THE UNIVERSITY of York

Incorporating Health Inequality Impacts into Cost-Effectiveness Analysis: A Framework

Richard Cookson
Centre for Health Economics
University of York

CHE
Centre For Health Economics

CHE home
Research
Economic evaluation of health technologies
Econometric methods
Equity
Measurement and determinants of inequality
Economic evaluation of equity concerns
Health and social care
Health policy
Staff
Publications
Courses and PhDs
News
Seminars

PHRC Project on Distributional Cost-Effectiveness Analysis (2011-13)

A research project funded by the Public Health Research Consortium

This research has developed new methods for using cost effectiveness analysis (CEA) to analyse the health inequality impacts of health care interventions.

Click on the links below for further information

- Summary of the project
- Working papers
- Workshop 1 in March 2012 (overview)
- Workshop 2 in February 2013 (bowel cancer screening case study)

Summary of the project

- Project title: Identifying appropriate methods to incorporate concerns about health inequalities into economic evaluations of health care programmes
- Funded by: DH Policy Research Programme Public Health Research Consortium (PHRC)
- Duration: 1 April 2011 – 31 March 2013 (24 months)
- PI: Mark Sculpher
- Project team: Susan Griffin, Richard Cookson, Miqdad Asaria
- Advisers: Nigel Rice, Karl Claxton, Tony Culyer

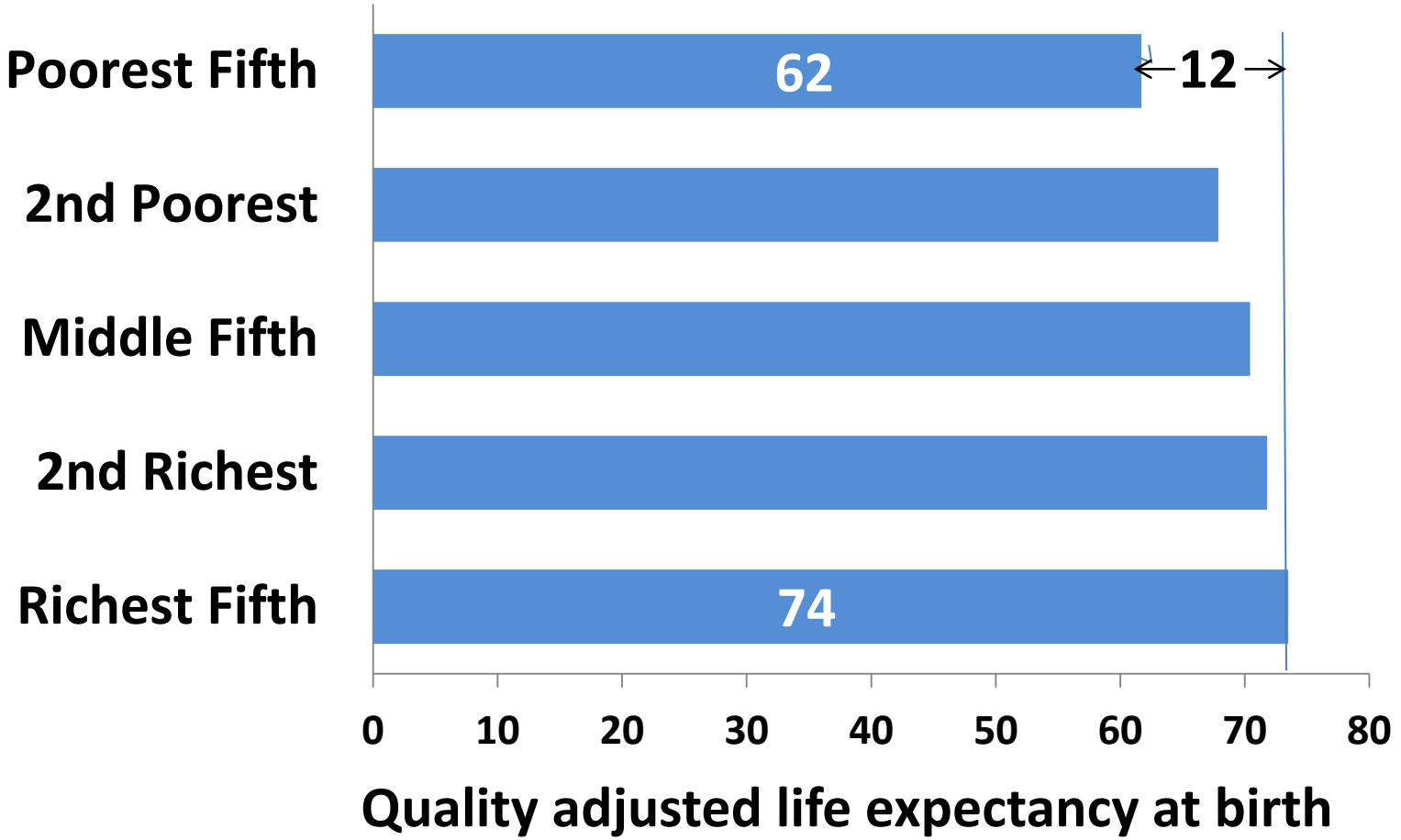
http://www.york.ac.uk/che/research/equity/d-c-e-a/phrc/

Outline of Talk

- Background
- Aims and Scope of the Framework
- Stage 1: Modelling Health Distributions
- Stage 2: Ranking Health Distributions

Background

Expected Years of Life in Full Health England and Wales



Source: Asaria, M, Griffin, S, Cookson, R, Whyte, S, Tappenden, P. (2012). Cost-equality analysis of health care programmes – a methodological case study of the UK Bowel Cancer Screening Programme. Paper presented to Health Economists Study Group in Exeter, January 2013.

World Health Organization

nd statistics | Media centre | Publications | Countries | Programmes and projects | A

Search

Health Impact Assessment (HIA)

Definitions of HIA

Many different people and organizations have defined HIA. Each definition is similar, differing through the emphasis given to particular components of the HIA approach. There is no correct definition; this is merely a sample of ways to describe HIA.

Main definition

A combination of procedures, methods and tools by which a policy, programme or project may be judged as to its potential effects on the health of a population, and the distribution of those effects within the population.

Example HIA

Regeneration of the Ferrier Estate, Greenwich (early 2000s)

http://www.who.int/hia/examples/social_welfare/whohia138/en/index.html

(~£23m over 7 years; deprived estate with 6,800 people)

"The HIA led to the identification of a number of possible short- and longer-term health outcomes for the local population, including

- a decrease in accident rates as a result of the provision of better designed and better quality housing;
- lower rates of respiratory disease and of stress and anxiety amongst residents as a result of more appropriate central heating systems and the elimination of infestation in their homes;
- improvements to diet and other health-related choices as a result of increasing opportunities for paid employment and higher income levels; and
- better psychological health and well being as a result of improved security measures and a reduction in levels of crime and the fear of crime."

London Borough of Hammersmith and Fulham HEALTH IMPACT ASSESSMENT OF REGENERATION PROGRAMMES Ruth Barnes, Anthea Cooke, Dave Ellis, Nigel Gee and Stephen James *Part 1: Introduction* May 2001. http://www.apho.org.uk/resource/item.aspx?RID=44786

Why try to quantify health inequality impact within cost effectiveness analysis?

