The economics of antibiotics

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Outline of this session

- Key issues in the economics of antibiotics
- How do health economists view healthcare?
- Evaluating the cost effectiveness of interventions to improve antibiotic use
- Some final thoughts

Key issues in the economics of antibiotics

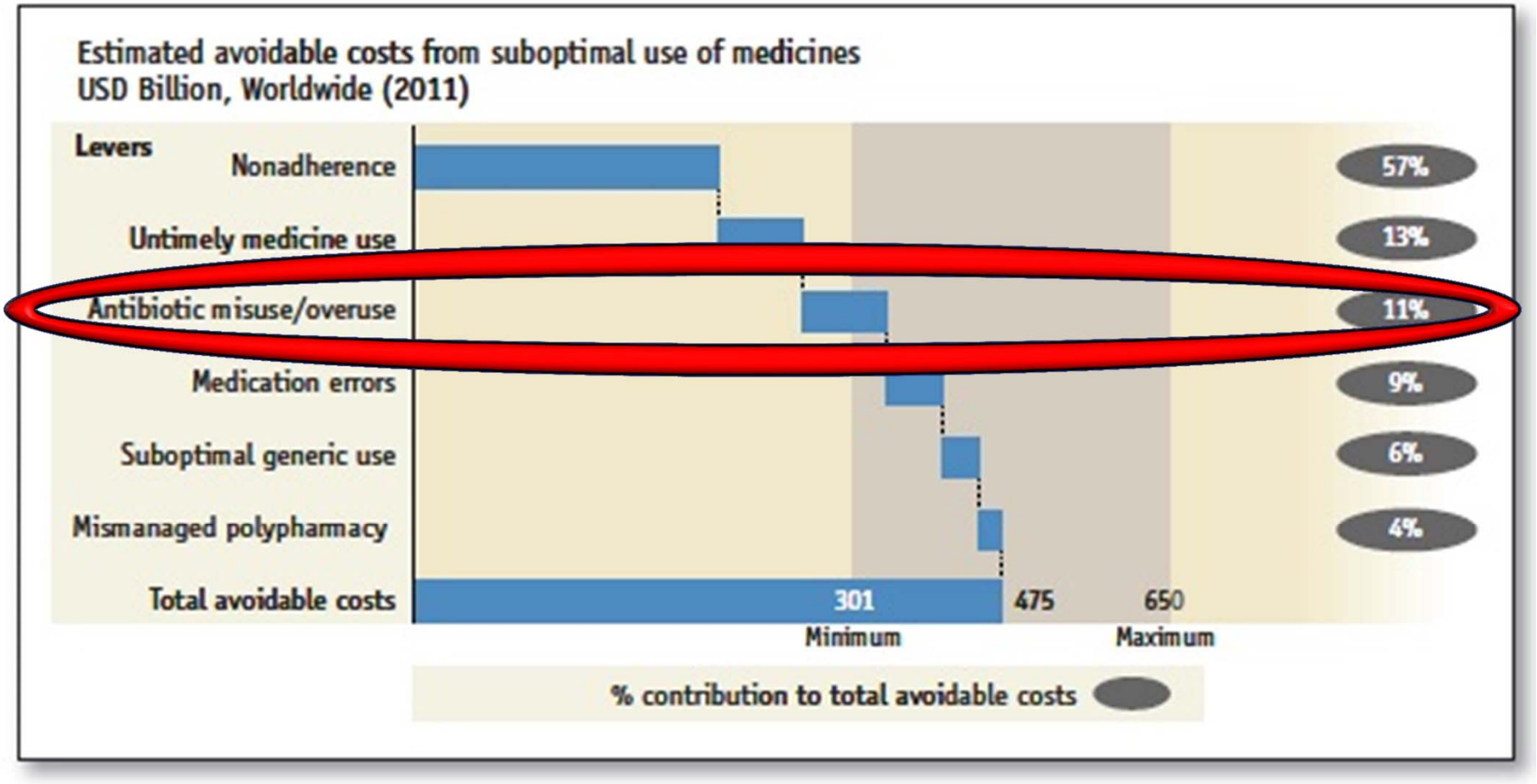
Key issues 1: ↑resistance, ↓innovation

- Systemic antibacterial agents approved for use in humans by the US FDA
  - 1983-1987 (16)
  - 2008-2012 (2)
- WHY?
  - Scientifically hard to discover new drugs
  - Poor return on investment for R&D
    - net present value of antibiotic to a drug company is -$50 million (cf +$1 billion for a new musculoskeletal drug)
  - More complex regulation pre and post approval
- EMEA/ECDC (2009) calculated the total societal costs of infection due to resistance to be € 1.5 billion per year, 25000 deaths in Europe *per annum*

Key issues 2: not seeing antibiotics as part of a process

- Restrictions in drug budgets have led to restrictions in antibiotic use to cut costs:
  - *Prior authorization,*
  - *Generic substitution,*
  - *Therapeutic substitution,*
  - *Restricted use of drugs on the formulary,*
  - *Usage guidelines, antibiotic order sheets,*
  - *Automatic stop orders,*
  - *Selective reporting of susceptibilities,*
  - *Dose minimization.*
  - *Cost shifting…….*

