Assessing health opportunity costs: UK estimates

Marta Soares, Senior Research Fellow
Centre for Health Economics, York

24/05/2016
ISPOR Washington

References and acknowledgements

- **Claxton K, Martin M, Soares M, Rice N, Spackman E, Hinde S, Devlin N, Smith PC and Sculpher M** (2015). Methods for the estimation of the NICE cost effectiveness threshold. Health Technology Assessment, 19(14) (https://www.york.ac.uk/che/research/teehta/thresholds/)
- Claxton, K., Sculpher, M., Palmer, S., et al. (2015). Causes for concern: is NICE failing to uphold its responsibilities to all NHS patients? Health Economics, 24, 1–7.
- **Ochalek J, Claxton K, Lomas J.** Country-level cost-effectiveness thresholds: what can we learn from econometric models using cross-country data? Centre for Health Economics, University of York; CHE Research Paper 122, 2015.

Other useful references:

- Woods B, Revill P, Sculpher M, Claxton K. Country-level cost-effectiveness thresholds: initial estimates and the need for further research. Centre for Health Economics, University of York; CHE Research Paper 109, 2015 (forthcoming Value in Health).
- Revill P, Walker S, Madan J, Ciaranello A, Mwase T, Gibb DM, Claxton K, Sculpher M. Using cost-effectiveness thresholds to determine value for money in low- and middle-income country healthcare systems: are current international norms fit for purpose? Centre for Health Economics, University of York; CHE Research Paper 98, 2014.

Assessing health opportunity costs

- What are the additional health benefits and additional costs of a proposed investment?
  - What are the health effects of those things we will need to give up or *others are likely to give up* if we commit to the resources?

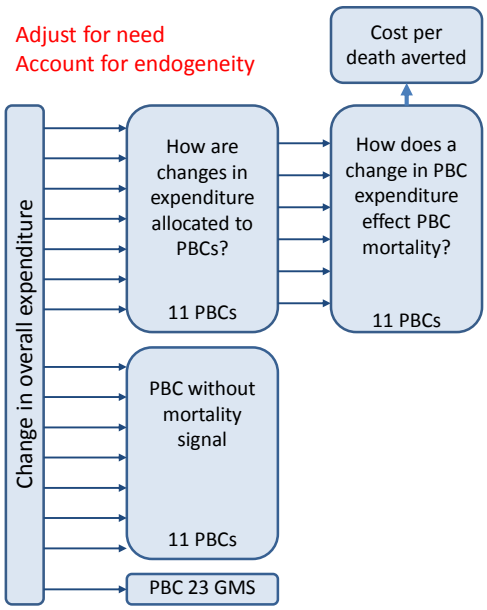
How did we estimate it?

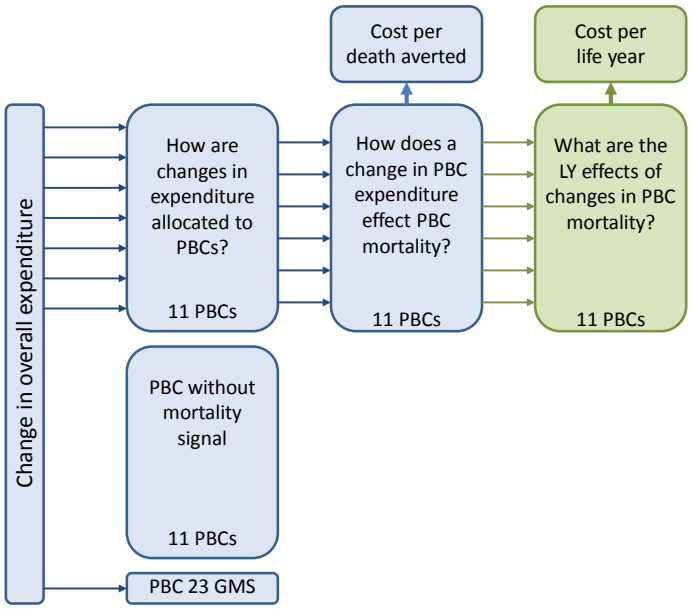
- Estimate the relationship between changes in expenditure and outcomes
  - 152 Primary Care Trusts (PCTs)
    - Local areas of the NHS responsible for commissioning
    - PBC expenditure and mortality by ICD code
  - 23 Programme Budget Categories (PBCs)
    - Disease areas (groups of ICD codes)
    - All expenditure allocated to each PBC