- Because public decision makers have to make hard choices about scarce resources and so need to know:

1. The ***SIZE*** of health inequality impact
   - Not enough to know: is the impact +ve or -ve?
   - Need to know: how large is the impact?

2. The ***NET*** health inequality impact
   - Reducing health inequality often requires investment
   - Other ways of investing resources can deliver health gain
   - Need to know: health gain MINUS health opportunity cost

Equity-efficiency trade-offs between improving population health and reducing health inequality

"Trade offs exist between redistribution of health resources to tackle health inequalities, and the NICE model of distribution, based on investing in the most cost-effective treatment for the whole population. These trade offs have never been explicitly articulated and examined and we recommend that they should be."

House of Commons (2009)

House of Commons (2009). Health Committee Health Inequalities Third Report of Session 2008–09. HC 286–I. London: The Stationery Office Limited

Standard CEA

- Standard CEA ignores health inequality
  - Sassi, F. Archard, L. and Le Grand, J. (2001). “Equity and the economic evaluation of healthcare” *Health Technology Assessment 5(3).*
  - Weatherly H, Drummond M, Claxton K, Cookson R, Ferguson B, Godfrey C, Sculpher M, Sowden, A. Methods for assessing the cost-effectiveness of public health interventions: key challenges and recommendations. *Health Policy* 2009; 93:85-92.
- Developmental methods proposed but rarely applied and never used to inform decisions
  - Cookson, R, Drummond, M and Weatherly, H. (2009) "Explicit incorporation of equity considerations into economic evaluation of public health interventions" *Journal of Health Politics, Policy and Law.* 4: 231-45
  - Johri M, Norheim OF. (2012). Can cost-effectiveness analysis integrate concerns for equity? Systematic review. *International Journal of Technology Assessment in Health Care*. 12:1-8.

Developmental methods

1. Equity weights
   - Wailoo, A., Tsuchiya, A. and McCabe, C. (2009) Weighting must wait: incorporating equity concerns into cost effectiveness analysis may take longer than expected. *Pharmacoeconomics* 27(12): 983-989
2. Opportunity cost of equity constraint
   - Epstein, D. M., Chalabi, Z., Claxton, K., & Sculpher, M. (2007). "Efficiency, equity, and budgetary policies: informing decisions using mathematical programming." *Medical Decision Making 27(2), 128-137*.
3. Multi criteria decision analysis
   - Baltussen, R. and L. Niessen. (2006). "Priority setting of health interventions: the need for multi-criteria decision analysis." *Cost Effectiveness and Resource Allocation* 4: 14.

Aims and Scope of the Framework

"Distributional Cost-Effectiveness Analysis" (DCEA)

Aims

- To help cost effectiveness analysts provide useful information about health equity impacts that can be used to inform decisions about public expenditure on health care

- To help cost effectiveness analysts accommodate different value judgements about health inequality made by different decision makers and stakeholders
  - Facilitating a deliberative decision making process, not imposing a fully pre-specified theory of justice

- To encompass previously proposed methods (equity weighting, mathematical programming and MCDA)
  - A general framework, not a rival method

Accountability for reasonableness

‘‘Resource allocation decisions in health care are rife with moral disagreements and a fair, deliberative process is necessary to establish the legitimacy and fairness of such decisions’’

Daniels and Sabin 2008

‘‘Key elements of fair process will involve transparency about the grounds for decisions; appeals to rationales that all can accept as relevant to meeting health needs fairly; and procedures for revising decisions in light of challenges to them. Together these elements assure ‘accountability for reasonableness’’’

Daniels 2000

Daniels, N. 2000. ‘‘Accountability for Reasonableness.’’ *British Medical Journal* 321(7272): 1300–1301.

Daniels, N., and J. E. Sabin. 2008. ‘‘Accountability for Reasonableness: An Update.’’ British Medical Journal 337: a1850.

Scope of the Framework

- Only decisions by health sector organisations operating within a fixed health sector budget
  - e.g. in England: NICE, National Screening Committee, Public Health England, NHS England, DH
- Only decisions with no important non-health costs or benefits
  - Health care public health programmes
    - e.g. screening, immunisation, case finding, chronic disease management, smoking cessation, exercise referral
  - Health care treatment programmes
    - e.g. new drug, surgery, talking therapy

Why focus on health care?

- To make progress
  - Learn to crawl before trying to run
- Cross government policies may have larger impacts on health inequality
  - Non-healthcare public health (e.g. alcohol minimum price, school-based health promotion, free sport etc.)
  - Social and economic policy (e.g. on family, education, employment, housing, environment, transport, tax and social security, etc.)
- BUT they are much more complicated
  - Non-health costs outside the health budget
  - Non-health benefits
  - Impacts on income inequality as well as health inequality

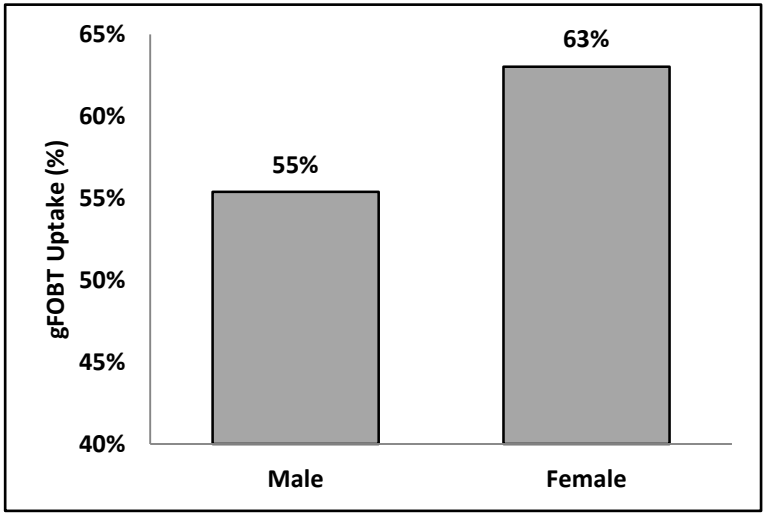
Illustrative Example

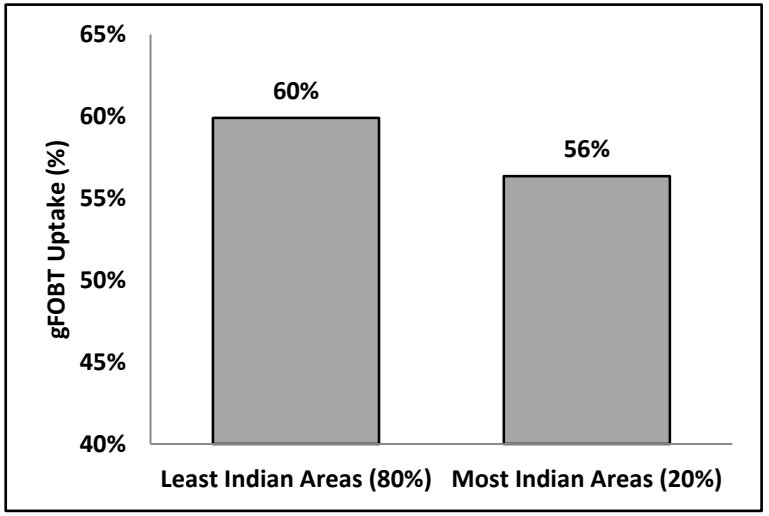
Re-Design Options to Increase Uptake of the NHS Bowel Cancer Screening Programme

