

Accounting for health opportunity costs in health benefits package design

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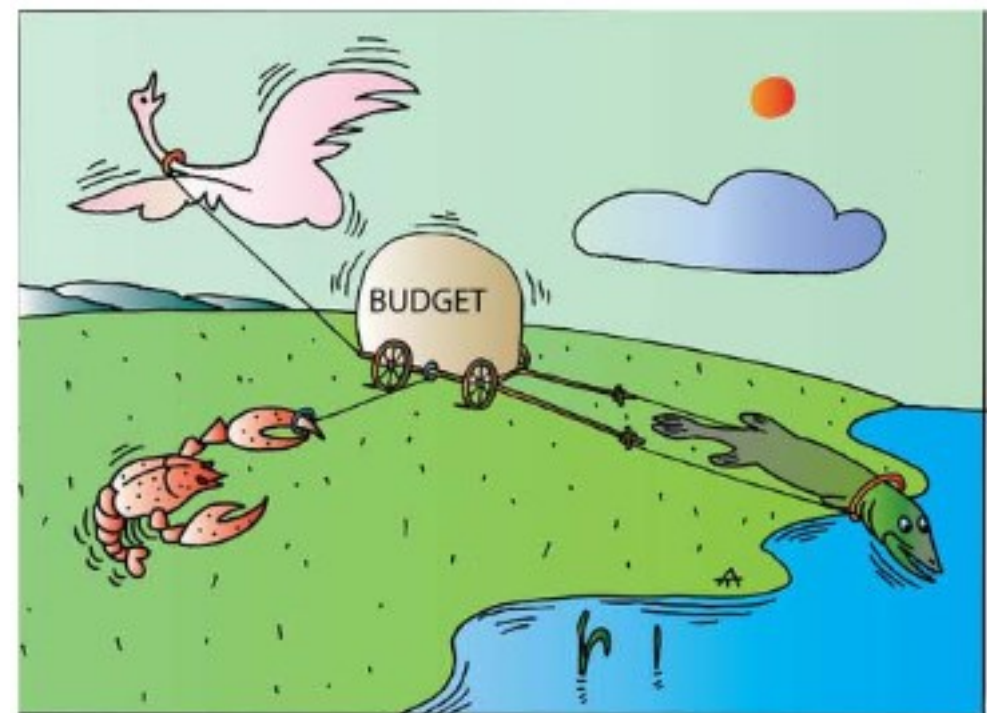
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RED CRITERIA

19 July 2018

Why set priorities using economic criteria?

- All health care systems make **choices about the allocation of health care resources**
- The underlying problem is one of **scarcity of resources**:
 - Not everything that offers a benefit can be feasibly funded
- The key notion of **Forgone Benefits** (Opportunity Costs)
- The underlying problem is one of scarcity of resources:
 - If resources are spent on one intervention, they are forgone for use elsewhere



Health benefits packages (HBPs)

- Method of **explicitly defining** which health services are provided through public expenditure
- There are many objectives of health care delivery, but principal amongst them is the generation of **health** itself
 - Additional objectives may include financial protection, improving equity, etc.

What do we need to know?

- What are the **health benefits** and **costs**?
 - Impact on length of life and quality of life
 - Comparable across different disease areas
 - Disability adjusted life years (DALYs) averted or quality adjusted life years (QALYs) gained

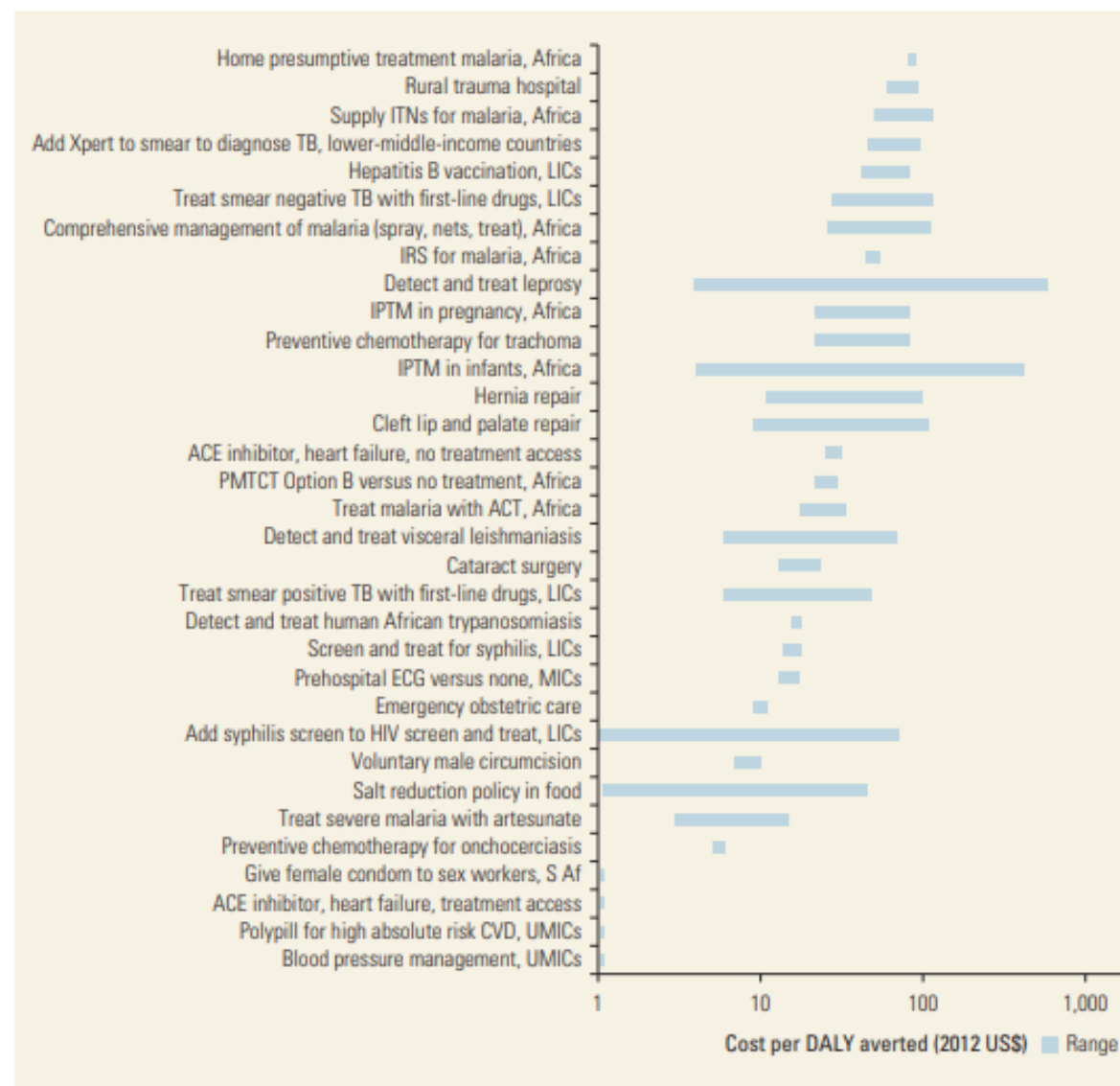
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- Estimates of the additional health benefits and costs
 - Combine evidence from multiple sources
 - Decision analytic modelling

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- Estimates of the additional health benefits and costs
 - Combine evidence from multiple sources
 - Decision analytic modelling
- Summary measure of cost-effectiveness
 - Incremental cost-effectiveness ratio (ICER)
 - Cost per disability adjusted life year (DALY) averted
 - Cost per quality adjusted life year (QALY) gained

Figure 7.1 Interventions Costing Less than US\$100 per DALY Averted for Adults



Note: ACE = angiotensin converting enzyme; ACT = artemisinin-based combination therapy; CVD = cardiovascular disease; ECG = electrocardiogram; IPTM = treatment for malaria; IRS = indoor residual spraying; ITNs = insecticide-treated nets; LICs = low-income countries; mgt = management; MICs = middle-income countries; UMICs = upper-middle-income countries.

