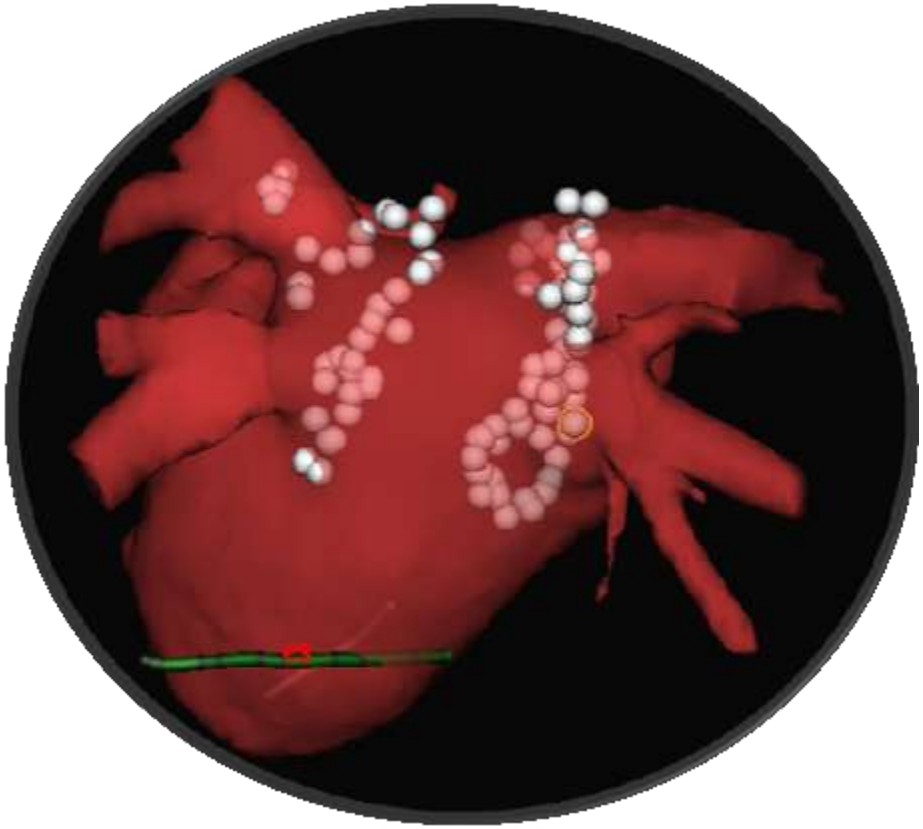
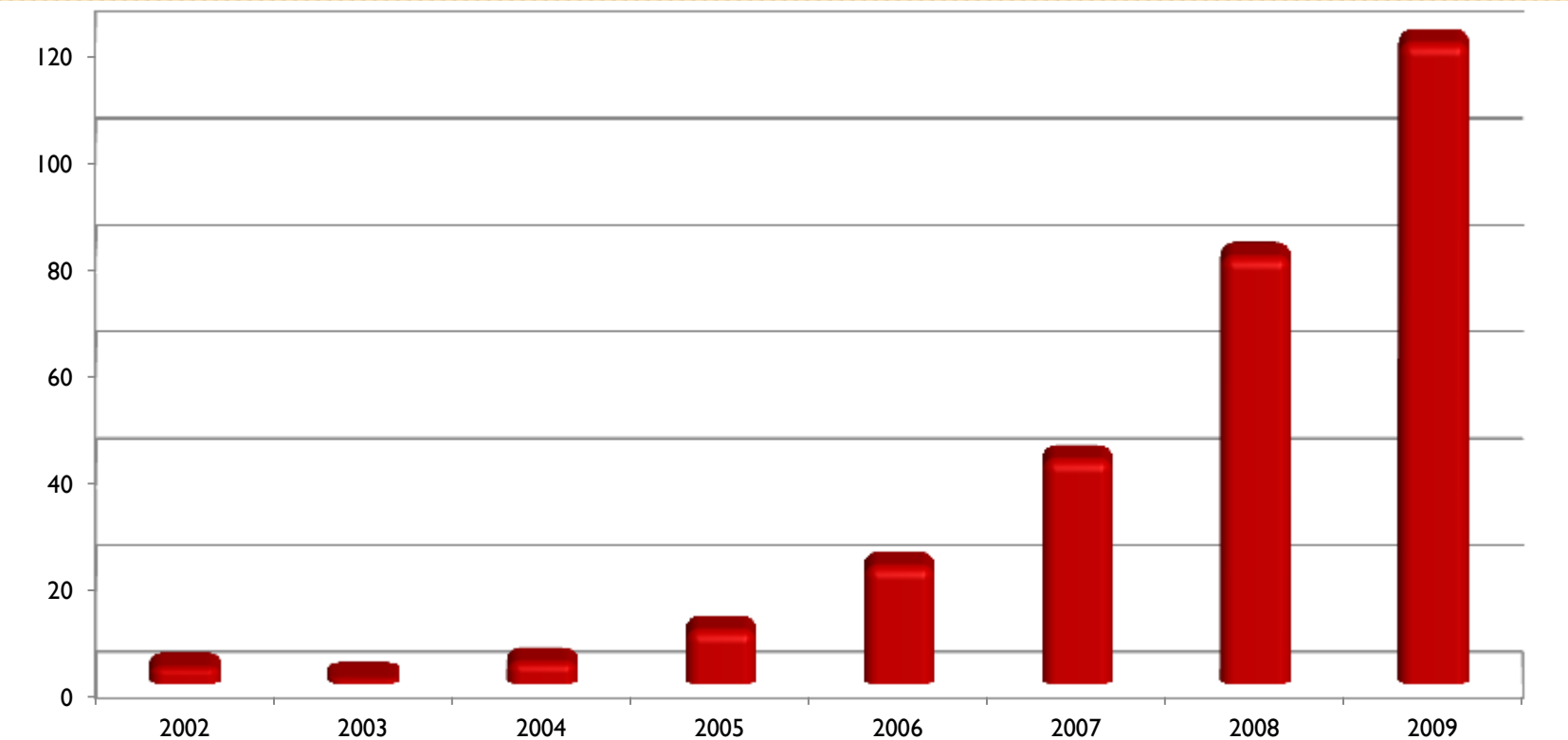
Cost Effectiveness of AF Ablation