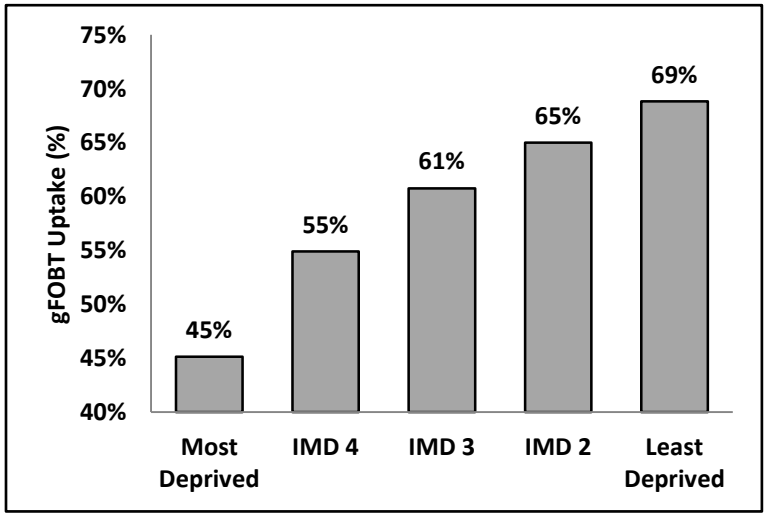
NHS Bowel Cancer Screening Programme

- Rolled out in 2006
- Everybody aged 60-74 invited for biennial gFOBT based screening
- Additionally flexible sigmoidoscopy currently being rolled out to people aged 55
- Overall uptake of pilots was 57% but large differences by gender, ethnicity and level of deprivation

Inequality in BCSP Uptake







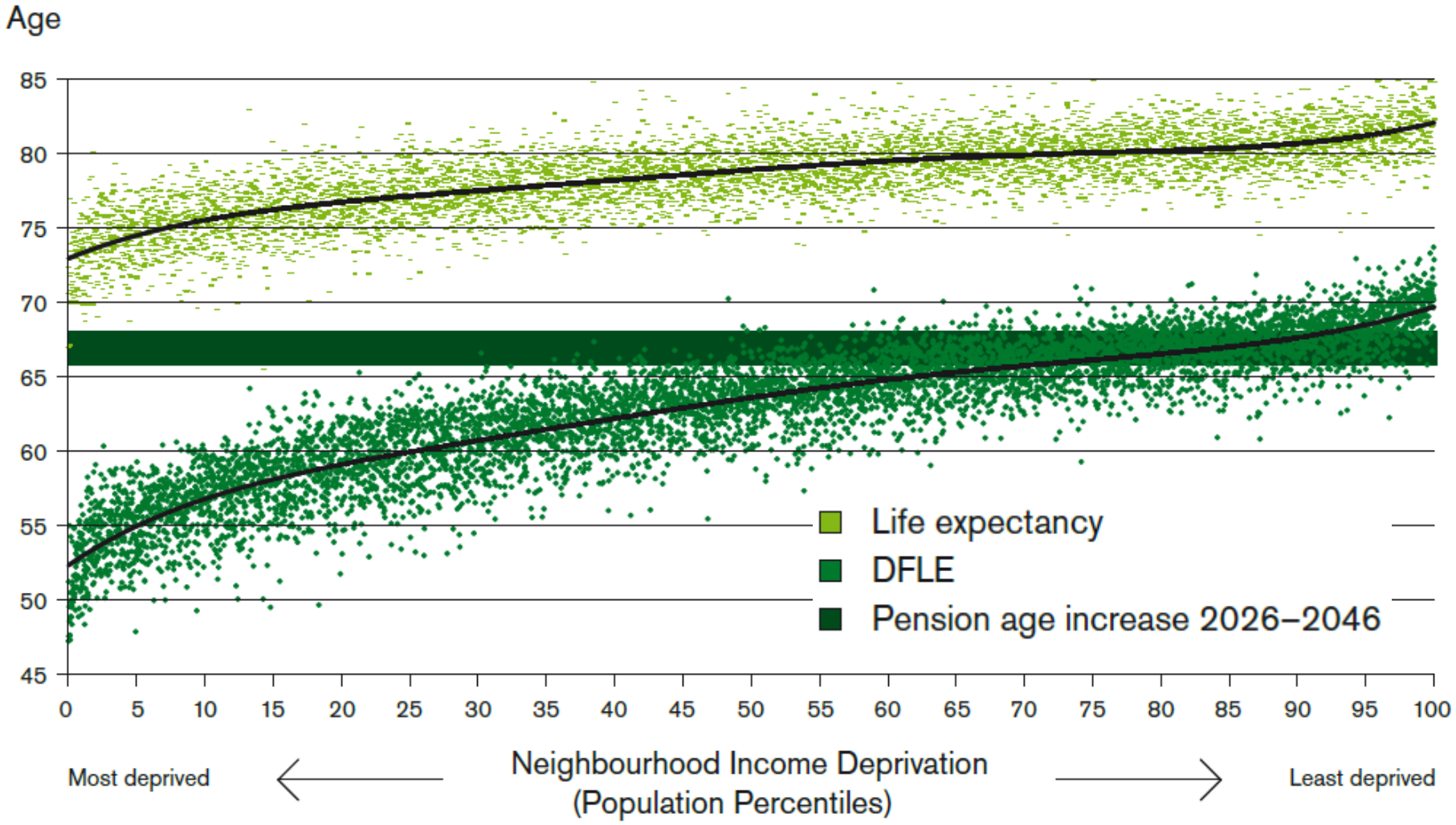
Two Redesign Options

- Universal Basic Reminder
  - Sent to everyone from central screening hub
  - Reminder letter sent to non-responders with statement that their GP recommends they participate
  - Assumed to increase uptake by 6% at a cost of £3.50 per person

- Targeted Enhanced Reminder
  - Sent to IMD groups 4 and 5 and to 20% of areas with highest population from Indian Subcontinent
  - Personal reminder letter and information pack sent by GP to non-responders
  - Assumed to increase uptake by 12% at a cost of £7 per person

- Both strategies have equal total costs per screening round of approximately £2.75 million