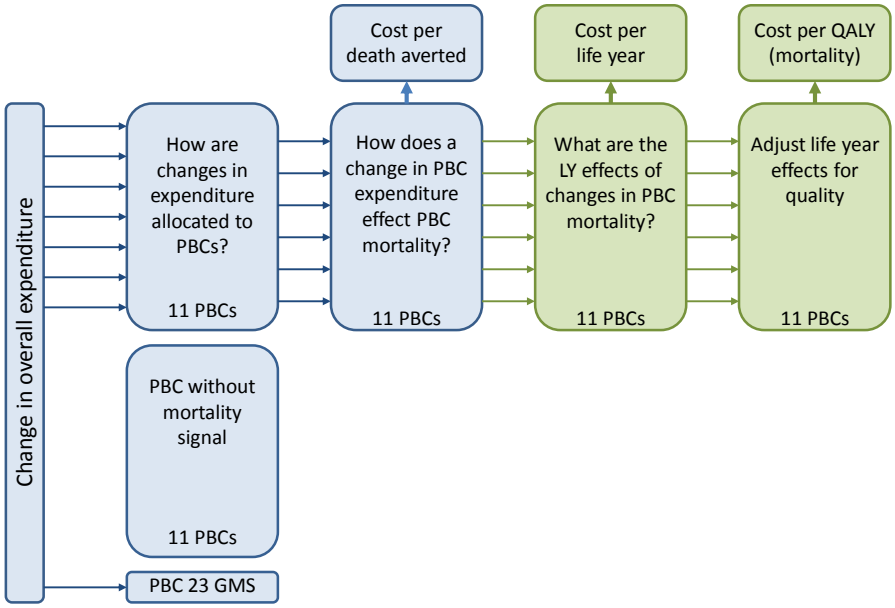
How can we estimate effects of expenditure on mortality (deaths)?

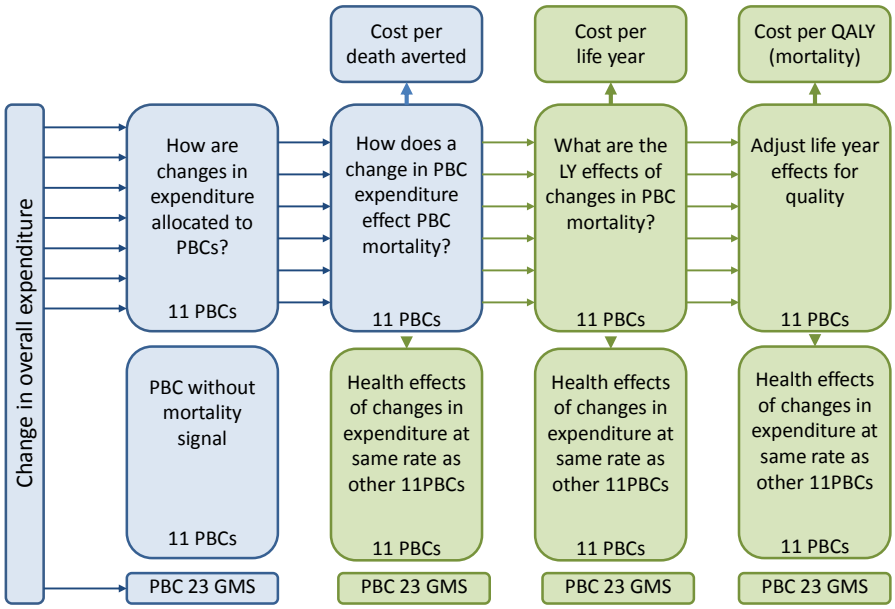
- Change in PBC expenditure due to change in overall expenditure
  - Differences in spend on a particular PBC and total spend across PCTs
  - Account for other reasons why PBC spend might differ between PCTs
  - Isolate the effects of changes in overall expenditure on PBC spend
- Change in PBC mortality (deaths) due to change in PBC expenditure
  - Differences in PBC mortality and PBC expenditure across PCTs
  - Account for other reasons why PBC mortality might differ between PCTs
  - Isolate the effects of changes in PBC spend on PBC mortality

