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Determining economic impact of a pharmacist-led IT-based intervention with simple feedback in reducing rates of clinically important errors in medicines management in general practices (PINCER)

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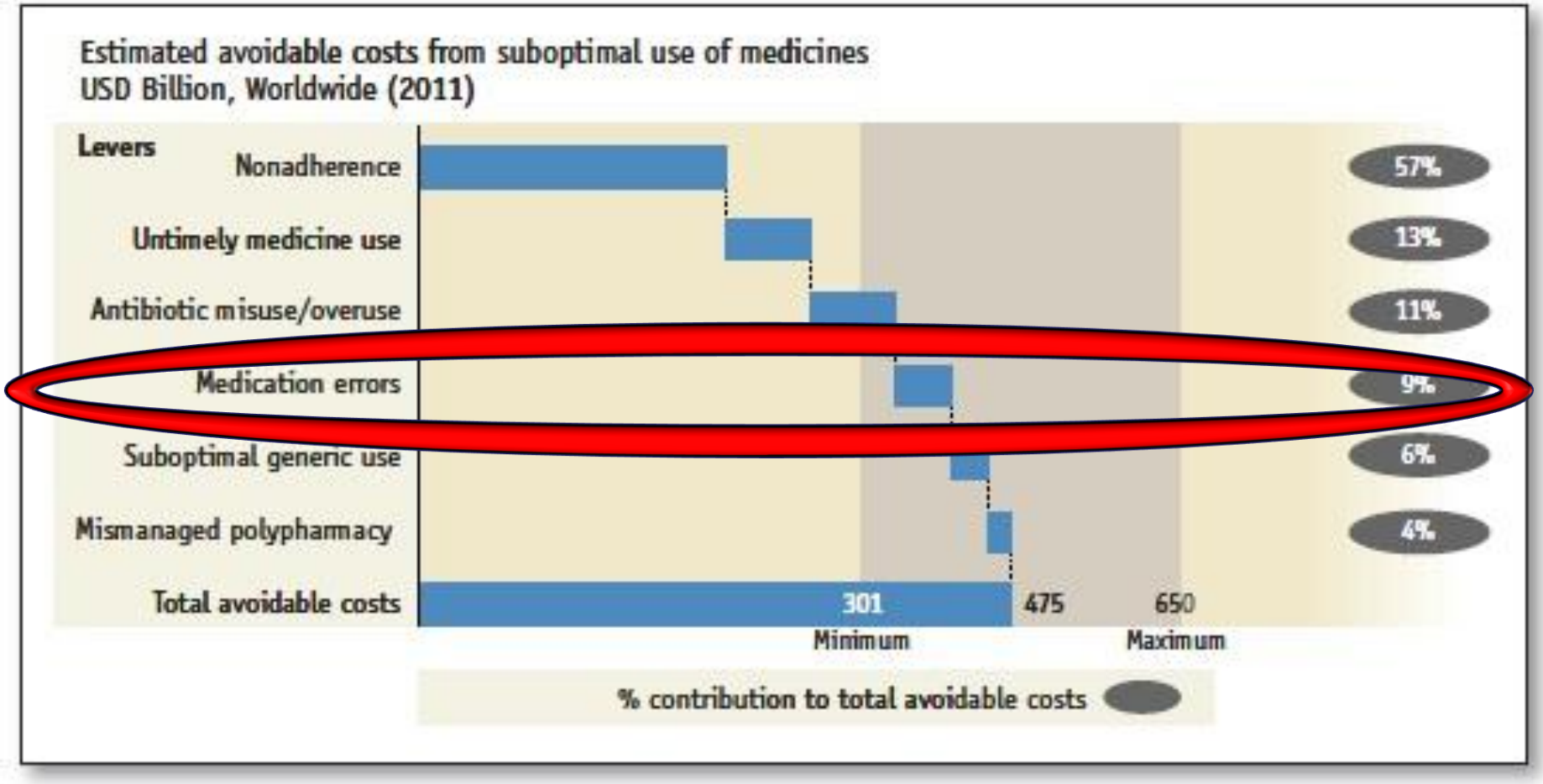
Economic impact of reducing medication errors

