NCD Countdown 2030: efficient pathways and strategic investments to accelerate progress towards the Sustainable Development Goal target 3.4 in low-income and middle-income countries

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Most countries have made little progress in achieving the Sustainable Development Goal (SDG) target 3.4, which calls for a reduction in premature mortality from non-communicable diseases (NCDs) by a third from 2015 to 2030. In this Health Policy paper, we synthesise the evidence related to interventions that can reduce premature mortality from the major NCDs over the next decade and that are feasible to implement in countries at all levels of income. Our recommendations are intended as generic guidance to help 123 low-income and middle-income countries meet SDG target 3.4; country-level applications require additional analyses and consideration of the local implementation and utilisation context. Protecting current investments and scaling up these interventions is especially crucial in the context of COVID-19-related health system disruptions. We show how cost-effectiveness data and other information can be used to define locally tailored packages of interventions to accelerate rates of decline in NCD mortality. Under realistic implementation constraints, most countries could achieve (or almost achieve) the NCD target using a combination of these interventions; the greatest gains would be for cardiovascular disease mortality. Implementing the most efficient package of interventions in each world region would require, on average, an additional US$18 billion annually over 2023–30; this investment could avert 39 million deaths and generate an average net economic benefit of $2·7 trillion, or $390 per capita. Although specific clinical intervention pathways would vary across countries and regions, policies to reduce behavioural risks, such as tobacco smoking, harmful use of alcohol, and excess sodium intake, would be relevant in nearly every country, accounting for nearly two-thirds of the health gains of any locally tailored NCD package. By 2030, ministries of health would need to contribute about 20% of their budgets to high-priority NCD interventions. Our report concludes with a discussion of financing and health system implementation considerations and reflections on the NCD agenda beyond the SDG target 3.4 and beyond the SDG period.

Introduction

The UN Sustainable Development Goal (SDG) target 3.4 calls for all Member States to reduce premature mortality from non-communicable diseases (NCDs) by a third between 2015 and 2030.[1] Some countries have made progress on NCDs in recent decades by scaling up evidence-based therapies, such as drugs for secondary prevention of cardiovascular disease, and targeting risk factors, such as smoking and raised blood pressure.[2,3] However, in a deviation from historical trends, reductions in death rates caused by NCDs have been decelerating since 2010; in some countries, rates have increased.[4] Before the COVID-19 pandemic, most countries were off track in achieving SDG target 3.4.[5,6]

NCDs encompass a broad range of conditions, and there is no universal strategy for meeting SDG target 3.4. In 2020, the NCD Countdown 2030 Collaborators identified a range of epidemiological pathways for countries to achieve SDG target 3.4.[6] For example, historical rates of decline in tobacco-related cancer deaths among women are generally sufficient for achieving the target in sub-Saharan African countries, but not in high-income European countries. These findings suggest that countries could achieve the target by considering trends in locally relevant NCDs and selecting interventions that quickly reduce cause-specific mortality. Unfortunately, the COVID-19 pandemic has upended national NCD programmes.[7] People living with NCDs have been especially affected, often with higher complication rates from infection[8–10] and disruptions in NCD care, leading to excess mortality.[11] As efforts to roll out COVID-19 vaccines accelerate, policy makers and planners will need concrete guidance for making progress on SDG target 3.4—often with overstretched health systems and fewer resources than before the pandemic.

In this Health Policy, we present evidence on the types of interventions that can help achieve SDG target 3.4 in different settings, and the resources required to implement these interventions (panel 1). Our work serves as a starting point for country-specific analyses to inform planning, financing, and implementation. We focus on the later years of the SDG period (2023–30) and on the 123 countries currently classified as low-income and middle-income countries (LMICs), grouped into seven regions used in previous reports. Our report builds on earlier Countdown reports[5,6] and includes demographic and epidemiological estimates that have been published since 2020. Our analyses are accompanied by discussion of implementation challenges and opportunities. We contend that focused scale-up of a small set of cost-effective and feasible interventions will help countries build back better, creating a sustainable foundation for a more ambitious NCD agenda in the decades to come.

Identifying candidate interventions

The interventions to help meet SDG target 3.4 are adapted from the Disease Control Priorities Project.[12–14] The third and most recent edition of Disease Control Priorities (DCP3) included nine volumes published over 2015–18. DCP3 volume 3 on cancer, and DCP3 volume 5 on cardiovascular, respiratory, and related disorders, had model lists of interventions that provided good value for money (usually related to cost-effectiveness), were feasible to implement in LMICs, and addressed a considerable disease burden. Recommendations from DCP3 were peer-reviewed in a process overseen by the US National Academies of Sciences, Engineering, and Medicine,[14] and key findings were summarised in previous reviews.[15,16]

We reviewed the DCP3 lists for any interventions that addressed mortality from the four main types of NCDs (referred to as NCD4 hereafter): cardiovascular diseases, cancer, chronic respiratory diseases, and diabetes (including chronic kidney disease due to diabetes). We identified 21 interventions that DCP3 recommended as essential (ie, cost-effective, feasible, and relevant) and could help countries achieve SDG target 3.4 (table 1), including 15 clinical interventions and six intersectoral policies. The intersectoral policies are population-based policies that are linked to non-health ministries (eg, taxes) but have substantial health benefits.

We compared our intervention list to the WHO Global Action Plan on Non-Communicable Diseases.[17] Our list was fully aligned with WHO's best buys but included several additional clinical interventions, including basic treatments for acute cardiovascular and pulmonary complications, some of which were mentioned in WHO documents. DCP3 also included many interventions, such as rehabilitation and palliative care, that address non-fatal NCD outcomes.[14,18] We note that mental health and wellbeing are included in SDG target 3.4, and self-harm mortality is used as an indicator. Interventions to address mental disorders and reduce self-harm are not discussed in this report, but NCD and mental health strategies are tightly linked, including shared delivery (through primary health care), shared risk factors such as alcohol use, and comorbidity (eg, treatment of depression among persons with NCDs).

The metric of SDG target 3.4, which is the probability of death from NCD4 between ages 30 and 70 years, excludes deaths of people younger than 30 years and deaths that might be averted after 2030; therefore, interventions, such as treatment of childhood cancers and human papillomavirus immunisation, were not considered for further analysis. These interventions are crucial to national NCD strategies and universal health coverage (UHC) benefits packages, even though they do not contribute to the target. Limitations of the target and implications for the NCD agenda are also discussed in this report.