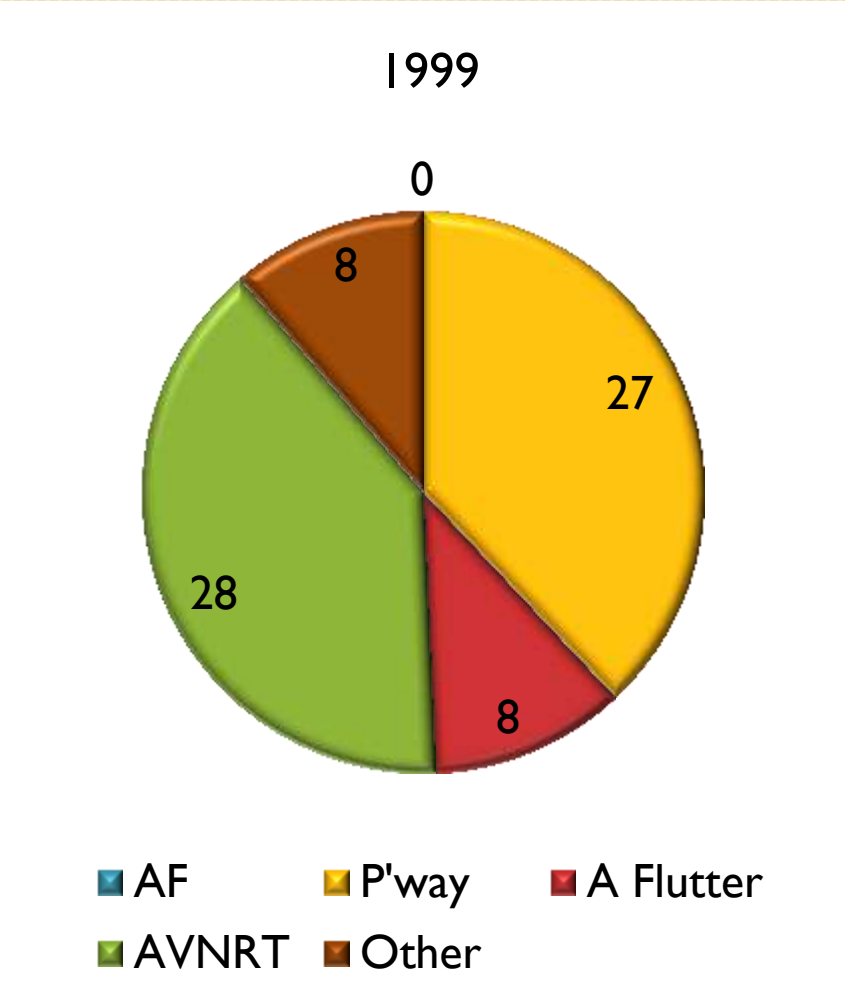
Chris Pepper

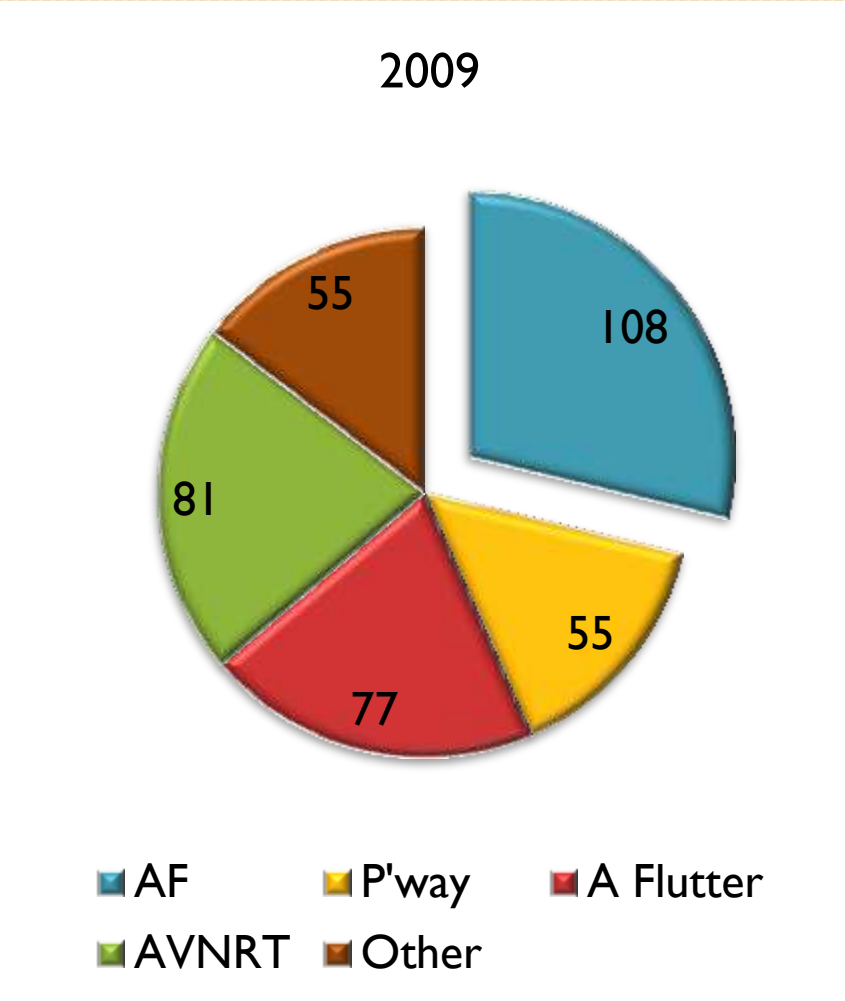
Leeds Teaching Hospitals NHS Trust





AF Ablation in Leeds