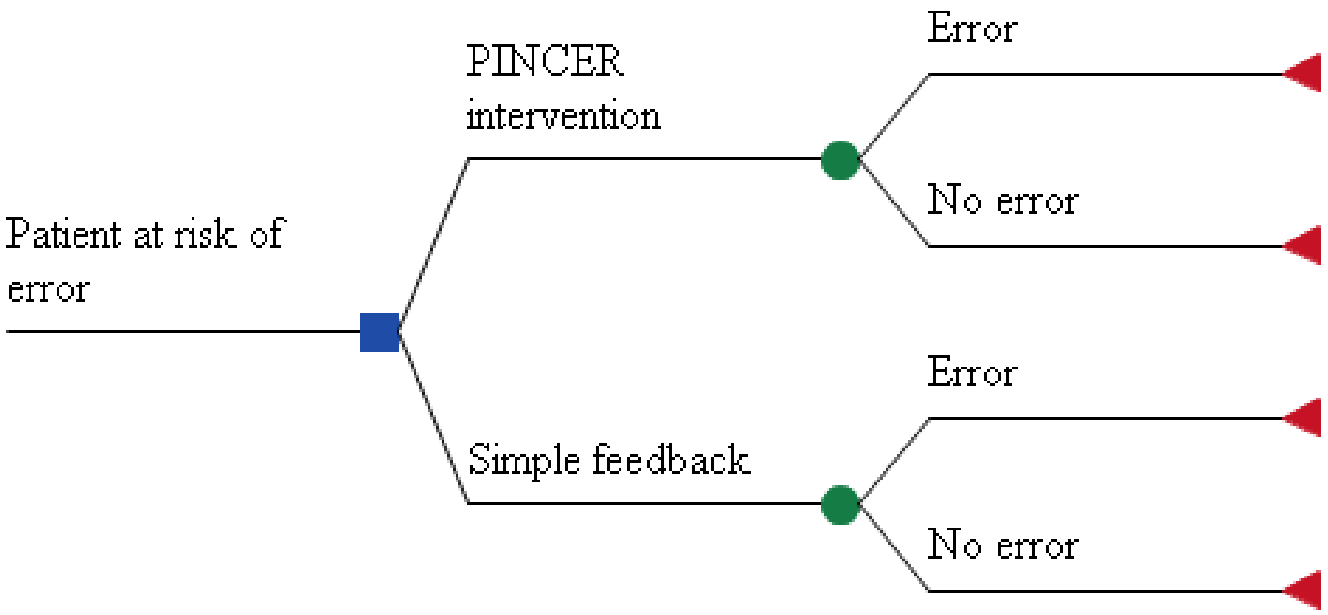
- Medication errors in general practice
  - important source of potentially preventable morbidity & mortality?
- Implicit assumption that improving safety is a “good thing”
  - most errors documented are minor
  - unlikely to affect patient outcome and associated cost.
- Initiatives to reduce medication errors are usually costly.
- What is the true economic impact of medication error?
- Is it worth doing something about it?

Economic impact of reducing errors in health care



Advancing the responsible use of medicines, IMS Institute for Healthcare Informatics, October 2012.

