

Technical appendix

The health of nations: Stronger health, stronger economies

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This appendix outlines the methodology and key assumptions underlying the Prioritizing Health model, which assesses the global disease burden and models the potential impact of scaling proven cost-effective health interventions on population-level health and the global economy.

This analysis represents an “art of the possible” approach, aiming to estimate the potential benefits of expanding access to proven health interventions on a global scale. While it provides a high-level perspective on the opportunities and impact, it is important to acknowledge that there are inherent limitations in the data, clinical evidence, and assumptions used. Further research in this area would be valuable to refine the estimates.

The model comprises three main analytical steps:

- Estimate the health improvements from scaling selected health interventions.
- Quantify the economic benefit of improved health.
- Estimate the incremental cost and economic return.

Estimate the health improvements from scaling selected health interventions

The model adopted a bottom-up approach, assessing individual health conditions in detail and estimating the potential reduction in disease burden achievable through the scale-up of specific interventions. It encompassed approximately 90 conditions, representing about 85 percent of the total global disease burden, and incorporated risk-attributable burden from around 27 risk factors, which together accounted for roughly 98 percent of the total risk-attributable disease burden. For these conditions, potential reductions in disease burden were estimated using the nine-step analytical approach described in Exhibit 1.

For the remaining conditions—constituting the residual 15 percent of the global disease burden—an average impact proportion was applied, derived from comparable conditions within the same disease group or category for which detailed analyses were conducted.

1. Select conditions for in-depth analysis

The model used the Institute for Health Metrics and Evaluation (IHME) Global Burden of Disease (GBD) 2021 data suite as the analytical baseline. Projections of future disease burden were drawn from IHME’s forecast estimates, which are based on a comprehensive and systematically curated global health database. Nevertheless, forecasts of disease burden are inherently uncertain, and unanticipated health shocks, policy changes, or geopolitical events may materially affect future outcomes.

Within the GBD data set, disease burden is quantified using disability-adjusted life years (DALYs) and causes are organized in a hierarchical structure: Level 0 aggregates all causes; Level 1 distinguishes broad cause groupings of communicable, noncommunicable, and injury causes; Level 2 disaggregates disease burden into 22 major disease groups, including cancers, cardiovascular disorders, and mental disorders; and Levels 3 and 4 comprise progressively more detailed, condition-specific classifications based on clinical and epidemiological similarity.¹ The IHME GBD data set, comprising 178 Level 3 conditions, served as the starting point for identifying leading health conditions for in-depth analysis, collectively accounting for approximately 80 percent of the global disease burden (measured in DALYs). To ensure comprehensive coverage of major health challenges across geographies and population segments, the selected conditions were benchmarked against the top ten causes of disability and mortality across

¹ *Global Burden of Disease 2021: Findings from the GBD 2021 study*, IHME, May 16, 2024.

Exhibit 1

There were nine key steps to estimate the health impact of scaling access to proven health interventions.

Per disease impact analysis

Analytical step	Detailed description	Main sources
Assess disease burden	1. Select conditions for in-depth analysis: Identify a set of health conditions that collectively account for approximately 85% of the total global disease burden for detailed modeling and analysis 2. Estimate risk-attributable burden: For each cause–risk pair across 27 risk factors, estimate the risk-attributable disease burden, adjusting for interdependencies between risks to avoid double-counting	Institute for Health Metrics and Evaluation (IHME) Global Disease Burden (GDB) 2021 data suite
Identify health interventions and research impact assumptions	3. Identify and categorize interventions: Review clinical literature to identify cost-effective and scalable interventions with the greatest potential for impact—covering both preventive interventions that reduce disease incidence and therapeutic interventions that address established conditions 4. Estimate effect sizes: For each intervention within each disease area, determine the effectiveness related to mortality and morbidity reduction, drawing on the best available clinical evidence 5. Estimate the baseline and target adoption rates: Assess the potential for increased adoption of each intervention under a best-practice scenario, accounting for factors such as uptake, sustained adherence, and implementation feasibility; adjust estimates by income archetype to reflect infrastructure and resource constraints 6. Estimate intervention ramp-up timeline: Using insights from clinical reviews and expert consultations, estimate the time required to reach full implementation and impact, including any delays in initial uptake 7. Define intervention sequence: Apply interventions sequentially—starting with environmental and behavioral interventions, followed by medical prevention and finally therapeutic interventions for established disease—each acting on the remaining burden after the preceding category has been applied	WHO guidelines, <i>Disease Control Priorities, third edition</i> , and international agencies; systematic reviews (eg, Cochrane), <i>The Lancet</i> , and high-impact journals
Calculate impact	8. Calculate the impact on years lived with disability (YLDs), and years of life lost (YLLs), and deaths: Estimate potential reductions in deaths, YLDs, and YLLs by incrementally applying effect sizes, adoption rates, and time adjustments to baseline IHME disease burden projections from 2025 to 2050 The sequential summation follows the formula: $Attributable\ burden \times Effect\ size \times Additional\ adoption \times Time\ adjustment$ 9. Estimate impact on life expectancy and health-adjusted life expectancy (HALE): Use deaths averted to recalculate abridged life tables and estimate gains in life expectancy; derive improvements in HALE by combining YLDs averted with the revised life expectancy estimates	IHME GBD 2021 data suite

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regions, income archetypes,² and age groups. Additional conditions were included where needed to ensure representativeness. This process resulted in a preliminary list of 46 conditions, presented in Exhibit 2.