***Panel 1*: Key messages**

- Most low-income and middle-income countries are off track to reach SDG target 3.4 for NCD mortality. To help countries get back on track, we propose a framework for NCD investment that is centred around a model package of 21 interventions that are feasible to implement and can form the backbone of national NCD strategies.
- Implementing these interventions could result in a reduction of a third or more in mortality by 2030 for several specific NCDs, especially cardiovascular diseases. Although most of these interventions are cost-effective in nearly all world regions, national governments could further tailor this package by scaling up the most cost-effective subset of interventions that addresses the top NCD causes locally.
- Under ambitious but realistic implementation conditions, the intervention strategy would allow low-income and middle-income countries to achieve SDG target 3.4, including nearly all world regions and 55% of countries; other countries might fall short of the target because of especially unfavourable recent trends and health system constraints.
- Achieving SDG target 3.4 worldwide would require US$140 billion in new spending over 2023–30, an average of $18 billion annually, but 39 million deaths could be averted over this period and $2·7 trillion in net economic benefits could be generated, with benefits outweighing costs nineteen-to-one. These costs would comprise a considerable share of the health budget (median value of 20% by 2030); mobilisation of additional resources would be required in low-income and lower-middle-income countries.
- Although countries exhibit wide variation in NCD epidemiology and health system capacity, cross-cutting intersectoral policies on tobacco, alcohol, and unhealthy diet are relevant and essential in all countries, contribute two-thirds of the total mortality impact of the package, and can reduce need for costly clinical services.
- We conclude with a summary of non-financial challenges that health planners need to consider when developing their NCD strategies; health workforce development is among the most important of these. As such, advocates and policy makers need to have a long-term approach to NCDs that emphasises feasibility and sustainability and is aligned with national health system strengthening and universal health coverage agendas.

NCDs=non-communicable diseases. SDG=Sustainable Development Goal.

The 21 interventions are a subset of all the options for reducing NCD4 mortality (table 1). For instance, DCP3 and WHO do not include multimodal treatment of oesophageal cancer in their lists, although some countries might already be offering this intervention, and it might be important in countries with a high prevalence of oral tobacco use or alcohol drinking. Table 1

See Online for appendix

	Countdown cause groups
Intersectoral policies	
Alcohol excise taxes	All
Alcohol regulations	All
Tobacco excise taxes	All
Smoking regulations and information, education, and communication	All
Sodium reduction measures	Ischaemic heart disease, ischaemic stroke, haemorrhagic stroke, all other cardiovascular diseases
Trans fat bans	Ischaemic heart disease
Community platform	
Pulmonary rehabilitation	Chronic respiratory diseases
Health centre platform	
Primary prevention for cardiovascular disease	Ischaemic heart disease, ischaemic stroke, haemorrhagic stroke, all other cardiovascular diseases
Secondary prevention for cardiovascular disease	Ischaemic heart disease, ischaemic stroke, all other cardiovascular diseases
Aspirin for suspected acute coronary syndrome	Ischaemic heart disease
Chronic treatment for heart failure	Ischaemic heart disease, all other cardiovascular diseases
Chronic treatment for asthma and COPD	Chronic respiratory diseases
Diabetes screening and treatment	Diabetes
First-level hospital platform	
Medical management of acute coronary syndrome	Ischaemic heart disease
Acute treatment for heart failure	Ischaemic heart disease, all other cardiovascular diseases
Early-stage cervical cancer screening and treatment	Cervix uteri cancer
Acute treatment for asthma and COPD	Chronic respiratory diseases
Referral and specialised hospital platform	
Percutaneous coronary intervention for acute coronary syndrome	Ischaemic heart disease
Management of acute ventilatory failure	Chronic respiratory diseases
Treatment of early-stage breast cancer	Breast cancer
Treatment of early-stage colorectal cancer	Colon cancer and rectum cancer

Diabetes screening and treatment includes glycaemic control (eg, oral medications and insulin as needed), foot care, and screening and treatment of albuminuric kidney disease with angiotensin blockade therapies. Cardiovascular disease preventive therapies among individuals with diabetes are analysed as part of the primary prevention for cardiovascular disease. Early-stage cervical cancer screening and treatment includes screening and treatment of precancerous lesions at health centres. Management of acute ventilatory failure focuses on severe acute exacerbations of asthma and COPD requiring either invasive or non-invasive mechanical ventilation. Specific measures for sodium reduction are specified as per the WHO sodium reduction package: product reformulation, front-of-pack labelling, information, education, and communication on discretionary salt use, and supporting an enabling environment (appendix p 33). COPD=chronic obstructive pulmonary disease. For full descriptions of interventions, including specific types of recommended medications and procedures, see appendix pp 15–34.

Table 1: **High-priority intervention options for reducing mortality from non-communicable diseases**

serves as a model package, reflecting the essentials of NCD4 prevention and treatment that merit special consideration and preferential scale-up. Additional interventions will be relevant in countries with well resourced health systems.

Prospects for reducing mortality from specific NCDs

Worldwide, NCD4 mortality has not decreased quickly enough to reach SDG target 3.4, and some specific causes and risks, such as diabetes and obesity, are increasing, leading to diverging outcomes and increasing inequality across countries.[4] Building on the previous Countdown reports,[5,6] and using mortality estimates that have since become available,[19] we modelled the effect of our interventions on cause-specific and sex-specific mortality by 2030 (appendix pp 4–7). The purpose of this exercise was to understand whether the interventions could help countries meet SDG target 3.4 and to reduce mortality by a third in each specific NCD4. As such, we modelled the effects by instantly increasing the coverage of all interventions to 90% in 2023 and sustaining this coverage level through 2030 (appendix p 37).

Figure 1 shows the global distribution of country-specific rates of decline for both men and women for each NCD4 cause, comparing historical annualised rates of change to rates that would be realised over 2015–30 with full implementation starting in 2023. The figure shows that the interventions would drastically accelerate NCD4 mortality reduction, allowing 90% of countries to achieve the target. The greatest acceleration would be for ischaemic heart disease, with the lowest acceleration for stomach and liver cancer, because interventions for these cancers would be limited to tobacco and alcohol reduction.

