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Priority Setting for NCD Control and Health System Investments

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INTRODUCTION

As underscored in several background papers developed for the HLI Commission, noncommunicable diseases (NCDs) represent a major and growing threat to the health of the world's aging populations. Unfavorable trends in risk factors like smoking, alcohol use, unhealthy diet, and low physical activity, when combined with accelerations in population growth and aging, paint a picture of a future world dominated by a greater number of NCD cases and deaths in nearly all countries (Foreman et al. 2018; Watkins et al. 2018). Yet many NCD deaths are amenable to simple and relatively inexpensive interventions, such as provision of basic medical care for acute heart attacks, or they are largely preventable, for example through tobacco control policies (Prabhakaran et al. 2018).

Ever since the first UN High-Level Meeting in 2011, the global NCD agenda has faltered and has suffered from insufficient national and international resources (Nishtar et al. 2018). Only a handful of countries are on track to achieve the Sustainable Development Goal (SDG) target 3.4, which calls for a one-third reduction in premature mortality from NCDs between 2015 and 2030 (NCD Countdown Collaborators 2020). The COVID-19 pandemic made matters much worse by causing major disruptions to health systems. In the aftermath of the pandemic, the medium-term fiscal and macroeconomic outlook remains uncertain for many low-income countries (LICs) and middle-income countries (MICs) because of tepid growth rates and large government debts made worse by inflationary pressures (IMF 2022).

The challenge for ministries of health that want to act on NCDs will be to find ways of doing more with the same (or potentially fewer) resources. This is fundamentally a challenge to achieve greater efficiency in health systems. This chapter seeks to provide guidance on the sort of NCD interventions that could generate high returns for the money spent, thereby improving spending efficiency over the long run. These interventions could be considered top priorities for health benefits packages and universal health coverage systems. We argue that any new health sector resources available for NCDs should be spent on these interventions rather than on ones that are politically popular (e.g., chronic hemodialysis) or establish new markets for industry (e.g., novel on-patent chemotherapy agents) but do not generate much health per dollar spent.

We acknowledge that each health system is unique and that countries with different resource levels and disease contexts will have different priorities. The primary objective of this chapter is to present a framework for setting priorities around NCD interventions and demonstrate how it could be used to pare down a list of candidate interventions to a manageable set that fits within a given health budget.

IDENTIFYING CANDIDATE NCD INTERVENTIONS

This chapter builds heavily on previous projects the authors have led. The list of interventions presented here (see Table 15.1 below) is modified from recommendations that came from the Disease Control Priorities Project, specifically, the 3rd edition (DCP3), published between 2015 and 2018 (Jamison et al. 2018). The methods we use for modeling intervention cost and impact are adapted from a report we prepared for the NCD Countdown 2030 Collaborators that provided guidance to countries on how to get back on track to achieve the SDG 3.4 target (NCD Countdown Collaborators 2022). However, this chapter takes a broader view of NCDs than the Countdown report and considers any DCP3 intervention that can reduce NCD mortality, broadly defined, including surgical care and mental healthcare. The annex to this chapter provides an overview of methods.

From a cost and volume-of-care standpoint, these interventions represent a significant proportion of what health systems do for NCDs. For example, cardiovascular disease (CVD) primary prevention, diabetes management, and mental healthcare together address the plurality of primary care need for chronic disease in most countries (except for those heavily affected by HIV/AIDS). Still, most countries are nowhere near full implementation of these interventions. For example, fewer than half of persons with hypertension worldwide are on treatment, and in LICs like Mozambique the percentage is closer to 15 percent (NCD Risk Factor Collaboration 2021).

TABLE 15.1 Interventions considered in this chapter

Intervention cluster	Specific interventions
Interventions outside the health sector (risk factor reduction)	Tobacco excise taxes
	Alcohol excise taxes
	Smoking regulations and information/education/communication
	Alcohol regulations
	Sodium regulations and information/education/communication
	Trans fat bans
Outpatient cardiometabolic and respiratory disease care	Diabetes screening/treatment
	Cardiovascular disease primary prevention
	Aspirin for suspected acute coronary syndromes
	Cardiovascular disease secondary prevention
	Heart failure chronic treatment
	Chronic pulmonary disease treatment
Outpatient mental, neurological, and substance use disorder care	Injection drug use harm reduction measures
	Alcohol use screening/brief intervention
	Depression chronic treatment
	Bipolar disorder chronic treatment
	Schizophrenia chronic treatment
	Epilepsy acute and chronic treatment
First-level hospital cardiometabolic and respiratory disease care	Medical management of acute coronary syndromes
	Heart failure acute treatment
	Treatment of acute exacerbations of chronic pulmonary disease
First-level hospital surgical care	Screening and treatment of early-stage cervical cancer
	Management of bowel obstruction
	Management of appendicitis
	Repair of hernias
	Repair of gastrointestinal perforations
Referral hospital services	Percutaneous coronary intervention for acute coronary syndromes
	Advanced care for severe acute-on-chronic pulmonary disease
	Treatment of early-stage breast cancer
	Treatment of early-stage colorectal cancer

We first looked at the cost and impact of scaling up all the interventions in Table 15.1 to achieve 80 percent population coverage in all countries by 2050 or sooner. The gap in coverage and thus the "incremental cost" as a share of the current health budget would be modest for high-performing upper-MICs but very large for LICs with weak health systems. Table 15.2 presents our findings. Overall, fully implementing the package of interventions could avert up to 180 million deaths (or 2.7 billion disability-adjusted life-years [DALYs]) by 2050, at an incremental cost of US$ 5.4 trillion, translating to US$ 20,000 per death averted or US$ 2000 per DALY averted, the latter of which is just over one-third of GDP per capita per DALY averted for these countries.