Source: Jamison, D. T., H. Gelband, S. Horton, P. Jha, R. Laxminarayan, C. N. Mock, and R. Nugent, editors. 2018. Disease Control Priorities: Improving Health and Reducing Poverty. Disease Control Priorities (third edition), Volume 9. Washington, DC: World Bank. doi:10.1596/978-1-4648-0527-1. License: Creative Commons Attribution CC BY 3.0 IGO

AMR B: Cost effectiveness results for Tuberculosis

Interventions:Codes_and_Descriptions	Coverage	Cost per year (I\$, millions) per one million_population [i.e. cost per capita]	% Program costs	% Patient costs	DALYs averted per year per one million_population	Average Cost per DALY averted	Incremental Cost per DALY averted
TB-1: SmearPos: Treatment of new smear-positive cases only under DOTS	50%	0.56	82%	18%	46,795	12	Dominated
TB-2: SmearPosNeg: As for SmearPos, plus treatment of smear-negative cases under DOTS	50%	0.63	78%	22%	48,535	13	Dominated
TB-3: SmearPosMDR: As for SmearPos, plus DOTS-plus treatment	50%	0.77	65%	35%	47,651	16	Dominated
TB-4: Combination: As SmearPos, plus DOTS treatment of smear-negative cases plus DOTS-plus standardized second-line drug re-treatment	50%	0.83	63%	37%	49,371	17	Dominated
TB-5: SmearPos: Treatment of new smear-positive cases only under DOTS	80%	0.82	81%	19%	74,872	11	Dominated
TB-6: SmearPosNeg: As for SmearPos, plus treatment of smear-negative cases under DOTS	80%	0.93	76%	24%	77,655	12	Dominated
TB-7: SmearPosMDR: As for SmearPos, plus DOTS-plus treatment	80%	1.15	62%	38%	76,241	15	Dominated
TB-8: Combination: As SmearPos, plus DOTS treatment of smear-negative cases plus DOTS-plus standardized second-line drug re-treatment	80%	1.25	61%	39%	78,994	16	Dominated
TB-9: SmearPos: Treatment of new smear-positive cases only under DOTS	95%	0.97	81%	19%	88,910	11	11
TB-10: SmearPosNeg: As for SmearPos, plus treatment of smear-negative cases under DOTS	95%	1.12	77%	23%	92,216	12	46

Incremental cost-effectiveness ratios (ICERs)

	Expected cost (\$)	Expected DALYs averted
B	700	5
A	500	4

- Incremental cost of B compared to A = $C_B - C_A = \$200$
- Incremental benefit of B = $H_B - H_A = 1$
- $ICER = (C_B - C_A) / (H_B - H_A) = \$20,000 / 1 = \$200 / \text{DALY averted}$
- Should we change to B or stick with A?

Fundamental principles



Fundamental principles

Guide to the methods of technology appraisal 2013 (PMG9)

- 1.4.2 In general, a technology can be considered clinically effective if, in normal clinical practice, it confers a health benefit, taking account of any harmful effects and opportunity costs. A technology can be considered to be cost effective if its health benefits are greater than the opportunity costs of programmes displaced to fund the new technology, in the context of a fixed NHS budget. In other words, the general consequences for the wider group of patients in the NHS are considered alongside the effects for those patients who may directly benefit from the technology.

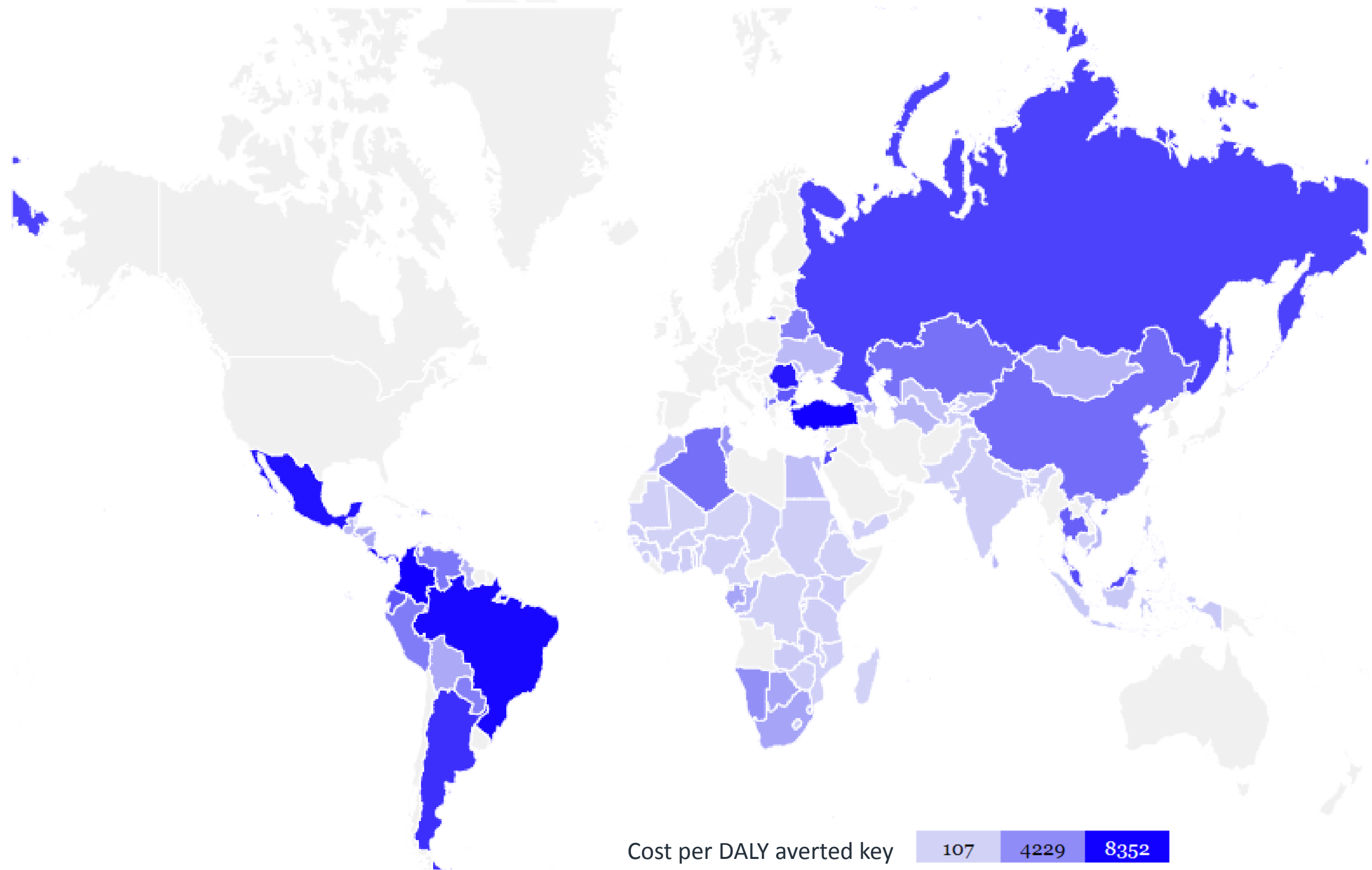
Estimating the opportunity cost

- Opportunity cost of a new intervention funded:
 - with additional resources
 - What are the health effects of other things we could choose to do if the resources were made available for other uses?
 - from existing resources
 - What are the health effects of those things we will need to give up are likely to give up if we commit these resources?
- Need to know what the health care system is currently able to afford to generate gains in health

Estimating the opportunity cost

- What is the health care system currently able to afford to generate gains in health?
 - Recent estimates from higher income countries
 - UK £12,936 per QALY (Claxton et al 2015)
 - Australia AUS\$28,033 per QALY (Edney et al 2018)
 - Spain €21,000 and €24,000 per QALY (Vallejo-Torres et al 2016)
 - Netherlands, Norway, South Africa
 - Potential implications for other HCS (Woods et al 2016)
 - Using published estimates of the mortality effect of health care expenditure from country level data (Ochalek et al 2015)

What is the health care system currently able to afford to generate gains in health?