Economic impact of suboptimal use of medicines



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

Antibiotics as a proportion of costs of care

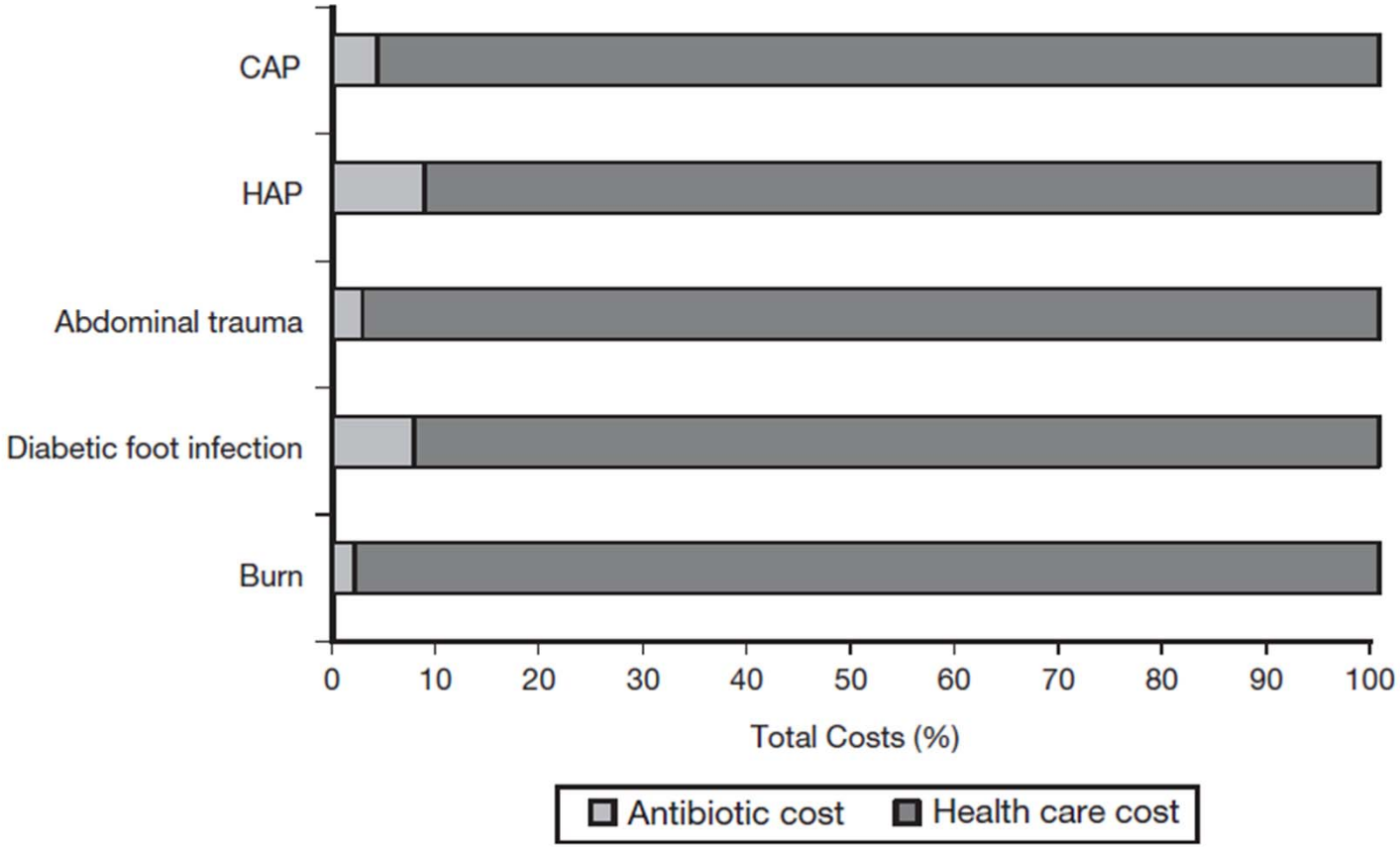


Figure 1. Antibiotics as a percentage of total health care costs: (level 2 costs/level 3 costs) x 100, in selected studies.[5–9] CAP = community-acquired pneumonia; HAP = hospital-acquired pneumonia.

Paladino, J.A., Economics of Antibiotic Use Policies Pharmacotherapy 2004;24(12 Pt 2):232S–238S

How do health economists view health care?

What is cost effectiveness?