Estimates for the UK NHS




Cost per death averted
Cost per life year
Change in overall expenditure
How are changes in expenditure allocated to PBCs?
11 PBCs
How does a change in PBC expenditure effect PBC mortality?
11 PBCs
What are the LY effects of changes in PBC mortality?
11 PBCs
PBC without mortality signal
11 PBCs
PBC 23 GMS


Cost per death averted
Cost per life year
Cost per QALY (mortality)
Change in overall expenditure
How are changes in expenditure allocated to PBCs?
11 PBCs
How does a change in PBC expenditure effect PBC mortality?
11 PBCs
What are the LY effects of changes in PBC mortality?
11 PBCs
Adjust life year effects for quality
11 PBCs
PBC without mortality signal
11 PBCs
PBC 23 GMS

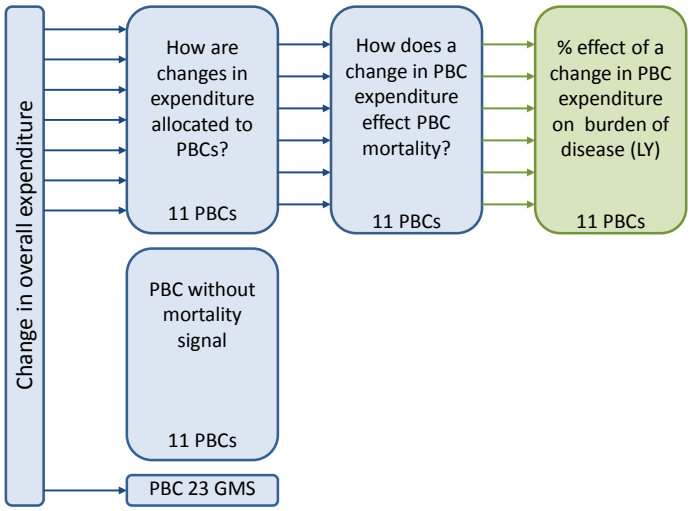


How can we account for possible effects on quality of life?