Case Mix 1999 vs 2009

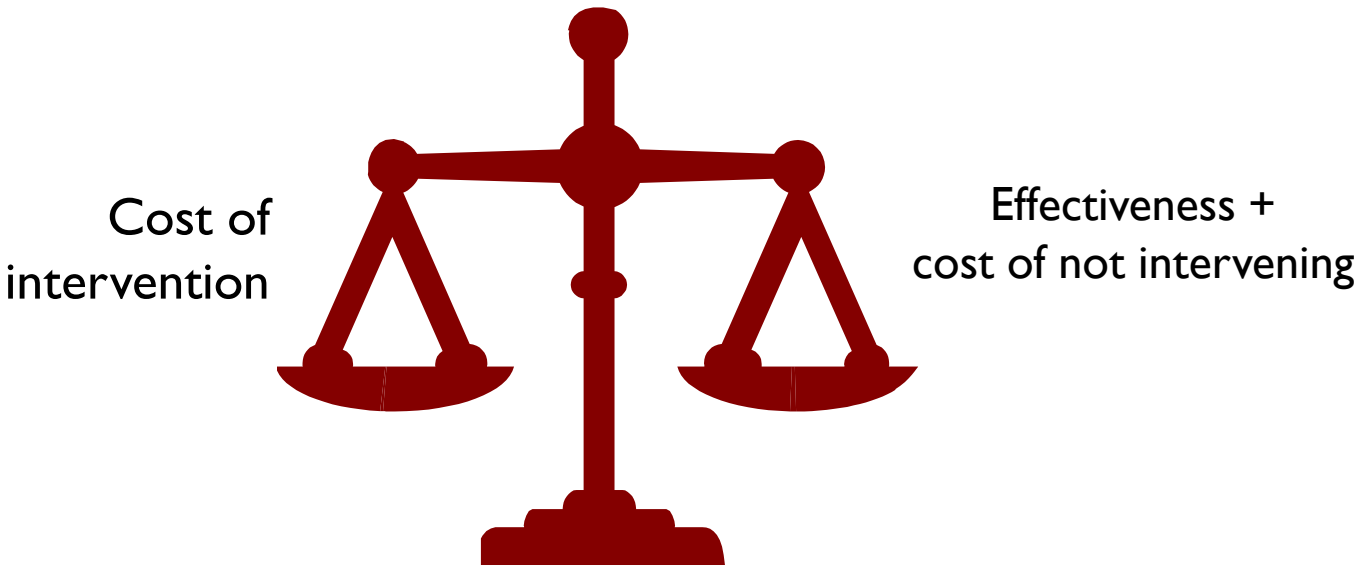
AF ablation is

- Unpredictable in outcome
- Growing rapidly
- Expensive
- Placing major demands on cardiac services