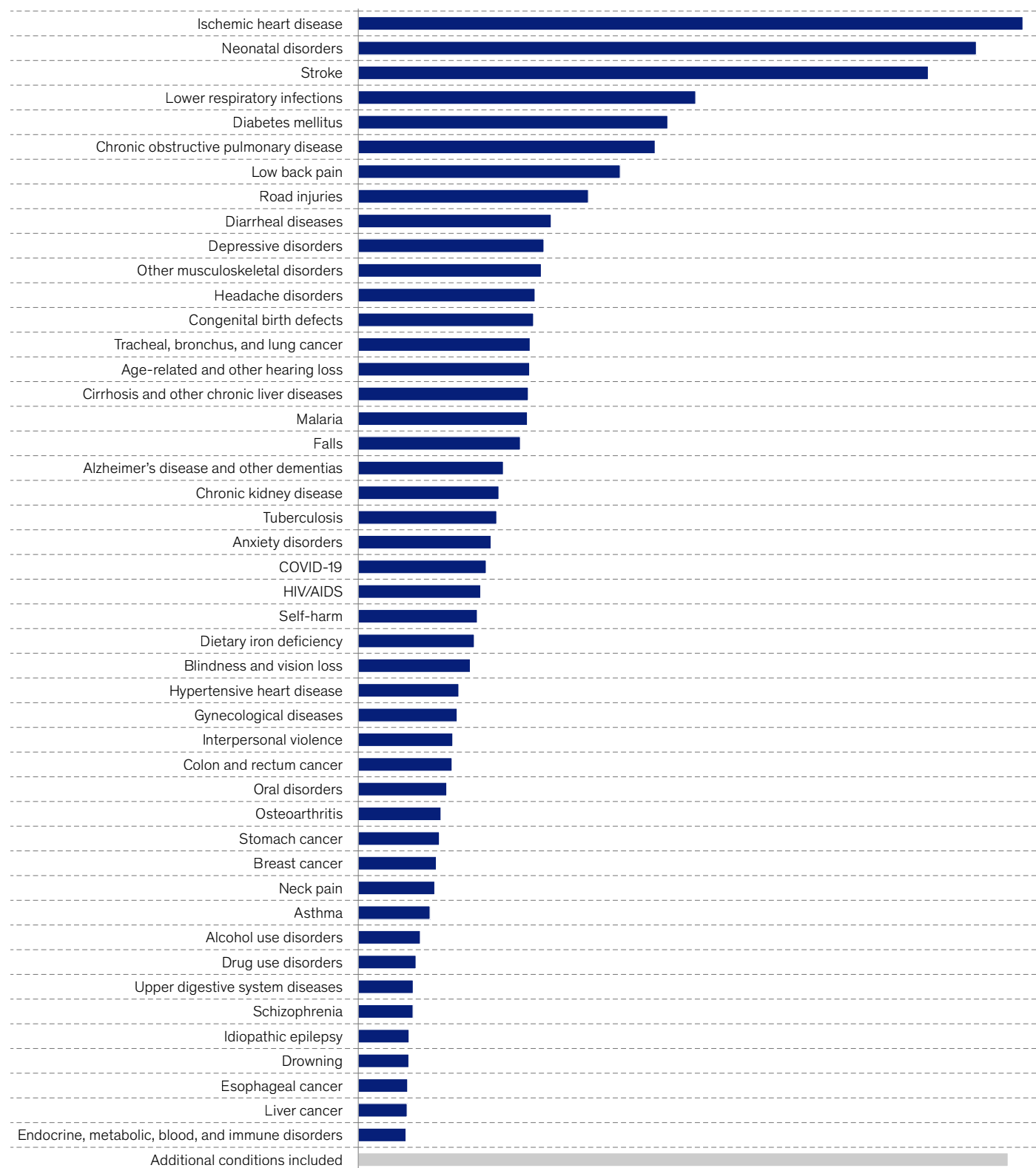
Each condition on the list was then reviewed to determine whether it was defined in a way that enabled the identification of proven interventions and the estimation of potential impact through incidence reduction,

² The country income archetypes were based on World Bank income classifications.

Exhibit 2

A list of 46 disease groups was included in the in-depth analysis.

Share of global disability-adjusted life years, 2025, %



Source: Global Burden of Disease, Institute for Health Metrics and Evaluation, 2021 (used with permission, all rights reserved); McKinsey Health Institute analysis

severity reduction, or both. For certain broad disease categories, more detailed analysis at a lower classification level was deemed necessary to improve accuracy. In such cases, Level 3 categories were replaced with their corresponding Level 4 disease classifications. This refinement was applied to conditions such as diabetes mellitus (assessed separately as type 1 and type 2), stroke (ischemic stroke, intracerebral hemorrhage, and subarachnoid hemorrhage), headache disorders (migraine and tension-type), blindness and vision loss (cataract, glaucoma, age-related macular degeneration, refractive disorders, and near-vision loss), and drug use disorders (including cocaine, amphetamine, opioid, cannabis, and other drug use disorders).

Following these adjustments, the final deep-dive analysis covered 89 diseases, with all disease groups well represented, covering about 85 percent of the total global disease burden.

2. Estimate risk-attributable disease burden

For conditions in which disease burden is attributable to specific risk factors (for example, type 2 diabetes linked to high BMI or ischemic heart disease associated with high blood pressure), more-granular risk-attributable disease burden estimates were incorporated into the model. The analysis included 27 risk factors spanning metabolic, environmental or occupational, and behavioral categories, aligned with the classifications defined by the IHME GBD data set. Collectively, these risk factors account for approximately 98 percent of the total risk-attributable disease burden, enabling the targeted application of interventions to address specific underlying risks.

According to the IHME risk burden data set, most conditions are associated with multiple risk factors that contribute jointly to the overall disease burden. These risk factors are often interdependent—for instance, metabolic risks such as high fasting plasma glucose and high BMI may overlap in their contribution to disease outcomes. To prevent double counting when estimating the potential impact of interventions aimed at reducing these risks, the model applied a deduplication adjustment. This adjustment allocated proportional burden within each Level 1 risk group—namely, metabolic, environmental or occupational, and behavioral risks—ensuring that the aggregate burden was accurately represented without overestimation.

3. Identify and categorize interventions

A review of clinical literature was conducted to identify cost-effective and scalable interventions with the greatest potential for health impact, including both preventive measures aimed at reducing disease incidence and therapeutic interventions addressing established disease. The objective of this process was to determine high-impact interventions that could substantially reduce disease burden if implemented more effectively and if access gaps were minimized. Sources used for the intervention review included clinical guidelines (from a range of national professional bodies); World Health Organization (WHO) guidance; the *Disease Control Priorities, third edition (DCP-3)*; and other international health agencies—as well as evidence from systematic reviews (for example, Cochrane) and peer-reviewed publications in *The Lancet* and other high-impact journals.