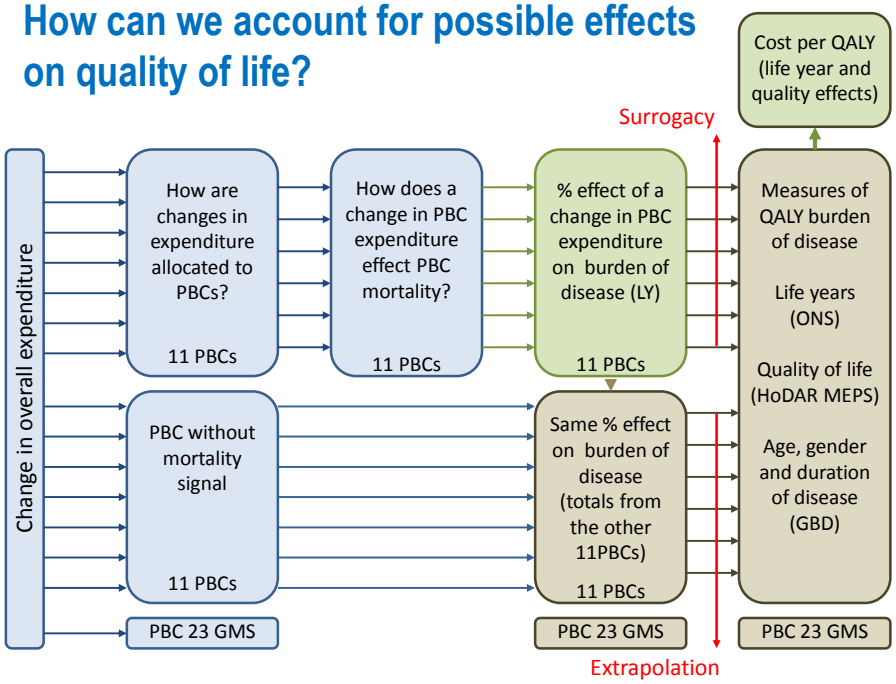
- No observations of quality life by PBC at PCT level
  - Quality of life is important in 11 PBCs with mortality
  - Mortality is (almost) irrelevant in the other 11 PBCs
  - Much NHS activity is primarily to improve quality of life

- Possible responses
  - Surrogacy
    - Proportionate effect mortality burden used as surrogate for Qol effects
  - Extrapolation
    - Proportionate effect on QALY burden is similar in the other 11 PBCs
  - Use what can be observed

How can we account for possible effects on quality of life?



How can we account for possible effects on quality of life?



UK estimates of the 'threshold'

	Cost per death averted	Cost per life year	Cost per QALY (mortality effects)	Cost per QALY
QoI associated with LYs	-	*1*	*Norms*	*Based on burden*
QoI during disease	-	*0*	*0*	*Based on burden*
YLL per death averted	-	*4.5 YLL*	*4.5 YLL*	*4.5 YLL*
QALYs per death averted	-	*4.5 YLL*	*3.8 QALY*	*12.7 QALY*
11 PBCs (with mortality)	£105,872	£23,360	£28,045	£8,308
All 23 PBCs	£114,272	£25,214	£30,270	**£12,936**

What are the expected health consequences of £10m?

	Change in spend	Additional deaths	LY lost	Total QALY lost	Due to premature death	Quality of life effects
Totals	**10 (£m)**	**51**	**233**	**773**	**150**	**623**
Cancer	0.45	3.74	**37.5**	26.3	24.4	1.9
Circulatory	0.76	22.78	**116.0**	107.8	73.7	34.1
Respiratory	0.46	13.37	**16.1**	229.4	10.1	**219.3**
Gastro-intestinal	0.32	2.62	**24.7**	43.9	16.2	27.7
Infectious diseases	0.33	0.72	5.3	15.7	3.6	12.1
Endocrine	0.19	0.67	5.0	60.6	3.2	57.3
Neurological	0.60	1.21	6.5	109.1	4.3	**104.8**
Genito-urinary	0.46	2.25	3.3	10.6	2.1	8.5
Trauma & injuries*	0.77	0.00	0.0	0.0	0.0	0.0
Maternity & neonates*	0.68	0.01	0.4	0.2	0.2	0.1
Disorders of Blood	0.21	0.36	1.7	21.8	1.1	20.7
Mental Health	1.79	2.83	12.8	95.3	8.3	**87.0**
Learning Disability	0.10	0.04	0.2	0.7	0.1	0.6
Problems of Vision	0.19	0.05	0.2	4.2	0.2	4.1
Problems of Hearing	0.09	0.03	0.1	14.0	0.1	13.9
Dental problems	0.29	0.00	0.0	6.8	0.0	6.8
Skin	0.20	0.24	1.1	1.9	0.7	1.2
Musculo skeletal	0.36	0.39	1.8	23.2	1.2	22.1
Poisoning and AE	0.09	0.04	0.2	0.8	0.1	0.7
Healthy Individuals	0.35	0.03	0.2	0.7	0.1	0.6
Social Care Needs	0.30	0.00	0.0	0.0	0.0	0.0
Other (GMS)	1.01	0.00	0.0	0.0	0.0	0.0

Cost per DALY estimates

Ochalek J, Claxton K, Lomas J. Country-level cost-effectiveness thresholds: what can we learn from econometric models using cross-country data? Centre for Health Economics, University of York; CHE Research Paper 122, 2015.