Resources:
Staff
Equipment
Drugs

Options:
1) Intervention A
2) Intervention B

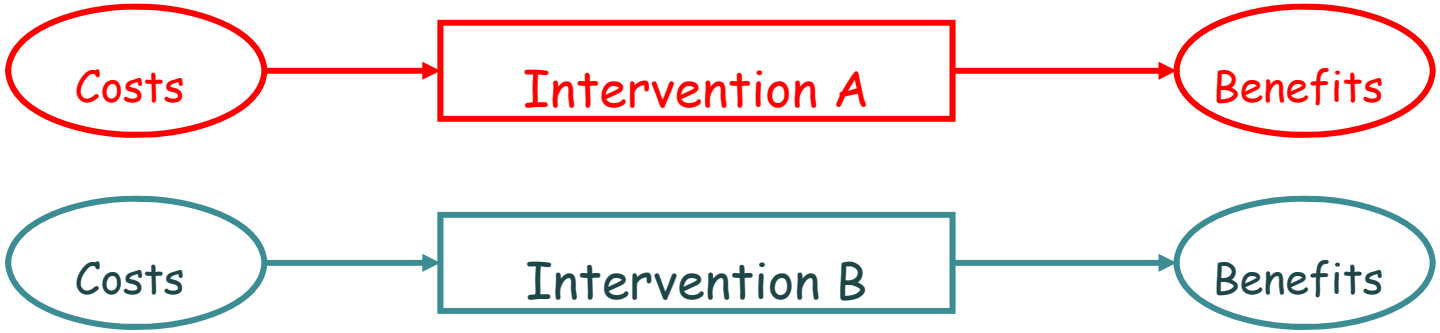
Effectiveness

Quality adjusted life years

"Willingness to pay"

Elliott RA, Payne K. Essentials of economic evaluation for health care. Pharmaceutical Press, London. 2005

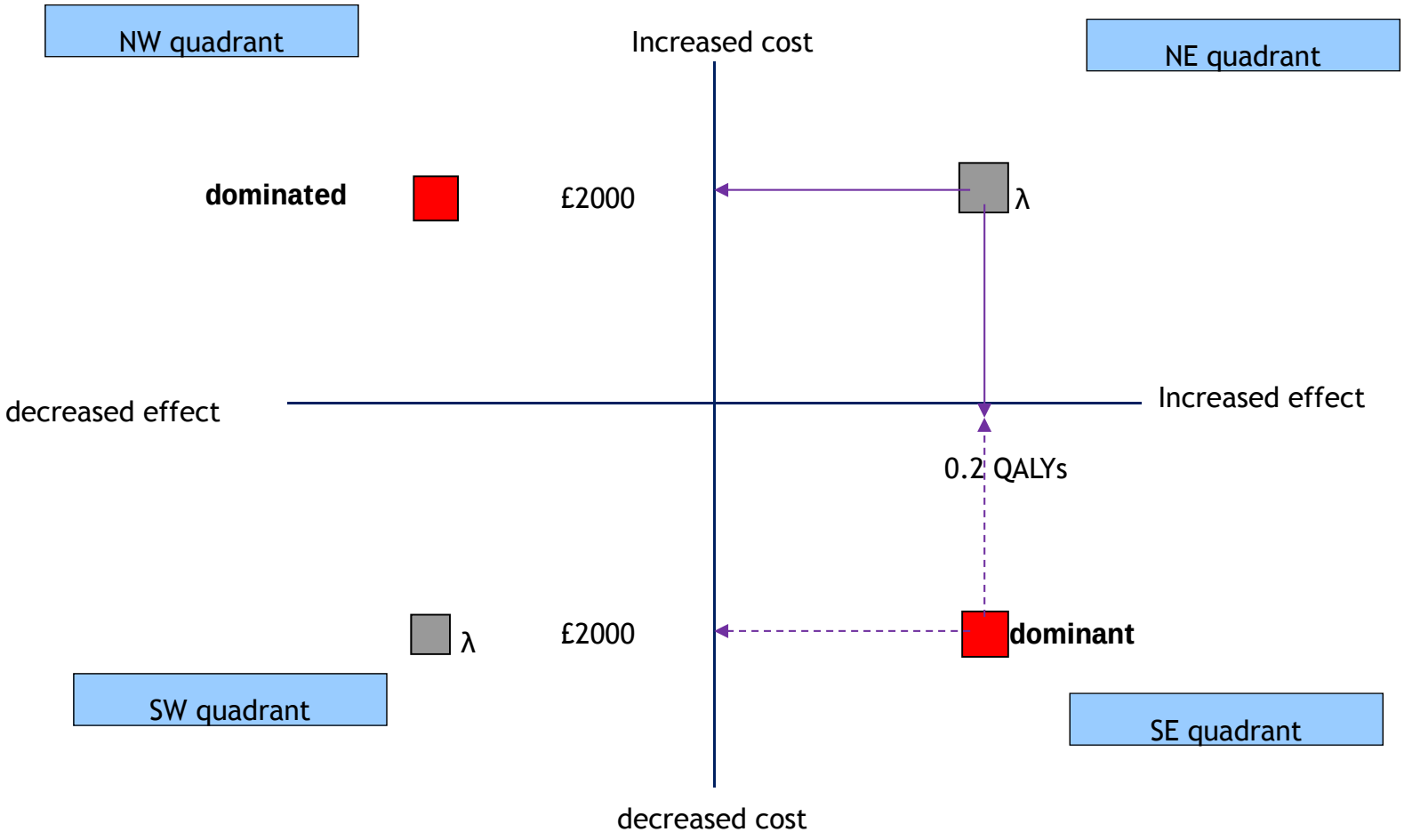
How health economists choose between different health care interventions



