Health opportunity costs in the NHS:
assessing the implications of uncertainty using elicitation methods with experts
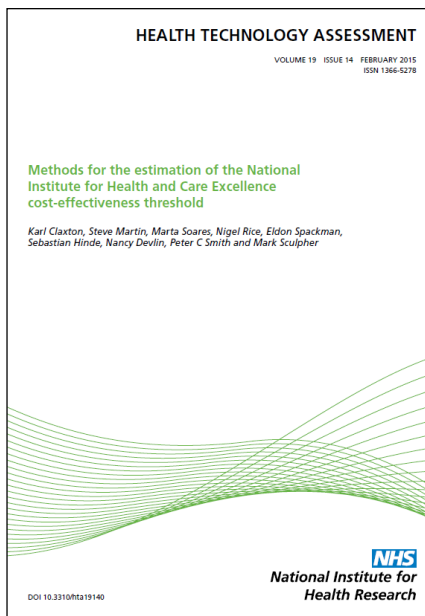
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Context

HEALTH TECHNOLOGY ASSESSMENT

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Methods for the estimation of the National Institute for Health and Care Excellence cost-effectiveness threshold

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NHS
National Institute for Health Research

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Claxton et al 2015

- Set out to estimate the health opportunity costs in the NHS
- Used evidence on the impact of changes in spend on mortality
- Data was limited for important aspects, e.g. quality of life impacts, duration of mortality effects
- Assumptions on key quantities required

We propose eliciting these judgements from individuals close to policy

2

Summary. Elasticities (08/09).

PBC	Description	Spend, £M	spend elast.
1	Infectious diseases	1201	1.54
2	Cancer	4843	0.52
3	Disorders of Blood	998	1.17
4	Endocrine problems	2222	0.48
5	Mental Health Disorders	9794	1.04
...	...	...	...
20	Poisoning and adverse effects	938	0.56
21	Healthy Individuals	1831	1.10
22	Social Care Needs	1874	0.91
23	Other	11666	0.49

A 1% increase in overall budget increases PBC spend by 0.52%

A 1% increase in overall budget increases PBC spend by 1.04%

3

Summary. Elasticities (08/09).

PBC	Description	Spend, £M	spend elast.	Δ spend, £M
1	Infectious diseases	1201	1.54	18.6
2	Cancer	4843	0.52	25.4
3	Disorders of Blood	998	1.17	11.7
4	Endocrine problems	2222	0.48	10.7
5	Mental Health Disorders	9794	1.04	101.5
...	...	...	...	...
20	Poisoning and adverse effects	938	0.56	5.3
21	Healthy Individuals	1831	1.10	20.1
22	Social Care Needs	1874	0.91	17.1
23	Other	11666	0.49	57.6
	sum	78398		568.2

(1% x PBC spend) x spend elasticity

Not 1% of

(elasticities estimated independently across PBCs)

4

2

Summary. Elasticities (08/09). Adjustment of spend elasticities

PBC	Description	Spend, £M	spend elast.	Δ spend, £M	spend elast. (adj)	Δ spend, £M (adj)
1	Infectious diseases	1201	1.54	18.6	2.13	25.6
2	Cancer	4843	0.52	25.4	0.72	35.1
3	Disorders of Blood	998	1.17	11.7	1.62	16.1
4	Endocrine problems	2222	0.48	10.7	0.67	14.8
5	Mental Health Disorders	9794	1.04	101.5	1.43	140.0
...	...	...	...	...	...	...
20	Poisoning and adverse effects	938	0.56	5.3	0.77	7.3
21	Healthy Individuals	1831	1.10	20.1	1.51	27.7
22	Social Care Needs	1874	0.91	17.1	1.26	23.6
23	Other	11666	0.49	57.6	0.68	79.5
	sum	78398		568.2		783.98

Elasticities adjusted (scaled up) so that change in spend represents 1% of

5

Summary. Elasticities (08/09)

PBC	PBC description	Spend elasticities (adjusted)
2	Cancer	0.72
10	Circulatory problems	0.89
11	Respiratory problems	0.90
13	Gastro-intestinal problems	0.63
1	Infectious diseases	2.13
4	Endocrine problems	0.67
7	Neurological problems	1.35
17	Genito-urinary problems	0.96
16	Trauma & injuries	1.85
18+19	Maternity & neonates	1.34
3	Disorders of Blood	1.62
5	Mental Health Disorders	1.43
6	Problems of Learning Disability	0.28
8	Problems of Vision	0.90
9	Problems of Hearing	1.64
12	Dental problems	0.71
14	Problems of the Skin	0.93
15	Musculo skeletal system	0.70
20	Poisoning and adverse effects	0.77
21	Healthy Individuals	1.51
22	Social Care Needs	1.26
23	Other	0.68

6

Summary. Elasticities (08/09)

PBC	PBC description	Spend elasticities (adjusted)	outcome elasticities (negative sign omitted)
2	Cancer	0.72	0.31
10	Circulatory problems	0.89	1.32
11	Respiratory problems	0.90	1.81
13	Gastro-intestinal problems	0.63	1.36
1	Infectious diseases	2.13	0.50
4	Endocrine problems	0.67	1.17
7	Neurological problems	1.35	0.42
17	Genito-urinary problems	0.96	1.62
16	Trauma & injuries	1.85	0
18+19	Maternity & neonates	1.34	0.12
3	Disorders of Blood	1.62	
5	Mental Health Disorders	1.43	
6	Problems of Learning Disability	0.28	
8	Problems of Vision	0.90	
9	Problems of Hearing	1.64	
12	Dental problems	0.71	**No relationship detected**
14	Problems of the Skin	0.93	
15	Musculo skeletal system	0.70	
20	Poisoning and adverse effects	0.77	
21	Healthy Individuals	1.51	
22	Social Care Needs	1.26	
23	Other	0.68	

A 1% increase in PBC spend reduces disease-specific mortality by 0.31%

11 PBCs: with measured mortality effects

A 1% increase in PBC spend reduces disease-specific mortality by 1.81%

Other 12 PBCs: without measured mortality effects

7

Summary. Elasticities (08/09). First 11 PBCs.

PBC	Spend (£M)	spend elasticities	Change in spend (£M)	Net YLL *	outcome elasticities	Change in net YLL
2	4,843	0.72	£35.1	1,322,166	0.31	2,940
10	6,655	0.89	£59.5	771,038	1.32	9,092
11	3,994	0.90	£35.9	77,434	1.81	1,259
13	3,989	0.63	£25.1	225,254	1.36	1,933
1	1,201	2.13	£25.6	38,794	0.50	417
4	2,222	0.67	£14.8	49,817	1.17	389
7	3,466	1.35	£46.9	90,069	0.42	508
17	3,779	0.96	£36.3	16,508	1.61	256
16	3,255	1.85	£60.4	N/A	0	0
18+19	3,978	1.34	£53.5	19,781	0.12	33
	sum		393.1 (£M)			16,829 LY

1% x spend elasticity x outcome elasticity x net YLL

* Net YLL consider all observed deaths, both those that occur below and those that occur above the normal LE of a matched population that is not at risk. Deaths occurring below LE generate YLL. Deaths that occur at ages above LE generate YLGs. net YLL is thus YLL – YLG.
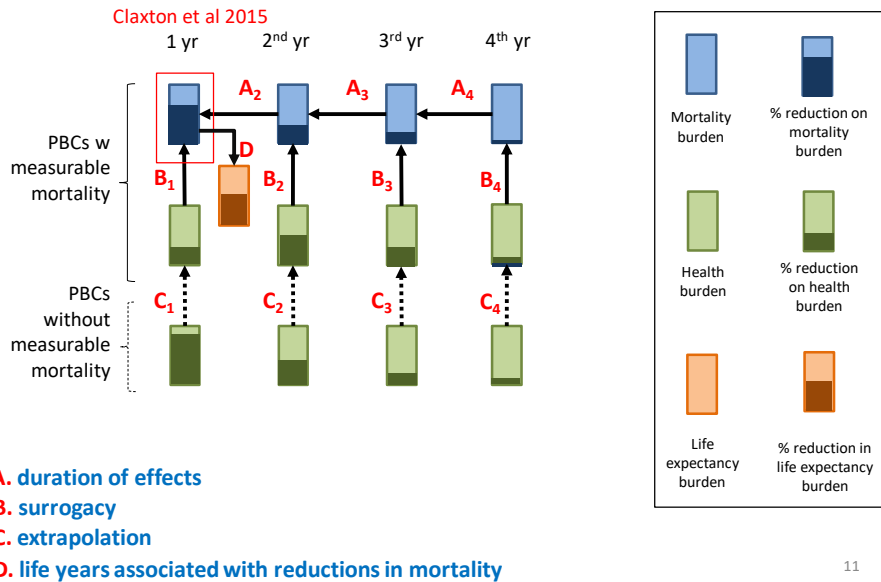
8

Summary. Elasticities (08/09). First 11 PBCs.

