An introduction to using cost-effectiveness analysis to inform spending decisions on HIV testing

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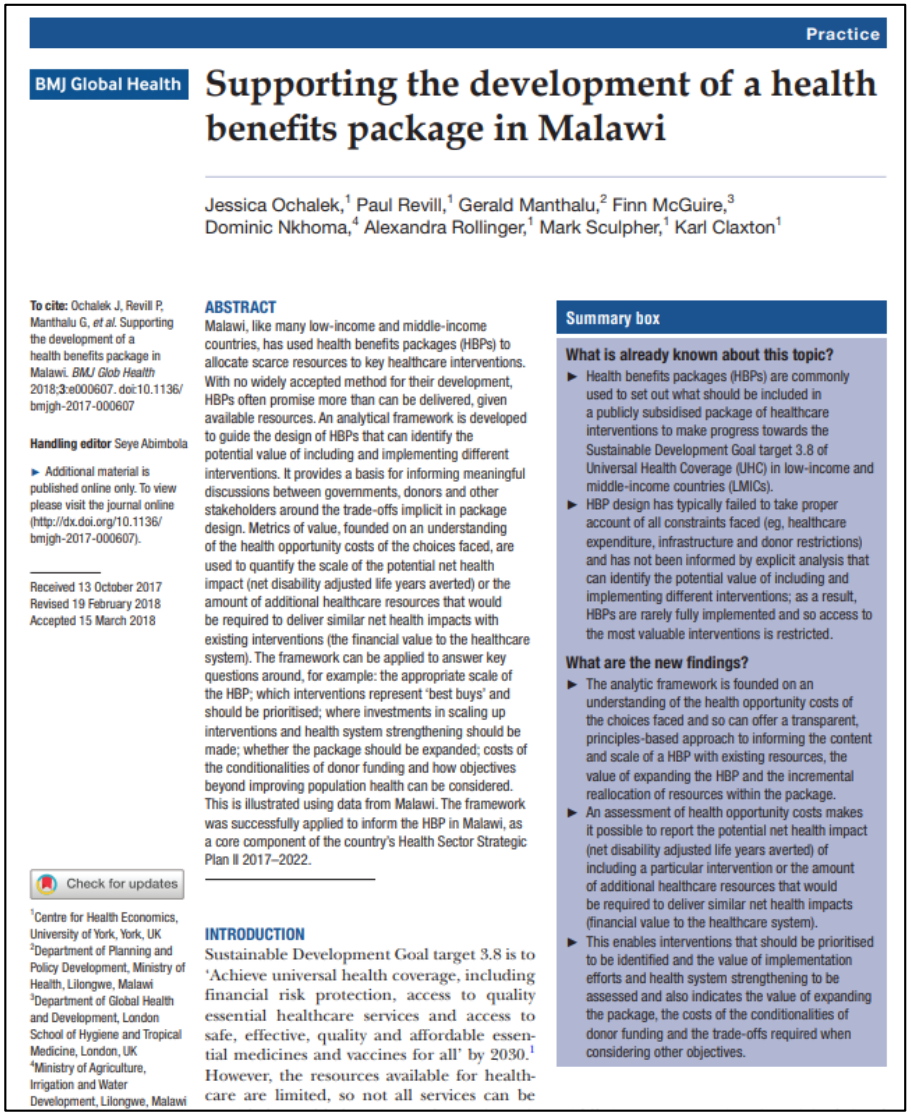
Overview

- Background: the need for economic evaluation
- Health outcomes
  - Vehicles for economic evaluation
- Using economic evaluation to inform health care decisions

Background

- Economics is not simply focused on costs
- Economics is a scientific approach to dealing with scarcity
- Focus is on value- is this the best thing we can do with the resources available

1. Ochalek et al* show Malawi would exhaust its health care budget if it were to fund only interventions offering healthy-life years at <US$70.



Practice

BMJ Global Health

Supporting the development of a health benefits package in Malawi

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To cite: Ochalek J, Revill P, Manthalu G, *et al*. Supporting the development of a health benefits package in Malawi. *BMJ Glob Health* 2018;**3**:e000607. doi:10.1136/bmjgh-2017-000607

Handling editor Seye Abimbola

► Additional material is published online only. To view please visit the journal online (http://dx.doi.org/10.1136/bmjgh-2017-000607).

Received 13 October 2017
Revised 19 February 2018
Accepted 15 March 2018

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ABSTRACT

Malawi, like many low-income and middle-income countries, has used health benefits packages (HBPs) to allocate scarce resources to key healthcare interventions. With no widely accepted method for their development, HBPs often promise more than can be delivered, given available resources. An analytical framework is developed to guide the design of HBPs that can identify the potential value of including and implementing different interventions. It provides a basis for informing meaningful discussions between governments, donors and other stakeholders around the trade-offs implicit in package design. Metrics of value, founded on an understanding of the health opportunity costs of the choices faced, are used to quantify the scale of the potential net health impact (net disability adjusted life years averted) or the amount of additional healthcare resources that would be required to deliver similar net health impacts with existing interventions (the financial value to the healthcare system). The framework can be applied to answer key questions around, for example: the appropriate scale of the HBP; which interventions represent 'best buys' and should be prioritised; where investments in scaling up interventions and health system strengthening should be made; whether the package should be expanded; costs of the conditionalities of donor funding and how objectives beyond improving population health can be considered. This is illustrated using data from Malawi. The framework was successfully applied to inform the HBP in Malawi, as a core component of the country's Health Sector Strategic Plan II 2017–2022.