TABLE 15.2 Cost and impact of all NCD interventions by 2050, by world region

Country income group	Deaths averted through 2050 (millions)	DALYs averted through 2050 (millions)	Incre-mental cost through 2050 (USD billions)	Total cost in 2050 (USD billions)	Projected public spending on health in 2050 (USD billions)	Total cost per capita 2050 (USD)	Total cost vs. projected public spending on health in 2050
LICs	12	240	140	17	28	14	59%
Lower-MICs	100	1600	1700	200	720	45	27%
Upper-MICs	70	860	3600	490	2500	190	20%
All LICS and MICs	180	2700	5400	710	3300	87	22%

Notes: DALYs = disability-adjusted life-years. Estimates are for a linear scale-up by 2 percent per year to a target of 80 percent coverage by the year 2050. (Not all countries would achieve 80 percent coverage if current coverage is very low.) Incremental costs and health gains are the difference between the status quo, in which coverage is assumed to remain constant, and this scale-up scenario. "Public spending on health" is from National Health Accounts data (general government expenditure on health from domestic sources). The total cost is the sum of the incremental cost and the cost of maintaining the status quo. Numbers may not add up due to rounding.

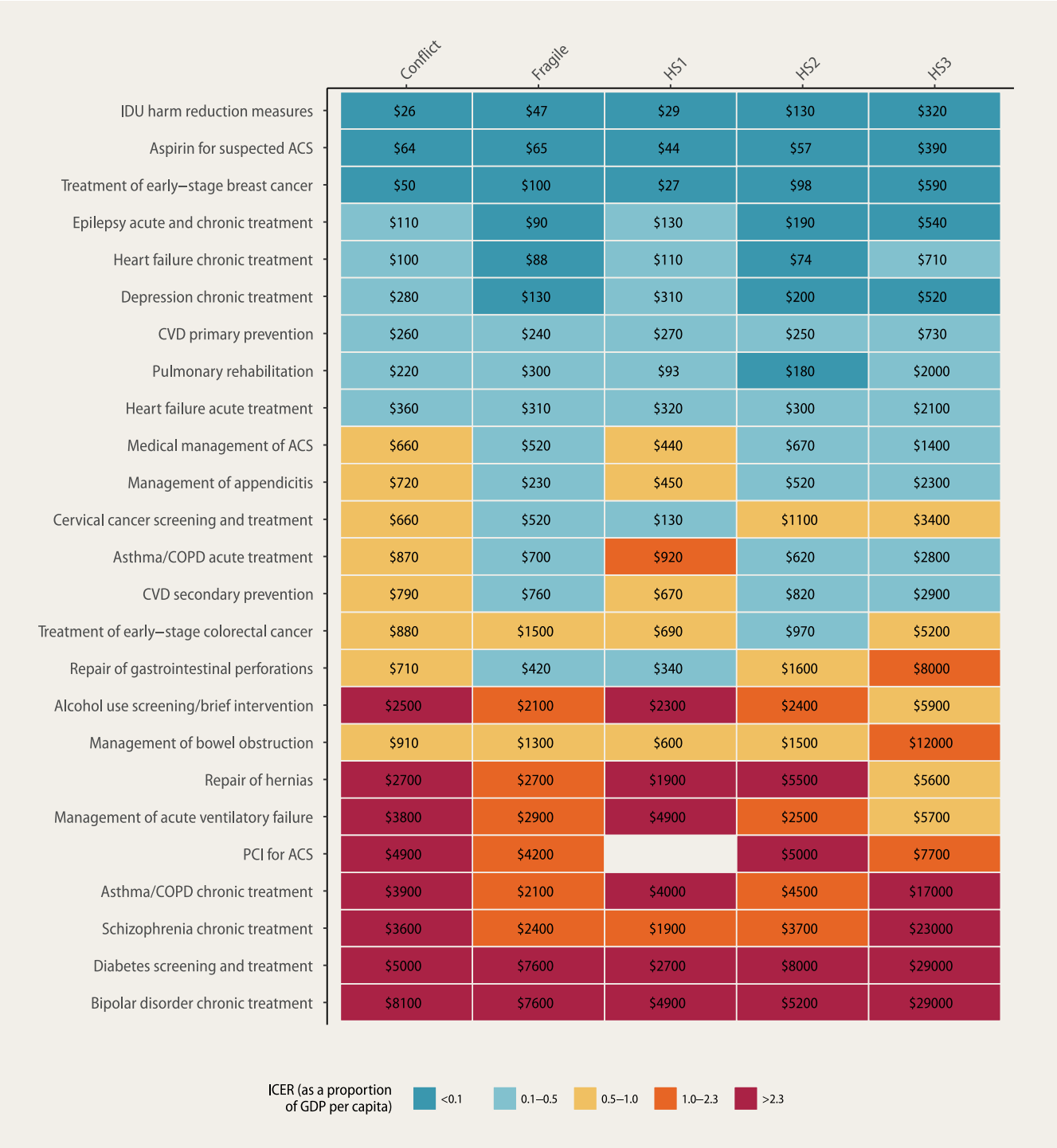
While the package overall would be very cost-effective, the budgetary consequences would be considerable. The final column in Table 15.2 shows the total cost for the year 2050 as a share of projected public-sector spending on health in 2050. This share would range from 20 percent in upper-MICs to 59 percent in LICs. The reason for this discrepancy is that most LICs and lower-MICs are under-spending on health, so without political action to allocate additional resources to the health sector, i.e., above and beyond the spending increases that would result purely from economic growth, these countries would struggle to afford the entire package of interventions. (We stress that our cost estimates assume the interventions are all provided to everyone and at no cost at the point of care, which is in keeping with the progressive universalist approach to health benefits package design but is far from reality in many countries that provide larger benefits packages to smaller segments of the population or with considerable out-of-pocket costs.)