Source: <https://www.york.ac.uk/che/research/teehta/health-opportunity-costs/estimating-health-opportunity-costs-for-lmics/#tab-4>

Created using Open Heat Map (www.openheatmap.com)

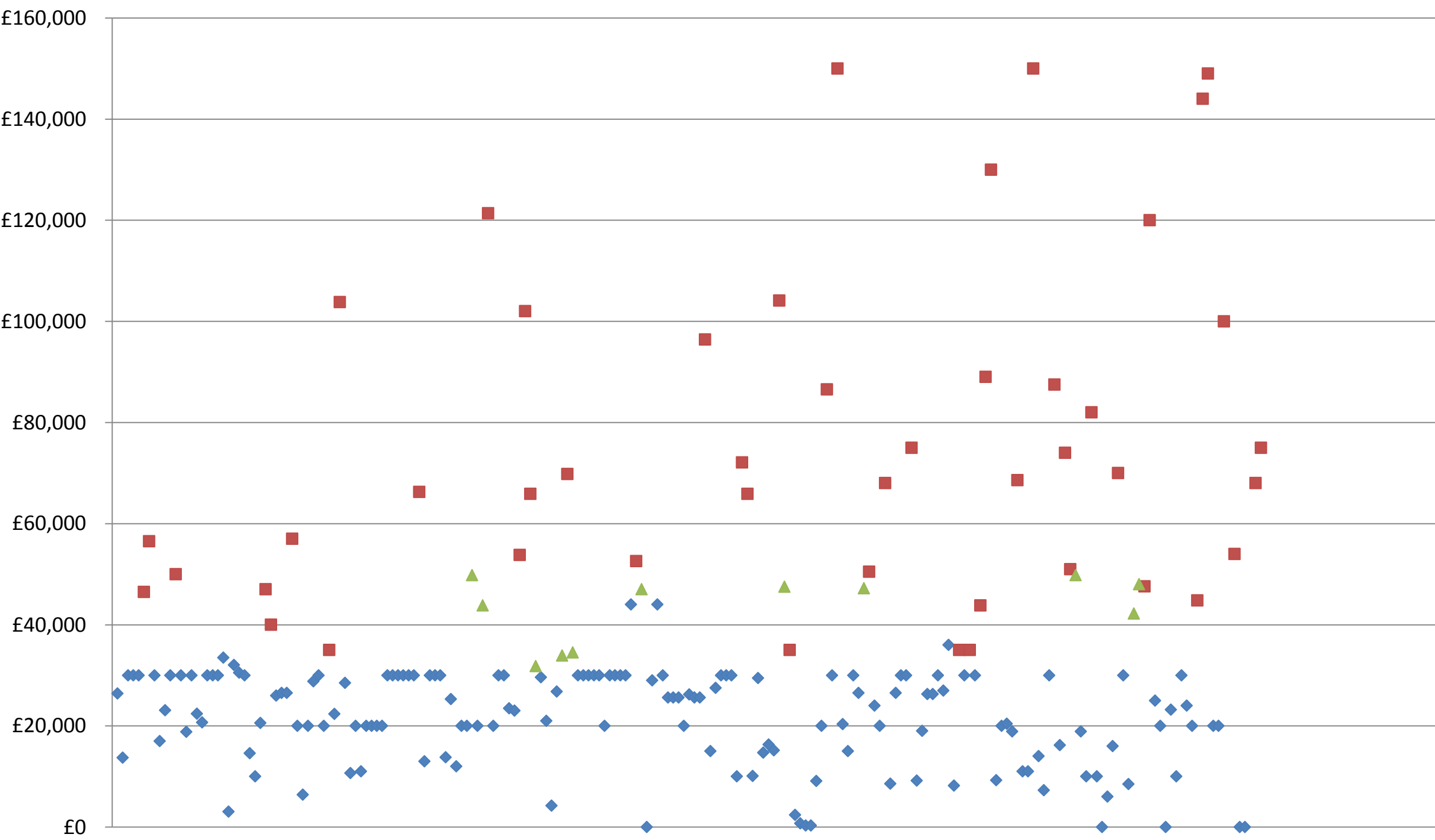
Clarity about cost-effectiveness “thresholds”

- Health opportunity costs
 - “Supply side”
 - What the health care system is currently able to afford to generate gains in health
- Implied values or norms
 - WHO-CHOICE 1 and 3x GDP per capita
 - NICE (UK) £20,000 to £30,000 per QALY
- Society’s monetary valuation of health gains
 - “Demand side”
 - Tend to be higher than “supply side” estimates

Results of NICE appraisal (2007 to Sept 2013)

◆ Recommended/ optimised ■ Not recommended ▲ Recommended under EoL

Incremental cost-effectiveness ratio (assessed by NICE)



TA114

TA296

Source: NICE

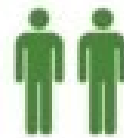
What should the “threshold” be?

Example of the UK

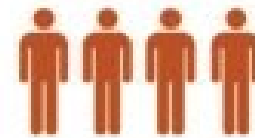
- NICE threshold range (2004)
 - £20,000 to £30,000 per QALY (implied by past decisions)
 - NICE does not reject below £30,000 per QALY
 - Evidence that the effective threshold is £40,000 per QALY
 - In some circumstances £50,000 per QALY
 - £100,000 and £300,000 per QALY when appraising treatments for ‘very rare diseases’
- Estimate of what the health care system is currently able to afford to generate gains in health
 - £12,936 per QALY (Claxton et al 2015)

**"Standard" technology with an ICER of £26,000 per QALY
(cost-effective under £20,000-£30,000 per QALY threshold)**

Health gains



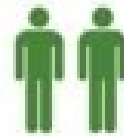
Health losses



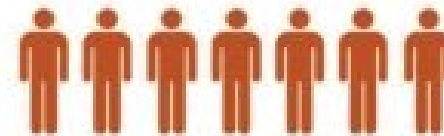
2x greater

**"End-of-life" technology with an ICER of £45,500 per QALY
(cost-effective under £50,000 per QALY threshold)**

Health gains



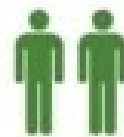
Health losses



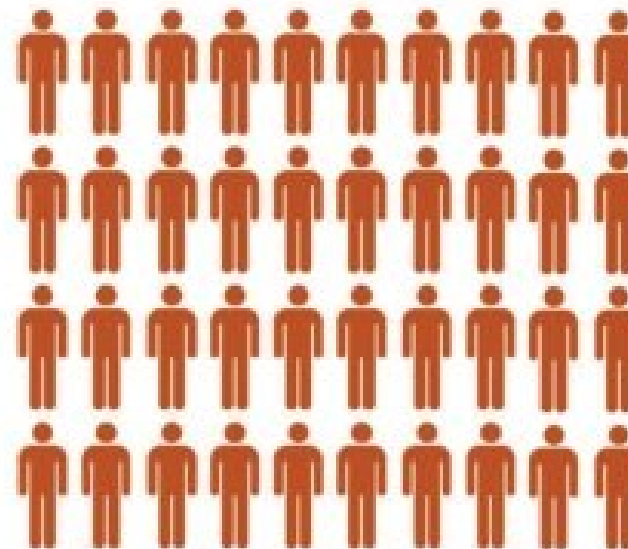
3.5x greater

**"Very rare disease" technology with an ICER of £260,000 per QALY
(cost-effective under maximum £300,000 per QALY threshold)**

Health gains



Health losses



20x greater

Figure 1. Health gains and losses when NICE recommends a new health technology, assuming that a QALY is forgone by other NHS patients for every £13,000 spent on the technology.

Consequences of using a “threshold” that is too high

- Does not reflect how much health the HCS currently delivers
 - Reduction in health outcomes
 - Underestimates the value of increased health expenditure
- For example: using “threshold” of £30,000 per QALY when the health care system is able to produce health at a rate of 1 QALY per £12,946
 - Intervention at £26,000 is implemented but reduces health outcomes overall
 - Additional £10 million would gain 773 not 273 QALYs

What do we need to know to inform HBP design?

- Requirements
 - Per patient costs
 - Per patient benefits
 - Estimate of what the health care system is currently able to afford to generate gains in health (i.e., a measure of opportunity cost)
- Other commonly used inputs
 - ICERs
 - Enable categorical assessment of cost-effectiveness
 - Thresholds
 - Can have varying empirical and conceptual foundations
 - Should represent what the health care system can currently afford to generate gains in health

Accounting for the scale of costs and benefits

- Need a measure of the scale of the potential health impact of including an intervention in the HBP net of associated health opportunity costs
 - Net health impact (net DALYs averted)
 - Difference between DALYs averted by an intervention and DALYs that could have been averted with any additional HCS resources required to implement it, or, if the intervention saves HCS costs, it is the DALYs averted by the intervention plus the DALYs that can also be averted with the cost savings offered
 - Financial value to the HCS
 - Amount of additional healthcare resources that would be required to deliver the equivalent net DALYs averted with other interventions

Accounting for the scale of costs and benefits

- Which interventions represent ‘best buys’ for the HCS and should be prioritised?
- How can objectives beyond improving population health be considered?
- Where should investments in scaling up interventions and health system strengthening be made?