This set of interventions was not intended to represent an exhaustive catalog of all possible measures available in a fully resourced health system but rather to reflect those with the strongest evidence base and highest impact and scalability potential. In total, the model incorporated about 300 interventions across the analyzed conditions.

Health interventions were categorized into three broad groups:

Population-level prevention:

- Environmental interventions: Policies and regulatory measures (for example, alcohol taxation) and place-based programs (such as school-based drug prevention, needle and syringe programs, or workplace initiatives addressing high-risk alcohol use)

Individual-level prevention:

- Behavioral interventions: Approaches promoting individual behavior change, including smoking-cessation support and weight management through lifestyle modification
- Health promotion and preventive interventions: Activities encompassing screening, early detection, primary care, and preventive pharmacotherapy (for example, antihypertensives or GLP-1 receptor agonists for obesity)

Therapeutic interventions:

- Therapeutic interventions: Measures such as specialized care (for example, joint replacement surgery), pharmacological treatment (such as antibiotics), care management, counseling and psychotherapy (for example, peer support programs and talking therapies), and digital therapeutic tools

4. Estimate effect sizes

Estimates of intervention effectiveness were extracted from systematic reviews and, if no systematic review was identified, from other clinical studies. Effectiveness was estimated separately for morbidity and mortality. For morbidity reduction, the most appropriate available outcome measure was selected—for example, change in symptoms severity. Where an intervention was only applicable to a proportion of the disease burden, such as a specific age group, effect estimates were applied only to appropriate groups. For example, a schools-based obesity-prevention program was applied only to the associated burden in age groups from five to 19 years. Effectiveness was assumed to be consistent across country income archetypes. The estimates used in this model were intended as averages across relevant patient populations and may vary for specific subpopulations in ways not considered in the model.

5. Estimate target adoption rates

The model aims to estimate the incremental impact of scaling up access to proven cost-effective health interventions relative to the current baseline. Adoption assumptions were derived from the difference between current adoption levels and aspirational target adoption levels. Current adoption rates were estimated for each intervention and country income archetype using the best available evidence, reviewed and validated by subject matter experts.

Two scenarios were developed to estimate target adoption rates:

- *Aspirational best-practice scenario.* Target adoption rates for each intervention were estimated by accounting for factors such as uptake, sustained adherence, and implementation feasibility. The best available evidence was used for each intervention–disease combination, drawing on real-world examples where data existed. Where direct evidence was unavailable, adoption rates were inferred from analogous intervention trends over time and subsequently reviewed with disease-area experts (Exhibit 3). Estimates were further adjusted by income archetype to reflect variations in infrastructure and resource availability.
- *Theoretical maximum scenario.* This scenario assumed 100 percent target adoption for all interventions, representing the upper limit of potential impact achievable through existing, proven interventions. The purpose of this scenario was to quantify the residual disease burden that could not be addressed without future innovation or new intervention development.

Exhibit 3

Aspirational best practice adoption assumptions were used where credible evidence was not available.

Aspirational best practice adoptions where credible/precise estimates are not available

Intervention category	Intervention type	Aspirational adoption	Rationale
Population-level prevention (environmental interventions)	National policies and regulations (eg, road safety measures, alcohol and tobacco controls)	100%	Assumes policies are designed to further restrict/control high risk exposures from baseline (current) position
	Industry standards (eg, occupational exposure limits for known pollutants)	75% (low-income countries [LIC]/lower-middle-income countries [LMIC]/upper-middle-income countries[UMIC]), 100% (high-income countries [HIC])	Assumes varying baseline (current) levels of regulation and resourcing for enforcement/compliance
Individual-level prevention (behavioral and health prevention and promotion interventions)	Vaccines	95%	Assumes 95% target adoption unless another standard is proposed in clinical practice guidelines
	Screening	75%	Assumes 75% target uptake unless another standard is proposed in screening guidelines
	Preventive medicines (interventions requiring prolonged adherence)	75%	Assumes 75% target adherence across all eligible groups (including currently undiagnosed patients)
	GLP-1s for obesity and diabetes risk	37% (HIC), 20% (UMIC), 8% (LMIC), 7% (LIC)	Assumes adoption rate seen for existing generic meds used in cardiovascular prevention by 2050
	Participatory interventions (requiring regular attendance over time)	60%	Assumes 60% voluntary, regular participation unless evidence found suggesting another level for specific interventions delivered in line with best practice
Therapeutic	Standard clinical practice (eg, routine surgery, medicines for acute management)	90%	Assumes high level of adherence to clinical practice guidelines can be achieved over time
	Medicines for chronic disease management	90%	Assumes high level of diagnosis and adherence to clinical practice guidelines can be achieved over time
	Interventions with high infrastructure needs (workforce, facilities) (eg, complex surgery)	83% (HIC), 65% (UMIC), 49% (LMIC), 42% (LIC)	Assumes investment in infrastructure over time is aligned to urbanization rate in 2050 (World Bank estimates)
	New/advanced interventions (eg, digital therapeutics, biologics, new medtech)	80% (with time lag for implementation)	Assumes interventions currently considered new/advanced will become standard clinical practice by 2050

6. Estimate intervention ramp-up timeline

Expanding access to interventions takes time. Assumptions around implementation ramp-up times to reach peak (or aspirational target) adoption were built into the model, tailored to different types of intervention and to each of the four country income archetypes. These estimates were based on real-world examples of time to implementation in different health system contexts, as well as universal health coverage trends. The analysis utilized an s-shaped ramp-up curve, reflecting a slower initial adoption rate followed by accelerated adoption over time, to better simulate real-life scenarios.

If there was a time lag between accessing an intervention and realizing the health benefit for a specific condition, this was also accounted for through an adjustment to the ramp-up curve. For example, smoking-cessation support not only has immediate benefits for some conditions but also reduces the risk of developing other conditions over subsequent decades.