PBC	Spend (£M)	spend elasticities	Change in spend (£M)	Net YLL *	outcome elasticities	Change in net YLL
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17	3,779	0.96	£36.3	16,508	1.61	256
16	3,255	1.85	£60.4	N/A	0	0
18+19	3,978	1.34	£53.5	19,781	0.12	33
sum			393.1 (£M)			16,829 LY

* Net YLL consider all observed deaths, both those that occur below and those that occur above the normal LE of a matched population that is not at risk. Deaths occurring below LE generate YLL. Deaths that occur at ages above LE generate YLGs. net YLL is thus YLL – YLG.

Cost per LY (first11)   393.1 (£M)/ 16,829 =
= 23,360 £/LY

Summary. Elasticities (08/09). First 11 PBCs.
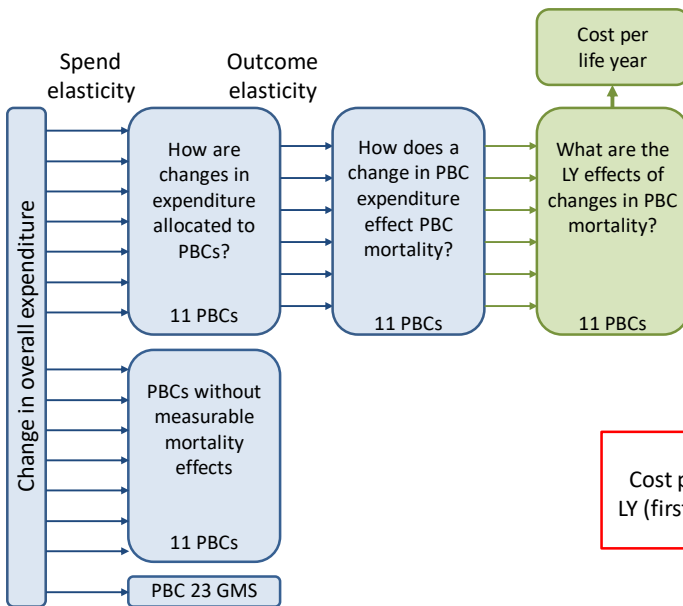
Cost per LY (first11)   23,360 £/LY

10

Summary. Critical assumptions to focus on for the elicitation

A. **duration of effects**
B. **surrogacy**
C. **extrapolation**
D. **life years associated with reductions in mortality**

11

Summary. Critical assumptions to focus on for the elicitation

A. **duration of effects:** changes in expenditure may have an effect beyond the year of expenditure;

Claxton 2015 assumed no effects beyond one year

B. **surrogacy:** how the effects of changes in expenditure on mortality relate to effects on a broader measure of health that incorporates both duration and quality of life impacts;

Claxton 2015 assumed perfect surrogacy

C. **extrapolation:** how changes in expenditure affect health in disease areas for which previous work could not measure a mortality effect; and

Claxton 2015 extrapolated using the effects on other disease areas

D. **life years associated with reductions in mortality**

Claxton 2015 assumed that avoiding mortality (with a minimum survival benefits of 2 years on average) returns patients to the mortality risk of the general population matched for age and gender
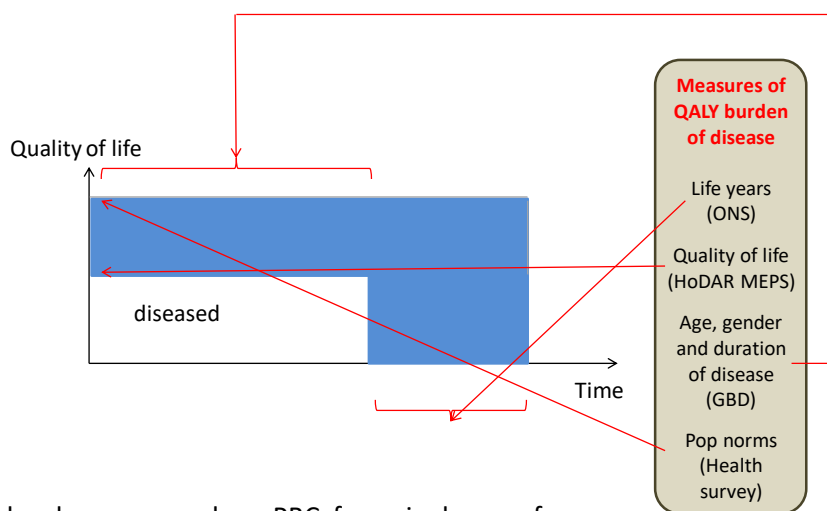
12

Summary. Health burden of disease.

Broader *health burden* of disease that considers its impact on both the rate of mortality (and any life years lost as a consequence) and on the level of health-related quality of life of individuals.

13

Summary. Health burden of disease. Data.

QALY burden expressed per PBC, for a single year, for the prevalent population

14

Summary. Health burden of disease.

| PBC | ICD | N prevalent patients | Per patient | | | | Prevalent patients |
			B (Ba + Bd)	Ba alive	Bd mortality	BLY	B (Ba + Bd)
...	...	...	...	...	...	...	...
2	C14	380	2.92	0.10	2.82	4.22	1,109
2	C15	7,881	5.64	0.05	5.59	8.54	44,464
2	C16	7,104	4.61	0.06	4.55	7.03	32,738
2	C17	1,478	2.20	0.09	2.11	3.17	3,247
2	C18	33,520	0.77	0.09	0.68	1.05	25,756
...	...	...	...	...	...	...	...
Total for PBC2							**928,112**

Reflects QoL losses (HoDAR/MEPS) during disease duration (GBD)

Reflects YLL (GBD, ONS) adjusted for QoL (pop norms age and gender adjusted)
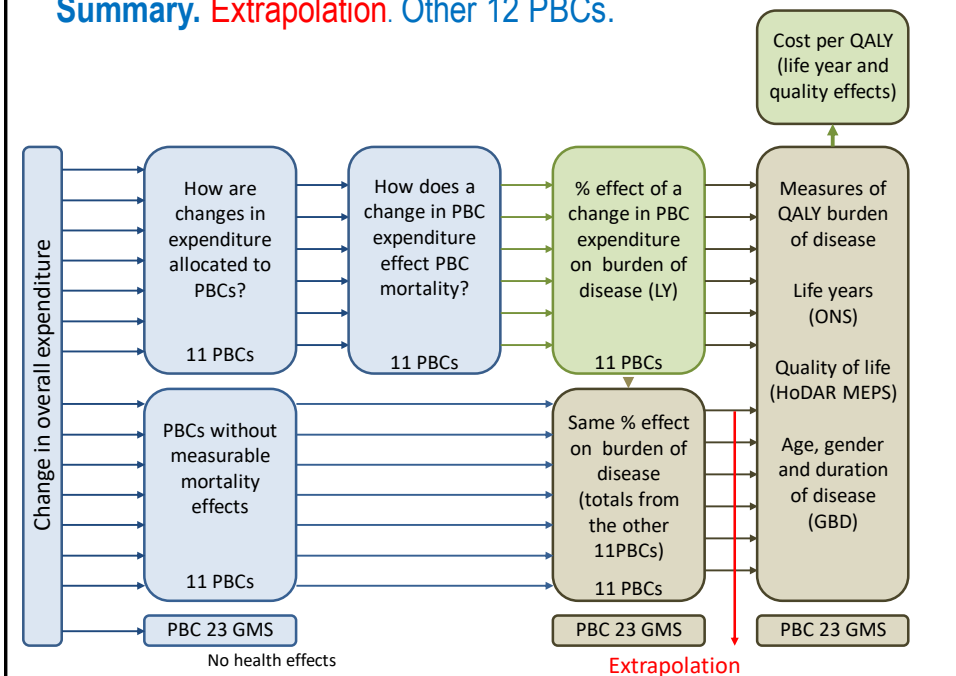
15