A FRAMEWORK FOR PRIORITIZING NCD INTERVENTIONS

In our view, priority setting starts with an assessment of cost-effectiveness. We first looked at the cost-effectiveness of all the clinical interventions in Table 15.1, grouping LICs and MICs according to WHO's health system typology (Stenberg et al. 2017) to acknowledge differences in implementation capacity. Figure 15.1 summarizes our findings; the analytical methods are detailed elsewhere (NCD Countdown Collaborators 2022) and summarized in Annex 15.1 on methods.

Figure 15.1 shows that there is considerable variation in intervention cost-effectiveness by health system type—which is correlated with epidemiological, demographic, and economic differences—underscoring the importance of local analysis rather than reliance on international literature for cost-effectiveness assessments. About half of the interventions would be very cost-effective (blue tones) in nearly all settings. Some of the surgical and mental health interventions (e.g., emergent hernia repair, chronic schizophrenia treatment) would be on the borderline of cost-effective in most settings, whereas others (e.g., appendicitis management, chronic depression treatment) would be very cost-effective. Diabetes care would be the only intervention that would not be cost-effective in any setting. However, diabetes is a special case, because most of the health benefits of caring for people with diabetes are from CVD prevention (which is captured in the "CVD primary prevention" and "CVD secondary prevention" interventions) rather than glycemic control, which is the focus of this intervention. Implementing comprehensive diabetes care that includes glycemic control and CVD prevention would be cost-effective, though more costly than doing CVD prevention alone.

FIGURE 15.1 **Cost per DALY averted for 24 clinical interventions, by health system type**



Notes: ACS = acute coronary syndrome; IDU = injection drug use; CVD = cardiovascular disease; COPD = chronic obstructive pulmonary disease; PCI = percutaneous coronary intervention; ICER = incremental cost-effectiveness ratio; GDP = gross domestic product. The five health system types (x axis) are based on a typology used by WHO,[10] where "conflict" and fragile" include nations in active conflict or who are post-conflict or otherwise at risk of collapse (respectively); "HS1" includes stable countries with low resources, whereas "HS2" and "HS3" include stable countries with medium and high resources, respectively. The thresholds used for cost-effectiveness in the key are based on our review of different proposed cost-effectiveness thresholds in the literature, summarized elsewhere.[8] Use of these thresholds here does not imply our endorsement of them.

Table 15.1 also includes several interventions "outside the health sector" that produce health. In our view, cost-effectiveness analysis is an incorrect approach to assessing the efficiency of these interventions. In a related analysis we did for the Copenhagen Consensus Center, we did benefit-cost analyses of these interventions using standard methods for valuing health gains in economic terms and including the costs and benefits of the interventions outside the health sector (Watkins, Ahmed, and Pickersgill 2023). Table 15.3 below presents benefit-cost ratios for these policies, again aggregated by health system type for comparison purposes.

As the Table demonstrates, all these interventions are incredibly cost-beneficial, with tobacco control providing the most impressive returns. In fact, the benefit-cost ratios for tobacco are much higher than most cross-sectional analyses would suggest (Jha et al. 2012), because the benefits of cessation (and prevention of initiation) accumulate over decades (Jha et al. 2013). Because all these interventions are very cost-beneficial and inexpensive for governments to implement, we include them by default in our stylized, locally-tailored, high-priority packages (below).

Beyond cost-effectiveness, we consider three other criteria for identifying high-priority health sector interventions for NCDs: equity, financial risk protection, and implementation feasibility. Equity and financial risk protection have been endorsed by WHO (along with cost-effectiveness) as core criteria for designing health benefits packages (Ottersen and Norheim 2014). We view implementation feasibility as a critical criterion for NCDs, because many NCD interventions are complex and place high demands on health systems, and they may require considerable up-front investments or specialist training. Table 15.4 below summarizes our semi-quantitative assessment of each intervention's relative performance on these three criteria. The construction of the equity and financial risk protection indicators is summarized in DCP3 volume 9, chapter 3 (Watkins et al. 2017). The construction of the implementation feasibility indicator is summarized in the aforementioned NCD Countdown report (appendix, pp. 13-15, NCD Countdown Collaborators 2022).