INTRODUCTION

Sustainable Development Goal target 3.8 is to 'Achieve universal health coverage, including financial risk protection, access to quality essential healthcare services and access to safe, effective, quality and affordable essential medicines and vaccines for all' by 2030.[1] However, the resources available for healthcare are limited, so not all services can be

Summary box

What is already known about this topic?

- Health benefits packages (HBPs) are commonly used to set out what should be included in a publicly subsidised package of healthcare interventions to make progress towards the Sustainable Development Goal target 3.8 of Universal Health Coverage (UHC) in low-income and middle-income countries (LMICs).
- HBP design has typically failed to take proper account of all constraints faced (eg, healthcare expenditure, infrastructure and donor restrictions) and has not been informed by explicit analysis that can identify the potential value of including and implementing different interventions; as a result, HBPs are rarely fully implemented and so access to the most valuable interventions is restricted.

What are the new findings?

- The analytic framework is founded on an understanding of the health opportunity costs of the choices faced and so can offer a transparent, principles-based approach to informing the content and scale of a HBP with existing resources, the value of expanding the HBP and the incremental reallocation of resources within the package.
- An assessment of health opportunity costs makes it possible to report the potential net health impact (net disability adjusted life years averted) of including a particular intervention or the amount of additional healthcare resources that would be required to deliver similar net health impacts (financial value to the healthcare system).
- This enables interventions that should be prioritised to be identified and the value of implementation efforts and health system strengthening to be assessed and also indicates the value of expanding the package, the costs of the conditionalities of donor funding and the trade-offs required when considering other objectives.

*Ochalek, J, Revill, P, Manthalu, 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,

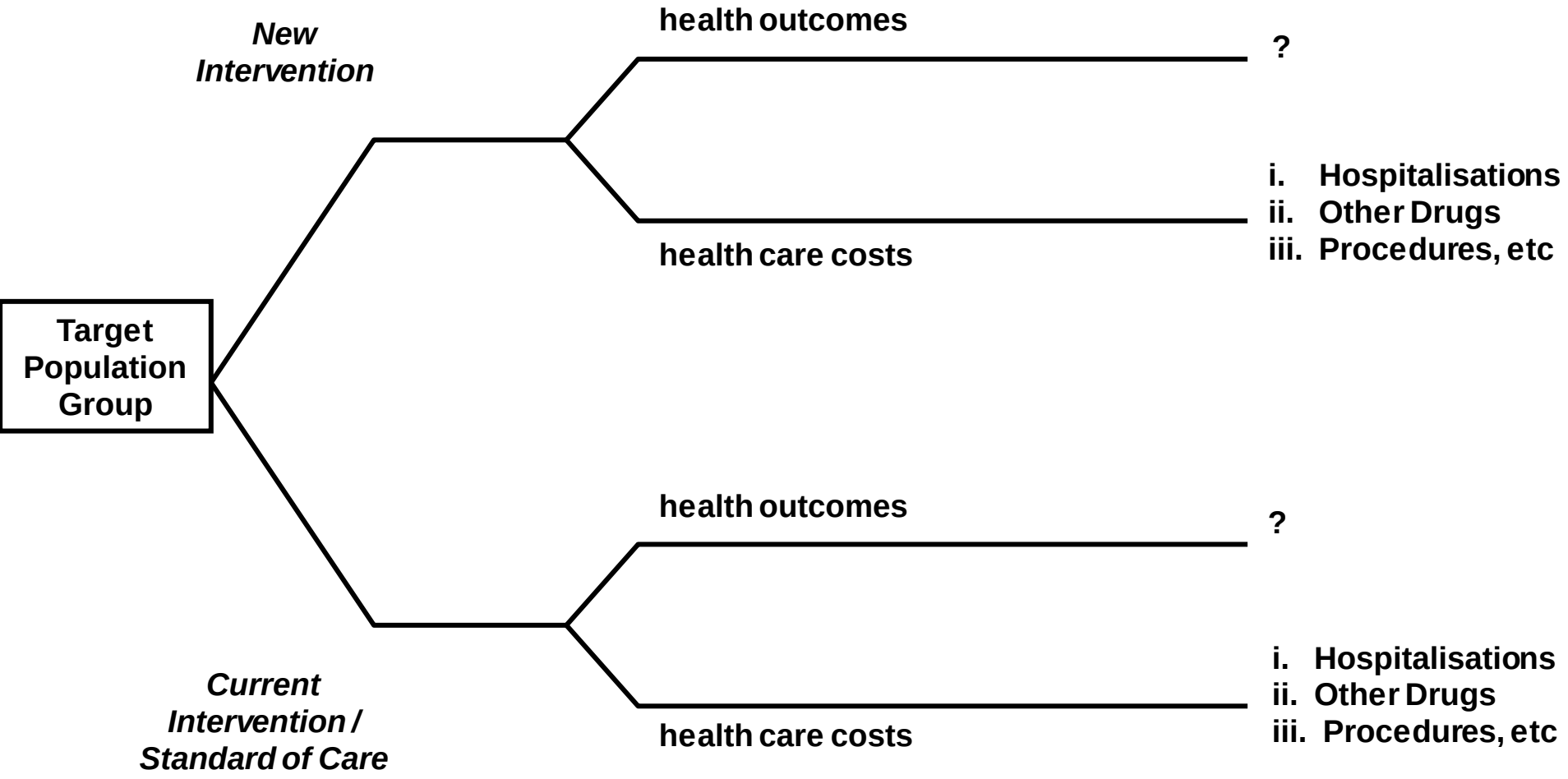
2. Meyer-Rath et al** show that many HIV interventions that are widely demanded cannot be afforded within South Africa's current and expected future HIV budgets.