The health benefits of behavioural risk reduction accumulate over many years. For example, Kontis and colleagues[20] estimated that eliminating excess risk for chronic respiratory diseases from smoking requires 30–40 years of cessation. These delayed effects are factored into our estimates of potential mortality reduction by 2030 (appendix p 45). Although the health effect of implementing the six intersectoral policies between now and 2030 is sufficient to justify urgent action, it is a subset of the health gains that will accrue as successive cohorts of younger individuals experience lower lifetime risk.[21]

Cost-effectiveness considerations

Because health resources are scarce, many policy makers rely on cost-effectiveness information to set priorities. We analysed the cost-effectiveness of each of our 15 clinical interventions, including variations across world regions (appendix pp 7–9). We modelled the health effects and costs of instantly increasing the coverage of each intervention by 10% in 2023 and sustaining this higher coverage through to 2030 (appendix p 37). The rationale

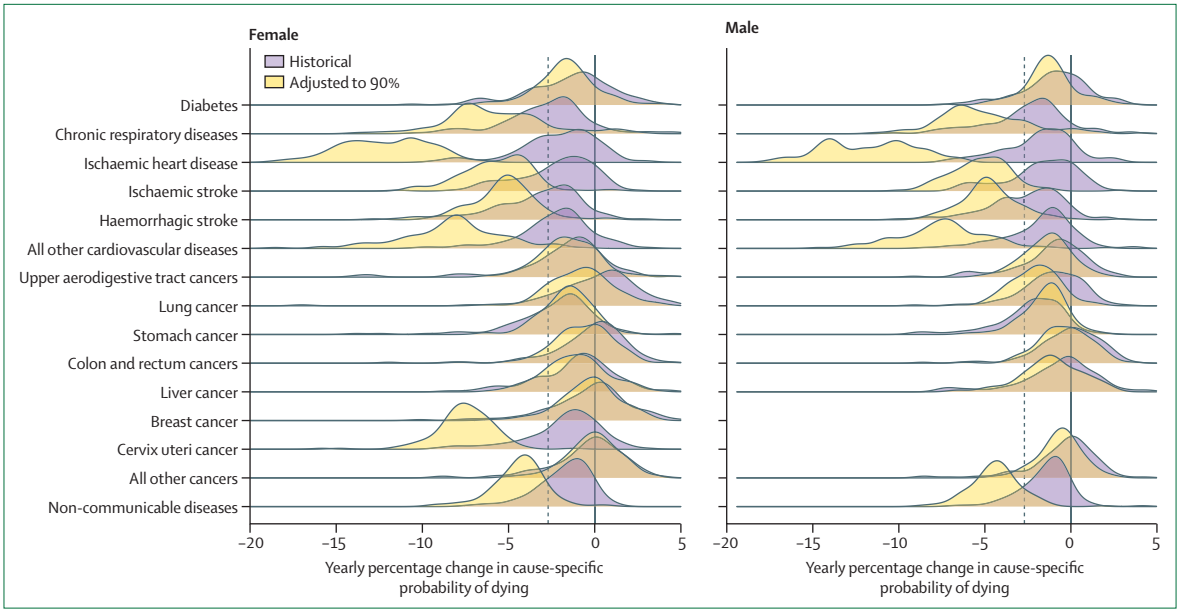

Figure 1: **Achievable reductions in cause-specific mortality from scale-up of priority NCD interventions across low-income and middle-income countries**
The density plots show the distribution of the rate of change in cause-specific mortality across all 123 low-income and middle-income countries. We compare historical (2015–19) average annual rates of change to average annual rates of change that would be observed over the period of 2015–30 if all interventions in table 1 were simultaneously fully implemented in 2023 (including all clinical interventions at 90% population coverage). The vertical dotted line marks the annual rate of change of –2·67%, which corresponds to a reduction in cause-specific mortality by a third over 15 years. The final row shows the distribution of the rate of change in the probability of death from NCD4 between ages 30 and 70 years (ie, the metric for the Sustainable Development Goal target 3.4) as a whole. NCDs=non-communicable diseases. NCD4=four main non-communicable diseases (cancer, cardiovascular diseases, chronic respiratory diseases, and diabetes).

for modelling a small change in coverage was to allow for comparability of cost-effectiveness ratios across interventions and countries with different baseline coverage. We used the Disease Control Priorities Cost Model[22] to calculate costs from the health-care sector perspective in 2020 US dollars.

We defined cost-effectiveness here as the percentage reduction in the probability of death from NCD4 between ages 30 and 70 years per million US dollars spent on each intervention. We used this metric instead of the cost per averted disability-adjusted life-year (DALY) because we were looking specifically at the comparative efficiency of the interventions at achieving SDG target 3.4. In a secondary analysis, we calculated intervention costs per averted DALY; the two metrics were highly correlated for our interventions (appendix p 46).

We do not report cost-effectiveness ratios for the six intersectoral policies. Most of the costs of these policies are borne outside the health sector and by non-government actors (ie, private enterprises and households), so cost-effectiveness ratios based on health-care sector costs are incomplete. It was outside the scope of this report to conduct benefit-cost analyses of these policies from the societal perspective.[23] The mortality impact of these policies is reflected in the other analyses in this report.

The cost-effectiveness findings show that there was a high consistency in comparative cost-effectiveness across regions, with most interventions differing by two to four ranks across regions (figure 2). For example, the ranks for primary prevention of cardiovascular disease ranged from four to six and for treatment of early-stage breast cancer from two to six. A league table for these interventions for all LMICs in the aggregate are in the appendix (p 38).

For policy makers who are more familiar with cost-per-DALY estimates, figure 2 also colour-codes each intervention according to its cost per averted DALY as a proportion of gross domestic product (GDP) per capita. On average, 14 of 15 interventions were below the upper threshold implied by the value of a life-year estimated by the *Lancet* Commission on Investing in Health (2·3 times GDP per capita),[24] which is liberal, and ten interventions were below the health opportunity cost threshold estimated by Claxton and colleagues (0·5 times GDP per capita),[25] the most conservative threshold proposed in the literature.