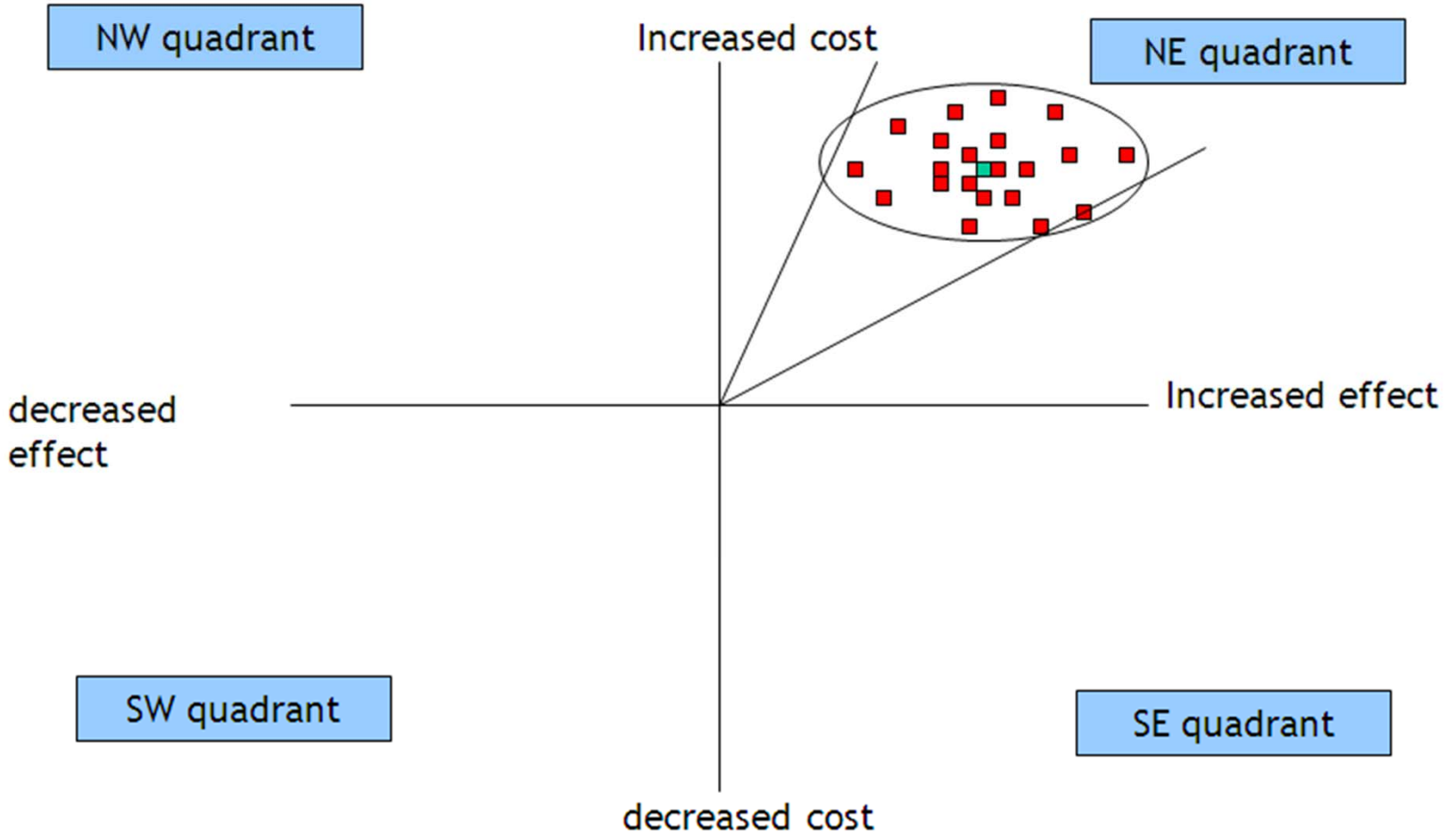
Incremental cost/effectiveness ratio

$$= \frac{[\text{Cost a} - \text{Cost b}]}{[\text{Outcome a} - \text{Outcome b}]}$$

Generating an incremental cost effectiveness ratio (ICER)