The assessments above are intended to serve as inputs to country-level (or subnational-level) priority setting processes. Each health ministry will inevitably place different weight on each of these criteria, and most ministries will also consider other criteria alongside these (Eregata et al. 2020). Below we present a stylized approach that synthesizes these criteria in a systematic way and illustrates how they can be used to generate a final, high-priority package for each type of health system.

We start by grouping interventions into three categories based on cost-effectiveness: provisionally high-priority (<0.25x GDP per capita per DALY averted), provisionally medium-priority (0.25-1.0x), and provisionally low priority (>1.0x). The provisionally high-priority category is based on the most stringent cost-effectiveness threshold proposed in the literature (Ochalek, Lomas, and Claxton 2015). Interventions in this group would, along with the six intersectoral interventions (Table 15.3), be the starting point for most countries' high-priority packages.

Yet other interventions might merit inclusion in a high-priority package on other grounds. For example, interventions in the provisionally medium-priority group that are attractive in terms of their equity or financial protection characteristics

TABLE 15.3 Value for money among interventions outside the health sector

Intervention	Conflict	Fragile	HS1	HS2	HS3
Tobacco excise taxes	290	310	170	310	320
Tobacco regulations and IEC	250	270	97	270	300
Alcohol regulations	150	250	110	200	270
Alcohol excise taxes	110	190	52	130	210
Sodium regulations and IEC	64	42	NA	53	130
Trans fat bans	32	50	2.6	71	79

Notes: IEC = information, education, and communication. See footnote to Figure 1 for an explanation of the five health system types. The quantities presented in the cells are benefit-cost ratios from a societal perspective, with costs and benefits discounted at 5 percent and a time horizon of 2023-2050 for the analysis. Sodium policies are "N/A" in HS1 because average sodium consumption in these countries is already at WHO-recommended levels (Pickersgill et al. 2022).

(i.e., ++ or +++, per Table 15.4) could be moved to the provisionally high-priority group. On the other hand, interventions in the provisionally high-priority group that are challenging to implement (i.e., +, per Table 15.4) could be moved to the provisionally medium-priority or low-priority group. For illustration purposes, we moved these interventions into the provisionally medium-priority group for countries with weaker health systems (i.e., Conflict, Fragile, and HS1 types) but retained them in the provisionally high-priority group for countries with stronger systems (i.e., HS2 and HS3 types).

TABLE 15.4 Non-cost-effectiveness criteria for prioritizing clinical interventions

Intervention	Equity impact	Financial risk protection	Implementation feasibility
Aspirin for suspected ACS	+	+	+++
Heart failure chronic treatment	+	+++	++
Treatment of early-stage breast cancer	+	++	+
Epilepsy acute and chronic treatment	+++	+	+++
IDU harm reduction measures	++	++	+++
Depression chronic treatment	+	+	+++
CVD primary prevention	+	+	+++
Pulmonary rehabilitation	+	+	++
Heart failure acute treatment	+	++	++
Medical management of ACS	+	++	++
Management of appendicitis	+	+	+++
Asthma/COPD acute treatment	+	++	++
CVD secondary prevention	+	+	++
Cervical cancer screening and treatment	+	+	++
Repair of gastrointestinal perforations	+	+	+++
Treatment of early-stage colorectal cancer	+	++	+
Alcohol use screening/brief intervention	+	+	+++
Management of acute ventilatory failure	+	++	+
Management of bowel obstruction	+++	++	+++
Repair of hernias	+	+	+++
PCI for ACS	+	++	+
Asthma/COPD chronic treatment	+	+	++
Schizophrenia chronic treatment	+	+	+++
Bipolar disorder chronic treatment	+	+	+++
Diabetes screening/treatment	+	+	++

Notes: ACS = acute coronary syndrome; CVD = cardiovascular disease; IDU = injection drug use; COPD = chronic obstructive pulmonary disease; PCI = percutaneous coronary intervention.

Figure 15.2 shows the results of this stylized prioritization exercise. Again, these categorizations are meant to be illustrative rather than prescriptive. As the Figure indicates, such a high-priority package would contain between 15 and 18 interventions for given country and would, include all six intersectoral interventions.

We stress that categorizing interventions as medium- or low-priority does not automatically imply they should be de-implemented in countries. Oftentimes, interventions with these characteristics are already being provided, even in low-income countries, although often at low coverage and considerable out-of-pocket cost. What the high-priori-

ty categorization implies is that any new resources for NCDs (i.e., over and above current spending) should be devoted preferentially to scaling up these interventions to maximal coverage (80 percent or higher) and minimal out-of-pocket cost (20 percent or lower (McIntyre, Meheus, and Rottingen 2017)).

On the other hand, medium-priority interventions could be maintained at their current coverage and out-of-pocket cost levels until sufficient resources become available to scale them up; they might also be allowed to persist in the system if they help achieve longer-term health system objectives (see below). Low-priority interventions are a more heterogeneous category, however. Some might be allowed to persist and financed through cost recovery (Eregata et al. 2020). One example from our analysis would be bipolar disorder treatment. On the other hand, some low-priority interventions should be de-implemented, or not allowed to enter the system until sufficient cost controls are put in place. Many of the novel targeted cancer drugs fall into this category.

