



## The Lancet NCDI Poverty Commission: bridging a gap in universal health coverage for the poorest billion

Gene Bukhman\*, Ana O Mocumbi\*, Rifat Atun, Anne E Becker, Zulfiqar Bhutta, Agnes Binagwaho, Chelsea Clinton, Matthew M Coates, Katie Dain, Majid Ezzati, Gary Gottlieb, Indrani Gupta, Neil Gupta, Adnan A Hyder, Yogesh Jain, Margaret E Kruk, Julie Makani, Andrew Marx, Jaime Miranda, Ole F Norheim, Rachel Nugent, Nobhojit Roy, Cristina Stefan, Lee Wallis, Bongani Mayosi†, for the Lancet NCDI Poverty Commission Study Group

### Executive summary

“As we embark on this great collective journey, we pledge that no one will be left behind. Recognizing that the dignity of the human person is fundamental, we wish to see the goals and targets met for all nations and peoples and for all segments of society. And we will endeavour to reach the furthest behind first.”

*Transforming our world: the 2030 agenda for sustainable development*<sup>1</sup>

We live in an era of unprecedented global wealth.<sup>2</sup> Nevertheless, about one billion people in low-income and lower-middle-income countries (LLMICs) still experience levels of poverty that have long been described as “beneath any reasonable definition of human decency”, in the words of former World Bank president, Robert McNamara.<sup>3-5</sup> This Commission was formed at the end of 2015 in the conviction that non-communicable diseases and injuries (NCDIs) are an important, yet an under-recognised and poorly-understood contributor to the death and suffering of this vulnerable population.<sup>6</sup> The aims of the Commission were to rethink global policies, mend a great disparity in health, and broaden the global health agenda in the interest of equity.

There are ways, with demonstrated effectiveness in real-world conditions, to address the constellation of afflictions known as NCDIs. We have found, however, that the world’s poorest billion are being systematically deprived of those life-saving and life-changing interventions. This unfair exclusion stems both from a lack of global solidarity with the poorest of the poor, and from inadequate descriptions and comprehension of the problem. NCDIs are commonly represented as complications of ageing and development. In fact, they also constitute a large and diverse burden of illness among children and young adults, who make up the largest proportion of people living in extreme poverty around the world. Public health discourse and global solutions have generally focused on preventing NCDIs through changes in human behaviours, and not on addressing the inadequate resources available for the poor to be properly nourished, live safely, and to access health care. Meanwhile, treatments for NCDIs account for the largest gap in health financing for LLMICs, making a mockery of international commitments to universal health coverage (UHC).

Many of the established global initiatives and frameworks for health equity are relevant for the heterogeneous set of conditions that comprise NCDIs among the poorest

billion, which we term NCDI Poverty. To date, none of these schemes have fully recognised the burden of NCDI Poverty or offered strategies to adequately mitigate its effect (figure 1). For instance, the Millennium Development Goals (MDGs) focused attention on the health of the poorest billion and went a long way toward addressing many of the underlying infectious and poverty-related causes of disease.<sup>7</sup> However, these goals did not respond to the specific epidemiology of NCDIs, nor to the complexity of prevention and treatment of these conditions. Likewise, the WHO Global Action Plans for non-communicable diseases (NCDs) focused initially on four major disease categories (cardiovascular disease, diabetes, chronic respiratory disease, and cancer) and four groups of associated risk factors (unhealthy diets, physical inactivity, tobacco use, and harmful use of alcohol), known as the 4×4 conditions. These are undoubtedly global

Lancet 2020; 396: 991–1044

Published Online  
September 14, 2020  
[https://doi.org/10.1016/S0140-6736\(20\)31907-3](https://doi.org/10.1016/S0140-6736(20)31907-3)

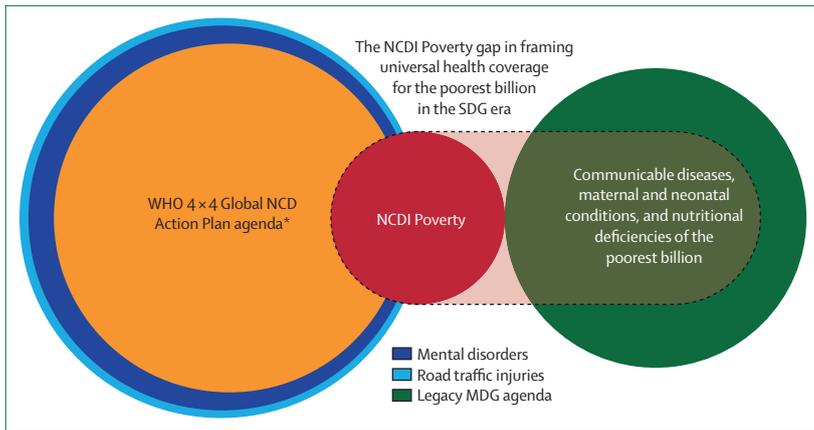
See [Comment](#) pages 939 and 941

\*Commission co-chairs

**Department of Global Health and Social Medicine** (Prof A E Becker MD, G Bukhman MD, M M Coates MPH, N Gupta MD, A Marx BA), **Program in Global NCDs and Social Change** (G Bukhman, M M Coates, N Gupta, A Marx), **Department of Psychiatry, Harvard Medical School** (Prof G Gottlieb MD), and **Department of Global Health and Population, Harvard T H Chan School of Public Health** (Prof R Atun FRCP, Prof M E Kruk MD, Prof O E Norheim FFFPH), **Harvard University, Boston, MA, USA**; **Partners In Health, Boston, MA, USA** (G Bukhman, N Gupta); **Division of Global Health Equity** (G Bukhman, M M Coates, N Gupta) and **Division of Cardiovascular Medicine, Department of Medicine, Brigham and Women’s Hospital, Boston, MA, USA** (G Bukhman); **Universidade Eduardo Mondlane, Maputo, Mozambique** (A O Mocumbi MD); **Instituto Nacional de Saúde, Maputo, Mozambique** (A O Mocumbi); **Center for Global Child Health, Hospital for Sick Kids, Toronto, ON, Canada** (Prof Z Bhutta PhD); **Centre of Excellence in Women and Child Health, Aga Khan University, Karachi, Pakistan** (Prof Z Bhutta); **Institute for Global Health & Development, Aga Khan University, South-Central Asia, East Africa, and UK** (Prof Z Bhutta); **University of Global Health Equity, Butaro, Rwanda** (Prof A Binagwaho PhD); **Clinton Foundation, New York, NY, USA** (C Clinton MPH); **Mailman School of Public Health,**

### Key messages

- For the poorest of our world, non-communicable diseases and injuries (NCDIs) account for more than a third of their burden of disease; this burden includes almost 800 000 deaths annually among those aged younger than 40 years, more than HIV, tuberculosis, and maternal deaths combined
- Despite already living in abject poverty, between 19 million and 50 million of the poorest billion spend a catastrophic amount of money each year in direct out-of-pocket costs on health care as a result of NCDIs
- Progressive implementation of affordable, cost-effective, and equitable NCDI interventions between 2020 and 2030 could save the lives of more than 4·6 million of the world’s poorest, including 1·3 million who would otherwise die before the age of 40 years
- To avoid needless death and suffering, and to reduce the risk of catastrophic health spending, essential NCDI services must be financed through pooled, public resources, either from increased domestic funding or external funds
- National governments should set and adjust priorities based on the best available local data on NCDIs and the specific needs of the worst off
- International development assistance for health should be augmented and targeted to ensure that the poorest families affected by NCDIs are included in progress towards universal health care



**Figure 1: Visualising NCDI Poverty**

The circle areas are drawn precisely to be proportional to the number of DALYs associated with each group of conditions globally. NCDI Poverty includes DALYs among the world's poorest billion people due to all causes of NCDs. The area where the circles overlap represents the NCDI burden among the poorest billion that is due to the 4 × 4 NCD conditions, mental and substance use disorders, and road traffic injuries. The circle areas within the dotted line represent the total number of DALYs among the poorest billion. Original analysis using data from the Global Burden of Disease 2017. SDG=Sustainable Development Goal. NCD=non-communicable disease. NCDI=non-communicable disease and injury. MDG=Millennium Development Goal. DALY=disability-adjusted life year. \*WHO 4 × 4 Global NCD Action Plan agenda includes cardiovascular disease, neoplasms, diabetes, and chronic respiratory disease.

Columbia University, New York, NY, USA (C Clinton); NCD Alliance, London, UK (K Dain MSc); MRC Centre for Environment and Health, School of Public Health, Imperial College London, London, UK (Prof M Ezzati FMedSci); Health Policy Research Unit, Institute of Economic Growth, Delhi, India (Prof I Gupta PhD); Milken Institute School of Public Health, George Washington University, Washington, DC, USA (Prof A A Hyder PhD); Jan Swasthya Sahyog, Bilaspur, Chhattisgarh, India (Y Jain MD); Muhimbili University of Health and Allied Sciences, Dar es Salaam, Tanzania (J Makani MD); CRONICAS Center of Excellence in Chronic Diseases, Universidad Peruana Cayetano Heredia, Lima, Peru (Prof J J Miranda PhD); Department of Global Public Health and Primary Care, University of Bergen, Bergen, Norway (Prof O E Norheim); Research Triangle Institute International, Seattle, WA, USA (R Nugent PhD); WHO Collaborating Centre for Research on Surgical Care Delivery in LMICs, Department of Surgery, BARC Hospital, HBNI University, Government of India, Mumbai, India (N Roy MD); Field Health Systems Laboratory, Bihar Technical Support Programme,

concerns, but leave out key NCDI priorities for the poorest billion.<sup>8</sup> The 2030 Sustainable Development Goal (SDG) targets, adopted in 2017, have remained consistent with these global NCD plans while expanding the focus to include mental health, substance use, and road traffic injuries.<sup>9</sup> Although the Sept 27, 2018, UN High-Level Meeting on NCDs extended the NCD agenda to include mental health and air pollution (thereby extending 4 × 4 to 5 × 5), it is necessary to go further if we are to address the full scope of diseases that constitute NCDI Poverty.<sup>10</sup> UHC holds great promise, but it will fulfil the promise of universality only if its structure and implementation recognise and respond to NCDI Poverty.<sup>11,12</sup>

Beginning in 2016, this Commission organised a team of 23 clinicians, researchers, and policy practitioners into four working groups with these objectives: to learn about the scale and pattern of the NCDI burden among the poorest; to identify priority interventions and delivery strategies to address this burden; to consider gaps and opportunities for NCDI financing in the countries where the poorest billion live; and to better understand the history and current state of NCDI framing and governance within key global institutions and at national levels.

Since its inception, the Commission has convened five global meetings. It has helped to establish National NCDI Poverty Commissions and Groups in 16 LMICs, involving more than 247 NCDI leaders, representing countries that are home to approximately half of the world's poorest billion people. The Commission has co-hosted five Knowledge Exchanges, bringing these National NCDI Poverty collaborators together both virtually and at World Bank offices of four continents.<sup>13</sup> Using videography, the Commission has documented the experience of over 40 patients with a diverse set of

NCDIs from sub-Saharan Africa, the Caribbean, and South Asia. The Commission has also participated in developments that have substantially expanded the NCDI and UHC agendas over the past 3 years to include a broader range of conditions, risks, interventions, and people.<sup>14–27</sup>

The Commission's working groups have developed six key messages based on original analyses of epidemiology, organisation of health interventions, financing, history, and governance (appendix p 3). The methodology behind the estimates used to support these messages and other findings and recommendations of the Commission is described throughout the report and in its appendices (panel 1).

We have found that NCDIs constitute more than a third of the disease burden among the poorest billion, and that around half of this burden is due to causes afflicting children and young adults. Section 1 of this report—the burden of NCDI Poverty—describes the geographical and demographic distribution of the world's poorest people and characterises the magnitude and pattern of their NCDI burden. More than 90% of the poorest billion live in rural areas of LMICs in sub-Saharan Africa and South Asia. More than half a billion people will probably still be living in extreme poverty until 2030. Some projections range as high as 1 billion, taking account of the adverse impact of climate change and inequalities in the distribution of economic growth. The COVID-19 pandemic is now pushing projections of extreme poverty even higher. The World Bank estimates that the pandemic will drive between 71 million and 100 million people into extreme poverty, 81% of them in sub-Saharan Africa and South Asia—the regions that are already home to more than 90% of the world's poorest billion people.<sup>28</sup> Around 80% of the poorest billion are aged younger than 40 years, and around 90% are younger than 55 years. Our analysis shows that NCDIs in these populations are due to a diverse set of conditions and risks. Notably, these conditions are heterogeneous in their effect on the lifetime health of those affected. Those NCDIs associated with the greatest health loss among the poorest billion result in the loss of 20 more years of healthy life per person than the same conditions in high-income populations. Much of this is because NCDIs among the poorest are acquired at younger ages (partly due to population age structure) and because NCDIs are more lethal when they occur among those living in extreme poverty with low access to quality health services.

This Commission has identified a set of cost-effective and equitable interventions to address NCDI Poverty. Although global initiatives have largely focused on health behaviours, the interventions we have identified also have to be delivered through the health sector, including at secondary facilities (such as, district hospitals) to treat established disease. In section 2—integrating NCDI Poverty in UHC—we describe these interventions and show how they can be implemented at scale. Intersectoral

**Panel 1: Key recommendations****Local action**

- Ministries of health in high-poverty countries should partner with academic and civil society groups to assess their national non-communicable disease and injury (NCDI) poverty burden, identify priority conditions and interventions using multiple criteria (including equity and cost-effectiveness), estimate the cost and impact of action, to develop delivery strategies, and advocate for expanded domestic and external financial resources; these NCDI interventions include intersectoral policies, as well as surgical, medical, psychosocial, and rehabilitative services
- National health statistics and surveillance should include information about socioeconomic status and a more diverse set of priority NCDIs
- Governments should establish multi-sectoral mechanisms to coordinate the efforts of ministries responsible for energy, transportation, and social protection so that they consider the special vulnerability of those with severe NCDIs
- National NCDI civil society organisations should make special efforts to channel the voices and priorities of the poor
- National research institutions in high-poverty countries should stimulate investigation to fill knowledge gaps regarding the cost-effectiveness and equity of NCDI interventions and delivery model design

- National professional societies should elaborate a scope of practice and develop career pathways for mid-level providers in priority NCDI service areas
- Ministries of finance should increase fiscal space for health care through taxation of unhealthy products and progressive revenue collection mechanisms.

**Making NCDI Poverty a global priority in the sustainable development goal (SDG) era**

- Broaden the interpretation of the SDG NCDI targets to encompass reducing NCDI mortality at all ages and from all causes, with particular attention to reducing mortality under the age of 40 years
- Disaggregate existing targets for reducing maternal and under-5 mortality by cause of death to highlight and address the role of NCDIs
- Expand universal health coverage and monitoring to include interventions for less common and more severe conditions and those that cause the most lifetime loss of health
- Disaggregate the existing SDG target for social protection to target poor and vulnerable people living with severe NCDIs
- High-income countries should fully implement their development assistance commitments and renew their focus on the comprehensive health and social needs of the poorest people in the poorest countries, inclusive of NCDIs

CARE India, Madhubani, Bihar, India (N Roy); SingHealth Duke-NUS Global Health Institute (SDGHI), Duke-NUS Medical School, Singapore (C Stefan PhD); African Medical Research and Innovation Institute, Cape Town, South Africa (C Stefan); and Division of Emergency Medicine (Prof L Wallis MD), Faculty of Health Sciences, University of Cape Town, Cape Town, South Africa (Prof B Mayosi MD)

†Prof Mayosi died on July 27, 2018

Correspondence to: Dr Gene Bukhman, Department of Global Health and Social Medicine, Harvard Medical School, Harvard University, Boston, MA 02115, USA [gene\\_bukhman@hms.harvard.edu](mailto:gene_bukhman@hms.harvard.edu)

For more on the Commission see <https://www.ncdipoverty.org> See Online for appendix

strategies can prevent drowning, road traffic injuries, heart attacks, strokes, type 2 diabetes, chronic lung disease, and some cancers. Better housing, sanitation, transportation and energy infrastructure, and nutritious foods can relieve other social determinants of NCDI Poverty. We find that health-sector interventions to address NCDI Poverty are diverse and require integration both within and across levels of the health system. We introduce the concept that delivery of these interventions through integrated care teams can help drive transformative change to improve the quality of services in health systems.

The resources being allocated to address NCDI Poverty are grossly insufficient. International development agencies have been the most neglectful. Section 3 of this report—financing to address NCDI Poverty—assesses the current state of both domestic and external NCDI financing in the LLMICs where the poorest billion live. Information from national health accounts suggests that government expenditure on NCDIs is low in these countries. Global development assistance for NCDIs has remained minimal, and little of this funding has been directed toward the poorest countries. The largest organisational channel for development assistance for NCDIs in 2017 was the WHO (US\$164 million). The dismal projected financing capacity in many LLMICs will be inadequate to address NCDI Poverty by 2030 at current levels of development assistance for health. Because NCDIs are the largest unmet need in LLMIC

health financing, expanding development assistance will be essential to achieving UHC in the poorest countries.

There are no existing institutions focused on addressing NCDI Poverty at either global or national levels. Section 4 of this report—global and national policy, governance, and agenda-setting for NCDI Poverty—identifies opportunities to strengthen current health governance arrangements both globally and at the country level. We find that efforts to improve the health of the world's poorest people and to control NCDIs have largely run on parallel tracks over the past 40 years. Poverty-focused global and national health initiatives have concentrated on infectious diseases, and maternal and child health. Meanwhile, the influential NCD priorities at WHO, largely adopted by the World Bank and other global institutions, have focused on a narrow set of conditions and risks (4×4, then 5×5). In the SDG era, these two perspectives have continued to shape UHC monitoring, as well as investments from global multilaterals, development agencies, philanthropists, and national governments. The thinking behind these arrangements seems obvious if unacknowledged: poor countries must use their own meagre resources to deal with their health problems. We hope that the new evidence from this Commission offers an opportunity for the expansion of these frameworks so that NCDI Poverty can be honestly acknowledged and addressed.

To tackle the current failure of reason and compassion, we offer seven recommendations for local action, based on our experience with National NCDI Poverty Commissions. We recommend the following: ministries of health in high-poverty countries should partner with academic and civil society groups to assess their National NCDI Poverty burden, identify priority conditions and interventions using multiple criteria (including equity and cost-effectiveness), estimate the cost and impact of action, develop delivery strategies, and advocate for expanded domestic and external financial resources; national health statistics and surveillance should include information about socioeconomic status and a more diverse set of priority NCDIs; governments should establish multi-sectoral mechanisms to coordinate the efforts of ministries responsible for energy, transportation, and social protection so that they consider the special vulnerability of those with severe NCDIs; national NCDI civil society organisations should make special efforts to channel the voices and priorities of the poor; national research institutions in high-poverty countries should stimulate investigation to fill knowledge gaps regarding the cost-effectiveness and equity of NCDI interventions and delivery model design; national professional societies should elaborate a scope of practice and develop career pathways for mid-level providers in priority NCDI service areas; and ministries of finance should increase fiscal space for health care through taxation of unhealthy products and progressive revenue collection mechanisms.

A commitment to the treatment and prevention of NCDIs is enshrined in the SDGs. To ensure that this commitment does not bypass the poorest people in the world, a global NCDI Poverty Network is being established to support the implementation of this Commission's recommendations. Composed of a growing group of National NCDI Poverty Commissions, this Network will strive to catalyse financial and technical partnerships to implement pro-poor NCDI interventions in the countries where the poorest billion live. This Network, working closely with *The Lancet* and the NCD Countdown 2030, will also monitor and report on implementation progress, strengthening both national and global accountability mechanisms.

In 2018, the Director General of WHO set an ambitious goal that would have an additional one billion people benefiting from UHC by 2023.<sup>29</sup> To fulfil the SDG promise –“to reach the furthest behind first”<sup>29</sup>– this billion should be the poorest billion. And, one of the greatest gaps in UHC for this population is NCDI Poverty.

Some will question whether this Commission is urging leaders in LLMICs to place NCDI Poverty above other pressing health and social concerns, such as infectious epidemics. We are not. Instead, we are calling to expand the pro-poor agenda and mend a deep historical injustice. There is a need for greater resources for health (both domestic and external) to adequately address the obscene lack of care for NCDIs (and other conditions) among

the poorest billion. The authors of this Commission are aware that an extraordinary global commitment will be required to realise our recommendations for redress and coverage. Based on our analyses, we believe it is crucial to articulate, defend, and advance these aspirations for global health equity.

### An introduction to NCDI Poverty

On March 2–3, 2011—ahead of the first UN High-Level Meeting on NCDs—a conference hosted in Boston (MA, USA) focused on the NCDs of the world's poorest billion, whose poverty was embodied in young average age, low energy intake, and subsistence through physical labour.<sup>30</sup> Participants at the Boston event argued that global thinking about NCDs had been too focused on a theory of epidemiological transition, which projected epidemics of chronic disease associated with development.<sup>31</sup> This theory created a blind spot regarding the existence and pattern of non-infectious conditions before declines in infectious mortality (pre-transitional NCDIs). The poorest populations were still experiencing NCDIs as part of a nexus of hunger, toxic environments, infectious diseases, and lack of health care. The NCDIs that emerged under these circumstances were both more severe and more varied than could be captured by frameworks developed for other populations.

In April, 2011, the WHO African Regional Office held a consultation of health ministers in Congo (Brazzaville).<sup>32</sup> The Brazzaville Declaration on NCDs called for an expanded NCDI agenda addressing haemoglobinopathies (sickle cell disease), mental disorders, and violence and injury.<sup>32</sup> Other prominent African health experts called for a 5×5 strategy inclusive of neuropsychiatric disorders and infectious risks.<sup>33,34</sup>

In July, 2013, at a meeting in Rwanda, a group of NCD unit leaders from ten African ministries of health called for a complementary strategy for NCDIs.<sup>35</sup> This NCDI equity agenda focused on policies and integrated health-sector interventions to eliminate deaths among the poorest children and young adults (aged <40 years) due to a broad range of conditions and risk factors, including, for example, rheumatic and congenital heart disease, sickle-cell disease, post-infectious kidney failure, type 1 diabetes, severe asthma, appendicitis, schizophrenia, epilepsy, burns, and drowning, to name a few. In April, 2015, many of the leaders from these countries testified during the first dialogue convened by WHO's Global Coordination Mechanism on NCDs.<sup>36</sup>

This Commission has built on concepts developed by this emerging NCDI Poverty community of academics, practitioners, and policy makers, and has connected those working in sub-Saharan Africa with colleagues in South Asia and Haiti. The Commission has helped to establish National NCDI Poverty Commissions, Groups, and Consortia (National Commissions) in 16 countries (and counting) that are doing analyses and identifying pro-poor priorities based on the best locally available data. The

countries that have organised these National Commissions as of August, 2020, include: Nepal, Haiti, Ethiopia, India (Chhattisgarh state), Mozambique, Tanzania, Rwanda, Malawi, Liberia, Afghanistan, Kenya, Zambia, Zimbabwe, Uganda, Sierra Leone, and Madagascar. These countries represent a range of poverty prevalence, geographies, health systems, and financial constraints, and are home to half of the world's poorest billion people. Their findings have informed this global Commission report, and they will also continue publishing independent reports.

This Commission tells the story of endemic diseases among the world's poorest population, for whom NCDIs are part of a nexus of infection and hunger, mitigated (one hopes) by life-saving technologies, policies, and social protection. The embodiment of extreme poverty in diseases such as tuberculosis, malaria, and childhood infection is well documented.<sup>37</sup> But in the case of so-called pre-transitional NCDIs, there is a need to recognise that they too are part of the unfinished health agenda for the poorest.<sup>38–40</sup>

## Section 1: The burden of NCDI Poverty

### The poorest billion: largely children and young adults living in rural sub-Saharan Africa and South Asia

A focus on the poorest billion people has been central to international health cooperation since at least the 1970s. In 1978, Jim Grant—then at the Overseas Development Council, and later the Executive Director of UNICEF—called for a “fresh approach to meeting the basic needs of the world's poorest billion”.<sup>41</sup> The 2001 Commission on Macroeconomics and Health stated that “the health prospects of the poorest billion could be radically improved.”<sup>42</sup> SDG target 1.1 calls for an end to extreme poverty by 2030.<sup>1</sup> And in his May 2017 acceptance speech as the new Director-General of WHO, Tedros Adhanom Ghebreyesus declared that “All roads lead to universal health coverage” and reasserted the need for WHO to “focus resources on the most vulnerable” as a key to getting there.<sup>43</sup>

For this Commission we have chosen a working definition of the poorest billion based on indicators of deprivations in living standards and education that are available through regularly conducted household surveys.<sup>44</sup> This non-monetary approach draws on the aggregated dataset of ten indicators of health, education, and living standards assembled by the Oxford Poverty and Human Development Initiative and used to construct the global multidimensional poverty index (appendix pp 7–15). This approach has allowed us to look at populations at a sub-national level, by 5-year age intervals, and to benefit from other linked household microdata. The term extreme poverty is more commonly used to describe income below an international poverty line threshold.<sup>45,46</sup>

To avoid confounding, this Commission excluded the two deprivations in health used in the multidimensional poverty index (household undernutrition and under-five

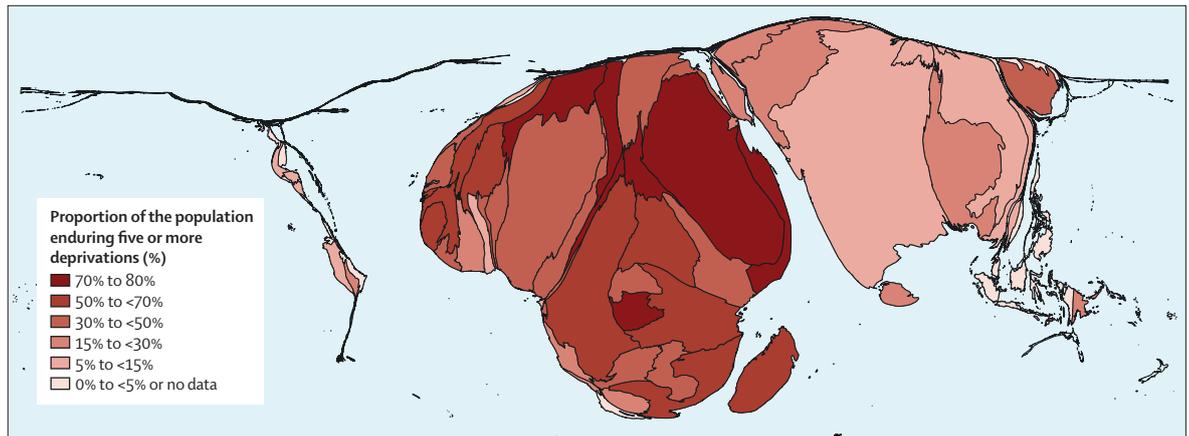
mortality) and used a threshold approach to define the poorest billion.<sup>47</sup> We have found that there are between 873 million and 1.3 billion people living in poorest billion poverty. At the lower end of that range, 873 million people live in households with at least five of eight of these deprivations in education and living standards; at the higher end, 1.3 billion people live with at least four of eight deprivations. We have chosen to use the lower and more conservative of these two estimates in our analyses (appendix pp 7–15). We refer to this group (living with 5 of 8 deprivations) as the poorest billion.

Our review of poverty projections using a different, monetary measure, also indicates that it is quite possible that the population living in extreme monetary poverty will continue to be around 1 billion people through 2030 and beyond (appendix pp 5, 6). This observation reflects estimates of disparities in the rate and distribution of economic growth, population growth, and the economic effect of climate change. The range of people likely to be living in extreme monetary poverty in 2030 is between 255 million in the best-case scenario and 1.1 billion in the least favourable case.<sup>4,47,48</sup>

Based on our analysis (presented in detail in appendix pp 7–15), we can draw several conclusions about the poorest billion. More than 90% of the poorest billion live in sub-Saharan Africa or South Asia. Around half of the poorest billion (46%) live in low-income countries and another half (53%) live in lower-middle-income countries. Furthermore, the lower-middle-income countries that have at least one sub-national region with more than 25% extreme poverty are on the lower end (US\$1853 on average) of the per capita gross national income range the World Bank uses to define lower-middle-income status (US\$1026–4035 in 2015 exchange-rate US dollars).<sup>48</sup> Collectively, these 55 low-income and poorer lower-middle-income countries (the poorest billion countries) accounted for 820 million (94%) of the world's poorest billion people in 2017.

Around 90% of the poorest billion are aged younger than 55 years; in fact, around 80% are younger than 40 years. Similarly, more than 90% of the poorest billion live in rural areas, with roughly two-thirds (65%) living in households engaged in (and at least partially dependent on) agriculture. The number of men and women in the poorest households is roughly the same (although surely there is unequal access to resources within these households). In figure 2, we show the geographical distribution and concentration of the poorest billion at a national level.

With regard to the specific deprivations suffered by the poorest according to our definition: 98% of these households use biomass fuels and few (14%) have access to electricity, increasing their exposure to household air pollution and putting them at risk of pneumonia as well as a variety of chronic diseases (appendix p 12).<sup>49</sup> More than 90% are deprived of decent sanitary facilities and almost 60% do not have reliable access to safe drinking



**Figure 2: Geographical distribution of the poorest billion in 2017**

Country size drawn in proportion to the number of people living with five or more of eight non-health indicators of deprivation. Original analysis using data from the most recent household surveys up to 2017.<sup>47</sup>

water, putting them at risk of diarrhoea and malnutrition.<sup>50</sup> The vast majority of the poorest live on dirt floors (88%), exposing them to faecal material and parasites.<sup>51</sup> Many of the poorest households have children out of school (around 40%) or have nobody in the house who has had completed a minimal 5 years of education (48%). The association between limited maternal education and childhood mortality is well established.<sup>50,52–54</sup> Few (28%) of the poorest households have more than one of a set of substantial assets such as radios, telephones, bicycles, motorcycles, or cars, with implications for patterns of injury and access to health care. More than 89% of the poor are rural in every geographical region we evaluated.

**NCDIs: an important cause of death and suffering among the poorest**

To assess the importance of NCDIs among the poorest, the Commission, working together with National NCDI Poverty Commissions and Groups, did three novel sets of analyses: an analysis of disease patterns among the poorest billion using national estimates; an analysis of cause of death patterns by socioeconomic status from seven health and demographic surveillance sites in sub-Saharan Africa and South Asia; and a survey of expert opinion on the relationship between poverty and cause-specific rates of incidence and death in LLMICs.<sup>55</sup>

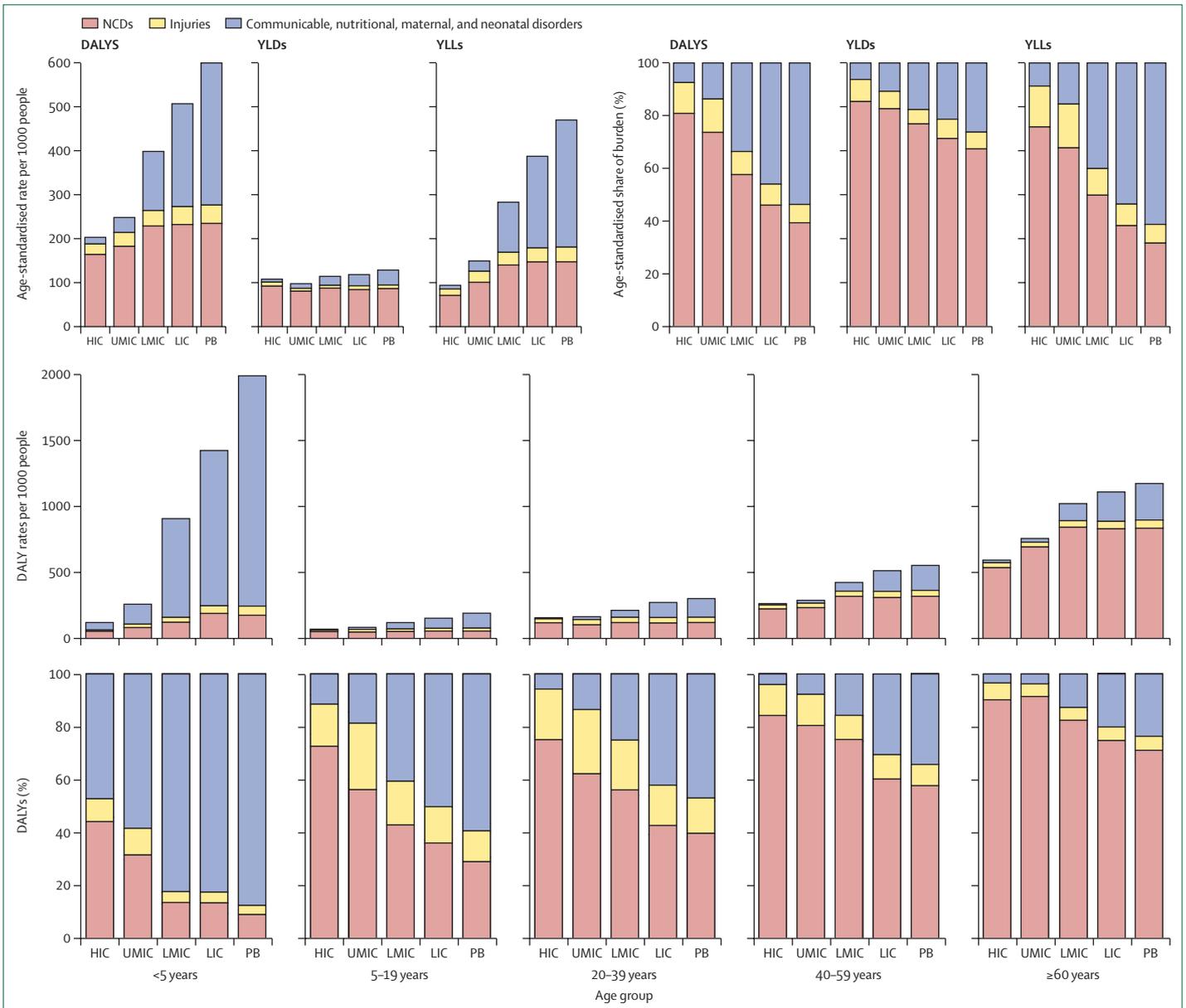
In addition, to add a human dimension to these analyses, we did interviews and produced video narratives with over 40 individual patients living with NCDI Poverty, as well as with family members and care providers. Patients were selected purposefully through National NCDI Poverty Commissions for experiences representative and illustrative of the diversity and severity of the NCDI Poverty burden in their respective countries. We modelled this project on pioneering work done in the Chhattisgarh state of India by colleagues at Jan Swasthya Sahyog.<sup>39</sup> Videos from this—Voices of NCDI Poverty—project are available on

the Commission website (appendix pp 130–37). These narratives speak to our epidemiological analysis, as well as issues raised in subsequent sections of this report regarding intervention prioritisation, catastrophic health expenditures, and NCDI governance.