* Ochalek, J, Revill, P, Manthulu, G, McGuire, F, Nkhoma, D, Rollinger, A, Sculpher, M & Claxton, K 2018, 'Supporting the development of a health benefits package in Malawi' *BMJ Global Health*, vol 3, no. 2,

** Government of the Republic of Malawi, Health Sector Strategic Plan II 2017-2022: Towards Universal Health Coverage, 2017.

Accounting for the scale of costs and benefits

- **Which interventions represent ‘best buys’ for the HCS and should be prioritised?**
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Which interventions to include?

- In a hypothetical simple world we would include the interventions that are cost-effective at our benchmark (e.g., \$61/DALY averted)

Intervention	Cost-effectiveness ratio
A	20
B	20
C	40
D	60
E	80

What interventions to prioritise?

- A and B same cost effectiveness ratio
- A averts fewer net DALYs than B or C per patient

Intervention	Cost per patient	DALYs averted per patient	patient population	Cost-effectiveness ratio	Net DALYs averted at 100% implementation
A	100	5	1	20	3
B	400	20	1	20	13
C	600	15	1	40	5
D	900	15	1	60	0
E	800	10	1	80	-3

What interventions to prioritise?

- Varying the size of the patient population

Intervention	Cost per patient	DALYs averted per patient	patient population	Cost-effectiveness ratio	Net DALYs averted at 100% implementation
A	100	5	1,000	20	3,361
B	400	20	500	20	6,721
C	600	15	10,000	40	51,639
D	900	15	1,000	60	246
E	800	10	10,000	80	-31,148

Prioritising interventions in terms of impact on overall population health (net DALYs averted)									
#	Intervention	ICER	Population DALYs averted		Implementation level	Total cost	Cumulative cost	Total DALYs averted	Net DALYs averted (full imp.)
			per 1,000	Cases per annum					
38	Male circumcision	\$ 22	45	4,073,429	100%	\$ 146,729,553	\$ 146,729,553	39,634,464	25,423,008
30	Management of obstructed labor	\$ 12	86	91,844	100%	\$ 1,099,805	\$ 147,829,358	2,497,118	2,025,734
4	Isoniazid Preventive Therapy for HIV+ no TB	\$ 1	887	55,132	100%	\$ 79,518	\$ 147,908,876	1,118,463	1,097,909
5	First line treatment for new TB Cases for adults	\$ 3	393	14,465	100%	\$ 178,018	\$ 148,086,894	1,045,196	1,001,800
7	First line treatment for new TB Cases for children	\$ 3	393	12,285	100%	\$ 116,948	\$ 148,203,842	887,697	850,840
23	Management of pre-eclampsia (Magnesium sulphate)	\$ 6	168	20,022	100%	\$ 45,439	\$ 148,249,281	534,719	482,789
9	Clean practices and immediate essential newborn care (home)	\$ 3	368	671,464	100%	\$ 415,687	\$ 148,664,968	237,281	226,760
33	Households owning at least one ITN/LLIN	\$ 13	77	6,751,618	100%	\$ 13,736,789	\$ 162,401,757	228,063	179,981
43	Cesearian section	\$ 32	31	33,982	100%	\$ 671,704	\$ 163,073,461	327,465	156,536
2	Mass media	\$ 1	903	16,879,044	100%	\$ 7,608,778	\$ 170,682,239	150,390	147,674
28	Labor and delivery management	\$ 11	89	918,437	100%	\$ 1,281,436	\$ 171,963,675	170,442	139,385
27	PMTCT	\$ 11	94	52,791	100%	\$ 600,432	\$ 172,564,107	157,074	129,751
6	First line treatment for retreatment TB Cases for adults	\$ 3	393	1,808	100%	\$ 99,632	\$ 172,663,740	130,651	125,227
29	Cesearian section (with complication)	\$ 12	86	5,051	100%	\$ 171,925	\$ 172,835,665	137,341	111,415
8	First line treatment for retreatment TB Cases for children	\$ 3	393	1,536	100%	\$ 65,831	\$ 172,901,496	110,963	106,356
...
1	Cotrimoxazole for children	cost saving	...	127,265	100%	\$ 219,803	\$ 248,642,789	318	22,564
15	Malaria treatment: Uncomplicated (children, <15 kg)	\$ 4	260	1,042,154	100%	\$ 4,576,454	\$ 253,219,243	14,115	13,231
16	Malaria treatment: Uncomplicated (children, >15 kg)	\$ 4	260	1,042,154	100%	\$ 4,768,246	\$ 257,987,489	14,115	13,231
17	Malaria treatment: Uncomplicated - 2nd line (children, <15 kg)	\$ 4	260	1,042,154	100%	\$ 35,322	\$ 258,022,811	14,115	13,231
18	Malaria treatment: Uncomplicated - 2nd line (children, >15 kg)	\$ 4	260	1,042,154	100%	\$ 70,685	\$ 258,093,496	14,115	13,231
35	Under five children who slept under ITN/LLIN	\$ 13	77	494,267	100%	\$ 1,005,632	\$ 259,099,129	16,696	13,176
42	Schistosomiasis Mass drug administration	\$ 29	35	388,695	100%	\$ 76,527	\$ 259,175,656	23,754	12,562
45	Antibiotics for pPRoM	\$ 40	25	64,291	100%	\$ 38,796	\$ 259,214,452	29,509	10,473
37	Blood safety	\$ 15	66	39,554	100%	\$ 1,625,986	\$ 260,840,439	11,866	8,914
32	Vaginal Delivery, with complication	\$ 12	83	137,766	100%	\$ 803,890	\$ 261,644,329	10,026	8,056
44	Maternal Sepsis case management	\$ 39	26	64,291	100%	\$ 2,730,718	\$ 264,375,047	20,052	7,324
21	Malaria treatment: Pregnant Women - complicated	\$ 5	198	15,613	100%	\$ 139,592	\$ 264,514,639	5,574	5,116
10	Case management of MDR TB cases	\$ 3	297	70	100%	\$ 12,249	\$ 264,526,889	5,182	4,898
63	GIT, Intestine cancer	\$ 804	1	156	100%	\$ 2,711	\$ 264,529,599	0	0
65	Cervical cancer (first line)	\$ 1,087	1	2,477	100%	\$ 161,625	\$ 264,691,224	1	-15
61	Ischemic heart disease	\$ 453	2	128,130	100%	\$ 4,193	\$ 264,695,417	7	-45
52	IPT (pregnant women)	\$ 110	9	734,750	100%	\$ 34,712	\$ 264,730,129	99	-79
57	Diabetes, type I	\$ 296	3	23,063	100%	\$ 4,303,914	\$ 269,034,043	25	-95
49	High Cholesterol	\$ 68	15	222,947	100%	\$ 6,702,709	\$ 275,736,752	921	-98
	Basic psychosocial support, advice, and follow-up, plus anti-								
50	epileptic medication	\$ 82	12	506,371	100%	\$ 1,265,925	\$ 277,002,677	689	-237
56	Treatment of depression	\$ 265	4	168,790	100%	\$ 331,621	\$ 277,334,298	115	-382
58	Diabetes, Type II	\$ 296	3	138,381	100%	\$ 4,210,622	\$ 281,544,920	149	-568
66	Treatment of acute psychotic disorders	\$ 1,646	1	168,790	100%	\$ 958,081	\$ 282,503,000	27	-693
62	Treatment of bipolar disorder	\$ 557	2	523,250	100%	\$ 10,361,966	\$ 292,864,966	182	-1,466
67	Treatment of schizophrenia	\$ 1,646	1	2,363,066	100%	\$ 13,413,129	\$ 306,278,095	376	-9,704
55	Hypertension	\$ 159	6	845,659	100%	\$ 1,337,730	\$ 307,615,825	44,495	-70,870

Accounting for the scale of costs and benefits

- Which interventions represent ‘best buys’ for the HCS and should be prioritised?
- **How can objectives beyond improving population health be considered?**
- Where should investments in scaling up interventions and health system strengthening be made?
 - Illustrated using data from Malawi where framework supported the development of an Essential Health Package and fed into latest Health Sector Strategic Plan

How can objectives beyond improving population health be considered?