Prioritization of interventions also provides a framework for sequencing them over time. In general, intersectoral policies are so effective at prevention and are so inexpensive that they should almost always be rolled out during the earliest possible policy window. In the spirit of Primary Health Care (Watkins et al. 2018), we argue that interventions that are very cost-effective and can be delivered through primary care platforms by non-physician health workers should also be scaled up as early as possible. These two sets of interventions could be the targets of the bulk of national and international resources during the Sustainable Development

FIGURE 15.2 Final prioritization of NCD interventions, by health system type

Note: see footnotes in Figure 1 for acronyms and explanation of health system types. The colors above reflect the authors' summative judgment about the priority level of each intervention based on value for money and, in the case of clinical interventions, equity, financial protection, and implementation feasibility.

Goal period. Less cost-effective outpatient and hospital-based interventions could be phased in more slowly, perhaps with greater emphasis beyond 2030 once the first wave of NCD interventions has been sufficiently implemented.

The exception to this general approach is specialized NCD care. Building specialist capacity takes many years; if a national government wants to have a well-functioning cancer system in 2035, it needs to start building physician subspecialty programs and raising capital for large items like new hospitals, advanced imaging, and pathology services in 2025. Physicians are often the bottleneck to rolling out these programs, as the most specialized ones (e.g., cardiac surgeons) require a decade or more of postgraduate training. What this means for benefit packages and national NCD strategies is that a modest amount of new financial resources for NCDs during a given policy cycle should be set aside for capacity-building and long-term investments, with a focus on building the necessary capacity to deliver medium-priority interventions. Put more simply: even if treatment of breast or colorectal cancer are not high priorities for a country's benefits package now, they eventually will be. Delaying the necessary upfront investments in health workforce could set this country even further back in the future.

The good news is that, compared to the entire list of interventions in Table 15.1, the high-priority packages outlined in Figure 15.2 would still generate meaningful health gains but at lower cost. Table 15.5 presents the same estimates of cost and impact by country income group as in Table 15.2, but only for the high-priority packages. Overall, fully implementing these interventions could avert up to 150 million deaths (or 2.2 billion DALYs) by 2050, at an incremental cost of US$ 1.3 trillion, translating to US$ 5600 per death averted or US$ 620 per DALY averted, the latter of which is just over 10 percent of GDP per capita per DALY averted for this group of countries. The budgetary implications of this package would be more modest, ranging from 6.2 percent of total public-sector health spending in upper-MICs to 20 percent in LICs.

TABLE 15.5 Cost and impact of locally tailored high-priority NCD packages, by world region

Country income group	Deaths averted through 2050 (millions)	DALYs averted through 2050 (millions)	Incre-mental cost through 2050 (USD billions)	Total cost in 2050 (USD billions)	Projected public spending on health in 2050 (USD billions)	Total cost per capita 2050 (USD)	Total cost vs. projected public spending on health in 2050
LICs	8.8	180	51	5.5	28	4.6	20%
Lower-MICs	82	1300	470	57	720	13	7.9%
Upper-MICs	55	650	830	160	2500	61	6.2%
All LICS and MICs	150	2200	1300	220	3300	27	6.7%

Notes: see footnotes from Table 15.2, which are also relevant to this Table.

POLICY IMPLICATIONS

In this chapter, we present a framework for selecting interventions to prevent and treat NCDs in LICs and MICs. We look at 30 recommended interventions, which include 24 personal health services—most of which can be delivered through primary healthcare systems—and six "primordial prevention" interventions outside the health sector. We summarize the evidence around the properties of each intervention in the domains of value for money, equity impact, financial risk protection afforded, and feasibility of implementation. We demonstrate how a balanced use of these criteria could allow countries to accelerate process on NCDs, practically doubling or tripling the rate of intervention scale-up compared to the status quo (see annex) and averting 240-280 million deaths by 2050.

To achieve these health gains, MICs would need to be spending at least 6 to 8 percent of their health budgets, and LICs 20 percent of their budgets, on high-priority interventions by 2050. Table 15.6 provides "benchmark" spending levels on NCD interventions for the years 2030, 2040, and 2050, assuming full implementation of all high-priority and medium-priority interventions (see Figure 15.2) by 2050.

TABLE 15.6 Total cost per capita for priority NCD interventions by year and country income group

	2030		2040		2050	
Country income group	High	High + medium	High	High + medium	High	High + medium
LICs	1.7	2.7	3.0	4.8	4.6	7.3
Lower-MICs	6.2	10	9.8	16	13	22
Upper-MICs	38	61	52	87	61	100
All LICS and MICs	17	28	23	39	27	45

Notes: Costs are total costs, i.e., sum of current spending and incremental costs required to scale up to target coverage. Costs per capita increase over time because coverage increases at a modest 2 percent per year and because of population aging and a continued epidemiological shift towards NCDs. Numbers may not add up due to rounding.

While drugs, consumables, and equipment would comprise the plurality of costs, greater investment in health systems would also be needed. We looked at the additional health workforce and health facilities that would be required to fully implement the high-priority NCD packages (Table 15.7). The most striking finding from this analysis is that an additional 48 million nurses would need to be in the LIC and MIC workforce by 2050. This finding is consistent with the well-documented crisis in the global nursing workforce (Buchan and Catton 2023). An additional 5.8 million physicians and 79,000 health facilities would also be required for full implementation of the package. These findings suggest that, alongside greater required public contributions to universal health coverage schemes to cover the cost of human and physical capital, governments also need to invest in expanded pre-service training for the health workforce, especially in building more schools of nursing.