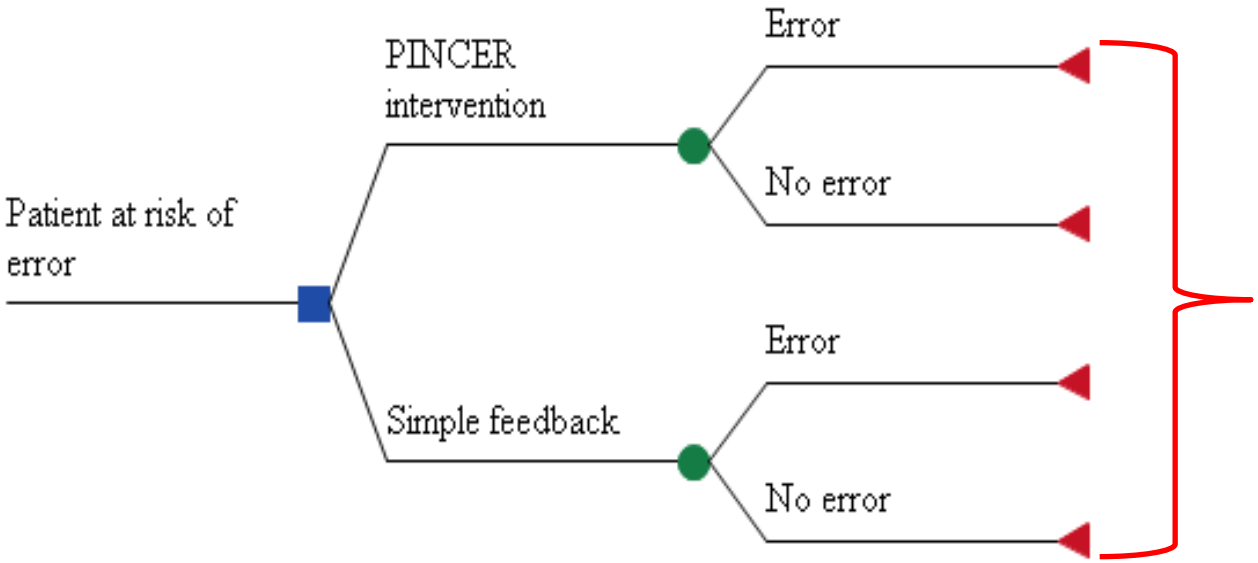
Decision problem for within-trial economic analysis



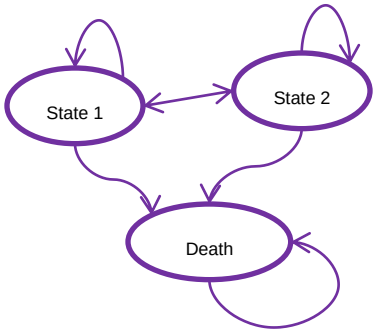
PINCER trial results: cost per error avoided

Mean cost per practice (range)/£	Simple feedback	PINCER intervention
Report generation	92·84 (n/a)	92·84 (n/a)
Pharmacist training costs	0	275·92 (79·54 – 591·23)
Quarterly facilitated strategic meetings	0	195·23 (56·28 – 418·33)
Monthly operational meetings	0	56·88 (16·40 – 121·88)
Practice feedback	0	22·07 (6·36 – 47·29)
Management of errors	0	406·70 (57·04 – 1 318·68)
Total cost	92·84 (n/a)	1 049·67 (329·22 – 2 086·78)
Mean incremental cost (95% CI)/£	871·88 (765·96 – 977·79)	
Mean incremental errors (95% CI)	-12·90 (-13·42 – -12·39)	
Mean ICER (2.5-97.5th percentile)/£ per error avoided	65·60 (58·2 – 73·0)	

What is the economic impact of PINCER?