7. Define intervention sequence

For each disease included in the analysis, the model quantified the impact of one or more relevant interventions. To more accurately reflect real-world implementation, the impact of interventions was calculated sequentially. The sequence was determined by intervention type: environmental and behavioral interventions were applied first, followed by health promotion and preventive measures, and finally therapeutic interventions.

Each subsequent intervention's potential impact was applied only to the remaining disease burden after accounting for the reduction achieved by preceding interventions. The ordering of interventions within each category was determined in consultation with clinical experts in the relevant fields. This sequencing approach was designed to avoid double counting of potential impacts and does not represent real-world clinical practice, where multiple interventions may be implemented concurrently and treatment order is determined by individual patient circumstances rather than a fixed sequence.

The sequencing was applied within the burden of each condition. Where an intervention was relevant to more than one condition, the sequencing order varied by condition as appropriate.

8. Calculate the impact on years lived with disability, years of life lost, and deaths

The model was applied to estimate the potential reduction in global disease burden achievable through the scaling of proven health interventions over a 25-year period. A comprehensive baseline data set was generated for the years 2025 to 2050, incorporating both risk-attributable and cause-specific burden estimates for all conditions included in scope, based on IHME GBD forecast estimates. This data set was disaggregated by country, sex, and five-year age groups, in alignment with the preceding methodological steps.

Health interventions and their corresponding effects were implemented sequentially over time, beginning with those addressing modifiable risk factors, followed by preventive and therapeutic interventions. Each subsequent intervention was applied only to the residual disease burden remaining after accounting for reductions achieved by prior interventions. Interventions were assigned to relevant age groups and population segments based on epidemiological appropriateness and available evidence.

To determine the annual impact, the baseline disease burden for each population segment was multiplied by the intervention efficacy rate, adjusted for the incremental adoption potential and the ramp-up factor corresponding to the year, intervention type, and income archetype of each country. This process allowed for dynamic, time-sensitive modeling of intervention effects under varying implementation and resource conditions. This procedure was conducted separately to estimate reductions in years lived with disability

(YLDs), years of life lost (YLLs), and deaths. The resulting estimates for YLDs and YLLs were combined to calculate the total change in DALYs, representing the aggregate improvement in population health under each modeled scenario.

The sequential summation of intervention effects followed the formula:

$$\text{Attributable burden} \times \text{Effect size} \times \text{Additional adoption} \times \text{Time adjustment}$$

Finally, model outputs were extrapolated to diseases not included in the detailed analysis—representing approximately 15 percent of the total global disease burden—by assuming an average impact proportion consistent with diseases within the same Level 2 category as defined in the IHME GBD data set.

9. Estimate impact on life expectancy and health-adjusted life expectancy

To estimate the impact of scaling health interventions on life expectancy (LE) and health-adjusted life expectancy (HALE), the model recalculated the underlying abridged life tables using the remaining deaths and YLD per capita derived from the previous steps after scaling proven health interventions. Comparing pre- and post-intervention values for LE and HALE resulted in a determination of the increase in LE and HALE that was due to the applied health interventions.³

All model inputs and outputs were reviewed by clinical experts specializing in relevant disease areas. These experts evaluated the selection of interventions, the assumptions on potential uptake, the sequencing of implementation, and the estimated health impacts across different country income groups. This review process ensured the appropriateness of evidence interpretation and provided an opportunity to test assumptions where data were limited. The expert review of model outputs, such as projected reductions in disease burden, was also used to validate and refine the findings.

The model results were further compared with published sources to assess consistency with external evidence. Findings for the top 26 conditions were triangulated with global multiyear disease reduction targets set by major international agencies, such as WHO and the United Nations (UN). Any differences observed were primarily attributable to variations in adoption assumptions or modeling parameters across studies.

Quantify the economic benefit of improved health

To quantify the economic impact of reducing the global disease burden through the scale-up of proven health interventions, the model estimated supply-side gains associated with a larger, healthier, and more productive workforce. Economic benefits arising from improved population health were projected for the period from 2025 to 2050 and expressed as incremental GDP gains, based on estimated reductions in disease burden. GDP provides a consistent and widely used framework for assessing macroeconomic impacts of health improvements; however, it does not capture all dimensions of societal well-being. In particular, it undervalues unpaid caregiving and household work—activities disproportionately undertaken

³ Haidong Wang et al., “Global age-sex-specific fertility, mortality, healthy life expectancy (HALE), and population estimates in 204 countries and territories, 1950–2019: A comprehensive demographic analysis for the Global Burden of Disease Study 2019,” *The Lancet*, October 2020, Volume 396, Number 10258; abridged life table definitions by M. Greenwood, “Discussion on the value of life-tables in statistical research,” *Journal of the Royal Statistical Society*, June 1922, Volume 85, Number 4; and Chin Long Chiang, *The Life Table and Its Application*, Krieger Publishing Company, 1984.

by women—and excludes social, environmental, and community-level contributions that also underpin long-term prosperity. In addition, the analysis assumes that labor markets can fully absorb increases in the workforce at average levels of productivity. These assumptions define the scope of the estimates and should be considered when interpreting the results.

The impact on GDP was assessed through six primary channels, as illustrated in Exhibit 4.

Exhibit 4

Six primary channels was used to estimate economic impact from scaling interventions.

Increase in labor force participation		Enhanced productivity	
1	Fewer early deaths	Preventing premature deaths to extend active life and enhance current workforce supply	
2	Fewer health conditions	Reducing disability in the potential labor force (absenteeism), enhancing current workforce supply	
3	Expanded participation from informal caregivers	Growth of workforce supply through increase in labor force participation from informal caregivers	
4	Increased productivity from better health	Reducing in presenteeism among adults	
5	Future earning potential for children	Preventing diseases in childhood and adolescence that affect future earnings potential (primarily from lower education attainment)	
6	Enhanced productivity of informal caregivers	Reducing presenteeism among employed informal caregivers due to recipient's improved health	

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1. Fewer early deaths

Improved health expands the labor force by preventing premature deaths. Based on the estimated averted deaths over time from the disease reduction portion of the model, it was possible to estimate the potential increase in labor supply. When a premature death is averted by preventing a disease, the model assumed the additional individuals would have the average labor force participation rate of others in their age group, sex, and country in a given year.