- Increasingly under scrutiny

- We are going to be required to demonstrate cost efficacy

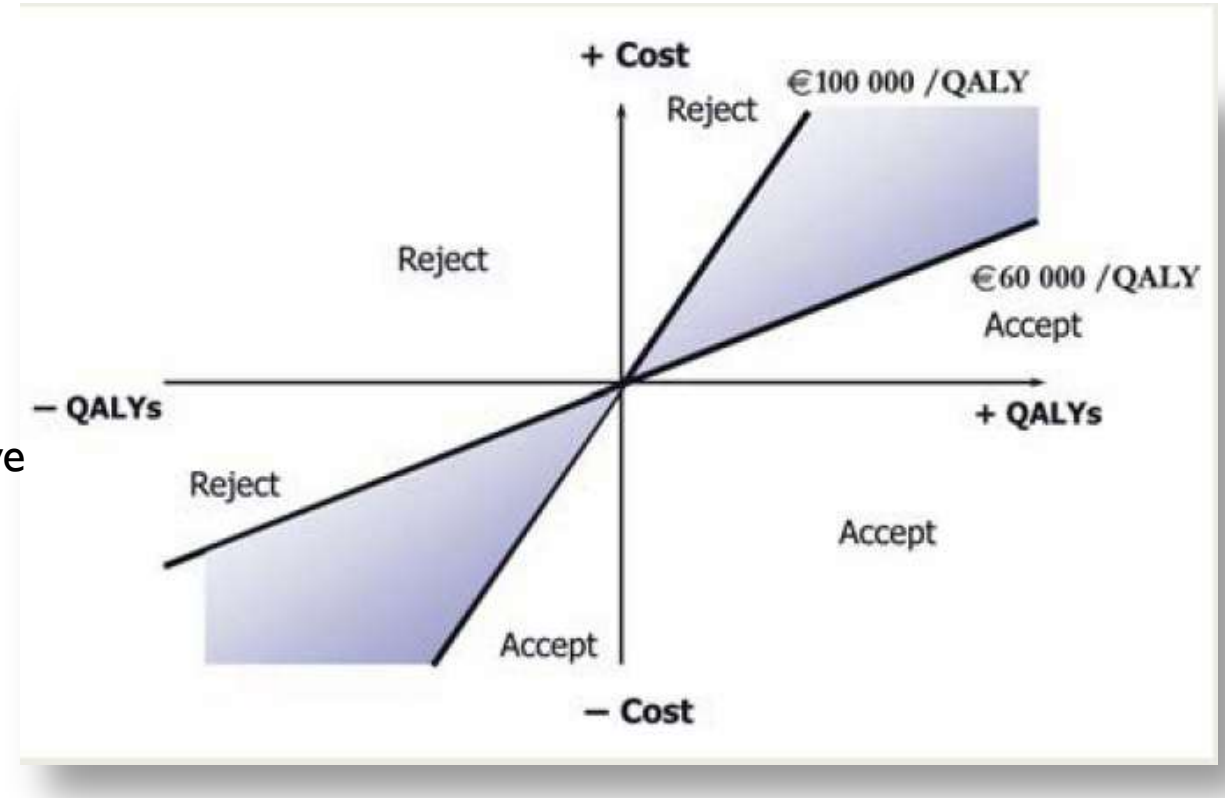
Value for Money?



- QALY: Quality adjusted life year
- Utility: impact on quality of life
- ICER: Incremental cost effectiveness ratio (Cost per QALY)
  - NICE threshold £20-30k / QALY

Cost Effectiveness

Less effective



More effective

Andrikopoulos 2009

Challenges of Cost efficacy analysis

- Multiple assumptions
- Multiple sources of data
- Variable techniques
- Variable centre success rates
- Heterogeneity of patient population

The evidence base

- Chan *et al* 2006
  - JACC 47:2513-20
- Khaykin *et al* 2007
  - JCE 18:907-913
- Khaykin *et al* 2009
  - JCE 20:7-12
- McKenna *et al* 2009
  - Heart 95:542-549
- Reynolds *et al* 2009
  - Circ. Arrh. EP. 2:362-369

Chan et al 2006

- Decision analysis model for LACA
- Compared:
  - Rate control + warfarin
  - Rhythm control (amiodarone + warfarin)
  - Ablation +/- warfarin
- Calculated required reduction in stroke risk to make LACA cost effective at:
  - $50,000 per QALY
  - $100,000 per QALY

JACC 2006;47:2513

Chan et al: Assumptions:

- 80% LACA efficacy
- 30% redo rate
- 2% p.a. relapse rate

- Moderate stroke risk (1 risk factor)
  - 3% risk per year
- Low stroke risk (no risk factors)
  - 1.4% risk per year

JACC 2006;47:2513

Chan et al: Conclusions

- Rate control + warfarin the most cost effective option
- For a 65y.o:
  - Would need to reduce risk of stroke by
    42% ($50k threshold)
    11% ($100k threshold)
    to make LACA 'cost effective'

JACC 2006;47:2513

Cost efficacy of LACA
Chan et al

Moderate stroke risk age 65	$51,800 per LY	(£32700)
Moderate stroke risk age 55	$28,700 per LY	(£18100)
Low stroke risk	$98,900 per LY	(£62500)