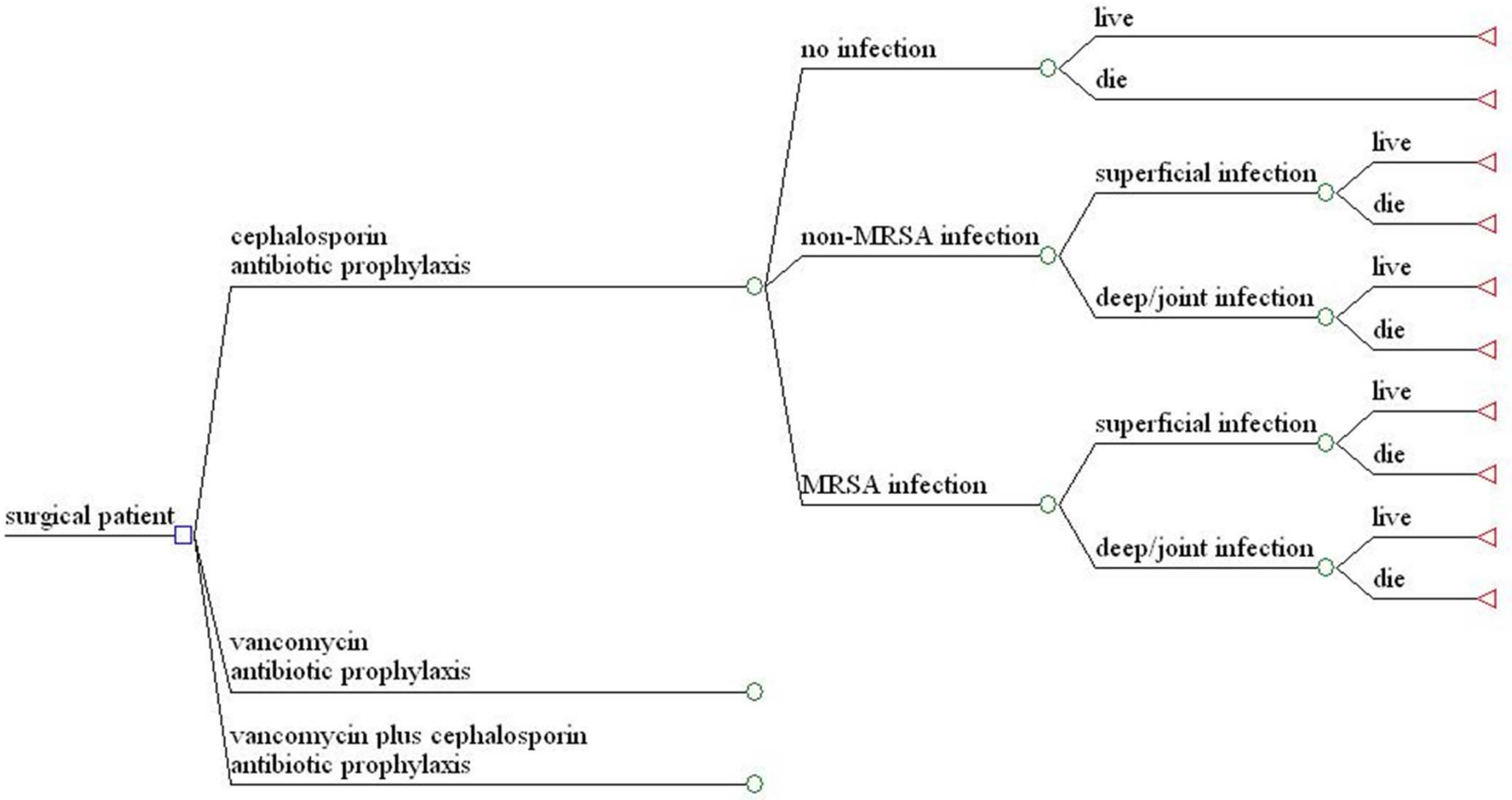


Quantifying uncertainty around ICERs



Evaluating the cost effectiveness of antibiotics

Decision analytic model of glycopeptide versus non-glycopeptide surgical prophylaxis in hip arthroplasty



Optimal form of prophylaxis (vancomycin (V), cephalosporin (C) or cephalosporin plus vancomycin (CV)) for a given baseline MRSA infection rate and other infection rate*

What haven't we included in this analysis?

- Costs to health care provider of implementing optimal prophylaxis
- Model assumes moving from 0% optimal to 100% optimal practice which isn't realistic
- Likelihood of use of these antibiotics in this setting on development of resistant strains
  - In the same hospital
  - More broadly in the population
- Costs to society of resistance developing (future morbidity and mortality)

Economics of antibiotic stewardship

- Goal should be to
  - Ensure that patients receive optimal, cost-effective pharmacologic treatment.
  - Manage the development of bacterial resistance.
- Reality is that the focus is on cutting costs
- Cost shifting to approved antibiotics may not reduce costs
- Formulary restrictions often accompanied by costs of time spent by clinicians, microbiologists and pharmacists (rarely included in the cost calculations)
- Effects of antibiotic stewardship programs don't last forever.
- 10 years ago, Paladino was reporting that patients were experiencing **worse outcomes** with increased costs overall from some antibiotic stewardship schemes.
- Cost-effective antimicrobial stewardship programs must take account of the whole process but do exist (Geissler 2003, Ruttiman 2004, Bantar 2003, Ng 2008)

Could antibiotics be classed as “orphan drugs”?