Strategic Review of Health Inequalities in England Post-2010 – The Marmot Review



Stage One:
Modelling Health Distributions

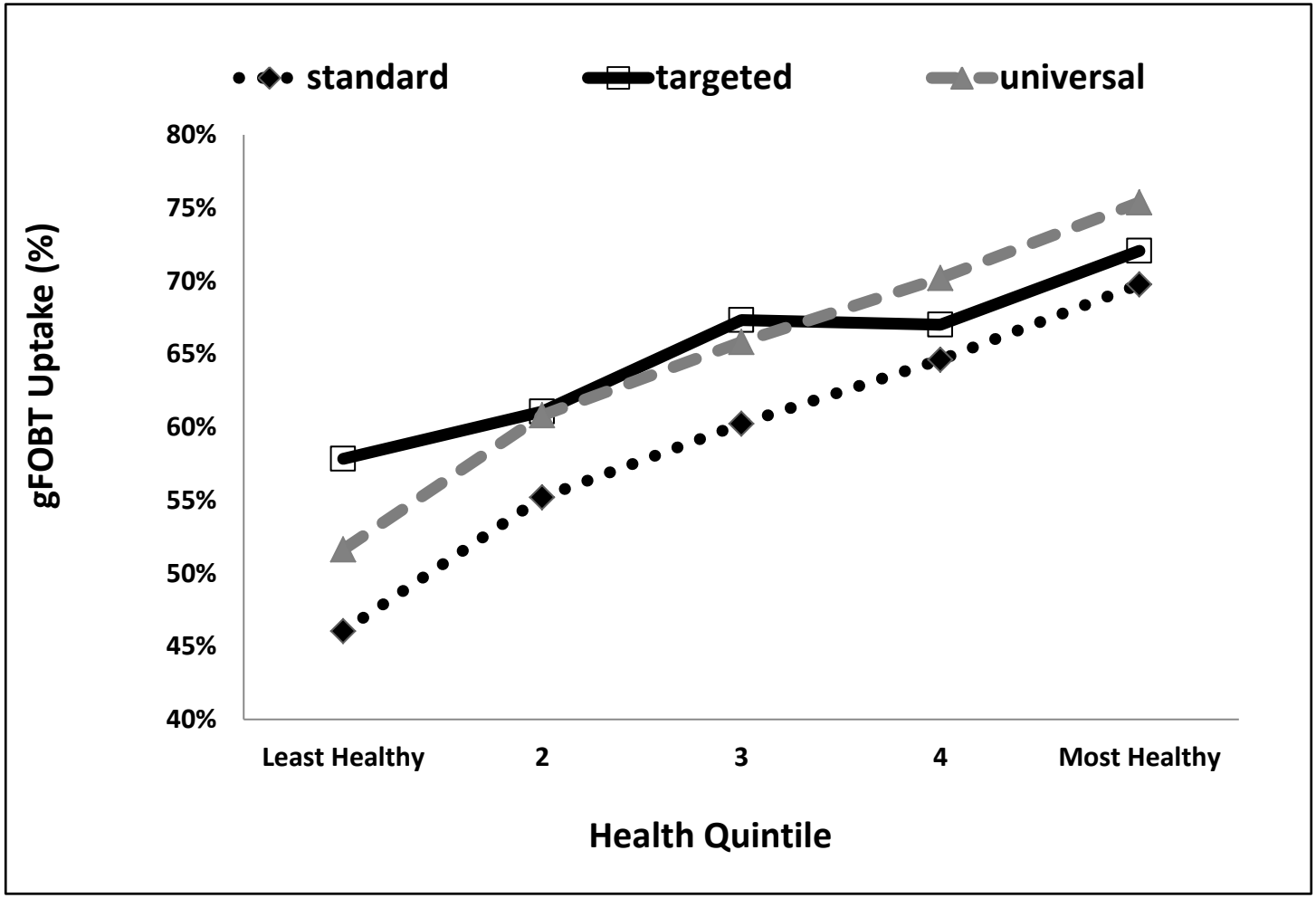
Modelling Health Distributions

- Select equity dimensions considered to represent “unfair” sources of inequality
  - e.g. income, gender, ethnicity etc.
- Health benefits by equity dimensions
  - Using QALYs or DALYs and other outcomes of interest e.g. utilisation, morbidity, mortality
- Health opportunity costs by equity dimensions
  - In general population, not just recipients
  - Using QALYs or DALYs (no other metric available, since displaced programmes are never known)