*Linking poverty and disease burden using national estimates*

Our work indicates that NCDIs are an important cause of death and disability among the poorest billion (appendix pp 16–41). Overall, we found that NCDIs account for around 35% of all-age disability-adjusted life-years (DALYs) in this population (45% before modelling to adjust for within-country differences in rates). Our findings coincide with the estimates made by Gwatkin and colleagues two decades ago (figure 3).<sup>56,57</sup> Furthermore, we find that NCDIs are responsible for nearly 800 000 deaths every year among people aged younger than 40 years in this population. As a point of comparison, that amounts to more under-40 deaths among those in extreme poverty than are caused by HIV, tuberculosis, and maternal causes combined. In addition, we found that rates of DALYs and years of life lost (YLLs) for NCDIs are higher at every age category among the poorest billion compared with full national populations in countries grouped by income level, even though they may constitute a smaller fraction of the burden among the most impoverished people (due to an even higher burden of communicable diseases and maternal and child death; figure 3). Tugwell and colleagues<sup>58</sup> have hypothesised that worse health among the poor can be explained through analysis based on the equity staircase model. This model posits that the poor face: higher risks of disease and mortality; lower financial or physical access to prevention, diagnosis, and treatment; and structural challenges that diminish the effectiveness of interventions. These structural challenges result in late diagnosis, lower treatment adherence, and make behavioural change less likely. Additionally, the quality of care provided to the poor is lower across a range of conditions.<sup>17</sup>

For the Voices of NCDI Poverty see <https://www.ncdi-poverty.org/voices-of-ncdi-poverty>



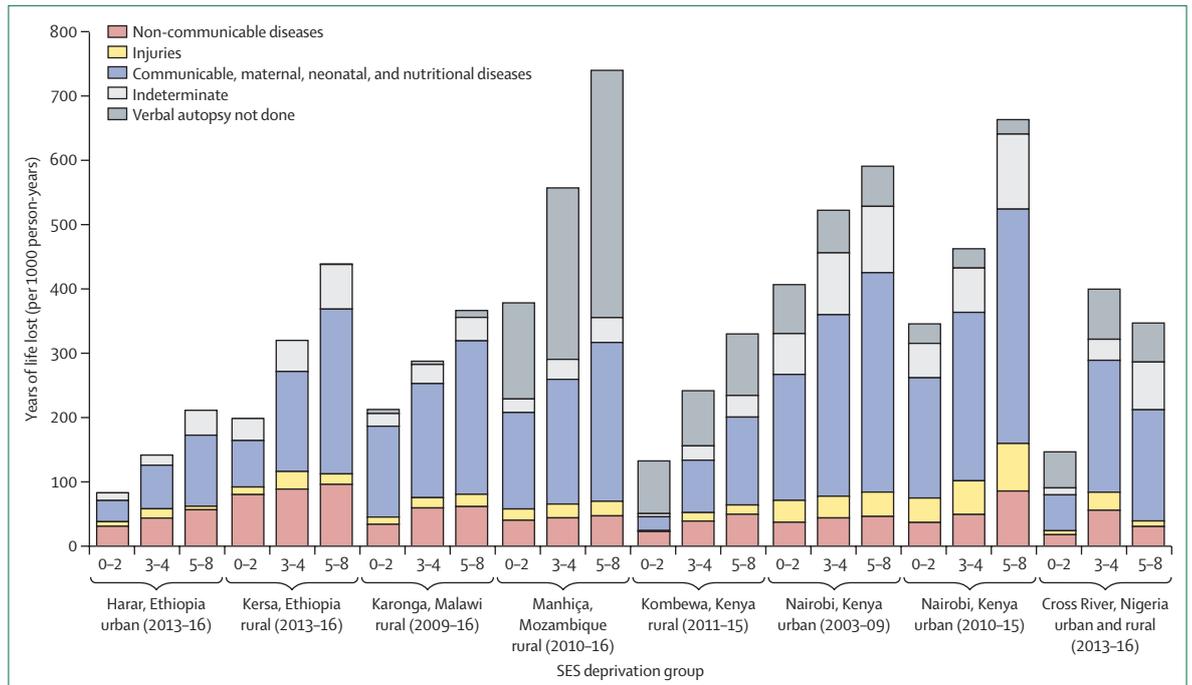
**Figure 3: Importance of NCDI disease burden for the poorest billion versus higher-income populations**  
 NCD=non-communicable disease. DALY=disability-adjusted life-year. YLD=years of life with disability. YLL=years of life lost. HIC=high-income countries. UMIC=upper-middle-income countries. LMIC=lower-middle-income countries. LIC=low-income countries. PB=poorest billion. NCDI=non-communicable disease and injury.

*Primary data on within-country cause of death in relation to extreme poverty*

To test and validate the ecological analysis of the Global Burden of Disease (GBD) data we presented in our first investigation previously described, we analysed available primary data from LLMICs to estimate the relationship between extreme poverty and mortality within countries.

For this analysis, we collaborated with four national NCDI Poverty Commissions and the INDEPTH Network to evaluate cause-of-death patterns at seven health and demographic surveillance system (HDSS) sites in

five countries (ie, Ethiopia, Kenya, Malawi, Mozambique, and Nigeria) in sub-Saharan Africa, representing both rural and urban locations. The INDEPTH Network has previously reported aggregate patterns of death, but these have not been linked to socioeconomic status in a multi-country analysis with a comprehensive set of causes of death.<sup>59-62</sup> Other studies have found higher death rates in poorer households among children and mothers, and from some particular causes, but there have been conflicting results for others, including NCDs overall.<sup>63-67</sup>



**Figure 4: Causes of mortality by SES deprivation groups at selected INDEPTH health and demographic surveillance system sites**  
 Groups are defined by the number of deprivations as per the eight indicators of living standards and education: 0-2=fewest deprivations and 5-8=poorest billion globally. Age and sex were standardised using the INDEPTH network 2013 population standards for sub-Saharan Africa. Education indicators were unavailable for Manhica, and deprivations from this site were reported out of six total indicators. Original analysis using data up to 2016 from sites in the INDEPTH network.<sup>55,68</sup> SES=socioeconomic status.

Briefly, we linked household socioeconomic survey data from seven INDEPTH HDSS sites in five countries with verbal autopsy data regarding deaths from households at those sites. We constructed a poverty index using variables available from each HDSS site, consistent with our global poverty index of eight indicators of deprivation in education and living standards as previously discussed (appendix p 42).<sup>55</sup> We then analysed age and sex standardised cause-specific rates of death and YLLs for deaths among individuals deprived in fewer than three of our indicators, between three and four indicators, and between five and eight indicators (the population classified as the poorest billion).

Consistent with our global estimates, this analysis of primary data shows that the rate of YLLs due to NCDs is higher in populations living in extreme poverty compared with other populations (figure 4). Injury YLL rates vary more by setting. At some sites, there was a substantial fraction of deaths for which verbal autopsy was not done, and at all sites, the causes of some deaths were indeterminate. Our analyses of rates treated these classifications as separate categories. Among those living in extreme poverty across INDEPTH sites in our analysis, the proportion of YLLs from NCDs among deaths with specific assigned causes ranged from 18% to 56% (28% with data from sites pooled). Among the poorest billion from our modelled analysis using GBD estimates, a comparable 28% of total YLLs were due to NCDs as well. Overall,

primary data from these HDSS sites confirm that NCDs account for around a quarter of YLLs even in the poorest populations.

**Primary data on extreme poverty and morbidity due to NCDs**  
 INDEPTH Network data enabled us to analyse within-country relationships between NCDI deaths and extreme poverty in several low and middle income countries with large concentrations of people living in extreme poverty. None of these INDEPTH sites, however, routinely collected and aggregated comprehensive data on NCDI morbidity, although efforts at morbidity surveillance are expanding.<sup>69</sup>

This Commission was able to identify only limited sources of data regarding within-country relationships between NCDI morbidity and socioeconomic status (appendix p 43). Large survey series such as the World Health Survey (WHS) and the STEPwise approach to Surveillance (STEPS) survey have some information on NCDI-related morbidity linked to socioeconomic status. The WHS was done over 15 years ago, however, and STEPS surveys focus primarily on risk factors for NCDs rather than diseases.<sup>70,71</sup> WHS analysis of self-reported symptoms has suggested higher morbidity for several NCDI conditions, including angina, asthma, arthritis, and depression, among the poorest socioeconomic quintiles.<sup>70</sup> Other large survey series in LMICs, such as the Demographic and Health Survey (DHS) and

Multiple Indicator Cluster Survey (MICS), tend to focus on infectious, nutritional, and reproductive, maternal, newborn, and child health issues, although the availability of NCD and injury modules is increasing.<sup>72</sup> Many severe but less-common conditions are not captured in these surveys, which tend to include more common NCDs and risk factors, such as hypertension, type 2 diabetes, and asthma.<sup>73,74</sup> Data from facility-based registries that would more likely capture rarer conditions are often not representative and frequently lack socioeconomic status data. A comprehensive literature search of morbidity and mortality from cardiovascular disease, cancer, diabetes, and chronic respiratory disease in LLMICs found that higher rates of morbidity or mortality from cancer and cardiovascular disease were often reported in lower socioeconomic status populations, whereas the opposite was true for diabetes. There were sparse results for chronic respiratory disease, and only 17 of 84 LLMICs were represented in the literature, suggesting paucity of evidence overall.<sup>75</sup> Furthermore, it is likely that the relationship between disease and poverty varies across specific conditions within these broad disease groups.

*Expert perspectives on extreme poverty, disease occurrence, and case fatality*

To address gaps in global epidemiological information linked to socioeconomic data, we did a survey of 93 individuals with expertise in specific health conditions and experience working as clinicians, policy makers, or researchers in low and middle income countries. Using purposive sampling, we recruited these experts based on literature reviews and from among National NCDI Poverty Commissions in 11 countries (appendix pp 44, 45). Briefly, experts were asked to grade both incidence and case fatality for each GBD cause on a qualitative scale from “much higher in the poorest” to “much higher in the non-poorest”. They were also asked to report their degree of certainty for each grade they assigned.

Respondents thought that case fatality is higher among the poorest for more than 90% of conditions and incidence for more than 75%. Conditions that were thought to have much higher rates of both incidence and case fatality among the poorest included many major infectious diseases and reproductive, maternal, newborn, and child health (RMNCH) conditions, as well as NCDIs such as rheumatic heart disease and cervical cancer (both of which are associated with infectious risks and insufficient access to health care). Conditions that were thought to have little difference in incidence but much higher case fatality among the poorest were mostly NCDs, including type 1 diabetes, breast cancer, paediatric cancers, and asthma. Congenital heart disease, neural tube defects, and other congenital disorders were thought to have much higher rates of case fatality among the poorest billion. Conditions that were thought to have a lower incidence, but higher case fatality, were all within

the NCD cause group, and included ischaemic heart disease and type 2 diabetes.

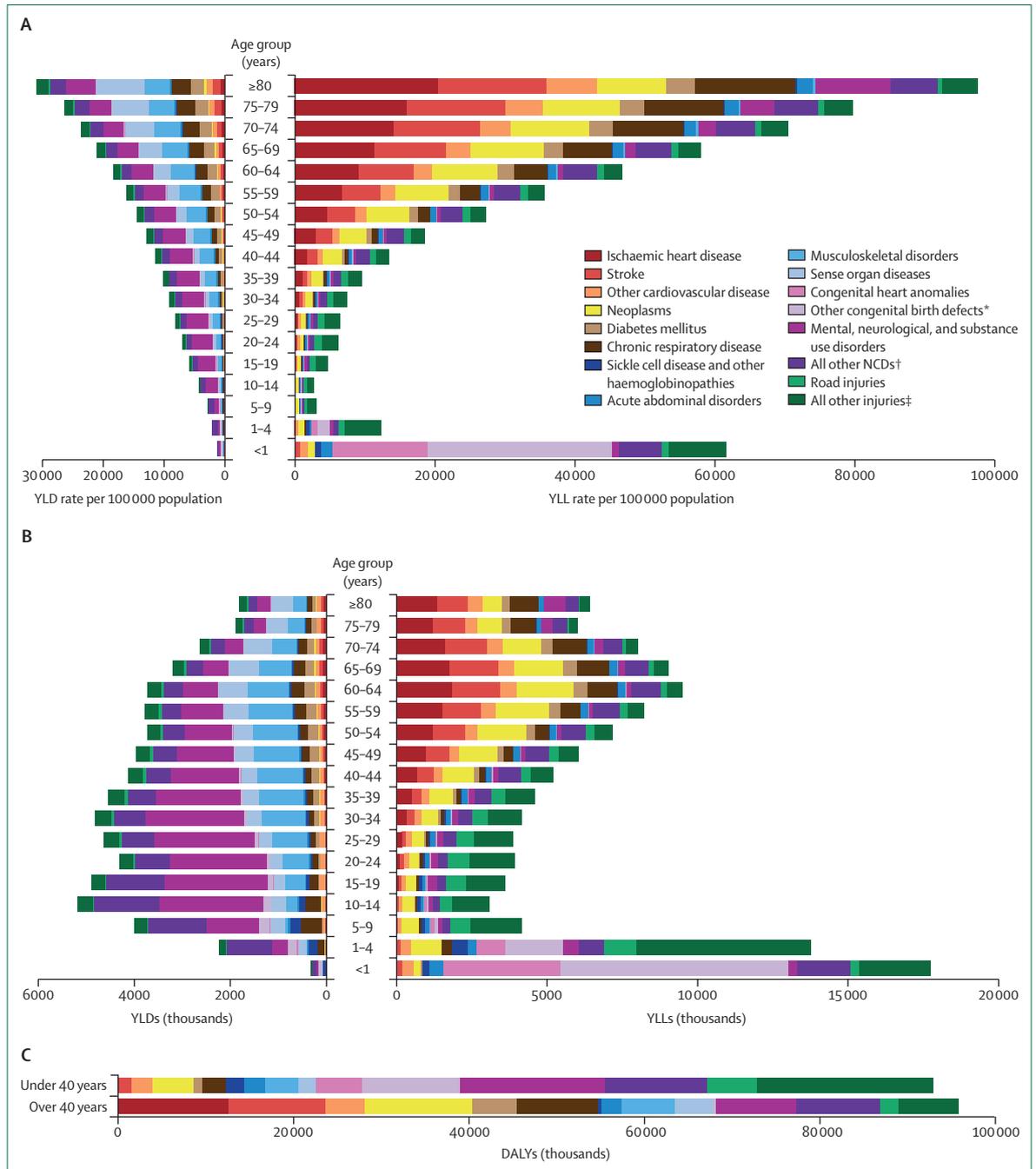
**Making sense of NCDIs of the poorest: diverse conditions, risk factors, and health loss**

So far in this section, we have shown evidence that NCDIs are an important part of the disease burden among the world's poorest billion people. We now examine the diverse pattern of conditions and risks that constitute NCDI Poverty. We find that: around 50% of the NCDI Poverty burden is accrued among the 80% of the poorest billion who are aged younger than 40 years; around 47% of the NCD burden among the poorest billion is due to conditions that have not yet been addressed in global 5×5 NCD frameworks, which have most recently focused on five disease categories (cardiovascular diseases, cancer, chronic respiratory disease, diabetes, and mental illness and substance use) and five associated risk factors (selected components of unhealthy diets, alcohol, tobacco, physical inactivity, and air pollution);<sup>76</sup> road injuries alone account for 22% of the injury burden among the poorest billion; half of the NCDI Poverty burden (49%) is avoidable as compared with rates in high-income countries; and finally, NCDIs are diverse in their effect on years of healthy life lost to death and morbidity for those affected, and that some NCDIs result in disproportionate health loss among the poorest billion due to the age structure and case-fatality rates in this population.<sup>77</sup>

*Pattern of NCDI burden by cause and age among the poorest billion*

Using our modelled estimates of the burden of disease in the poorest billion, we examined DALYs and DALY rates disaggregated into YLLs and years lived with disability (YLDs) by 5-year age group in the poorest billion population (figure 5 and appendix pp 16–41). Although the DALY rates for NCDIs go up with age (particularly for cardiovascular disease), the youth of the poorest populations means that 50% of all-age DALYs accrue before the age of 40 years. In high-income populations, only 19% of all-age NCDI DALYs accrue before the age of 40 years, although the pattern of rates by age group is similar to the poorest populations (appendix pp 46, 47).

There are 20 causes that account for 75% of the NCDI burden for those under the age of 5 years among the poorest billion: congenital conditions, such as congenital heart disease, neural tube defects, Down syndrome, and digestive and other congenital conditions; injuries due to drowning, falls, burns, iatrogenic causes, aspiration of foreign bodies, pedestrian and motor vehicle road injuries, and snake bites; bowel obstruction; medical conditions, such as sickle cell disease, asthma, and epilepsy. Congenital heart disease alone accounts for 14% of the total NCDI burden among the poorest billion in this age group, followed by neural tube defects (11%) and drowning (9%). Other rarer congenital conditions,



**Figure 5: Age-specific pattern of NCDI disease burden among the poorest billion**

Original analysis using data from Global Burden of Disease 2017.<sup>78</sup> (A) NCDI YLL and YLD rates among the poorest billion. (B) NCDI YLLs and YLDs among the poorest billion. (C) NCDI DALYs in those aged younger and older than 40 years among the poorest billion; 49.5% of DALYs occur before the age of 40 years. NCD=non-communicable disease. YLD=years lived with disability. YLL=years of life lost. DALYs=disability-adjusted life-years. NCDIs=non-communicable disease and injuries. \*Other congenital birth defects include neural tube defects, orofacial clefts, Down syndrome, congenital musculoskeletal and limb anomalies, digestive congenital anomalies, and other birth defects. †Other NCDs include cirrhosis and other liver diseases, chronic kidney disease, other abdominal and digestive disorders, other urogenital, blood and endocrine diseases, skin and subcutaneous diseases, and oral disorders. ‡Other injuries include unintentional injuries self-harm and interpersonal violence, other transport injuries, and forces of nature, conflict and terrorism, and executions and police conflict.

such as muscular dystrophies, congenital hypothyroidism and adrenal hyperplasia, and gastroschisis, additionally contribute to this disease burden.

For those among the poorest billion between the ages of 5 and 40 years, there are 52 causes that account for 75% of their NCDI burden: neurological conditions, such as epilepsy and migraine; injuries due to suicide and self-harm, road injuries, drowning, burns, falls, snake bites, interpersonal violence, and conflict and terrorism; mental and substance use disorders such as depression and anxiety, drug and alcohol disorders, bipolar disorder, conduct disorder, schizophrenia, and developmental disabilities; medical conditions, including ischaemic heart disease, strokes, asthma, chronic obstructive pulmonary disease, chronic kidney disease, rheumatic heart disease, epilepsy, diabetes, cirrhosis, and sickle cell disease; sense organ diseases, including hearing loss; skin diseases; musculoskeletal disorders, including low back and neck pain; digestive diseases, such as gastritis and duodenitis; congenital conditions, including congenital heart disease; and endocrine, metabolic, blood, and immune disorders. No single cause accounts for more than 5% of total NCDI burden among the poorest billion in this age group (panel 2).

40 causes account for 75% of the NCDI burden in those aged over 40 years: cardiovascular diseases, such as ischaemic heart disease, haemorrhagic stroke, ischaemic stroke, hypertensive heart disease, and rheumatic heart disease; chronic respiratory diseases; diabetes; musculoskeletal disorders, including low back and neck pain and osteoarthritis; injuries due to, such as falls, suicide and self harm, snake-bites, and road injuries; depression and anxiety disorders; neoplasms, such as cervical, breast, lung, stomach, oesophageal, and colon cancer; neurological conditions, such as migraines, epilepsy, and dementia; cirrhosis; chronic kidney disease; bowel obstruction; peptic ulcer disease; and sense organ diseases, such as cataracts, vision loss, and hearing loss. Ischaemic heart disease alone accounts for 13% of the total NCDI burden among the poorest billion in this age group.

#### *How much of the NCDI burden among the poorest billion is avoidable?*

We sought to estimate the extent and pattern of the NCDI Poverty burden that is in principle avoidable as compared with high-income countries in North America, Western Europe, Asia Pacific, and Australasia. Avoidable burden refers to death and disability that could be prevented through decreases in incidence, case fatality, or both, as opposed to the burden that is amenable to medical care alone.<sup>79</sup> To estimate this avoidable burden, we subtracted age, sex, and cause specific DALY rates among the poorest billion from those in high-income countries in North America, Western Europe, Asia Pacific, and Australasia. We have aggregated results for both sexes across groups of disease, after first omitting the negative avoidable

burden for conditions with lower DALY rates for specific causes among the poorest on an age-specific and sex-specific basis (figure 6). To show the overall burden in addition to the DALY rates, we multiplied these rates by populations in the poorest billion (figure 6 and appendix pp 46, 47).

We find that 49% of the total NCDI Poverty burden is avoidable, resulting in 2.4 million avoidable deaths and 93.8 million avoidable DALYs due to NCDIs every year among the poorest billion. Around half (52%) of the avoidable NCDI Poverty burden is accrued before the age of 40 years, and more than a third (39%) is accrued before the age of 20 years because the death rate for conditions affecting these ages is much higher in the poor than in high-income countries. The vast majority (74%) of the YLLs among those under the age of 40 are avoidable, as well as 61% of the YLLs among those over the age of 40.

The pattern of specific causes that constitute the avoidable NCDI Poverty burden in DALYs is similar to the pattern of YLLs. The four main disease categories (cardiovascular disease, cancers, diabetes, and chronic respiratory disease) plus mental and substance use disorders, and road traffic injuries account for 42% of the avoidable burden. When broken down by age, these specific conditions account for 65% of the avoidable NCDI burden in those over the age of 40 years among the poorest billion, but only 20% of the avoidable burden for those younger than 40 years. Nonetheless, there are conditions in each of these categories that cause a higher

#### **Panel 2: Voices of NCDI Poverty**

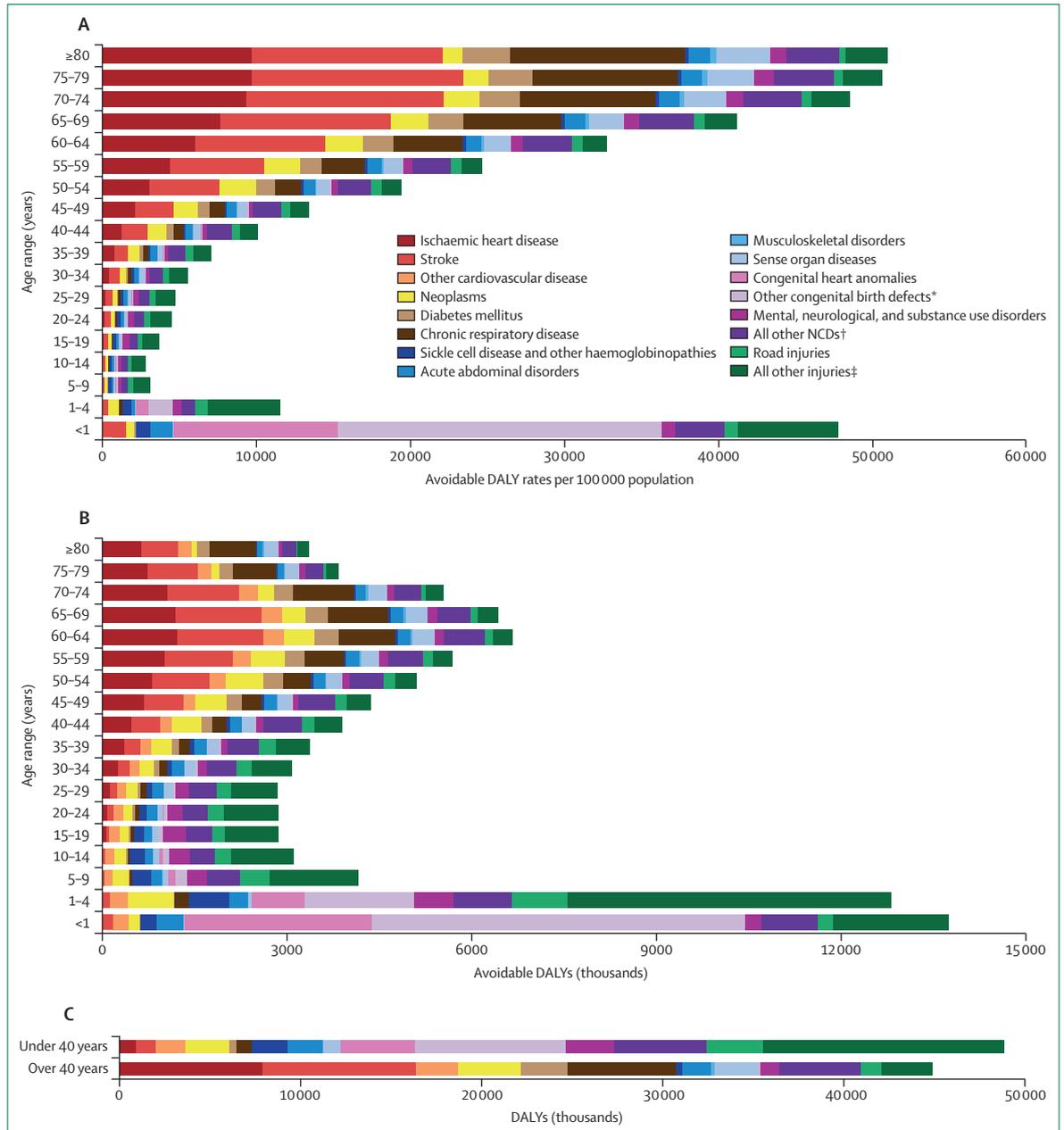
##### **Fede Francky, spinal cord injury, 22 years old (Haiti)\***

“The accident happened one day when I went to cut down a tree with my dad to make charcoal. As I was cutting the tree, it accidentally fell on me. Since then, things have been very difficult. I am young and I used to be in school, even though my parents did not have a lot of financial means. But with the accident, our financial situation has gotten worse. And since then, I have been like this.”

Since the tree fell on him when he was 17 years old, Fede Francky has been confined to a wheelchair and to the ramshackle house where he lives with his parents. His family has taken him to six different hospitals and spent all their limited resources in the quest for treatment that would allow him to walk again. But doctors have told him that he would need to go to the USA or Cuba to find the kind of surgical care that could make his dream come true.

“When I compare my life before and after the accident, it traumatises me. Because before the accident, I used to go to school, and that gave me hope of a better future. But ever since, I lost all the opportunities that I could have had in life. Because the government does not look after people who are disabled. The way that I see disabled people can help their country is for the government to create professional schools for the disabled so they can also build their lives. If I could go to a professional school, I could help my family. Because I can still learn. This would help my family in the future. Because it is only physically that we are impaired. In spirit, we are just like everyone else. The government needs to support and educate the youth, because the reason my situation has not gotten better five years later is that there are no neurosurgeons in Haiti. I would like the government to build schools for the youth of Haiti, so Haiti can have neurosurgeons just like any other country.”

\*Appendix p 131.



**Figure 6: Avoidable NCDI disease burden among the poorest billion**

Original analysis using data from Global Burden of Disease 2017.<sup>78</sup> (A) Age-specific avoidable NCDI DALY rates among the poorest billion. (B) Age-specific avoidable NCDI DALYs among the poorest billion. (C) Avoidable NCDI DALYs in those younger and older than 40 years among the poorest billion; 52% of avoidable DALYs occur before the age of 40 years. NCD=non-communicable disease. DALYs=disease-adjusted life-years. NCDI=non-communicable disease and injury. \*Other congenital birth defects include neural tube defects, orofacial clefts, Down syndrome, congenital musculoskeletal and limb anomalies, digestive congenital anomalies, and other birth defects. †Other NCDs include cirrhosis and other liver diseases, chronic kidney disease, other abdominal and digestive disorders, other urogenital, blood and endocrine diseases, skin and subcutaneous diseases, and oral disorders. ‡Other injuries include unintentional injuries self-harm and interpersonal violence, other transport injuries, and forces of nature, conflict and terrorism, and executions and police conflict.<sup>78</sup>

burden at every age among the poorest billion than they do in high-income countries (appendix p 46).

Injuries alone account for 34% of the avoidable burden in those aged under 40 years. The proportion of cancers among the avoidable causes of NCDI Poverty is smaller

than their share of the total NCDI Poverty burden. Six cancers account, however, for 53% of the avoidable NCDI Poverty cancer burden: cervical cancer, oesophageal cancer, non-Hodgkin lymphoma, stomach cancer, lip and oral cavity cancer, and liver cancer due to hepatitis B virus.

### *Behavioural, metabolic, and environmental risk exposure among the poorest billion*

The poorest billion face exposures to NCDI risk factors over the life course based on inadequate housing and sanitation, polluted environments, infection, food insecurity, unsafe transportation, working conditions, and vulnerable social position. Although the poorest do not tend to exhibit high rates of overweight and obesity, they face other nutrition-related risks such as, hunger, higher prevalence of stunting and aflatoxin exposure, consumption of fewer fruits and vegetables, less fish and nuts, and lower-quality carbohydrates, than other groups.<sup>79–88</sup> Low folic acid intake among mothers can predispose their children to neural tube defects and other congenital conditions.<sup>80</sup> Age-standardised rates of diabetes are higher in LLMICs than in some of the wealthiest countries, and hypertension tends to be high in sub-Saharan Africa in particular.<sup>40,81,82</sup> Many studies have found higher rates of tobacco use among the poor in sub-Saharan Africa and South Asia relative to higher-income groups in these countries.<sup>83–86</sup> Biomass fuel use is almost universal among the poorest.<sup>49,87,88</sup>

There are no comprehensive data, however, regarding within-country variation in exposure to these risk factors by socioeconomic status in LLMICs. A recent review of high-quality studies published since 1990 with socioeconomic variables linked to individual data on physical inactivity, alcohol, and diet in low and middle income countries was largely unable to find studies outside of India that were done in geographical areas with any substantial degree of extreme poverty by our calculations.<sup>89–91</sup>

We supplemented this literature review with ecological analysis of risk factor exposures using county-level estimates from the GBD and NCD Risk Factor Collaboration (NCD-RisC), as well as original analysis of household surveys (eg, DHS and MICS) that provide microdata on obesity, tobacco, alcohol, and the use of biomass fuels.<sup>72,92–94</sup> Complete results and discussion of our work regarding behavioural, metabolic, and environmental risk factor exposure for NCDs among the poorest billion are shown in the appendix (pp 48–51). Similar to observations in the literature, low rates of obesity in the poorest billion, higher rates of tobacco use compared with national rates in LLMICs, high rates of biomass fuel use, and higher blood pressure in the countries in which the poorest billion live compared with higher-income countries were found. Given limitations in data sources, we were unable to draw conclusions about within-country gradients for blood pressure and alcohol consumption in relation to socioeconomic status.

### *Attributable NCDI burden due to selected risk factors among the poorest billion*

We estimated the disease burden attributed to air pollution and selected risk factors targeted in the 2013–2020 Global NCD Action Plan (appendix pp 52–55), using data from

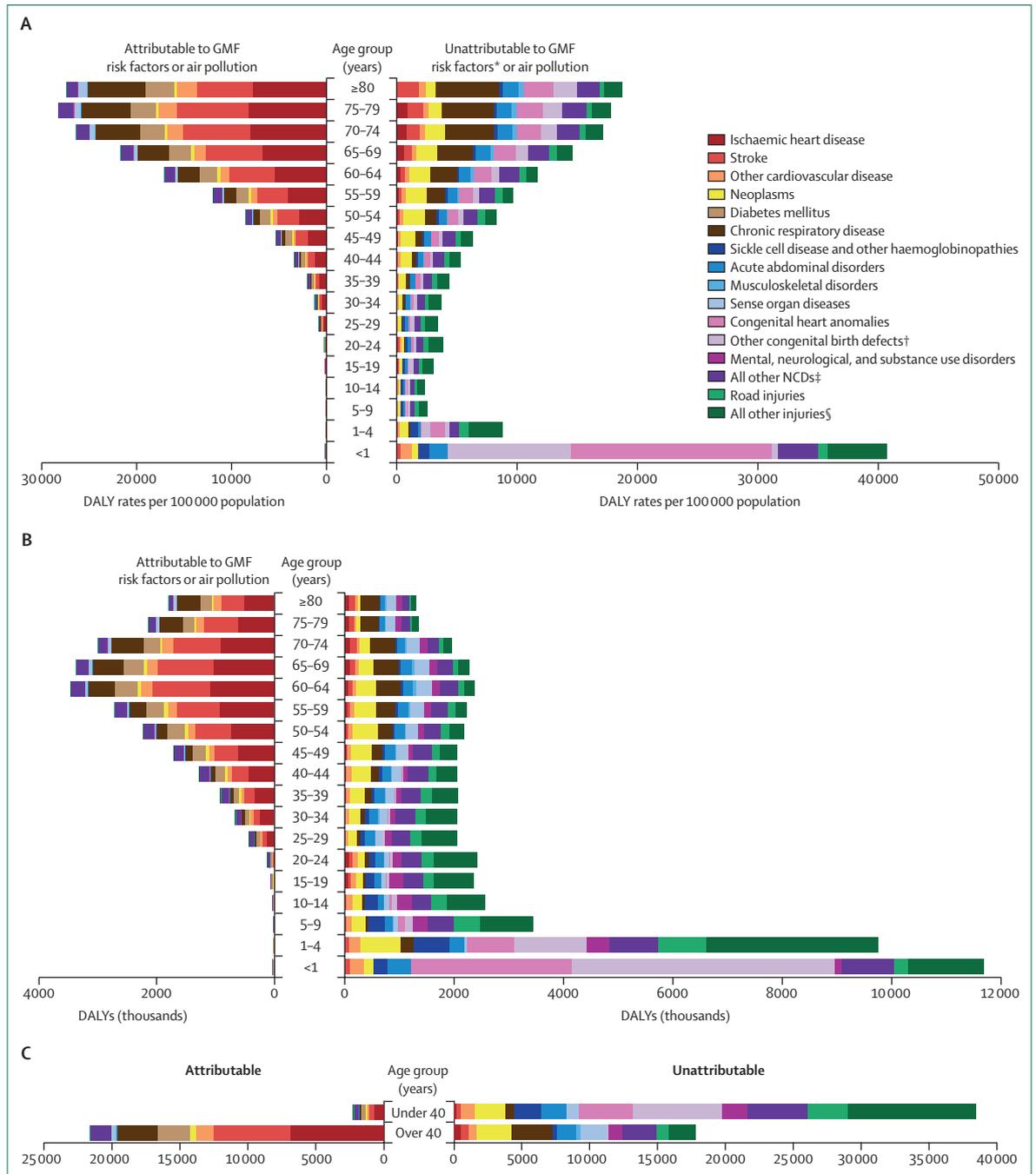
the GBD study. Counterfactual risk exposures are based on theoretical optimum levels (eg, systolic blood pressure 110–115 mm Hg and fasting blood glucose 81–97 mg/dL).<sup>94</sup> The WHO NCD Global Monitoring Framework (GMF; based on the 2013–30 NCD Global Action Plan) has 25 indicators to track progress.<sup>8,95</sup> The risk factors addressed in these indicators include alcohol consumption, physical inactivity, sodium consumption, tobacco use, high blood pressure, diabetes, overweight and obesity, high cholesterol, and diets high in trans fats and low in fruits and vegetables. Air pollution was added as an NCD risk factor in the political declaration of the third High-Level Meeting on NCDs in 2018.<sup>15,87,96</sup>

Based on these estimates, we calculated the age specific, avoidable component of the risk-attributable burden (figure 7). 30% of the avoidable NCDI Poverty burden is attributable to these selected risk factors and 90% of this risk-attributable avoidable burden is accrued after the age of 40 years. Most of this risk-attributable avoidable burden (87%) is due to cardiovascular diseases, diabetes, and chronic respiratory diseases. The avoidable burden that is not attributable to these selected risk factors is from a more diverse set of conditions, including most of the cancer burden.

In addition to the burden attributable to dietary risks identified in the WHO NCD GMF indicators, there is substantial burden related to other nutrition-associated risks that we could not quantify. This burden includes the effects of inadequate food processing leading to liver cancer from fungal aflatoxin in groundnuts and maize, the effect of food insecurity on anxiety and depression, late presentation and medication adherence, medication toxicity, as well as the development of conditions such as diabetes in underweight persons and congenital conditions associated with micronutrient deficiencies.<sup>97</sup> There is also evidence that undernutrition among mothers and in young children can predispose to some NCDs later in life.<sup>98,99</sup> The biological mechanisms for this risk are established, although additional research in low-income settings could help characterise the magnitude of associated burden better among the poorest.<sup>100,101</sup>

### *NCD burden among the poorest billion attributable to infectious risks*

The high burden from infectious diseases that the poorest billion face also contributes to the NCD burden.<sup>102</sup> Many cancers have infectious causes that are more common in countries in which the poorest billion reside.<sup>103,104</sup> There are a number of infections that can also lead to other NCDs.<sup>105–108</sup> These infections include chlamydia and gonorrhoea (infertility), *Streptococcus* (rheumatic heart disease and glomerulonephritis), HIV (cardiomyopathies, pericardial disease, pulmonary hypertension, stroke, ischaemic heart disease, and Kaposi's sarcoma), malaria (epilepsy and glomerulonephritis), hepatitis B and C virus (liver cancer and cirrhosis), Epstein-Barr virus (lymphoma and other cancers), human papilloma virus (cancers,



**Figure 7: Avoidable NCDI burden among the poorest billion, DALYs attributable or unattributable to GMF risk factors\* or air pollution, by age**  
 Original analysis using data from Global Burden of Disease 2017.<sup>78</sup> (A) Age-specific avoidable NCDI DALY rates among the poorest billion. (B) Age-specific avoidable DALYs among the poorest billion. (C) Avoidable NCDI DALYs in those aged younger and older than 40 years among the poorest billion; 90% of attributable avoidable DALYs occur after the age of 40 years and 68% of unattributable avoidable DALYs occur before the age of 40 years. GMF=global monitoring framework. NCD=non-communicable disease. DALYs=disease-adjusted life-years. NCDI=non-communicable disease and injury. \*GMF risk factors include alcohol consumption, physical inactivity, sodium consumption, tobacco use, raised blood pressure, high blood glucose, overweight and obesity, diets high in trans fats, high cholesterol, and diets low in fruits and vegetables. †Other congenital birth defects include neural tube defects, orofacial clefts, Down syndrome, congenital musculoskeletal and limb anomalies, digestive congenital anomalies, and other birth defects. ‡Other NCDs include cirrhosis and other liver diseases, chronic kidney disease, other abdominal and digestive disorders, other urogenital, blood and endocrine diseases, skin and subcutaneous diseases, and oral disorders. §Other injuries include unintentional injuries self-harm and interpersonal violence, other transport injuries, and forces of nature, conflict and terrorism, and executions and police conflict.

including cervical), schistosomiasis (bladder cancer), *Helicobacter pylori* (peptic ulcers and stomach cancer), tuberculosis (chronic obstructive pulmonary disease), trachoma (blindness), meningitis (neurological conditions), and other neglected tropical infections. Using a combination of methods, we estimated that as much as 10% of NCD DALYs in the poorest billion can be explained by a limited number of infectious risks that we were able to quantify (appendix pp 56–59).<sup>102</sup> Chronic exposure to infectious agents may also contribute to development of a range of NCDs through inflammatory pathways.<sup>109</sup>

#### Health loss from NCDs among the poorest billion

We have shown that NCDs among the poorest billion are caused by a diverse set of conditions and risk factors and are varied in their impact on the health of those affected. Greater health loss from a disease or injury can occur because the condition: is more likely to lead to death (especially at a younger age); lasts longer, particularly as a result of onset at a younger age; or is associated with larger loss of functional health or disability.