Efficient pathways to achieving SDG target 3.4

For most countries, achieving 90% coverage of all the interventions in this package by 2023 (figure 1) will be unrealistic. Countries that are closer to reaching SDG target 3.4 might not need to scale up all interventions during the SDG period, allowing them to direct scarce resources to other health objectives. We next identified locally tailored packages that would selectively implement these interventions in different settings based on local cost-effectiveness rankings. Within our population

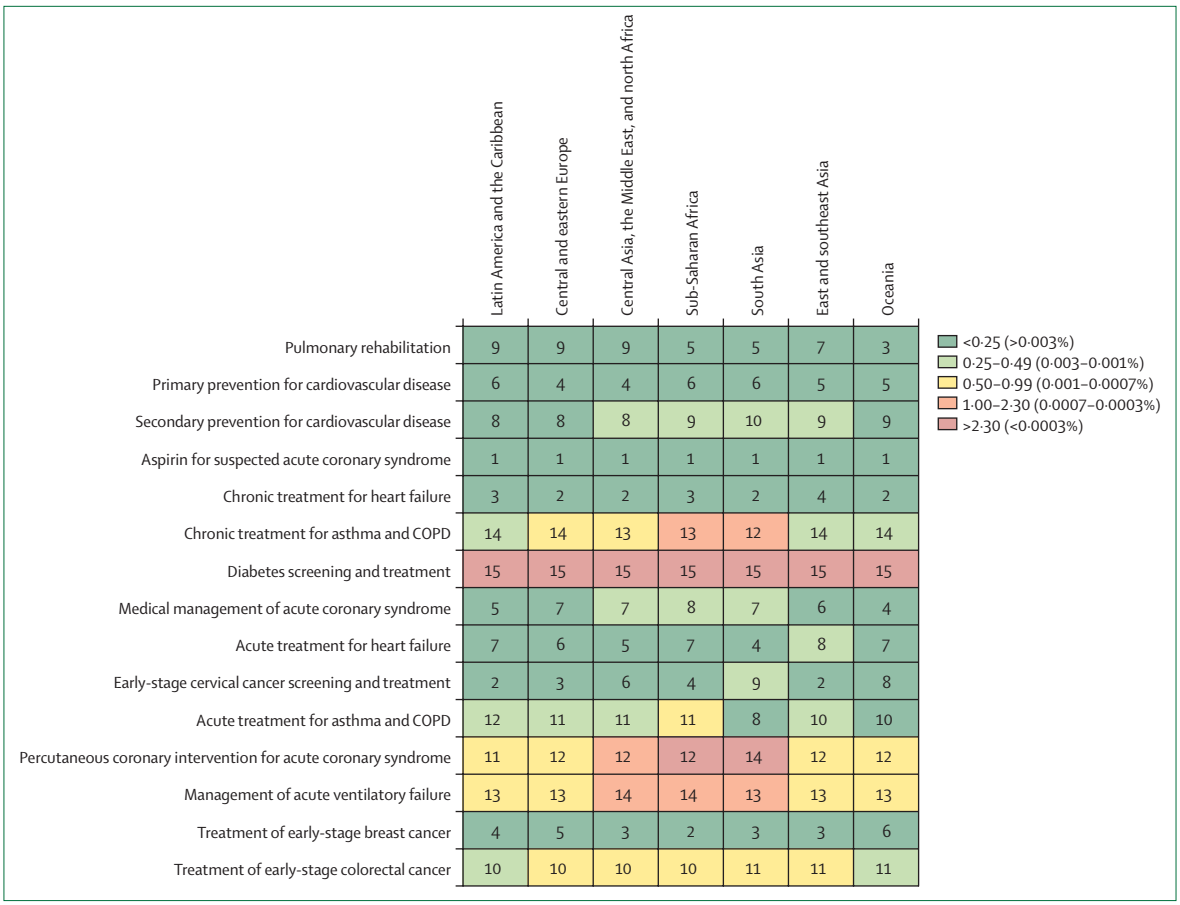

Figure 2: **Cost-effectiveness of priority clinical interventions for NCDs, by world region**
The values reflect the ranking of each intervention from largest to smallest change in the probability of death from NCD4 between ages 30 and 70 years resulting from a US$1 million increase in spending over 2023–30 in each region (for a list of countries in each region see appendix p 36). Cost-effectiveness (appendix pp 7–9) is evaluated from the perspective of the health-care system. To allow comparison with other studies, the values are also colour-coded on the basis of their cost-effectiveness in US dollars per disability-adjusted life-year averted as a share of gross domestic product per capita. Cardiovascular diseases include ischaemic heart disease and ischaemic and haemorrhagic stroke. Costs are in 2020 US dollars. NCDs=non-communicable diseases. NCD4=four main non-communicable diseases (cancer, cardiovascular diseases, chronic respiratory diseases, and diabetes). COPD=chronic obstructive pulmonary disease.

model, we developed an algorithm that sequentially added interventions in order of decreasing cost-effectiveness until the target reduction in the probability of death from NCD4 between ages 30 and 70 years was achieved, or until all interventions had been implemented (appendix pp 10–11). This exercise identified the pathway that would allow each country to achieve the SDG target 3.4 at the lowest cost. Our model included the effects and (health-care sector) costs of fully implementing all six intersectoral policies by 2025.

We found that the number of interventions required to reach the SDG target varied considerably, although the median number across all LMICs was 12 of 15 clinical interventions, once all six intersectoral policies were implemented (table 2). The total number of deaths from NCD4 between ages 30 and 70 years across all 123 LMICs would be reduced by 35%, and all regions except Latin America and the Caribbean and Oceania would achieve the target (appendix p 48), although several countries in each region would not be able to achieve the target, ranging from 24% in central Asia, the Middle East, and north Africa to 55% in sub-Saharan Africa (table 2; appendix p 49). Notably, countries that could not achieve the requisite reduction of a third in mortality would still experience considerable accelerations in rates of decline in cause-specific mortality (appendix p 50).

Cardiovascular disease interventions featured prominently in our algorithm, in part because ischaemic heart disease and stroke are the biggest causes of NCD4 mortality in nearly every country, and the intervention effects occur relatively quickly. Across all LMICs, the interventions with the lowest median rank in the pathway analyses (ie, first to be incorporated by the algorithm) were aspirin for suspected acute coronary syndrome, chronic heart failure treatment, cardiovascular disease primary prevention, and treatment of early-stage breast cancer (appendix p 39). Glycaemic control in diabetes was less cost-effective than most other interventions, but diabetes

management has substantial co-benefits when deployed alongside cardiovascular disease prevention. Because of insufficient data, we did not incorporate economies of scope for different combinations of interventions in our model, but these efficiencies would be important to consider in country-level policy applications. Notably, most of the mortality benefit from diabetes care comes from cardiovascular risk reduction rather than glycaemic control;[26] our analyses included cardiovascular risk management in people with diabetes as part of cardiovascular disease primary prevention.

