrease) to dark red (largest increase). Exposure is measured as the age-standardised summary exposure value. Summary exposure value is an integrated measure of risk exposure that allows comparison across continuous, polytomous, and dichotomous risk factors. ARC=annualised rate of change. DALYs=disability-adjusted life-years. SBP=systolic blood pressure.

suggesting important lessons for strategies to reduce obesity, for example. This progress is more likely to be linked to taxation and legislation facilitated in part by the Framework Convention on Tobacco Control<sup>19</sup> than to providing information to consumers about the harms of tobacco, particularly in low and low-middle SDI countries.<sup>20,21</sup> The failure to slow or reverse the global rise in BMI, to facilitate healthier diets, or to increase amounts of physical activity is probably partly due to inadequate policy attention and funding for public health action and behavioural research. The steady rise of these risks is likely to pose a massive threat to future health progress everywhere.<sup>22,23</sup> The increase in exposure to key metabolic risks and the slowing or reversals of long-term reductions in cardiovascular diseases seen in some locations suggest that the world might be approaching a turning point in terms of life expectancy gains.<sup>24</sup> Governments should invest more funding in research and action to tackle these stagnating or worsening risk exposures. A core obstacle to accelerating progress on behavioural risks is the notion of individual agency and the need for governments to let individuals make their own choices. This concept is naive, given that individual choices are influenced by context, education, and availability of alternatives.



**Figure 5: Number of countries and territories with negative natural rate of population increase, 1950–2019, and in the reference forecast scenario, 2020–2100**

The natural rate of increase is negative when the crude death rate exceeds the crude birth rate.

Governments can and should take action to facilitate healthier choices by rich and poor individuals alike. When there is a major risk to population health, concerted government action through regulation, taxation, and subsidies, drawing lessons from decades of tobacco control, might be required to protect the public's health.

### Social, fiscal, and geopolitical challenges of inverted population pyramids

As an extension of GBD, Vollset and colleagues<sup>25</sup> have developed population scenarios for 195 countries and territories to 2100. In 2019, 34 countries had negative natural rates of increase; in other words, the crude death rate was greater than the crude birth rate. When the natural rate of increase is negative, in the absence of net immigration, populations will decrease. Two variables, female educational attainment and met contraceptive need, explain 80·5% of the variation in the completed fertility for a cohort of women. When met contraceptive need reaches 95% and average educational attainment reaches 16 years of age, the global total fertility rate will decrease to 1·41. Globally, educational attainment is rising, as is contraceptive met need.<sup>26,27</sup> The effect of these trends will be a rapid increase in the number of countries with a negative natural rate of increase (figure 5).<sup>25</sup> Over time, negative rates of natural increase progressively lead to inverted age pyramids, in which older 5-year age groups (eg, aged 40–44 years) are more populous than younger 5-year age groups (eg, aged 5–9 years). In 2050, China is projected to have 79·6 million people aged 70–74 years, but only 46·0 million children aged younger than 5 years. Negative natural rates of increase will lead to an intensified national debate on immigration. The profound social, fiscal, economic, and geopolitical challenges of an inverted age pyramid might best

be addressed through liberal immigration policies. Countries such as Canada, Australia, New Zealand, and the USA have already used such a strategy to maintain or increase their working age populations in the face of decreasing fertility rates. Some countries will try to increase fertility rates rather than accept migrants into their societies. Russia has identified increasing the birth rate as their number one health priority.<sup>28</sup> In such cases, it is imperative that any policy initiatives protect women's sexual and reproductive rights. Yet, attempts to increase fertility rates through economic incentives and paid maternal and paternal leave in countries like Sweden,<sup>27</sup> Singapore,<sup>30</sup> South Korea,<sup>31</sup> Japan,<sup>32</sup> and Taiwan (province of China)<sup>33</sup> have had a minimal effect on fertility rates.<sup>25</sup>