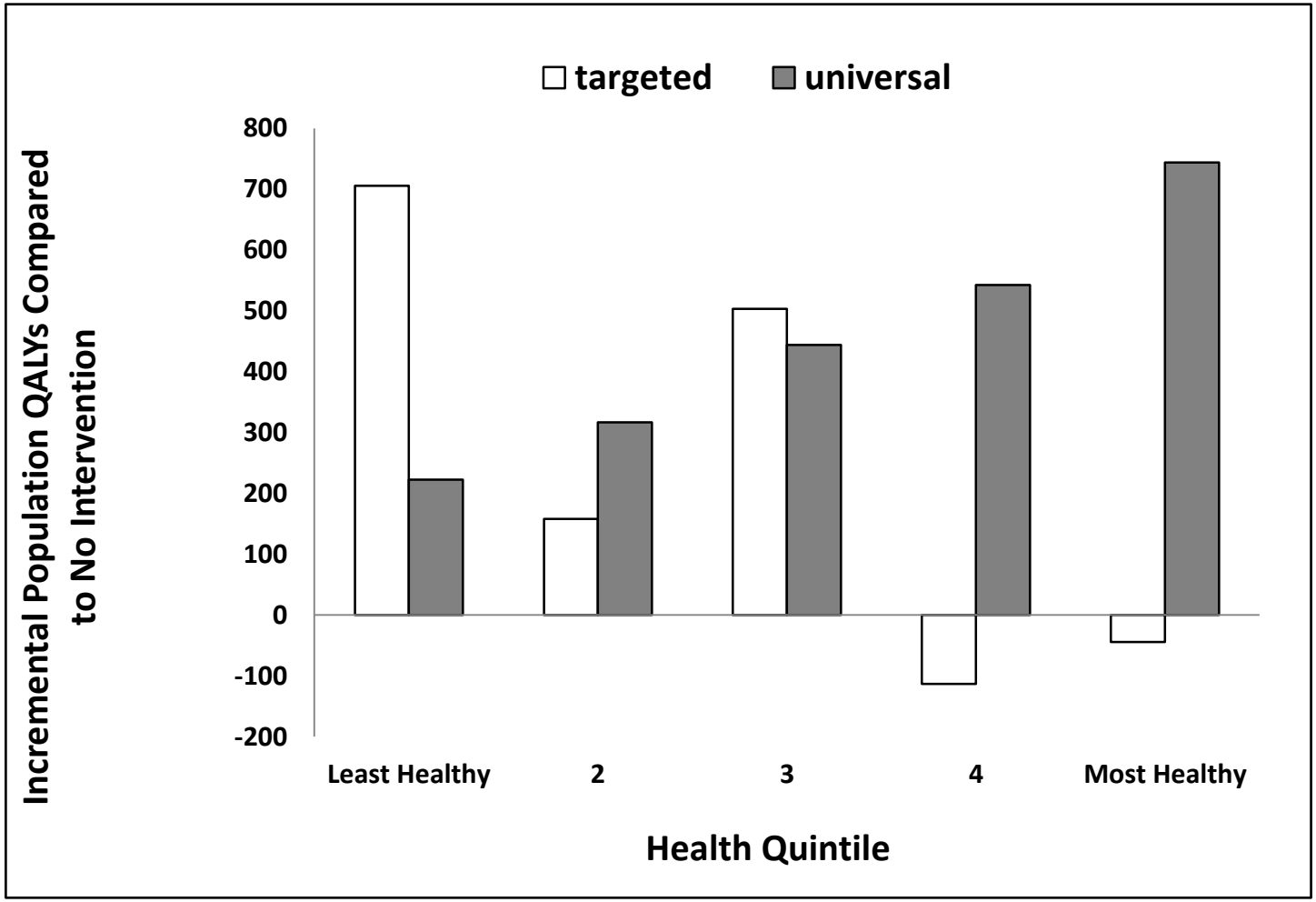
Modelling Health Distributions

- Baseline levels of lifetime health by equity dimensions
  - Using QALE or DALE ("Quality Adjusted" or "Disability Adjusted" Life Expectancy) and other outcomes of interest
- Overall and dimension-specific distributions of lifetime health with and without intervention
  - Using QALE or DALE (no other metric is available as opportunity costs are in QALYs or DALYs)
- Visualise the distributions
  - Use graphs and tables to describe, understand and communicate the patterns of distributional impact

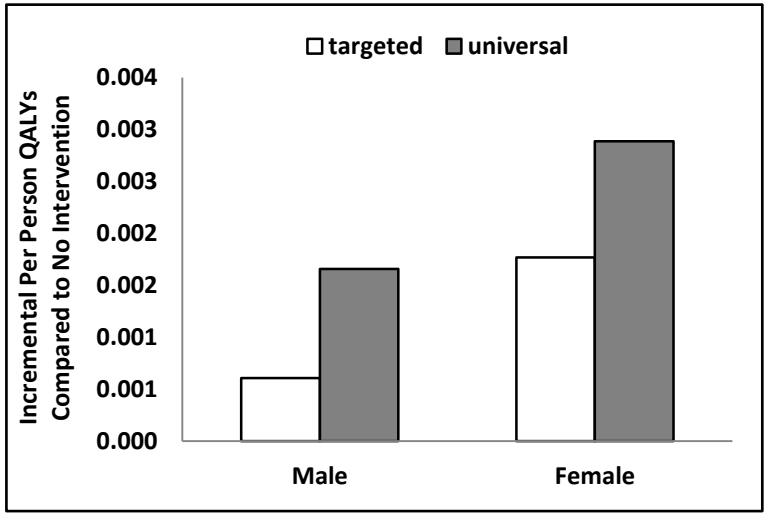
Impact of Redesign on Uptake

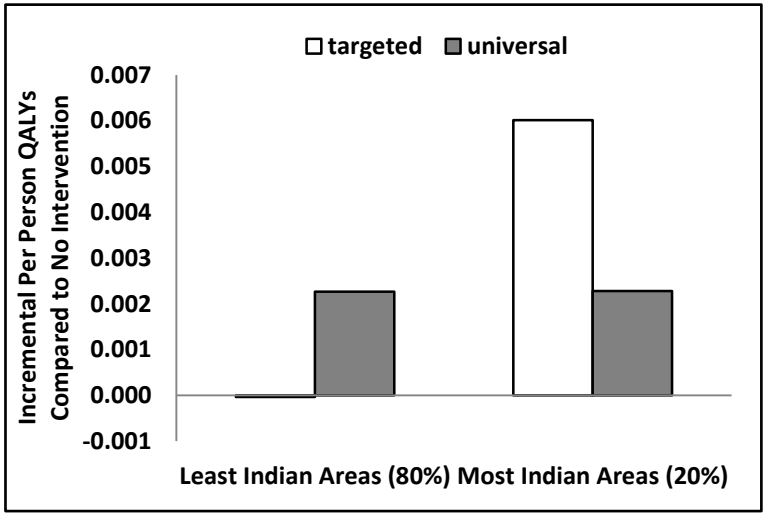


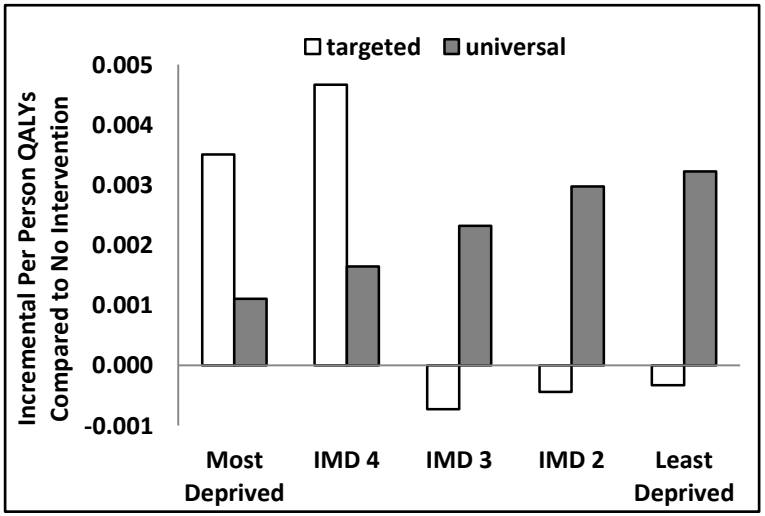
Impact of Redesign on Health



Impact of Redesign on Health







Interlude

Extended CEA ("ECEA")

- Dean Jamison and colleagues at the University of Washington have recently developed "Extended CEA" as part of their "Disease Control Priorities 3" project (www.dcp-3.org)
- This extends CEA to examines financial risk protection outcomes as well as health outcomes
- It also examines the distribution of outcomes in a manner consistent with our DCEA framework
- But does not exploit all potential features of DCEA:
  - Presents a "dashboard" of health and financial protection consequences by income group, in the form of a table
  - Focuses on one equity dimension at a time rather than overall distributions
  - Focuses on the distribution of health gains rather than the distribution of levels of lifetime health
  - Eschews Step 2: Rank Health Distributions

DCP3 Disease Control Priorities

economic evaluation for health

Contact Us | Log In

Search

Home | About | DCP3 | Country Network | Resources | News & Events | DCP2

NCD Synergies Network

DCP3 Project Director Rachel Nugent participates in inaugural network meeting in Kigali, Rwanda

Read More >

Welcome to DCP3

Disease Control Priorities, Third Edition will summarize and synthesize evidence of the effectiveness of global health interventions and provide comparative economic evaluation of policies to implement those interventions. Click here to learn more about the project.

Recent News

- Pan American Conference To Address Maternal and Child Health Inequalities
- DCP3 Chapters Available for Review
- Prioritize Cervical Cancer Screenings in Post-2015 Era, Experts Say

Millions Saved Second Call for Proposals

DCP3 and the Center for Global Development invite *DCP3* editors and authors to submit case study proposals for the newest edition of *Millions Saved: Case Studies in Global Health*.

Click here for more information on submitting case

Should ranking be eschewed or embraced?

"It is clear that with appropriate aggregation assumptions all entries on the dashboard could be collapsed into a single figure of merit. Our judgement, in going no further than presenting the dashboard, was that the inevitably arbitrary assumptions underlying aggregation would obscure the conclusions of an ECEA."