Understanding the nature of health loss in populations often informs planning and priority setting in the world of mental health. For example, mental health policy sometimes gives extra priority to less prevalent disorders such as schizophrenia and bipolar disorder because they are highly disabling conditions with typical onset in young adulthood, resulting in large lifetime health losses for the affected individuals (panel 3).<sup>110–112</sup> In comparison, common mental disorders such as mild-to-moderate depression and anxiety might not have as much of an effect on individuals, because of their lesser associated disability and duration, but collectively they might be responsible for more of the population disease burden.

Health-adjusted life expectancy, which incorporates both mortality risk and rates of disability, is 52·5 years in the poorest billion compared with 55·7 years in low-income and 69·4 years in high-income countries. This Commission has worked with researchers at the University of Bergen (Norway) to develop metrics to estimate disease-specific lifetime health loss for affected segments of the populations (appendix pp 60, 61).<sup>113</sup> To consider health loss from specific conditions, we used age-specific death rates and YLDs to construct a measure of healthy life-years in those affected by each disease or injury, incorporating both the risk of dying from that condition, as well as mortality risk and morbidity from competing causes. When comparing this metric with high-income populations, we assumed the risk of dying from and being disabled by other conditions was the same as in people living in high-income countries to isolate disease-specific differences. This measure is a function of age patterns of disease or injury onset, how fatal the condition is at different ages, how long the condition lasts among those who do not die, and how disabling the condition is. We then scaled this measure

#### Panel 3: Voices of NCDI Poverty

##### Enock Maloya Phiri, psychosis, 23 years old (Malawi)\*

“From time to time I would have an attack. Fear would just strike me, and I would take off running very fast. At that time, everyone was afraid of me. People would mock me shouting, ‘Crazy man! Crazy man!’ People would beat me. Some threw rocks at me. Others tied me up, saying I should be killed.”

Enock Maloya was 19 years old and thriving in 2013. Trained as a tailor by a development programme, he was married and had a good job in the city, working for a former cabinet minister. Then “some things started happening”. He lost his job, separated from his wife, and fled back to his home village.

“I never knew that a mentally ill person could get well. Because I have seen my friends who didn’t go to the hospital and sought help from traditional healers instead. Even now, they are still disturbed. Their illness hasn’t left them. But after I ran to the hospital, I got well. I feel fine and healthy and energetic in a good way. I take my medicine at the proper time, and yeah, that’s the way.”

Since his uncle convinced him to go to the hospital, Enock has been taking his medications and has benefited from regular visits from clinicians and community health workers. He has reunited with his wife and children and resumed his career as a tailor.

“People are nice to me now. They bring their clothes for me to sew sometimes. Kids can get close to me now. In the past, they would shout, ‘Enock is coming!’ and all the kids would hide indoors. Now, my relationship with the community is great. Now, they call, ‘Mr. Phiri, Mr. Phiri.’ Yeah, I am a happy person. I can feel free, yeah.”

\*Appendix p 133.

using the number of people affected by the disease, which depends on the age structure of the population.

Within the poorest billion, people with some NCDs experience far fewer years of healthy life than those with other conditions. For example, diseases such as sickle cell disease that start from birth cause morbidity over the lifespan and greatly increase the risk of early death (panel 4). Other conditions, such as Alzheimer’s disease occur much later in life, and as a result, although highly disabling during the course of the disease, cause fewer healthy years of life to be lost among those affected.<sup>114</sup> Quantifying this distribution of disease-specific lifetime health loss can help identify the “worse off”<sup>115</sup> in terms of health, which is one area of concern for priority setting.<sup>77,115</sup>

In figure 8, we show the relationship between disease-specific shortfall in healthy life expectancy and the all-age incidence of selected conditions among the poorest billion. The figure illustrates two types of conditions that lie along a continuum. The first type of condition is more

**Panel 4: Voices of NCDI Poverty**

**Gracia Vanel, sickle cell disease, 23 years old (Haiti)\***

"I was eight years old. I walked like a normal kid. I had a lot of energy. Then I started feeling pain all over my body and inside my bones. My parents brought me to the hospital. Doctors did a range of tests and determined that I had sickle cell anaemia. After that I started to feel sick again. I went back to the hospital, where I stayed for four years."

After his first long stay in the hospital, Gracia Vanel went back home and back to school. But he suffered repeated bouts of pain and fever and repeated trips to the hospital. "Stress and infection can cause the pain. Or if you don't eat or hydrate well, it can cause the symptoms to get worse." Then, when he was 22 years old, both his parents died, and his condition deteriorated.

"I couldn't move my legs; I couldn't move my toes. They became stiff. It did not happen all at once. First, I found that I lost sensation and strength in my knees. At first, I just needed help getting up. It took years before I finally had become paralysed to the point where I could no longer walk."

Since he became paralysed from the waist down, Gracia has been confined to a wheelchair and to the isolated home in rural Haiti where his siblings have cared for him. He can go from his bedroom to a dirt courtyard without assistance, but no further.

"It hurts me that I am not able to be more active. I was getting ready to graduate from high school. It's painful to see my classmates graduating while I am not able to do much. I can move around the house. But if I want to leave the house or use the bathroom, I need to find someone to help me. Get up, eat, go outside, sit outside by myself – I don't do much."

"I still have hope that one day I can get up and walk again if I receive good care. There could be another medication that comes out one day that I can be treated with that will help me walk again. I had a dream to learn something that would be useful for society and my family – to see if I could help them too. I haven't lost hope, as long as I have care. I hope to go back to school one day and realise my dreams."

\*Appendix p 132.

common, but results in less lifetime health loss, because it strikes later in life, is less disabling, or both. These types of conditions include major depressive disorder, tension-type headache, and low back pain. At the other end of the spectrum are conditions that are rarer but strike in childhood and cause a great deal of disability for the individual. These conditions include sickle-cell disease, congenital disorders such as neural tube defects, acute lymphoid leukaemia, bowel obstruction, and drowning.

We found that the average loss of lifetime health in segments of the population with some conditions was much higher in the poorest billion than in high-income populations (appendix pp 60, 61). Those affected by epilepsy among the poorest billion, for example, stood to lose 22 more years of healthy life than those affected by the same disease in high-income countries, if they had the same background mortality risks and morbidity from other conditions as in high-income countries. Part of this difference in loss of healthy life was due to the younger age structure of the poorest populations, leading to earlier age of onset of disease on average among the poorest billion, and some was due to insufficient access to treatment resulting in higher cause-specific case-fatality and higher disability due to the same conditions

among the poorest. We are describing this shift as an NCDI health loss transition. In the next section of this Commission, we will identify interventions that we hope can precipitate this shift.

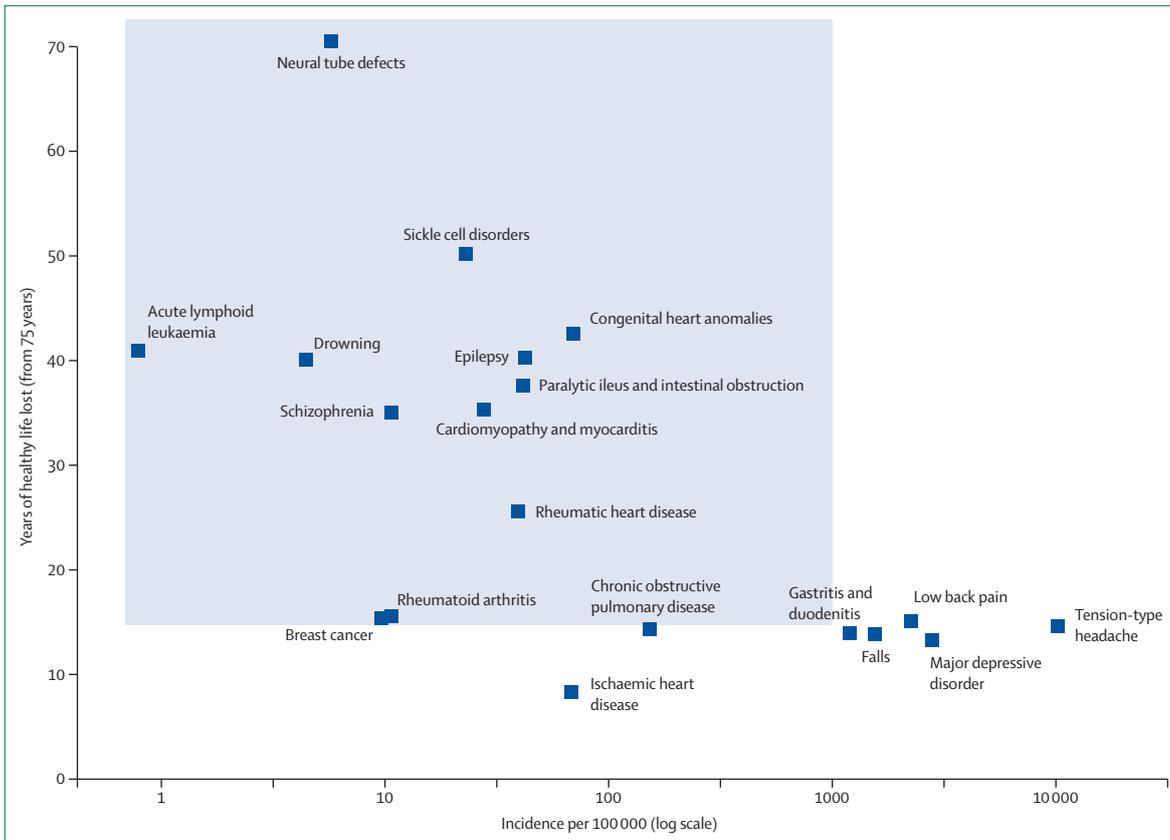
Based on what we have learned about the NCDI Poverty burden, we conclude that although preventive interventions to address a limited set of risk factors are still valuable in the poorest populations, much of the NCDI Poverty burden will remain unaddressed without broader investments aimed at addressing material poverty and increasing the diagnosis and treatment of established diseases.

**Section 2: Integrating NCDI Poverty in UHC**

LLMICs are increasingly committed to progressive achievement of UHC with equity.<sup>16</sup> In section 1 of this Commission, we have shown that a diverse set of NCDIs are an important cause of potentially avoidable suffering among the world's poorest and most vulnerable populations. In section 2, we review what is known regarding the cost-effectiveness of NCDI interventions, and the degree to which these interventions address the needs of those who are worst-off in terms of lifetime health loss and material poverty. We estimate the potential number of lives that could be saved, and disability avoided among the poorest billion if some of these interventions were implemented by 2030. Our concern for equity leads us to go beyond what might be considered low-hanging fruit to effectively address conditions that cause great individual suffering and are highly lethal at young ages in the absence of treatment.

We highlight the importance of interventions that can be delivered through the health sector and find that there are many interventions to diagnose and treat established NCDIs that rank very highly in terms of both cost-effectiveness and equity. These interventions are currently being implemented even in some of the poorest countries and can be feasibly delivered at scale.

Given the large number and heterogeneity of inter-sectoral and health-sector interventions to address NCDIs, we observe that services can be grouped according to common properties in order to facilitate planning and implementation through community, health centre, first-level hospital, and referral centre platforms. We also show that some LLMICs have been able to deliver sets of these clustered interventions through integrated care teams that take advantage of shared infrastructure. To be effective, we emphasise that these interventions will have to be introduced in the context of systematic transformations to improve the quality of health systems, consistent with the recommendations of the *Lancet* Commission on High Quality Health Systems in the SDG Era.<sup>17</sup> Addressing NCDI Poverty is one of the greatest prospects afforded by UHC. The introduction of NCDI interventions should provide an opportunity to build more durable health system structures at primary, secondary, and tertiary levels.



**Figure 8: NCDI health loss and incidence among the poorest billion: years of healthy life lost versus incidence by condition**

Original analysis using data from Global Burden of Disease 2017.<sup>73</sup> The blue rectangle encompasses less common conditions (<1000 per 100 000 incidence) resulting in greater health loss (≥15 years of healthy life lost). NCDI=non-communicable disease and injury.

### Intersectoral interventions to address NCDI risks

Given that a substantial fraction of the NCDI Poverty burden is attributable to potentially avoidable risks, we reviewed opportunities for intersectoral intervention (table 1). The Disease Control Priorities Project 3rd edition (DCP3) recognised 74 priority intersectoral interventions to address behavioural, environmental, and other NCDI risks in low and middle income countries (appendix pp 89–92).<sup>16</sup> These interventions are inclusive of 13 of 16 best buys identified in WHO's Global NCD Action Plans, which have called for effective policies and education to reduce tobacco, alcohol, and salt consumption, and encourage physical activity.<sup>119</sup> This Commission identified a subset of the intersectoral interventions prioritised by DCP3 that were thought to be particularly relevant to address NCDI Poverty, and added additional interventions through consultation with National NCDI Poverty Commissions. Additionally, this Commission independently reviewed the evidence for intersectoral interventions to prevent unintentional injuries.<sup>117</sup>

As noted in section 1, the poorest billion by our definition largely reside in rural areas of sub-Saharan Africa and South Asia, live in households supported through agriculture and other labour outside of the formal

economy, and have low levels of education and few material assets. Information and education interventions were thought to be generally less effective than regulation, fiscal policies, and public investment in the built environment in reaching these populations.<sup>120–123</sup> Exposure of the poorest to arsenic, asbestos, mercury, lead, silica, and other toxins could be reduced to some extent through public notification regarding contaminated sites, as well as legislation on hazardous waste disposal. Controls on pesticides and regulations to promote child-resistant containers could avert some intentional and unintentional poisonings. In addition to other benefits, micro-finance interventions and gender-equity training could reduce some of the burden of violence against women and girls. In addition to regulation and taxation to discourage consumption of unhealthy products, we emphasised investments to fortify foods and to make fruits, vegetables, healthy carbohydrates, and proteins more available to those living in extreme poverty. We also highlighted targeted investments to improve housing and household energy among the poorest, although we note that current interventions addressing household air pollution have been repeatedly shown to be ineffective at the community level.<sup>124,125</sup> High-quality evidence supports the effect of

	Information and education	Regulation and legislation	Fiscal	Built environment
Behavioural and metabolic	Swimming lessons for children in high-risk areas for drowning; microfinance combined with gender equity training; notification to public of locations of contaminated sites; school-based programmes to address gender norms and attitudes	Ban trans-fats and replace with polyunsaturated fats; setting and enforcement of blood alcohol concentration limits among drivers; impose strict regulation of advertising, promotion, packaging, and availability of alcohol and tobacco, with enforcement; enact legislation and enforce personal transport safety measures, including speed limits and seatbelts in vehicles and helmets and mandatory use of daytime running lights for motorcycle users	Tax to discourage use of sugar sweetened beverages; impose large excise taxes on alcohol and other addictive substances; impose large excise taxes on tobacco; subsidies to encourage production and consumption of fruits, vegetables, and healthy carbohydrates and proteins among the poorest	Increased visibility, areas for pedestrians separate from fast motorised traffic; early childhood education through crèches to prevent injuries
Environmental	..	..	Subsidies to promote the use of low-emission household energy devices and fuels among the poorest;* subsidies to improve housing quality among the poorest	Relocation of brick kilns for emission control when feasible; safer stove design to reduce risk of burns; public investment in transportation infrastructure
Occupational and industrial	..	Legislation and enforcement of standards for hazardous waste disposal; enact strict control and move to selective bans on highly hazardous pesticides; regulations on child-resistant containers for hazardous substances	..	..

Modified from interventions identified by the Disease Control Priorities 3rd edition project and through a systematic review of interventions to prevent unintentional injuries in low-income and lower-middle-income countries.<sup>117,118</sup> NCDIs=non-communicable diseases and injuries. \*Current interventions to address household air pollution at community level have not been effective.

**Table 1: Intersectoral interventions to address behavioural, environmental, and other NCDI risks among the poorest billion**

six interventions to prevent deaths from road injuries: helmet-use laws, and drink driving, traffic, seatbelt, speed, and helmet-use enforcement.<sup>117</sup> Additionally, high-quality evidence also supports the effects of swimming lessons, early childhood education, and supervision through crèches to prevent childhood drowning.<sup>117</sup>

### Cost-effectiveness and equity of health-sector NCDI interventions

Given that much of the NCDI Poverty burden will not be avoided through intersectoral interventions alone, this Commission has reviewed available evidence regarding the cost-effectiveness of health-sector NCDI interventions.<sup>126</sup> It has also evaluated these interventions from the standpoint of equity defined as priority to the worse off, consistent with recommendations of the WHO Consultative Group on Equity and Universal Health Coverage (appendix pp 62, 63).<sup>115</sup>

Given the uncertainties regarding measures of both cost-effectiveness and equity at a global level, we have emphasised that intervention assessment must be done in a local context. For illustrative purposes, this Commission aimed to identify highly cost-effective and equitable interventions to address the diverse set of NCDIs that affect the poorest billion. We partnered with National NCDI Poverty Commissions in LLMICs to develop and implement a process for assessing their NCDI burden and identifying and prioritising interventions to address this burden, with particular attention to the poorest populations.

At a global level, we began our analysis by referring to those NCDI interventions that had already been evaluated by the DCP3 project for low and middle income countries

and included in its essential UHC (EUHC) package.<sup>118</sup> Costs to deliver care to the poorest might be higher, and health gains lower than the averages estimated by DCP3. However, a benefit of drawing from the DCP3 approach is that a consistent methodology was used across interventions, facilitating priority setting. We also referred to the list of NCDI interventions included by WHO in its projections of resource needs for the achievement of the health SDG.<sup>127</sup> Health-sector interventions in the DCP3 package included 130 NCDI-specific interventions and 12 cross-cutting interventions related to palliative care, rehabilitation, pathology, radiology, patient referral, and patient education. We found that the DCP3 interventions were inclusive of the interventions considered by WHO. We added to the DCP3 intervention list through consultation with the National NCDI Poverty Commissions and Groups, ultimately introducing 38 additional health-sector NCDI interventions. In total, we analysed 183 NCDI interventions that are delivered through the health sector, all of which were either thought to be components of EUHC by DCP3 or considered likely to be important by this Commission and its collaborators. The appendix (pp 64–75, 76–88) maps all these interventions to cause groups, specifies interventions not considered essential by DCP3, and maps the interventions to an illustrative typology of care teams at each level of the health system. The identified health-sector interventions address more than 89 specific NCDI causes. Some of these interventions, such as vaccinations for hepatitis B and human papilloma virus, would have preventive effects in the future, whereas most will have more immediate effects on disease burden.

Although this list is quite parsimonious relative to the large number of interventions delivered (and thought

valuable) by health-care systems around the world, we recognised that LLMICs facing severe budgetary and health system constraints will need to prioritise where to start and how to scale up over time. Therefore, we developed a framework for scoring each of the identified NCDI health-sector interventions from the perspective of cost-effectiveness and equity (appendix pp 62–75), and identified interventions that are comparable to other global health priorities in both these dimensions.

Our assessment of cost-effectiveness relies largely on the systematic reviews by DCP3, supplemented by our own literature searches, and also through consultation with the Global Health Cost-Effectiveness Analysis Registry.<sup>128</sup> Consistent with DCP3, we ranked interventions on a scale of 1 to 4 from the standpoint of cost-effectiveness. For equity grading, we developed a composite score (also from 1 to 4) that incorporated concerns for priority to the poor, to women, to those with the least lifetime health, and to those with severely disabling conditions. Our approach was validated using a modified Delphi method among

the Commissioners (appendix pp 62, 63). Although there was not unanimity regarding the scoring system, a strong majority concurred that each of these elements was an important equity consideration.

Applying this framework, we found at least 27 health-sector NCDI interventions with evidence of the highest (category 4) levels of both equity and cost-effectiveness, comparable to several prioritised maternal and child health interventions (figure 9). These interventions include low cost, chronic medical treatment with little residual disability for several of the severe conditions that would otherwise be lethal or highly disabling in children and young adults (eg, type 1 diabetes, epilepsy, rheumatic heart disease, and sickle cell disease).

Other interventions ranked in this highest category for both cost-effectiveness and equity include low-cost medical treatments that definitively address acute and life-threatening manifestation of chronic conditions (such as, acute heart failure and myocardial infarction). The list also includes a number of surgical interventions

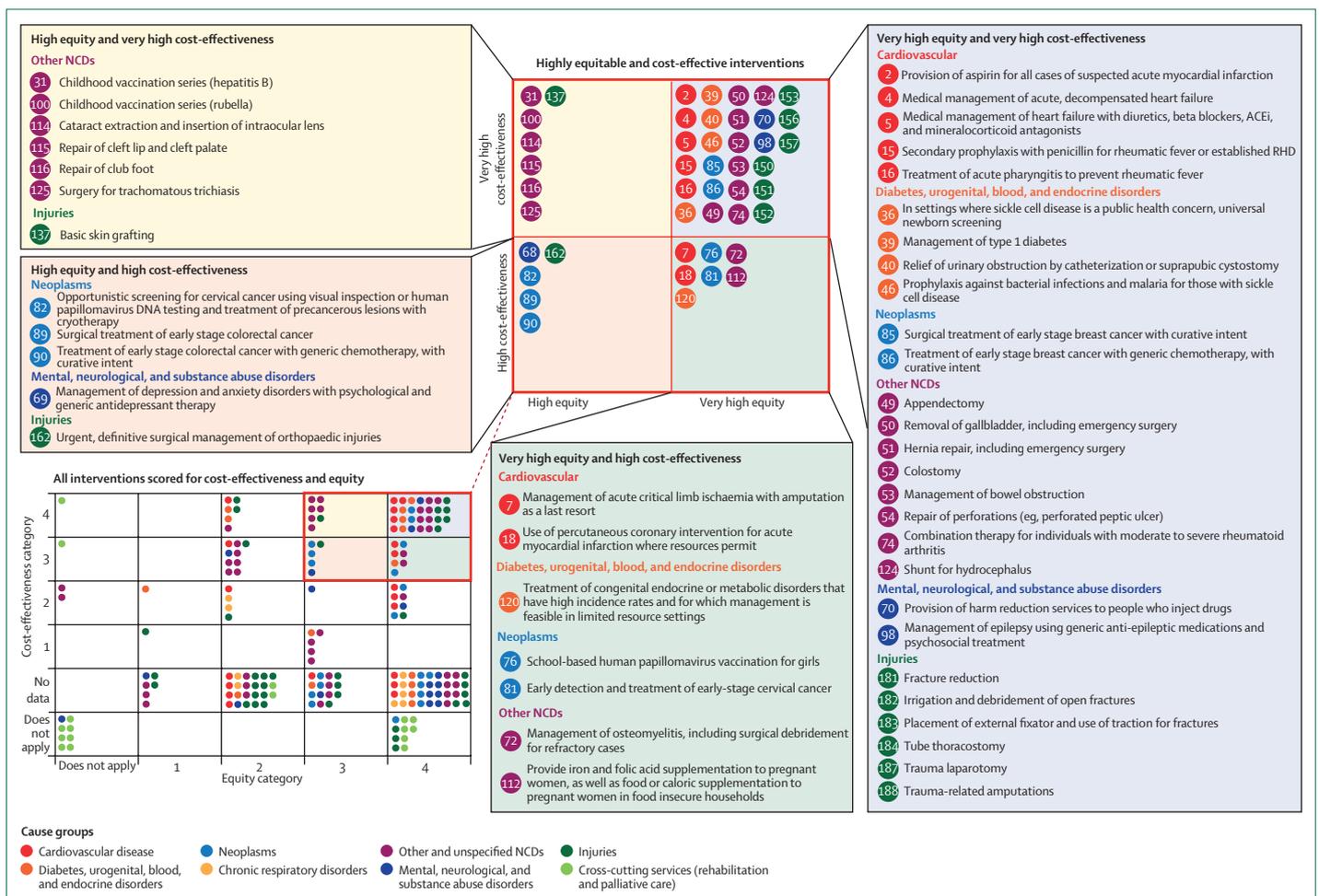


Figure 9: Health sector NCDI interventions scored for cost-effectiveness and equity

Cost-effectiveness data from the Disease Control Priorities 3rd edition (volume 9)<sup>128</sup> with additional equity analysis by this Commission. All interventions are identified and described in more detail in the appendix (pp 64–88). NCD=non-communicable disease. ACEi=angiotensin-converting enzyme inhibitors. RHD=rheumatic heart disease.

that are curative for severe and life-threatening conditions (appendectomies and other emergent laparotomies, tube thoracostomy, and relief of urinary obstruction), as well as surgical management of fractures and curative surgeries for early stage breast cancer and infant hydrocephalus.

Looking beyond interventions that ranked in the highest category for both cost-effectiveness and equity, another 19 health-sector interventions also ranked in the high (category 3) or highest categories for these dimensions. These interventions include vaccinations for rubella (to prevent congenital heart diseases of variable severity), hepatitis B (to avoid cirrhosis and liver cancer in adulthood), and human papilloma virus (to prevent cervical cancer), as well as management of depression and anxiety disorders with psychological and generic antidepressant therapy. Other interventions in these categories include treatment for early-stage cervical and colorectal cancer, as well as low-cost surgeries (and rehabilitation) to address moderate disability, such as repair of club foot and cleft lip and palate, basic skin grafting for mild-to-moderate burns, draining of superficial abscesses, suturing of lacerations, and surgery for cataracts and trichomatous trichiasis. The equity assessment of these interventions is sensitive to both the disability weights assigned to the associated health state and the degree of targeting within the conditions (eg, unilateral vs bilateral club foot). These

interventions would also include the prevention of congenital disorders, such as neural tube defects, at low cost through periconceptual folic acid supplementation and more costly treatment of acute medical conditions in adulthood (advanced management of critical limb ischaemia). The cost-effectiveness ranking of these interventions is sensitive both to local costs and quality of service delivery.

Similarly, we identified an additional nine health-sector NCDI interventions that are ranked in the high or highest categories (3 or 4) with respect to equity, but which ranked less highly (2 or moderate) in terms of cost-effectiveness. These interventions include chronic treatment of the most severe mental health conditions (schizophrenia and bipolar disorder) at low cost with moderate effectiveness; screening and treatment at moderately low cost for life-threatening congenital disorders such as hypothyroidism and phenylketonuria; and medical treatment of childhood cancers. The cost-effectiveness ranking of these interventions is sensitive both to local costs and quality of service delivery.

There are an additional 36 health-sector NCDI interventions that were scored most highly in terms of equity, but for which there were no data regarding their cost-effectiveness in low and middle income countries. These interventions include moderately expensive specialised surgical or percutaneous procedures that could provide major benefits to children (cardiac surgery and percutaneous intervention for rheumatic and congenital heart disease, paediatric renal transplantation, paediatric surgery for congenital gastroschisis, Hirschsprung's disease, and anorectal malformations). These interventions also include elements of emergency and high-dependency care such as peritoneal dialysis for acute kidney failure in children, and adherence support and palliation in the community for high-risk conditions (eg, severe mental disorders and severe chronic NCDs such as advanced malignancies and type 1 diabetes). All these interventions were thought to be potentially important by the NCDI poverty collaborators and should be prioritised for economic evaluation (panels 5, 6). An additional eight interventions were cross-cutting diagnostic, palliative, rehabilitation, and mental health services for which ranking in terms of equity and cost-effectiveness was not relevant.

#### Leading with equity to deliver NCDI interventions on the path to UHC

Martin Luther King famously stated, "Of all the forms of inequality, injustice in health care is the most shocking and inhumane."<sup>135</sup> We have shown that many NCDI interventions exist that are cost-effective and equitable. However, the poorest countries, with their financial and health system constraints, face difficult choices about which conditions and interventions to prioritise and how to implement and scale them up effectively. The per-capita cost of the DCP3 EUHC NCDI interventions

#### Panel 5: High volume, low cost, and high quality publicly funded cardiac surgery in a low-income country (Nepal)

Nepal is a low-income country in South Asia, with a population of close to 30 million in 2016.<sup>48</sup> Advanced rheumatic and congenital heart disease are still among the most common cardiac causes of hospital admission in Nepal.<sup>129-131</sup> These conditions primarily affect children and young adults, have a disproportionate effect among the poor, and are correctable through cardiac surgery in many cases.<sup>132</sup> Beginning in 1995, Nepal—with a per-capita gross domestic product at the time of US\$206—began to publicly finance open heart surgery; first through the Shahid Ganga National Heart Center, and later through Manmohan Cardiothoracic and Transplant Center (since 2011). Nepal increased its volume of valvular and congenital heart surgery up to more than 2000 cases per year by 2015.<sup>133-134</sup> 30-day surgical mortality for single valve replacements has been below 5%, and in the order of 1–2% for correction of septal defects (both good by international standards). Both institutions have maintained low operating expenses, and the average cost for a double valve replacement is around US\$2500, whereas the cost of simple congenital heart surgery is around US\$2000. Although these costs are low, they are still unaffordable to Nepal's poorest. To increase access to cardiac surgery, the Government of Nepal established the Child Assistance Program to fully subsidise cardiac care for those aged under 15 years. Additionally, the Senior Citizen Program finances care of patients aged over 75 years. Patients between the ages of 15 and 75 years who are poor are eligible to apply for government support up to US\$1000 through the Poor Patients Relief Fund. In 2016, the Government of Nepal announced a new initiative to fully subsidise all care, including surgery, for patients with rheumatic heart disease. Public financing for cardiac surgery for the poor with severe cardiac diseases in Nepal has developed local capacity and supported high surgical volumes with high quality at low cost. Nepal is creating a successful and sustainable model for equitable cardiac care in resource-poor settings.

in the poorest LLMICs is little more than a rounding error compared with health-care spending in high-income countries. But, as we will discuss in section 3 of this report, this cost is far higher than total government spending on health in most of the poorest countries. Furthermore, health systems in these countries will need to improve human resources, infrastructure, supply chains, and information systems to implement these interventions at scale with quality.<sup>17</sup> Examples from the worlds of infectious diseases and maternal and child health suggest one successful strategy that addresses both challenges—focusing initially on interventions for severe conditions that affect children and young adults and leveraging them strategically to strengthen the health system overall.

In the case of NCDIs, we observe that there is a similar opportunity to drive pro-poor UHC expansion by leading with equity. In many cases, this might be starting to happen already through initiatives focused on severe conditions affecting children and young adults. These conditions include congenital and rheumatic heart disease, type 1 diabetes, severe asthma, sickle cell disease, acute kidney injury in children, acute abdominal conditions and trauma, severe mental illness, epilepsy, rheumatoid arthritis and psoriasis, and paediatric and women's cancers, to name a few.<sup>136–143</sup> Interventions addressing these conditions were frequently prioritised by National NCDI Poverty Commissions and Groups.

### Delivering with equity and quality

Debates about progress toward UHC have appropriately focused on the prioritisation of interventions. This focus has been particularly useful in the case of highly standardised interventions that address a large fraction of the disease burden. As we have seen, however, health-sector interventions to address NCDIs among the poorest are often complex to implement and do not individually address dominant diseases. *The Lancet Commission*<sup>17</sup> on high-quality health systems in the SDG era has noted that structural health system reforms will be needed to deliver effective health care, and particularly to deliver complex interventions. Given the abysmal quality of care that exists even for simple services, incremental improvements will not be sufficient to fix the problem. Therefore, we focus on the need for service redesign.

#### *Right-placing high equity interventions*

Understanding the dynamics of delivery for health interventions requires us to think about where in the health system these interventions could be carried out. Health systems try to maximise two aspects of delivery design that are sometimes in tension: decentralisation and quality. Decentralisation aims to bring services as close as possible to the patient to minimise indirect costs such as transportation, which are impoverishing and reduce use of health-care services. At the same time,

### Panel 6: Voices of NCDI Poverty

#### Dipesh Rai, rheumatic heart disease, 17 years old (Nepal)\*

"The first time it happened, I had gone to a temple and fell ill after coming back that evening. I used to get headaches and a fever, and my feet felt numb. After I was sick for about two weeks, we took help from a shaman. They cut a chicken, but it didn't help. After that I went to the hospital."

Dipesh Rai lives with his parents, two younger siblings, and his grandmother in rural Nepal. The family's home was destroyed in the devastating 2015 earthquake, and they have been forced to mortgage their small plot of land to pay for medical expenses. "I have no education and no work or job," his father says. "We had hoped to educate the children so that they would be capable. But he has a heart ailment."

"The doctor said my valve is damaged and it needed an operation. But I came back home without doing the operation, because we didn't have any money to pay for it. So we didn't operate, and later as time went by, it became more difficult to breathe. Now two of my valves are damaged, one of which is more severe. It needs to be replaced."

Dipesh's family has struggled to save and borrow money to pay for hospital bills, transportation costs, and the surgery they now understand he needs. "We don't know what to do," his mother explains. "If we could cure him and educate him, he would be able to clear the debts. But he is in this condition. He cannot work or earn. The little work we do is just enough to buy us food. But the children fall sick and their grandmother cannot survive without medicines for high blood pressure and asthma. Life has always been hard. There has never been a happy day, not a single day."

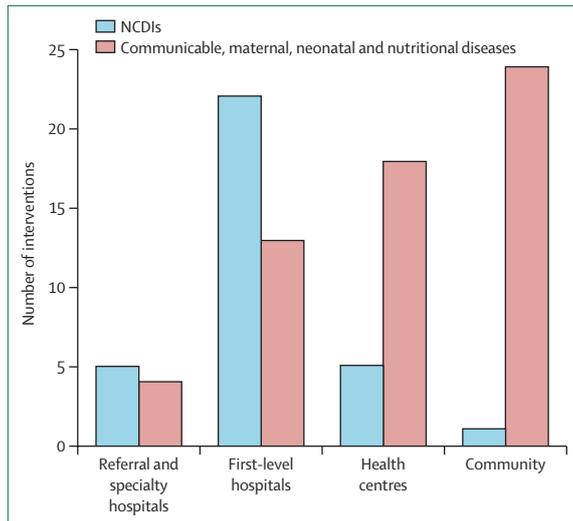
"I don't feel good [about living in Kathmandu to be closer to treatment]. It does not feel like home. I think of my parents a lot. I want to educate myself so I can take care of them. They are very humble. They always agree to what other people say. I want to study Japanese so I can go to Japan to study and work. I will go to Japan, make money, and clear the loans. That's my plan."

Months after this interview was conducted, Dipesh underwent successful surgery to replace two valves in his heart free of charge—shortly after Nepal expanded its pioneering public cardiac surgery programme to fully subsidise all costs for rheumatic heart disease treatment, including surgery.

\*Appendix p 134.

more complex interventions have training, supervision, and practice volume requirements that make decentralisation challenging. Right placing describes the process of organising health services at the right level of the health system and by the right providers, so that they can be delivered at high levels of quality. In the case of communicable and RMNCH conditions in LLMICs, the most equitable interventions are often already being delivered at health centres and through community platforms using standardised protocols for highly prevalent conditions.