JACC 2006;47:2513

Chan et al: Problems

- Stroke risk reduction unproven
- No consideration of quality of life benefits

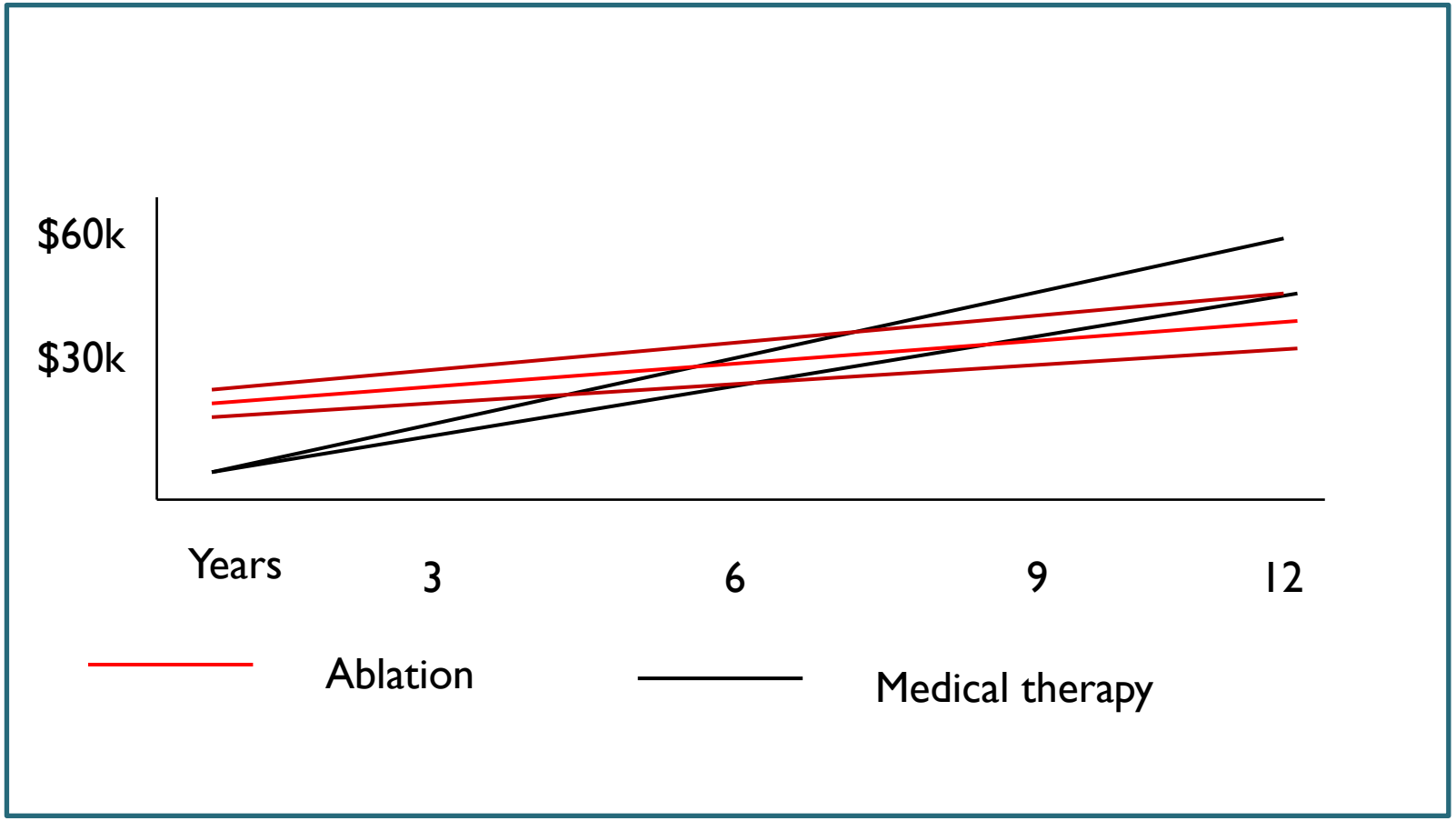
Khaykin 2007

- Cost *comparison* study
- Canadian healthcare costs
  - CARAF registry
- Don't specify pattern of AF
- No utility assessment
- Assume constant anti-arrhythmic drug use
- Sensitivity analysis modelled varying success rates and redo rates

Khaykin et al 2007

- Ablation
  - Treatment costs: $16278-$21294
  - Follow up per year: $1597-$2132
- Medical therapy
  - $4176 - $5060 p.a.
- Costs equalise at 3.2 - 8.4 years of F/U