Verguet, Laxminarayan and Jamison (2012)

Verguet, S, Laxminarayan, R and Jamison, D T. (2012). Universal Public Finance of Tuberculosis Treatment in India: An Extended Cost Effectiveness Analysis. Disease Control Priorities in Developing Countries, 3rd Edition, Working Paper No.1

Stage Two:
Ranking Health Distributions

Ranking Health Distributions

- Estimate total health for each decision option
  - Encompasses analysis of the opportunity cost of equity constraints = difference in total health between “equitable” and “inequitable” options
- Check for distributional dominance
  - Is one distribution better for everyone? (Pareto)
  - Does one distribution improve total health and reduce health inequality according to almost any concept of inequality?

    (Atkinson, Shorrocks)

Ranking Health Distributions

- Compute multiple health inequality measures
  - Use multiple measures of interest to stakeholders, including absolute and relative measures and summary and extreme group measures
- Examine trade-offs between (1) improving population health and (2) reducing health inequality
  - Use appropriate simple SWFs with one or two inequality aversion parameters (e.g. Atkinson for relative inequality and Kolm for absolute inequality)
  - Encompasses MCDA: other decision criteria can be added
  - Encompasses equity weighting: values of the SWF parameter(s) imply different sets of equity weights

Health Inequality Measures

Relative Inequality Indices	*standard gFOBT*	*gFOBT + targeted*	*gFOBT + universal*
Relative Gap Index (ratio)	***0.17592***	***0.17586***	***0.17596***
Relative Index of Inequality (RII)	***0.18674***	***0.18668***	***0.18678***
Gini Index	***0.03112***	***0.03111***	***0.03113***
Atkinson Index (ε=1)	***0.00172***	***0.00172***	***0.00172***
Atkinson Index (ε=30)	***0.06281***	***0.04305***	***0.04309***

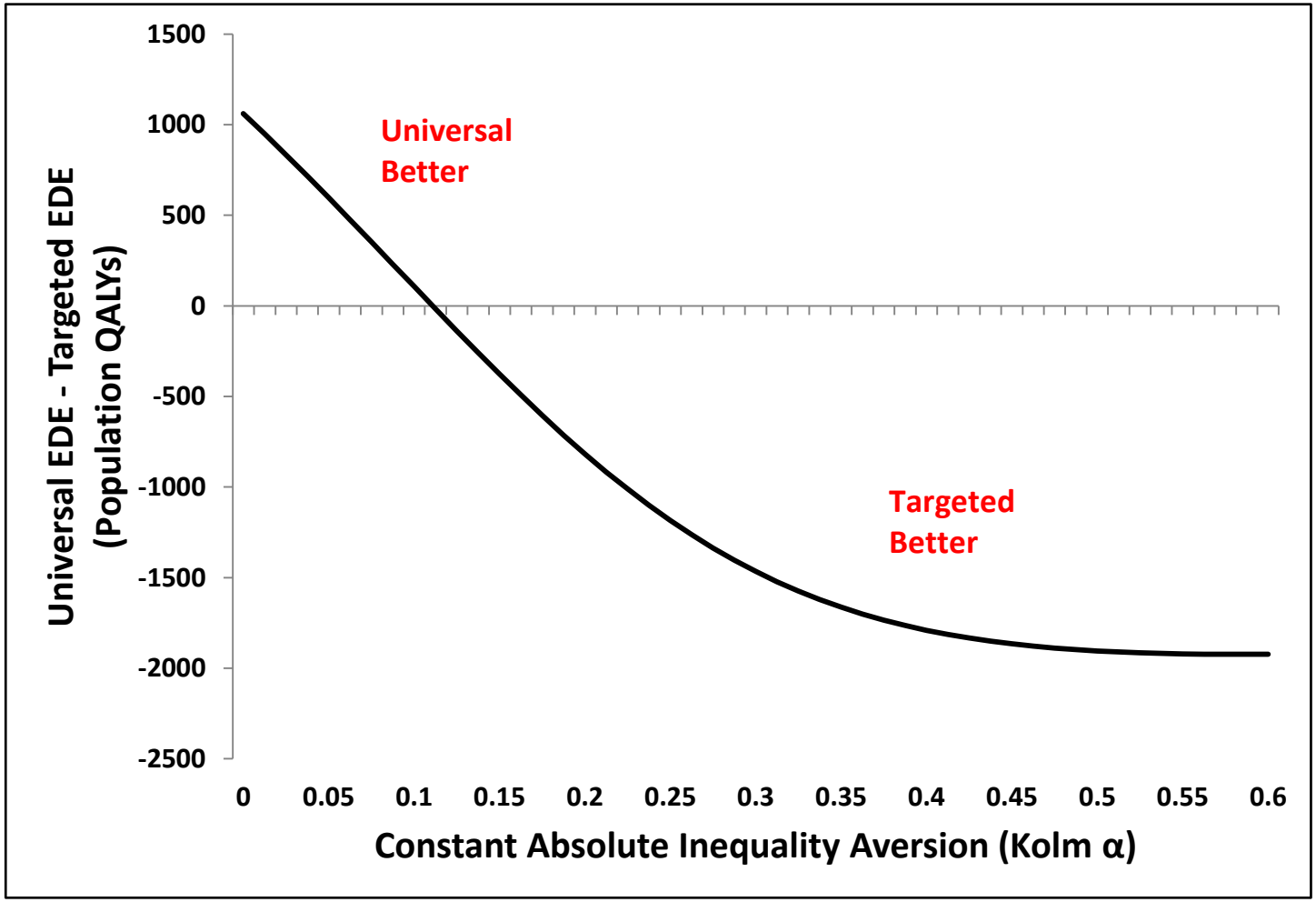
ε=1 represents low relative inequality aversion while ε=8 represents high relative inequality aversion

Absolute Inequality Indices	*standard gFOBT*	*gFOBT + targeted*	*gFOBT + universal*
Absolute Gap Index (range)	***11.03064***	***11.02726***	***11.03325***
Slope index of inequality (SII)	***12.94123***	***12.93691***	***12.94438***
Kolm Index (α=0.025)	***0.20430***	***0.20416***	***0.20439***
Kolm Index (α=0. 5)	***4.48739***	***4.58587***	***4.58883***

α=0.025 represents low absolute inequality aversion while α=0.125 represents high absolute inequality aversion

Which Policy is Best (Relative)?

Which Policy is Best (Absolute)?