In contrast, the most equitable NCDI interventions in LLMICs are often restricted to referral hospitals, whereas they could be delivered at first-level hospitals under more optimal conditions (figure 10 and appendix pp 93, 94). This restriction results in low use of services and high direct and indirect costs to patients, effectively negating the equity of the interventions. This high level of centralisation may be unavoidable for some services, such as many specialised surgical procedures, cancer



**Figure 10: Number of equitable and cost-effective interventions by level of health system health centres**

Calculations based on data from Disease Control Priorities 3rd edition.<sup>118</sup> Includes conditions ranked 4 on equity and either 4 or 3 on cost effectiveness. NCDI=non-communicable disease and injury.

chemotherapy, and advanced imaging and pathology services. In these cases, equity in achieving UHC requires financial risk protection, including efforts to offset indirect costs (such as, transportation), particularly for the poor. However, high levels of centralisation are also present for less complex interventions, such as those that address severe chronic conditions (eg, heart failure and type 1 diabetes), as well as acute NCDI manifestations (eg, diabetic ketoacidosis, acute abdominal conditions, and trauma).<sup>140,144</sup>

Interventions to address these severe NCDIs are less standardised and require greater experience and judgment to provide with quality. There is a danger in delivering these services through generalised providers at first-level hospitals (let alone health centres) that they could do more harm than good. One solution to this problem is to cluster interventions based on shared workflow patterns, competencies, and infrastructure. Conventional medical specialisation pathways recognise this approach, but many countries have struggled to produce enough specialists or to retain them at rural facilities. There is a tradition of service bundling for task shifting or sharing in maternal and child health.<sup>145,146</sup> Service packaging for NCDs has largely focused on more common, less severe conditions at health centres (eg, type 2 diabetes, hypertension, and asthma).<sup>147,148</sup>

We discuss a potential strategy to right place priority NCDI interventions by building teams of mid-level providers, auxiliaries, and physicians to deliver packages of related services through existing health system platforms. In many health systems, the priority will be to establish these teams initially at first-level hospitals (figure 10).

*From prioritised interventions to integrated delivery*

Integrated care teams (ICTs) are groups of health workers who deliver a set of interventions that require related skills and benefit from shared space and information systems.<sup>149</sup> ICTs have a mix of auxiliaries, mid-level providers, and physicians, who deliver a set of NCDIs, and communicable and RMNCH interventions. The design of ICTs is specific to the evolution of local health systems, and changes over time as services are progressively made available and integrated at lower levels of the health system with increasing human resource availability (figure 11). ICTs are established by identifying gaps in service delivery, defining what competencies, training, equipment, and infrastructure are required to address them, and then assessing what other interventions have similar requirements.

Health system planners often work intuitively in terms of ICTs. Funding and advocacy streams, however, often develop around particular diseases. We believe it is possible to channel disease-specific NCDI initiatives (domestically or externally funded) through the ICT concept to develop groups of high-quality health services over time. This strategy is consistent with previous calls for a diagonal approach to achieving gains in child survival.<sup>150</sup>

ICT development is driven by three guiding principles: leveraging inefficiencies in existing space and staffing when possible; right-placing services to provide quality care, establish mentorship, and introduce supervision structures while increasing access; and optimising the level of specialisation at a given point in time and level of the health system through clustering of related tasks. ICTs aim to occupy their staff on a full-time basis, and with some redundancy to avoid fragmentation and insure against turnover. ICTs spend a substantial portion of their time training, supervising, and mentoring staff at lower-level ICTs, and in turn, are supervised and mentored by higher-level ICTs. Communication and appropriate referral between health system platforms are also central to the ICT concept. Integration of mental health services is a cross-cutting concern across ICTs.<sup>151-153</sup>

*Illustrative ICTs for NCDIs within existing service delivery platforms*

To generate ideas for how to organise delivery of priority NCDI interventions through existing health service delivery platforms, this Commission has mapped health sector interventions to specific prototype ICTs (appendix p 95). Illustrative staffing requirements and supervision pathways have been developed for these ICTs based on our experience with health service organisation in LLMICs (figure 11 and appendix p 95). Additionally, we have estimated what fraction of the NCDI costs in EUHC is accounted for by each of the illustrative ICTs (appendix p 96).

Our intent is not prescriptive, and there are many reasonable ways to organise health service delivery. We

recognise that countries will design their service delivery based on considerations that include earmarked resources, human resource and infrastructure availability, and political feasibility. In some settings, priority NCDI interventions can be delivered through existing care teams, for example, by expanding the repertoire of community health workers currently focused on maternal and child health to include additional preventive services. In other cases, expanding high-quality coverage of priority NCDI interventions will require additional human resources and more substantial redesign of service delivery models.

**Referral hospital platforms**

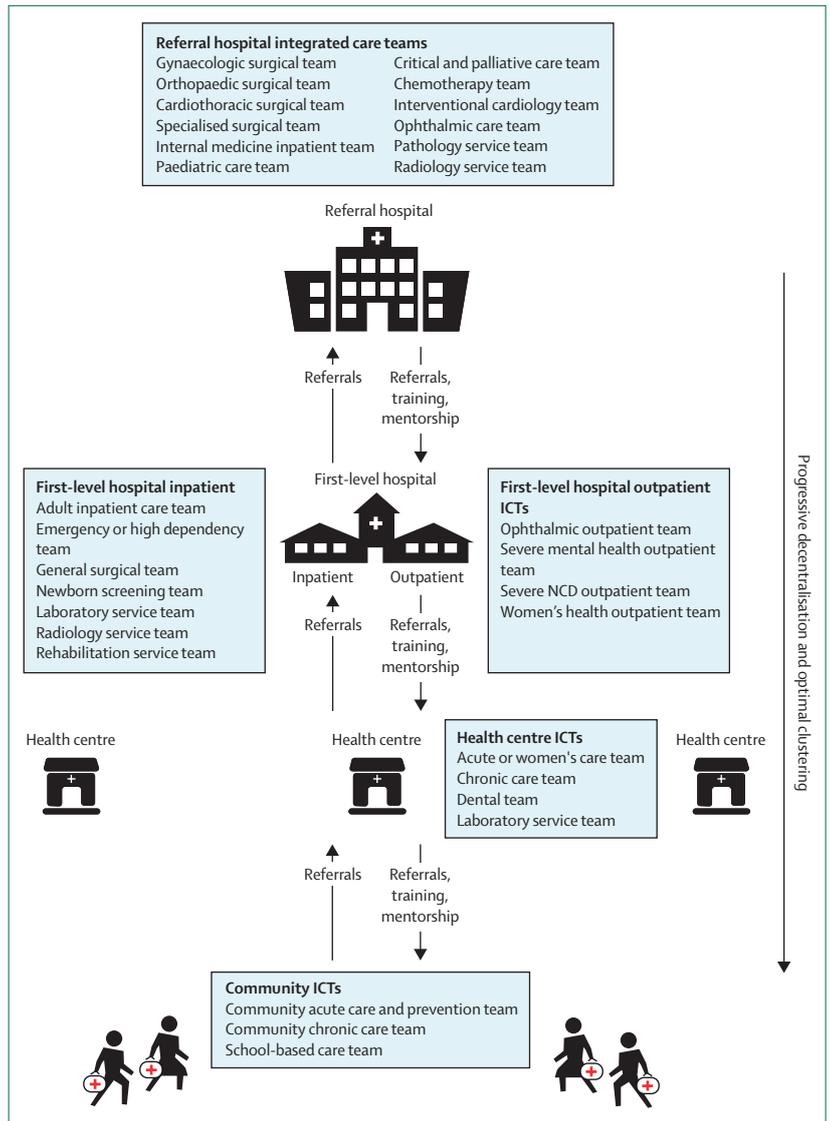
Referral hospitals typically serve populations of around 10 million people. In larger countries, these will be regional centres. In smaller countries, these will be national centres. These facilities are crucial for the training, supervising, and mentoring of lower levels of the health system. They also deliver high-equity interventions for severe conditions affecting children and young adults. At very early stages of UHC expansion (eg, post conflict) and in the most constrained health systems, even services for common and less complex NCDIs (eg, type 2 diabetes) are restricted to referral hospitals. However, these centres often lack the capacity to provide many specialised surgeries, advanced pathology, and radiology services, or chemotherapy and radiotherapy for cancer.<sup>154-156</sup> Their effect on population health will be modest.

There are, however, many highly equitable interventions for NCDIs, that require referral centres. These interventions include, for example, cardiac surgery and percutaneous interventions for rheumatic and congenital heart disease, specialised surgeries for women’s cancers, congenital conditions such as gastroschisis, cleft lip and palate, and club foot, paediatric renal transplantation, and chemotherapy for paediatric and breast cancer.<sup>157</sup> Less is known about the cost-effectiveness of some of these interventions in LLMICs, and economic evaluation in this area should be prioritised.

Countries might want to consider early investments in strengthening and development of ICTs at referral level through academic partnerships that support medical and nursing schools, as well as postgraduate training through teaching hospitals.<sup>158,159</sup>

**First-level hospital platforms**

First-level hospitals (otherwise known as district hospitals, first-referral level hospitals, or secondary care facilities) serve populations of around 250000 people and are often the hubs of district health systems.<sup>32,160-164</sup> In many countries, they are considered as part of the primary health-care system. An insufficient number of facilities can limit geographical access.<sup>165</sup> As discussed, the largest number of NCDI interventions with the most attractive properties in terms of both equity and



**Figure 11: Illustrative integrated care teams for NCDIs within existing service delivery platforms**  
 ICT=integrated care team. NCDs=non-communicable diseases. NCDIs=non-communicable diseases and injuries.

cost-effectiveness can potentially be delivered at these facilities (figure 10). Coverage of these priority NCDI interventions might be low at these facilities at the early stages of UHC expansion. Integration of additional NCDI interventions at this level might trigger the need for creation of new ICTs or might improve the efficiency of existing ICTs. In many health systems, an early priority in UHC expansion could be to develop ICTs that address, for example severe chronic NCDs including type 1 diabetes, advanced rheumatic heart disease, sickle-cell disease, and advanced malignancies requiring palliation or a chronic deliverable, such as tamoxifen or imatinib; severe mental illness; advanced women’s health interventions such as breast ultrasound and biopsy, cervical colposcopy, and advanced family

**Panel 7: Integrated care teams for severe chronic NCDs at first-level hospitals in Rwanda (PEN-Plus)<sup>166-168</sup>**

In Rwanda, the Ministry of Health, with the support of the non-governmental organisation Inshuti Mu Buzima (Partners In Health-Rwanda), identified a gap in continuous care for patients with advanced chronic non-communicable diseases (NCDs) such as heart failure, rheumatic heart disease, type 1 diabetes, and malignancies. They also identified opportunities for shared training, workflow patterns, and competencies (such as managing medications with narrow therapeutic windows such as insulin, heart failure medications and anticoagulants, and morphine for palliative care). In 2006, they implemented integrated chronic NCD clinics at two district hospitals as a proof-of-concept innovation project, and in 2010 they added a clinic at a third district hospital. These three district-level clinics provided critical implementation lessons and became practical training facilities for a 3-month course that was established to prepare advanced NCD nurses nationally. Each clinic is staffed by two to three advanced nurses who see 10–20 patients per day. Physicians supervise initial consultations and consult on complex cases. Specialists visit the clinics every 1–2 months to confirm diagnoses and provide ongoing training. By 2016, the Rwanda Ministry of Health scaled this integrated clinic for chronic care of severe NCDs to all 42 district hospitals in the country and progressively decentralised services for more common NCDs, such as hypertension, diabetes, and asthma to the health centre and community levels. In 2019, WHO in the African region held a technical consultation, recognising the Rwandan model as the basis for a Package of Essential Noncommunicable (PEN) Disease Interventions for District Hospitals (PEN-Plus), building on its PEN package for primary health centres

Although challenges remain, this example shows how integrated care teams (ICTs) can leverage inefficiencies in existing space and staffing by optimising the level of integration and clustering of related services. It also illustrates how ICTs at different levels of the health system interact with and support each other to make a full range of services for prioritised conditions accessible to poor populations. For example, a severe NCD clinic: provides outpatient care for severe chronic NCDs at the district hospital; receives training mentorship, and supervision from adult and paediatric care teams at tertiary referral hospitals; receives referrals from an emergency or high-dependency inpatient district hospital ICT that treats patients who present with complications such as acute heart failure or diabetic ketoacidosis; and provides mentorship, supervision, and referrals, in turn, to a chronic care ICT at the health centre level.

planning; general surgery to address trauma and acute abdominal conditions; emergency or high dependency units to address acute manifestations of chronic conditions such as acute asthma exacerbations and heart failure, as well as initial management of trauma; and newborn screening units to identify newborns with life-threatening congenital conditions such as sickle cell disease (depending on local epidemiology).

Rwanda provides one illustration of an ICT to address severe chronic NCDs that has been successfully implemented as a proof of concept at three district hospitals and then scaled up to all 42 district hospitals in the country (panel 7).

District hospitals are still far from patients, and present substantial barriers to use for patients with both chronic NCDs and acute NCDI manifestations. It is possible to mitigate against these barriers through transport subsidies and other forms of social protection. It might

also be important to continue to decentralise many first-level hospital interventions down to health centres as part of UHC expansion.

*Health centre platforms*

Health centres and health posts serving between 5000 and 20000 people are generally the facilities physically closest to where patients live. These facilities are central to primary health care and present the fewest barriers to access. Once district hospital NCDI interventions are being delivered at a high level of quality, it may make sense to make care available for stable patients at this lower level of the health system. At the same time, creating awareness of priority NCDIs in general or acute consultation can improve case finding for conditions such as breast cancer, rheumatic fever, type 1 diabetes, and rheumatoid arthritis.<sup>148</sup> Screening and treatment of common chronic NCDIs, such as type 2 diabetes, hypertension, mild asthma, mild-to-moderate depression or anxiety can have substantial budget implications for health systems. These interventions also rank somewhat less highly from the standpoint of equity. As these chronic care interventions are introduced, it may be beneficial to pursue integration with existing follow-up services for HIV, tuberculosis, and neglected-tropical diseases to create a general chronic care ICT.<sup>169,170</sup>

*Community platforms*

Community health workers already have a key role in many health systems with respect to acute and preventive care for maternal and child health.<sup>171</sup> There are also a growing number of models and increasing interest in training and supporting community health workers to provide integrated adherence support, palliation, and rehabilitation for chronic conditions, including both infectious and non-infectious diseases (panel 8).<sup>122,173-180</sup> In addition, these health workers can play a valuable part in the registration and investigation of vital events such as births and deaths.<sup>181,182</sup> As the community health workforce grows, it may make sense to separate the workers into at least two teams: one for acute and preventive care, and another for chronic care, although polyvalent models exist as well. Additionally, schools offer an important site for human papillomavirus vaccination, education, and recognition and referral for symptoms of NCDIs such as vision and hearing disorders in school-aged children.

**Leveraging sentinel conditions**

Here, we consider how prioritised NCDI interventions map onto potential ICTs within existing health service delivery platforms. For this exercise, we considered interventions to address NCDIs that are responsible for a large amount of lifetime health loss in the absence of treatment: rheumatic heart disease, type 1 diabetes, paediatric cancers, women's cancers, paediatric asthma, sickle cell disease, severe mental illness, and physical trauma. These sentinel NCDIs could be related to selected

ICTs at each level of the health system (appendix p 97). For example, patients with some of these conditions (rheumatic heart disease, type 1 diabetes, paediatric cancers, women's cancers, paediatric asthma, and sickle cell disease) could receive more complex management through severe NCD outpatient teams at the first-level hospital (panel 4). When the patients' conditions are stable, all of them could also receive ongoing adherence and psychosocial support from the chronic care clinic at the health centre level. When acute complications arise, on the other hand, patients with rheumatic heart disease, type 1 diabetes, sickle cell disease, and asthma could be treated by inpatient emergency or high-dependency teams that would also provide initial management of trauma. For specialised surgical, pathology, and radiology services, patients with rheumatic heart disease, cancer, sickle cell disease, and trauma could be referred to ICTs at the tertiary hospital level.

ICTs established to provide highly cost-effective and highly equitable interventions for prioritised conditions could also serve as the essential building blocks for a diagonal strengthening of the health system that would accelerate expansion and improve quality of services for other conditions

To understand and illustrate this diagonal effect, we catalogued the health-sector interventions prioritised by 80–100% of the National NCDI Poverty Commissions and mapped them onto ICTs at every level of the health system. We then examined what other interventions those ICTs could typically provide that ranked in the high or highest categories for both equity and cost-effectiveness and had been prioritised by at least some of the National Commissions. Many of these prioritised interventions map onto the same ICTs, providing advantages for staffing, training, and other resources (figure 12). In addition, these same ICTs also typically provide interventions for other conditions that had been prioritised by at least some of the National Commissions.

The severe NCD outpatient team at first-level hospitals, for example, offers highly equitable and cost-effective interventions for type 1 diabetes, heart failure, and rheumatoid arthritis, each of which had been prioritised by at least one of the National Commissions, in addition to the interventions for other severe NCDs that had been prioritised by almost all of them. Similarly, the chronic care team at health centres could offer interventions for sickle cell disease, substance abuse disorders, basic palliative care and pain control, and prevention of congenital disorders, in addition to the interventions for prevention, screening, and management of cardiovascular conditions, diabetes, asthma, kidney disease, epilepsy, and depression and anxiety disorders prioritised by almost all of the National Commissions.

#### Impact and cost of some priority NCDI interventions

Previously in this section, we identified priority interventions to address NCDI Poverty and have discussed some

#### Panel 8: Communitisation of NCDI care through peer support groups in Chhattisgarh State, India<sup>172</sup>

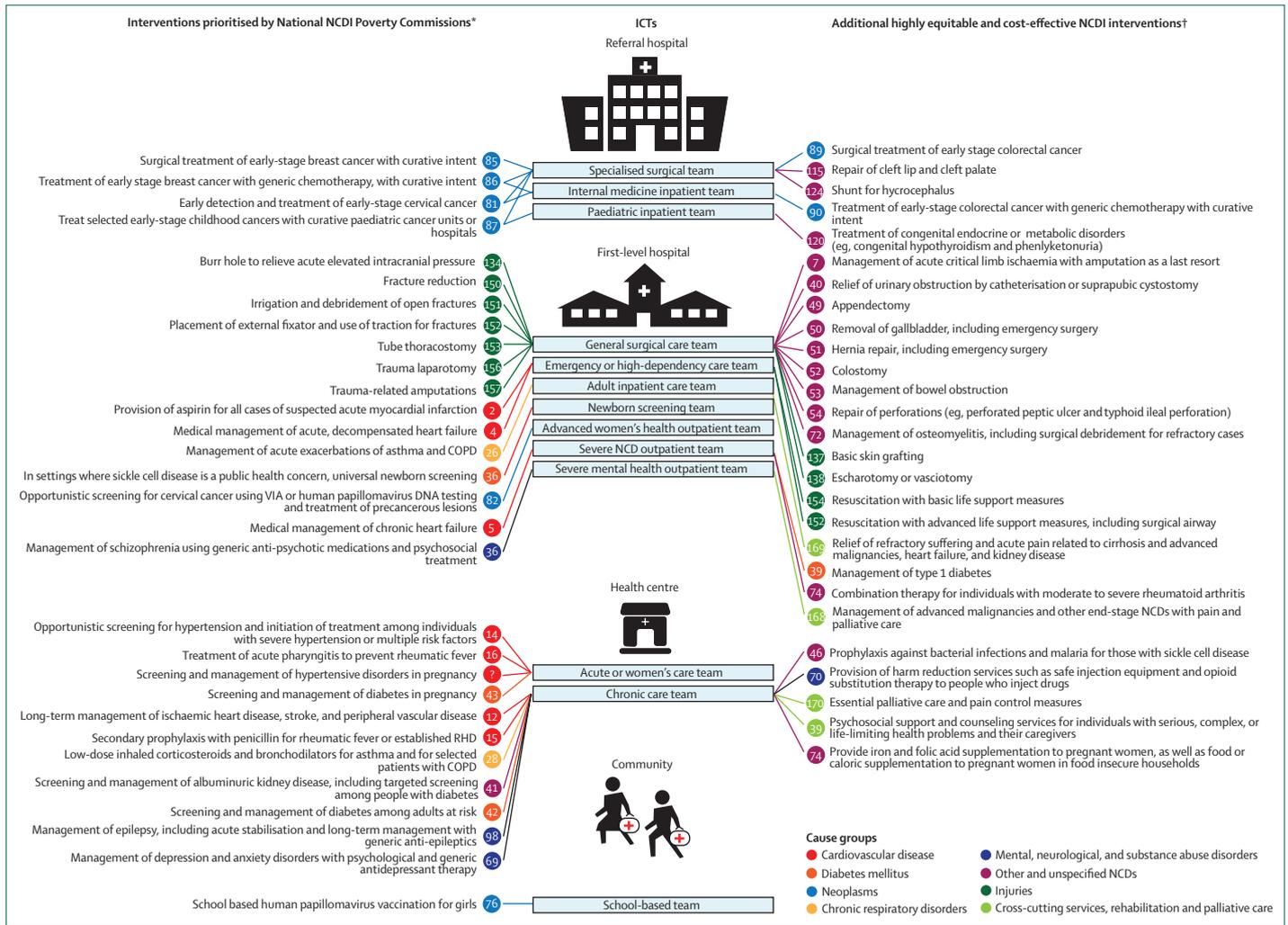
Chhattisgarh is one of the poorest states in India (16% prevalence of extreme multidimensional poverty), with a population of more than 25 million people. 30% of the population is categorised as tribal, and 80% of the population lives in rural areas. Jan Swasthya Sahyog is a non-profit health-care organisation that has been providing health care for the people of Bilaspur district in Chhattisgarh for the past 20 years. Due to low rates of therapy adherence among patients with chronic diseases, in January, 2013, Jan Swasthya Sahyog initiated peer support groups, organised by community health workers, to improve outcomes. Groups of six or more patients with the same condition were organised at the village level (with village populations of 500–2000 people typically). Peer support groups were formed separately for sickle cell disease, epilepsy, type 1 and 2 diabetes, severe mental illness, alcohol dependence, airborne contact dermatitis, hypertension, chronic arthritides, asthma, and chronic lung diseases. Community health workers helped to facilitate these groups by providing educational content and keeping records of the meetings. These health workers also learned from these groups to improve provider training and quality of services. The groups met monthly and allowed patients to share their experiences and to ask questions. By October, 2017, Jan Swasthya Sahyog had organised 49 groups, representing 10 chronic diseases, with 693 participants. Adherence to therapy had increased to 76–94%. Additionally, Jan Swasthya Sahyog found that peer groups undertook community mobilisation to lobby for treatment access, improved food quality, and social protection, and to generate income.

illustrative strategies for integrated delivery of these interventions. Here, we predict the potential health impact on the poorest billion of some of the interventions reviewed by this Commission (appendix pp 98, 99). We focused on the years from 2020 to the 2030 SDG horizon. For health-sector NCDI interventions, we limited ourselves to the 141 interventions included in the DCP3 EUHC package because the cost and effect size of these interventions had previously been evaluated.<sup>183</sup>

We did not consider the potential impact of all inter-sectoral interventions because the effect sizes on health were unknown in some cases. The impact of interventions to increase physical activity, and reduce salt, tobacco, and alcohol use has previously been established.<sup>184–186</sup> Much of the impact of these interventions will, however, occur after 2030 because of the delay between risk exposure and disease onset. This delayed effect is also true of health sector interventions such as vaccination against human papillomavirus to protect against cervical cancer. We estimated the additional impact of 11 interventions to prevent unintentional injuries.<sup>117</sup>

#### *Lives saved and disability averted through NCDI Poverty interventions*

We estimated the number of deaths that would be averted among the poorest billion if effective coverage of these 11 injury-prevention and 141 health-sector NCDI interventions were increased linearly from currently low levels up to 98% between 2020 and 2030. 98% was chosen as a benchmark because it represented the coverage required for these interventions to reduce NCDI mortality among the poorest billion aged under



**Figure 12: National NCDI Poverty Commission health-sector intervention priorities converge on a smaller set of integrated care teams**  
 NCDI=non-communicable disease and injury. ICT=integrated care team. COPD=chronic obstructive pulmonary disease. VIA=visual inspection with acetic acid. NCD=non-communicable disease. RHD=rheumatic heart disease. \*Includes interventions that were prioritised by at least 5 of the 6 national NCDI Poverty Commissions that had completed the priority-setting phase of their analyses as of Sept 10, 2019. †Includes interventions that were graded as 3 or 4 (on a 4-point scale) for both equity and cost-effectiveness as well as those that were graded 3 or 4 for equity for which cost effectiveness was not applicable (eg, palliative care).

40 years—as well as between ages 40 and 69 years—by about 30% by 2030. This high level of intervention coverage would also achieve the SDG 3.4 target: to reduce NCD mortality by a third between the ages of 30 and 70 years due to cardiovascular disease, cancer, chronic respiratory disease, and diabetes.<sup>1</sup> We recognise that achieving this high level of coverage would require an extraordinary global commitment.

Scaling up these interventions could avert 4.6 million premature deaths (before the age of 70 years) among the poorest billion over a 10-year period. 1.3 million of these deaths would be averted among those who would have otherwise died before the age of 40 years. Injury prevention interventions would avert 400 000 of these under-40 deaths due to NCDI Poverty, and health sector interventions would avert an additional

920 000 deaths. The burden from certain conditions, such as mental, neurological, and substance use disorders, comes mainly from morbidity rather than mortality. By scaling up the EUHC for these conditions to 98% coverage between 2020 and 2030, the poorest LLMICs could avert 20.5 million YLDs among the poorest billion. The majority of these averted YLDs (62%) would otherwise be accrued before the age of 40 years.

A more modest increase in NCDI intervention coverage by 25% between 2020 and 2030 would avert almost 1.5 million premature deaths and 6.4 million YLDs among the poorest billion. Approximately 424 000 of these deaths, as well as 3.9 million of these YLDs would otherwise be incurred among those under the age of 40 years.



available data on domestic financing suggest that the poorest governments are not able to spend enough to address their NCDI burden. Even with optimistic projections of economic growth, taxation, and allocation of government revenues to health, most of the poorest countries will not have sufficient domestic resources to fully address NCDIs by 2030.

We endorse the emphasis on increasing domestic financing set by the SDGs.<sup>170</sup> Our analysis highlights the importance of development assistance to address NCDI Poverty, however, particularly in low-income countries. Research for this Commission shows that external financing for NCDIs has remained minimal and has not been targeted to the poorest countries. Yet, most donors say equity is important, and that they want to reach marginalised populations. However, at present, they do not associate NCDIs with those goals.

**Domestic financing for NCDIs**

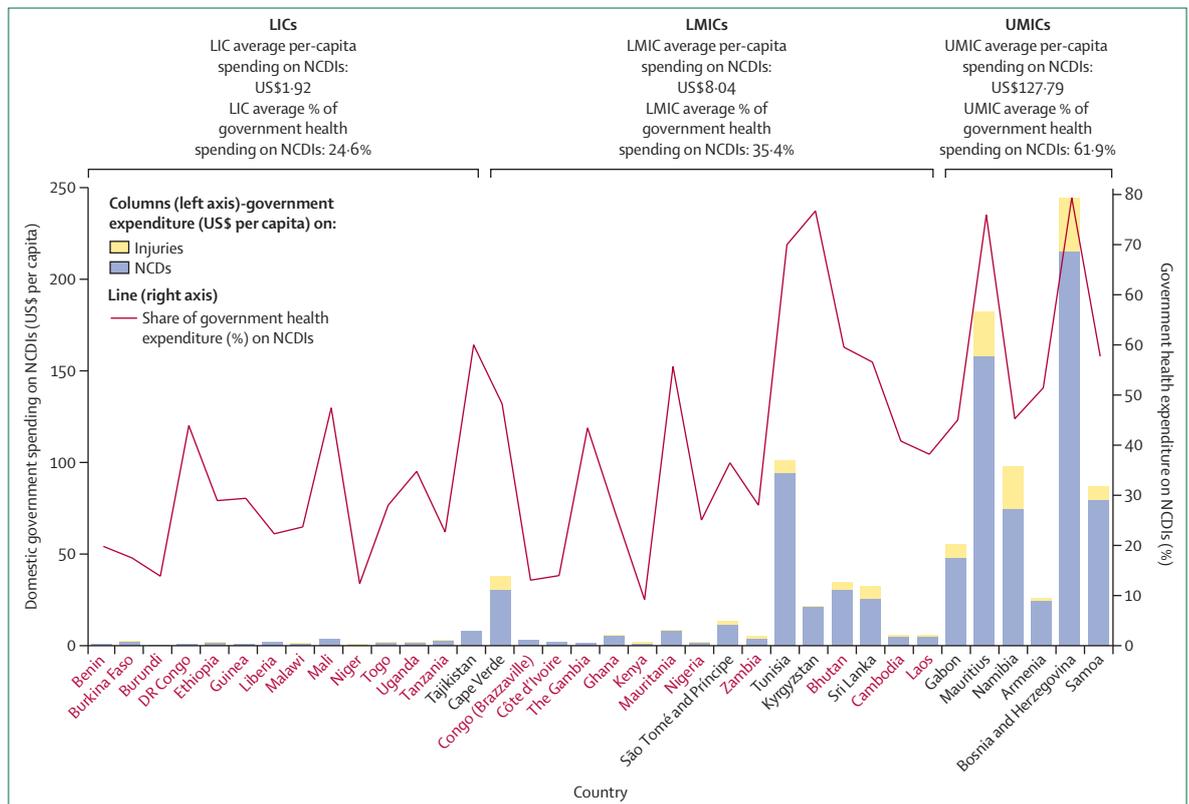
*Government spending on NCDIs*

This Commission pursued multiple avenues to determine the amount of domestic government spending for NCDIs of the poorest. The results provide some insight into how much national governments in 55 low-income and

lower-middle-income poorest billion countries are spending on NCDIs, but shed less light on what services are being purchased and for whom (appendix pp 100, 101).

The best official source for health expenditure data across countries is the WHO National Health Accounts (NHA). WHO's NHA system follows the International Classification for Health Accounts scheme for health care functions with some small differences.<sup>188</sup> Selected NHA information is publicly available through WHO and the Organisation for Economic Co-operation and Development websites.<sup>189</sup> WHO works collaboratively with member states to collect the underlying data, although little information is available regarding data quality assurance. Figure 14 shows the most recent available information on NCDI spending from low and middle income countries in the NHA database from 2017 (appendix pp 100, 101). Disease-specific health expenditure data is shown for NCDIs from 23 of the 55 poorest billion countries (45% of the poorest population).

Most of the poorest countries report low government expenditures on health, with a variable fraction spent on NCDIs. Low-income countries spent between US\$0·6 per capita (Niger) and US\$3·9 per capita (Mali), corresponding to between 3% and 15% of government



**Figure 14: Domestic government spending on NCDIs in low-income and middle-income countries.**

USD\$ per capita and percentage of general government expenditure on health\*. The countries in red are the poorest billion countries. Data are from the WHO Global Health Expenditure Database.<sup>169</sup> LIC=low-income country. LMIC=lower-middle income country. UMIC=upper-middle-income country. NCDI=non-communicable disease and injury. NCD=non-communicable disease. \*36 low-income and middle-income countries for which National Health Account data at WHO Global Health Expenditure Database include spending on NCDIs.

health expenditures. The poorest lower-middle-income countries spent between US\$1·8 per capita (Kenya) and US\$35 per capita (Bhutan), corresponding to between 3% and 38% of government health expenditures. Injuries accounted for an average of 22% of government NCDI spending in the poorest countries. The Commissioners concluded that reliable information on domestic spending for NCDs must ideally be gathered and verified through a detailed search of budgetary documents within the countries.

For a deeper understanding of the scale and distribution of domestic NCD funding, the India NCDI Poverty Consortium undertook an examination of local health budget information for India, a country with extremely low domestic spending on NCDs in the context of low government priority for health spending. India spends only 1·1% of its gross domestic product (GDP) on health, putting it at the low end of countries ranked by public investment in health care. Estimates based on local and central government budgets indicate that slightly more than one-fourth of total health expenditure targets NCDIs, and about four-fifths of this expenditure takes place at the state level. Although the gap between spending and DALYs from NCDIs is greatest in the economically vulnerable states that have the highest concentrations of poorest billion populations, NCDI spending is low almost across the board in India (panel 9).<sup>190</sup>

#### Household spending on NCDIs

The largest source of payment for NCDI care in many of the poorest countries is direct household expenditure. For example, in Ethiopia, according to the Sixth National Health Accounts, 68% of all NCDI services were financed by out-of-pocket expenditures from households; the government was responsible for approximately 30% of NCDI expenditures; and donors contributed only 2%.<sup>191</sup>

This reliance on out-of-pocket spending for NCDI services among those who can least afford it is consistent with the long-known fact that the highest rates of out-of-pocket spending as a proportion of total health spending occur in low-income countries.<sup>192</sup> High out-of-pocket costs associated with NCDIs might cause patients to forego life-saving care, or it might result in CHE.

A systematic review by the *Lancet* Taskforce on NCDs and Economics identified 66 studies that evaluated the effect of NCDs on household economics in low and middle income countries.<sup>193,194</sup> These studies included data from 9 of the 55 poorest billion countries (Bangladesh, Cambodia, India, Indonesia, Laos, Myanmar, Nepal, Nigeria, and Tanzania). Based on their analysis of those studies, the Taskforce found that “NCDs can lead to devastating, long-term economic consequences for individuals and their households, particularly in resource-poor settings”.<sup>193</sup> More than 60% of some NCD patient populations were found to experience catastrophic spending, especially—but not exclusively—among the uninsured.<sup>195–197</sup>

#### Catastrophic health expenditure and impoverishment due to NCDI Poverty

This Commission sought to better understand the effect of out-of-pocket payments related to NCDI specifically for the world’s poorest billion people (panel 10). A modelling study to quantify the magnitude CHE among the poorest billion was done (appendix p 102).<sup>198</sup> Corroborating evidence regarding the effect of NCDIs on CHE and household impoverishment from National NCDI Poverty Commissions that had carried out country-level studies was sought.

Between 27 million and 50 million of the world’s poorest billion people were estimated to spend a catastrophic amount each year in direct costs of health care for NCDIs (defined as more than 40% of their capacity to pay). The poorest experience this high level of CHE (plunging them into deeper poverty) despite the fact that they frequently forgo health care because of the associated costs. The total number of people annually experiencing CHE globally using the 40% threshold was previously estimated to be 208 million.<sup>199</sup>

The India NCDI Poverty Consortium analysed National Sample Survey data in India to assess the burden and the subsequent effect on poverty of expenditures on outpatient visits and hospitalisations for NCDIs. National Sample Survey data indicate that self-reported NCDIs are substantial among socioeconomically vulnerable groups (eg, rural residents, scheduled castes and tribes, lower income quintiles, and some of the economically vulnerable states such as Uttar Pradesh and Rajasthan). The study found that out-of-pocket expenditures on NCDIs were much higher than that for communicable diseases—more than twice as high for hospitalisations and almost 60% higher for outpatient visits—pushing many NCDI patient households into poverty. The headcount of poverty

#### Panel 9: A case study of domestic NCDI financing in India<sup>190</sup>

Government spending on non-communicable diseases and injuries (NCDIs) in India represents slightly more than a quarter of total government health spending, which itself is low at 1·1% of gross domestic product. The bulk of the spending (80%) takes place in the states, leaving considerably less space for policy manoeuvres at the federal level. The Ministry of Health and Family Welfare (MOHFW) itself only accounts for about 65% of all federal spending on health, with other ministries together spending the remainder. NCDI spending by the MOHFW increased gradually from 14% of total Ministry health spending in 2014 to 20% in 2019. An analysis of state-level poverty, spending, and disability-adjusted life-years indicates that poor states spend the least on NCDIs and many high burden states are not able to spend commensurate amounts on NCDIs.

India does not depend on donor funding for health, and will have to step up domestic funding to address the increasing disease burden of NCDIs and to reduce the high out-of-pocket expenditure. The challenge will be forming and implementing a cogent all-India policy with commensurate funding. Given that responsibility for meeting these financing and operational challenges will fall mainly on the states, the federal government will have to determine whether and how a uniform approach towards control, prevention and treatment of NCDIs can be implemented in the country.

**Panel 10: Voices of NCDI Poverty**

**Pabitra Manandhar, chronic kidney disease, 26 years old (Nepal)\***

"Life used to be good. I had a very beautiful family. We were four of us. I was pursuing my higher secondary education. I attended my classes regularly, and I also used to work in a finance company. Suddenly my head started to hurt. I was unable to do the regular chores and missed a lot of working days. So I decided to go to the clinic. They told me my blood pressure was too high for someone my age. They prescribed medication and asked me to come back in a week. After a week, they suspected some issues with my kidney and sent me to a bigger hospital. The doctors told me that my condition wasn't good."

Since Pabitra Manandhar was diagnosed with chronic kidney disease in 2010, life has become difficult for her and her family. Pabitra had been the first member of her family to learn to read and start a professional job. But she is no longer able to work, and her family has been forced to sell off their land and go into debt to pay for the dialysis treatment that keeps her alive.