We identified two particularly important unknowns in our analysis. The first was the temporary increase in NCD4 mortality rates during the pandemic, which would affect our demographic projections and trends in the probability of death from NCD4 between ages 30 and 70 years. The second was the rate at which countries could scale up the interventions starting in 2023. We did a series of scenario analyses reflecting best-case to worst-case values of these two parameters (appendix p 47). We identified a range of five plausible values for each of these two parameters (appendix pp 11–12) and ran our pathway analysis 25 times; estimates presented in this report are for the reference scenario only (appendix p 51).

We found that the excess NCD4 mortality from COVID-19 would probably not, in a strictly epidemiological sense, affect achievement of SDG target 3.4, since it would not directly result in long-term changes in age-specific death rates. However, local control of the pandemic matters greatly: all else equal, a larger shock from the COVID-19 pandemic would result in a greater number of NCD4 deaths during the pandemic (appendix p 51). The rate at which the NCD4 interventions can be scaled up (appendix p 51) would determine the likelihood of achieving the target. This rate could be influenced by COVID-19-related health system collapse, or the strengthening of NCD investments. If new technologies, implementation strategies, and policies could be developed to scale these interventions at the same rate as vertical HIV/AIDS and immunisation programmes (historically, around 4–5% per year, as compared to the 2·5% per year assumed in our reference scenario), 83% of countries could achieve the target.

Costs and benefits of achieving SDG target 3.4

We next estimated the increase in spending (incremental cost) required in the reference scenario and the resulting health and economic gains. To do this, we subtracted the costs of maintaining interventions at their current coverage levels (ie, no additional action) from the total costs of scale-up, giving the incremental costs. We estimated the number of deaths in the reference scenario and subtracted these from projections of cause-specific mortality if no additional action were taken (appendix, pp 4–6), giving the number of deaths averted.

Over 2023–30, the total investment implied in the reference scenario would be US$2·0 trillion, averaging

	Projected reduction in the probability of death from NCD4 between ages 30 and 70 years with no additional action*	Percentage of countries achieving SDG target 3.4†	Median number of clinical interventions across all countries in a region‡	Percentage of countries in a region reducing NCD4 mortality by a third in the reference scenario§
Latin America and the Caribbean	10% (5–17)	0%	12	59%
Central and eastern Europe	17% (15–21)	0%	14	50%
Central Asia, the Middle East, and north Africa	12% (11–20)	5%	5	76%
Sub-Saharan Africa	10% (6–24)	6%	14	45%
South Asia	6% (4–13)	0%	12	50%
East and southeast Asia	15% (8–19)	8%	15	54%
Oceania	10% (8–13)	0%	11	75%
All low-income and middle-income countries	12% (7–19)	4%	12	55%

Data are % (IQR) unless otherwise specified. For a list of countries in each world region see appendix p 36. NCD4=four main non-communicable diseases (cancer, cardiovascular diseases, chronic respiratory diseases, and diabetes). SDG=Sustainable Development Goal. *These values reflect the distribution of country-specific progress towards SDG target 3.4 in each region under a business-as-usual scenario in which no additional policy implementation or scale-up of clinical interventions occurs. †These percentages are based on our model that uses historical trends and factors in demographic shifts that could considerably hinder progress in many countries. Additionally, we used the latest mortality statistics (WHO Global Health Estimates 2019 *vs* Global Health Estimates 2016), and in the reference scenario factored in a modest disruption due to the COVID-19 pandemic (appendix pp 10–12). ‡The effects of all six intersectoral policies are included in the analysis before modelling the effect of sequentially adding clinical interventions. §Although nearly all regions could achieve or nearly achieve the target in the aggregate (appendix p 48), there would be a range of country-specific trajectories, with some countries surpassing the target and others not quite achieving it (appendix p 49).

Table 2: **Findings from pathway analysis: achievement of the SDG target 3.4 at the country level and regional level if all interventions are implemented**

	Total cost of no additional action (billions)	Total cost of accelerated progress (billions)	Incremental cost (billions)*	Total deaths averted (thousands)	Cost per death averted	Incremental annual cost per capita
Latin America and Caribbean	$320	$350	$35	3600	$9800	$6·8
Central and aastern Europe	$160	$170	$12	1900	$6200	$4·5
Central Asia, the Middle East, and north Africa	$190	$200	$7·0	2400	$3000	$1·4
Sub-Saharan Africa	$45	$54	$9·3	3400	$2700	$1·0
South Asia	$160	$180	$21	14 000	$1500	$1·4
East and southeast Asia	$1000	$1100	$57	14 000	$4200	$3·3
Oceania	$1·1	$1·7	$0·56	80	$7000	$6·6
All low-income and middle-income countries	$1900	$2000	$140	39 000	$3600	$2·6

Costs are in 2020 US dollars. Costs and deaths averted are totals over 2023–30. Average annual costs reported in the main text are calculated by dividing these costs by 8 years. Numbers might not add up exactly due to rounding. For a list of countries in each world region see appendix p 36. *Incremental cost is the difference of the total cost of accelerated progress and the total cost of no additional action.

Table 3: **Costs and benefits of achieving the Sustainable Development Goal target 3.4 through scale-up of priority non-communicable disease interventions, by world region**

***Panel 2*: NCD planning and resource mobilisation challenges in Malawi**

Several studies have shown that Malawi has a limited ability to mobilise domestic resources for health. The health budget remains dependent on external aid, with a small margin for reallocation of funds to different programmatic areas. A 2018 resource mapping exercise found that 75% of health sector resources are contributed by 189 external donors,[30] each with their own health priorities and budgets, mostly for communicable, maternal, neonatal, and nutritional diseases. NCDs received less than US$2 million of the $693 million budgeted for the 2017–18 fiscal year, with half the funds coming from donors.

Like many countries without vital registration systems,[31] estimates of cause-specific mortality in Malawi are based on models that use data from other countries. According to WHO data, simply maintaining the 2015–19 rate of decline in the probability of death from NCD4 between ages 30 and 70 years would result in a 31% reduction by 2030, very close to SDG target 3.4. This puts local planners in a conundrum: are the WHO estimates reliable? If so, should the government even focus on NCDs when there are many other pressing concerns? If not, how can a government hedge its bets, investing strategically in NCDs while not diverting resources from successful vertical programmes?