### Conclusion

Success in reducing the disease burden from causes of CMNN diseases by global collective action to fund key programmes should be celebrated. Catch-up social and economic development is fuelling more rapid health progress in the lower SDI quintiles. But there is reason to believe that, although the past 70 years have largely been a story of sustained improvements in health, rising exposure to crucial risks, such as high BMI, high fasting plasma glucose, and ambient particulate matter pollution, as well as stagnant exposure to many other behavioural risks, including diet quality and physical activity, might attenuate progress. Most alarmingly, the mortality decreases in cardiovascular diseases of the past half a century have slowed substantially, or even reversed, in some nations with high SDI. New challenges, such as rising temperature and the associated increases in poverty, need to be urgently addressed. Low fertility in many nations is likely to emerge as a profound social and economic challenge. Tracking progress across this myriad of global health challenges, and with health development goals more broadly, reinforces the policy value of global comparative assessments in the health sector, such as the ongoing GBD.

#### Contributors

Please see the appendix for more detailed information about individual authors' contributions to the research, divided into the following categories: managing the estimation process; writing the first draft of the manuscript; providing data or critical feedback on data sources; developing methods or computational machinery; applying analytical methods to produce estimates; providing critical feedback on methods or results; drafting the work or revising it critically for important intellectual content; extracting, cleaning, or cataloguing data; designing or coding figures and tables; and managing the overall research enterprise.

#### About the Global Burden of Disease Collaborator Network

The Institute for Health Metrics and Evaluation (IHME) at the University of Washington engages a large network of individual collaborators with specialties in various topic areas to conduct the Global Burden of Diseases, Injuries, and Risk Factors Study (GBD) and its affiliated projects. GBD is a systematic, scientific effort to quantify the comparative magnitude of health loss due to diseases, injuries, and risk factors by age, sex, and geographies for specific points in time and is the largest and most comprehensive effort to date to measure epidemiological levels and trends worldwide. Collaborators are crucial in

See Online for appendix

both the data analysis as well as the policy uptake and proliferation of GBD and affiliated projects. Below, we list the individual collaborators who are authors on the publications listed in this issue.

#### First and senior authors

##### *Five insights from the Global Burden of Disease Study 2019:*

Christopher J L Murray (first author) and Alan D Lopez, Theo Vos, and Stephen S Lim (senior authors). *Global age-sex-specific fertility, mortality, healthy life expectancy (HALE), and population estimates for 204 countries and territories, 1950–2019: a comprehensive demographic analysis for the Global Burden of Disease Study 2019:* Haidong Wang (first author) and Christopher J L Murray (senior author). *Global burden of 369 diseases and injuries in 204 countries and territories, 1990–2019: a systematic analysis for the Global Burden of Disease Study 2019:* Theo Vos and Stephen S Lim (first authors) and Mohsen Naghavi and Christopher J L Murray (senior authors). *Global burden of 87 risk factors in 204 countries and territories, 1990–2019: a systematic analysis for the Global Burden of Disease Study 2019:* Christopher J L Murray (first author), Aleksandr Aravkin, Peng Zheng, (ordered authors) and Michael Brauer, Ashkan Afshin, and Stephen S Lim (senior authors). *Measuring universal health coverage based on an index of effective coverage of health services in 204 countries and territories, 1990–2019: a systematic analysis for the Global Burden of Disease Study 2019:* Rafael Lozano (first author), Nancy Fullman, John Everett Mumford, Megan Knight, and Celine Barthelemy (ordered authors) and Christopher J L Murray (senior author). *Fertility, mortality, migration, and population scenarios for 195 countries and territories from 2017 to 2100: a forecasting analysis for the Global Burden of Disease Study:* Stein Emil Vollset (first author), Emily Goren, Chun-Wei Yuan, Jackie Cao, Amanda E Smith, Thomas Hsiao, Catherine Bisignano (ordered authors), and Christopher J L Murray (senior author).

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