Results of the South African HIV Investment Case	ICER (USD/LYS)
Condom availability	Cost saving
Male medical circumcision	Cost saving
ART at 500 CD4 cells/microl	84
PMTCT	103
Universal treatment	187
Infant testing at 6 weeks	193
SBCC campaign 1 (HCT, reduction in MSP)	547
SBCC campaign 2 (condoms)	872
General population HCT	932
SBCC campaign 3 (condoms, HCT, MMC)	1,374
HCT for sex workers	2,004
Infant testing at birth	2,207
PrEP for sex workers	7,476
HCT for adolescents	15,307
PrEP for young women	19,993
Early infant male circumcision	68,969,435

Affordable under current budget

** Meyer-Rath G, van Rensburg C, Larson B, Jamieson L, Rosen S, Revealed willingness-to-pay versus standard cost-effectiveness thresholds: evidence from South African HIV Investment Case

Nature of economic evaluation in health care



Forms of Economic Evaluation

- Cost analysis/cost-minimisation analysis
  - Consider **only costs** and not outcomes (e.g. estimates of cost reductions from task shifting)
- Cost-outcome analysis
  - Use **disease-specific/surrogate measures**(e.g. years of virological suppression; per HIV infection averted)
- Cost-effectiveness analysis
  - Generic measures that reflect impact on both **length** and **quality of life** (“healthy life years”)

Issues of terminology – economic evaluation

Term	Meaning
Cost / budget impact analysis	Deals only with the costs of activities and their impact on some available budget
Cost-effectiveness	Assessment of whether the effects of an intervention are worth its costs
Value for money	A statement of the value of an intervention. *It can mean the same as cost-effectiveness.*
Resource allocation / optimization	The way in which limited resources are allocated (e.g. across interventions, geographies, to facilities), with the aim of maximizing a defined outcome (e.g. population health). *It can mean the same as cost-effectiveness.*

"Economic evaluation is the branch of health economics that deals with the costs and benefits of a drug therapy, health technology, or any other health care intervention. It usually, though not always, requires both costs and benefits to be considered simultaneously"

Cost-effectiveness analysis - some brief observations

- An *aid* to decision making, not a substitute for it.
- It incorporates both technical and value judgements.
- If performed properly, it should *make these judgements explicit* rather than obscure them.
- Cost-effectiveness analysis should be judged in comparison to other approaches (e.g. guesswork, professional opinion).

Overview

- Background: the need for economic evaluation
- Health outcomes
  - Vehicles for economic evaluation
- Using economic evaluation to inform health care decisions

Health outcomes

What are health outcomes?

- Change in health of an individual or group
- The intended endpoints of care
- Attributable to an intervention, rather than simply change over time
- Allows us to compare 'Intervention A' v 'Intervention B'

What are the health outcomes of HIV testing?
How do we measure/quantify these health outcomes?

HIV-negative	Circumcision/PreP	HIV infection averted
HIV-positive	Anti-retroviral treatment	Death averted

Generic V Disease specific health outcomes

- **Disease-specific**
  - HIV tests performed; HIV-positive individuals identified: HIV infections averted
  - **But could be**: TB patients identified; TB cases averted
    - Health outcomes relate only to that disease
    - OK if decision maker is focussed only on that disease
      - » 'ring-fenced' budgets
- Does such a decision maker exist?
- How can we compare the health impact of an HIV intervention to a TB intervention?

Generic measures of health outcome

- The Quality-Adjusted Life-Year (QALY)
- The Disability-Adjusted Life Year (DALY)

“A QALY is a QALY is a QALY”