TABLE 15.7 Workforce and facility requirements for implementing the high-priority NCD package by 2050

Input	Current density (most recent year)	Required increase in density by 2050	Target density in 2050 for full implementation
Nurses	2.6 per 1000	7.3 per 1000	10 per 1000
Physicians	1.3 per 1000	0.88 per 1000	2.2 per 1000
Health facilities	4.9 per 100,000	1.2 per 100,000	6.1 per 100,000

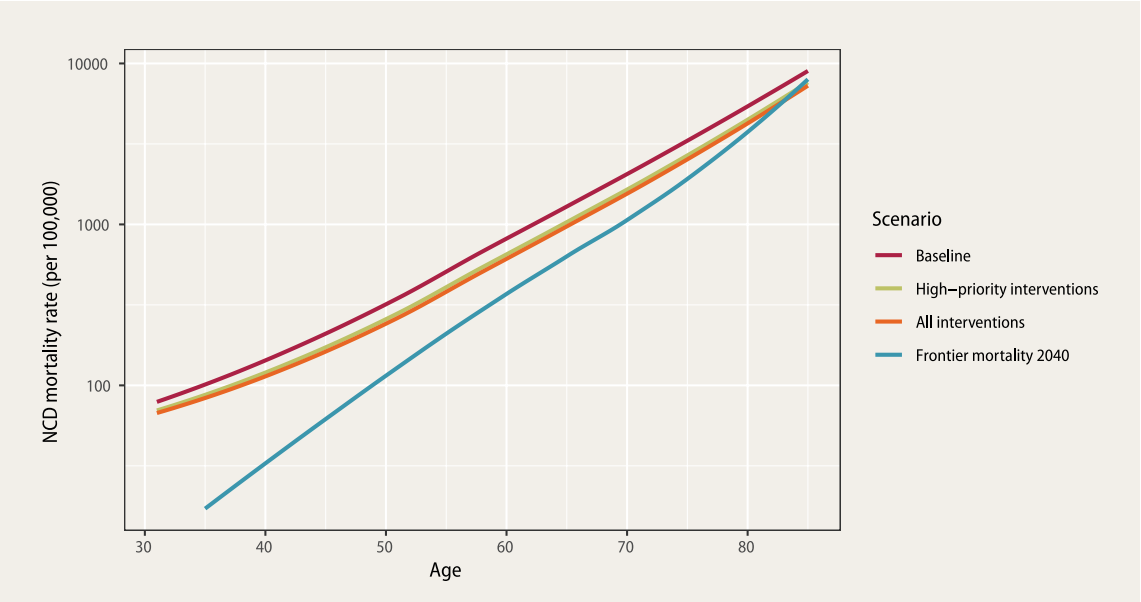
Notes: Most recent density estimates are for the year 2018 for health workforce and 2013 for health facilities, as per the WHO Global Health Observatory. Results are average values across all LICs and MICs. The latter two columns only reflect the increases needed to implement the NCD package; additional increases would be needed to scale up interventions for communicable diseases, injuries, and other health conditions. It is also possible that COVID-19-related burnout and accelerated retirements from nursing and medicine have reduced the density of health workers and larger increases will be required.

Still, these interventions could substantially advance the healthy aging agenda. Figure 15.3 shows how far the intervention packages could get LICs and MICs towards the avoidable NCD mortality frontier (Chang et al. 2024) by the year 2040. (In this analysis, the frontier is defined as the 20th percentile cause-specific mortality rate rather than the lowest observed rate.)

As the figure shows, the full NCD package and the high-priority subset would accelerate movement towards the NCD mortality levels projected for the best-performing countries. Compared to the baseline/status quo scenario, the progress towards the frontier would be 22 percent to 28 percent for individuals in their early 40s, 38 percent to 47 percent for individuals in their early 60s, and 57 percent to 71 percent for individuals in their early 80s. Roughly speaking, across all age groups, the HLI package would get the world about halfway to the mortality rates observed in the best-performing countries.

Still, there is a significant gap between achievable and avoidable mortality. Part of the reason the package has a greater impact at older ages (Figure 15.3) is that a greater share of NCD deaths at older ages are from causes addressed by the HLI package, whereas at younger ages there are other drivers of NCDs (e.g., liver disease from chronic infections, rheumatic heart disease, cancers other than those featured in the HLI package, etc.). Additionally, it is possible that there are other risk factors that are not addressed by

FIGURE 15.3 Contribution of NCD interventions towards avoidable all-cause mortality



the HLI package interventions that are driving NCD deaths in younger ages; for example, diets high in saturated fats and refined carbohydrates and low in fiber have been documented to account for early-onset colorectal cancer (Carroll et al. 2022), which is a rapidly increasing problem in most countries (GBD 2019 Diseases and Injuries Collaborators 2020).