Summary. Surrogacy. First 11 PBCs.
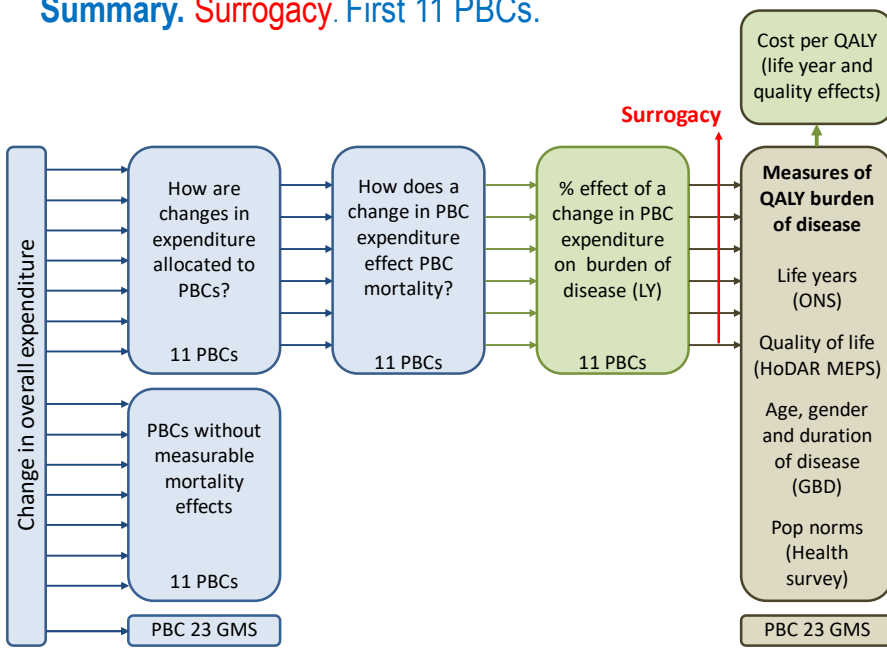
Summary. Surrogacy. First 11 PBCs.

PBC	Burden, QALY	outcome elasticities	Change in burden, QALY	Breakdown of change in QALY		
				Due to premature mortality	while alive	LY
2	928,112	0.31	2,064	152	1,912	2,940
10	716,850	1.32	8,453	2,675	5,778	9,092
11	1,105,538	1.81	17,981	17,192	789	1,259
13	400,984	1.36	3,441	2,173	1,268	1,933
1	114,405	0.50	1,229	947	282	417
4	607,845	1.17	4,749	4,495	254	389
7	1,516,627	0.42	8,551	8,217	335	508
17	53,408	1.61	829	668	162	256
16	N/A	0	0	0	0	0
18+19	18,093	0.12	30	6	25	33
sum			47,328 QALY			16,829 LY

Cost per QALY gained (first11)	393.12 (£M)/ 47,328 = = 8,306 £/QALY

Summary. Extrapolation. Other 12 PBCs.

05/03/2020

Summary. Extrapolation. Other 12 PBCs.

PBC	Burden	Spend elast.	Outcome elast.	Change in Total QALY
2	92,8112	0.72	0.31	2064
10	716,850	0.89	1.32	8453
11	1,105,538	0.90	1.81	17981
13	400,984	0.63	1.36	3441
1	114,405	2.13	0.50	1229
4	607,845	0.67	1.17	4749
7	1,516,627	1.35	0.42	8551
17	53,408	0.96	1.61	829
16	--	1.85	0	0
18+19	18,093	1.34	0.12	30
3	137,191	1.62	?	?
5	676,530	1.43	?	?
6	24,827	0.28	?	?
8	47,732	0.90	?	?
9	86,537	1.64	?	?
12	97,491	0.71	?	?
14	21,233	0.93	?	?
15	338,110	0.70	?	?
20	10,696	0.77	?	?
21	4,500	1.51	?	?
22	--	1.26	0	0
23	--	0.68	0	0

First 11 PBCs: with measurable mortality effects

Other 12 PBCs: w/o measurable mortality effects

Procedural ICDs (Z codes).

19

Summary. Extrapolation. Other 12 PBCs.

PBC	Burden	Spend elast.	Outcome elast.	Change in Total QALY
2	92,8112	0.72	0.31	2064
10	716,850	0.89	1.32	8453
11	1,105,538	0.90	1.81	17981
13	400,984	0.63	1.36	3441
1	114,405	2.13	0.50	1229
4	607,845	0.67	1.17	4749
7	1,516,627	1.35	0.42	8551
17	53,408	0.96	1.61	829
16	--	1.85	0	0
18+19	18,093	1.34	0.12	30
3	137,191	1.62		
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14	21,233	0.93		
15	338,110	0.70		
20	10,696	0.77		
21	4,500	1.51		
22	--	1.26		
23	--	0.68		

Average outcome elasticity *
= **0.77**

* recently reviewed and corrected to 0.86, with limited impact on estimates (from 12,936 to 12,631£/QALY)

20

10

Summary. Extrapolation. Other 12 PBCs.

PBC	Burden	Spend elast.	Outcome elast.	Change in Total QALY
2	92,8112	0.72	0.31	2064
10	716,850	0.89	1.32	8453
11	1,105,538	0.90	1.81	17981
13	400,984	0.63	1.36	3441
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17	53,408	0.96	1.61	829
16	0	1.85	0	0
18+19	18,093	1.34	0.12	30
3	137,191	1.62	0.77	1712
5	676,530	1.43	0.77	7469
6	24,827	0.28	0.77	54
8	47,732	0.90	0.77	333
9	86,537	1.64	0.77	1098
12	97,491	0.71	0.77	533
14	21,233	0.93	0.77	152
15	338,110	0.70	0.77	1819
20	10,696	0.77	0.77	64
21	4,500	1.51	0.77	53
22	--	1.26	--	0
23	--	0.68	0	0

47,328 QALY

60,616 QALY

Cost per QALY   784(£M)/60,616 = = 12,936 £/QALY

Summary. Results. All PBCs.

PBC	Burden	Spend elast.	Outcome elast.	Change in Total QALY	QALY death	QALY alive
2	92,8112	0.72	0.31	2064	1912	152
10	716,850	0.89	1.32	8453	5778	2675
11	1,105,538	0.90	1.81	17981	789	17192
13	400,984	0.63	1.36	3441	1268	2173
1	114,405	2.13	0.50	1229	282	947
4	607,845	0.67	1.17	4749	254	4495
7	1,516,627	1.35	0.42	8551	335	8217
17	53,408	0.96	1.61	829	162	668
16	0	1.85	0	0	0	0
18+19	18,093	1.34	0.12	30	25	6
3	137,191	1.62	0.77	1712	88	1624
5	676,530	1.43	0.77	7469	652	6817
6	24,827	0.28	0.77	54	11	44
8	47,732	0.90	0.77	333	13	319
9	86,537	1.64	0.77	1098	8	1090
12	97,491	0.71	0.77	533	1	532
14	21,233	0.93	0.77	152	56	96
15	338,110	0.70	0.77	1819	90	1729
20	10,696	0.77	0.77	64	10	54
21	4,500	1.51	0.77	53	8	44
22	0	1.26	--	0	0	0
23	0	0.68	0	0	0	0

Cost per QALY

12,936 £/QALY

Elicitation

- Seeks for the judgements of relevant individuals on critical assumptions:

    A. duration of effects
    B. surrogacy
    C. extrapolation
    D. life years associated with reductions in mortality

- Elicitation is a systematic process for formalising and quantifying expert judgements about **uncertain** quantities, aiming to minimise the use of cognitive heuristics and avoid biases.