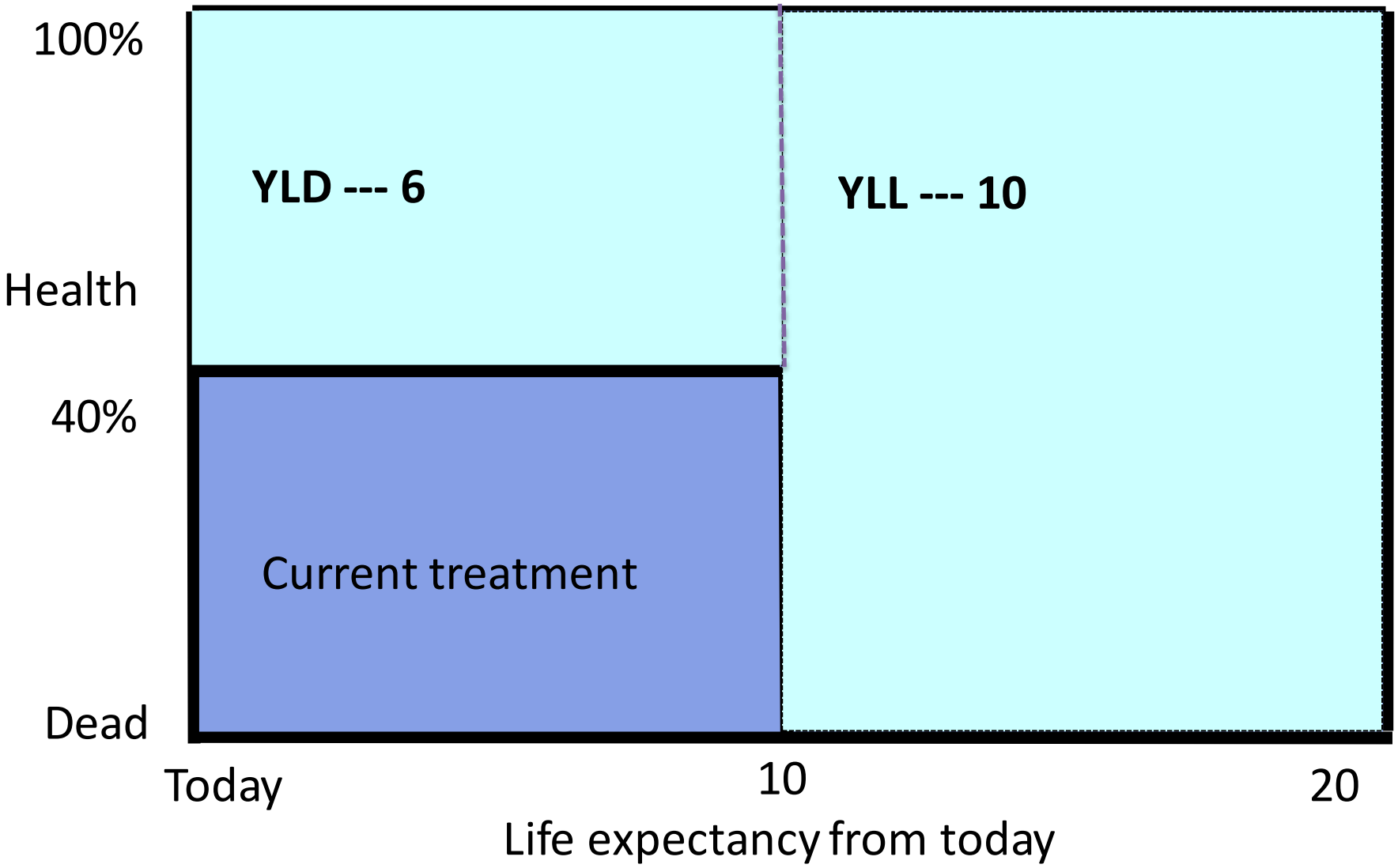
“A DALY is a DALY is a DALY”

- Comparing Intervention A v Intervention B
  - QALYs gained
  - DALYs averted

QALYs and DALYS?

Quality-adjusted (QALYs)	Disability-adjusted (DALYs)
Looks at the remaining years we live	Looks at what we lose in comparison to life expectancy
The number of years we live is important	The number of Years of Life Lost (YLL) to premature death is important
But so is our quality of life (QoL) during those years	But so is the number of Years Lost to Disability (YLD)
If we apply a 'QoL-weight" to those years we live:	YLD estimated by applying a 'Disability-weight" to years we live
QALY = Σ(length of life) x (QoL)	**DALY = YLL + YLD**

Calculating DALYs



Disability-Adjusted Life Year (DALY)

- Widely used in low and middle income countries
- Developed to measure of disease burden
- Allow international comparisons
- Life expectancy based on that in Japan
- Disability weights
  - 13 902 household survey and 16 328 in the web survey
  - Reflect disability associated with ‘illness A’
  - Do not directly measure change in ‘disability’ from receiving ‘Intervention A’

Calculating QALYs

Measurement → Valuation →

Questionnaire (e.g, EQ-5D) → Health states → QALYs

Public Preferences → QALYs

Patient describes their health by answering questionnaire

Society/Healthy Public assigns a preference-elicited value (generally between 0-1) to all health state from questionnaire (Tariff set)

'Tariff set': converts responses to questionnaire to the QoL weight

EQ-5D-3L descriptive system

English Version

Mobility
I have no problems in walking about
I have some problems in walking about
I am confined to bed

Self-care
I have no problems with self-care
I have some problems washing and dressing myself
I am unable to wash and dress myself

Usual activities (eg. work, study, housework, family or leisure activities)
I have no problems with performing my usual activities
I have some problems with performing my usual activities
I am unable to perform my usual activities

Pain/discomfort
I have no pain or discomfort
I have moderate pain or discomfort
I have extreme pain or discomfort

Anxiety/depression
I am not anxious or depressed
I am moderately anxious or depressed
I am extremely anxious or depressed