Markov model*



Probability and resource use data from trial

Probability, resource use and utility data from published sources

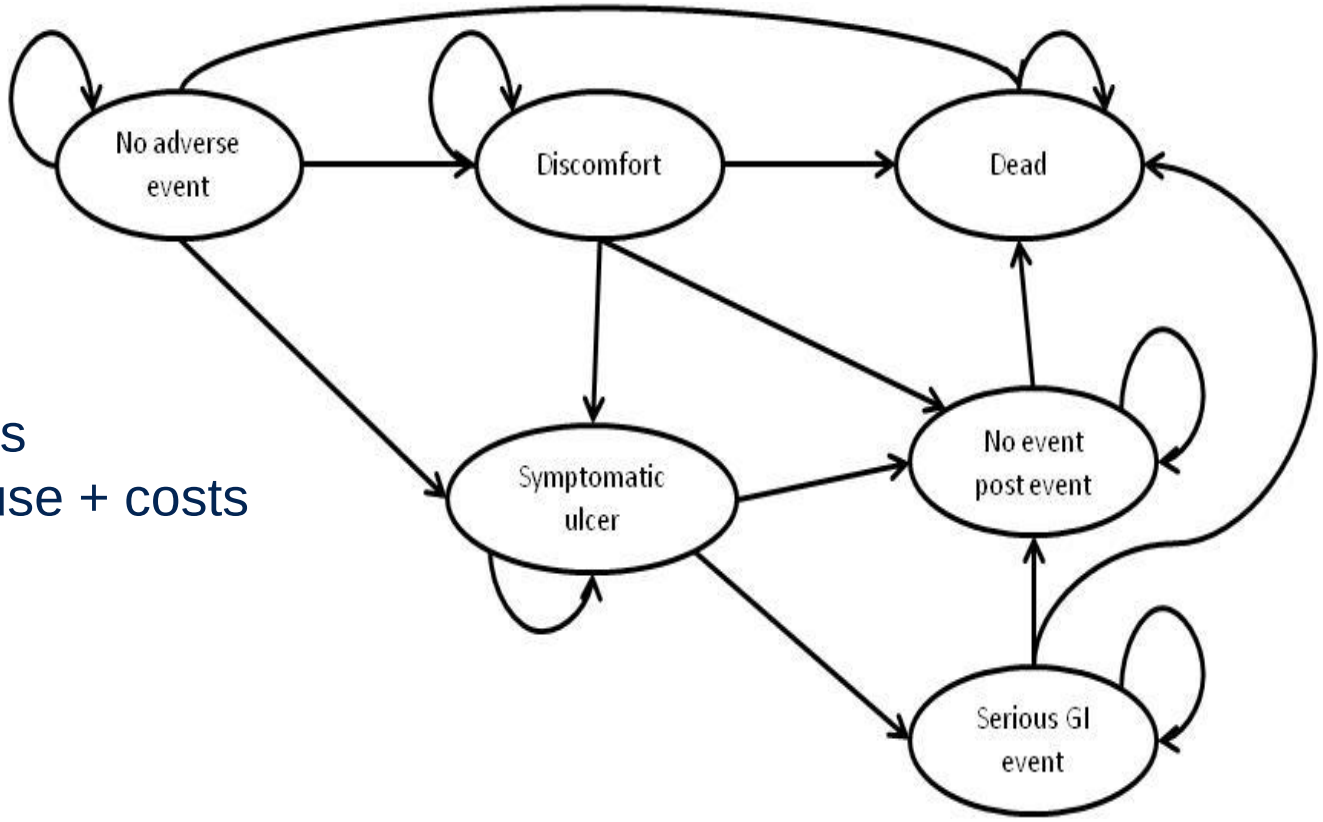
*number and type of health states will depend on the prescribing or monitoring error

PINCER composite economic model

- Develop and populate treatment pathway models for each error
  - Probabilistic Markov model, clinical face validity
  - 5 yr time horizon, NHS perspective
  - UK resource use and unit costs
- Generate incremental utility and cost per patient for each error
- Combine treatment pathways with within trial PINCER analysis
  - Error rates observed per practice in trial: (mean practice population at risk:799) OM1: 7%; OM2: 71%; OM3: 16%; OM5: 4%; OM7: 1%; OM8: 1%
- Generate base case cost per QALY, CEAC, net benefit
- Sensitivity analysis (cost of intervention, size of practice)
- Scenario analysis (effect of different errors)

Example of a specific error model:

Patients with a past medical history of peptic ulcer who have been prescribed a non-selective NSAID and no PPI



1. Specify model
2. Obtain data:
   a) Probabilities
   b) Resource use + costs
   c) Utilities
3. Generate:
   a) Δ outcome
   b) Δ cost