Labor force estimates used are from the International Labour Organization, which projects rates by country, sex, and year.⁴ The model also considered an adjustment to the labor force participation rate using a factor that reflects the lower likelihood of returning to the workforce after a period of ill health by assigning the probability of return to work post-therapy as a factor between zero and one.⁵ The forecast size of the labor force was also adjusted by the unemployment rate because not everyone who is willing to work will find employment. Last, the total number of people added to each country's labor supply was multiplied by GDP per employed person.⁶

⁴ International Labour Organization Department of Statistics. Used latest forecasts available per country and calculated the average using a five-year lookback from the latest year available, assuming forecasted rates after that year remain consistent, for modeling purposes.

⁵ Kenneth Sandin et al., "Sick leave and return to work for patients with anxiety and depression: A longitudinal study of trajectories before, during and after work-focused treatment," *BMJ Open*, September 2021, Volume 11, Number 9; David C. Chant and Geoffrey R. Waghorn, "Employment restrictions among persons with ICD-10 anxiety disorders: Characteristics from a population survey," *Journal of Anxiety Disorders*, 2005, Volume 19, Number 6; Päivi Rissanen et al., "Factors associated with returning to work after long term absence due to mental disorders," *Humanities and Social Sciences Communications*, November 2021, Volume 8, Number 263; Barbara Biasi, Michael S. Dahl, and Petra Moser, *Career effects of mental health*, National Bureau of Economic Research (NBER) working paper, number 29031, July 2021; *The Buckland Review of Autism Employment: Report and recommendations*, Department for Work and Pensions (UK), February 28, 2024; "Fact sheet 1: Learning disability and employment," Mencap, September 5, 2023; Michael R. Frone et al., "Workplace supported recovery from substance use disorders: Defining the construct, developing a model, and proposing an agenda for future research," *Occupational Health Science*, December 2022, Volume 6, Number 4; "Workplace supported recovery," Centers for Disease Control and Prevention (CDC), December 21, 2023.

⁶ Forecast data on GDP per employed person are from Oxford Economics.

For deaths averted through better treatment or management of chronic health conditions, a wage discount was applied for people in high-income countries who were formerly chronically ill, because the evidence suggests that some of those conditions are negatively correlated with wages.⁷ We anticipate similar wage penalties in non-high-income countries but were unable to find literature quantifying their magnitude. As a result, the wage penalties were applied exclusively to high-income countries.

2. Fewer health conditions

Improved health raises labor force participation by reducing absenteeism. The reduction in disability is based on the reduction in YLDs from the disease burden reduction portion of the model. For diseases prevented, labor market participation rates, unemployment, and wage discounts were applied similarly to the case of early deaths averted. For diseases treated, these estimates were adjusted considering a reduced likelihood of reentering the labor force after treatment, again consistent with the approach used for premature deaths averted by treatment of health conditions as described above.

3. Expanded participation from informal caregivers

Healthier populations would result in fewer demands on informal caregivers, who could then choose to enter the formal economy. Informal caregivers are defined as family members or friends who provide long-term care to people who cannot perform daily activities without support.⁸ A multistep modeling approach was employed to estimate the impact of improved health on labor force participation among informal caregivers. The prevalence of informal caregivers was derived using data from the OECD indicator data set (covering 25 high-income countries) and the WHO World Health Survey (covering 38 low- and middle-income countries).⁹ For countries lacking specific data, weighted averages by country income archetype were applied.

To estimate age- and sex-specific prevalence, distributions from the 2020 AARP report (United States) were used for high-income countries, while those from the WHO World Health Survey were applied for low- and middle-income countries. Employment status of caregivers was assessed using available indicators from the aforementioned sources.

For caregivers currently outside the labor force, the potential for workforce reentry was estimated based on (i) the share of individuals who left employment due to caregiving responsibilities (from the 2020 AARP report) and (ii) the reduction in caregiver recipient burden across age groups as calculated in the health impact model described in the preceding section.

The economic impact resulting from the increased participation of informal caregivers was estimated by applying the product of the labor force participation rate, GDP per employed person, and one minus the unemployment rate.

4. Increased productivity from better health

Certain health conditions—such as brain health conditions, musculoskeletal disorders, and gynecological conditions—are associated with above-average levels of presenteeism, defined as reduced productivity

⁷ Nikki Bond and Conor D'Arcy, *Mind the income gap*, Money and Mental Health Policy Institute, September 2020; Biasi Barbara, Michael S. Dahl, and Petra Moser, *Career effects of mental health*, National Bureau of Economic Research (NBER) working paper, number 29031, July 2021; "Disability pay gaps in the UK: 2014 to 2023," Office for National Statistics, October 17, 2024; *Paying the price: The economic and social impact of eating disorders in Australia*, the Butterfly Foundation, November 2012; Kevin Delucchi, Joseph Gurdish, and Jean Oggins, "Gender differences in income after substance abuse treatment," *Journal of Substance Abuse Treatment*, April 2001, Volume 20, Number 3.

⁸ *Health at a glance 2023: OECD Indicators*, OECD, November 7, 2023.

⁹ Louis Jacob, et al., "Informal caregiving and physical activity among 204,315 adults in 38 low- and middle-income countries: A cross-sectional study," *Preventive Medicine*, March 2020, Volume 132.

or unproductive time while at work.¹⁰ A comprehensive literature review was conducted to identify health conditions that have a documented impact on workplace productivity among working-age adults. Based on this evidence, the model determined the subset of the population likely to experience productivity gains by combining the prevalence of each condition and the expected reduction in disease burden derived from the health impact model. For each condition, the potential improvement in productivity was quantified using the identified population subset and the proportion of work hours lost to reduced productivity, as reported in the literature. For example, we have assumed a 5 percent productivity boost from avoided presenteeism associated with depression and anxiety disorders.¹¹ The economic impact of enhanced productivity was subsequently estimated by multiplying the calculated productivity gains with the labor force participation rate, GDP per employed person, and one minus the unemployment rate, consistent with the broader economic modeling framework described in earlier sections.