- Bokhari et al. (2007): cross-section of 127 countries from the year 2000 estimates the effect of public expenditure on health, under-5 mortality and maternal mortality.
  - Considers endogeneity (IV estimation)
- Ochalek 2015 replicates Bokhari's methodology using data from GBD that are not available in panel form, but exist for the year 2000, as well as additional data from the World Bank, on:
  - 15-60 year old mortality, for males and females,
  - YLL per capita,
  - YLD per capita and
  - DALY per capita.

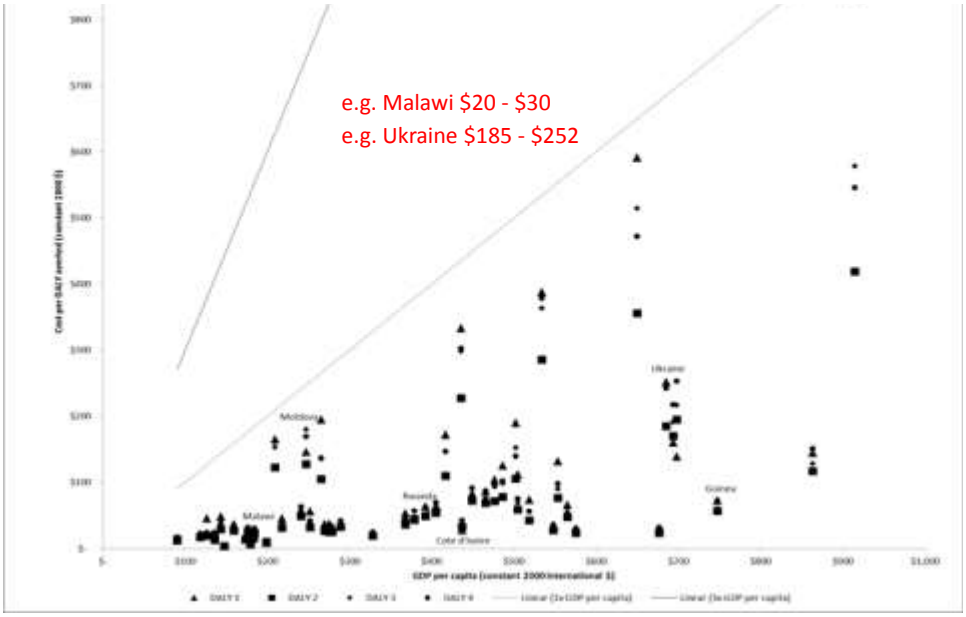
Cost per DALY estimates

Ochalek et al, 2015

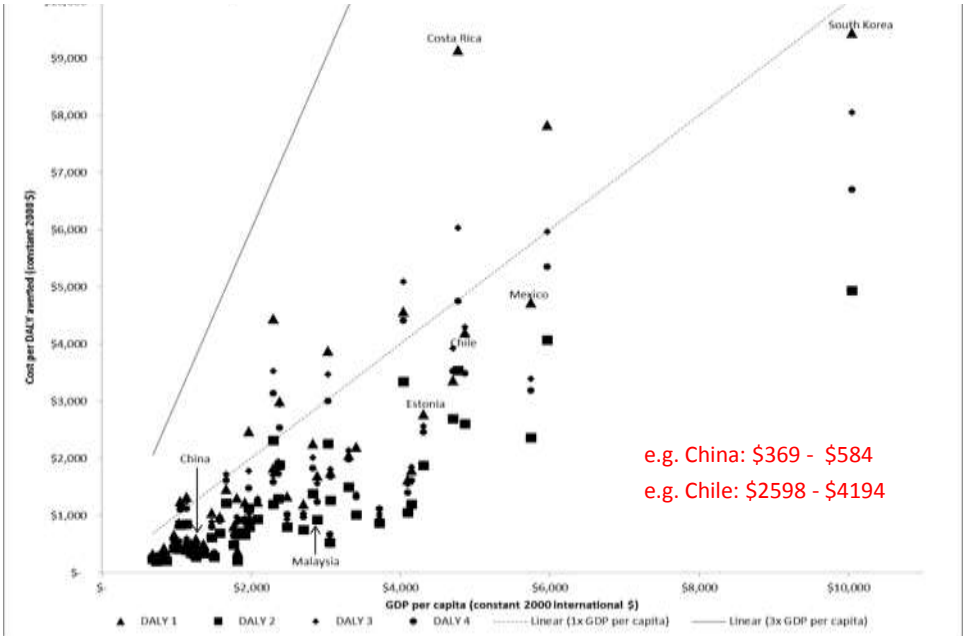
- Given the range of outcomes, Ochalek 2015 estimated DALYs averted in four different ways:

	Survival (YLL)		Morbidity (YLD)		DALY
	Based on mortality estimates	directly estimated	Mortality as surrogate for morbidity effects	directly estimated ,or adjusted	directly estimated DALY
DALY 1	X		X		
DALY 2		X	X		
DALY 3		X		X	
DALY 4					X

Cost per DALY estimates, low income countries



Cost per DALY estimates, middle income countries