Probabilities for NSAIDs model

Transition probabilities for patients in the non-error-group						
	Transition to:					
Transition from:	No GI adverse event	Discomfort	Symptomatic ulcer	Serious GI event	No further GI following initial GI event	Death
No GI AE	0.894*	0.099	0.0047	0.0001	0.0	0.0003
Discomfort	0.0	0.188	0.0069	0.00015	0.802*	0.0003
Symptomatic ulcer	0.0	0.148	0.0183	0.00039	0.824*	0.001
Serious GI event	0.0	0.148	0.0183	0.00039	0.725*	0.1083
No GI post GI	0.0	0.0985	0.0001	0.0001	0.894*	0.0003
Death	0.0	0.0	0.0	0.0	0.0	1.00

**1-(sum of other probabilities)*

Example of resource use for NSAIDs model

Cost per patient for pathway: discomfort, therapy switch + inpatient medical management			
Resource	Mean	Minimum	Maximum
Costs of original drug for 3 months	£7.10	£7.10	£7.10
One GP visit at end of first month	£34.00	£34.00	£34.00
Remaining treatment period	Adding PPI to original drug		
Inpatient investigation	£2,578.49	£2,464.34	£2,841.64
2 months PPI	£62.61	£62.61	£62.61
Total	**£2,682.21**	**£2,568**	**£2,945**

Utilities for NSAIDs model

Health state	Utility weight
No GI adverse events	1.000
Discomfort	0.910
Symptomatic ulcer	0.870
Serious GI event	0.824
No further GI event following initial GI event	1.000
Death	0

PINCER intervention vs current practice: deterministic CEA

Prevalence of patient group in practice	Control event rate per practice	RRR intervention	QALYs generated per practice*		Cost/£ per practice	
			Control	Inter.	Control	Inter.
7%	0.04	0.35	256.61	256.62	95252.79	94938.75

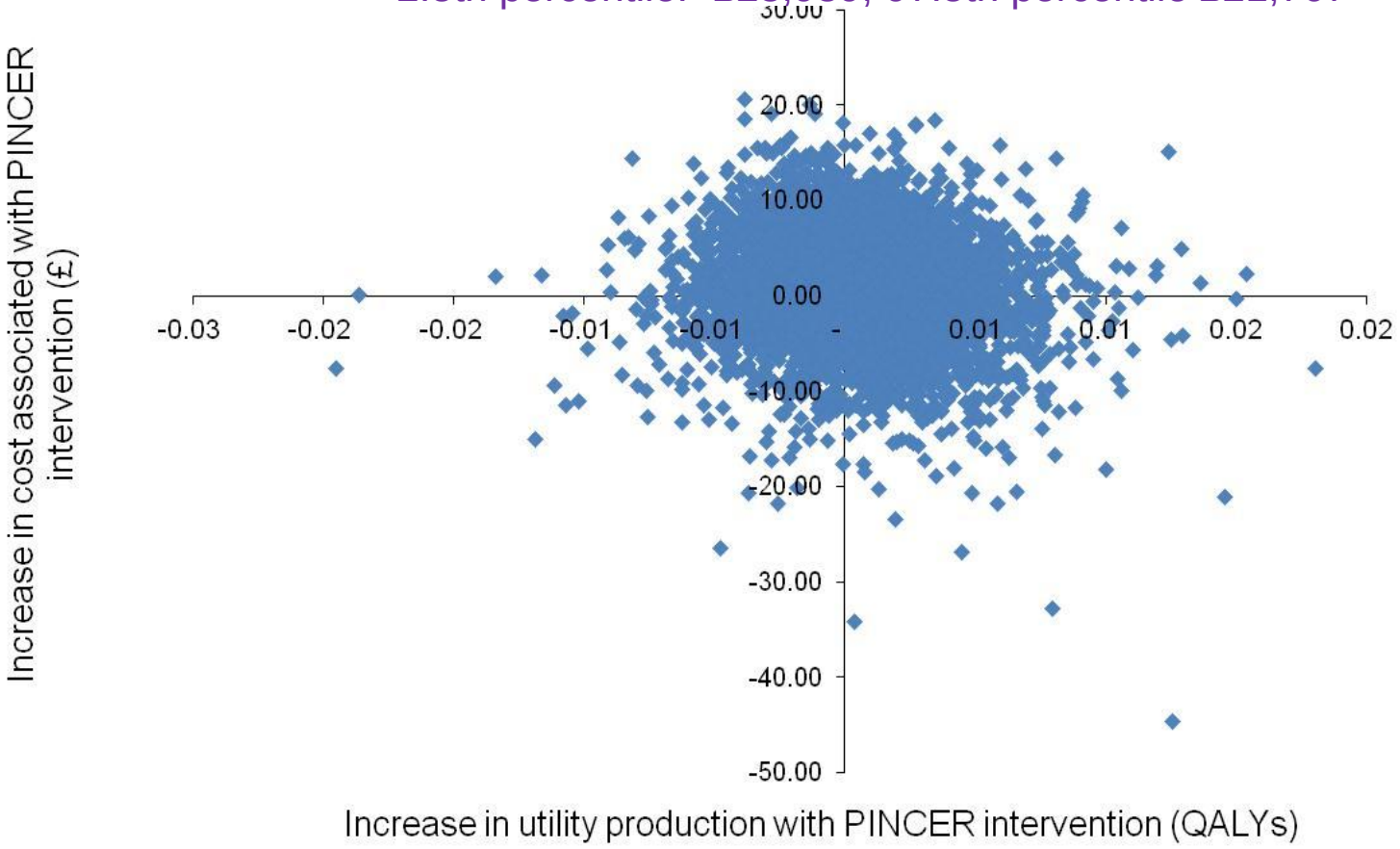
ΔQALY per practice	Δ Cost per practice (£)
0.01	-314.03