6.2.21 The concept that underlies the Committee decision-making is that of the opportunity cost of programmes that could be displaced by the introduction of new technologies. This way, NICE seeks to maximise the health benefit gained from a fixed NHS budget. This principle is correct if the sole purpose of the health service is to improve health. While this may be the primary purpose of the NHS, it is acknowledged that care delivered by the NHS could have other benefits that are considered socially valuable but are not directly related to health and are not easily captured in a cost per QALY analysis. Techniques exist to consider the trade-off between health benefits and non-health benefits quantitatively. These techniques require that all relevant criteria are identified in advance, quantified and then weighted to reflect aspects of social value in a way that can be regarded as legitimate by all stakeholders. At present the introduction of such techniques into the Committee's decision-making is considered unsuitable. Therefore the Committee will take non-health objectives of the NHS into account by considering the extent to which society may be prepared to forego health gain in order to achieve other benefits that are not health related.

How can objectives beyond improving population health be considered?

- Objectives may include promoting financial protection, reducing health inequalities or recognising the impact of interventions on wider social objectives such as productivity, etc.
 - In principle, possible to extend the measures of benefit and opportunity cost to include other considerations (e.g., extended CEA, distributional CEA)
 - In practice, challenging based on available evidence
- Inform trade-offs based on changes in population health

Health maximising package

- Aim: health maximisation
- Constraint: budget



Health maximising package

- Aim: health maximisation
- Constraint: budget

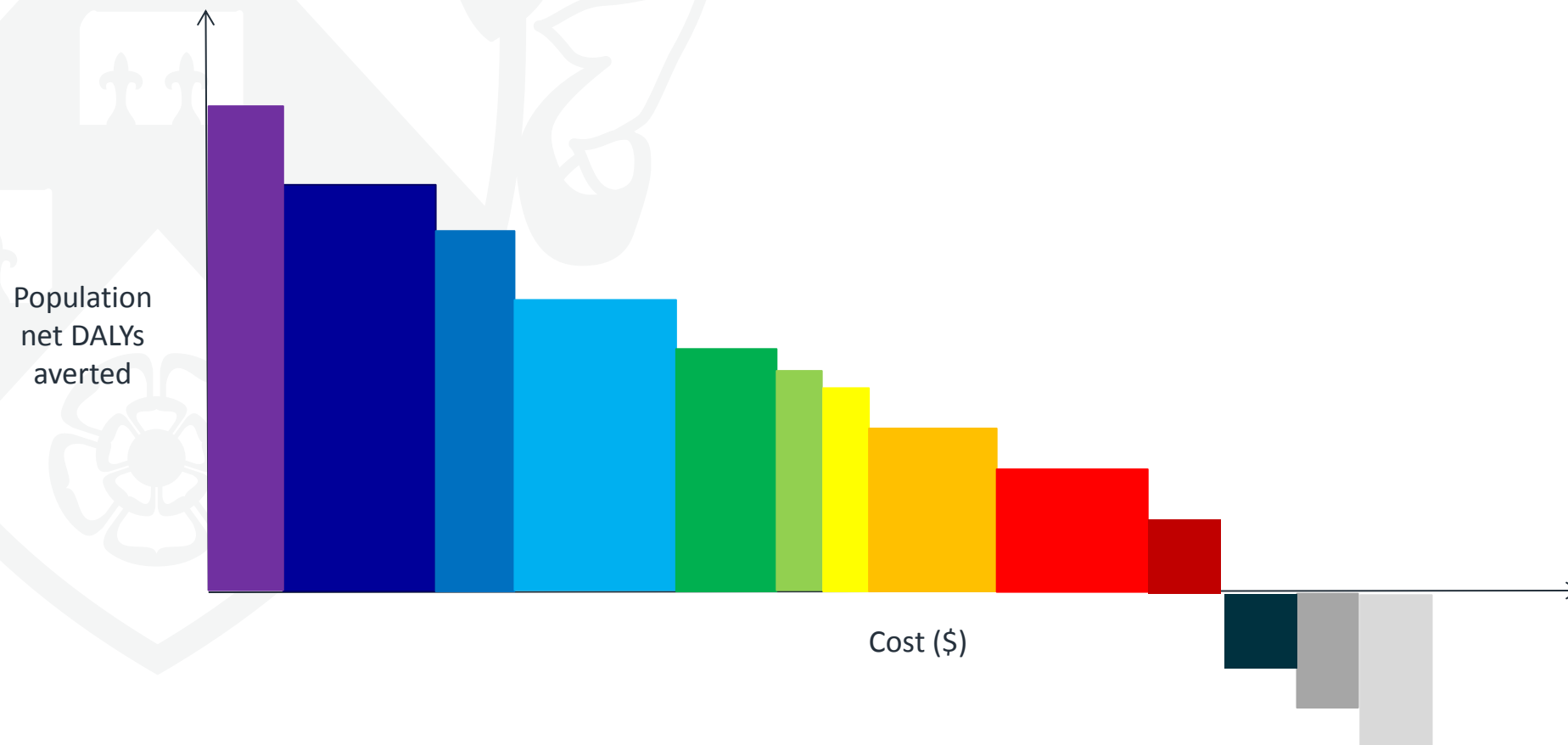


Health maximising package

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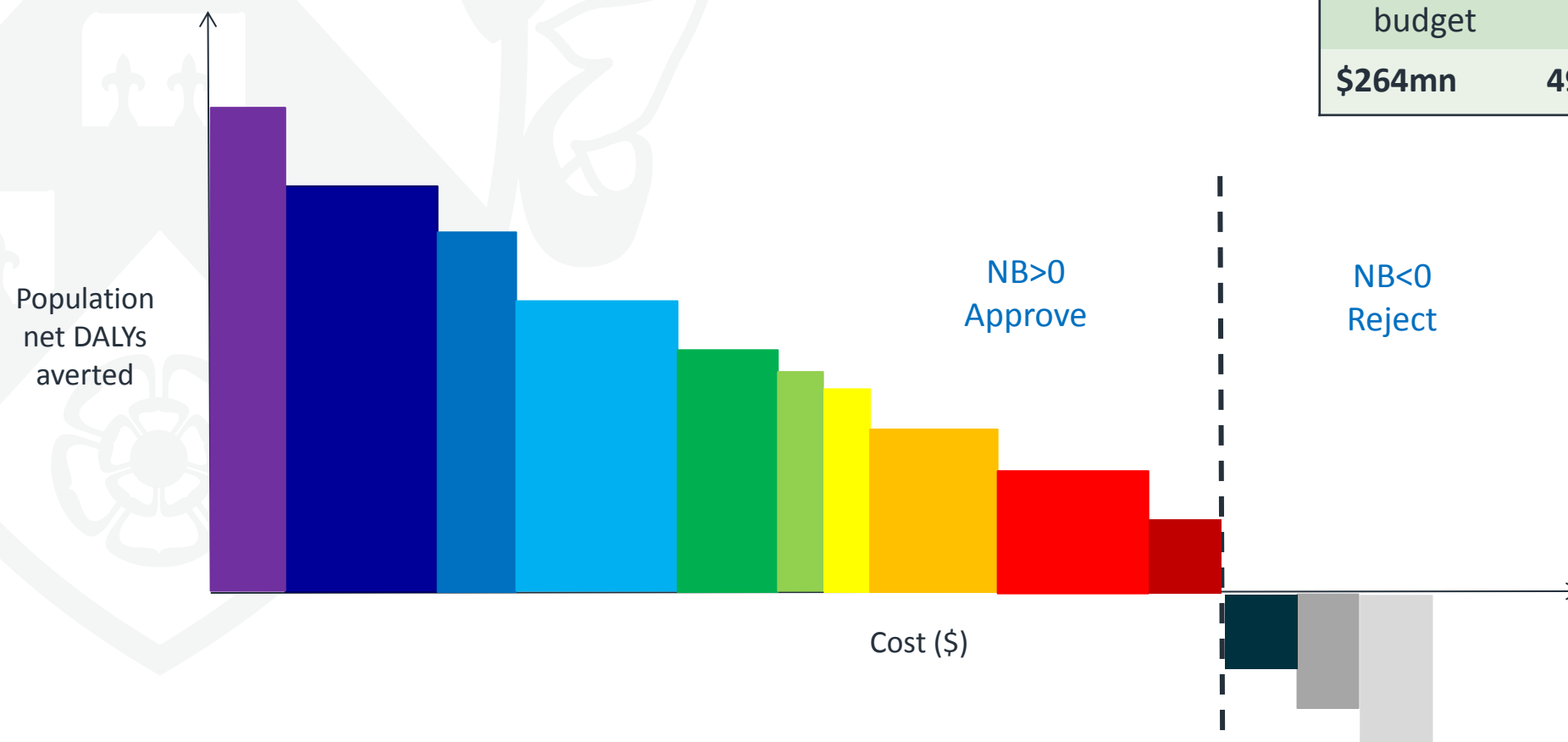