Cumulative Costs of AF Ablation



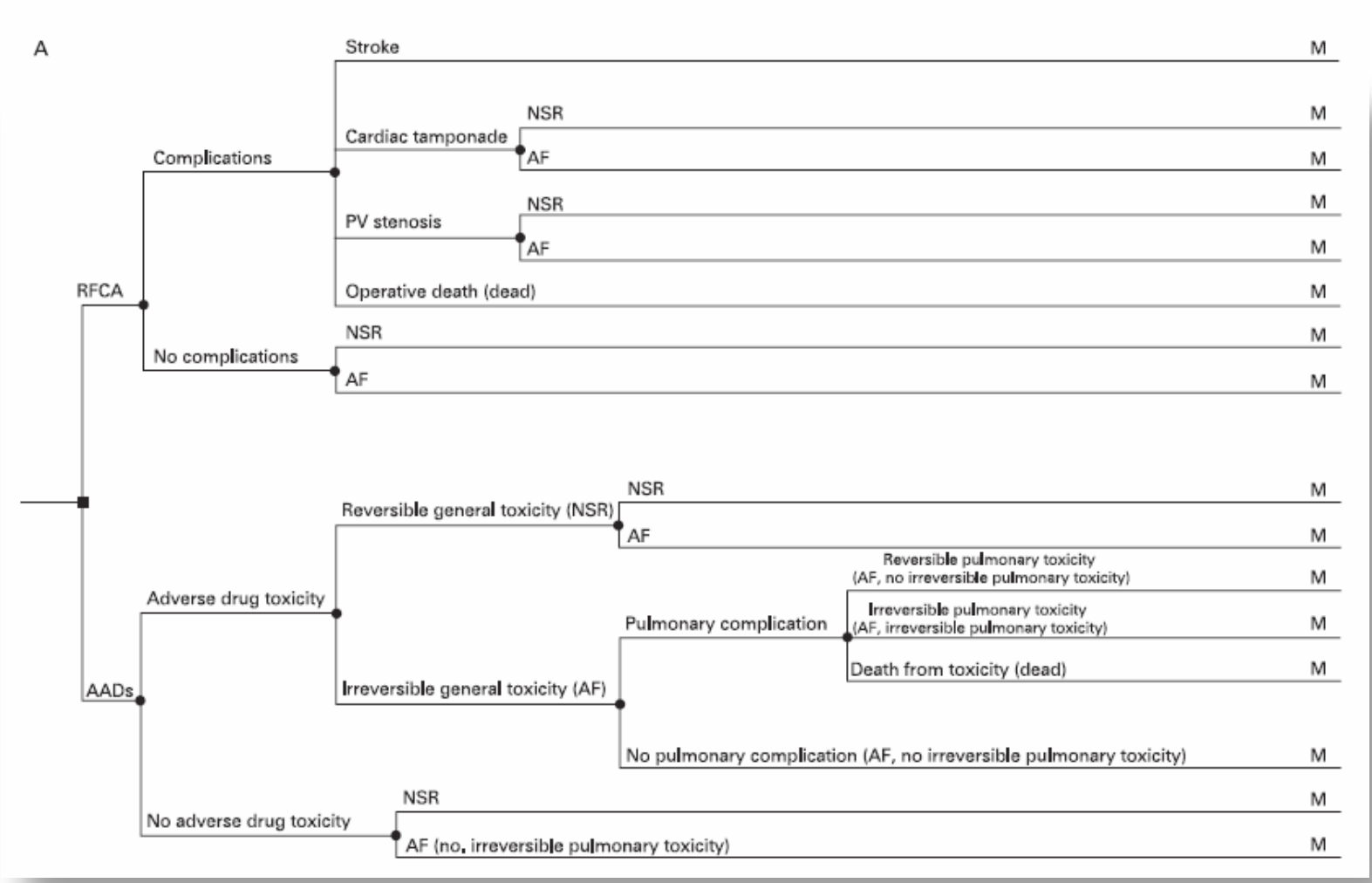
Modified from Khaykin et al 2007

McKenna et al

- True cost-effectiveness study
- Markov decision-analysis model with Monte-Carlo simulation
- Paroxysmal AF
- Assumptions
  - 1.3 procedures per patient
  - Comparator drug amiodarone
- Procedure costs from Adam Fitzpatrick
  - £7848
- Success rates from a systematic literature review
- Multiple sources for stroke, mortality and QOL (SF36, EQ-5D) outcomes

McKenna et al Health Technology Assessment 2008 Vol. 12 No. 34

Short Term Model (12 months)



McKenna et al Health Technology Assessment 2008 Vol. 12 No. 34

RFCA

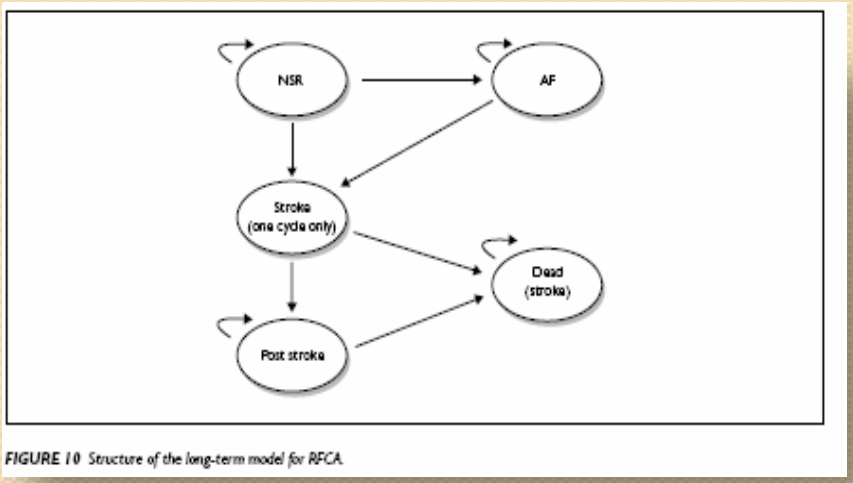


FIGURE 10 Structure of the long-term model for RFCA.