- Experts will be asked to think honestly about their uncertainty in knowledge regarding each question and to express how uncertain they are about it in their responses.

23

Elicitation. Experts

Judgement of interest are from policy experts

- <u>policy experts</u>: drawn from organisations that develop or implement policy, or that have a major interest in policy in this area.

However, their judgements will be elicited considering information from clinical experts.

- <u>clinical experts</u> acting as substantive experts in key disease areas.

Subset of disease areas: those where the uncertainties had more influence on overall estimates of health opportunity costs.

Organisations from which policy experts are drawn	Clinical areas from which clinical experts are drawn
Department of Health	Circulatory
NHSE	Respiratory
PHE	Gastrointestinal
NICE	Neurological
JCVI	Mental health
ABPI	Endocrinology
Patients' organisations	Musculoskeletal
	Primary care

24

12

Elicitation. How to elicit

- Elicit mode and 80% credible intervals
- Single limit estimates (shown to minimise overconfidence)

	My best guess for the value of this quantity is:	I am very certain (90% certain) that the true value for this quantity is …	
		… higher than:	… lower than:
Consider each of the following disease areas:			
Circulatory	_____ years	_____ years	_____ years
Respiratory	_____ years	_____ years	_____ years
Gastrointestinal	_____ years	_____ years	_____ years
Neurological	_____ years	_____ years	_____ years
Endocrinology	_____ years	_____ years	_____ years
Other diseases <u>with</u> measurable mortality effects (Cancers and Tumours; Problems of the genitourinary system; Infectious diseases; Problems due to trauma and injuries; Maternity and reproductive health; Conditions of neonates)	_____ years	_____ years	_____ years

25

Elicitation. Face validity

Use a scale of 1 (not confident) to 10 (very confident) to indicate your level of confidence on...

|	
… whether you understood question B1.	_____
… whether the answers you gave to question B1 reflect your views and uncertainties.	_____

26

Elicitation. Quantities to elicit:

A. duration of effects
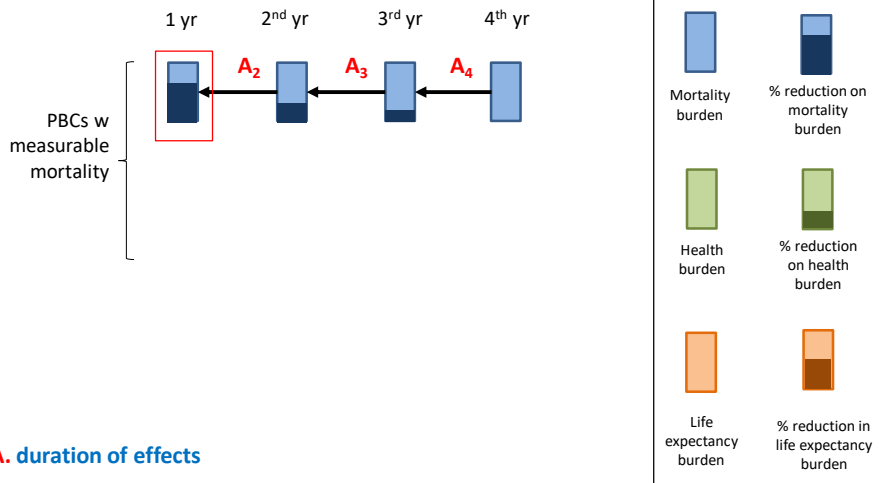
27

A. Duration of mortality effects

Available data allowed quantifying the effect of expenditure in one year.

But increasing expenditure in a particular year may also affect the disease-specific mortality rate of those same individuals in <u>subsequent years</u>.
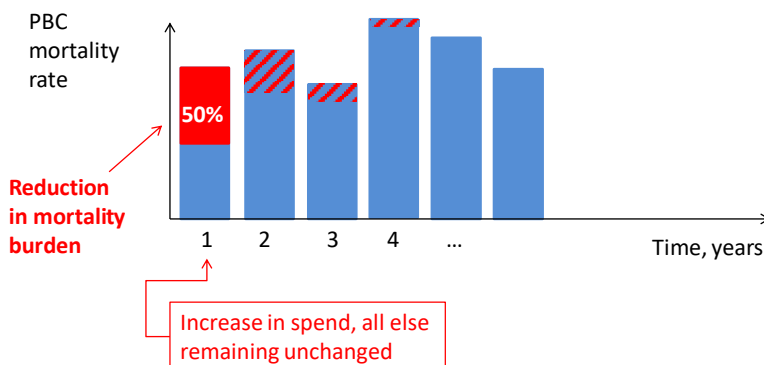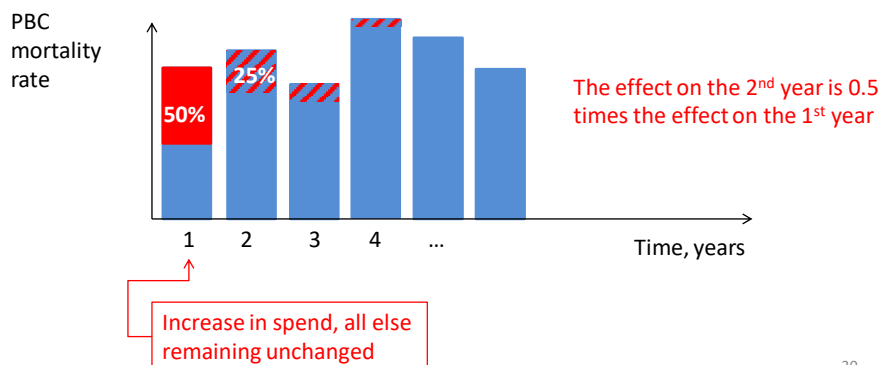

28

A. **Duration of mortality effects.** Elicitation

A1. On average, for how many more years (beyond the year of increased expenditure) would patients see their mortality rate reduced?

3 years

PBC mortality rate

1   2   3   4   …   Time, years

Increase in spend, all else remaining unchanged
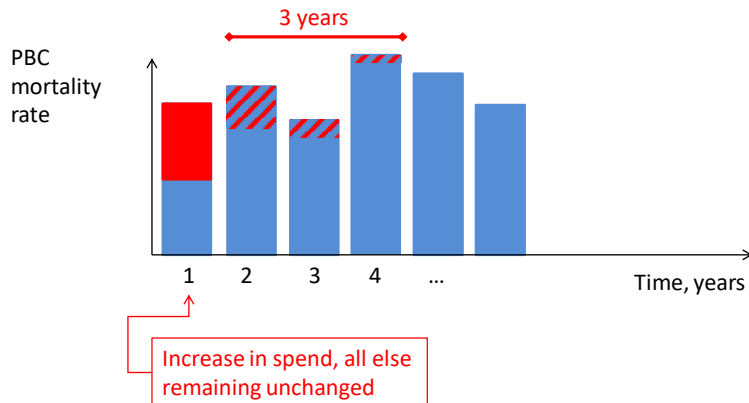
29

A. **Duration of mortality effects.** Elicitation

A2. From an increase in expenditure in a particular year, how do reductions in mortality rates in subsequent years compare to the reduction observed in the first year.