In addition to reducing adult mortality (the focus of this chapter), these interventions could improve nonfatal outcomes by reducing the incidence of disease overall and by reducing the severity of chronic illness, especially for mental and substance use disorders. Still, there are other intervention options for countries seeking to improve nonfatal outcomes, such as post-stroke rehabilitation and custodial care for individuals with dementia. Assessing a broader set of interventions around healthy aging was also outside the scope of this work but will be an important area of emphasis in the upcoming 4th edition of Disease Control Priorities.

Identifying and prioritizing interventions is not enough: countries also need to implement them. This chapter does not cover implementation considerations except tangentially (see Table 15.4), but these issues are discussed in the aforementioned NCD Countdown report (NCD Countdown Collaborators). That report also contains a detailed assessment of the financing landscape for NCDs and provides some general guidance for ministries of health as well as the development assistance community.

The intersectoral interventions, while financially inexpensive to implement, require spending of political capital and anticipatory management of relationships with food, beverage, and tobacco industries that will probably lobby against them. On the other hand, bringing industry to the table can in some cases result in more ambitious policy targets and better implementation. For example, the South African government engaged with industry from the very beginning of its salt reformulation regulations, resulting in mandatory (as compared to voluntary) targets and encouraging preliminary findings on changes in dietary sodium consumption (Charlton et al. 2021). Additionally, doing more on tobacco and alcohol taxes can pave the way for developing a more comprehensive fiscal policy approach to NCDs that includes, for example, introduction of sugar-sweetened beverage taxes and removal of subsidies on high-energy density agricultural commodities. We note that sugar-sweetened beverage taxes appear to be cost-beneficial, but their impact on population health is modest compared to alcohol and tobacco taxes (Watkins et al. 2019).

We acknowledge several important limitations of this work, most of which were reviewed in the NCD Countdown report (NCD Countdown Collaborators). We did not have sufficient data to implement nonlinear cost functions or model economies of scope or scale, so our cost estimates will differ from the real world. We are still uncertain about the effect of the COVID-19 pandemic on NCD incidence and mortality as well as health sys-

tem resources in the medium term. We do not know much about the current coverage level of most of these interventions in many countries, requiring us to employ generic assumptions about the status quo scenario as well as the rate of scale-up required to achieve 80 percent population coverage by 2050. These data gaps hinder our ability to produce precise estimates of incremental costs and health gains.

In summary, we provide a set of recommendations to help countries achieve significant reductions in NCD mortality, helping them to achieve the SDG 3.4 target and post-SDG targets for NCDs. We anticipate that this guidance could help bring a necessary focus and fiscal discipline to national NCD strategies and plans. Additionally, our list of interventions and their associated health system investments could be used as benchmarks for future World Bank lending efforts to support NCD program development in lower-resource countries.

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ANNEX 15.1

METHODS

Intervention selection and aggregation

The starting point of this analysis is a set of interventions recommended in the third edition of the Disease Control Priorities (DCP3) series (Jamison et al. 2018). DCP3 was a set of nine volumes containing 172 chapters that covered all major areas of global health interest. The volumes were published over 2015-2018, with the final volume being a synthesis of the previous eight volumes. DCP3 chapters underwent peer review in a process overseen by the US National Academy of Medicine. Each chapter covered a particular health topic (e.g., tuberculosis, cancer screening, neurological disorders) and synthesized the evidence in a series of recommended interventions that (i) provide good value for money, (ii) are feasible to implement in low- and middle-income countries, and (iii) address a significant cause of death or disability.

These criteria were applied to systematic reviews of economic evaluations of health interventions done in low- and middle-income country settings, supplemented by other information such as clinical and implementation studies and expert judgment. The latter was especially important, because robust cost-effectiveness information is lacking for many services that are being provided, and topical expertise is needed to be able to make sense of the literature. For example, DCP3 did not identify any published studies of the cost-effectiveness of cardiopulmonary resuscitation, but this intervention was recommended because it is an essential part of the emergency healthcare system and is nearly impossible to study using conventional economic evaluation techniques. In other words, DCP3 strove to avoid both "false negatives" and "false positives" (Jamison et al. 2018).

DCP3's final list of recommended interventions was separated into 218 health sector interventions and 71 intersectoral interventions. The entire list of interventions is available in a series of appendices accompanying the DCP3 capstone paper in the Lancet (Jamison et al. 2018). For this analysis, we selected 30 interventions that are proven to reduce mortality from NCDs and can achieve meaningful impacts by 2050. HPV vaccination for adolescent girls, for example, is highly cost-effective but has at least a 30-year lag between administration and attainment of any meaningful health benefits, so it was not included in our analysis, which was focused on the next 25 years. Our analysis looks at both clinical and intersectoral interventions through a benefit-cost lens.

Modeling intervention costs

Our cost estimates build on those done for a previous publication from the Disease Control Priorities Project (Watkins et al. 2020) and the aforementioned NCD Countdown report (NCD Countdown Collaborators 2022). Costs borne by governments in implementing the intersectoral policies were estimated on a per-capita basis, using published costing studies or grey literature (e.g., government budget reports). For the clinical interventions, the focus was on unit costs (e.g., cost per patient-year of chronic treatment, cost per episode for acute care, etc.) to healthcare sector. All interventions were assumed to be publicly financed (i.e., through universal health coverage systems), so out-of-pocket costs currently paid by households would be shifted to governments and accounted for in our estimates.