Population net DALYs averted reflects burden of disease: i.e. population net DALYs averted by an intervention = net DALYs averted per person * # of people requiring intervention
ICERs do NOT



Health maximising package



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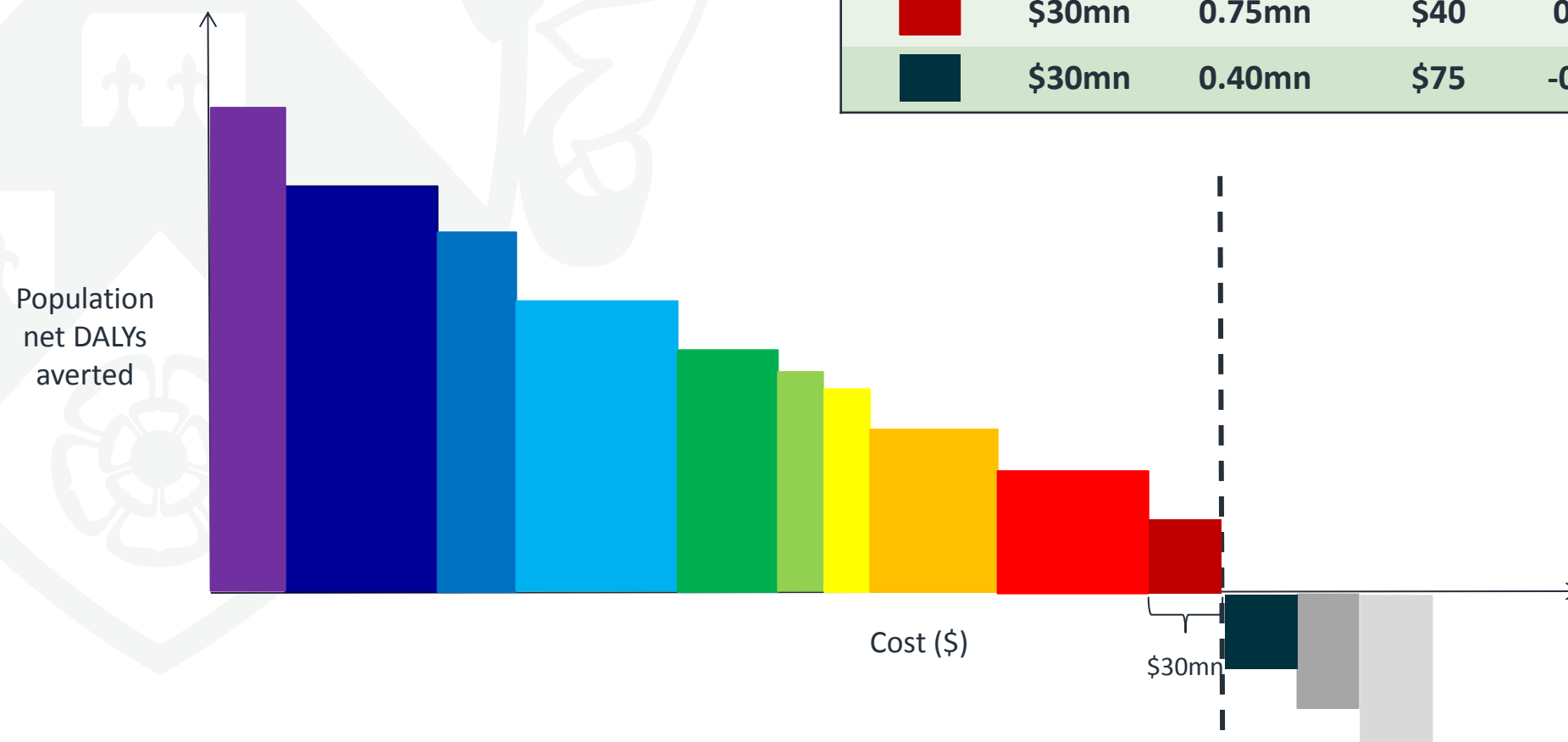


Malawi	
Total budget	Total DALYs averted
\$264mn	49mn

Health maximising package

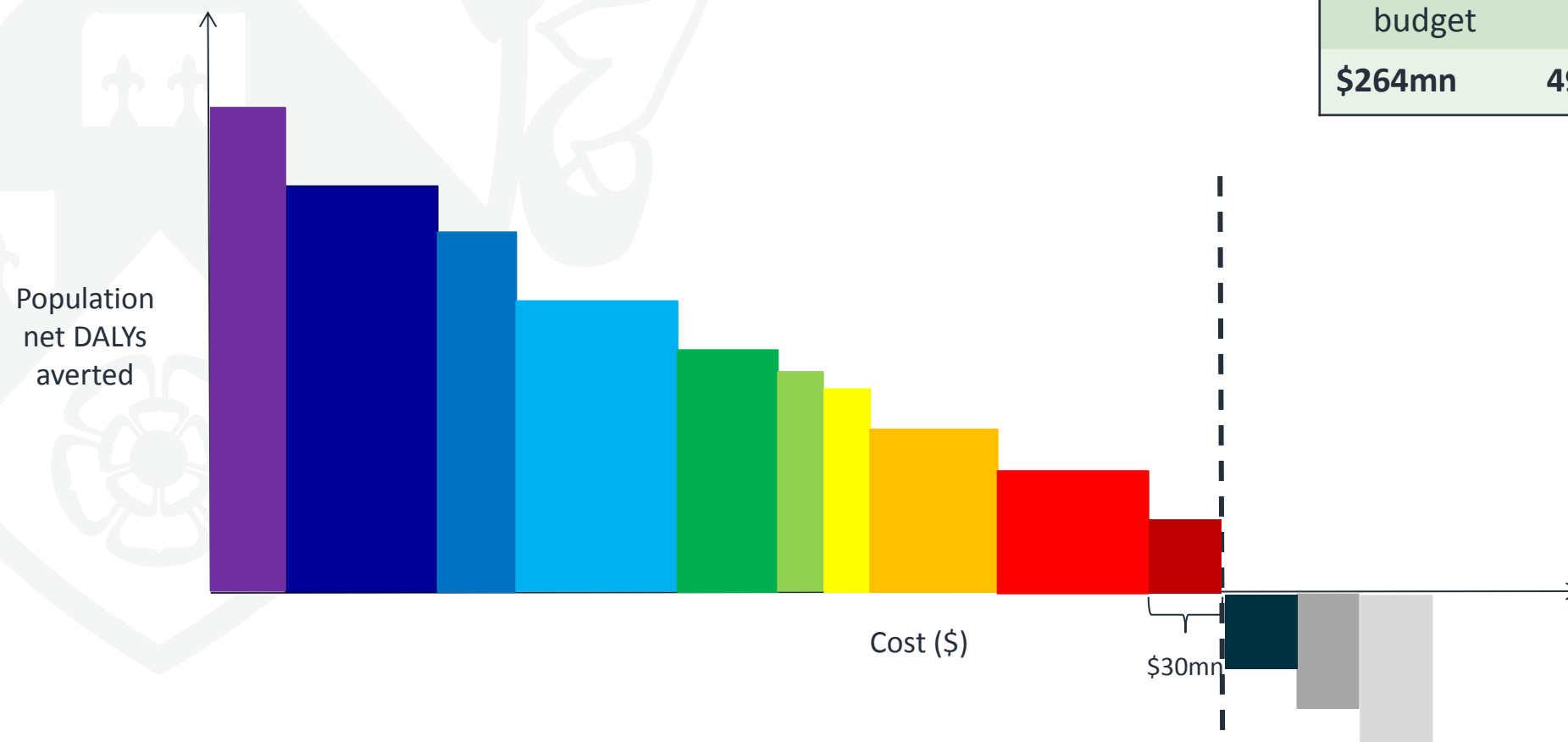
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Quantifying the value of interventions					
Interven- tion	<i>Total</i> cost	<i>Total</i> DALYs averted	Cost per DALY averted	Net DALYs averted	\$ value to the HCS
	\$30mn	0.75mn	\$40	0.26mn	16mn
	\$30mn	0.40mn	\$75	-0.09mn	-6mn