PBC mortality rate

25%

50%

The effect on the 2nd year is 0.5 times the effect on the 1st year

1   2   3   4   …   Time, years

Increase in spend, all else remaining unchanged

30

Elicitation. Quantities to elicit:

1 yr   2nd yr   3rd yr   4th yr

A_2 A_3 A_4

PBCs w measurable mortality

B_1 B_2 B_3 B_4

Mortality burden   % reduction on mortality burden

Health burden   % reduction on health burden

Life expectancy burden   % reduction in life expectancy burden

A. duration of effects
B. surrogacy

31

B. Surrogacy. Claxton et al 2015

PBC	Burden, QALY	outcome elasticities	Surrogacy	Change in burden, QALY
2	928,112	0.31	?	?
10	716,850	1.32	?	?
11	1,105,538	1.81	?	?
13	400,984	1.36	?	?
1	114,405	0.50	?	?
4	607,845	1.17	?	?
7	1,516,627	0.42	?	?
17	53,408	1.61	?	?
16	N/A	0	N/A	0
18+19	18,093	0.12	?	?
sum				? QALY

surrogacy relationship = ?

Cost per QALY gained (first11)   **?**

32

B. Surrogacy. Health burden profile of disease

Broader *health burden* of disease that considers its impact on both the rate of mortality (and any life years lost as a consequence) and on the level of health-related quality of life of individuals.
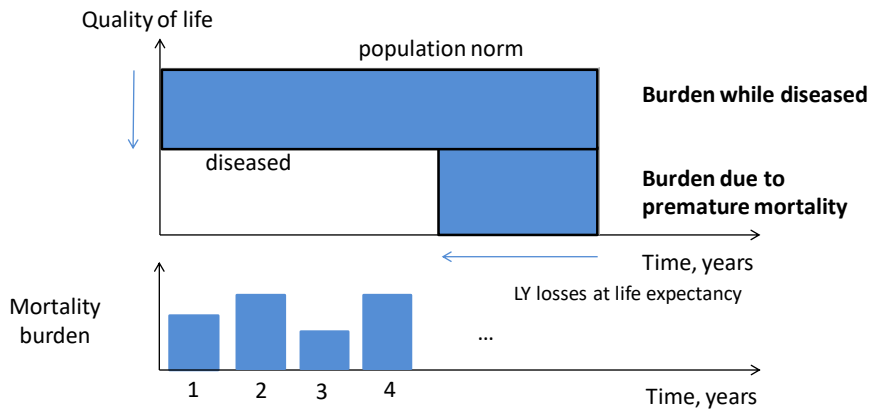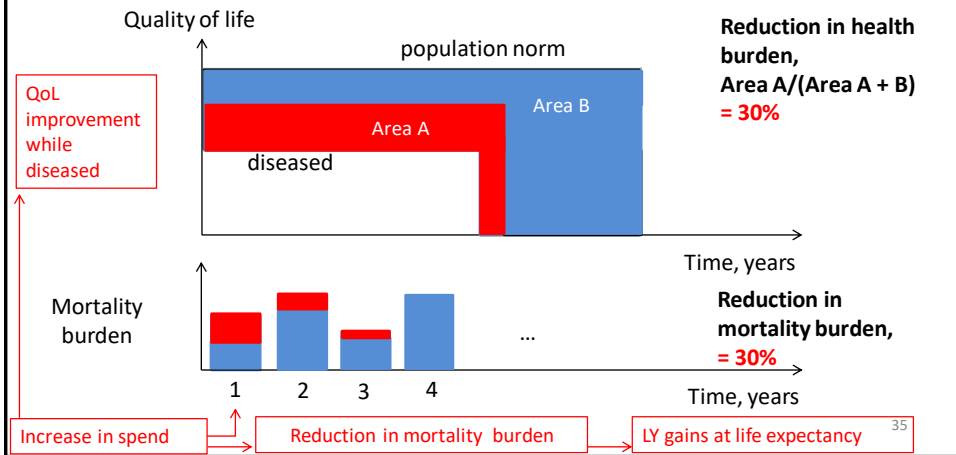

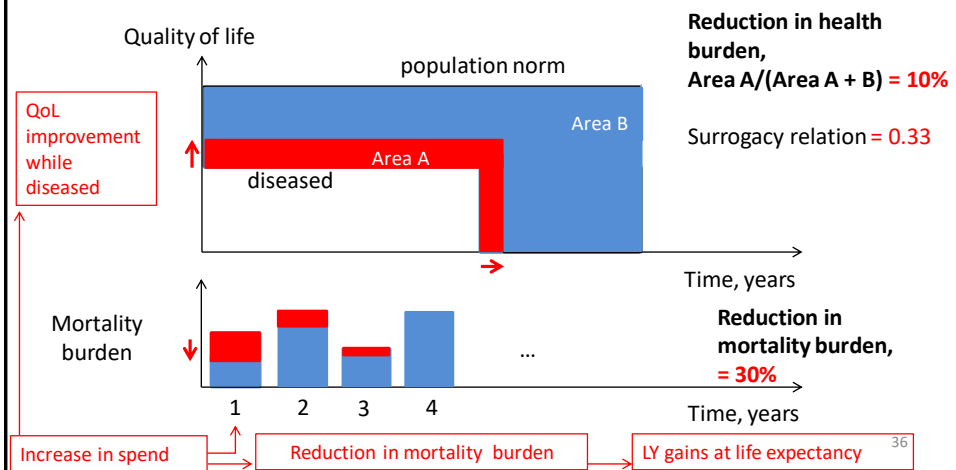## B. Surrogacy. Effects of expenditure

B. Surrogacy.

Effect on health burden = effect on mortality effects of increased
expenditure on health burden compare with its effects on mortality
Surrogacy relation = 1, assumed in Claxton et al effects on mortality
burden – surrogacy relationship

Quality of life

population norm

QoL
improvement
while
diseased

Area A

Area B

diseased

Time, years

Reduction in health
burden,
Area A/(Area A + B)
= 30%

Mortality
burden

...

1   2   3   4

Time, years

Reduction in
mortality burden,
= 30%

Increase in spend

Reduction in mortality burden

LY gains at life expectancy

35

B. Surrogacy.

Effect on health burden **<** Effect on mortality burden

Surrogacy relation **< 1**

Quality of life

population norm

QoL
improvement
while
diseased

Area A

Area B

diseased

Time, years

Reduction in health
burden,
Area A/(Area A + B) = 10%

Surrogacy relation = 0.33

Mortality
burden

...

1   2   3   4

Time, years

Reduction in
mortality burden,
= 30%

Increase in spend

Reduction in mortality burden

LY gains at life expectancy

36

B. Surrogacy.

Effect on health burden **>** Effect on mortality burden

Surrogacy relation **> 1**

Quality of life

population norm

Reduction in health burden,
Area A/(Area A + B) = 70%

QoL improvement while diseased

Area B

Area A

Surrogacy relation = 2.33

diseased

Time, years

Mortality burden

Reduction in mortality burden, = 30%

...

1   2   3   4

Time, years

Increase in spend | Reduction in mortality burden | LY gains at life expectancy

37

B. Surrogacy. Elicitation

B1. How do the effects of increased expenditure on health burden compare with its effects on mortality burden?

Experts will be asked to consider the year of increased expenditure (1st year) separately from later effects of expenditure on the 2nd, 3rd and 4th years subsequent to increased expenditure.