"I had to pay 2500 rupees (US\$25) for every dialysis. Neither I nor my family had enough money to pay for it. It was a very difficult time. I had no money for dialysis. I felt hopeless. My dad offered to sell the land he owned. We all agreed as my life was more valuable than a piece of land."

Pabitra's father is also in poor health. Soon after Pabitra fell ill, his eyesight began to fail and construction contractors stopped hiring him as a labourer. More recently he was diagnosed with cancer. Her brother, who had hoped to donate a kidney if they could ever afford transplant surgery, died by suicide. Her mother, who works as a farm labourer, is now the sole breadwinner for the family.

"I got my mother tested because she was willing to donate her kidney to me. With the loss of my brother, I saw my mother suffering. Her health was deteriorating as she began losing weight. I decided not to take her kidney, because I cannot afford to lose her. Life will be worthless without her. We are bankrupt. The earthquake destroyed our house and we are living in this makeshift shelter. If only I had a piece of land, I could sell it for the treatment, build a house, and give my parents a good life."

\*Appendix p 135.

for people who report NCDIs in rural areas almost doubles, from 20% before NCDI expenditure to 38% after.<sup>200</sup>

The Ethiopia NCDI Poverty Commission found, based on self-reported data, that NCDIs account for almost a quarter of total out-of-pocket expenditures in Ethiopian households. More than a quarter (27%) of patients with cardiovascular disease in Addis Ababa who sought care experienced CHEs, and this proportion was even higher in low-income households outside the capital.<sup>201</sup> A modelling study also showed the potentially high burden of medical impoverishment related to NCDIs in Ethiopia. The study further showed that some NCDI interventions could contribute to efficiently reducing such impoverishment.<sup>202,203</sup>

Drawing on analyses of data from the Kenya Household Health Expenditure and Utilization Survey of 2007, the Kenya NCDI Poverty Commission reported that out-of-pocket expenditures and loss of productivity caused by NCDIs have a profound impoverishing effect on households. NCDs reduce household income by 28.6%, more than double the impoverishing effect of general health conditions (14%).<sup>204</sup> Nearly a third (30%) of households

affected by NCDs in the lowest quintile experienced CHEs (defined by this study as >30% of total household income). Furthermore, the odds of becoming impoverished due to out-of-pocket expenditures were over 30% higher for households affected by NCDs as compared with households affected by communicable diseases.

The Nepal NCDI Poverty Commission used data from the 2010–11 Nepal Living Standards Survey to estimate the disease-specific impoverishing effects of NCDIs.<sup>205,206</sup> The Nepal Commission found that every case of cancer, high blood pressure, injuries, and heart, kidney, and liver disease could cause between 0.3 and 1.5 cases of poverty. At the population level, injuries, gastrointestinal diseases, and heart disease had the highest effect on impoverishment due to their prevalence.

To reduce the risk of CHEs, essential NCDI services must be financed through pooled resources, either from increased domestic funding or external funds. High out-of-pocket expenditures for essential NCDI services create financial stress and are inefficient and inequitable.<sup>207</sup>

*Domestic charitable spending on NCDIs*

Domestic non-governmental sources of funding, such as local charitable organisations and local disease-specific foundations, provide diverse services in the countries where the poorest billion live, but documentation and independent evaluation are rare. Thus, it is not possible to access in a systematic manner the part that charities play in addressing NCDI Poverty, but examples suggest that they provide tertiary services that would otherwise be completely unavailable or unaffordable to poor populations. The Heartfile Health Financing programme in Pakistan, for example, has been able to channel individual philanthropic contributions towards patients in need of specialised surgical and medical care for NCDIs.<sup>208</sup>

*External financing for NCDIs and NCDI Poverty*

We examined trends in external financing for NCDIs in general, and more specifically for the share targeted to the 55 LLMICs where the vast majority of the poorest billion lives (figure 15). Drawing on data from the Institute for Health Metrics and Evaluation, we found that between 1% and 2% of total Development Assistance for Health (DAH) has been targeted to NCDIs since 2001.<sup>209</sup> Our analysis also shows that the poorest countries have received a small and shrinking fraction of the limited DAH that goes to NCDIs. In 2011, the year of the first UN High-Level Meeting on NCDs, only US\$74 million in external financing for NCDIs was directed to the poorest countries.<sup>209</sup> This represented 14% of all global development assistance for NCDIs in 2011. Between 2011 and 2016, even as NCDs were adopted as priorities within the UHC and SDG agendas, the amount of external financing targeted for NCDIs in the poorest countries had increased to just US\$83 million. This represented only 10% of global development assistance for NCDIs, and approximately

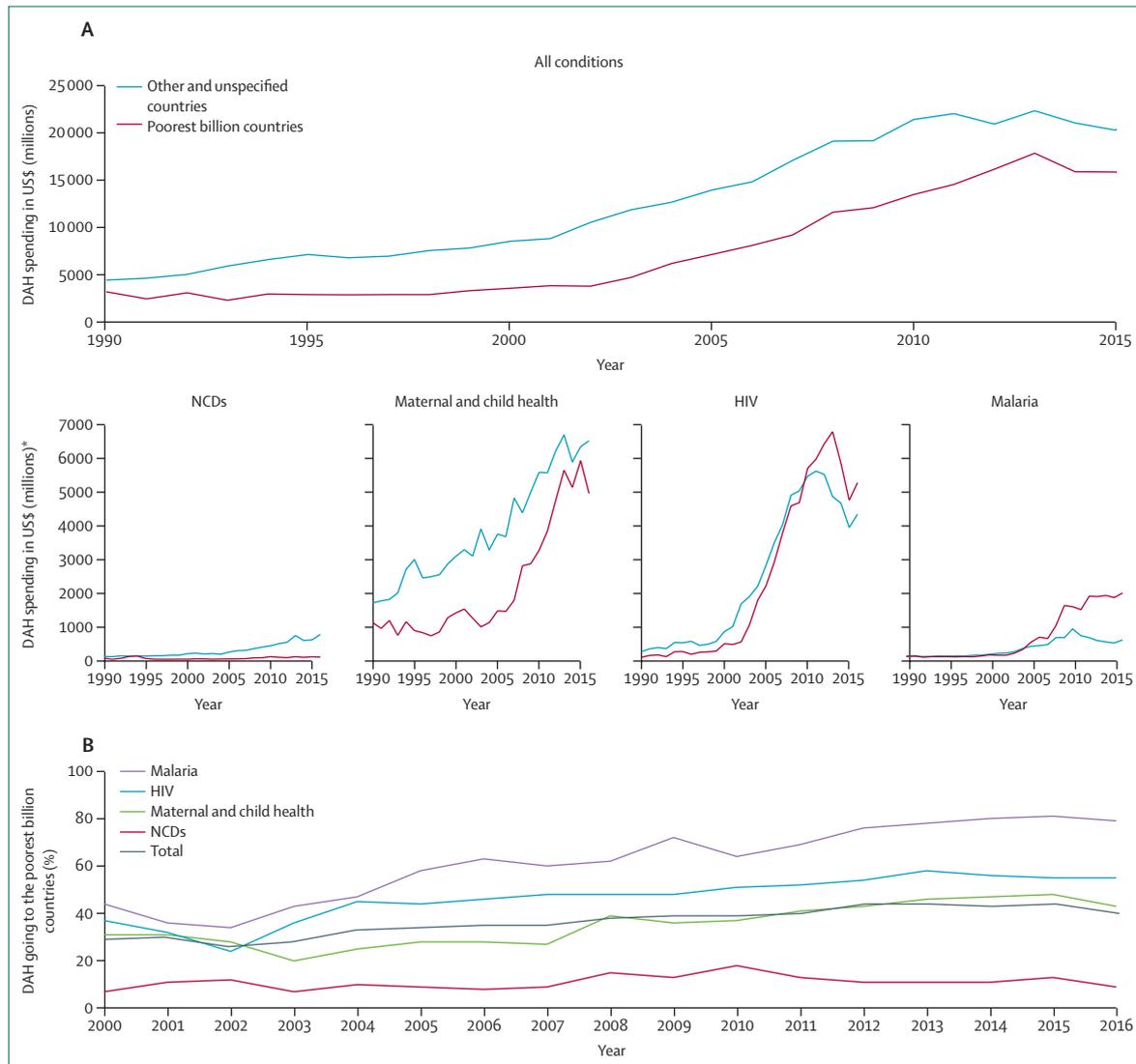
0.3% of the US\$24.6 billion in all country-allocable DAH in 2016.

To better understand how external financing has addressed the NCDIs of the poorest, we reviewed databases of donor funding for health to extract the amounts, sources, and destinations of NCDI funding from DAH for 2010–14 (appendix pp 103–105). There is little evidence that NCDI donors are targeting the poor in the poorest countries. Of the total DAH for NCDIs in 2014, 70% was not allocated to any specific country. Of the NCDI DAH that was targeted to specific countries in that year, US\$68 million (6%) was allocated to one of the poorest 55 countries. 434 NCDI projects were identified in these countries, with a total budget of US\$10 million that were explicitly targeting the poor.

*Projected financing capacity for NCDI Poverty in LLMICs*

Currently, there is a large gap between the cost of implementing the package of EUHC interventions (as defined by the DCP project) and available health financing capacity in the poorest countries (figure 16). Including both government and out-of-pocket expenditures and external financing, the poorest countries (except for a few, such as Rwanda) are not spending enough on health to fully finance the EUHC interventions to address infectious diseases and RMNCH issues. NCDI interventions are an additional opportunity that is currently out of reach for all but a handful.

We have made projections until 2030 to understand the potential health financing capacity that could be available to countries as a result of economic growth



**Figure 15: DAH going to poorest billion countries versus other countries by condition, 1990–2016**

Data are from Institute for Health Metrics and Evaluation. (A) DAH to the poorest billion and other countries by condition (1990–2016). (B) Share of DAH going to the poorest billion countries by condition (2000–16). DAH=Development Assistance for Health. NCDs=non-communicable diseases. \*US\$ currency based on the 2017 exchange rate.

and renewed domestic commitments even if external financing remains constant (figure 16 and appendix pp 106–108 [where we also provide country-specific estimates]). A range of plausible rates of per capita GDP growth during this period were considered.<sup>4,211</sup> We linearly scaled the rates of revenue generation from domestic taxation for each country based on estimates of taxation potential from the Overseas Development Institute.<sup>210</sup> Additionally, we scaled the proportion of

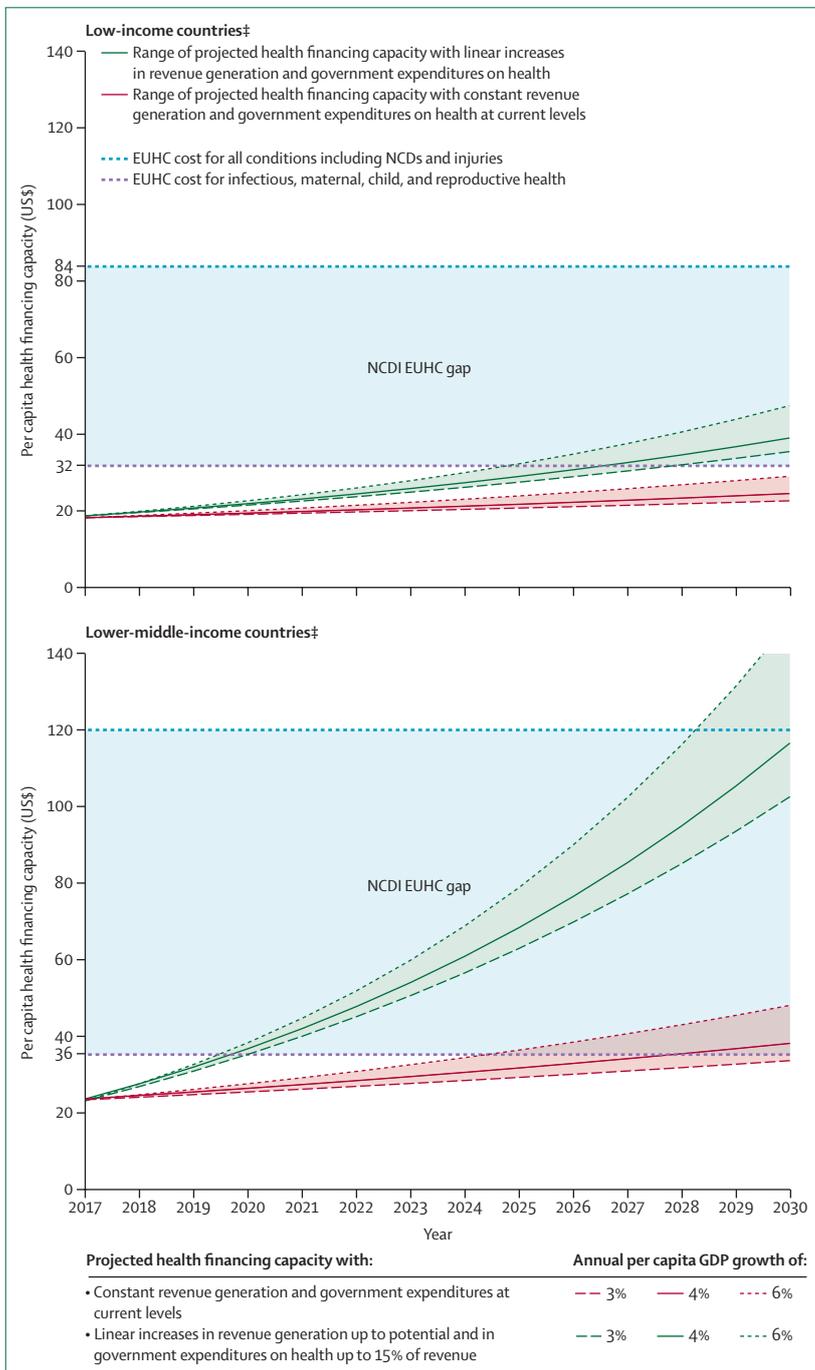
government expenditure devoted to health up to 15% for all countries.<sup>212</sup>

We found that, on average, both low-income and the poorest lower-middle-income countries have an opportunity to finance the US\$32 to US\$36 per capita estimated cost of essential interventions for infectious disease and RMNCH from domestic sources by 2030 even if external assistance remains constant.<sup>210</sup> Additionally, the poorest lower-middle-income countries might have an opportunity to finance essential NCDI interventions from additional domestic sources by 2030. However, these countries will struggle unless economic growth is strong, they are able to increase taxation, and they allocate a greater fraction of government expenditures to health. Even under highly optimistic scenarios, low-income countries and the poorest lower-middle-income countries will have a large gap in health financing capacity for NCDIs without additional development assistance (appendix pp 106–108).

### Section 4: Global and national policy, governance, and agenda-setting for NCDI Poverty

In previous sections of this report, evidence about the importance of a diverse collection of NCDIs among the world's poorest billion people (NCDI Poverty) has been presented. Much of this burden has been shown to be among children and young adults and is avoidable through cost-effective interventions both within and outside the health sector. Additionally, the cost of these interventions collectively exceeds available resources in the countries where the poorest billion live. Without global solidarity, there will continue to be much unnecessary death, suffering, and impoverishment.

This Commission may lead to a greater insight into the nature of NCDI Poverty. However, the Commission will only be successful if it convinces global actors and national governments to contribute to the health of the poorest on a greater scale, consistent with country priorities. Theories of political priority for movements in global health have focused on the importance of ideas and issue characteristics in addition to the strength of actors and the political



**Figure 16: Projected health financing capacity\* versus essential EUHC† costs in the poorest billion countries, 2017–30**

Data are from Global Health Expenditure Database,<sup>169</sup> Overseas Development Institute,<sup>210</sup> and World Bank.<sup>4</sup> GDP=gross domestic product. EUHC=essential universal health coverage. UHC=universal health coverage. \*Baseline includes government health financing plus external health financing. Projection includes constant external health financing. Government health financing increases as a function of GDP growth and linear increases up to potential additional revenue generation and to government expenditure on health of 15% of revenue. All estimates are based on 2017 GDP and current US dollars. †EUHC consists of interventions included in a model benefits package defined by the Disease Control Priorities Network as essential for achieving UHC and appropriate to the health needs and constraints of low-income and lower-middle-income countries. ‡Estimates for 52 poorest billion countries (27 lower-income countries and 25 lower-middle-income countries) for which data are available. The poorest billion countries are characterised by having at least one sub-national region where over 25% of the population are deprived of five or more of eight non-health, multi-dimensional poverty indicators.

contexts in which they operate.<sup>213,214</sup> In this section of our report, we seek to understand how NCDI Poverty has been addressed in global and national health and development policies, plans, targets and frameworks. We also seek to explore how issue framing might have contributed to the neglect of NCDI Poverty in global and national health and development agendas and resourcing.

The UN system has been singularly important for global NCDI policy and governance. In 2017, WHO alone commanded 20% (US\$164 million) of all NCDI development financing globally, more than any other single entity.<sup>169</sup> The World Bank had the second largest share (US\$93.7 million in 2017), but most (78%) of this financing is provided at nearly commercial terms. In the context of otherwise extremely low amounts of development assistance for NCDIs (as discussed in section 3), WHO's resources enable it to play crucial normative, standard-setting, and convening functions. The dialogues, consultations, conventions, regulations, guidelines, and recommendations for public health policy that WHO produces—which are adopted and adapted by its 194 member states—are the means through which it fulfils its technical leadership role in health.

We have reviewed the history of NCDIs within WHO and the World Bank have been reviewed using archival documents and interviews. To track the evolution of NCDI framing and policies at WHO, we examined approximately 500 documents from the WHO archives, as well as more than 450 published WHO documents, including official histories and technical report series. We conducted semi-structured interviews with four living former directors of the NCD units at WHO. Policy documents and assessments of the World Bank's engagement with global health over the same period were reviewed. The influence of NCDI framing at these two entities within the UN system on the discourse of other global actors were analysed through document reviews and key informant interviews (appendix pp 109–115). The influence of global NCDI frameworks on national policy in countries where the poorest billion live was evaluated.

We find that, over the past 40 years, NCDI efforts in the UN system have been on a parallel track, separate and disconnected from the agenda to address the health of the poorest billion (figure 17). The agenda for the poorest billion, embodied by the MDGs, has been largely concerned with priority infectious diseases, maternal, and child health. Meanwhile, an agenda for NCD prevention and control was developed in WHO's European regional office in the late 1970s, and was later applied in low and middle income countries, based on a shared, common risk factor framework and consistent with increasingly popular theories of epidemiological transition. These NCD frameworks grew out of efforts to control cardiovascular disease and stroke in high-income countries, and increasingly replaced the broader understandings of NCDIs prevalent at WHO headquarters in

earlier decades. This approach to NCDs was crystallised during the first UN High-Level Meeting on NCDs in 2011 in the 4×4 (four diseases and four risk factors) concept and its associated monitoring framework and best buys.

In the SDG era, this legacy NCD framework continues to shape how NCDIs are understood by global multilaterals, development agencies, and philanthropists. At the same time, institutions designed to support the MDG agenda (such as the US President's Emergency Plan for AIDS Relief and the Global Fund to Fight AIDS, Tuberculosis, and Malaria) continue to channel the flow of most DAH.

We found some modest indications from key informant interviews that reframing NCDI Poverty in terms of a broader range of severe conditions affecting children and young adults might shift the global financing landscape (appendix pp 104, 105). We find that NCDI Poverty Commissions are prioritising a broader range of interventions addressing a larger set of conditions than those identified among the global best buys. These interventions include treatment to manage (and in some cases cure) existing NCDIs using platforms at primary, secondary, and tertiary levels of the health system.

Our analysis suggests that the SDG era has sustained a compromise wherein development assistance continues to provide catalytic funding for the MDG agenda for the poorest (although inadequately), while even low-income countries are expected to finance NCDI prevention from domestic resources. At the moment, external financing to treat NCDIs among the poorest children and young adults isn't even on the table. In part, global actors can claim that they are responding to country priorities.<sup>32,195–197</sup> At the same time, the countries in which the poorest billion live have not had the resources to define their NCDI priorities based on country-level data and ethical principles. As a result, there has been a vicious cycle in which neither national planning nor global strategies are fully addressing NCDI Poverty.

### The NCDI Poverty gap at global institutions

On the eve of the UN SDG summit, a group of prominent health economists suggested that NCDIs should not yet be considered a priority for a “pro-poor pathway to UHC as an essential pillar of development”.<sup>215,216</sup> Writing in *The Lancet*, the economists declared that, “Our generation has a historic opportunity to achieve a grand convergence in global health, reducing preventable maternal, child, and infectious disease deaths to universally low levels by 2035”; reductions in preventable NCDI deaths were notably absent from the envisioned grand convergence. The tracks for the poorest billion and the NCDI agenda appeared to be distinct and parallel going into the SDG era. The 2011 UN High Level Meeting had assured that NCDs would be included in early 21st century global health priorities. But by importing 20th century chronic disease frameworks, the meeting also reinforced a prevailing NCDI Poverty gap.

This Commission has worked to understand how the NCDI framing that developed within the UN system over the past 40 years has influenced the prioritisation and agendas of global institutions during the SDG era. We focused on those institutions that have an out-sized role in DAH as a proxy for their influence regarding policies

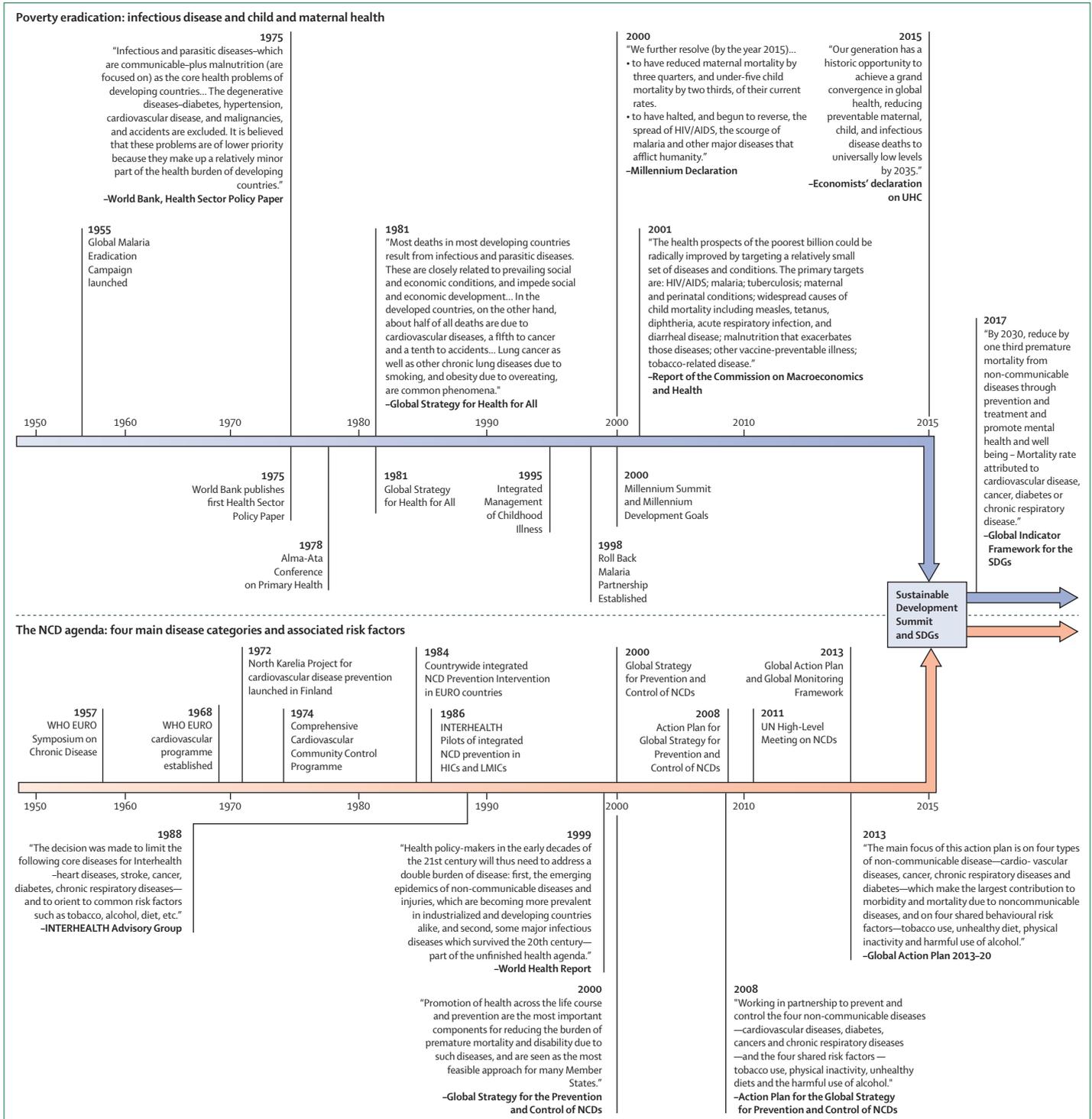


Figure 17: NCDs and the poorest billion on two separate tracks (1948–2015)

UHC=universal health coverage. SDGs=sustainable development goals. WHO EURO=WHO Regional Office for Europe. HICs=high-income countries. LMICs=low and middle income countries. NCDs=non-communicable diseases.

for health, poverty reduction, and economic development. Institutions reviewed in our analysis included: multilateral health and development organisations, bilateral funders, and corporate and family foundations (appendix pp 110–116).

In total, we examined 35 entities, and extracted textual mentions of NCDs and risk factors, as well as text that discussed health equity, prioritisation of poor populations, and financial and social risk protection (figure 18). To the extent that they have addressed NCDs at all, we found that all of the global multilaterals and bilateral institutions, without exception, have adopted the 4×4 framing and the emphasis on health promotion and prevention of WHO's Global NCD Action Plan as the foundation of their approach to NCDs. Although most of these institutions focus on poverty reduction as a priority, none of them identify NCDs as either a cause or a consequence of extreme poverty to be addressed as a priority within the poverty eradication agenda.

Regional institutions located in parts of the world with large concentrations of people living in extreme poverty have built and expanded on the 4×4 foundation to address other conditions and risk factors that disproportionately affect the poor. WHO regional offices in Africa and South East Asia, for example, discuss the four main diseases and risk factors with a focus on preventive health services, but also address other conditions and risk factors that are important in their regions. The Brazzaville Declaration, adopted by the WHO African Regional Office in advance of the 2011 UN High Level Meeting, emphasised the importance of “haemoglobinopathies (in particular sickle cell disease), mental disorders, violence and injuries, oral and eye diseases in the WHO African Region”.<sup>32</sup> Similarly, the WHO South East Asia Regional Office noted that “in addition to the four main NCDs, many other chronic conditions and diseases contribute significantly to the NCD burden in the Region” and highlighted the importance of infectious and environmental risks such as indoor air pollution.<sup>96</sup>

Most of the corporate and family foundations that are influential in global health and development do not address NCDs broadly as a category in their strategies and policies. With one notable exception, the large corporate or family foundations that do fund NCD programmes typically target specific conditions or risk factors, such as mental health, injuries, vision disorders, tobacco control, or road safety, without mentioning NCDs as a group.

The exception is Bloomberg Philanthropies. In its 2018 annual report, Bloomberg Philanthropies introduces its health programme by stating, “The Public Health program combats noncommunicable diseases and injuries by spreading solutions that are proven to save lives”.<sup>217</sup> The Bloomberg Philanthropies public health programme strategy aligns closely with the 4×4 framing and health promotion and prevention best buys of the Global Action Plan. The strategy features programmes to control tobacco use, prevent obesity, and

improve road safety, as well as a leading role in the Resolve to Save Lives initiative to combat cardiovascular disease through treatment of high blood pressure and promotion of healthy diets.<sup>218</sup>

Our analysis suggests that even global institutions with a focus on extreme poverty have tended to adopt an approach to NCD framing (4×4) that was historically developed by and for high-income regions. The lack of global resource mobilization for NCDI Poverty might be due, in part, to the way the full scope of this issue has been made invisible in current framing of the NCD agenda and its propagation through development and philanthropic institutions.

### NCDIs in national planning in the poorest countries

As we had done with the global institutions, we sought to understand whether and how NCDI framing within the UN system has shaped health sector and poverty reduction planning in the countries where the poorest billion live. Since 2003, four high-level forums on aid effectiveness have emphasised the importance of alignment of development assistance around country-owned priorities.<sup>195–197,219</sup> National strategic planning should be guiding international cooperation and aid on NCDIs. Instead, our analysis suggests that the opposite is happening in practice: international frameworks are being replicated in the poorest countries even when these frameworks were not developed in response to local disease patterns and concerns. Additionally, at a national level, NCDI planning and anti-poverty strategy continue on the parallel tracks laid globally: NCDI Poverty in not being addressed in poverty eradication and sustainable development plans.

Both National NCD Strategic Plans (NCDSPs) and Poverty Reduction Strategy Papers (PRSPs) were examined from LLMICs with at least one major sub-national region with more than a 25% prevalence of extreme poverty by multidimensional measures.

NCDSPs are the country-owned planning documents that set out national priorities and resource needs for NCDI control—typically for a 5-year period—consistent with broader health-sector strategic plans.<sup>220</sup> Countries committed to developing NCDSPs during the first UN High-Level Meeting on NCDs in 2011, and again during the second High-Level Meeting on NCDs in 2014.<sup>221</sup> In advance of the third UN High-Level Meeting on NCDs in 2018, the Secretary General reported that 48% of UN member states had developed these plans.<sup>222</sup>

PRSPs are country-owned planning documents that identify operational strategies and resource requirements for poverty reduction. Between 1999 and 2015, PRSPs were prepared by the poorest countries every 3 years to qualify for concessional lending from the World Bank and the International Monetary Fund.<sup>223,224</sup> PRSPs have since been replaced by sector-specific lending frameworks, but remain a valuable record of how health-sector interventions have been positioned as part of poverty eradication.

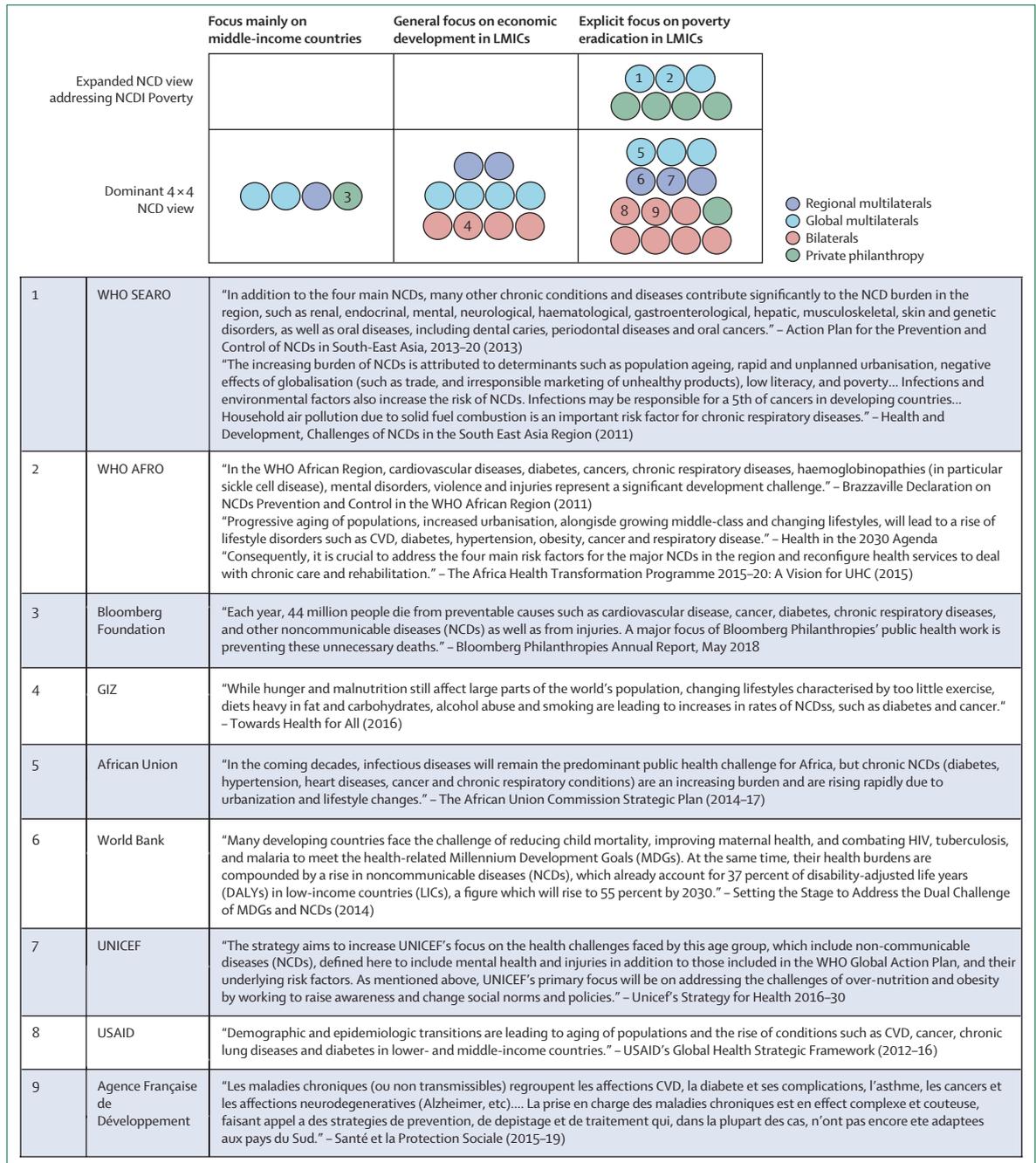


Figure 18: NCDI framing and population focus of global institutions

Each circle represents one of the 35 organisations included in the policy review. Representative quotations from selected organisations are presented in this figure. A full list of organisations included, and documents reviewed is presented in the appendix (pp 110–16). LMICs=low and middle income countries. NCD=non-communicable disease. NCDIs=non-communicable disease and injury. SEARO=WHO Regional Office for South East Asia. AFRO=WHO Regional Office for Africa. GIZ=German Development Agency; Deutsche Gesellschaft für Internationale Zusammenarbeit.

We were able to identify the most recent publicly available NCDSPs from 27 of the poorest LLMICs that collectively were home to 47% of the world's poorest billion population (appendix pp 117–124). We also identified publicly available PRSPs prepared by 29 of these countries since 2000 (appendix pp 125–127). We analysed

what NCDI conditions, risk factors, and interventions were discussed in these documents.

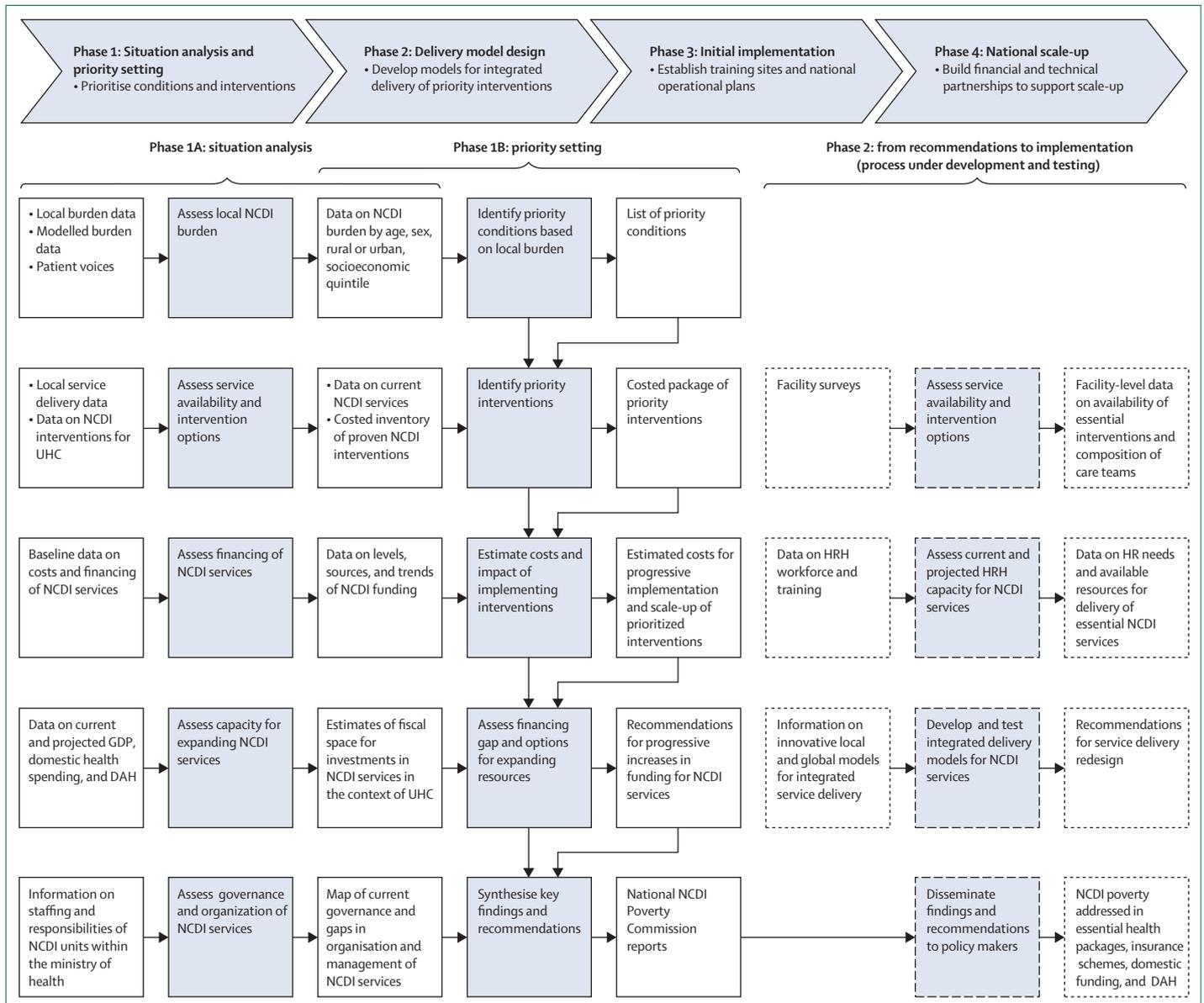
What we found suggests that health sector policy-makers in most countries recognise the importance of conditions and risk factors not targeted in GMFs. However, these countries have also largely adopted the

voluntary targets and best buys of the 2013 Global NCD Action Plan (GAP) and GMF as the foundation of their NCD strategies.<sup>8,95</sup> Adherence to the 4x4 framework, GAP targets, and best buys was all but universal in the PRSPs.