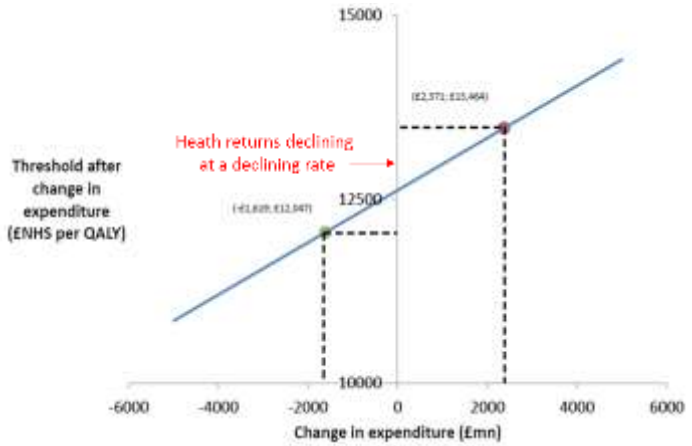
Thresholds?
Assessing health opportunity costs

Thanks

marta.soares@york.ac.uk
karl.claxton@york.ac.uk

Affordability and cost-effectiveness?

- Greater health opportunity costs for large budget impact
  - Cost per LY for under and over target allocation (4 PBCs)
  - Lower threshold when less resources (under target)
  - Extend to cost per QALY (all PBCs)



Affordability and cost-effectiveness?

Change (£m)	Threshold at the 'new' margin	Health opportunity costs (non marginal impact)	Health opportunity costs (marginal impact)	Health benefits of 'smoothing' budget impact
-£416	£12,475	-33,152	-32,157	994 (£12m)
-£772	£12,348	-61,833	-59,677	2,156 (£27m)
-£2,000	£11,912	-163,037	-154,603	8,434

- No conflict between costs effectiveness and affordability
  - Threshold represents likely health opportunity costs
  - Some evidence of qualitative effects
- Benefits of smoothing
  - More health at given price or a higher price
  - Funders smooth – discount representing opportunity costs
  - Manufacturers smooth – charge opportunity costs of capital