Chichewa Version for Malawi

		Chongani mu gulu lilironse pansipa, chonde sonyezani mfundo zimene zikufotokoza bwino za umoyo wanu.
B07	MOB	Mayendedwe ☐ 1. Ndilibe vuto lina lililonse poyenda ☐ 2. Ndimakhala ndi mavuto ena poyenda ☐ 3. Ndimangobindikira pa kama
B08	SELF	Kudzisamalira ndekha(mwachitsazo kusamba ndi kudziveka ndekha) ☐ 1. Ndilibe vuto podzisamalira ndekha ☐ 2. Ndimakhala ndi mavuto ena posamba kapena podziveka ndekha ☐ 3. Ndimalephera kusamba kapena kudziveka ndekha
B09	USUAL	Zochitika za tsiku ndi tsiku (monga kugwira ntchito, kuwerenga,ntchito za pakhomo, za m'banja kapena kuchita zimene zimandisangalatsa) ☐ 1. Ndilibe mavuto ali onse pogwira ntchito zanga za nthawi zonse ☐ 2. Ndili ndi mavuto ena pang'ono pogwira ntchito za nthawi wonse ☐ 3. Ndimalephera kugwira ntchito zanga za nthawi zonse
B10	PAIN	Ululu/kuphwanya m'thupi kusowetsa mtendere? ☐ 1. Ndilibe ululu kapena sindikumva kuphwanya m'thupi ☐ 2. Ndimakhala ndi ululu kapena kumva kuphwanya m'thupi mwapakatikati ☐ 3. Ndimakhala ndi ululu kapena kumva kuphwanya m'thupi kwambiri
B11	ANX	Nkhawa/Khumudwa? (Osasangalala) ☐ 1. Sindikuda nkhawa kapena kukhumudwa ☐ 2. Ndimakhala oda nkhawa kapena okhumudwa mwapakatikati ☐ 3. Ndimakhala oda nkhawa kapena okhumudwa kwambiri

EQ-5D-3L is available in more than 170 languages!

The QALY – measurement

Mobility
I have no problems in walking about ❑
I have some problems in walking about ❑
I am confined to bed ❑

Self-Care
I have no problems with self-care ❑
I have some problems washing or dressing myself ❑
I am unable to wash or dress myself ❑

Usual Activities *(e.g. work, study, housework, family or leisure activities)*
I have no problems with performing my usual activities ❑
I have some problems with performing my usual activities ❑
I am unable to perform my usual activities ❑

Pain/Discomfort
I have no pain or discomfort ❑
I have moderate pain or discomfort ❑
I have extreme pain or discomfort ❑

Anxiety/Depression
I am not anxious or depressed ❑
I am moderately anxious or depressed ❑
I am extremely anxious or depressed ❑

Examples of QoL weights derived from UK tariff:

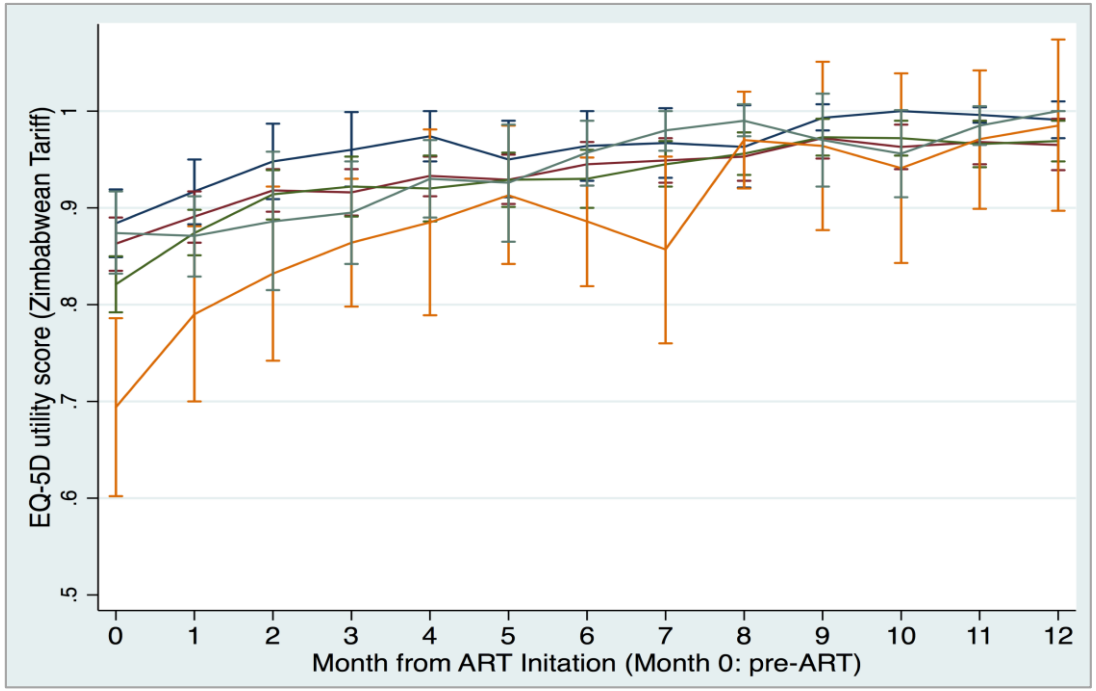
Patient	A	B	C	D	E
Mobility	1	1	1	3	3
Self-Care	1	1	1	3	3
Usual activities	1	2	1	3	3
Pain/discomfort	1	2	3	1	3
Anxiety/Depression	1	2	3	1	3
	↓	↓	↓	↓	↓
QOL Score	**1**	**0.69**	**0.03**	**0.03**	**-0.59**

- EQ-5D has 243 possible health states
- Only value set for Africa is from Zimbabwe

Impact of HIV disease stage and ART on QoL

- QoL poorer amongst those with more advanced HIV disease (lower CD4 count)
- QoL improved with time on ART
- Majority of participants report *'perfect'* health after 1 year of ART

➢ HIV testing strategies that increase timely access to ART for HIV-positive individuals will result in more QALYs