PINCER intervention vs current practice: deterministic CEA

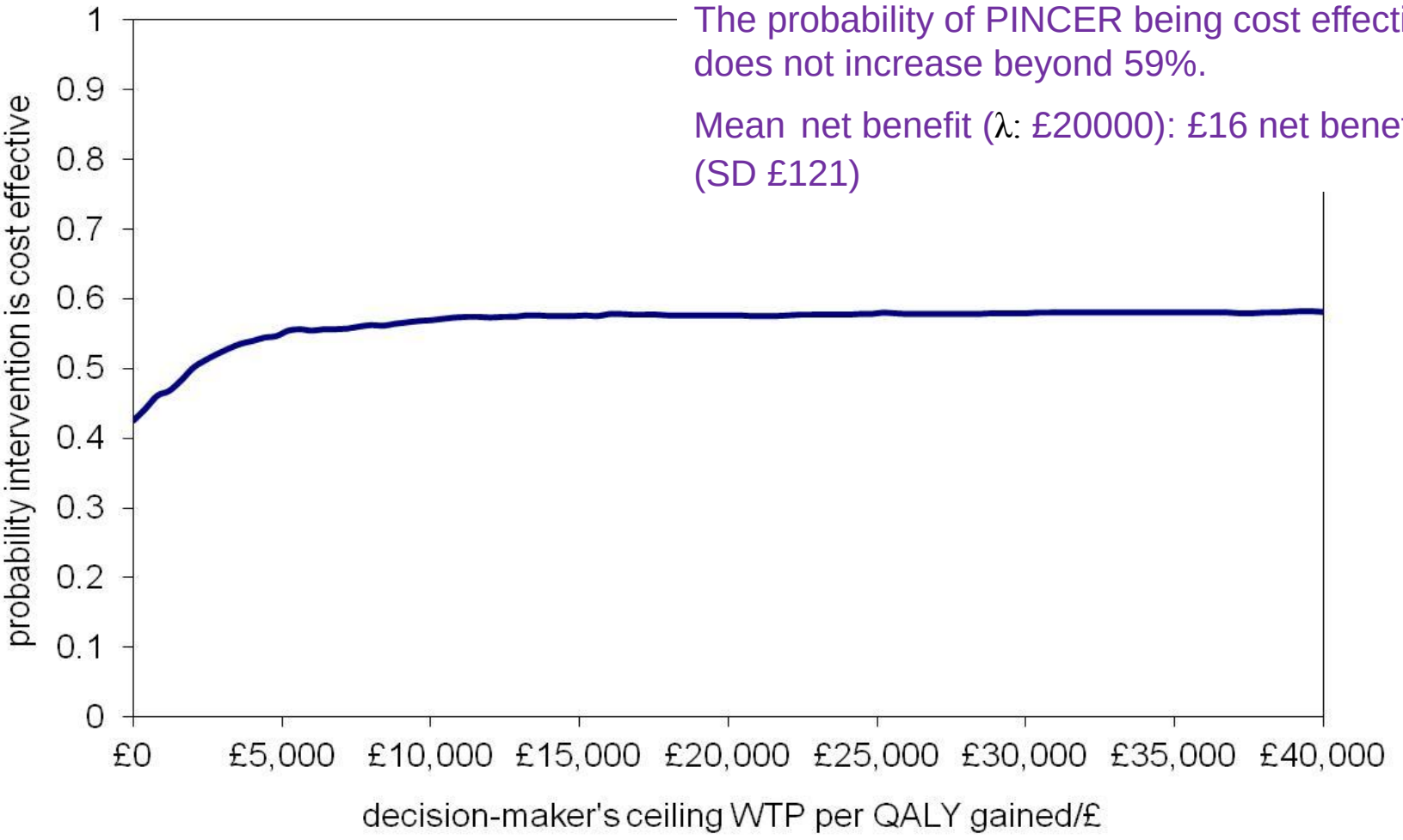
Error	Prevalence of patient group in practice	Control event rate per practice	RRR intervention	QALYs generated per practice*		Cost/£ per practice		QALY difference per practice	Cost difference per practice (£)
				Control	Intervention	Control	Intervention		
NSAIDs	7%	0.04	0.35	256.61	256.62	95252.79	94938.75	0.01	-314.03
Bblockers	71%	0.03	0.17	1530.27	1530.53	241722.54	240758.77	0.26	-963.77
ACEI	16%	0.08	0.36	407.62	407.79	112325.80	111077.01	0.16	-1248.79
Methotre	4%	0.31	0.19	124.64	124.81	53790.15	52821.93	0.16	-968.22
Lithium	1%	0.40	0.11	24.19	24.19	95148.32	94939.67	0.00	-208.65
Amiodar	1%	0.45	0.25	36.84	37.05	15837.85	16058.50	0.21	220.65
							Difference in intervention cost /practice		**871.88**
							Total	**0.81**	**-2611**
							ICER	***-3,243*/CS**	

PINCER intervention vs current practice: probabilistic CEA

mean ICER: -£2519 per QALY gained (SD 97,460; median -£159; 2.5th percentile: -£23,939; 97.5th percentile £21,767