- The term “orphan drug” is used in both US and EU legislation to describe a drug indicated for a rare disease (“orphan disease”).
- The definition of an orphan disease varies:
  - in the US it is one with a prevalence < 200,000 affected persons;
  - in the EU it is one with a prevalence < 5 per 10,000 of the population.
- Under both schemes, a potential product can be granted “orphan drug status” if it is proposed for use to treat an orphan disease.
- Orphan drug status gives manufacturers various benefits:
  - waiver of licensing fees
  - extended patent protection
- US also offers tax relief on development costs.

Some final thoughts

- Overuse of antibiotics important source of potentially preventable morbidity & mortality
- Initiatives to improve antibiotic stewardship usually costly with variable effectiveness. Is the benefit associated with managing antibiotic use worth the cost?
- What do we mean by benefit? Benefit to whom? When?
- What do we mean by cost? Cost to whom? When?
- Should we treat antibiotics as orphan drugs to encourage development?

Useful references

- Kobelt G. An introduction to economic evaluation. 3rd edition 2013. Published by OHE
- Alliance for the Prudent Use of Antibiotics. Confronting Today's Crisis in Antibiotic Development Volume 30 Issue 1. 2011 (www.apua.org)
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- Elliott RA et al. An economic model of switching from non-glycopeptide to glycopeptide antibiotic prophylaxis for surgery. European Journal of Health Economics 2010; 11 (1): 57-65, doi: 10.1007/s10198-009-0175-0.
- Sculpher, M. Evaluating cost-effectiveness of interventions designed to increase the utilization of evidence-based guidelines. Family Practice. 2000; 17 Suppl 1:S26-31.
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Thank you

Any questions?

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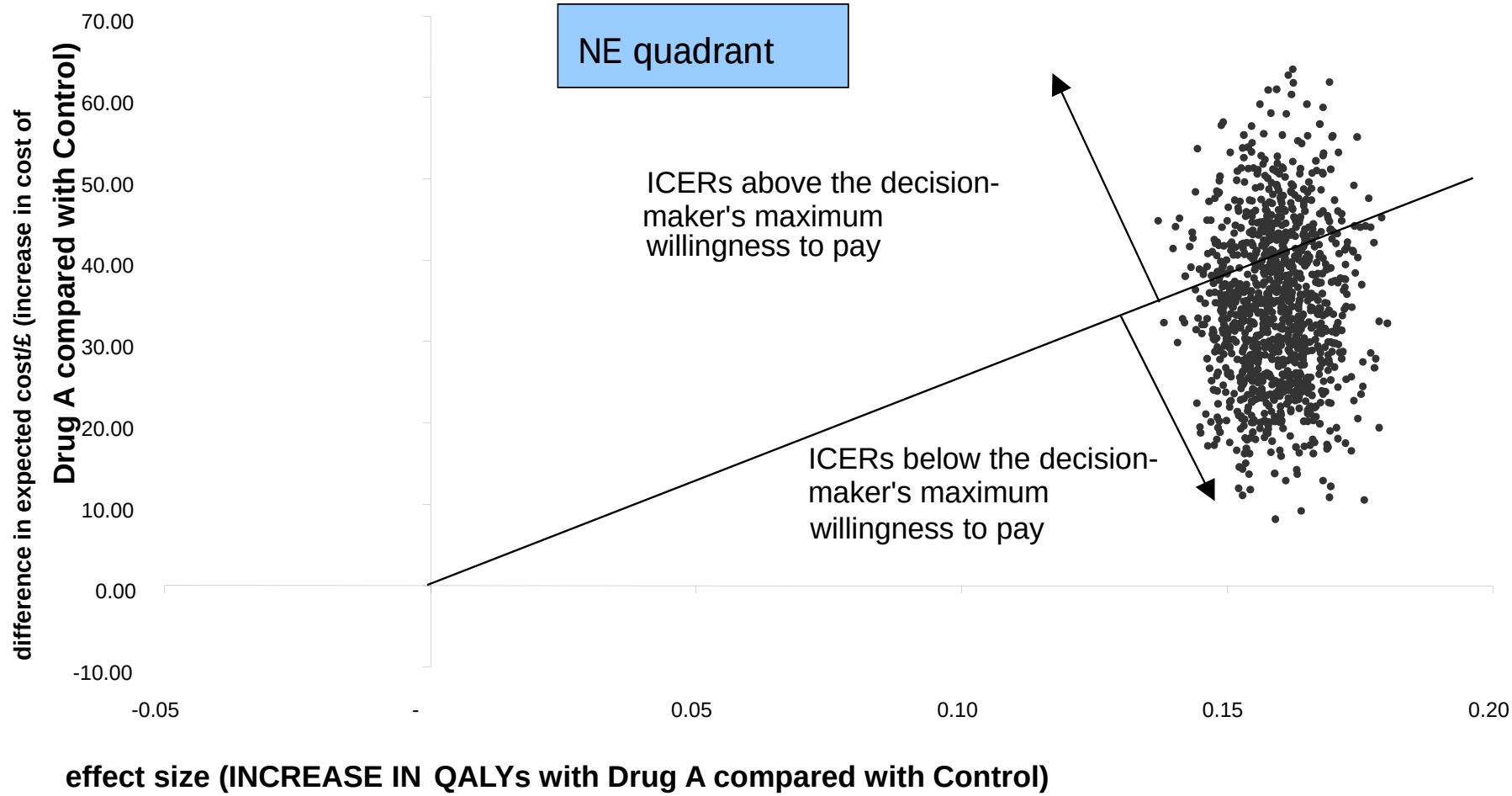
Estimating the probability of cost-effectiveness