*An expanded NCDI situation with a 4x4 monitoring framework in national NCD planning*

Our review of NCDSPs suggests that most countries' national NCD strategies have been strongly influenced

by and oriented toward the NCD agenda advanced in WHO's Global NCD Action Plans and adopted in the SDGs. Most of the plans explicitly reference the 2011 High-Level Meeting on NCDs and WHO's 2013 GAP and GMF.<sup>8,95</sup> With a single exception, all of them discuss all four of the main disease categories that are included in the 4x4 framework and highlighted in the mortality reduction targets of the GPA and the SDGs. More than half discuss specific conditions within



**Figure 19: National NCD Poverty Commission process**

This diagram depicts the conceptual and analytic framework for the work of National NCDI Poverty Commissions and Groups. The blue boxes represent processes while all the other boxes represent inputs and outputs. The dotted boxes indicate inputs that are being developed and tested. The dashed boxes indicate processes that are being developed and tested. Each Commission and Group adapts and implements the process to align with local conditions, needs, and available resources. As of August, 2020, 11 commissions have completed phase 1A of the process, nine have completed both phases 1A and 1B, and seven have published and launched reports presenting their phase 1 findings and recommendations. Three Commissions have initiated phase 2 activities. NCDI=non-communicable disease and injury. UHC=universal health coverage. HRH=human resources for health. GDP=gross domestic product. DAH=Development Assistance for Health. HR=human resources.

each of the categories, but only one other NCD condition—sickle cell disease—is mentioned by as many as half of the countries.

Adherence to the framing and targets of global monitoring frameworks is even more pronounced in the NCD risk factors that are discussed in these NCD Strategic Plans. More than 80% of the plans reviewed explicitly discuss all four of the behavioural risk factors that define the 4×4 framework and are featured in the GMF’s nine voluntary targets. The only other risk factors mentioned in more than half the plans are the four metabolic risk factors that are also included in the GMF’s nine voluntary targets and 25 indicators.

Most of the NCDSPs do recognise other conditions and risk factors that are important to the NCDI burden of their populations. More than three-quarters discuss injuries, and two-thirds include mental health and substance use disorders, anticipating the expanded 5×5 definition of NCDs adopted at the UN High-Level Meeting in 2018.<sup>10</sup> Most of the plans reviewed also address other NCDs that do not fall within the four

main disease categories. More than 40% of these poorest billion countries discuss sickle cell disease and epilepsy. In addition, many of the specific conditions within the four main disease categories that are mentioned are not associated with the shared behavioural risk factors of the 4×4 model, including cervical cancer, rheumatic heart disease, and asthma, all of which are mentioned in more than 40% of the plans. Notably, these same conditions were also highlighted by our analysis of the severe NCDs that disproportionately affect the poorest billion and were prioritised by national NCDI Poverty Commissions that have completed their analyses.

We did a deeper analysis of the 21 NCDSPs that included both situation analyses and frameworks for monitoring implementation and progress (appendix pp 117–124). Conditions and risk factors mentioned in background narratives were compared with those included in implementation monitoring frameworks. Our analysis found that although these countries discuss a broad range of conditions and risk factors in narrative situation analyses of their NCDI burden, the only conditions and risks included in 50% or more of the monitoring frameworks are the four main disease categories, plus six behavioural and metabolic risk factors that are included in the voluntary targets and indicators of WHO’s Global Monitoring Framework.

#### *NCDs and poverty eradication on separate tracks in national poverty reduction planning*

To understand how NCDIs are being framed as part of poverty eradication in the countries where the poorest billion live, we analysed PRSPs publicly available through the International Monetary Fund. As was the case with the NCDSPs, our analysis strongly suggests that the 2011 UN High-Level Meeting prompted these countries to include some mention of NCDs. This suggests that global political processes can have an effect on national agendas. At the same time, our analysis of the PRSPs suggests that in the SDG era, countries are continuing to view NCDIs as part of a health agenda that is separate and distinct from the health priorities of the poorest and from strategies for poverty eradication.

Very few (only 3 of 14) of the PRSPs prepared before 2011 and the UN High-Level Meeting mention NCDs. Almost all (11 of 15) of those published after 2011 do mention NCDs. Those that do include a discussion of NCDs generally used the term generically, often referring to the category as an emerging problem, or specifically mentioned some or all of the four main disease categories and risk factors of the 4×4 framework. Many of the PRSPs included a discussion of mental health disorders. Consistent with the Brazzaville Declaration, several of the African countries also addressed sickle cell disease. Of the 29 PRSPs reviewed, none propose to undertake and monitor interventions specifically to address NCDIs among the poor (appendix pp 125–127).

#### **Panel 11: The Ethiopia NCDI Poverty Commission**

In August, 2016, Ethiopia established a National NCDI Poverty Commission with 18 members drawn from government, academia, and civil society, and a mandate to build the country’s NCDI evidence base, and to create a forum for applying fair priority-setting principles through an accountable process. The Commission held five additional meetings before publishing its final report in November, 2018.<sup>226</sup>

The Ethiopia Commission pursued a three-step priority-setting process based on WHO recommendations to consider cost-effectiveness, priority to the worse off (equity), and financial risk protection.<sup>115</sup>

Step 1 was to identify relevant services and evidence. The Ethiopia Commission began with a list of NCDI services judged to be essential by the Disease Control Priorities 3rd edition (DCP3) project<sup>227</sup> and adapted it for the Ethiopian context. Each intervention was graded for cost effectiveness (based on evidence from DCP3 and available country-specific estimates), equity (based on estimates of lifetime loss of health due to specific causes), and financial risk protection.<sup>228,229</sup>

Step 2 was to select the highest priority set of NCDI services. To determine which interventions to include, the Commission first ranked the list based on incremental cost-effectiveness and then adjusted it according to expected impact on equity and financial risk protection.

Step 3 was to estimate costs and fiscal space. Costs were estimated using the OneHealth Tool (version 4.5) with most services scaled by 25% over the period from 2019 to 2023. Considerations of fiscal space suggested that incremental costs for NCDIs could not exceed around US\$5 per capita (about 17% of total government health expenditure). By 2022, the incremental cost of the prioritised set of NCDI services would be around US\$550 million, corresponding to US\$4.7 per capita.

The final list of prioritised NCDI services included 90 health-sector interventions, including palliative care, human papillomavirus vaccination, treatment of acute pharyngitis, chronic management of rheumatic fever, depression, those at high cardiovascular risk in the community; general surgery and chronic management of type 1 diabetes, heart failure, and psychosis at first-level hospitals; and surgery for congenital conditions, as well as chemotherapy for selected cancers at referral hospitals.

### *NCDI Poverty Commissions: expanding NCDI frameworks with a focus on the poorest*

To enable the countries where the poorest billion live to end the neglect of NCDIs, this Commission has supported National NCDI Poverty Commissions in LLMICs with a high prevalence of extreme poverty. As of August, 2020, 16 National NCDI Poverty Commissions have been established in the following countries: Afghanistan, Ethiopia, Haiti, India (Chhattisgarh State), Kenya, Liberia, Madagascar, Malawi, Mozambique, Nepal, Rwanda, Sierra Leone, Tanzania, Uganda, Zambia, and Zimbabwe (appendix pp 128, 129). Ten other countries in sub-Saharan Africa, Asia, and Latin America responded in July, 2020, to a Request for Applications for technical and financial support in establishing new National Commissions. Collectively, these Commissions already represent around half the world's poorest billion people. We hope that these National Commissions will break the cycle in which neither national planning nor global agendas are fully addressing NCDI Poverty.

The composition of these National Commissions has mirrored *The Lancet* NCDI Poverty Commission, with around 10–20 members and co-chairs typically representing an academic institution and the Ministry of Health. In addition to regular meetings within country to develop and review analyses and recommendations, leadership from these Commissions participated in teleconference Knowledge Exchange meetings, co-hosted by the World Bank.<sup>225</sup>

The initial work of these National Commissions has been focused on situation analysis and priority setting. Seven of the National Commissions have completed this work, and three have moved on to a second phase, focused on: the strategic dissemination of key findings and recommendations to elevate NCDI Poverty as a priority for national policies and financing; and the design of integrated delivery strategies for prioritised interventions. We hope that these National Commissions will move on to pilot the implementation of these delivery models and ultimately to national scale-up with the support of financial and technical partnerships (figure 19).

The goals of the first phase of the National Commissions have also mirrored this Commission: analyse and highlight the national NCDI burden of disease, particularly in relation to poverty; understand the availability and coverage of NCDI services in the health sector; prioritise among conditions and interventions to address the NCDI burden, taking into account, at a minimum, both cost-effectiveness and equity (by giving some priority to the worst off in terms of both material poverty and disease severity); estimate the cost and potential impact of prioritised interventions; and forecast potential fiscal space to afford these interventions.

Eight of the National Commissions (Afghanistan, Ethiopia, Haiti, Kenya, Liberia, Malawi, Mozambique, and Nepal) have already completed some or all this first

phase of the Commission process and have published their initial reports. The Ethiopia Commission offers a good example of National Commission development in Africa (panel 11) and the Nepal Commission offers a good example from South Asia (panel 12).

These Commissions prioritised a wide range of interventions, spanning prevention, medical management, surgery, and palliative care at primary, secondary, and tertiary levels (panel 13). The National NCDI Poverty Commissions have been focused primarily on interventions that can be delivered through the health sector. Many of these Commissions also recommended health promotion through intersectoral interventions. In this way, the National NCDI Poverty Commissions have offered a complementary agenda to the one identified in the WHO Global Action Plan for NCDs and its best buys, which have been primarily focused on policies to address behavioural risk factors for NCDs (figure 20).<sup>8,196</sup>

#### **Panel 12: The Nepal NCDI Poverty Commission**

Nepal established a National NCDI Poverty Commission in 2016 with a mandate to analyse the state of non-communicable diseases and infections (NCDIs) in Nepal and to recommend a package of cost-effective health sector interventions addressing the NCDI burden, with an emphasis on conditions affecting the poor in Nepal.

The Commission convened its first meeting in November, 2016, and completed phase 1 of the National Commission Process—situation analysis and priority setting—over the next 18 months (figure 19). In March, 2018, the Commission published a report presenting its findings and recommendations.<sup>230</sup>

The Commission found that NCDIs account for nearly two-thirds (65%) of the burden of disease in Nepal and that more than half of the NCDI conditions with the highest burden of disability-adjusted life-years (DALYs) in Nepal are not related to the 4 × 4 risk factors that have been emphasised by global monitoring frameworks and action plans. Their analysis also determined that, with the notable exceptions of diabetes and high blood pressure, the prevalence of many NCD categories was highest among the poorest quintiles of the population.

To establish priorities for conditions and interventions, the Commission first ranked all NCDI conditions based on their overall health impact (total DALYs) and prevalence in Nepal. They then evaluated each condition for severity, inequity in outcomes between those who are poor and not poor, and impoverishing impact, to arrive at a list of 25 conditions requiring priority attention.

To identify interventions to address this burden, the Commission worked from the Disease Control Priorities 3rd edition package of cost-effective interventions to achieve universal health coverage (UHC) in low-income countries. 23 of these interventions were selected for further evaluation based on their alignment with the disease conditions prioritised by the Commission, feasibility in the Nepali context, cost-effectiveness, financial risk protection, and equity. If these interventions are introduced and incrementally intensified to establish UHC, the Commission estimated that nearly 10 000 premature deaths per year could be averted by 2030, with an increase in costs of approximately US\$8.76 per capita.

In June, 2018, the Commission initiated work on phase 2 of the National Commission Process. The Commission's key objectives for this second phase include: disseminating the findings in the Commission report, determining the readiness of the Nepal Government to incorporate the recommendations of the report, critically analysing NCDI poverty issues among children and young adults, and developing and piloting models for integrated delivery of prioritised NCDI services.

**Panel 13: Voices of NCDI Poverty**

**Estifanos Balcha, type 1 diabetes, 20 years old (Ethiopia)\***

"I have type 1 diabetes, the kind you need insulin for. I used to be a street kid, though my parents are alive. My father is with someone else and my mother is with someone else. And they both see me as a bastard child. From the age of 6 to 13, I lived on the street. Getting food was difficult at times. When my sugar used to drop, I used to steal soda to get it up. While I was taking insulin, I used to sniff glue, smoke hash, hookah, cigarettes. I drank different kinds of alcohol. All this to forget my problems. On top of that, I didn't have anywhere to put my medicine. So I used the refrigerator in various stores. I didn't always take my medicine appropriately. I used to mess up the time, and sometimes I just didn't care."

At the age of 6 years, Estifanos Balcha was forced to fend for himself on the streets of Addis Ababa, Ethiopia. His parents had separated and neither of them wanted to take responsibility for a child with type 1 diabetes—a disease that is costly to treat and usually fatal for children in low-resource settings.

"When I turned 16, I started to work. I looked for odd jobs so that I could earn money to pay for transportation to the doctor. But it was tough, so I tried to leave and go to Kenya. That didn't work, so I tried to leave for Sudan. I wasn't able to leave the country. But that's OK. Those experiences got me here."

The "here" Estifanos refers to is the Ethiopian Diabetes Association, where Misrak Tarekegn serves as the Project Director. The Association provides treatment and education for Estifanos and over 200 other children with type 1 diabetes. As Misrak explains: "The fact that diabetes and other non-communicable diseases have not gotten the same prioritization [as HIV, TB, and malaria] will always be an obstacle for our work. So what we want to tell the government is, even if their numbers are only 10 or 5 percent, each life has value."

Estifanos has his own message for the government and for the world: "The government must get involved with this issue. Let them get involved. Let them say, 'We are here,' so that we can have hope. I really...I really...I really have to pass this message on."

\*Appendix p 136.

In the second phase of National Commission work, countries are investigating how to implement prioritised interventions through integrated delivery strategies. This work involves a baseline assessment of health system team structure, followed by recommendations for redesign of services to improve quality and access through optimal task distribution. Acting on these recommendations will require initial implementation at pilot training sites, followed by national scale-up with financial and technical support.

As discussed in section 3 of this report, the cost of increasing coverage of these prioritised interventions exceeds available fiscal space in the poorest countries. Modest progress may still be possible in countries able to commit more domestic resources to health, but for many more there is an urgent need for global solidarity.

**Section 5: Making room for NCDI Poverty in the UHC agenda in the SDG era**

This Commission has analysed the pattern of the NCDI Poverty burden, identified priority interventions to address this burden, and documented gaps in NCDI Poverty

financing and governance at global and national levels (panel 14). In this section, we make recommendations to address NCDI Poverty in the UHC agenda in the poorest countries, in SDG monitoring, and, in conclusion, as an imperative for global solidarity. These recommendations are based on our analysis and experience with NCDI Poverty Commissions and Groups.

**National NCDI Poverty action in the poorest billion countries**

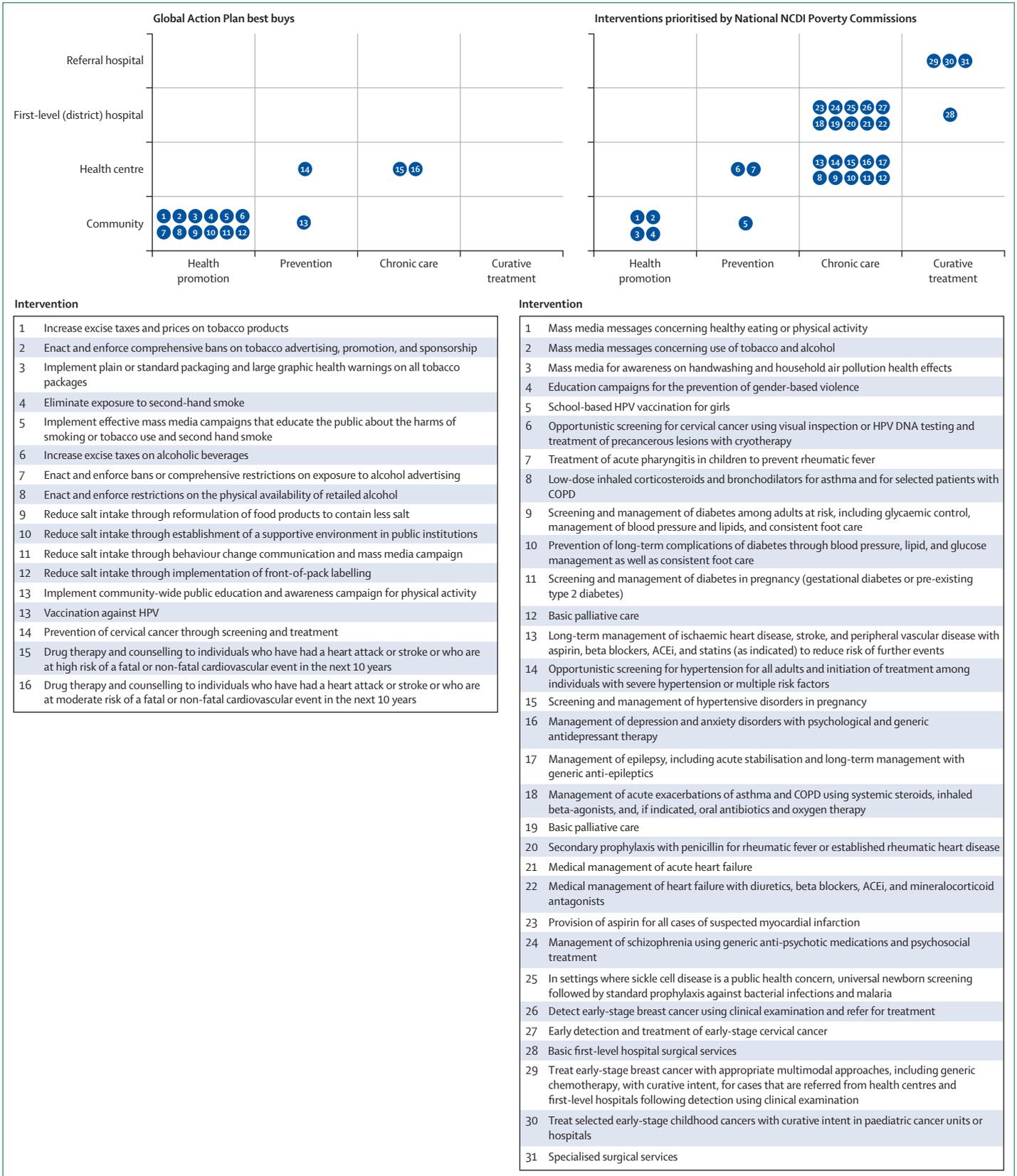
By our calculations, in 2015 there were at least 55 LLMICs that had sub-national regions with more than 25% extreme poverty (section 1). These countries vary in their national prevalence of extreme poverty from 3.6% in Indonesia to 89% in South Sudan. We have found that many of these countries are already taking steps to address their NCDI burden with equity, but all should be made aware of the potentially distinct epidemiology, diversity, and effect of NCDIs among their poorest populations. Important actors in these countries include governments, professional societies, academics, and civil society organisations. In this section, we will direct our call to action, seven sets of specific recommendations, to each of these groups in turn.

**National governments**

National governments are ultimately accountable for protecting the poorest populations from the effects of NCDIs on health and financial wellbeing. Many countries have established NCD units in their ministries of health and have developed NCD strategic plans. Some have initiated partnerships to increase the quantity and improve the quality of their specialised health-care workers. Others have begun to progressively decentralise integrated NCDI interventions. Few poorest billion countries, however, have set NCDI priorities based on both a systematic review of local epidemiological data disaggregated for poverty and an intervention assessment process that takes into account both cost-effectiveness and equity. In the absence of such a process, national plans risk repetition of global or regional frameworks without regard for local epidemiology and values. Revenue generating or budget neutral intersectoral policies are important and insufficiently implemented. Many of the countries where the poorest live have very low levels of service availability to address these conditions beyond major referral centres in national or regional capitals.

Local action and experimentation will be necessary for any effective response to NCDI Poverty. Here, we have focused on national governments as levers of change.

**Figure 20: Global Action Plan best buys and prioritised interventions of National NCDI Poverty Commissions: a complementary agenda**  
 HPV=human papillomavirus. COPD=chronic obstructive pulmonary disease  
 ACEi=angiotensin converting enzyme inhibitors.



**Panel 14: Key findings**

**The burden**

- The burden of non-communicable diseases and injuries among the poorest billion (NCDI Poverty) is a major cause of death and suffering; compared with high-income populations, the poorest billion suffer higher morbidity and mortality from NCDs at every age
- Half of the total NCDI Poverty burden (49%) is avoidable in principle as compared with high-income regions, resulting in 2.4 million avoidable deaths and 93.8 million avoidable disability-adjusted life-years every year among the poorest billion
- More than half of this avoidable NCDI Poverty burden is accrued before the age of 40 years and more than a third (39%) is accrued before the age of 20 years because death rates for conditions affecting these ages are much higher in the poor than in high-income regions

**Interventions**

- There are highly cost-effective and equitable interventions to address NCDs; these interventions include medical, surgical, psychosocial, and rehabilitative services to treat a wide range of conditions, and are not limited to prevention alone
- Addressing NCDI Poverty is one of the greatest benefits that could be realised by universal health coverage (UHC)
- Integrated care teams may be helpful to deliver clusters of related health-sector interventions based on shared provider competencies and common patient characteristics
- The introduction of NCDI interventions is an opportunity to build durable health institutions at primary, secondary, and tertiary levels of the poorest countries, but will only translate to health gains if accompanied by structural health system reforms to raise quality

**Financing**

- Adequate resources for NCDI interventions could bridge one of the largest gaps in UHC for the poorest billion;

NCDs account for 60–70% of the UHC financing needs in the low-income and lower-middle-income countries where the poorest billion live

- Not enough is known about domestic financing directed toward NCDs in these countries, but there is evidence that it is low; among low-income countries for which data are available, government health expenditures on NCDs average only US\$1.90 per capita
- High out-of-pocket expenditures for essential NCDI services are inefficient and inequitable
- Between 2011 and 2016, the fraction of development assistance for NCDs (US\$532 million in 2011) that was allocated to countries where the poorest billion live declined from 14% (US\$74 million) to 10% (US\$83 million), representing just 0.3% of a total of US\$24.6 billion in all country-programmable health aid
- Given very low national incomes in most of the poorest countries, UHC financing from domestic revenue sources will be insufficient to address NCDI Poverty by 2030 unless supplemented by increased external financing

**Governance**

- Over the past 40 years, NCDI efforts in the UN system have been on a parallel track, separate and disconnected from the agenda to address the health of the poorest billion
- The UN's Sustainable Development Goals currently focus on three sets of NCDI conditions: cardiovascular diseases, cancer, chronic respiratory diseases, and diabetes between the ages of 30 and 70 years; mental illness; and road traffic injury, failing to address the full scope of the diverse NCDI Poverty
- At a national level, NCDI planning and anti-poverty strategy largely continue on the parallel tracks laid globally: NCDI Poverty is not being addressed as a priority in national planning for NCDs, poverty eradication, or sustainable development

First, we recommend that ministries of health in high-poverty countries consider partnering with academic and civil society groups to establish national or sub-national NCDI Poverty Commissions. As shown in the eight countries where commissions have completed the first phase of their process, these commissions can inform future NCDI policies and strategies, and help bring NCDI Poverty into focus as a priority for national NCDI implementation and global cooperation. These commissions have assessed the national NCDI burden, identified intervention priorities using multiple criteria (including equity and cost effectiveness), estimated the cost and effect of increased intervention coverage, advocated for expanded financing to reduce reliance on out-of-pocket payments for funding of priority NCDI interventions, and initiated efforts to develop integrated delivery strategies. In some countries, this analytical work focused on NCDI

Poverty could be undertaken through existing national NCD coordination bodies such as technical working groups, multi-sectoral NCD mechanisms, and NCD alliances.

Second, we recommend that countries consider NCDI Poverty in their poverty-reduction, NCD, and UHC strategic planning, including consideration of equity in priority setting and publicly financed benefit packages and insurance schemes. Routine health examination surveys in LLMICs typically include information about multiple dimensions of poverty to facilitate disaggregation of data for equity. In the case of NCDIs, however, the most common health examination surveys (eg, STEPS) are largely focused on behavioural and metabolic risk factors and elicit little information regarding socioeconomic status. Countries are increasingly pushing to integrate NCDs as part of demographic

and health surveys, although challenges remain with respect to sampling frames and tensions between scope and data quality. Community health workers are beginning to register mortality and undertake cause-of-death inquiries. National NCDI Poverty Commissions can help countries develop roadmaps to expand these efforts.

Third, we recommend that publicly funded health examination surveys routinely include a larger set of priority NCDIs and incorporate multiple indices of poverty.

Fourth, we recommend that health service delivery platforms routinely gather individual socioeconomic information as part of their data systems and integrate cause of death registration in the community. NCD divisions and programmes in health ministries are most often organised around diseases (eg, cardiovascular disease, cancer, and diabetes) or around risk factors (eg, tobacco control). This organisation can reflect donor priorities. In the intervention section of this Commission (section 3), we discuss how structural reforms to increase quality will be needed to improve health through NCDI interventions. Service redesign is an essential element of these reforms. NCDI interventions might benefit from redesigning services to be delivered through integrated care teams. These teams can deliver interventions that depend on related skills and infrastructure but address a variety of diseases.

Fifth, we recommend that ministries of health invest in structural reforms to improve the quality of health services through better governance and regulation, pre-service education, building community demand, and service redesign.

Sixth, we recommend that ministries of health redesign planning and delivery of NCDI services around priority integrated delivery strategies such as, for example, integrated chronic care in the community, chronic care for severe NCDs at first-level hospitals, and referral-level cancer centres. Ministries of Health should partner with teaching hospitals and universities through technical working groups that also incorporate disease-specific expertise. Addressing NCDIs in the poorest countries will require a combination of wise policies, leadership, and increased health-sector investments. We call on ministries of finance to increase fiscal space for health care through progressive revenue collection, and by allocating these general government revenues to spending on health care consistent with recent targets.<sup>231</sup> Heavy taxation of sugar-sweetened beverages, alcohol, and tobacco can potentially generate (modest) revenues and importantly, discourage consumption of these unhealthy products particularly by the poor. These fiscal policies are important even in countries where the poor currently have low rates of exposure to these risks and are consistent with existing global recommendations for NCD control.

Finally, we recommend that governments establish formal coordinating mechanism across energy, health,

agriculture, social protection, and transportation to prioritise and implement intersectoral policies addressing NCDI Poverty. For countries that have already established such intersectoral bodies in line with WHO guidance, we recommend that these groups factor in the special vulnerability and needs of those living in extreme poverty with NCDIs.

#### *National civil society organisations*

In countries where they exist, national civil society organisations (CSOs), such as diabetes associations, heart foundations, and non-communicable disease alliances (NCDAs) have an important role by advocating for patients affected by NCDIs (panel 15). A vibrant and strong civil society movement is necessary to accelerate the NCDI poverty response at national and regional levels. This civil society movement should be capable of delivering its four primary roles: advocacy, awareness raising, improving access through service delivery, and accountability. Victories in several global health and development issues, particularly HIV/AIDS, have shown the importance of strong CSOs and community-based efforts in accelerating action and ensuring that governments meaningfully engage with civil society in

#### **Panel 15: Voices of NCDI Poverty**

##### **Fortuna Messaye, leukaemia, 14 years old (Ethiopia)\***

"My illness started when I was 10 years old. In the beginning, I felt sleepy when I went to school. I couldn't learn; each time I sat down, I would fall asleep. They told me I had to come to Addis Ababa because they didn't have the necessary equipment [in the village where her family lives]. My mother brought me here. At Black Lion Hospital, they took a bone marrow biopsy. It took 15 days for the results to be ready. Then they told me it was cancer. I went back to Black Lion Hospital and took a lot of chemo."

Since she was diagnosed with leukaemia, Fortuna Messaye has lived in Addis Ababa, Ethiopia where she can receive chemotherapy and treatment for opportunistic infections. First her mother and then her grandmother stayed with her. But both of them fell ill themselves and moved back to their village. And other relatives complained, "What's the point of helping her, since she will not live?" Since then, Fortuna has lived with the Mathios Wondu Ethiopian Cancer Society (MWECS), a community-based organisation founded by the parents of a child who died of leukaemia.

"Now I am not going to school. I want to go to school here. I don't have anyone in the village. If I go to the village, the kids who help my grandmother complain. They say, "How can we help two people?" Also, when I go there, I get very sick. I got really sick there two times."

Fortuna's chemotherapy cost more than US\$8000 over 3 years—25 times the average per capita income in Ethiopia. Fortuna would not have been able to afford her treatment without the support of MWECS. "We give services here for women and children from rural areas who have cancer," explained Berhanu, a nurse and social worker. "We give them food, transport, access to health care, and pay for medicine."

Fortuna's goal is to become a doctor so that she can help make quality treatment available to others who need it: "The reason I want to be a doctor is to take care of people in my community and all others, to help them heal. Those who are sick have to know they can be cured. And they have to teach others that it's possible. That's what I think."

\*Appendix p 137.

developing and implementing policies. The demand for and effectiveness of a unified approach to NCDI advocacy is indicated by the emergence of a network of national and regional NCDAs around the world, including in countries having large concentrations of extreme poverty. Many of these NCDAs have been led by organisations representing diabetes, cancer, and heart disease, and some have focused mainly on the limited number of conditions and risk factors prioritised globally. They have had challenges engaging and representing the experience of the rural poor.

We recommend that national CSOs make special efforts to channel the voices of the poor affected by a broad group of severe NCDIs. They can do so by reaching out to providers on the front lines of delivering services to the poorest populations, especially in rural areas, and will require resources from global and local partners. CSOs should also help align service demands from patients with particular diseases into strategic alliances around integrated health service teams that address groups of related conditions (such as those affected by sickle cell disease advocating for integrated new-born screening). We also recommend that NCDAs in countries with large concentrations living in extreme poverty work alongside National NCDI Poverty Commissions in a complementary fashion to reflect the NCDI Poverty agenda in their advocacy. In high-poverty countries without NCDI Poverty Commissions, NCDAs can be important NCDI Poverty advocates in their own right.

### *National research and educational institutions*

As discussed, there are major gaps in epidemiological data regarding NCDIs in the poorest countries. This Commission's review of the literature published in 11 countries over the past 10 years has found that the little data that does exist is biased toward the urban areas where researchers are located, is focused on a small set of diseases, and does not routinely incorporate socioeconomic variables. Additionally, we have identified many NCDI interventions that are attractive from the standpoint of equity but for which there is no published evaluation of cost-effectiveness. There are also gaps in research regarding the cost and effect of integrated NCDI delivery strategies. Funding to address these gaps might need to come from global or regional sources.

We recommend that national research institutions and funders in high-poverty countries stimulate investigation regarding a broad range of priority NCDIs and integrated delivery channels with an additional focus on the rural poor. We also recommend that researchers in low and middle income countries work to fill evaluation gaps around the cost-effectiveness for high-equity NCDI interventions.

### *National professional societies*

National professional societies have an important role in helping to establish scopes of practice and to ensure the

quality of initial training and continuing professional education. It is important that these societies embrace the sharing of tasks and encourage the development of new areas of specialisation for mid-level providers to lead integrated delivery of NCDI services at first-level hospitals, health centres, and in the community.

We recommend that professional societies representing physicians and surgeons work with nursing and community health worker associations to develop specialised certification and career pathways for mid-level providers and community health workers in priority NCDI service areas such as chronic care for severe NCDs, advanced women's health, emergency and high-dependency care, and integrated chronic care.

### **Recommendations for making NCDI Poverty a global priority in the SDG era**

The SDGs are the framework for global cooperation over the next decade. Eight of the 17 SDGs (goals 1, 2, 3, 4, 5, 7, 8, 16, and 17) directly address some of the key dimensions of the NCDI burden globally and among the poorest.<sup>9</sup> In Table 2, we discuss targets for which the Commission has identified pro-poor adaptations of agreed-upon monitoring indicators. In many cases, we call to disaggregate indicators by multidimensional indices of poverty and by disease area. Fundamentally, we call for an expanded understanding of SDG target 3.4 to more fully include NCDI Poverty.

#### *Targeting mortality from NCDI Poverty (SDG targets 3.1, 3.2, 3.4, 3.6, and 16.1)*

Targets and associated indicators related to NCDI mortality are found under SDG 3 (ensure healthy lives and promote wellbeing for all ages), but also under SDG 16 (promote peaceful and inclusive societies). In general, these targets and indicators tend to frame NCDs as problems of older ages that are restricted to a small group of diseases, and to limit the focus of injury monitoring to road traffic accidents, homicide, and violent conflict. Whereas such a focus might be appropriate in some high-income and middle-income settings, this focus is not well aligned with the heterogeneity of NCDI Poverty that we have identified in LLMICs. The metadata for these indicators often fail to recommend disaggregation by measures of poverty. We have shown that NCDIs among the poorest are substantial causes of death in childhood, adolescence, and among adults of reproductive age. We recommend that the existing target focused on maternal mortality (SDG target 3.1) should be disaggregated by cause of death to highlight the role of underlying NCDs such as depression, rheumatic heart disease, peripartum cardiomyopathy, and uncorrected congenital heart disease as indirect causes of maternal mortality.<sup>232</sup> Similarly, we recommend disaggregation by cause of under-five mortality (target 3.2) to highlight, for example, congenital causes of death in this age group, as well as the importance of a variety of injuries.

Meanwhile, SDG targets focused on NCDIs more specifically need to be more broadly interpreted in their scope and embrace disaggregation by multidimensional poverty indicators such as nutrition, household education, and living standards. In particular, the indicators for SDG target 3.4, which are currently restricted to deaths due to cardiovascular disease, cancer, diabetes, and chronic respiratory disease between the ages of 30 and 70 years, as well as suicide across age groups, should be expanded

to include all ages and NCD causes. Particular attention should be paid to reductions in age-standardised mortality under the age of 40 years. Similarly, SDG target 3.4 should be expanded to include all causes of injury and disaggregated by cause.