We primarily sourced unit cost data for the clinical interventions from DCP3's systematic reviews of cost and cost-effectiveness studies (see, e.g., a review of cardiovascular disease treatment costs by Brouwer et al. 2015). Since NCD costing studies are few, we selected the highest-quality study that we identified that most closely reflected the medical components of the intervention in question. All costs were updated to 2020 US dollars using procedures recommended by the Global Health Costing Consortium (Vassall et al. 2017). They were then extrapolated to other countries in two stages. First, we decomposed costs into traded and nontraded components. Traded components were assumed to be constant across countries. Nontraded components were adjusted based on ratios of gross national income (GNI) per capita across countries. As described in the DCP3 costing paper and its appendix (Watkins et al. 2020),this approach has several limitations but represents the most feasible approach for a global-level modeling study. Our costs were meant to be illustrative of the magnitude and range of costs across LICs and MICs rather than precise estimates used for budgeting country-level NCD programs. Country-level empirical (micro)costing of the 30 inter-

ventions was outside the scope of this chapter.

Unit costs were then multiplied by the population requiring each intervention and further by the target coverage level of the intervention each year. For example, the cost of an intervention costing $20 per patient-year that addressed a chronic disease with a prevalence of 1 million cases and a current coverage of 30 percent was calculated as $20 * 1,000,000 * 30 percent = $6,000,000. The "incremental" cost of increasing coverage of that intervention by a certain amount would be calculated as the difference in coverage year over year. We defined full coverage of each intervention as 80 percent of the population covered by the year 2050, consistent with DCP3 and WHO assumptions (Stenberg et al. 2017; Jamison et al. 2018). Epidemiological and demographic data used to estimate population in need were taken from the WHO (WHO 2020), UN Population Division (UN 2022), and Global Burden of Disease 2019 Study (GBD 2019 Diseases and Injuries Collaborators 2020). Coverage data were taken from the literature, WHO, or expert opinion.

As Table 15.2 shows, different countries currently have different levels of coverage for the various NCD interventions, so the incremental cost and impact (below) of achieving 80 percent target coverage will be different. We imposed a standard 2 percent per year increase in coverage for all interventions and countries in our model, meaning that they all increase coverage at the same rate but reach 80 percent at different time points (and some do not reach 80 percent by 2050, especially LICs). The assumption of a 2 percent annual increase is based on recent trends in hypertension coverage (1.0-1.5 percent annual increases in well-performing countries (NCD Risk Factor Collaboration 2021)) and in antiretroviral drug therapy coverage (4-5 percent annual increases (World Bank 2022)). Hence a 2 percent increase reflects an acceleration of progress on access to NCD care but within reason, considering that NCD programs do not have the same resources or political momentum as HIV/AIDS.

For the non-health sector interventions, there are two major types of costs that are borne outside the government/healthcare sector. The first type is the cost to firms of implementing government regulations. Again, we used literature-based estimates of these costs and extrapolated them across countries, like we did for the clinical interventions (above). The second type of cost is the forgone consumer surplus due to taxes and regulations on unhealthy products. As outlined in our paper for the Copenhagen Consensus Center (Watkins, Ahmed, and Pickersgill 2023), we used recommendations from US-based regulatory impact analyses (FDA 2014) to inform our approach, which used an offset parameter that was applied to the estimated economic benefits from improved health (see below). For tobacco and alcohol policies, the offset value was 0.9, and for sodium and trans-fat policies, it was 0.5.

Modeling intervention health and economic outcomes

We quantify improvements in health as a reduction in mortality and disability rates, and therefore total deaths and disability-adjusted life-years (DALYs), following the scale-up of an intervention. To do this, we used a population model we developed for the NCD Countdown report (NCD Countdown Collaborators 2022). In brief, this model combined demographic projections (UN 2022) – (including population counts and all-cause mortality rates) with cause-of-death data (WHO 2020)[28] and disease incidence and prevalence rates (GBD 2019 Diseases and Injuries Collaborators 2020). The baseline projection that we used as a reference for calculating intervention-specific health gains was calibrated to the UN Population Division medium projections, representing a business-as-usual scenario for intervention implementation.

Changes in disease-specific mortality and disability rates were a function of (i) the effectiveness of the intervention on these outcomes, usually expressed as a rate ratio or hazard ratio, and (ii) the change in intervention coverage. Effectiveness data were usually taken from clinical trials, favoring meta-analytic estimates when available. We did our own searches for effectiveness data for the NCD Countdown report (see appendix). Intervention-specific effectiveness parameters are detailed in the online appendix (see Github URL below). We multiplied each literature-based effect size by 0.70 to account for imperfect implementation in real-world settings (NCD Countdown Collaborators 2022).

To calculate the economic value of reduced mortality and disability, we multiplied projected DALYs by the standardized time series estimates for the value of a DALY that were used throughout the Copenhagen Consensus project. One potential benefit of tobacco and alcohol taxes is a gain in revenue to governments. We took a societal perspective on costs and benefits, so these revenue gains are fully offset by additional costs to consumers—i.e., they are, functionally, transfer payments.

All input data, including citations of the literature used to estimate the cost of each intervention, are available at https://github.com/Disease-Control-Priorities/CCC.