AAD

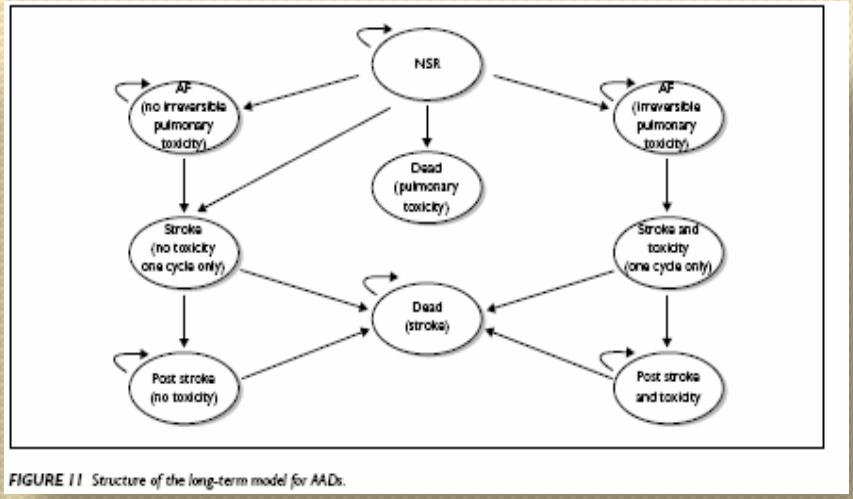
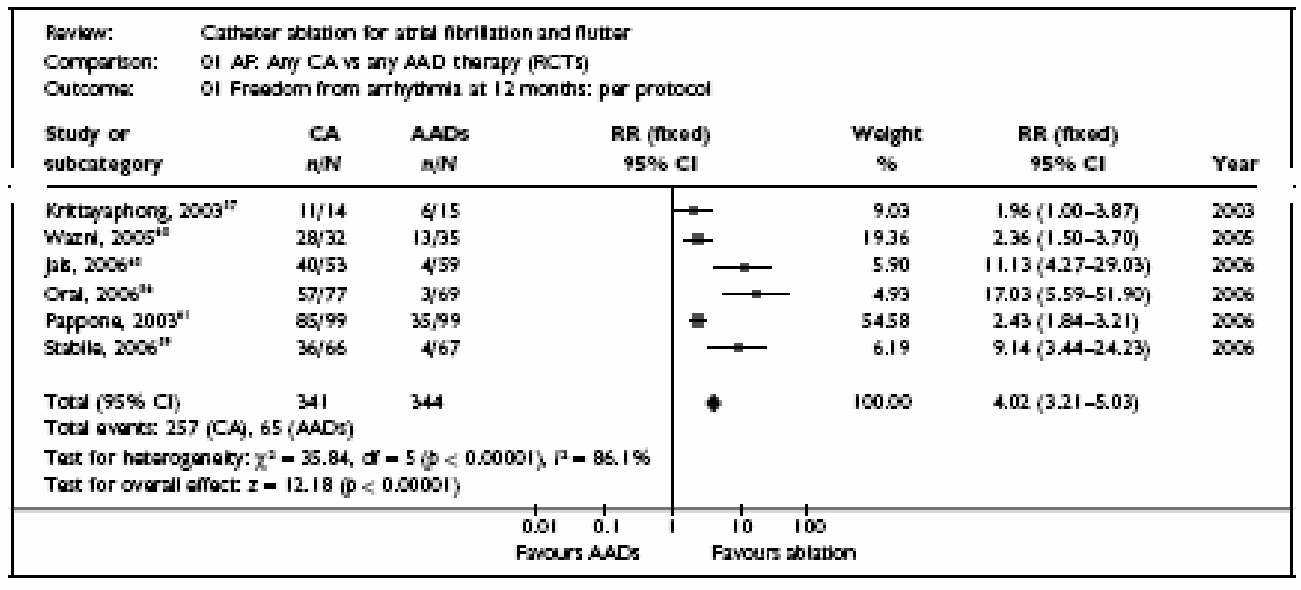


FIGURE 11 Structure of the long-term model for AADs.

Long Term Model

McKenna et al Health Technology Assessment 2008 Vol. 12 No. 34

Outcomes: systematic review



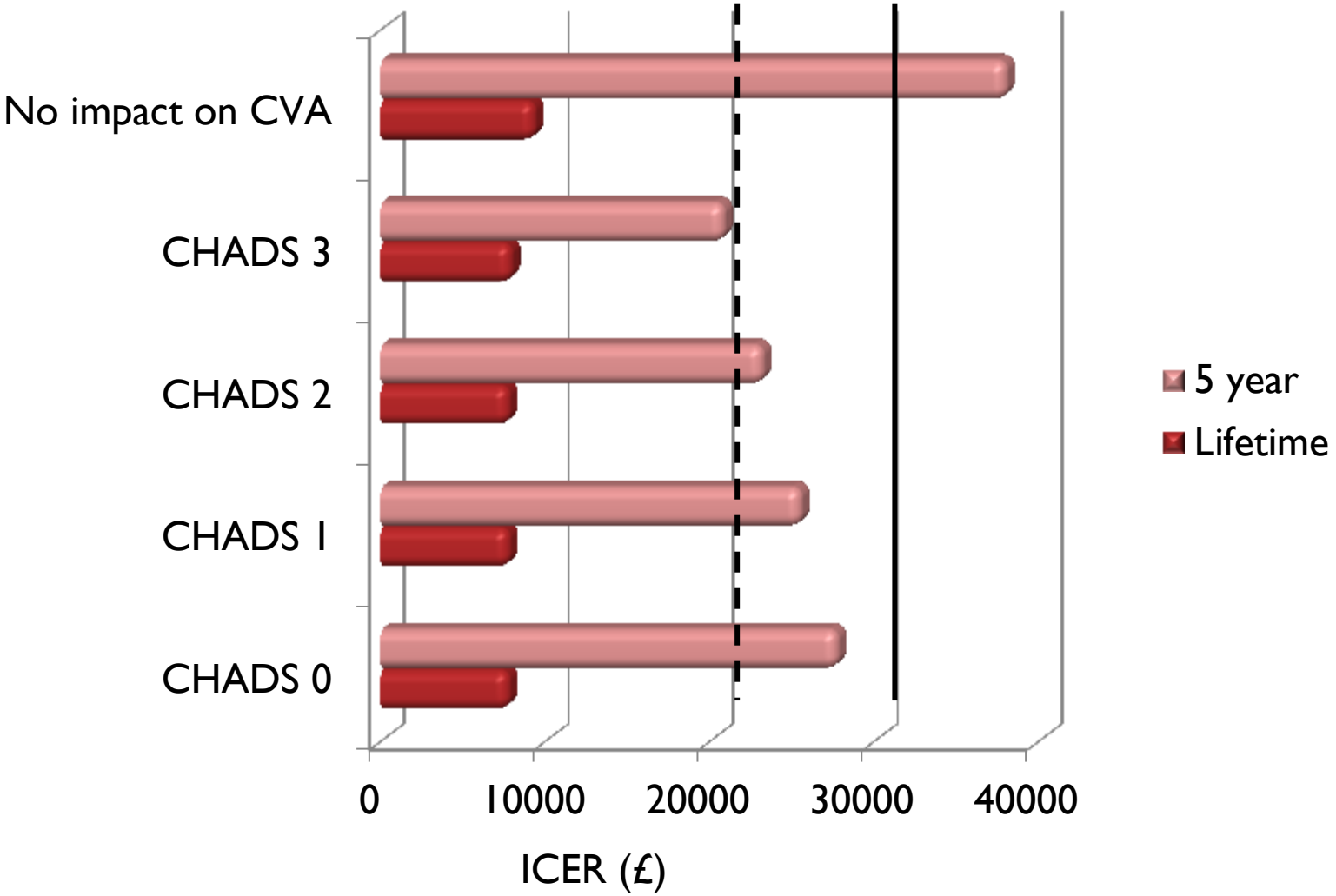
Review: Catheter ablation for atrial fibrillation and flutter
Comparison: 01 AF: Any CA vs any AAD therapy (RCTs)
Outcome: 01 Freedom from arrhythmia at 12 months: per protocol