Quantifying health losses

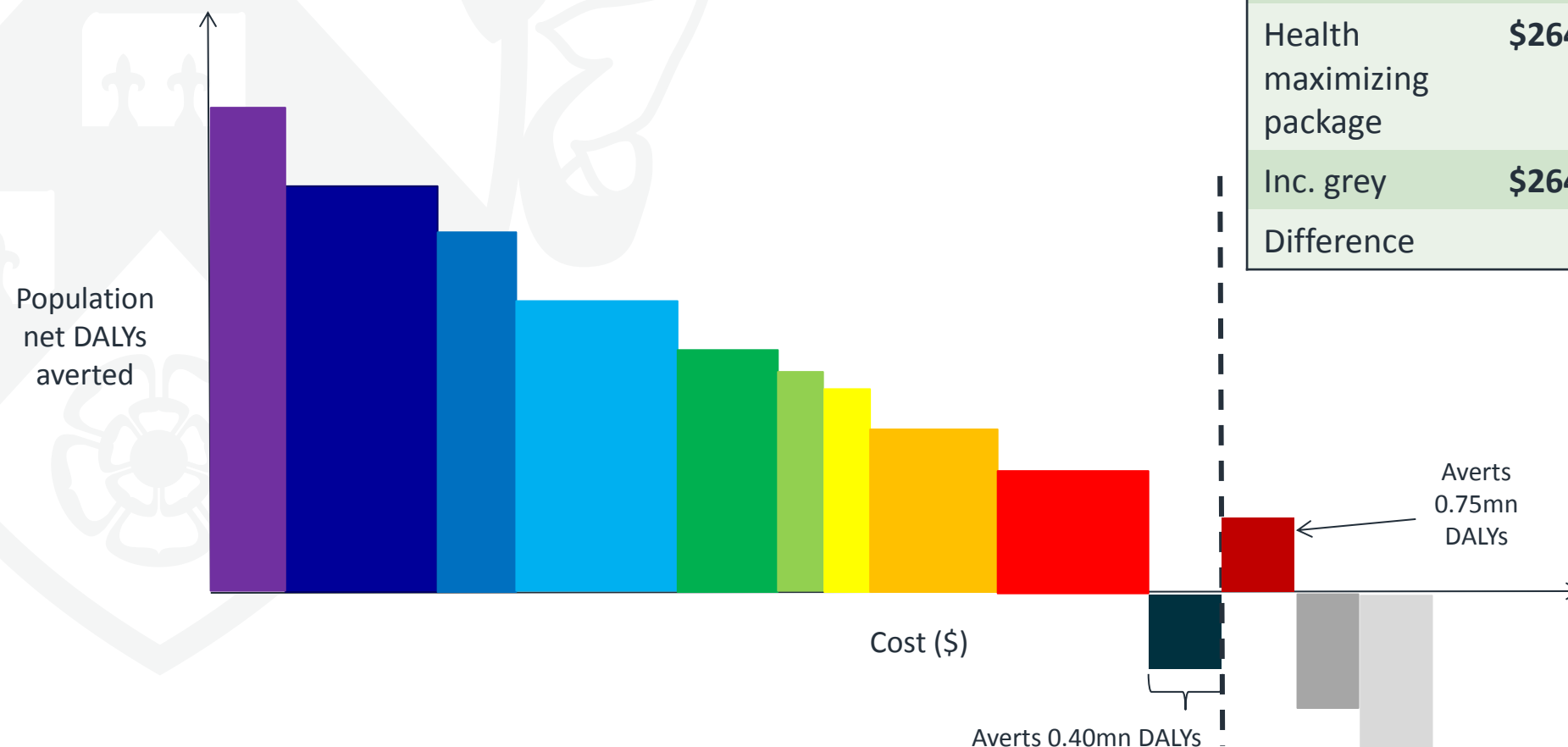
- E.g. include dark grey
- May reach the poor or contribute toward financial protection goals



Malawi	
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Quantifying health losses

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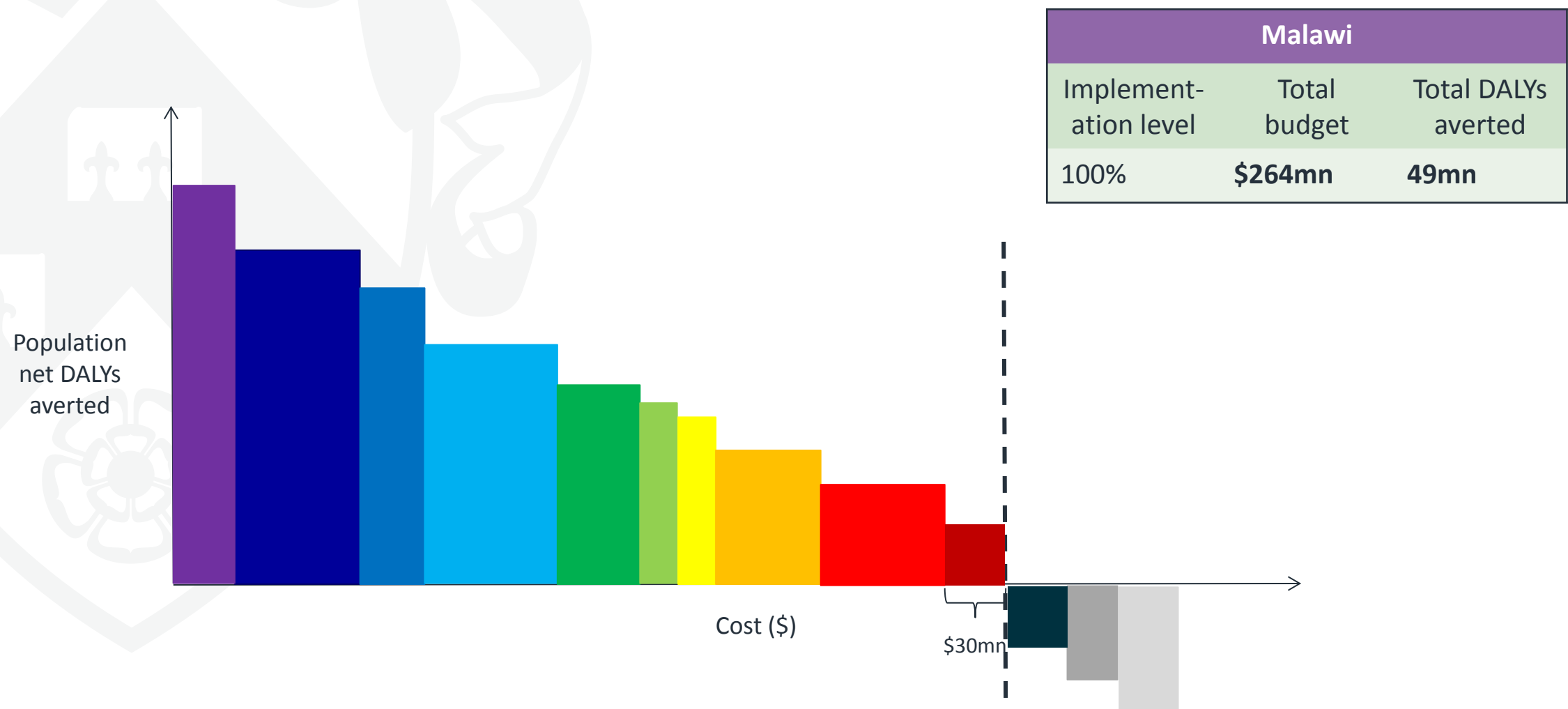
Malawi		
	Total budget	Total DALYs averted
Health maximizing package	\$264mn	49mn
Inc. grey	\$264mn	48.65mn
Difference		-350,000