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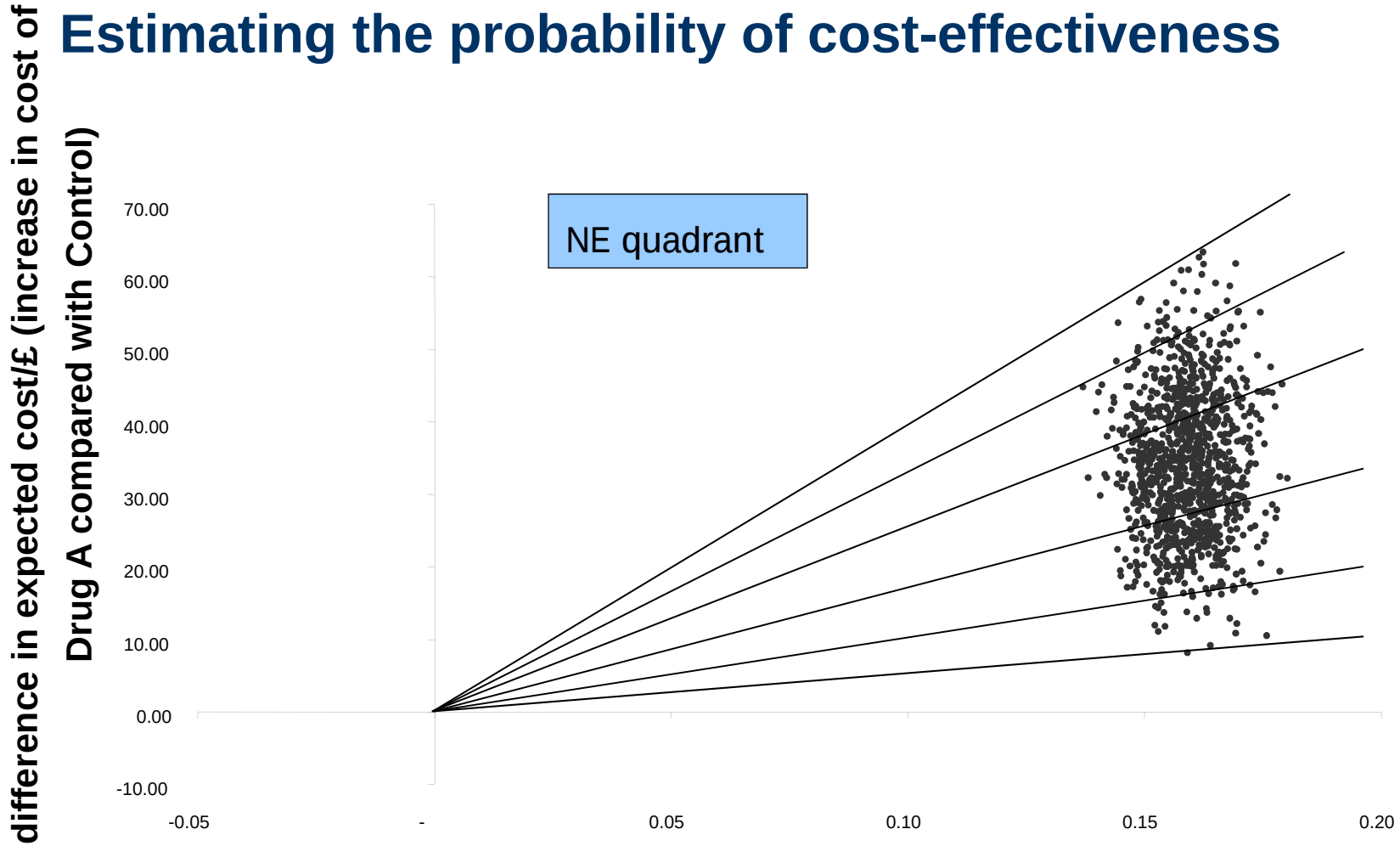