38

19

B. **Surrogacy.** Health burden profile of disease, 1st year
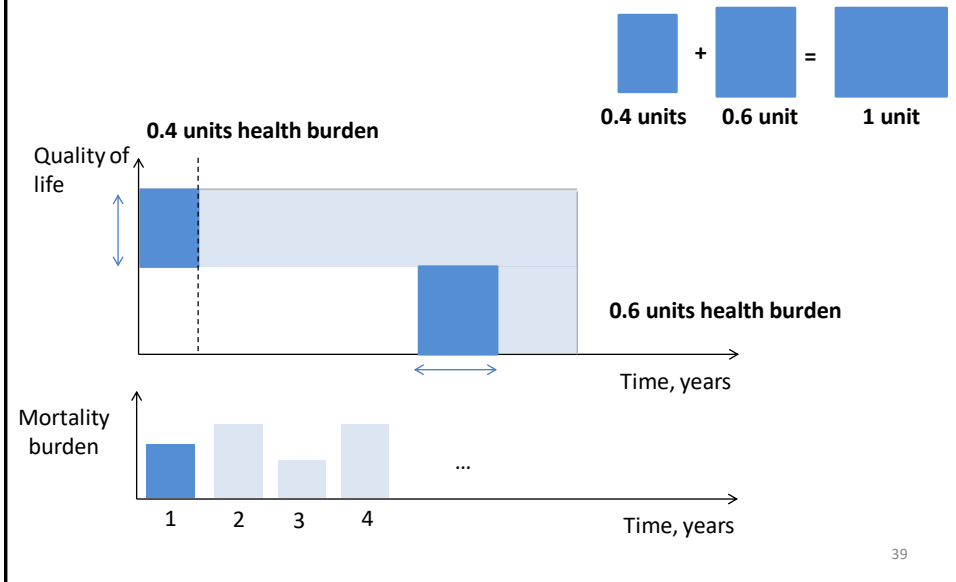
0.4 units   +   0.6 unit   =   1 unit

0.4 units health burden

Quality of life

0.6 units health burden

Time, years

Mortality burden

...

1   2   3   4

Time, years

39

B. **Surrogacy.** Effects of expenditure, 1st year

Surrogacy relationship, 1st year   = 1

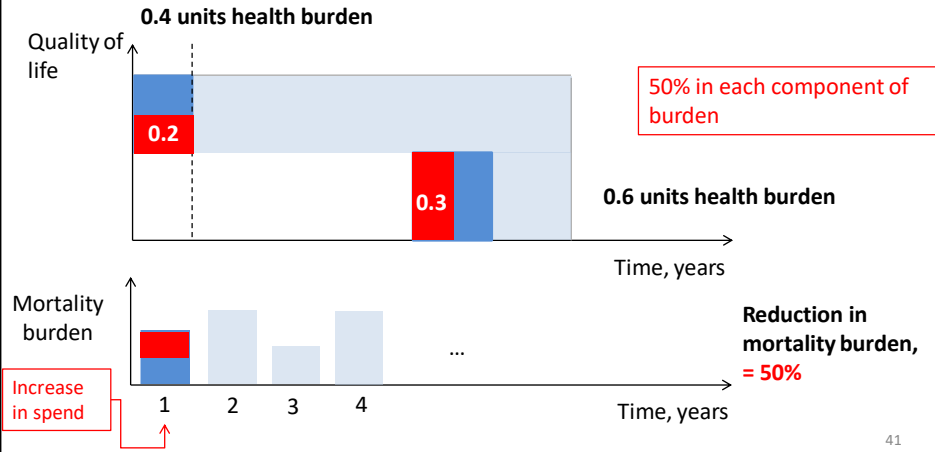Assumed reduction in health burden,
= 50% = 0.5 units

1 unit

Health burden

Makes no assumptions about how gains are distributed across the two components of burden
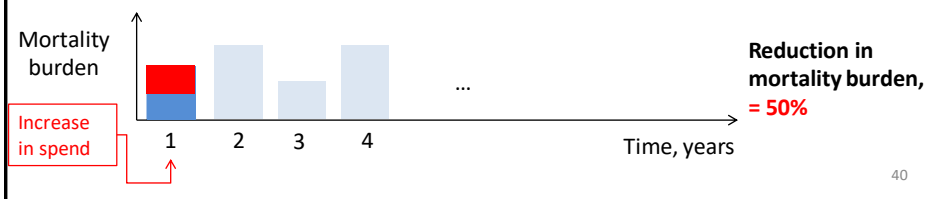
Mortality burden

...

Reduction in mortality burden,
= 50%

Increase in spend

1   2   3   4

Time, years

40

B. Surrogacy. Effects of expenditure, 1st year

Surrogacy relationship, 1st year = 1
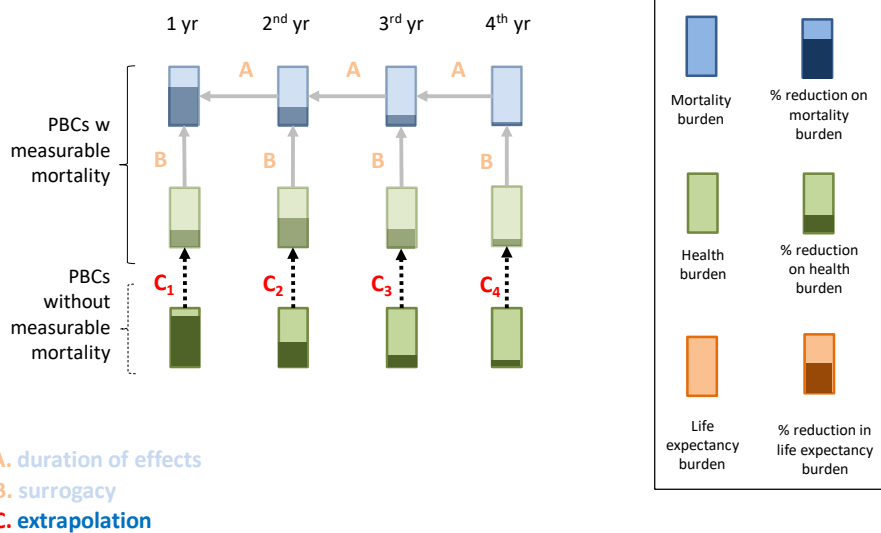
Assumed reduction in health burden, = 50% = 0.5 units

1 unit

0.4 units health burden

Quality of life

0.2

50% in each component of burden

0.3

0.6 units health burden

Time, years

Mortality burden

Reduction in mortality burden, = 50%

Increase in spend

1 2 3 4 ... Time, years

41

B. Surrogacy. Effects of expenditure, 1st year

Surrogacy relationship, 1st year = 1

Assumed reduction in health burden, = 50% = 0.5 units

1 unit

0.4 units health burden

Quality of life

0.4

Most health attained by improving qol during disease

0.1

0.6 units health burden

Time, years

Mortality burden

Reduction in mortality burden, = 50%

Increase in spend

1 2 3 4 ... Time, years

42
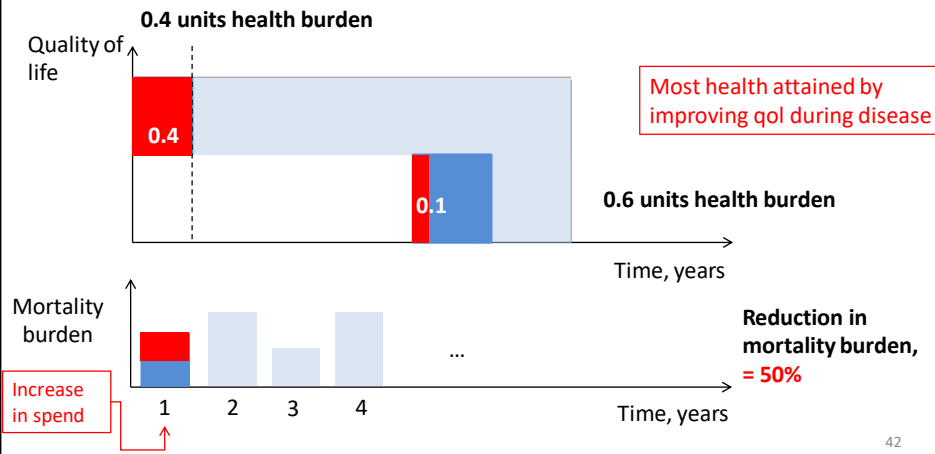
B. **Surrogacy.** Effects of expenditure, 2nd year

Surrogacy relationship, 2nd year = 1

0.4 units   0.2 units   0.6 units

Quality of life

Reduction in health burden,
= 33% = 0.2 units

Time, years

Mortality burden

Reduction in mortality burden,
= 33%

Increase in spend

1   2   3   4   Time, years

43

Elicitation. Quantities to elicit:

1 yr   2nd yr   3rd yr   4th yr

PBCs w measurable mortality

PBCs without measurable mortality

C_1 C_2 C_3 C_4

Mortality burden

% reduction on mortality burden

Health burden

% reduction on health burden

Life expectancy burden

% reduction in life expectancy burden

A. duration of effects
B. surrogacy
C. extrapolation

44

C. **Extrapolation.** Claxton et al 2015

PBC	Burden	Spend elast.	Outcome elast.	Extrap.	Change in Total QALY
2	92,8112	0.72	0.31		2064
10	716,850	0.89	1.32		8453
11	1,105,538	0.90	1.81		17981
13	400,984	0.63	1.36		3441
1	114,405	2.13	0.50		1229
4	607,845	0.67	1.17		4749
7	1,516,627	1.35	0.42		8551
17	53,408	0.96	1.61		829
16	0	1.85	0		0
18+19	18,093	1.34	0.12		30
3	137,191	1.62	0.77	?	?
5	676,530	1.43	0.77	?	?
6	24,827	0.28	0.77	?	?
8	47,732	0.90	0.77	?	?
9	86,537	1.64	0.77	?	?
12	97,491	0.71	0.77	?	?
14	21,233	0.93	0.77	?	?
15	338,110	0.70	0.77	?	?
20	10,696	0.77	0.77	?	?
21	4,500	1.51	0.77	?	?
22	--	1.26	--	--	0
23	--	0.68	0	N/A	0

47,328 QALY

?

Cost per QALY   **?**

45

All disease areas with a measurable effect of spend on mortality (average)

Area A   Area B

Increase in spend

Area A/(Area A + B) = = **50%**

Specific disease area, e.g. mental health

extrapolation relationship = 1

Area C   Area D

Increase in spend

Area C/(Area C + D) = = **50%**

46

23
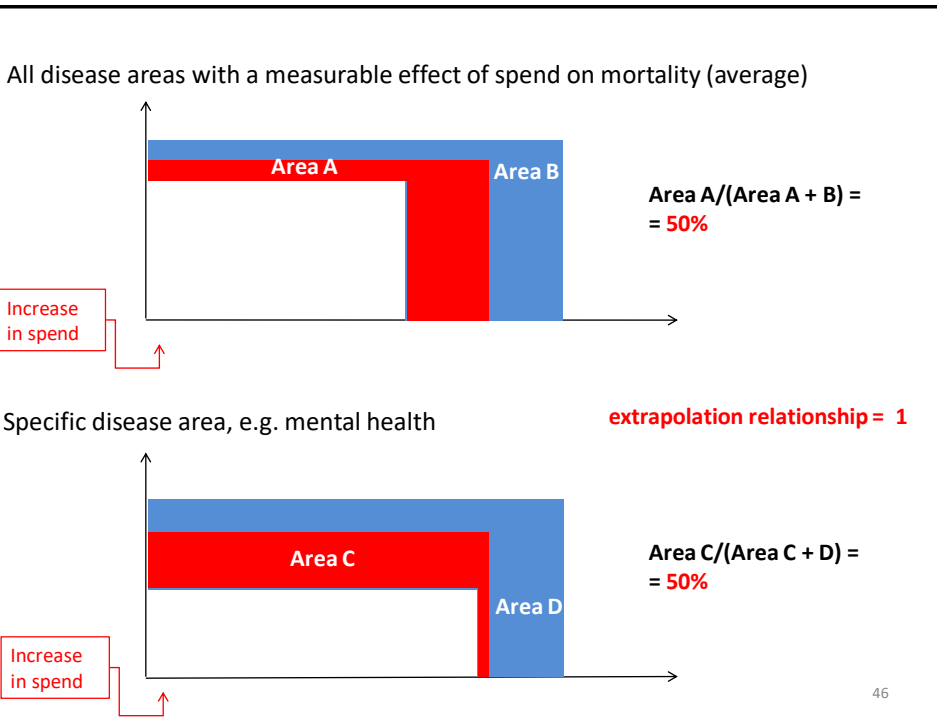
C. **Extrapolation.** Elicitation

C1. How do reductions in health burden (quality-adjusted life-years lost due to disease) from an increase in NHS expenditure in the following disease areas compare to reductions in health burden from increased expenditure in disease areas that had measurable mortality effects?
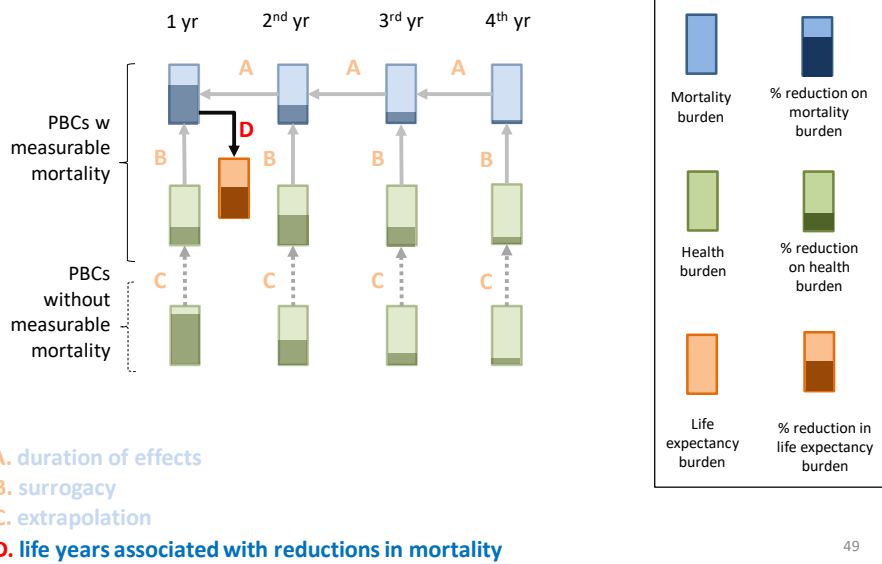
Please indicate your beliefs on this relationship for the year of expenditure (1st year) and also for any later effects of expenditure on subsequent years (2nd, 3rd and 4th).
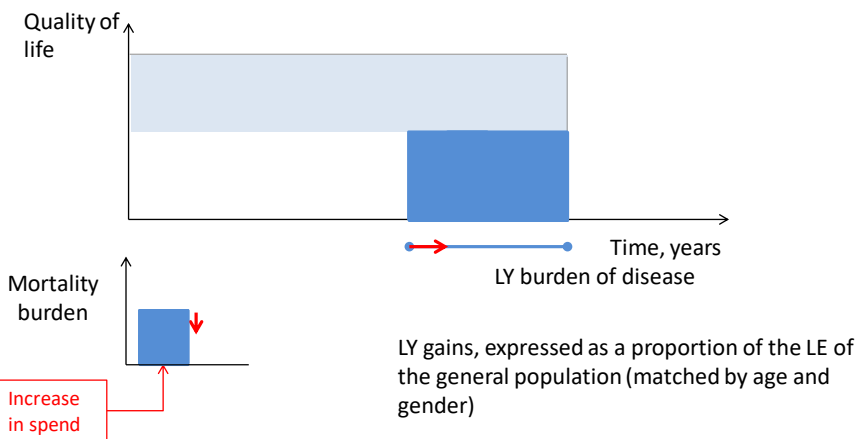
47

All disease areas with a measurable effect of spend on mortality (average), 1st year

Increase in spend

Specific disease area, e.g. mental health, 1st year

extrapolation relationship = ?

Increase in spend

48

24

Elicitation. Quantities to elicit:

1 yr   2nd yr   3rd yr   4th yr

PBCs w measurable mortality

PBCs without measurable mortality

Mortality burden

% reduction on mortality burden

Health burden

% reduction on health burden

Life expectancy burden

% reduction in life expectancy burden

A. duration of effects
B. surrogacy
C. extrapolation
D. life years associated with reductions in mortality

49

D. Life years associated with reductions in mortality.

What are the implications to LYs gained at life expectancy?