5. Future earnings potential for children

Certain health conditions such as mental disorders, substance use disorders, and malnutrition experienced during childhood and adolescence can affect future earning potential, primarily because of reduced educational attainment.¹² The model estimated the percentage improvement in annual future earnings through reduced burden of these conditions in childhood.

To estimate the productivity impact, the disease reduction potential derived from the disease impact model was applied to age-specific incidence estimates for each condition across the modeled period (2025–50). This approach enabled the estimation of the number of individuals who benefited from health interventions and allowed the projection of future productivity gains as these individuals entered or remained in the labor force.

The magnitude of productivity benefits was derived from empirical studies that examined the relationship between health experiences in childhood and future earnings potential, as compared with the peer average. The resulting benefits were then multiplied by the labor force participation rate, GDP per employed person, and one minus the unemployment rate to estimate the aggregate economic impact.

¹⁰ Dan Chilsholm et al., "Scaling-up treatment of depression and anxiety: A global return on investment analysis," *The Lancet Psychiatry*, May 2016, Volume 3, Number 5; Miriam K. Hassan, Kiran E. Laxman, and Kate S. Lovibond, "Impact of bipolar disorder in employed populations," *The American Journal of Managed Care*, November 2008, Volume 14, Number 11; Manjiri Pawaskar et al., "Comparison of quality of life, productivity, functioning and self-esteem in adults diagnosed with ADHD and with symptomatic ADHD," *Journal of Attention Disorders*, January 2020, Volume 24, Number 1; Toru Nakai et al., "Work productivity, quality of life, and depressive symptoms in undiagnosed adults with and without attention-deficit/hyperactivity disorder (ADHD) symptoms during the COVID-19 pandemic," *Neuropsychiatric Disease and Treatment*, July 2022, Volume 18; Eiji Kirino et al., "Sociodemographics, comorbidities, healthcare utilization and work productivity in Japanese patients with adult ADHD," *PLoS One*, July 2015, Volume 10, Number 7; Alain Joseph et al., "Health-related quality of life and work productivity of adults with ADHD: A U.K. web-based cross-sectional survey," *Journal of Attention Disorders*, December 2019, Volume 23, Number 13; Elizabeth Packnett, Robert Fowler, and Liisa A. Palmer, "Presenteeism in employees with chronic conditions: An analysis using linked claims and self-reported employee health risk assessment data," *Value in Health*, July 2025, Volume 28, Number 6; Donna Allen et al., "Four-year review of presenteeism data among employees of a large United States health care system: a retrospective prevalence study," *Human Resources for Health*, November 9, 2018, Volume 16, Number 1; Dam Kim, Yuko Kaneko, and Tsutomu Takeuchi, "Importance of obtaining remission for work productivity and activity of patients with rheumatoid arthritis," *The Journal of Rheumatology*, August 2017, Volume 44, Number 8; Marco daCosta DiBonaventura, et al., "Evaluating the health and economic impact of osteoarthritis pain in the workforce: results from the National Health and Wellness Survey," *BMC Musculoskeletal Disorders*, April 28, 2011, Volume 12.

¹¹ Dan Chisholm et al., "Scaling-up treatment of depression and anxiety: a global return on investment analysis," *The Lancet Psychiatry*, May 2016, Volume 3, Number 5.

¹² Martin Knapp et al., "Economic outcomes in adulthood and their associations with antisocial conduct, attention deficit and anxiety problems in childhood," *Journal of Mental Health Policy and Economics*, September 2011, Volume 14, Number 3; Gillian C. Smith and James Patrick Smith, "Long-term economic costs of psychological problems during childhood," *Social Science & Medicine*, July 2010, Volume 71, Number 1; Jason M. Fletcher, "The effects of childhood ADHD on adult labor market outcomes," *Health Economics*, February 2014, Volume 23, Number 2; Andreas Jangmo et al., "Attention-deficit/hyperactivity disorder and occupational outcomes: The role of educational attainment, comorbid developmental disorders, and intellectual disability," *PLoS ONE*, March 2021, Volume 16, Number 3; Adam Martin, Richard Mattock, and Nasir Rajah, "How do childhood ADHD symptoms affect labour market outcomes?," *Economics & Human Biology*, January 2023, Volume 48; Jennifer Tabler and Rachel L. Utz, "The influence of adolescent eating disorders or disorder eating behaviors on socioeconomic achievement in early adulthood," *International Journal of Eating Disorders*, September 2015, Volume 48, Number 6.

Because health interventions introduced in early life were expected to generate long-term improvements in lifetime health and earnings, the 2050 estimate included in this analysis represented only a portion of the total benefits, as many beneficiaries were projected to remain in their prime working years well beyond 2050.

6. Enhanced productivity of informal caregivers

As described in an earlier section, the model estimated the economic impact arising from increased labor force participation of informal caregivers. However, improved health outcomes are also expected to enhance the productivity of informal caregivers who were already part of the workforce.

To estimate this additional impact, a similar methodological approach was applied to estimate the prevalence of informal caregivers, consistent with the procedure outlined previously. For the subset of caregivers already employed, evidence from the literature on the proportion of work hours lost due to presenteeism was reviewed and incorporated.

The total number of work hours gained was calculated by combining the prevalence of informal caregivers within the workforce, the reduction in disease burden among care recipients (as estimated in the health impact model), and the average proportion of productivity loss reported in relevant studies.

Finally, the economic value of the productivity gains was estimated by multiplying the calculated work-hour improvements by economic metrics per person, consistent with the approach described in preceding sections.

Estimate the incremental cost and economic return

A bottom-up costing approach was used to estimate the incremental costs required to scale access to the modeled interventions. These cost estimates were combined with previously estimated GDP impacts to calculate the high-level economic return of scaling proven health interventions. The analysis followed six key steps to estimate total costs and return on investment (Exhibit 5).