The data requirements to monitor a broader range of ages and NCDI cause groups are no different than for current indicators. Reporting of cause-specific maternal and under-5 mortality rates will require continued

	Current indicators	NCDI Poverty adaptations
<b>Measuring NCDI mortality</b>		
Target 3.1: By 2030, reduce the global maternal mortality ratio to less than 70 per 100 000 livebirths	Maternal mortality ratio (3.1.1)	Disaggregated by cause of death
Target 3.2: By 2030, end preventable deaths of newborns and children under 5 years of age, with all countries aiming to reduce neonatal mortality to at least as low as 12 per 1000 livebirths and under-5 mortality to at least as low as 25 per 1000 livebirths	Under-5 mortality rate (3.2.1); and neonatal mortality rate by sex, age, wealth quintile, residence, and mother's education (3.2.2)	Disaggregated by cause of death
Target 3.4: By 2030, reduce by a third premature mortality from NCDs through prevention and treatment and promote mental health and wellbeing	Mortality rate attributed to cardiovascular disease, cancer, diabetes, or chronic respiratory disease (between the ages of 30 and 70 years) by sex (3.4.1); and suicide mortality rate by sex and age (3.4.2)	Mortality rate for all NCDs across the lifespan, disaggregated by cause, age group, sex, household nutrition, education, and living standards; mortality rates should be standardised within age groups and reported for the following specific intervals: under 5, 5-14, 15-24, 25-39, 40-59, 60-74, and 75 years and over
Target 3.6: By 2020, halve the number of global deaths and injuries from road traffic accidents	Death rate due to road traffic injuries by type of road user, sex, age, and income (3.6.1)	Mortality rate for all injuries across the lifespan, disaggregated by cause, age group, sex, household nutrition, education, and living standards
Target 16.1: Significantly reduce all forms of violence and related death rates everywhere	Number of victims of intentional homicide per 100 000 population, by sex and age (16.1.1); and conflict-related deaths per 100 000 population, by sex, age, and cause (16.1.2)	Disaggregated by household nutrition, education, and living standards
<b>Universal health coverage</b>		
Target 3.8: Achieve universal health coverage, including financial risk protection, access to quality essential health-care services and access to safe, effective, quality and affordable essential medicines and vaccines for all	Coverage of essential health services (defined as the average coverage of essential services based on tracer interventions that include reproductive, maternal, newborn and child health, infectious diseases, NCDs and service capacity and access, among the general and the most disadvantaged population; 3.8.1); proportion of population with large household expenditure on health as a share of total household expenditure or income (3.8.2)	Tracer interventions should include those that address high-severity, less prevalent NCDs (3.8.1); disaggregation by cause of expenditure (3.8.2)
<b>Social protection</b>		
Target 1.3: Implement nationally appropriate social protection systems and measures for all, including floors, and by 2030 achieve substantial coverage of the poor and the vulnerable	Proportion of population covered by social protection floors or systems, by sex, distinguishing children, unemployed people, people aged older than 50 years, people with disabilities, pregnant women, newborns, work-injury victims and the poor and the vulnerable (1.3.1)	Disaggregated for people living with severe NCDIs
<b>Financing</b>		
Target 17.2: Developed countries to implement fully their official development assistance commitments, including the commitment by many developed countries to achieve the target of 0.7% of ODA and GNI to developing countries and 0.15-0.20% of ODA and GNI to least developed countries	Net official development assistance, total and to least developed countries, as a proportion of the Organization for Economic Cooperation and Development and Development Assistance Committee donors' GNI by donor, recipient country, type of finance, type of aid, sub-sector, etc (17.2.1)	Disaggregated by NCDI cause, sub-national geography, and target recipient household nutrition, education, and living standards
NCDs=non-communicable diseases. NCDIs=non-communicable diseases and infections. ODA=official development assistance. GNI=gross national income.		
<b>Table 2: Current Sustainable Development Goal targets, indicators, and NCDI Poverty interpretation</b>		

improvements in vital registration systems and facility-based delivery. Although information about the socioeconomic status of decedents might be difficult to obtain, household indices of multidimensional poverty should be more available. This Commission has shown how this information can be used through its collaboration with the INDEPTH network of Demographic and Health Surveillance sites. In the meantime, models such as those from the GBD study, can continue to be improved to make predictions for different socioeconomic groups as we have done for this Commission.<sup>233</sup> One way forward would be to extract and link socioeconomic information from available sources with epidemiologic data whenever possible.

#### *NCDs in UHC (SDG target 3.8)*

Strategies to monitor progress toward UHC are in development and constrained by data limitations. One general tendency has been to exclude NCDs from core indicators (such as WHO's global reference list).<sup>234</sup> Another approach has been to select tracers based on those common interventions routinely reported in STEPS surveys. These have primarily been interventions to address behavioural risks (eg, tobacco, diet, alcohol, and physical inactivity), and metabolic risks (eg, hyperglycaemia and high blood pressures).<sup>235</sup> Although STEPS surveys have been essential for monitoring interventions to address these NCD risks, they have not been adequate to monitor interventions for less common and more severe conditions and those that cause the most lifetime loss of health. Monitoring coverage of interventions to address these severe conditions will require greater investment in individual health records by governments and partners as part of strengthening health information systems. These records will also need to capture information about individual socioeconomic status.<sup>236</sup>

Indicators of catastrophic spending (SDG target 3.8.2) will need to be disaggregated to capture disease-specific impoverishment. Household expenditure surveys could gather more information regarding the modalities and disease-specific indications for health services. Other indicators of progress toward UHC include measures of health workforce development (SDG target 3.c). We recommend that health workforce indicators should also include community health workers and be disaggregated by physician, nurse, and mid-level provider specialty (eg, generalist physician, internal medicine physician, paediatric cardiologist, oncologist, and chronic care nurse practitioner), and by level of the health system (ie, referral centre, first-level hospital, health centre, and community). This kind of disaggregation can help to monitor the development of integrated health service delivery.

#### *Social Protection for NCDI Poverty (SDG target 1.3)*

Social protection was the major focus of chronic disease policy in high-income countries during the early

20th century.<sup>237</sup> Prepayment mechanisms to avoid catastrophic expenditures due to the direct (and indirect) costs of NCDI treatment constitute one important element of social protection. An even more challenging issue is the impoverishment caused by lost household productivity due to NCDI death and disability among working-age adults. SDG 1 (end poverty in all its forms) addresses social protection (target 1.3) and calls for disaggregation relative not only to poverty, but also to disability. We have found that most of the disability among the poorest (71% of years-of-life-lived with disability) is due to NCDIs. Targeting social protection to specific groups can be both costly to administer and challenging to do precisely, but advances in biometrics and information technology will continue to make this approach more attractive.<sup>238,239</sup> The NCDI and disability rights agendas should be more closely linked.<sup>240</sup> The SDG target on social protection should disaggregate for severe NCDIs in addition to disability.

#### *Financing NCDI Poverty (SDG target 17.2)*

As noted in the financing section of this Commission (section 4), little DAH is going to NCDIs, even less is going to the poorest countries, and almost none is explicitly targeted to the poorest people in the poorest countries (the poorest billion). SDG 17 calls to strengthen the means of implementation; and SDG target 17.2 specifically calls on high-income countries to raise levels of official development assistance and to target around 20% of this assistance to the least developed countries. It is essential that aid be accountable for reaching the poorest. We recommend that the indicators for this target disaggregate aid recipients by NCDI cause, sub-national geography, and household indices of multidimensional poverty. Although this kind of disaggregation will introduce new data burdens for recipients, it will also encourage measurement of benefit incidence relative to poverty. The variety of pro-poor pathways for channelling public finance toward UHC has been well described previously in the 2013 *Lancet* Commission on Investing in Health.<sup>241</sup>

#### **Progress on NCDI Poverty in the SDG era**

We have previously discussed the gaps in global and national governance for NCDI Poverty in the SDG era. Fortunately, in the 5 years since we started this Commission at the end of 2015, we have seen signs of progress. The nine volumes of DCP3 were published between 2015 and 2018.<sup>242,243</sup> DCP3 lays out a far more inclusive agenda for NCDI priorities in UHC than we have previously seen in the UN System. We have made extensive use of DCP3 in our analysis of intervention priorities. Building on the work of DCP3, the Commission on Investing in Health (first published in 2013) has updated its findings to newly incorporate some NCDs (rheumatic heart disease, cervical cancer, and chronic liver disease due to hepatitis B) in its vision of a convergence agenda for

infectious, childhood, and maternal deaths toward very low rates for the world's poorest people.<sup>243</sup> The update from the Commission on Investing in Health also placed a high priority on global investments in NCD planning and pooled procurement. *The Lancet* Taskforce on NCDs and Economics identified NCDs as an important cause and consequence of poverty.<sup>194</sup> The WHO Independent High-Level Commission on NCDs recommended expanding the 4×4 framework to also include mental health and environmental risk factors.<sup>15</sup> This recommendation for a 5×5 framework was adopted by the 3rd UN High-Level Meeting on NCDs in 2018.<sup>10</sup> The NCD Countdown 2030 collaborators have also expanded NCD mortality monitoring to go beyond the SDGs' focus on NCD deaths from four main disease categories at older ages in order to include accountability for deaths at all ages and across all NCDs.<sup>14</sup> *The Lancet* Commission on High-Quality Health systems in the SDG Era has called for a greater focus on quality health care delivery for NCDIs.<sup>17</sup>

The NCDI Poverty agenda, however, remains unfinished. There appears to be little urgency in the global development community to include NCDIs in its agenda to prevent deaths among the poorest children and young adults.<sup>244</sup> In the aftermath of the 2019 UN High-Level Meeting on UHC—with its renewed global commitment “to meet the health needs of all throughout the life course, and in particular those who are vulnerable or in vulnerable situations”—<sup>245</sup> we hope that this Commission, with its associated National Commissions and partners, can help make addressing NCDI Poverty a priority in the SDG era.

### Conclusion: global solidarity for NCDI Poverty and universal health coverage

Propelled by a 2001 UN General Assembly Special Session, the first decade of the 20th century saw dramatic growth in development assistance for HIV. In many cases, HIV financing has had collateral benefits for those afflicted by other conditions, but it has not been sufficient. We have estimated that around 85% of the poorest billion live in countries with a per-capita GDP of less than US\$1600 in 2015 exchange-rate US dollars. Simply put, these countries do not have the domestic resources to address even their most urgent health-care needs.

NCDIs have been understood by development agencies and multilateral institutions as an emerging problem associated with ageing, urbanisation, and economic growth, rather than a constituent part of the most extreme poverty. The 2011 UN High-Level Meeting on NCDs was greeted with hope for a new era of global solidarity despite the 2008 financial crisis. These hopes have not materialised. Our Commission has shown that little development assistance for NCDIs has been mobilised for NCDIs over the past decade, and that almost none has gone to the poorest countries.

The framing of NCDs that crystallised through the 2011 UN High-Level Meeting was, in part, a solution

to the perceived weakness inherent in the heterogeneity of a large array of non-infectious conditions. This Commission proposes that this complexity should be recognised as an inescapable part of the NCDI burden in the poorest populations. More than that, this complexity should be leveraged to build global solidarity and to catalyse structural reforms for quality and innovations in integrated service delivery for the world's poorest and most vulnerable people.

To begin to remedy the shocking neglect of NCDI Poverty by rich countries, this Commission is launching an NCDI Poverty Network. This Network is composed of a growing group of National NCDI Poverty Commissions and their allies. The Network will work over the next decade to catalyse financing and technical partnerships to support implementation of integrated delivery strategies for locally prioritised interventions. The Network will also work closely with *The Lancet* and the NCD Countdown 2030 Group to report on progress toward locally identified goals. In doing so, we hope that this Commission will elevate an emerging NCDI Poverty movement and accountability mechanism that will contribute to health and shared prosperity for all.

Addressing NCDI Poverty offers a chance for the poorest countries to build durable, high-quality health systems. It also presents an important occasion to act on the underlying social determinants of disease such as housing, household energy, food insecurity, education, and transportation. In order to be successful, these countries will require greater global commitments to health equity. Private philanthropic organisations have small resources at their disposal but can have an outsized effect on policy and research. We ask that, when funding disease-specific initiatives, these organisations consider the poorest billion and recognise the need to invest in integrated strategies that drive health system improvements.

Bilateral donors must increase their investments in health in the poorest countries. When funding NCDIs as part of UHC expansion pathways, bilateral donors and multilateral institutions must also begin with the poorest billion in mind. Prospects exist to build on existing investments and to crowd-in resources for NCDI Poverty in priority countries and populations. Financing to address treatment gaps in the poorest countries should not be neglected even as resources should also be increased to support common goods for health such as research, policy, and coordination.<sup>243,246</sup>

We call on WHO to expand its UHC monitoring and NCD action plan after 2020 to address the diverse set of diseases and conditions recognised as NCDIs in its own Global Health Estimates; intervention priority setting at WHO to give due consideration to equity (including condition severity and distribution among the poorest) in addition to cost-effectiveness and feasibility; and WHO to strengthen its work on integrated service delivery for NCDIs, and particularly to invest in development of technical packages for first-level hospitals.

NCDI Poverty is one of the largest gaps and largest opportunities for UHC and global health equity in the SDG era. The Director General of WHO has called for one billion more people to benefit from UHC by 2023.<sup>29</sup> The scope of UHC recognised by this commitment must be broadened to include NCDI Poverty. Consistent with the SDG pledge that, “no one will be left behind”, and the SDG commitment, “to reach the furthest behind first”, the next billion to benefit from this more inclusive conception of the UHC should be the poorest billion.<sup>1</sup>

#### Contributors

The Commission co-chairs (GB and AOM) developed the initial concept for the Commission. The Secretariat for the Commission was based at the Program in Global NCDs and Social Change in the Department of Global Health and Social Medicine at Harvard Medical School. The Commission met in London, UK in January, 2016, and in November, 2017; in Kigali, Rwanda in September, 2016; in Dubai, United Arab Emirates in May, 2017; and in Boston in October, 2017. Research for the report sections was done under the supervision of the co-chairs and the respective working group leads (section 1: ME and YJ; section 2: OFN and ZB; section 3 RG and IG; section 4: CC and AB). MMC contributed to the analyses in the executive summary, and sections 1, 2, and 3. AM developed the Commission's figures and provided editorial guidance. NG, AOM, and GB coordinated the work of the National NCDI Poverty Commissions. GB led the writing of the initial draft of the report, as well as subsequent revisions. All Commissioners participated in the conceptualisation, writing, and editing of the manuscript. *The Lancet* NCDI Poverty Commission study group includes the co-chairs and coordinators of the first 11 countries to initiate National NCDI Poverty Commissions, Groups, and Consortia. These individuals contributed to all sections of this Commission and are listed by country (names of *Lancet* Commissioners are also included here if they were involved in National Commissions): Bashir Noormal and Said Habib Arwal (Afghanistan); Abraham Mitike Haileamlak, Solomon Tessema Memirie, and Wubaye Walelgne Dagnaw (Ethiopia); Jean Roland Cadet, Nancy Charles Larco, and Gene F Kwan (Haiti); Indrani Gupta, Yogesh Jain, and Nobhojit Roy (India); Kibachio Joseph Muiruri Mwangi, Mary Kigasia Amuyunzu-Nyamongo, and Gladwell Gathecha (Kenya); Fred Amegashie, Jason A Beste, and Zoe Taylor Doe (Liberia); Jones Masiye, Emily B Wroe, and Noel Kasomekera (Malawi); Ana Olga Mocumbi and Humberto Nelson Muquingue (Mozambique); Bhagawan Koirala, Senendra Raj Upreti, and Biraj Karmacharya (Nepal); Gilles François Ndayisaba (Rwanda); and Sarah Maongezi and Mary Mayige (Tanzania). Additionally, *The Lancet* NCDI Poverty Commission Study Group also includes the following individuals who did original research for Commission: Gisela Robles Aguilar and Andrew P Sumner (section 1: the geography and demographics of the poorest billion); Osman A.Sankoh, Peter Byass (deceased), and Mamusu Kamanda (section 1: poverty-specific mortality patterns in the INDEPTH network); Kjell Arne Johansson (section 1: disease-specific individual loss of healthy life); Paul Park and Alma Adler (section 2: integrated care teams); David Watkins (section 2: intervention cost-effectiveness and population health impact); Akshar Saxena (section 3: analysis of national health accounts); Annie Haakenstad and Stéphane Verguet (section 3: modelling disease-specific catastrophic health expenditure among the poorest billion); Andrea Feigl (section 3: targeting of external NCDI financing to the poorest billion); Leah N Schwartz, Nicole Bassoff, and Jonathan D Shaffer (section 4: history of NCDs at WHO); Amy McLaughlin and Maia Olsen (sections 1 and 4: voices of NCDI Poverty and analysis of NCDI framing at global institutions and in national poverty reduction strategy papers); Arielle Wilder Eagan, Kafui Adjaye-Gbewonyo, Dan K Schwarz, and Alex Kintu (section 4: National NCDI Poverty Commissions); Chantelle Boudreaux and Christopher A Noble (section 4: analysis of national NCD strategic plans). All authors approved the final manuscript and are solely responsible for its accuracy.

#### Declaration of interests

GB reports grants from the Leona M and Harry B Helmsley Charitable Trust, Stryker Johnston Foundation, Minneapolis Foundation, American Cancer Society, and Inter-American Development Bank; and non-financial support from Partners In Health, Harvard Medical School, Johns Hopkins Bloomberg School of Public Health, Wellcome Trust, *The Lancet*, and World Bank, during the conduct of the study. GG was the Chief Executive Officer of Partners in Health from the beginning of the formation of the Commission through June, 2019, and was paid salary until July 30, 2019. GG is a Professor of Psychiatry at Harvard Medical School but receives no salary for this position. OFN's work was supported by the Norwegian Agency for Development Cooperation. All other authors declare no competing interests.

#### Acknowledgments

This Commission is dedicated to Bongani M Mayosi, a fellow Commissioner, who died on July 27, 2018. Prof Mayosi devoted his career to the cardiovascular diseases of poverty in Africa. He was our inspiration, colleague, friend, and mentor. We miss him profoundly and hope that this Commission contributes to the kind of positive change he wanted to see in the world. The Leona M and Harry B Helmsley Charitable Trust provided major funding for the Commission research and meetings. All Commissioners were supported by their home institutions to participate in the project. Other organisations that provided financial or in-kind contributions for this Commission included Partners In Health, Department of Global Health and Social Medicine at Harvard Medical School, Harvard Medical School Center for Global Health Delivery-Dubai, Johns Hopkins Bloomberg School of Public Health, Wellcome Trust, *The Lancet*, Stryker Johnston Foundation, American Cancer Society, Minneapolis Foundation, Norwegian Agency for Development Cooperation (Ethiopia NCDI Commission), World Bank (Knowledge Exchanges), and Inter-American Development Bank (Haiti NCDI Poverty Commission). The funding sources had no role in the design or content of this Commission. We thank the following research assistants at Harvard Medical School who contributed to literature reviews in support of the National NCDI Poverty Commissions: Mamka Anyona, Amiya Bhatia, Sarah M Frank, Gilberto Lopez, and Azhra Syed. We thank Jennifer Puccetti, Catherine M Player, Claire McDonell, Debra Keaney, Rebecca Grow, Carol Benoit, and London Hardy, who provided administrative support and guidance to the Commission Secretariat at Harvard Medical School. We thank Miriam Schneidman at the World Bank for her support and advice throughout the Commission process and for facilitating Knowledge Exchanges between the National NCDI Poverty Commissions and World Bank country-based staff. We thank David Murdock and Mehret Mandefro for their work on the Voices of NCDI Poverty project. We thank the following individuals who gave their perspective and advice on this project over the course of its development (all errors and omissions are solely the responsibility of the report authors): Paul E Farmer, S V Subramanian, Adam Wagstaff (deceased), Sabina Alkire, Michael Engelgau, Lincoln Chen, Mickey Chopra, Borwornsom Leerapan, Tracy Kidder, John Flanigan, Giuseppe Raviola, Stephanie Smith, Shekhar Saxena, Crick Lund, Vikram Patel, Ruma Rajbhandari, Kee Park, Mark Shrimme, Jennifer Kreshak, Blake Alkire, John G Meara, Vatshalan Santhirpala, Bente Mikkelsen, Téa Collins, Cherian V Varghese, Ali H Mokdad, Alice K Bukhman, Daniel Vigo, Alex Beith, Corrado Cancedda, Sally Cowal, Robert Riviello, Lauren Eberly, Joia Mukherjee, Sheila Davis, Darius Leopold Fenelon, Egide Mpanumusingo, Joseph Dieleman, Chrisoph Kurowski, Timothy G Evans, Igor Glasunov, and David S Jones. We thank the individuals who participated in National NCDI Poverty Commissions, Groups, and Consortia at the time this report was produced in the following countries (*Lancet* Commissioners are also listed if they were involved in National Commissions. This list is not exhaustive.): Ahmad Jan Naeem, Bashir Noormal, Said Habib Arwal (co-chairs), Farhad Farewar, Humayoon Gardiwal, Khwaja Mir Islam Saeed, Ahmad Masoud, Mohammad Shafiq Shams, Abdullah Noorzai, and Sayed Attaullah Saeedzai (Afghanistan); Abraham Mitike Haileamlak, Solomon Tessema Memirie (co-chairs), Aklilu Azazh, Amsalu Bekele Binagdie, Alemayehu Bekele Mengesha, Wondu Bekele Woldemariam, Molla Gedefaw, Mahlet Kifle Habtemariam, Yoseph Mamo, Misrak Tareegn Wondimagegn, Meiraf Tadesse Tolla,

Taye Tolera Balcha, Wubaye Walelgne Dagnaw, and Dejuma Yadeata (Ethiopia); Jean Roland Cadet, Gene F Kwan, Nancy Charles Larco (co-chairs), Paul Adrien, Densa Bélonny, Jacques Clerville, Jean Claude Desgranges, Ruth Damuse, Eddy Eustache, Pascale Hertelou Gassant, Benisa Joassaint, Stanley Juin, René Domersant Junior, Ryan McBain, Julio Pedroza, and Shada Rouhani (Haiti); Indrani Gupta, Yogesh Jain, and Nobhojit Roy (co-chairs; India); Kibachio Joseph Muiruri Mwangi, Mary Kigasia Amuyunzu-Nyamongo (co-chairs), Zipporah Ali, Gladwell Gathecha, Abubakar A Hussein, Alfred Karagu, Dorcas Jepsongol Kiptui, Daniel Mwai, Joyce Nanjala Nato, Mary Nyangasi, Loise Nyanjau, Wilson Odero, Frank Odhiambo, and Samuel Oti (Kenya); Fred Amegashie, Jason A Beste (co-chairs), Dawn Cooper Barnes, Zoe C Y Taylor Doe, Mosoka P Fallah, Methodius George, William Karloweah, Victoria Katawera, Cate Oswald, and Maude Somah (Liberia); Jones Masiye, Emily B Wroe (co-chairs), Alemayehu Amberbir, Grace Banda, Sosten Chilumpha, John Chipolombwe, Mia Crampin, Katie Cundale, Luckson Dullie, Beth Dunbar, Noel Kasomekera, Ronald Manjomo, Leo Masamba, Colin Pfaff, Sam Phiri, and Michael Udedi (Malawi); Ana Olga Mocumbi, Humberto Munquingue (co-chairs), Carlos Arnaldo, Carla Carrilho, Matchecane Cossa, Humberto Albino Cossa, António S Franco, Sarah M Frank, Sam Patel, António Prista, and Patricia Silva (Mozambique); Bhagawan Koirala, Serendra Raj Upreti (co-chairs), Krishna K Aryal, Meghnath Dhimal, Arpana Kalaunee, SP Kalaunee, Biraj M. Karmacharya, Rajendra Koju, Suresh Mehata, Shiva Raj Mishra, Dinesh Neupane, Saroj Prasad Ojha, Achyut Raj Pandey, Bhaskar Raj Pant, Anant Raut, Dan K Schwarz, Deewakar Sharma, Abha Shrestha, Archana Shrestha, and Abhinav Vaidya (Nepal); Gilles Gahire, Joseph Mucumbitsi, Clarisse Musanabaganwa, Gilles François Ndayisaba, Gedeon Ngoga, Jean Pierre Nyemazi, André Rusanganwa, Blaise Uhagaze, and Stella Matutina Umuhoza (Rwanda); Santigie Sesay (co-chair), Michael Alex Conteh, Chiyembekezo Kachimanga, Mutiva Kappia, Hawantu K Koroma, and John Makanga Ngorongo (Sierra Leone); Mary Mayige, Sarah Maongezi (co-chairs), Ayoub Magimba, Julie Makani, and Janneth Mghamba (Tanzania); Mary M Ajiko, Ann R Akiteng, Sarah Byakika, David Guwatudde, Dan Kajungu, Robert Kalyesubula, Nathan Kenya-Mugisha, Ivan Kimuli, Christopher Kwizera, Roy Mayega, Noleb Mugisha, Deogratias Munube, Martha Nadabba, David Ojut Okello, Emmy Okello, Jeremy Schwartz, William Lumu (Uganda); Patrick Banda, Patricia Mupeta Bobo, Samuel Bosomprah, Roma Chilengi, Fastone M Goma, Jane Matambo, Susan Citonje Msadabwe, John Musuku, Wilbrod Mutale, Earnest Muyunda, Peter Ngalama Songolo (Zambia); and Justice Mudavanhu (co-chair), Michelle Chishamiso Madzudzo, Venus Mushininga, Alvern Mutengerere, Lee Nkala, Anna Mary Nyakabau, Wenceslas Nyamayaro, Gerald Shambira, Janneke van Dijk, and Hajo Zeeb (Zimbabwe). We thank the 7 anonymous reviewers who generously gave us feedback on this report at an earlier stage. Finally, we thank Richard Horton, Elizabeth Zuccala, and Jennifer Sargent for encouraging this project and working with us as editors at *The Lancet* over the course of this Commission.

#### References

- 1 Transforming our world: the 2030 Agenda for sustainable development. Resolution adopted by the General Assembly on 25 September 2015. New York, NY: United Nations, 2015.
- 2 Alveredo F, Chancel L, Piketty T, Saez E, Zucman G. World Inequality Report 2018. Cambridge, MA, USA: Harvard University Press, 2018.
- 3 World Bank. World Development Report 1978. Washington, DC: World Bank, 1978.
- 4 Poverty and Shared Prosperity 2018. Washington, DC: World Bank, 2018.
- 5 Hallegatte S, Rozenberg J. Climate change through a poverty lens. *Nature Clim Change* 2017; 7: 250–56.
- 6 Bukhman G, Mocumbi AO, Horton R. Reframing NCDs and injuries for the poorest billion: a Lancet Commission. *Lancet* 2015; 386: 1221–22.
- 7 Annan KA. We the Peoples. The Role of the United Nations in the 21st Century. New York: United Nations, 2000.
- 8 WHO. Global action plan for the prevention and control of NCDs 2013–2020. Geneva: World Health Organization, 2013.
- 9 UN Economic and Social Council. Report of the Inter-Agency and Expert Group on Sustainable Development Goal Indicators. E/CN.3/2016/2/Rev.1. New York, NY: UN Economic and Social Council, 2016.
- 10 UN General Assembly. Political declaration of the 3rd High-Level Meeting of the General Assembly on the prevention and control of non-communicable diseases. A/RES/73/2. New York, NY: United Nations General Assembly, 2018.
- 11 UN General Assembly. A/RES/67/81. Global health and foreign policy. Geneva: United Nations, 2013.
- 12 WHO. Sustainable health financing, universal coverage and social health insurance. World Health Assembly 58.33. Geneva: World Health Organization, 2005.
- 13 *The Lancet* NCDI Poverty Commission. National NCDI Poverty Commissions and Groups. <https://www.ncdipoverty.org/overview> (accessed May 20, 2020).
- 14 Countdown NCD. NCD Countdown 2030: worldwide trends in non-communicable disease mortality and progress towards Sustainable Development Goal target 3.4. *Lancet* 2018; 392: 1072–88.
- 15 WHO. Report of the WHO independent high-level commission on noncommunicable diseases. Geneva: World Health Organization, 2018.
- 16 Jamison DT, Alwan A, Mock CN, et al. Universal health coverage and intersectoral action for health: key messages from Disease Control Priorities, 3rd edn. *Lancet* 2018; 391: 1108–20.
- 17 Kruk ME, Gage AD, Arsenault C, et al. High-quality health systems in the Sustainable Development Goals era: time for a revolution. *Lancet Glob Health* 2018; 6: e1196–252.
- 18 Knaul FM, Farmer PE, Krakauer EL, et al. Alleviating the access abyss in palliative care and pain relief—an imperative of universal health coverage: the Lancet Commission report. *Lancet* 2018; 391: 1391–454.
- 19 Jain Y, Desiraju K. It is not enough to grieve; we must learn from Gorakhpur. *Indian J Med Ethics* 2017; 2: 221–23.
- 20 WHO. Rheumatic fever and rheumatic heart disease. Geneva: World Health Organization, 2017.
- 21 Consunji R, Ameratunga S, Hyder AA. Trauma care in the developing world: introduction to special issue. *Surgery* 2017; 162: S2–3.
- 22 Agyepong IA, Sewankambo N, Binagwaho A, et al. The path to longer and healthier lives for all Africans by 2030: the Lancet Commission on the future of health in sub-Saharan Africa. *Lancet* 2018; 390: 2803–59.
- 23 Tluway F, Makani J. Sickle cell disease in Africa: an overview of the integrated approach to health, research, education and advocacy in Tanzania, 2004–2016. *Br J Haematol* 2017; 177: 919–29.
- 24 Mould-Millman N-K, Dixon JM, Sefa N, et al. The state of Emergency Medical Services (EMS) systems in Africa. *Prehosp Disaster Med* 2017; 32: 273–83.
- 25 Mendoza W, Miranda JJ. Global shifts in cardiovascular disease, the epidemiologic transition, and other contributing factors: toward a new practice of global health cardiology. *Cardiol Clin* 2017; 35: 1–12.
- 26 Bhutta ZA, Lassi ZS, Bergeron G, et al. Delivering an action agenda for nutrition interventions addressing adolescent girls and young women: priorities for implementation and research. *Ann N Y Acad Sci* 2017; 1393: 61–71.
- 27 Atun R, Davies JI, Gale EAM, et al. Diabetes in sub-Saharan Africa: from clinical care to health policy. *Lancet Diabetes Endocrinol* 2017; 5: 622–67.
- 28 World Bank Blogs. Updated estimates of the impact of Covid-19 on global poverty. 2020. <https://blogs.worldbank.org/opendata/updated-estimates-impact-covid-19-global-poverty> (accessed Aug 27, 2020).
- 29 WHO. Thirteenth general programme of work 2019–2023. Geneva: World Health Organization, 2018.
- 30 Boston statement on non-communicable diseases of the poorest billion people. Boston, MA: Harvard Medical School, Department of Global Health and Social Medicine, Program in Global NCDs and Social Change, 2011. [https://www.ghdonline.org/uploads/Revised\\_Boston\\_Statement\\_3\\_14\\_2011.pdf](https://www.ghdonline.org/uploads/Revised_Boston_Statement_3_14_2011.pdf) (accessed Jan 18, 2020).
- 31 Omran AR. The epidemiologic transition. A theory of the epidemiology of population change. *Milbank Mem Fund Q* 1971; 49: 509–38.

- 32 WHO Africa. The Brazzaville declaration on noncommunicable diseases prevention and control in the WHO African region. Congo (Brazzaville): WHO Regional Office for Africa, 2011.
- 33 Mensah GA, Mayosi BM. The 2011 United Nations high-level meeting on non-communicable diseases: the Africa agenda calls for a 5-by-5 approach. *S Afr Med J* 2012; **103**: 77–79.
- 34 Mocumbi AO. Focus on non-communicable diseases: an important agenda for the African continent. *Cardiovasc Diagn Ther* 2013; **3**: 193–95.
- 35 Binagwaho A, Muhimpundu MA, Bukhman G. 80 under 40 by 2020: an equity agenda for NCDs and injuries. *Lancet* 2014; **383**: 3–4.
- 36 WHO. Report of the first dialogue convened by the World Health Organization Global Coordination Mechanism on Noncommunicable Diseases. Geneva, 20–21 April 2015. Geneva: World Health Organization, 2015.
- 37 WHO. Health, Economic Growth, and Poverty Reduction: a report of Working Group 1 of the Commission on Macroeconomics and Health. Geneva: World Health Organization, 2002.
- 38 Trowell HC. Non-infective disease in Africa. London, UK: Edward Arnold, 1960.
- 39 Jan Swasthya Sahyog. Chronicles from Central India: an atlas of rural health. Chattisgarh, India: Jan Swasthya Sahyog, 2016.
- 40 Ezzati M, Pearson-Stuttard J, Bennett JE, Mathers CD. Acting on non-communicable diseases in low- and middle-income tropical countries. *Nature* 2018; **559**: 507–16.
- 41 Grant JP. A fresh approach to meeting the basic needs of the world's poorest billion. *Int Asienforum* 1978; **9**: 7–25.
- 42 Macroeconomics and Health. Investing in Health for Economic Development. Geneva: World Health Organization, 2001.
- 43 Ghebreyesus TA. WHO: Appointment of Dr Tedros Adhanom Ghebreyesus as new WHO Director-General. 2017. <https://youtu.be/5oUdOYARcRA> (accessed May 25, 2017).
- 44 Alkire S, Roche JM, Seth S, Sumner A. Identifying the poorest people and groups: strategies using the global multidimensional poverty index. *J Int Dev* 2015; **27**: 362–87.
- 45 Alkire S, Foster J, Seth S, Santos ME, Roche JM, Ballon P. Introduction. In: Alkire S, Foster J, Seth S, Santos ME, Roche JM, Ballon P, eds. Multidimensional poverty measurement and analysis. Oxford, UK: Oxford University Press, 2015: 1–23.
- 46 Castañeda A, Doan D, Newhouse D, Nguyen MC, Uematsu H, Azevedo JP. A new profile of the global poor. *World Dev* 2018; **101**: 250–67.
- 47 Robles Aguilar G, Sumner A. Who are the world's poor? A new profile of global multidimensional poverty. *World Dev* 2020; **126**: 104716.
- 48 World Bank. World Development Indicators 2017. Washington, DC: World Bank, 2017.
- 49 Smith KR, Bruce N, Balakrishnan K, et al. Millions dead: how do we know and what does it mean? Methods used in the comparative risk assessment of household air pollution. *Annu Rev Public Health* 2014; **35**: 185–206.
- 50 Fewtrell L, Kaufmann RB, Kay D, Enanoria W, Haller L, Colford JM Jr. Water, sanitation, and hygiene interventions to reduce diarrhoea in less developed countries: a systematic review and meta-analysis. *Lancet Infect Dis* 2005; **5**: 42–52.
- 51 Cattaneo MD, Galiani S, Gertler PJ, Martinez S, Titiumik R. Housing, health, and happiness. *Am Econ J Econ Policy* 2009; **1**: 75–105.
- 52 Berman P, Kendall C, Bhattacharyya K. The household production of health: integrating social science perspectives on micro-level health determinants. *Soc Sci Med* 1994; **38**: 205–15.
- 53 Caldwell JC. How is greater maternal education translated into lower child mortality? *Health Transiti Rev* 1994; **4**: 223–29.
- 54 Pradhan E, Suzuki E, Martinez S, Schäferhoff M, Jamison DT. The effects of education quantity and quality on child and adult mortality: their magnitude and their value. In: Bundy D, de Silva N, Horton S, Jamison DT, Patton G, eds. Disease Control Priorities (third edition): volume 8, child and adolescent health and development. Washington, DC: World Bank, 2017: 423–39.
- 55 Coates MM, Kamanda M, Kintu A, et al. A comparison of all-cause and cause-specific mortality by household socioeconomic status across seven INDEPTH network health and demographic surveillance systems in sub-Saharan Africa. *Glob Health Action* 2019; **12**: 1608013.
- 56 Gwatkin DR, Guillot M, Heuveline P. The burden of disease among the global poor. *Lancet* 1999; **354**: 586–89.
- 57 Gwatkin DR, Guillot M. The burden of disease among the global poor. Current situation, future trends, and implications for strategy. Washington, DC: World Bank, Human Development Network, Global Forum for Health Research, 2000.
- 58 Tugwell P, de Savigny D, Hawker G, Robinson V. Applying clinical epidemiological methods to health equity: the equity effectiveness loop. *BMJ* 2006; **332**: 358–61.
- 59 Streatfield PK, Khan WA, Bhuiya A, et al. Mortality from external causes in Africa and Asia: evidence from INDEPTH Health and Demographic Surveillance System Sites. *Glob Health Action* 2014; **7**: 25366.
- 60 Streatfield PK, Khan WA, Bhuiya A, et al. Cause-specific mortality in Africa and Asia: evidence from INDEPTH health and demographic surveillance system sites. *Glob Health Action* 2014; **7**: 25362.
- 61 Streatfield PK, Khan WA, Bhuiya A, et al. Cause-specific childhood mortality in Africa and Asia: evidence from INDEPTH health and demographic surveillance system sites. *Glob Health Action* 2014; **7**: 25363.
- 62 Streatfield PK, Khan WA, Bhuiya A, et al. Adult non-communicable disease mortality in Africa and Asia: evidence from INDEPTH Health and Demographic Surveillance System sites. *Glob Health Action* 2014; **7**: 25365.
- 63 McKinnon B, Harper S, Kaufman JS, Bergevin Y. Socioeconomic inequality in neonatal mortality in countries of low and middle income: a multicountry analysis. *Lancet Glob Health* 2014; **2**: e165–73.
- 64 Abera SF, Gebru AA, Biesalski HK, et al. Social determinants of adult mortality from non-communicable diseases in northern Ethiopia, 2009–2015: evidence from health and demographic surveillance site. *PLoS One* 2017; **12**: e0188968.
- 65 Nabukalu D, Klipstein-Grobusch K, Herbst K, Newell M-L. Mortality in women of reproductive age in rural South Africa. *Glob Health Action* 2013; **6**: 22834.
- 66 Rossier C, Soura AB, Duthé G, Findley S. Non-communicable disease mortality and risk factors in formal and informal neighborhoods, Ouagadougou, Burkina Faso: evidence from a health and demographic surveillance system. *PLoS One* 2014; **9**: e113780.
- 67 Kabudula CW, Houle B, Collinson MA, et al. Socioeconomic differences in mortality in the antiretroviral therapy era in Agincourt, rural South Africa, 2001–13: a population surveillance analysis. *Lancet Glob Health* 2017; **5**: e924–35.
- 68 Sankoh O, Sharrow D, Herbst K, et al. The INDEPTH standard population for low- and middle-income countries, 2013. *Global Health Action* 2014; **7**: 23286.
- 69 Sankoh O. CHES: an innovative concept for a new generation of population surveillance. *Lancet Glob Health* 2015; **3**: e742.
- 70 Hosseinpoor AR, Bergen N, Mendis S, et al. Socioeconomic inequality in the prevalence of noncommunicable diseases in low- and middle-income countries: results from the World Health Survey. *BMC Public Health* 2012; **12**: 474.
- 71 Riley L, Guthold R, Cowan M, et al. The World Health Organization STEPwise approach to noncommunicable disease risk-factor surveillance: methods, challenges, and opportunities. *Am J Public Health* 2016; **106**: 74–78.
- 72 Hirai M, Grover N, Huang C. The measurement of non-communicable diseases in 25 countries with demographic and health surveys. Rockville, MD: ICF International, 2015.
- 73 Jain Y. Lean diabetes in rural poor populations—management of this subset of patients needs rethinking. 2019. <https://blogs.bmj.com/bmj/2017/09/08/yogesh-jain-lean-diabetes-in-rural-poor-populations-management-of-this-subset-of-patients-needs-rethinking/> (accessed Jan 24, 2020).
- 74 Jain Y, Juneja R, Patil S. Global Burden of Rheumatic Heart Disease. *N Engl J Med* 2018; **378**: e2.
- 75 Williams J, Allen L, Wickramasinghe K, Mikkelsen B, Roberts N, Townsend N. A systematic review of associations between non-communicable diseases and socioeconomic status within low- and lower-middle-income countries. *J Glob Health* 2018; **8**: 020409.
- 76 WHO. Follow-up to the political declaration of the third high-level meeting of the General Assembly on the prevention and control of non-communicable diseases. Geneva: World Health Organization, 2019.