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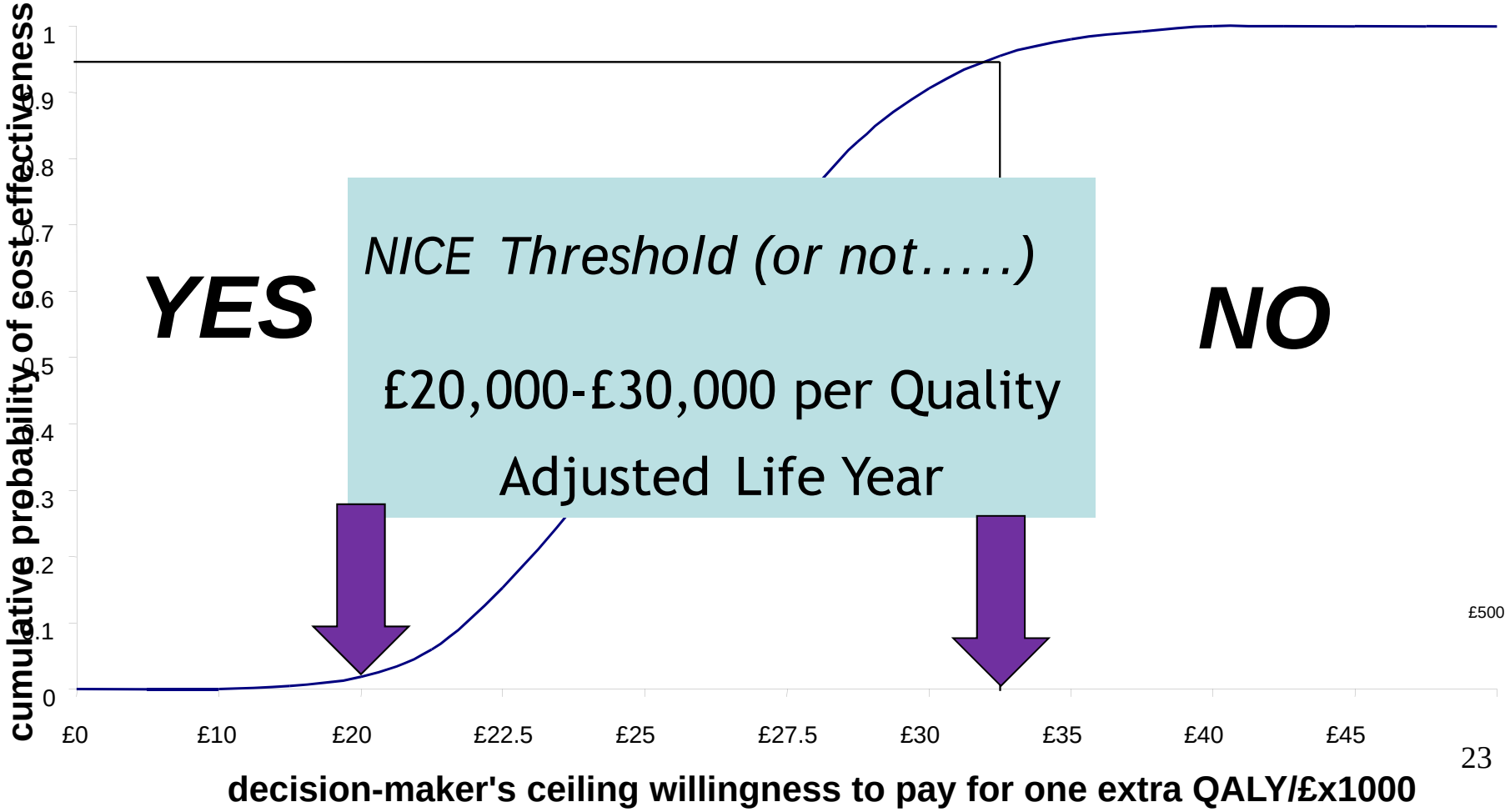

Effect size of glycopeptide versus non-glycopeptide surgical prophylaxis in hip arthroplasty[1]

Option	Infection events	Number of infections	N	P %	odds
Vancomycin	MRSA	2	452	0.44	0.0044
	Other	41	452	9.07	0.0998
Cephalosporin	MRSA	7	433	1.62	0.0164
	Other	32	433	7.39	0.0798

[1] Finkelstein R et al Vancomycin versus cefazolin prophylaxis for cardiac surgery in the setting of a high prevalence of methicillin-resistant staphylococcal infections. J. Thoracic and Cardiovascular Surgery 2002; 123:326-332.

Resource use associated with glycopeptide versus non-glycopeptide surgical prophylaxis

Resource use	Units	Cost/£	Source
Vancomycin prophylaxis			
Vancomycin prophylaxis 1g bd for 24 hours	2	£32.22	BOA, BNF
Administration costs:100ml 0.9% NaCl solution	2	£0.60	Local NHS contract costs
Total		£32.82	
Deep/joint non-MRSA infection			
Non-MRSA antibiotic treatment with erythromycin 500mg qds for 14 days	56	£10.64	Personal communication , BNF
MRSA test	1	£7.09	NHS reference costs
Inpatient day	22.8	£4,560.00	Coello 2005
Wound exploration	1	£1,107.00	Blom 2003
Total		£5,684.73	
Superficial MRSA infection			
Antibiotic treatment: vancomycin 1g bd for 1 week	14	£225.54	BOA BNF
Administration costs:100ml 0.9% NaCl solution	14	£4.20	Local NHS contract cost
MRSA test	1	£7.09	NHS reference costs,
Barrier nursing	8.9	£3,099.60	Kunori 2002
Inpatient day	8.9	£1,780.00	Coello 2005
Total		£5,116.43	