1. Identify cost data sets

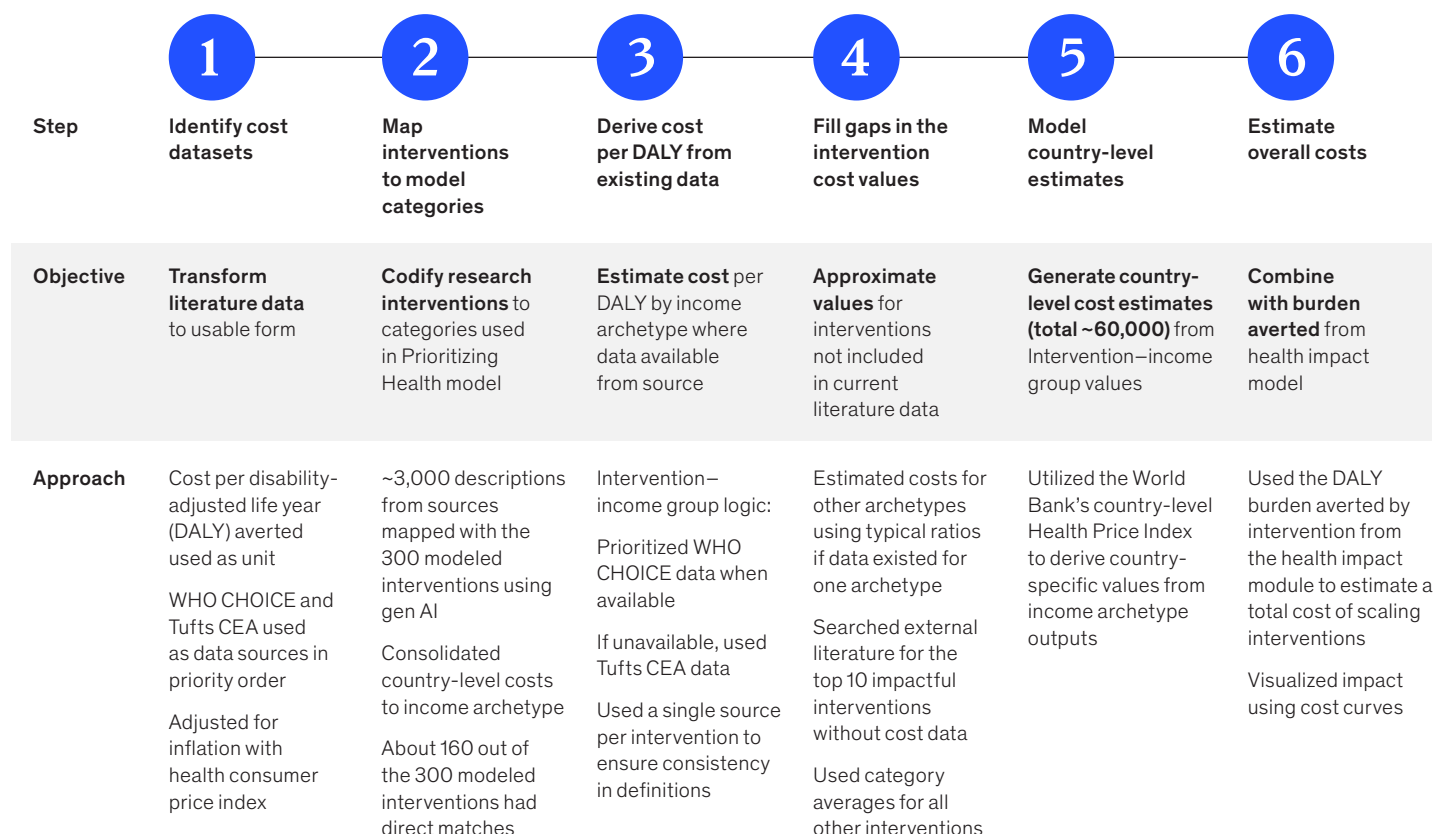
The cost-per-DALY-averted metric was selected because it is the most widely available and consistently reported measure that can be directly applied to estimates of disease burden averted expressed in DALYs. A limited number of gold-standard data sources were identified to support this analysis:

- Tufts Medical Center Cost-Effectiveness Analysis (CEA) Registry
- WHO Universal Health Coverage (UHC) Compendium Cost-Effectiveness Data Portal, including data from *Disease Control Priorities*
- Additional peer-reviewed literature, including *DCP-3*, and selected *Lancet* publications

This analysis is constrained by the availability, consistency, and comparability of cost-effectiveness estimates across sources. Methodologies used to calculate cost-per-DALY-averted vary across the referenced data sets and reflect differences in original study designs, intervention definitions, and reporting standards. The underlying estimates incorporate numerous context-specific parameters—such as local input prices, healthcare worker wages, and service delivery models—which can vary substantially both within and across countries.

Exhibit 5

Six key steps were used to estimate the incremental cost of scaling interventions.



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Furthermore, reported cost-effectiveness estimates generally reflect operational costs only and typically exclude fixed or start-up costs, such as health-worker training, infrastructure development, or system-level implementation investments. As a result, the cost estimates presented should be interpreted as directionally indicative rather than as precise forecasts of intervention costs for any specific country or setting.

The analytical framework is designed to be iterative and updateable. As additional research becomes available and as primary data sources—particularly the Tufts CEA Registry and the WHO UHC Compendium—continue to update their databases, new or revised cost-per-DALY-averted estimates can be incorporated into future analyses.

2. Map interventions to model categories

Generative AI was used to map approximately 3,000 unique intervention entries from external cost-effectiveness sources to the approximately 300 standardized intervention names and descriptions used in the Prioritizing Health (PH) model. Source data sets differed substantially in structure and nomenclature. The WHO source categorized interventions under standardized “WHO-CHOICE Interventions,” whereas the Tufts data set reported interventions as unstructured free-text fields labeled “Intervention description.”