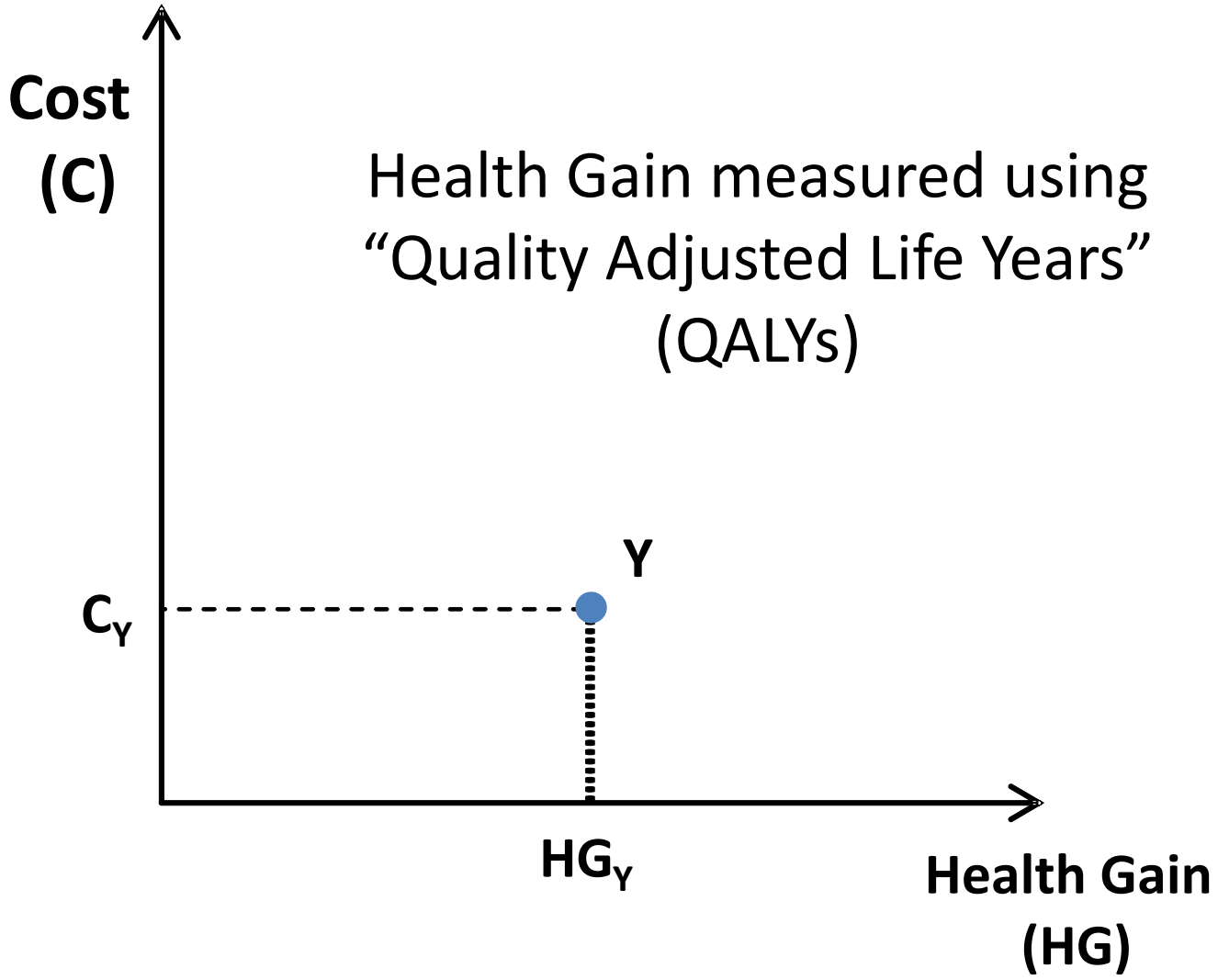


Sensitivity of Results to Alternative Social Value Judgements

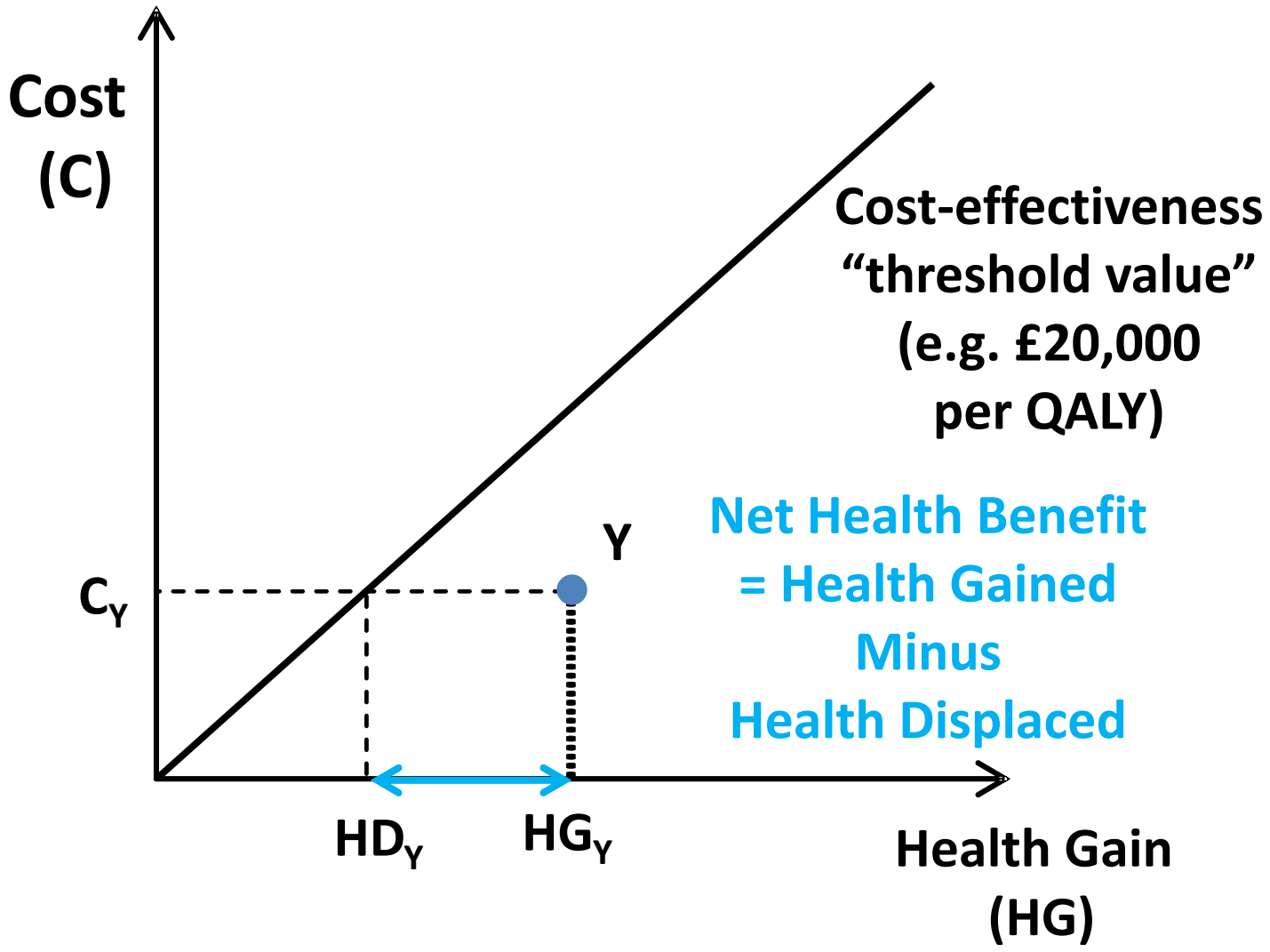
Social Value Judgment			**Preferred Strategy based on Social Welfare Index** S = standard screening U = screening + universal basic reminder T = screening + targeted enhanced reminder			
IMD	**Ethnic Diversity**	**Gender**	**Atkinson EDE (ε = 1)**	**Atkinson EDE (ε = 20)**	**Kolm EDE (α = 0.025)**	**Kolm EDE (α = 0.5)**
Fair	Fair	Fair	U	U	U	U
Fair	Unfair	Fair	U	U	U	U
Fair	Fair	Unfair	U	U	U	U
Fair	Unfair	Unfair	U	U	U	U
Unfair	Fair	Fair	U	T	U	T
Unfair	Unfair	Fair	U	T	U	T
Unfair	Fair	Unfair	U	T	U	T
Unfair	Unfair	Unfair	U	T	U	T

Thank you.