Accounting for the scale of costs and benefits

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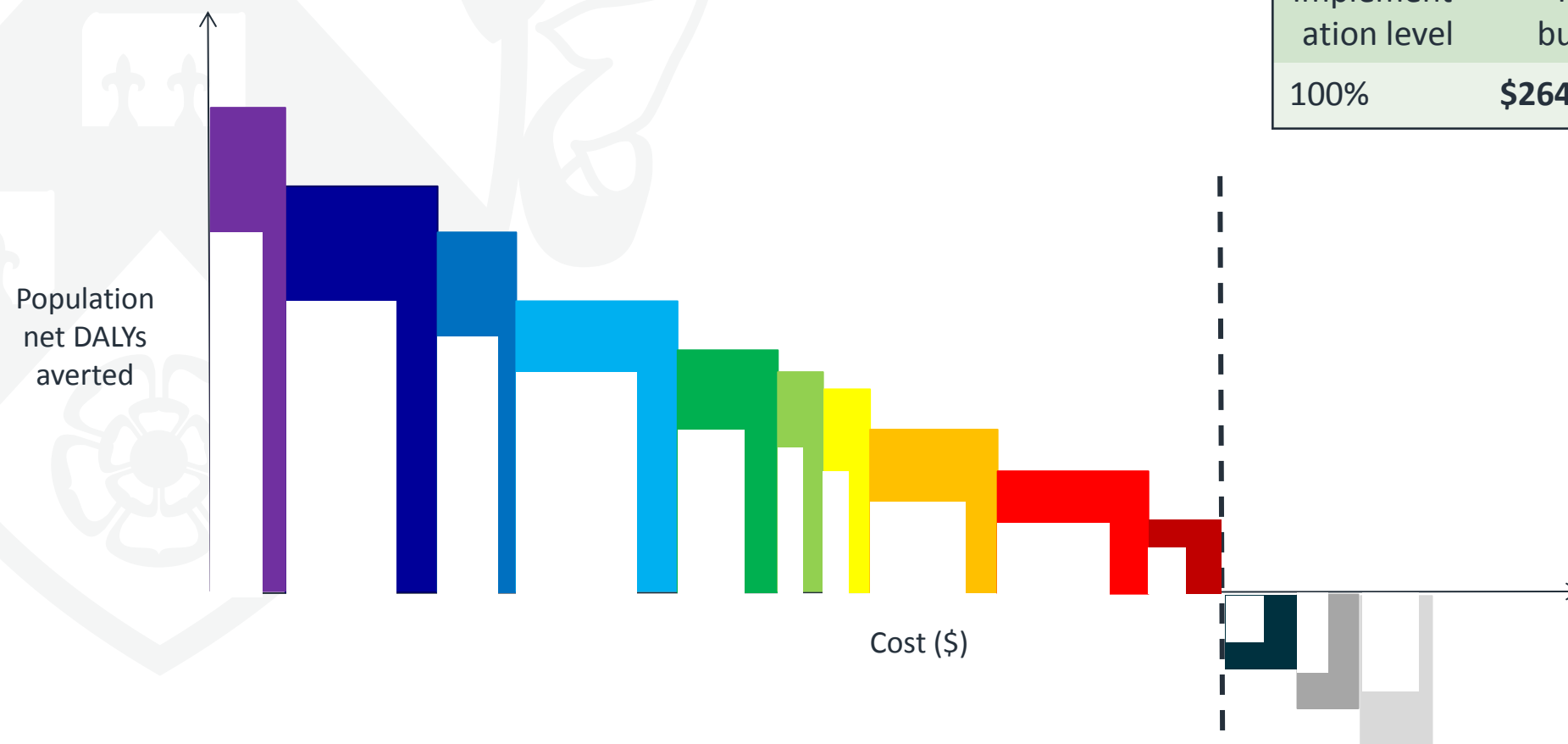
Constraints to implementing interventions

- Demand and supply side constraints
- In Malawi, plausible levels of implementation closer to 50%



Constraints to implementing interventions

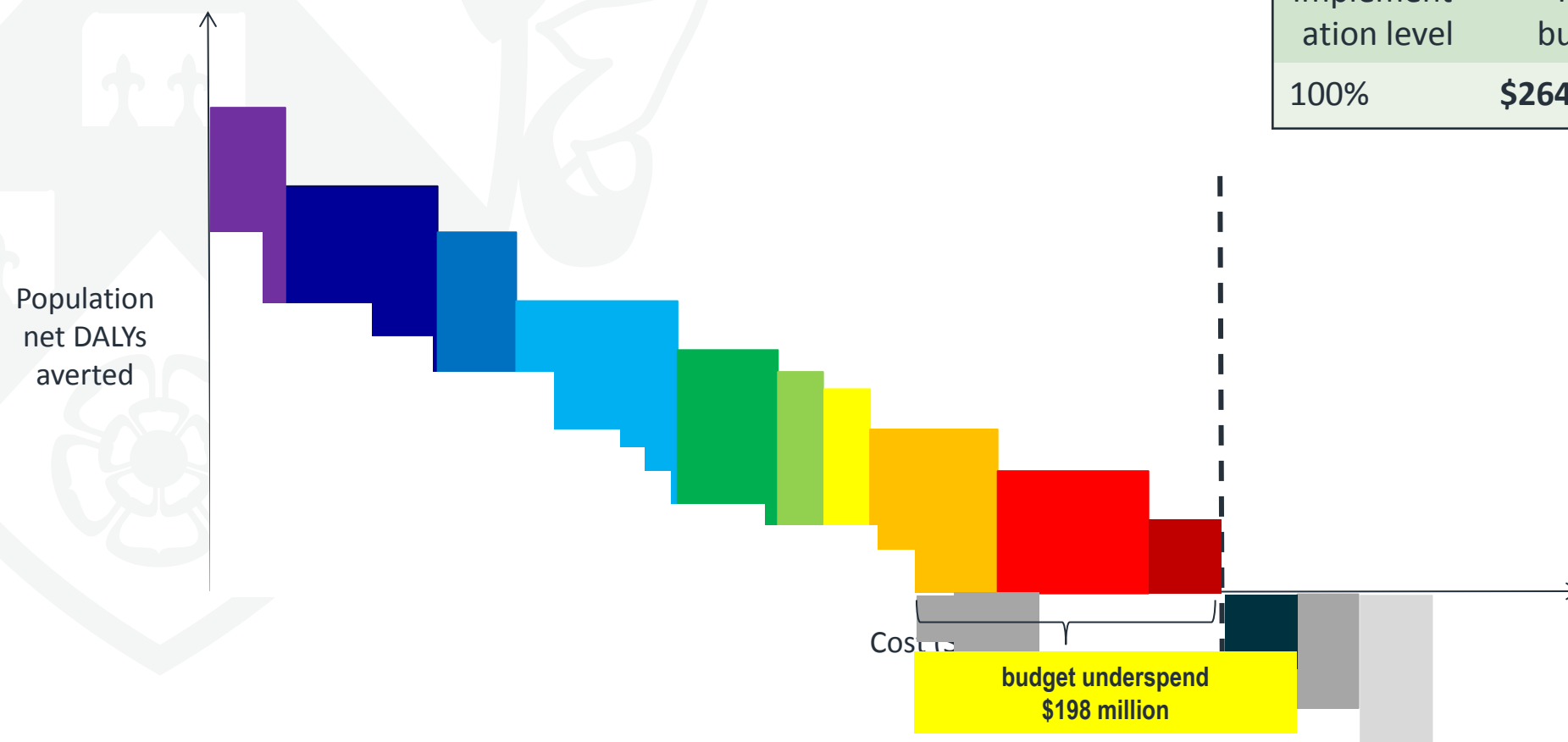
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Implement- ation level	Total budget	Total DALYs averted
100%	\$264mn	49mn

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Malawi		
Implement- ation level	Total budget	Total DALYs averted
100%	\$264mn	49mn

Scaling up interventions

- Which interventions, if scaled up, will offer the most returns in terms of health?
 - Difference between net DALYs averted at full implementation and realistic implementation
- What is the maximum we should be willing to spend to scale the intervention up?
 - Equal to the financial value to the HCS of scale up (i.e., monetary value of the health generated)

Summary

- Cost effectiveness thresholds should reflect evidence of the likely health opportunity costs in the settings and HCS in which it will be used.
- Health opportunity costs are the amount of health that a HCS currently delivers with more or less resources.
- Many of the cost-effectiveness “thresholds” that have been recommended, or have become widely cited, are not founded on an assessment of the likely health opportunity costs, their use is likely to reduce rather than improve health outcomes overall.