From the WHO source, an initial list of 104 interventions was mapped to 76 corresponding PH model interventions (for example, WHO “H. influenzae b vaccine” mapped to PH “Influenza vaccine”). Most of these contextual matches included cost estimates for both low-income country (LIC) and lower-middle-

income country (LMIC) archetypes, resulting in a total of 151 cost estimates. Approximately half of the initial gen AI-generated matches were classified as partial matches, reflecting the broad or nonspecific nature of intervention descriptions in the WHO database. These partial matches were subsequently reviewed by subject matter experts and either approved or excluded based on considerations of cost magnitude, intervention effectiveness, clinical applicability, and alignment with PH model definitions.

WHO cost estimates, originally reported in 2021 prices, were indexed to 2025 price levels using median health-sector consumer price index (CPI) inflation rates for LIC and LMIC archetypes. Average annual inflation rates applied were 3.6 percent for LICs and 4.6 percent for LMICs, respectively.¹³

The Tufts data set included approximately 3,000 intervention descriptions, of which a subset was successfully mapped to PH model interventions. Individual intervention descriptions in the Tufts registry may report cost values for one or multiple countries. The Tufts mapping approach aimed to construct a distribution of cost-per-DALY estimates for each PH intervention–income archetype pairing, from which a median cost value was derived. Tufts cost estimates, reported as “USD per DALY averted (final, current USD 2022),” were indexed to 2025 prices using country-specific health CPI inflation rates where available. When country-level CPI data were unavailable in the International Monetary Fund data set, median inflation rates by income archetype were applied, consistent with the approach used for WHO estimates.

To further improve data quality and robustness, additional cleaning steps were applied across sources. These included removal of statistical outliers, exclusion of negative cost-per-DALY values, and—specifically for the Tufts data set—exclusion of intervention estimates exhibiting extreme variability across income groups.

3. Derive cost-per-DALY-averted from existing data

To estimate the cost-per-DALY-averted for each modeled intervention in the PH model, available cost-effectiveness evidence was compiled from WHO-CHOICE and the Tufts Cost-Effectiveness Analysis Registry. The methodology prioritized consistency across income archetypes by relying on a single data source per intervention to ensure alignment in intervention definitions.

When WHO-CHOICE provided estimates for a given intervention and income archetype, those values were used preferentially. In cases where multiple WHO-CHOICE estimates were available for the same income group, the cost-per-DALY-averted values were averaged to produce a single representative estimate.

For interventions without WHO-CHOICE estimates, cost-per-DALY-averted values by intervention and income archetype were drawn from the Tufts CEA Registry. Where multiple Tufts estimates existed for the same intervention–income group pair, these values were averaged to generate a single cost-per-DALY-averted estimate.

4. Fill gaps in the intervention cost values

Because not all modeled interventions were represented in the WHO-CHOICE or Tufts data sets, and because cost estimates were not consistently available across all income archetypes for each intervention, a systematic two-stage imputation approach was applied to complete the cost-effectiveness data set.

Cost estimation for interventions with missing data. For interventions with no cost-per-DALY-averted estimates available from either WHO or Tufts, substitute values were generated. For each such intervention,

¹³ CPI inflation data from International Monetary Fund.

an average cost-per-DALY-averted was calculated using comparable interventions that had at least one available estimate. Comparability was defined based on alignment at the intervention category level, and availability within the same income archetype. This approach ensured that every modeled intervention was assigned at least one cost-per-DALY-averted estimate grounded in empirical data or category-consistent estimates.

Imputation across missing income archetypes. For interventions with partial income-group coverage, missing cost-per-DALY-averted values were imputed using income-group scaling ratios derived from a subset of 36 Tufts interventions that reported cost estimates across all four global income archetypes in the same study. The resulting ratios were as follows:

- Low-income countries (LIC): 1.0
- Lower-middle-income countries (LMIC): 1.4
- Upper-middle-income countries (UMIC): 4.1
- High-income countries (HIC): 7.6

These ratios were applied to scale the available empirical or category-based cost-per-DALY-averted estimates to the missing country income archetypes.

This process produced a complete matrix of cost-per-DALY-averted values for all modeled interventions across all four global income archetypes.

5. Model country-level estimates

A complete intervention-level cost-per-DALY-averted matrix by income archetype was translated into country-specific estimates to ensure contextual relevance. Archetype-level cost values were adjusted using Health Price Index (HPI) factors derived from World Bank country-level HPI data and GDP per capita. Country-level scaling was implemented by applying the ratio of each country's HPI to the GDP per capita of its corresponding country income archetype.

For countries with no estimate of HPI from the World Bank, HPI values were estimated using a linear projection based on the empirical relationship between GDP per capita and HPI across countries.

This procedure produced a comprehensive set of country-level cost-per-DALY-averted estimates for all modeled interventions, encompassing approximately 60,000 country–intervention combinations.

6. Estimate overall costs

Using country-level cost-per-DALY-averted estimates, the total cost of scaling interventions—at the global level and for specific regions and countries—was calculated by combining these cost values with modeled health impact outputs. For each intervention–country combination, cost-per-DALY-averted estimates were multiplied by the projected number of DALYs averted from the health impact model to derive total intervention scaling costs.

Country-level cost-per-DALY-averted estimates, together with corresponding health impact results, were then used to construct cost-effectiveness curves that illustrate the relative cost-effectiveness of individual interventions.

Economic return was estimated as the ratio of GDP uplift to the total cost of scaling interventions for a given geography.

This analysis focuses on interventions that are cost-effective. Given that cost-effectiveness thresholds vary across regions and country contexts, an established benchmark was applied to determine intervention inclusion. Specifically, the WHO cost-effectiveness threshold was used, under which an intervention is considered cost-effective in a given country if the cost-per-DALY-averted is less than three times that country's GDP per capita.

This benchmark has recognized limitations. The WHO has subsequently moved away from endorsing a single global threshold, reflecting concerns regarding its applicability across heterogeneous economic conditions and health system capacities.¹⁴ However, in the absence of a universally accepted alternative that supports consistent global comparison, this threshold was applied as a well-established and interpretable reference point for intervention screening.

¹⁴ Melanie Y. Bertram et al., "Cost-effectiveness thresholds: pros and cons," *Bulletin of the World Health Organization*, December 1, 2016, Volume 94, Number 12.

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