According to our pathway analysis, Malawi could achieve SDG target 3.4 using only the intersectoral policies (table 1), none of which have been fully implemented to date. The costs of this strategy would be modest (about $8000 annually for policy monitoring and enforcement). However, if there is insufficient political will to implement tobacco and alcohol policies, the country could achieve SDG target 3.4 by expanding the three most cost-effective clinical interventions to an additional 20% of the population (appendix p 42). This approach would cost an additional $4·5 million in total over 2023–30 ($560 000 per year) but could avert 3000 deaths ($1500 per death averted) and 54 000 DALYs ($83 per averted DALY) and begin to expand primary health-care capacity to respond to NCDs.

We conclude that one of the most urgent priorities for the NCD agenda in Malawi—and many other countries—is collection of local data on causes of death so that policy makers do not run the risk of being falsely reassured by (modelled) global health estimates. Beyond better measurement, implementation of tobacco and alcohol control policies and a small set of primary health-care interventions, initially at a reduced coverage, is likely to be feasible and will allow the country to make strides on NCDs in the face of considerable fiscal challenges.

NCDs=non-communicable diseases. NCD4=four main non-communicable diseases (cancer, cardiovascular diseases, chronic respiratory diseases, and diabetes). SDG=Sustainable Development Goal.

about $253 billion annually across all LMICs, which is $18 billion higher annually than simply maintaining current coverage ($235 billion annually). Across all LMICs, the per-capita annual incremental cost would be $2·6 on average, representing an additional 0·6% of current gross national income per capita. Regional costs would vary widely, and since each region is comprised of countries with a range of income levels and health-care prices, per-capita costs would be lower-than-average in a region's low-income countries (LICs) and higher in its upper-middle-income countries.

In the reference scenario, 39 million deaths could be averted across all LMICs over 2023–30 (table 3). The overall cost per death averted would be $3600. Using standard methods for valuing mortality risk reduction,[27] we calculated the net economic benefits—ie, economic value of reduced mortality less intervention cost—of achieving the target and benefit–cost ratios. Worldwide, the net benefits would be $2·7 trillion ($390 per capita), roughly 19 times the incremental cost. Net benefits and benefit-cost ratios would vary considerably, although the investments would be very cost-beneficial in all regions (appendix p 41). Our economic analysis shows that, even if some countries could not achieve SDG target 3.4 because of logistical constraints, they would still yield considerable returns and build capacity to do more on NCDs as resources permit.

Domestic financing to achieve SDG target 3.4

US$18 billion annually in new spending to achieve SDG target 3.4 worldwide would be a relatively small sum compared with the size of the overall health economy of these countries ($890 billion). It would also be lower than the additional annual spending needed to finance a comprehensive set of NCD and injury interventions in LICs and lower-middle-income countries ($72 billion, in 2012 US$)[18] and the additional spending required to achieve all the health SDGs across 67 LMICs ($274 billion, in 2014 US$).[28] Some countries would still struggle to finance a basic NCD package through domestic resources alone. Studies before the COVID-19 pandemic that looked at UHC and SDG financing found that LICs, and some lower-middle-income countries, face substantial budgetary shortfalls.[28,29] Countries whose economic growth has been disproportionately affected by the pandemic, such as tourism-dependent LICs, could be drastically affected.

To explore the affordability of our package in different world regions, we used WHO National Health Accounts data and macroeconomic projections from the International Monetary Fund to estimate annual growth in health budgets through 2030. These projections factored in the medium-term macroeconomic effect of the COVID-19 pandemic; we made conservative assumptions about medium-term growth in the health budget using historical trends (appendix pp 12–13). For the median country, the total cost of implementing the locally tailored package would need to be approximately 20% of government health expenditure by 2030 (appendix p 53). This estimate includes the costs of scaling up the higher-priority interventions (in the pathway analysis) and the costs of maintaining the other interventions (table 1) at their current coverage.

For some middle-income countries, spending 20% of the health budget to achieve SDG target 3.4 might be a reasonable proposition, particularly considering their higher NCD burden and level of health system resources overall. Other countries, especially LICs, face challenges in raising sufficient new revenues for their new NCD programmes. The situation is particularly acute in heavily aid-dependent countries with an outsized influence of global health initiatives. Some countries, such as Malawi, could achieve considerable mortality reductions at relatively low cost (panel 2).

It is our view that domestic NCD financing efforts should start by enhancing public finance capability through general taxation or social health insurance, coupled with fiscal reforms.[32] Complementary approaches, such as results-based financing, debt buy-backs and swaps, and public–private partnerships, have shown promise for mobilising private capital and merit further study for specific NCD issues, but their application could be limited by an absence of a robust private sector, especially in LICs.[33,34] We stress the importance of removing harmful or ineffective subsidies, such as those on fossil fuels and some agricultural commodities (eg, sugar, and intensive livestock production), in some countries; these actions could generate substantial fiscal space, leading to more resources for health.[4,35]

National governments should also be made aware that public finance of NCD interventions reduces household out-of-pocket spending and can provide considerable protection against medical impoverishment,[36,37] extending the benefits of NCD investments beyond SDG target 3.4 to SDG target 3.8 (achieving UHC) and SDG target 1 (poverty reduction). Finally, ministries of health urgently need to implement robust and transparent priority-setting and health technology assessment mechanisms to limit the use of low value-for-money NCD technologies, including in the private sector.[38,39] Rationalising NCD spending and aligning national health benefits packages with the model list (table 1) could promote stewardship and respond to increasing pressure from commercial interests.[40] Our recommendations could bring focus to national NCD strategies by guiding scarce resources towards high-value care that benefits the greatest number of patients. In 2020, the Ministry of Health in Ethiopia revised their health benefits package to consider a wide range of NCD interventions,[41] underscoring the importance of priority-setting institutions and mechanisms in shaping the national NCD agenda (panel 3).