Maheswaran et al, JAIDS 2017

Vehicles for Economic Evaluation

- Economic evaluation alongside clinical trials
- Decision-analytic modelling

Economic Evaluation: alongside clinical trials

- Alongside a clinical trial
  - Participants randomly assigned to intervention or control arm
  - Trial evaluates health outcomes: e.g. mortality; uptake of HIV testing
  - Economist additionally collects from participants':
    - What healthcare resources they used during trial period
    - What their QoL (EQ-5D) was at beginning; middle; end of trial

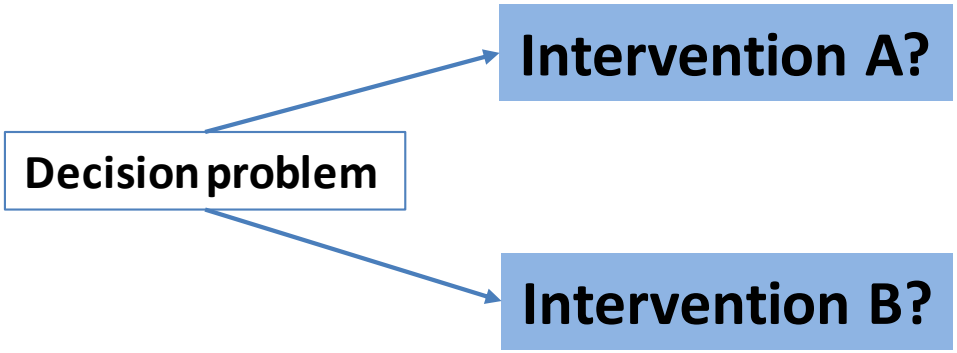
- Problems:
  - Evaluation of costs/health only over trial time period
  - Only able to compare intervention v control treatments
  - Powered to detect health outcomes
  - Logistics and costs of data collection
  - Should a single study form the basis for decision making?

Specific Challenges in HIV testing trials

- You may not know be able to follow-up individuals
  - HIV self-test result is confidential
  - Participants may access HIV care at non-study sites or at later dates
- Often randomise communities
- A multitude of potential benefits (ART; HIV prevention)
- Benefits may not be realised for +++years

Decision-analytic modelling

- Determine the decision that needs to be made
- Population affected by decision
- Mathematically model health-related events
- Assign costs and health outcomes to these events
- Sufficiently long-time horizon to capture all costs and consequences
- Synthesise data from various sources
- Take into account Uncertainty in data inputs