- 77 Ottersen T. Lifetime QALY prioritization in priority setting. *J Med Ethics* 2013; **39**: 175–80.
- 78 Institute for Health Metrics and Evaluation. GBD results tool. <http://ghdx.healthdata.org/gbd-results-tool> (accessed Nov 20, 2018).
- 79 Nolte E, McKee M. Does health care save lives? Avoidable mortality revisited. London: Nuffield Trust, 2004.
- 80 Wilson RD, Wilson RD, Audibert F, et al. Pre-conception folic acid and multivitamin supplementation for the primary and secondary prevention of neural tube defects and other folic acid-sensitive congenital anomalies. *J Obstet Gynaecol Can* 2015; **37**: 534–52.
- 81 Hosseinpoor AR, Bergen N, Kunst A, et al. Socioeconomic inequalities in risk factors for non-communicable diseases in low-income and middle-income countries: results from the World Health Survey. *BMC Public Health* 2012; **12**: 912.
- 82 Zhou B, Lu Y, Hajifathalian K, et al. Worldwide trends in diabetes since 1980: a pooled analysis of 751 population-based studies with 4.4 million participants. *Lancet* 2016; **387**: 1513–30.
- 83 Hosseinpoor AR, Parker LA, Tursan d'Espaignet E, Chatterji S. Socioeconomic inequality in smoking in low-income and middle-income countries: results from the World Health Survey. *PLoS One* 2012; **7**: e42843.
- 84 Sreeramareddy CT, Pradhan PM, Sin S. Prevalence, distribution, and social determinants of tobacco use in 30 sub-Saharan African countries. *BMC Med* 2014; **12**: 243.
- 85 Sreeramareddy CT, Pradhan PMS, Mir IA, Sin S. Smoking and smokeless tobacco use in nine South and Southeast Asian countries: prevalence estimates and social determinants from Demographic and Health Surveys. *Popul Health Metr* 2014; **12**: 22.
- 86 Pampel F. Tobacco use in sub-Saharan Africa: estimates from the demographic health surveys. *Soc Sci Med* 2008; **66**: 1772–83.
- 87 Landrigan PJ, Fuller R, Acosta NJR, et al. The Lancet Commission on pollution and health. *Lancet* 2018; **391**: 462–512.
- 88 Gordon SB, Bruce NG, Grigg J, et al. Respiratory risks from household air pollution in low and middle income countries. *Lancet Respir Med* 2014; **2**: 823–60.
- 89 Allen L, Williams J, Townsend N, et al. Socioeconomic status and non-communicable disease behavioural risk factors in low-income and lower-middle-income countries: a systematic review. *Lancet Glob Health* 2017; **5**: e277–89.
- 90 Geldsetzer P, Manne-Goehler J, Theilmann M, et al. Diabetes and hypertension in India: a nationally representative study of 1.3 million adults. *JAMA Intern Med* 2018; **178**: 363–72.
- 91 Corsi DJ, Subramanian SV. Socioeconomic gradients and distribution of diabetes, hypertension, and obesity in India. *JAMA Netw Open* 2019; **2**: e190411.
- 92 Abarca-Gómez L, Abdeen ZA, Hamid ZA, et al. Worldwide trends in body-mass index, underweight, overweight, and obesity from 1975 to 2016: a pooled analysis of 2416 population-based measurement studies in 128.9 million children, adolescents, and adults. *Lancet* 2017; **390**: 2627–42.
- 93 Zhou B, Bentham J, Di Cesare M, et al. Worldwide trends in blood pressure from 1975 to 2015: a pooled analysis of 1479 population-based measurement studies with 19.1 million participants. *Lancet* 2017; **389**: 37–55.
- 94 Stanaway JD, Afshin A, Gakidou E, et al. Global, regional, and national comparative risk assessment of 84 behavioural, environmental and occupational, and metabolic risks or clusters of risks for 195 countries and territories, 1990–2017: a systematic analysis for the Global Burden of Disease Study 2017. *Lancet* 2018; **392**: 1923–94.
- 95 WHO. Draft comprehensive global monitoring framework and targets for the prevention and control of noncommunicable diseases. Sixty-sixth World Health Assembly provisional agenda item 13.1. Geneva: World Health Organization, 2013.
- 96 Gupta D. Technical working group meeting on regional action plan and targets for prevention and control of noncommunicable diseases Bangkok, Thailand, 11–13 June 2013. Background document for including household air pollution as a regional target for prevention and control of non-communicable diseases. World Health Organization Regional Office for South-East Asia, 2013.
- 97 Bukhman G. Food insecurity and non-communicable disease among the poorest. In: Ivers L, ed. Food insecurity and public health. Boca Raton, FL, 2015: 114–31.
- 98 Barker DJ, Winter PD, Osmond C, Margetts B, Simmonds SJ. Weight in infancy and death from ischaemic heart disease. *Lancet* 1989; **2**: 577–80.
- 99 Victora CG, Adair L, Fall C, et al. Maternal and child undernutrition: consequences for adult health and human capital. *Lancet* 2008; **371**: 340–57.
- 100 Fleming TP, Watkins AJ, Velazquez MA, et al. Origins of lifetime health around the time of conception: causes and consequences. *Lancet* 2018; **391**: 1842–52.
- 101 Hobbs A, Ramsay M. Epigenetics and the burden of noncommunicable disease: a paucity of research in Africa. *Epigenomics* 2015; **7**: 627–39.
- 102 Coates MM, Kintu A, Gupta N, et al. Burden of non-communicable diseases from infectious causes in 2017: a modelling study. *Lancet Glob Health* (in press).
- 103 Plummer M, de Martel C, Vignat J, Ferlay J, Bray F, Franceschi S. Global burden of cancers attributable to infections in 2012: a synthetic analysis. *Lancet Glob Health* 2016; **4**: e609–16.
- 104 de Martel C, Ferlay J, Franceschi S, et al. Global burden of cancers attributable to infections in 2008: a review and synthetic analysis. *Lancet Oncol* 2012; **13**: 607–15.
- 105 Kwan GF, Mayosi BM, Mocumbi AO, et al. Endemic cardiovascular diseases of the poorest billion. *Circulation* 2016; **133**: 2561–75.
- 106 Moolani Y, Bukhman G, Hotez PJ. Neglected tropical diseases as hidden causes of cardiovascular disease. *PLoS Negl Trop Dis* 2012; **6**: e1499.
- 107 Ogoina D, Onyemelukwe GC. The role of infections in the emergence of non-communicable diseases (NCDs): compelling needs for novel strategies in the developing world. *J Infect Public Health* 2009; **2**: 14–29.
- 108 Hotez PJ, Daar AS. The CNCDs and the NTDs: blurring the lines dividing noncommunicable and communicable chronic diseases. *PLoS Negl Trop Dis* 2008; **2**: e312.
- 109 Libby P, Loscalzo J, Ridker PM, et al. Inflammation, immunity, and infection in atherosclerosis: JACC review topic of the week. *J Am Coll Cardiol* 2018; **72**: 2071–81.
- 110 Habtamu K, Alem A, Hanlon C. Conceptualizing and contextualizing functioning in people with severe mental disorders in rural Ethiopia: a qualitative study. *BMC Psychiatry* 2015; **15**: 34.
- 111 Shibre T, Hanlon C, Medhin G, et al. Suicide and suicide attempts in people with severe mental disorders in Butajira, Ethiopia: 10 year follow-up of a population-based cohort. *BMC Psychiatry* 2014; **14**: 150.
- 112 Fekadu A, Medhin G, Kebede D, et al. Excess mortality in severe mental illness: 10-year population-based cohort study in rural Ethiopia. *Br J Psychiatry* 2015; **206**: 289–96.
- 113 Johansson KA, Coates MM, Økland J-M, Tsuchiya A, OF N, Haaland Ø. Baseline health by disease categories. In: Cookson R, Griffin S, Norheim OF, Culyer AJ, eds. Distributional cost-effectiveness analysis: a handbook of equity-informative health economic evaluation. Oxford, UK: Oxford University Press, 2020.
- 114 Burstein R, Fleming T, Haagsma J, Salomon JA, Vos T, Murray CJ. Estimating distributions of health state severity for the global burden of disease study. *Popul Health Metr* 2015; **13**: 31.
- 115 Ottersen T, Norheim OF, Chitah BM, et al. Making fair choices on the path to universal health coverage. Final report of the WHO Consultative Group on Equity and Universal Health Coverage. Geneva: World Health Organization, 2014.
- 116 WHO and The World Bank. Tracking Universal Health Coverage. 2017 Global Monitoring Report. Geneva, Switzerland and Washington, DC: World Health Organization and International Bank for Reconstruction and Development, and The World Bank, 2017.
- 117 Vecino-Ortiz AI, Jafri A, Hyder AA. Effective interventions for unintentional injuries: a systematic review and mortality impact assessment among the poorest billion. *Lancet Glob Health* 2018; **6**: e523–34.
- 118 Jamison DT, Gelband H, Horton S, et al. Disease control priorities: improving health and reducing poverty. Volume 9, disease control priorities (third edition). Washington, DC: World Bank, 2018.
- 119 WHO. Best buys and other recommended interventions for the prevention and control of noncommunicable disease. Updated (2017) appendix 3 of the Global Action Plan for the Prevention and Control of Noncommunicable Diseases 2013–2020. Geneva: World Health Organization, 2017.

- 120 McGill R, Anwar E, Orton L, et al. Are interventions to promote healthy eating equally effective for all? Systematic review of socioeconomic inequalities in impact. *BMC Public Health* 2015; **15**: 457.
- 121 Cappuccio FP, Kerry SM, Micah FB, Plange-Rhule J, Eastwood JB. A community programme to reduce salt intake and blood pressure in Ghana [ISRCTN88789643]. *BMC Public Health* 2006; **6**: 13.
- 122 Neupane D, McLachlan CS, Mishra SR, et al. Effectiveness of a lifestyle intervention led by female community health volunteers versus usual care in blood pressure reduction (COBIN): an open-label, cluster-randomised trial. *Lancet Glob Health* 2018; **6**: e66–73.
- 123 Capewell S, Graham H. Will cardiovascular disease prevention widen health inequalities? *PLoS Med* 2010; **7**: e1000320.
- 124 Clark S, Carter E, Shan M, et al. Adoption and use of a semi-gasifier cooking and water heating stove and fuel intervention in the Tibetan Plateau, China. *Environ Res Lett* 2017; **12**: 075004.
- 125 Ezzati M, Baumgartner JC. Household energy and health: where next for research and practice? *Lancet* 2017; **389**: 130–32.
- 126 WHO. WHO methods and data sources for global burden of disease estimates 2000–2015. Global Health Estimates. Geneva: World Health Organization, 2017.
- 127 Center for Evaluation of Value and Risk in Health. Global Health Cost Effectiveness Analysis Registry. Boston, MA: CEVR, Tufts Medical Center, 2019.
- 128 Stenberg K, Hanssen O, Edejer TT-T, et al. Financing transformative health systems towards achievement of the health Sustainable Development Goals: a model for projected resource needs in 67 low-income and middle-income countries. *Lancet* 2017; **5**: E875–87.
- 129 Shrestha B. Nepal's noble echocardiography-database with video clips and color still images: a single individual's 6 years' experience at the Echocardiography Lab of Nepal Medical College, Teaching Hospital. *Nepal Med Coll J* 2012; **14**: 180–86.
- 130 Shrestha NR, Karki P, Mahto R, et al. Prevalence of subclinical rheumatic heart disease in eastern Nepal: a school-based cross-sectional study. *JAMA Cardiol* 2016; **1**: 89–96.
- 131 Limbu Y, Maskey A, Bahadur KC M, Malla R, Sharma D, Shrestha NK. A study on cardiovascular disease pattern of admitted cases in newly emerged national heart centre. *JNMA J Nepal Med Assoc* 2001; **41**: 284–88.
- 132 Pezzella AT. Global aspects of cardiothoracic surgery with focus on developing countries. *Asian Cardiovasc Thorac Ann* 2010; **18**: 299–310.
- 133 Manmohan Cardiothoracic, Vascular and Transplant Centre. Cardiothoracic & Vascular Surgery (CTVS). <https://www.mcvtc.org.np/department/cardiothoracic-vascular-surgery-ctvs-> (accessed Jan 18, 2020).
- 134 Shahid Gangal National Heart Centre. Annual report 2015. <https://www.sgnhc.org.np/files/1562479093Annual-Report-2015.pdf> (accessed Aug 15, 2020).
- 135 Moore A. Tracking down Martin Luther King, Jr.'s words on health care. 2013. [https://www.huffingtonpost.com/amanda-moore/martin-luther-king-health-care\\_b\\_2506393.html](https://www.huffingtonpost.com/amanda-moore/martin-luther-king-health-care_b_2506393.html) (accessed Aug 25, 2017).
- 136 Watkins D, Zuhlke L, Engel M, et al. Seven key actions to eradicate rheumatic heart disease in Africa: the Addis Ababa communiqué. *Cardiovasc J Afr* 2016; **27**: 184–7.
- 137 Bukhman G, Bavuma C, Gishoma C, et al. Endemic diabetes in the world's poorest people. *Lancet Diabetes Endocrinol* 2015; **3**: 402–03.
- 138 Zheleva B, Atwood JB. The invisible child: childhood heart disease in global health. *Lancet* 2017; **389**: 16–18.
- 139 Mehta RL, Cerdá J, Burdmann EA, et al. International Society of Nephrology's Oby25 initiative for acute kidney injury (zero preventable deaths by 2025): a human rights case for nephrology. *Lancet* 2015; **385**: 2616–43.
- 140 Meara JG, Leather AJM, Hagander L, et al. Global Surgery 2030: evidence and solutions for achieving health, welfare, and economic development. *Lancet* 2015; **386**: 569–624.
- 141 Patel V. Universal health coverage for schizophrenia: a global mental health priority. *Schizophr Bull* 2016; **42**: 885–90.
- 142 Farmer P, Frenk J, Knaul FM, et al. Expansion of cancer care and control in countries of low and middle income: a call to action. *Lancet* 2010; **376**: 1186–93.
- 143 Ginsburg O, Bray F, Coleman MP, et al. The global burden of women's cancers: a grand challenge in global health. *Lancet* 2017; **389**: 847–60.
- 144 Carlson S, Duber HC, Achan J, et al. Capacity for diagnosis and treatment of heart failure in sub-Saharan Africa. *Heart* 2017; **103**: 1874–79.
- 145 Integrated management of childhood illness: field test of the WHO/UNICEF training course in Arusha, United Republic of Tanzania. WHO Division of Child Health and Development & WHO Regional Office for Africa. *Bull World Health Organ* 1997; **75**(suppl 1): 55–64.
- 146 WHO. Optimizing health worker roles to improve access to key maternal and newborn health interventions through task shifting. Geneva: World Health Organization, 2012.
- 147 WHO. General principles of good chronic care. Integrated Management of Adolescent and Adult Illness (IMAI). Interim guidelines for first-level facility healthcare workers. Geneva: World Health Organization, 2004.
- 148 WHO. Package of essential noncommunicable (PEN) disease interventions for primary health care in low-resource settings. Geneva: World Health Organization, 2010.
- 149 Atun R, de Jongh T, Secci F, Ohiri K, Adeyi O. Integration of targeted health interventions into health systems: a conceptual framework for analysis. *Health Policy Plan* 2010; **25**: 104–11.
- 150 Sepúlveda J, Bustreo F, Tapia R, et al. Improvement of child survival in Mexico: the diagonal approach. *Lancet* 2006; **368**: 2017–27.
- 151 Patel V, Saxena S, Lund C, et al. The Lancet Commission on global mental health and sustainable development. *Lancet* 2018; **392**: 1553–98.
- 152 Diez-Canseco F, Toyama M, Ipince A, et al. Integration of a technology-based mental health screening program into routine practices of primary health care services in Peru (The Allillanchu Project): development and implementation. *J Med Internet Res* 2018; **20**: e100.
- 153 Diez-Canseco F, Ipince A, Toyama M, et al. Integration of mental health and chronic non-communicable diseases in Peru: challenges and opportunities for primary care settings. *Rev Peru Med Exp Salud Publica* 2014; **31**: 131–36.
- 154 Shulman LN, Mpunga T, Tapela N, Wagner CM, Fadelu T, Binagwaho A. Bringing cancer care to the poor: experiences from Rwanda. *Nat Rev Cancer* 2014; **14**: 815–21.
- 155 Calland JF, Holland MC, Mwirerwa O, et al. Burn management in sub-Saharan Africa: opportunities for implementation of dedicated training and development of specialty centers. *Burns* 2013; **40**: 157–63.
- 156 Atun R, Jaffray DA, Barton MB, et al. Expanding global access to radiotherapy. *Lancet Oncol* 2015; **16**: 1153–86.
- 157 Hewitson J, Brink J, Zilla P. The challenge of pediatric cardiac services in the developing world. *Semin Thorac Cardiovasc Surg* 2002; **14**: 340–45.
- 158 Binagwaho A, Kyamanywa P, Farmer PE, et al. The human resources for health program in Rwanda—new partnership. *N Engl J Med* 2013; **369**: 2054–59.
- 159 Virginia Noormahomed E, Carrilho C, Ismail M, et al. The Medical Education Partnership Initiative (MEPI), a collaborative paradigm for institutional and human resources capacity building between high- and low- and middle-income countries: the Mozambique experience. *Glob Health Action* 2017; **10**: 1272879.
- 160 Rajbhandari R, McMahan DE, Rhatigan JJ, Farmer PE. The neglected hospital—the district hospital's central role in global health care delivery. *N Engl J Med* 2020; **382**: 397–400.
- 161 WHO Western Pacific Regional Office. Regional workshop on planning and design of district hospitals in support of primary health care, Seoul and Kyungju, Republic of Korea, 24 August–1 September 1988. Manila, Philippines: World Health Organization Regional Office for the Western Pacific, 1988.
- 162 Van Berberghe W, Lafort Y. The role of the hospital in the district. Delivering or supporting primary health care. Geneva: World Health Organization, Division of Strengthening of Health Services, 1990.
- 163 WHO. The hospital in rural and urban districts: report of a WHO study group on the functions of hospitals at the first referral level. Geneva: World Health Organization, 1992.
- 164 WHO. Hospitals and health for all: report of a WHO Expert Committee on the role of hospitals at the first referral level. Geneva: World Health Organization, 1987.

- 165 Ouma PO, Maina J, Thuramira PN, et al. Access to emergency hospital care provided by the public sector in sub-Saharan Africa in 2015: a geocoded inventory and spatial analysis. *Lancet Glob Health* 2018; **6**: e342–50.
- 166 WHO Regional Office for Africa. WHO PEN and integrated outpatient care for severe, chronic NCDs at first referral hospitals in the African region (PEN-Plus): report on regional consultation. Brazzaville, Congo: World Health Organization, Regional Office for Africa, 2020.
- 167 Eberly LA, Rusangwa C, Ng'ang'a L, et al. Cost of integrated chronic care for severe non-communicable diseases at district hospitals in rural Rwanda. *BMJ Glob Health* 2019; **4**: e001449.
- 168 Bukhman G, Kidder A, eds. The Partners. Health Guide to Chronic Care Integration for Endemic Non-Communicable Diseases. Rwanda Edition. Cardiac, Renal, Diabetes, Pulmonary, and Palliative Care. Boston: Partners In Health, 2011.
- 169 WHO. Global health expenditure database. 2018. <https://apps.who.int/nha/database> (accessed Aug 28, 2020).
- 170 Addis Ababa Action Agenda. New York: United Nations, 2015.
- 171 WHO. WHO guideline on health policy and system support to optimize community health worker programmes. Geneva: World Health Organization, 2018.
- 172 Jain Y, Jain P. Communitisation of healthcare: peer support groups for chronic disease care in rural India. *BMJ* 2018; **360**: k85.
- 173 Patterson V, Samant S, Singh MB, Jain P, Agavane V, Jain Y. Diagnosis of epileptic seizures by community health workers using a mobile app: a comparison with physicians and a neurologist. *Seizure* 2018; **55**: 4–8.
- 174 Ojo TT, Hawley NL, Desai MM, Akiteng AR, Guwatudde D, Schwartz JI. Exploring knowledge and attitudes toward non-communicable diseases among village health teams in Eastern Uganda: a cross-sectional study. *BMC Public Health* 2017; **17**: 947.
- 175 De Neve J-W, Garrison-Desany H, Andrews KG, et al. Harmonization of community health worker programs for HIV: a four-country qualitative study in Southern Africa. *PLoS Med* 2017; **14**: e1002374.
- 176 Mishra SR, Neupane D, Preen D, Kallestrup P, Perry HB. Mitigation of non-communicable diseases in developing countries with community health workers. *Glob Health* 2015; **11**: 43.
- 177 Condo J, Mugeni C, Naughton B, et al. Rwanda's evolving community health worker system: a qualitative assessment of client and provider perspectives. *Hum Resour Health* 2014; **12**: 71.
- 178 Franke MF, Kaigamba F, Socci AR, et al. improved retention associated with community-based accompaniment for antiretroviral therapy delivery in rural Rwanda. *Clin Infect Dis* 2013; **56**: 1319–26.
- 179 Federal Democratic Republic of Ethiopia Ministry of Health, The Open University: Health Education and Training Africa. Non-communicable diseases, emergency care and mental health. Part 2: mental health problems. Blended learning module for the health extension programme. Addis Ababa: Ethiopia Ministry of Health, 2011.
- 180 Federal Democratic Republic of Ethiopia Ministry of Health, The Open University: Health Education and Training Africa. Non-communicable diseases, emergency care and mental health. Part 1: chronic diseases and emergencies. Blended learning module for the health extension programme. Addis Ababa: Ethiopia Ministry of Health, 2010.
- 181 Ntizimira C. Rolling out Rwanda's national palliative care programme. *Bull World Health Organ* 2018; **96**: 736–37.
- 182 Mukasahaha D, Uwinkindi F, Grant L, et al. Home-based care practitioners: a strategy for continuum of care for very ill patient. *J Glob Oncol* 2018; **4** (suppl 2): 4.
- 183 Watkins DA, Norheim OF, Jha P, Jamison DT. Reducing mortality within Universal Health Coverage: the DCP3 model. 2017. [https://dcp-3.org/sites/default/files/resources/21.%20UHC%20Impact%20Working%20Paper\\_Watkins%20\\_final%2013%20Nov.pdf](https://dcp-3.org/sites/default/files/resources/21.%20UHC%20Impact%20Working%20Paper_Watkins%20_final%2013%20Nov.pdf) (accessed March 17, 2019).
- 184 Bertram MY, Sweeny K, Lauer JA, et al. Investing in non-communicable diseases: an estimation of the return on investment for prevention and treatment services. *Lancet* 2018; **391**: 2071–78.
- 185 Kontis V, Mathers CD, Bonita R, et al. Regional contributions of six preventable risk factors to achieving the 25×25 non-communicable disease mortality reduction target: a modelling study. *Lancet Glob Health* 2015; **3**: e746–57.
- 186 Kontis V, Mathers CD, Rehm J, et al. Contribution of six risk factors to achieving the 25×25 non-communicable disease mortality reduction target: a modelling study. *Lancet* 2014; **384**: P427–37.
- 187 Watkins DA, QI J, Horton SE. Costing universal health coverage: the DCP3 model. Seattle, WA; University of Washington, 2017.
- 188 OECD, Eurostat, WHO. A system of health accounts 2011: revised edition. Paris: OECD Publishing, 2017.
- 189 OECD. Glossary of statistical terms: system of national accounts (SNA). 2003. <https://stats.oecd.org/glossary/detail.asp?ID=2640> (accessed Dec 18, 2018).
- 190 Gupta I, Ranjan A. Public expenditure on noncommunicable diseases and injuries in India: a budget-based analysis. Delhi, India: Institute for Economic Growth, 2017.
- 191 The Ethiopia Sixth Health Accounts. 2013/14: statistical report. Addis Ababa: Federal Democratic Republic of Ethiopia Ministry of Health, 2017.
- 192 Dieleman JL, Schneider MT, Haakenstad A, et al. Development assistance for health: past trends, associations, and the future of international financial flows for health. *Lancet* 2016; **387**: 2536–44.
- 193 Jan S, Laba T-L, Essue BM, et al. Action to address the household economic burden of non-communicable diseases. *Lancet* 2018; **391**: 2047–58.
- 194 Nugent R, Bertram MY, Jan S, et al. Investing in non-communicable disease prevention and management to advance the Sustainable Development Goals. *Lancet* 2018; **391**: 2029–35.
- 195 Organisation for Economic Co-operation and Development. Accra agenda for action. Paris: OECD Publishing, 2008.
- 196 Organisation for Economic Co-operation and Development. Rome declaration on harmonization. Paris: OECD Publishing, 2003.
- 197 Organisation for Economic Co-operation and Development. Paris declaration on aid effectiveness. Paris: OECD Publishing, 2005.
- 198 Haakenstad A, Coates M, Marx A, Bukhman G, Verguet S. Disaggregating catastrophic health expenditure by disease area: cross-country estimates based on the World Health Surveys. *BMC Med* 2019; **17**: 36.
- 199 Adam W, Flores G, Hsu J, et al. Progress on catastrophic health spending in 133 countries: a retrospective observational study. *Lancet Glob Health* 2018; **6**: e169–79.
- 200 Gupta I, Chowdhury S, Prinja S, Trivedi M. Out-of-pocket spending on out-patient care in India: assessment and options based on results from a district level survey. *PLoS One* 2016; **11**: e0166775.
- 201 Tolla MT, Norheim OF, Verguet S, et al. Out-of-pocket expenditures for prevention and treatment of cardiovascular disease in general and specialised cardiac hospitals in Addis Ababa, Ethiopia: a cross-sectional cohort study. *BMJ Glob Health* 2017; **2**: e000280.
- 202 Verguet S, Memirie ST, Norheim OF. Assessing the burden of medical impoverishment by cause: a systematic breakdown by disease in Ethiopia. *BMC Med* 2016; **14**: 164.
- 203 Verguet S, Olson ZD, Babigumira JB, et al. Health gains and financial risk protection afforded by public financing of selected interventions in Ethiopia: an extended cost-effectiveness analysis. *Lancet Glob Health* 2015; **3**: e288–96.
- 204 Mwai D, Muriithi MM. Catastrophic health expenditure and household impoverishment: a case of NCDs prevalence in Kenya. *Epidemiol Biostat Public Health* 2016; **13**: 1–7.
- 205 The Nepal NCDI Poverty Commission. An equity initiative to address noncommunicable diseases and injuries. National Report–2018. Kathmandu, Nepal: Nepal NCDI Poverty Commission, 2018.
- 206 Adhikari SR. Effect of payments for disease specific care on poverty estimates in Nepal. *Econ J Devel Iss* 2018; **23**, **24**: 18–34.
- 207 WHO. Health systems financing: the path to universal coverage. Geneva: World Health Organization, 2010.
- 208 Feinmann J. Heartfile: using technology to get healthcare funding to poor patients in Pakistan. *BMJ* 2012; **345**: e5156.
- 209 Dieleman J. Financing global health 2016. Seattle, WA: Institute for Health Metrics and Evaluation, 2017.
- 210 Manuel M, Desai H, Samman E, Evans M. Financing the end of extreme poverty. London, UK: Overseas Development Institute, 2018.

- 211 Leimbach M, Kriegler E, Roming N, Schwanitz J. Future growth patterns of world regions – A GDP scenario approach. *Glob Environ Change* 2017; **42**: 215–25.
- 212 Abuja Declaration on HIV/AIDS, Tuberculosis and other Related Infectious Diseases. Abuja, Nigeria 24–27 April 2001. Abuja, Nigeria: Organization of African Unity, 2001.
- 213 Shiffman J, Smith S. Generation of political priority for global health initiatives: a framework and case study of maternal mortality. *Lancet* 2007; **370**: 1370–79.
- 214 Geneau R, Stuckler D, Stachenko S, et al. Raising the priority of preventing chronic diseases: a political process. *Lancet* 2010; **376**: 1689–98.
- 215 Summers LH. Economists' declaration on universal health coverage. *Lancet* 2015; **386**: 2112–13.
- 216 Beaglehole R, Bonita R. Economists, universal health coverage, and non-communicable diseases. *Lancet* 2016; **387**: 848.
- 217 Bloomberg Philanthropies. Annual report May 2018. <https://assets.bbhub.io/dotorg/sites/2/2018/05/Bloomberg-Philanthropies-Annual-Report-2018.pdf> (accessed Aug 28, 2020).
- 218 Frieden TR, Bloomberg MR. Saving an additional 100 million lives. *Lancet* 2017; **391**: 709–12.
- 219 Organisation for Economic Co-operation and Development. Busan partnership for effective development co-operation: fourth high level forum on aid effectiveness, Busan, Republic of Korea. Paris: OECD Publishing, 2011.
- 220 WHO. Noncommunicable diseases country profiles 2018. Geneva: World Health Organization; 2018.
- 221 United Nations General Assembly. Political declaration of the High-level Meeting of the General Assembly on the Prevention and Control of Non-Communicable Diseases. New York, USA: United Nations, 2011.
- 222 Progress on the prevention and control of non-communicable diseases. Report of the Secretary-General. A/72/662. New York: United Nations, 2017.
- 223 WHO. Poverty reduction strategy papers: their significance for health. Geneva: World Health Organization, 2004.
- 224 Bartlett S. Poverty Reduction Strategy Papers and their contribution to health: An Analysis of Three Countries. *McGill J Med* 2011; **13**: 22.
- 225 The Lancet NCDI Poverty Commission. Knowledge exchanges. <https://www.ncdipoverty.org/knowledge-exchanges> (accessed Dec 18, 2019).
- 226 Ethiopia NCDI Commission. Addressing the impact of noncommunicable diseases and injuries in Ethiopia: findings and recommendations from the noncommunicable diseases and injuries (NCDI) commission of Ethiopia. [https://static1.squarespace.com/static/55d4de6de4b011a1673a40a6/t/5bfc17e24fa51a471a8399d9/1543247843790/Ethiopia+NCDI+Commission\\_Full+Report\\_Nov+2018.pdf](https://static1.squarespace.com/static/55d4de6de4b011a1673a40a6/t/5bfc17e24fa51a471a8399d9/1543247843790/Ethiopia+NCDI+Commission_Full+Report_Nov+2018.pdf) (accessed Dec 18, 2019).
- 227 Jamison DT. Disease Control Priorities, 3rd edition: improving health and reducing poverty. *Lancet* 2015; **391**: e11–14.
- 228 Strand KB, Chisholm D, Fekadu A, Johansson KA. Scaling-up essential neuropsychiatric services in Ethiopia: a cost-effectiveness analysis. *Health Policy Plan* 2016; **31**: 504–13.
- 229 Tolla MT, Norheim OF, Memirie ST, et al. Prevention and treatment of cardiovascular disease in Ethiopia: a cost-effectiveness analysis. *Cost Effectiveness and Resource Allocation* 2016; **14**: 1–14.
- 230 The Lancet NCDI Poverty Commission. The Nepal NCDI Poverty Commission report. <http://www.ncdipoverty.org/nepal-report> (accessed Dec 18, 2019).
- 231 Mcintyre D, Meheus F, Rottingen JA. What level of domestic government health expenditure should we aspire to for universal health coverage? *Health Econ Policy Law* 2017; **12**: 125–37.
- 232 Storm F, Agampodi S, Eddleston M, Sørensen JB, Konradsen F, Rheinländer T. Indirect causes of maternal death. *Lancet Glob Health* 2014; **2**: e566.
- 233 Murray CJL. Choosing indicators for the health-related SDG targets. *Lancet* 2015; **386**: 1314–17.
- 234 The Kingdom of Cambodia Health System Review. Geneva: World Health Organization, Asia Pacific Observatory on Health Systems and Policies, 2015.
- 235 UN. Metadata for tracer indicators used to measure the coverage of essential health services for monitoring SDG indicator 3.8.1. New York, NY: United Nations, 2017.
- 236 Chakraborty NM, Fry K, Behl R, Longfield K. Simplified asset indices to measure wealth and equity in health programs: a reliability and validity analysis using survey data from 16 countries. *Glob Health Sci Pract* 2016; **4**: 141–54.
- 237 Weisz G. Chronic disease in the twentieth century: a history. Baltimore, Maryland: Johns Hopkins University Press, 2014.
- 238 Inchauste G, Lustig N, eds. The distributional impact of taxes and transfers evidence from eight low- and middle-income countries. Washington, DC: World Bank, 2017.
- 239 Mitra S. Disability and social safety nets in developing countries. Washington, DC: World Bank Institute, 2005.
- 240 Global Disability Action Plan WHO. 2014–2021. Better health for all people with disability. Geneva: World Health Organization, 2015.
- 241 Jamison DT, Summers LH, Alleyne G, et al. Global health 2035: a world converging within a generation. *Lancet* 2013; **382**: 1898–955.
- 242 Jamison DT, Alwan A, Mock CN, et al. Universal health coverage and intersectoral action for health: key messages from Disease Control Priorities, 3rd edn. *Lancet* 2017; **391**: 1108–20.
- 243 Watkins DA, Yamey G, Schäferhoff M, et al. Alma-Ata at 40 years: reflections from the Lancet Commission on Investing in Health. *Lancet* 2018; **392**: 1434–60.
- 244 Skirbekk V, Ottersen T, Hamavid H, Sadat N, Dieleman JL. Vast majority of development assistance for health funds target those below age sixty. *Health Aff (Millwood)* 2017; **36**: 926–30.
- 245 United Nations General Assembly. 74/2 political declaration of the high-level meeting on universal health coverage. 2019. <https://undocs.org/en/A/RES/74/2> (accessed Aug 27, 2020).
- 246 Yazbeck AS, Soucat A. When both markets and governments fail health. *Health Syst Reform* 2019; **5**: 268–79.

© 2020 Elsevier Ltd. All rights reserved.