Quality of life

Time, years
LY burden of disease

Mortality burden

Increase in spend

LY gains, expressed as a proportion of the LE of the general population (matched by age and gender)
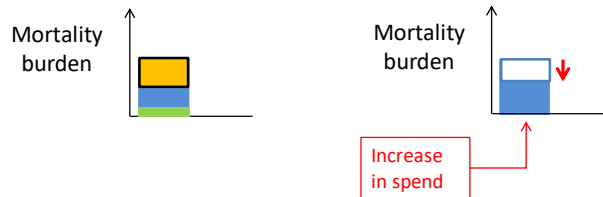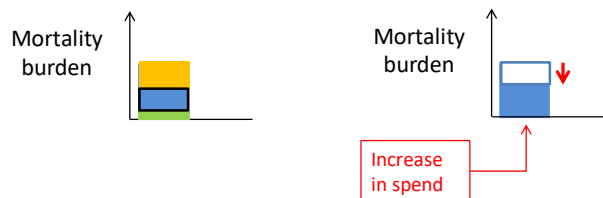
50

25

D. Life years associated with reductions in mortality.

There is more information we can draw from the existing data

Lets have another look at the mortality data analysed in Claxton et al 2015:

    At PCT level, PBC mortality for 3 consecutive years was summed

    PBC spend in a particular year was then regressed against mortality

Mortality burden

Mortality burden

Increase in spend

D. Life years associated with reductions in mortality.

There is more information we can draw from the existing data….

Lets have another look at the mortality data analysed in Claxton et al 2015:

    At PCT level, PBC mortality for 3 consecutive years was summed

    PBC spend in a particular year was then regressed against mortality

Mortality burden

Mortality burden

Increase in spend
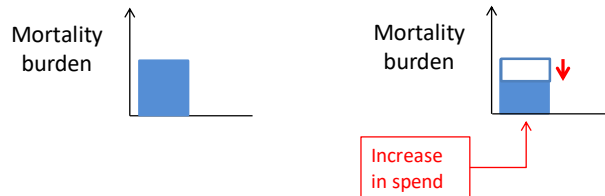
Some deaths occur in the 3rd year

Others in the 2nd year

Others in the 1st year

D. **Life years associated with reductions in mortality.**

There is more information we can draw from the existing data….

Lets have another look at the mortality data analysed in Claxton et al 2015:

> At PCT level, PBC mortality for 3 consecutive years was summed
>
> PBC spend in a particular year was then regressed against mortality

Deaths in the 3rd year could only be counted as averted if they didn't occur within that same year – averted for between 1 day and 1 year

---

D. **Life years associated with reductions in mortality.**

There is more information we can draw from the existing data….

Lets have another look at the mortality data analysed in Claxton et al 2015:

> At PCT level, PBC mortality for 3 consecutive years was summed
>
> PBC spend in a particular year was then regressed against mortality

Deaths in the 2nd year could only be counted as averted if they didn't occur within that same year or the year after – averted for a minimum of 1 year

D. Life years associated with reductions in mortality.

There is more information we can draw from the existing data….

Lets have another look at the mortality data analysed in Claxton et al 2015:

At PCT level, PBC mortality for 3 consecutive years was summed

PBC spend in a particular year was then regressed against mortality

Mortality burden

Mortality burden

Increase in spend
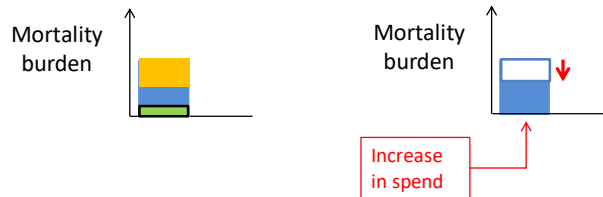
Deaths in the 1st year could only be counted as averted if they didn't occur within that same year, the year after, or the following – averted for a minimum of 2 years

D. Life years associated with reductions in mortality. Elicitation

D1. Of those patients that have seen their deaths averted by at least 2 years, 1 year and 1 day, what proportion is likely to return to (or exceed) the life expectancy of the general population of the same age and gender?

D2. Now consider only those patients who have not returned to, or exceeded, normal life expectancy. Please report your beliefs on their life expectancy as a proportion of the life expectancy in the general population of the same age and gender:

56

Health opportunity costs in the NHS:
assessing the implications of uncertainty using elicitation methods with experts

Marta Soares, Karl Claxton, Mark Sculpher

Centre for Health Economics, York

16/11/2016

YLL

Published YLL estimates (ONS)

include only deaths below 75 years, and are based on the difference between age 75 years and the age of each death below 75 years

- Implicitly, this treats 75 years as the appropriate normal LE for males and females for the population at risk in each PBC.
- However, with the exception of maternity and neonates, most deaths in PBCs occur above the age of 75 years and LEs are significantly greater than 75 years.
- Based on 2006–8 data, LE at birth is greater than 75 years (77.7 years for males and 81.9 years for females).
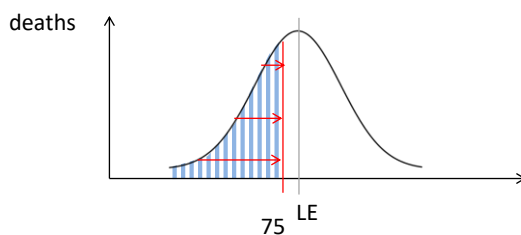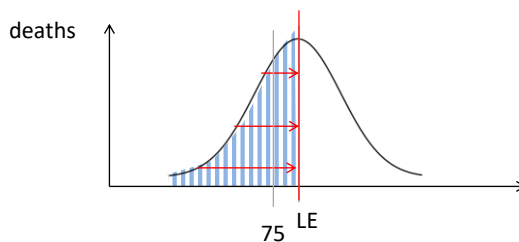

58

YLL

Reflect the normal LE for the at risk population

- Use LE conditional on age (80.7 years for males and 84.4 years for females).
- When increasing LE two effects occur: more deaths are included and each death previously counted below 75 years will generate more YLL.
- Therefore, the cost per death averted and cost per life-year thresholds are lower.

59

YLL

Years of life lost and accounting for counterfactual deaths

- Both previous approaches ignore those deaths that occur above LE.
- Only appropriate if reasonable to assume that no deaths would have otherwise occurred prior to LE and that there are no deaths (survivors) beyond LE in the at risk population.
- Biased as:
    - some deaths below LE would have occurred (at the same age) in a similar population not at risk in the PBC -- not all deaths observed below LE are 'excess' deaths
    - and some of the deaths observed above LE may be 'excess' deaths that would not otherwise have occurred at that age
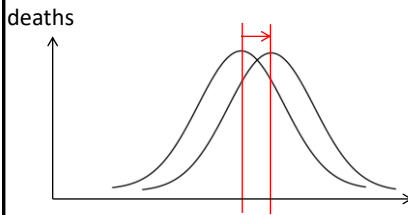
60

YLL

Years of life lost and accounting for counterfactual deaths

- Cannot know excess deaths without the counterfactual
- But can compare LE with a perfectly matched sample of the general population

$$YLL_{per\ patient} = LE^{norm} - LE^{PBC} = \frac{1}{N}\sum_{i=1}^{N} age_{death,\,i}^{norm} - \frac{1}{N}\sum_{i=1}^{N} age_{death,\,i}^{PBC}$$

$$\left(LE^{norm} - \frac{1}{N}\sum_{i=1}^{N} age_{death,\,i}^{PBC} \right) = \sum_{i=1}^{N} \left(LE^{norm} - age_{death,\,i}^{PBC} \right)$$

deaths

- The calculations require all observed deaths to be taken into account.
- Deaths occurring below LE generate YLL ; deaths that occur at ages above LE generate life-years 'gained' → **net YLL** = YLL – YLG.

61

31