The role of development partners and international finance

Our report has important implications for international agencies, bilaterals, and civil society organisations. National governments bear primary responsibility for financing NCD care, and in general, development aid needs to shift from directly financing health care—in all but the poorest countries—to financing global public goods and supporting collective action.[4,24] Less than 2% of development assistance for health is devoted to NCDs;[48] this share has remained stagnant over the past decade and is not proportionate to need or disease burden, even in the poorest countries.[18] Our findings could inform emerging collective finance efforts, such as the Multi-Partner Trust Fund for NCDs,[49] and provide guidance for donors looking for catalytic investment opportunities. Development partners working in countries that are struggling to finance a basic NCD package should strongly consider primary health-care investments that have spill-over benefits for NCD care and protect hard-won gains in priority populations, such as people living with HIV and tuberculosis.[50,51] Other bilaterals could follow the Norwegian government's example by developing NCD strategies.[52]

Advocacy for NCD financing and collective action should not be framed as another global health initiative. The COVID-19 pandemic has shown that siloed programmes are increasingly unfit for purpose and need to be integrated within primary health care.[4,7] The growing burden of multimorbidity and the bidirectional relationships between communicable diseases and NCDs underscore the need to dismantle disease-specific silos, emphasising reforms and investments that improve a wide range of health outcomes. Additionally, missed opportunities to prevent NCDs have arguably increased population susceptibility to COVID-19-related mortality, a pattern that could repeat itself in future pandemics.[53] Pandemic preparedness and global health security cannot be separated from efforts to prevent NCDs and strengthen basic services for chronic care and acute complications.[54]

Panel 3: Priority-setting for NCDs in Ethiopia

NCDs are quickly becoming a major health issue in Ethiopia: the proportion of total deaths due to NCDs increased from 19% in 2000 to 37% in 2017.[42] Surveys have found that nearly all adults have at least one NCD risk factor, although the specific risk factors and their magnitude vary between urban and rural settings.[43] Coverage of essential NCD interventions range from 5% to 10%, and more than 90% of health centres and hospitals do not have adequate human resources for managing NCDs.[44] Only 11% of total health expenditure (US$33 per capita in 2017) is spent on NCDs, with 60% of costs paid out-of-pocket.[45,46]

Ethiopia's 2019 Essential Health Services Package[41] emphasised the growing burden of NCDs and their risk factors, which were generally neglected in previous health sector strategies.[47] The Package serves to rationalise NCD investment, particularly in advanced care. For example, it includes several services for high-burden cancers, and it categorises each as high, medium, or low priority. In the case of oesophageal cancer, endoscopic and pathological diagnosis is given high priority, multimodal treatment of oesophageal cancer is given low priority (due to high cost and low effectiveness), and tobacco and alcohol cessation interventions to prevent oesophageal and other cancers are given high or medium priority. Explicitly prioritising different components of oesophageal cancer care while emphasising the value of risk reduction and the need to focus scarce resources on risk reduction and diagnosis and surveillance ensures that the condition is not neglected altogether; this prioritisation scheme can be reassessed as more resources become available and the Essential Health Services Package is revised.

Unfortunately, because of budget shortfalls and the need to address the priorities of global health initiatives, the medium-priority NCD interventions in the Package are offered only on a cost-sharing basis, and the low-priority NCD interventions are offered only on a full cost-recovery basis. Given development partners' weaker engagement on NCDs, and insufficient public resources, the financial responsibility for achieving Sustainable Development Goal target 3.4 in Ethiopia will probably fall largely on patients.

NCDs=non-communicable diseases.

	Principal health worker implementing intervention	Typical annual case volume per 100 000 population	Complexity of case management system	Potential for major human resource obstacles	Potential for major drug, equipment, or facility obstacles
Community platform					
Pulmonary rehabilitation	Allied professionals	45	Lower	Higher	Lower
Health centre platform					
Primary prevention for cardiovascular disease	Clinical officers	3200	Lower	Moderate	Lower
Secondary prevention for cardiovascular disease	Clinical officers	2600	Moderate	Higher	Moderate
Aspirin for suspected acute coronary syndrome	Nurses	170	Lower	Lower	Lower
Chronic treatment for heart failure	Clinical officers	460	Moderate	Moderate	Moderate
Chronic treatment for asthma and COPD	Clinical officers	3600	Lower	Moderate	Moderate
Diabetes screening and treatment	Clinical officers	4300	Moderate	Moderate	Lower
First-level hospital platform					
Medical management of acute coronary syndrome	Clinical officers	260	Moderate	Lower	Moderate
Acute treatment for heart failure	Clinical officers	230	Moderate	Moderate	Moderate
Early-stage cervical cancer treatment	Clinical officers	2	Lower	Moderate	Higher
Acute treatment for asthma and COPD	Clinical officers	560	Moderate	Moderate	Moderate
Referral and specialty hospital platform					
Percutaneous coronary intervention for acute coronary syndrome	Specialist doctors	45	Higher	Higher	Higher
Management of acute ventilatory failure	Generalist doctors	33	Higher	Moderate	Higher
Treatment of early-stage breast cancer	Specialist doctors	4	Higher	Higher	Higher
Treatment of early-stage colorectal cancer	Specialist doctors	4	Higher	Higher	Higher

Descriptions of the data inputs and criteria used to make these assessments are in the appendix (pp 13–15). The principal health worker implementing intervention is the primary provider of the main components of the intervention. The typical case volume per 100 000 population is taken from estimates of the number of persons requiring the intervention (at 100% population coverage) from the cost model used in this report. The last three columns reflect differential constraints to scale-up that might emerge if specific countries were to implement the interventions listed in table 1 over the next 8 years. The information included in this table shows how health system capacity and anticipated barriers to scale-up might serve as an adjunct to cost-effectiveness estimates, influencing the prioritisation of different interventions in different countries. COPD=chronic obstructive pulmonary disease.

Table 4: **Health system implementation requirements for priority clinical interventions for non-communicable diseases**

Our assessment of costs and benefits aligns with previous country-specific NCD investment cases that have shown high returns.[55,56] Policy makers can be assured that these NCD interventions represent a good use of money, on par with many interventions for the unfinished agenda of communicable, maternal, perinatal, and nutritional conditions.[24,57] Many governments face international and local pressure to deliver on the unfinished agenda. We do not advocate for diversion of resources from successful, cost-effective programmes. Instead, we propose that any increases in health spending carefully balance the urgent need to close gaps in maternal and child health and communicable disease outcomes with the need to enhance capacity to prevent and treat NCDs, which are now responsible for comparable loss of health and other emerging health issues. Rapid epidemiological and demographic transitions in LICs and lower-middle-income countries mean that there is a substantial opportunity cost to not building capacity for NCDs: many of these countries already have the highest NCD mortality rates in the world, and their situation, and thus global inequalities, will worsen without pre-emptive action.[4,58]

Non-financial implementation considerations

Adequate funding is necessary but not sufficient to deliver on SDG target 3.4; non-financial barriers also need to be addressed. To date, the six intersectoral policy interventions in the package have been insufficiently implemented worldwide, including in LMICs.[59] These policies require considerable political will, a shift towards a whole-of-government approach to health,[60] and strong civil society support.[61] Tobacco taxes are particularly effective, but in many countries, tax

rates have not kept up with income growth, so the affordability of cigarettes has either stayed the same or increased over time.[62] Top priorities for international collective action[4] in the coming decade include better monitoring of the effectiveness of health taxes using scorecards that factor in affordability, tax structure, and other considerations beyond prices,[63] and support for regional harmonisation of fiscal and regulatory policies to reduce smuggling between countries with porous borders.[64]