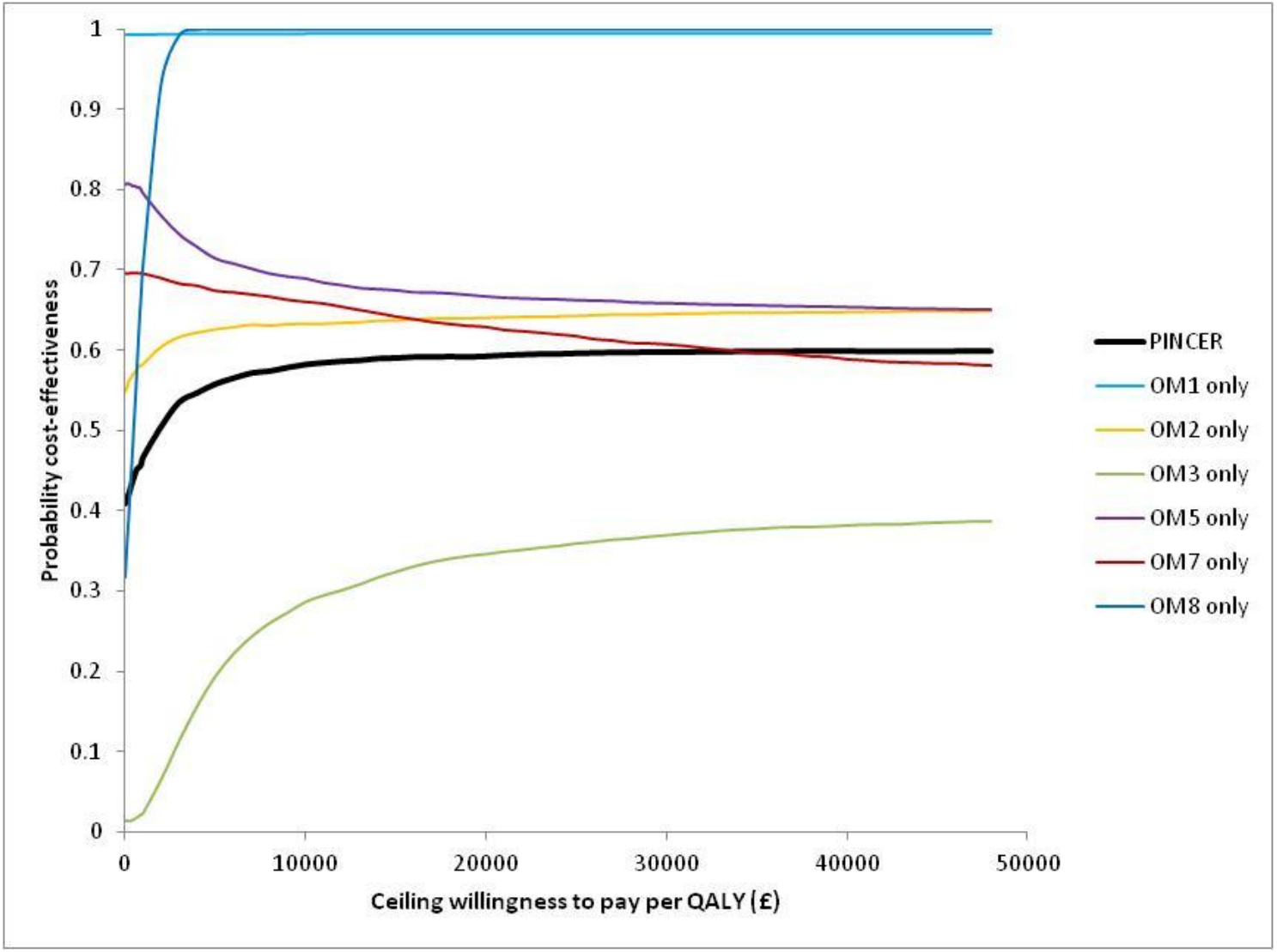
CEAC of PINCER intervention vs current practice



The probability of PINCER being cost effective does not increase beyond 59%.

Mean net benefit (λ: £20000): £16 net benefit (SD £121)

CEAC of PINCER intervention: individual errors



Discussion

- ↓errors associated with primary outcomes in the PINCER trial leads to ↑QALYs and ↓ costs
- Uncertainty around some specific error models (eg beta-blockers) very large due to lack of data

- Mean ICER low, but huge variation, so poor probability of cost effectiveness, negligible net benefit
- Cost effectiveness affected by inclusion of particular errors (esp those with better evidence)
- Changing intervention costs had little effect on ICER

Using economic evaluation to evaluate safety in health care

- Emerging safety culture in health care (finally), moving from person-centred to system-centred paradigm
- System-centred interventions are costly
- Preventing errors and adverse events completely is prohibitively expensive with diminishing returns
    - Eg testing everyone for allergies to antibiotics
- So, preventability of adverse events is determined (to some greater or lesser extent) by affordability
- Therefore, CEA should be involved in development of safety interventions (but usually isn't).....
- But, are standard health economic methods able to evaluate safety interventions?

Thank you

Any questions?

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