?Population
?Impact on costs
?Impact on health outcomes

Overview

- Background: the need for economic evaluation
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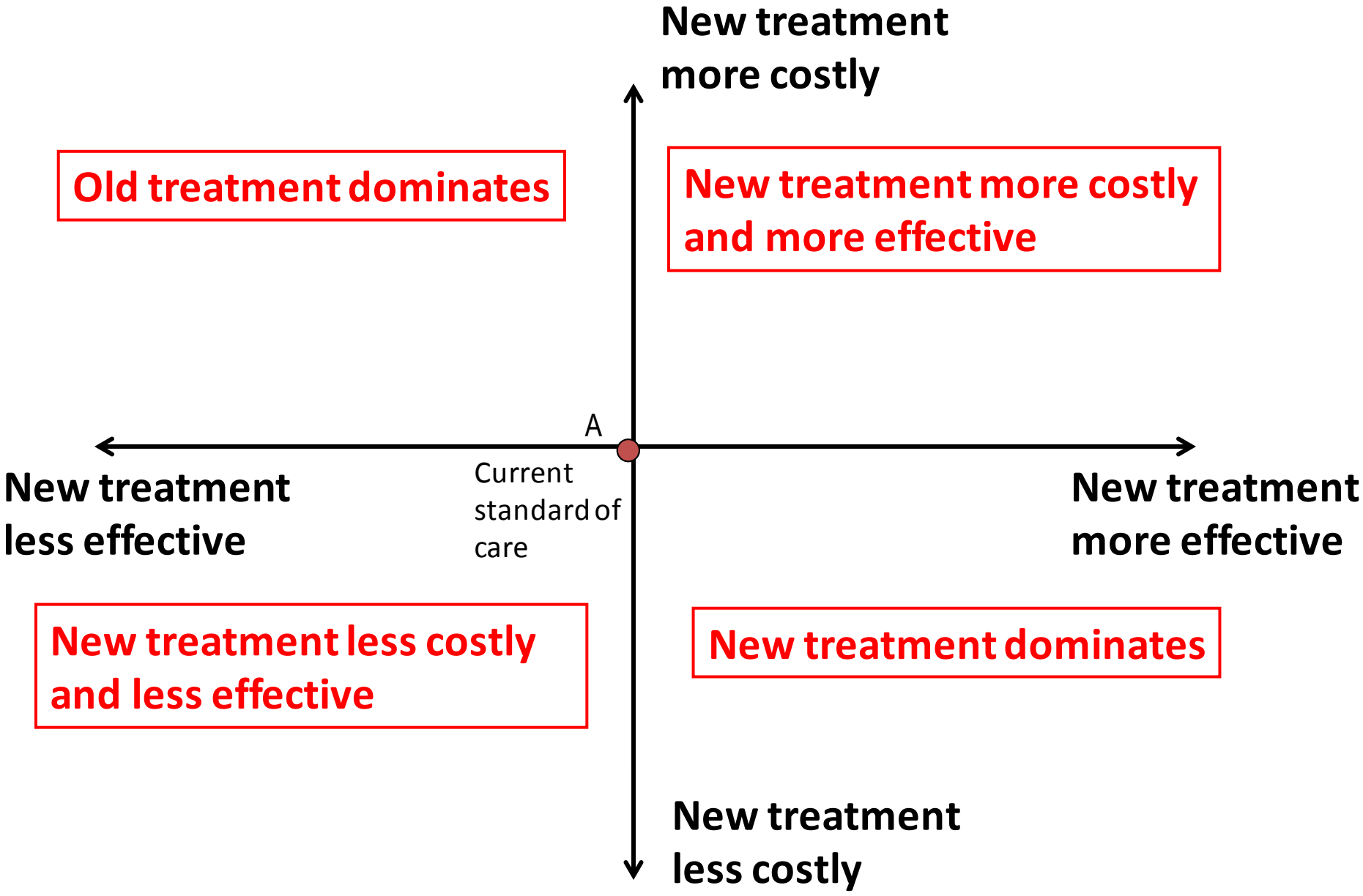
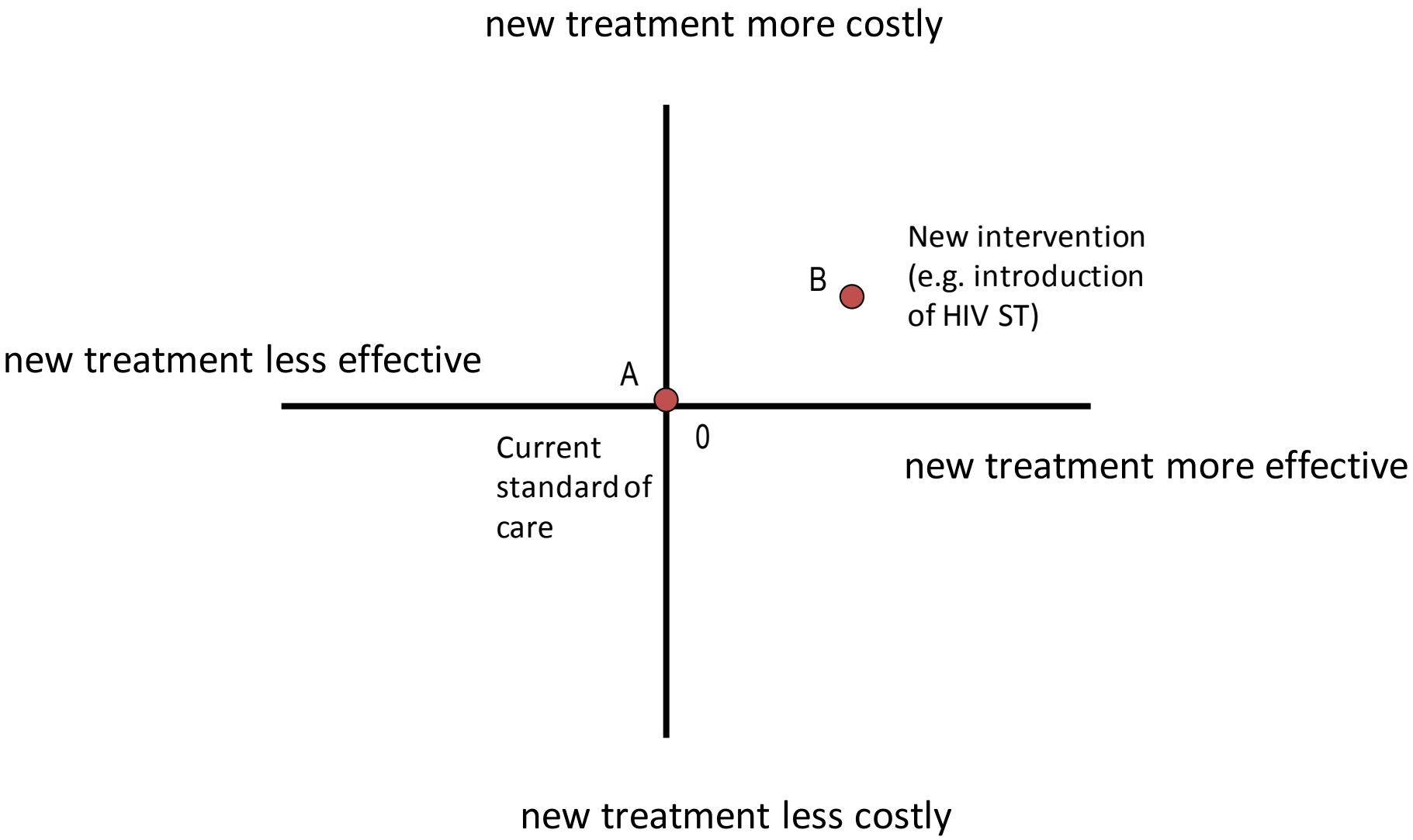
What do we need to inform decisions?