Taxes and regulations on unhealthy products are usually met with strong and influential opposition from the industries concerned, so another priority for collective action in the coming years will be supporting LMICs to help counter industry efforts and reduce resistance. In some cases, health advocates will need to call for roll-back of policies that are too accommodative to industry and less effective, such as voluntary (rather than mandatory) food regulations.[65] The stakes are high: fully implementing these six intersectoral policies, without even scaling up any clinical interventions, could achieve a 24% reduction in the probability of death from NCD4 between ages 30 and 70 years worldwide, accounting for about two-thirds of the health gains in the reference scenario (appendix p 43). However, if these policies were not implemented, an additional US$38 billion annually would need to be spent on clinical interventions to achieve similar mortality reductions (appendix p 44)—triple the costs we estimated in the reference scenario.

Cost-effectiveness is not the only criterion by which countries can set priorities to achieve SDG target 3.4. Most of the interventions we analysed require a skilled health workforce that can deliver longitudinal care and has access to adequate supplies of medications and diagnostics. Table 4 presents several characteristics (appendix pp 13–15) related to implementation feasibility in very resource-limited settings. The potential for substantial human resource bottlenecks (eg, long training times for oncologists and cardiologists) might temper local enthusiasm for some interventions in settings where preservice training programmes are relatively less developed or have been disrupted by the pandemic. In addition, although we presume public finance of the intervention package, most countries will require some component of private sector provision. Contracting with private sector providers to implement priority interventions has notable strengths and pitfalls.[4]

The rate at which clinical interventions can be scaled is a key factor in determining achievement of SDG target 3.4. Scale-up will require new case-finding efforts, especially for conditions that are largely asymptomatic and often go undiagnosed, and complementary measures to ensure high-quality care.[66] Organised screening activities need to be implemented for cervical cancer and cardiovascular disease primary prevention; these can be readily integrated into general primary health care and into communicable diseases programmes in some cases (eg, HIV/AIDS).[51] In addition, operation and implementation research perspectives are urgently needed to design, refine, and scale approaches to delivering care, especially in hard-to-reach populations.[67,68] To expand access to NCD care, including specialised providers, health ministries should consider developing telehealth policies and strategies that align with their locally tailored package.[69]

Even when cost-effective primary health-care interventions are an option, as is the case for cardiovascular disease, interventions at referral and specialised hospitals warrant consideration within national NCD strategies.[18] For example, administration of multimodal cancer therapies is best done at referral centres, which can provide support for early detection and primary treatment efforts at first-level hospitals.[70] Referral hospitals also serve as teaching centres that can oversee preservice and in-service training of the primary health-care workforce on NCD management and help provide quality assurance.[71]

Limitations and caveats

The analyses we undertook in this report have several important limitations and caveats (appendix pp 34–35). There is a great deal of uncertainty regarding mortality trends since 2019 that we attempt to address through scenario analyses. Intervention-specific parameters are derived from the best available evidence, but data in LMICs are scarce, especially on intervention costs and coverage levels. Our modelling assumes the COVID-19 pandemic will be under control in most countries by 2023, but faltering roll-out of COVID-19 vaccines and emergence of new variants might extend this timeline and further constrain action on NCDs. Our report focuses on one NCD outcome, premature mortality. Health systems have many objectives, including reductions in non-fatal diseases and improvements in non-health outcomes, such as pain and distress, and financial protection. Finally, the recommendations in this report are intended to be generic guidance, not a prescription. We merely provide a framework, acknowledging that local cultural, political, and economic factors will greatly influence the application of our work in particular countries.

Conclusion

This Health Policy lays out an ambitious but pragmatic approach to helping LMICs get back on track towards achieving SDG target 3.4 in the wake of the COVID-19 pandemic. Focusing on a relatively small number of highly cost-effective NCD interventions to scale up fits with the progressive universalist approach to UHC.[24,72] The interventions featured in this report cover a range of diseases, risk factors, and delivery platforms and build a foundation for future expansion of NCD services within integrated UHC systems.

Our report has implications for NCD target-setting beyond 2030. Unlike communicable, maternal, perinatal, and nutritional conditions, NCDs are less well suited to short-term targets, especially on mortality. Some countries that invest in these interventions might fail to achieve SDG target 3.4, but these investments could contribute to long-term sustained reductions in NCDs. We propose that discourse about NCD targets should be reoriented for the long term, particularly in the leadup to the UN High-Level Meeting on NCDs in 2025. Future global goals, if they are to be developed at all, should bear in mind the marked heterogeneity in NCD epidemiology and health system capacity across countries. Targets should be set to be achievable in the poorest countries and include both outcome and process targets and indicators, emphasising interventions that make health systems more resilient, nimble, equitable, and responsive to accelerating demographic and epidemiological transitions. Further, since population ageing will only accelerate in the next decades, post-2030 targets will increasingly need to monitor NCD outcomes among individuals over age 70 years.[73]

We conclude that achieving SDG target 3.4 is realistic in many countries, although some LICs and lower-middle-income countries might require considerable financial and technical support from the international community. Additionally, new delivery approaches are urgently needed to support rapid scale-up of these interventions. Although SDG target 3.4 calls for substantial reductions in NCD mortality, the reality is that the future of global health is a future dominated by NCDs. By investing now, countries can alter this epidemiological trajectory to enhance the health of working-age adults and save scarce public resources, especially by implementing intersectoral policies to reduce tobacco, alcohol, and sodium intake. The discourse around NCD priorities must shift away from quick wins and siloed thinking: the NCD agenda is an integral part of sustainable development.[74] Fundamentally, investments in NCD prevention and care are investments in the health systems of tomorrow, and they can yield high returns during the SDG period and beyond, provided they are made wisely.

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Contributors

DAW designed the study with input from OFN, KC, and ME. WTM, SJP, YK, and AG collected and analysed the data and developed the tables, figures, and appendix. All authors interpreted the data. DAW drafted the manuscript. All authors revised the draft manuscript critically for important intellectual content. The views expressed in this report are solely the responsibility of the authors and they do not necessarily reflect the views, decisions, or policies of the institutions with which they are affiliated.

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