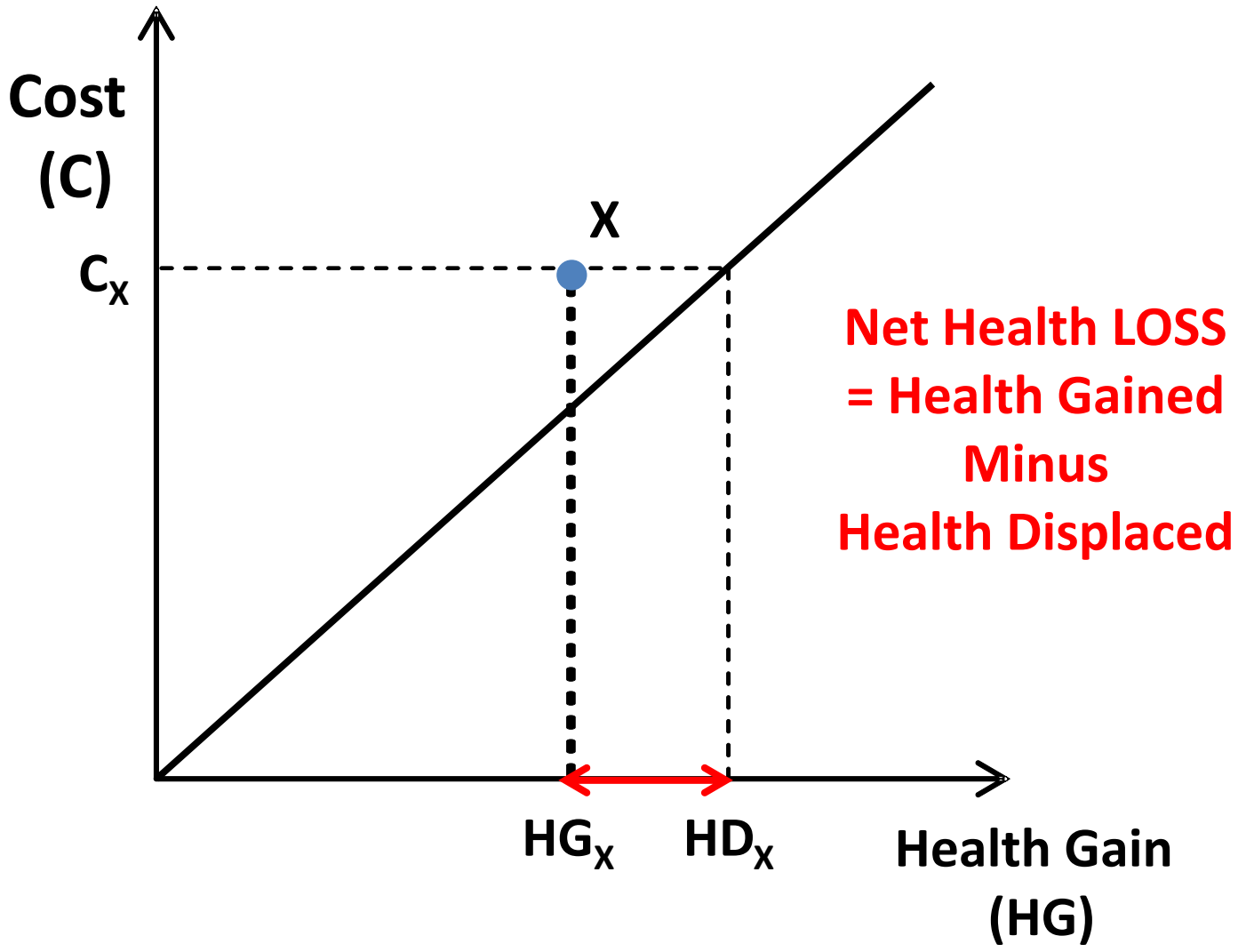
Standard CEA



Standard CEA



Standard CEA



Intervention X

- Health $Gain_X$ 70,000 QALYs
- $Cost_X$ £1.6bn
- Threshold value £20,000
- Health $Displaced_X$ = £1.6bn / £20,000
  = 80,000 QALYs
- Net Health Loss = 70,000 – 80,000 = 10,000 QALYs

  i.e. not cost effective: => an overall population health loss
- But does X reduce inequality, and if so by how much?
- Is this health inequality reduction "worth" the health loss?

Extensions to Existing Sheffield CEA Model

Parameter that varies by subgroup	Handled in analysis	Adjustment variables
All cause mortality	☑	**Gender, Deprivation**
Incidence of bowel cancer and severity	☒	
Uptake of screening programme	☑	**Gender, Deprivation, Ethnic Diversity**
Quality adjustment of health gains	☑	**Gender, Deprivation**
Opportunity cost of spending NHS money on screening	**Partially**	**Equally distributed but modelled**

Atkinson SWF

h * (1 – I)

- h is mean health
- I is the Atkinson index of inequality in health on a scale from 1 (fully unequal) to 0 (fully equal)
- ε is the "inequality aversion" parameter
  (ε = 0 implies that only mean health matters; higher ε implies greater concern for inequality *vis a vis* mean health; and as ε tends to infinity concern focuses only on the worst off person)

$$A_\varepsilon = 1 - \frac{h_{ede}}{\bar{h}}$$

equally distributed equivalent health divided by mean health

$$A_\varepsilon = 1 - \left[\frac{1}{n}\sum_{i=1}^{n}\left[\frac{h_i}{\bar{h}}\right]^{1-\varepsilon}\right]^{\frac{1}{1-\varepsilon}}$$

$$h_{ede} = \left[\frac{1}{n}\sum_{i=1}^{n}[h_i]^{1-\varepsilon}\right]^{\frac{1}{1-\varepsilon}}$$

Project title:	Identifying appropriate methods to incorporate concerns about health inequalities into economic evaluations of health care programmes
Funded by:	DH Policy Research Programme Public Health Research Consortium (PHRC)
Conducted by:	University of York, Centre for Health Economics (CHE)
Duration:	1 April 2011 – 31 March 2013 (24 months)
PI:	Mark Sculpher
Project team:	Susan Griffin, Richard Cookson, Miqdad Asaria
Advisers:	Nigel Rice, Karl Claxton, Tony Culyer

PHR

CHE
Centre For Health Economics