- Compare
  - Estimate health *expected* to be gained
  - Estimate additional (net) costs *expect* to impose
  - As assessment of *whether the health gains in respect of their costs* are *represent a good use of a limited budget*

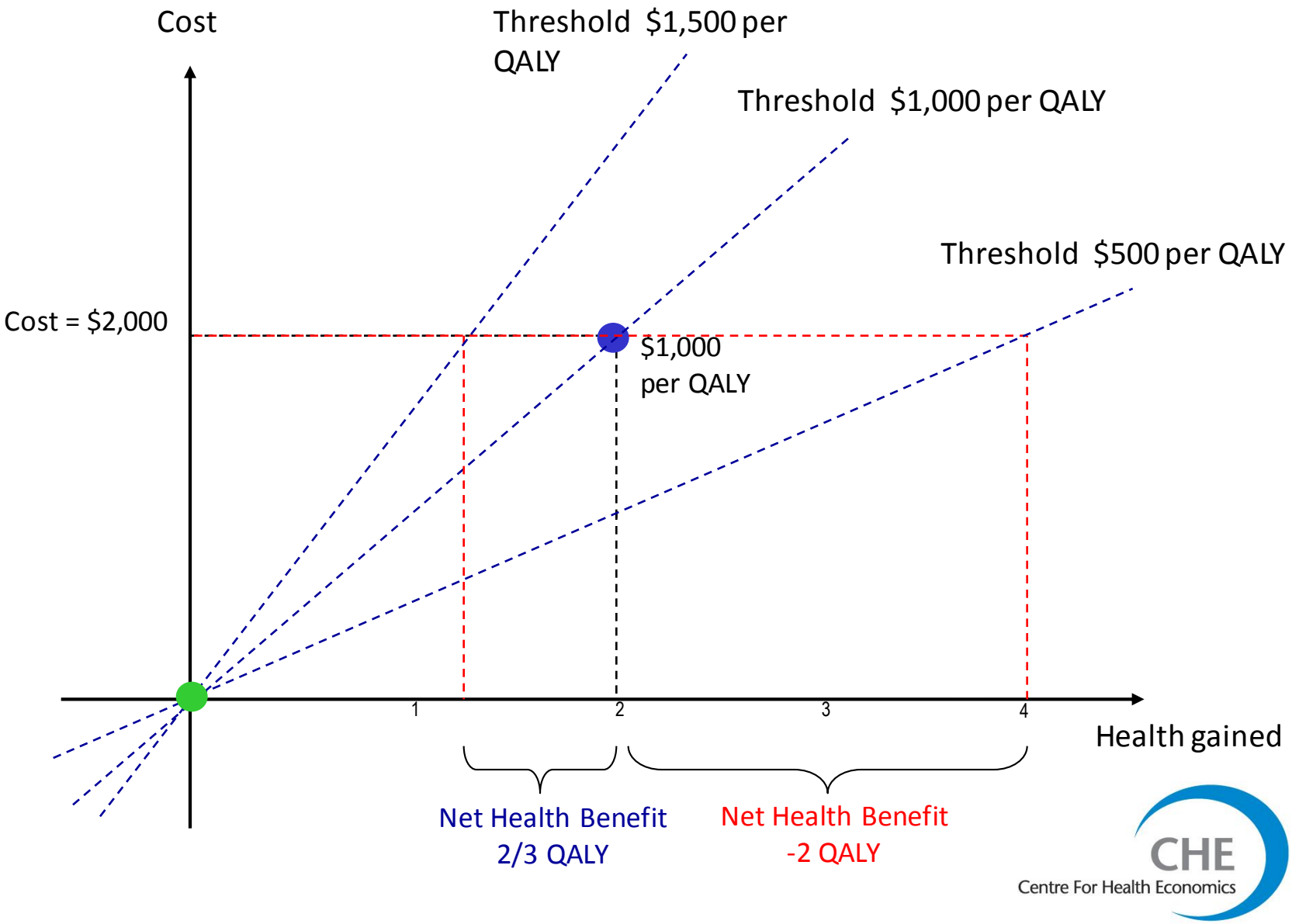
Cost-effectiveness plane



Cost-effectiveness plane



CEA as a guide to resource allocation



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What do we need to inform decisions?

- Compare
  - Estimate health *expected* to be gained
  - Estimate additional (net) costs *expect* to impose
  - Health *expected* to be lost due to these additional costs (a **supply-side concept**)
- What the CET is not
  - A notional value for health (e.g. willingness to pay) (a **demand-side concept**)

CETs for HIV spending decisions

- What do we know about optimizing HIV budgets?
  - ICERs: ART full cov less than 350 < Circumcision < Other 'BC comms' < Early ART < … < … < PrEP.*
  - Broadly, HIV interventions are unlikely to be cost-effective if ICER > $500
- What do we know about optimizing general HC?
  - Some work indicates that for
    - LICs shadow prices 1-51% GDP p.c.**
    - MICs shadow prices 18-71% GDP p.c.**

*Anderson, S.J., Kilonzo, N., Dybul, M., Ghys, P, Hallett, T, HIV prevention where it is needed most: comparison of strategies for the geographical allocation of interventions, JIAS, 2017.

**Woods B, Revill P, Sculpher M, Claxton K. Country-level cost-effectiveness thresholds: initial estimates, Value in Health, 201

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Cost-effectiveness thresholds- Summary

- Efficient resource allocation requires using resources where they can generate greatest benefits – requires assessment of opportunity costs
- Instead of a 'demand-side' to informing investment, a 'supply-side' estimate of constraints (and opportunity costs) is required
- The appropriate cost-effectiveness threshold depends upon other claims on the budget, but for HIV interventions is likely to be $500 or below.

THANK YOU