Study or subcategory	CA n/N	AADs n/N	RR (fixed) 95% CI	Weight %	RR (fixed) 95% CI	Year
Krittayaphong, 2003[17]	11/14	6/15		9.03	1.96 (1.00–3.87)	2003
Wazni, 2005[18]	28/32	13/35		19.36	2.36 (1.50–3.70)	2005
Jais, 2006[41]	40/53	4/59		5.90	11.13 (4.27–29.03)	2006
Oral, 2006[34]	57/77	3/69		4.93	17.03 (5.59–51.90)	2006
Pappone, 2003[21]	85/99	35/99		54.58	2.43 (1.84–3.21)	2006
Stabile, 2006[19]	36/66	4/67		6.19	9.14 (3.44–24.23)	2006
Total (95% CI)	341	344		100.00	4.02 (3.21–5.03)	

Total events: 257 (CA), 65 (AADs)
Test for heterogeneity: $\chi^2 = 35.84$, df = 5 ($p < 0.00001$), $I^2 = 86.1\%$
Test for overall effect: $z = 12.18$ ($p < 0.00001$)

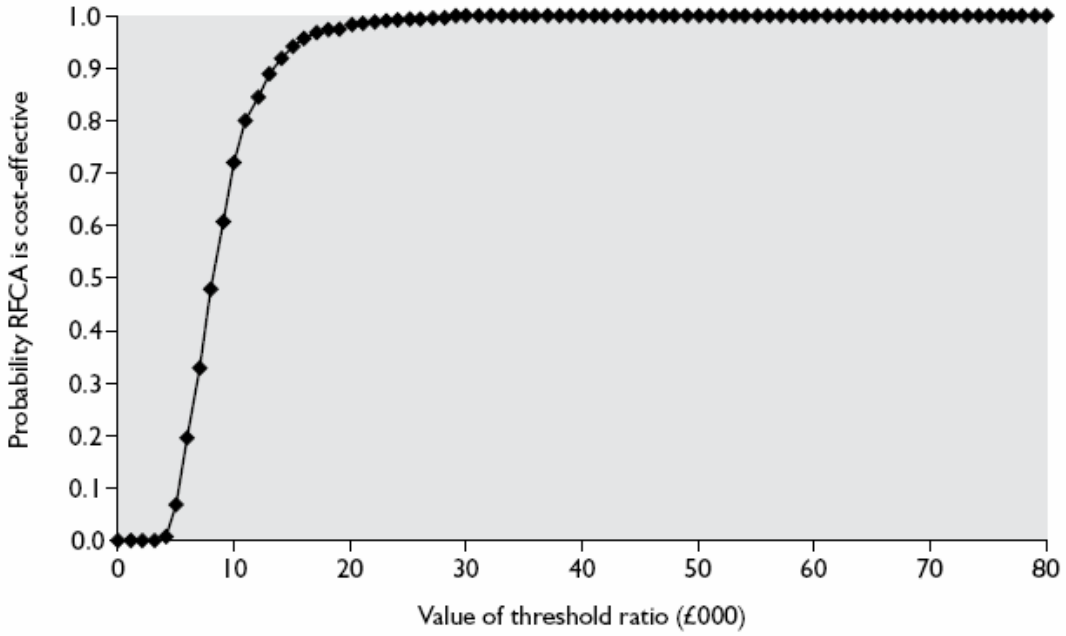
0.01 0.1 1 10 100
Favours AADs Favours ablation

Base-case Estimates



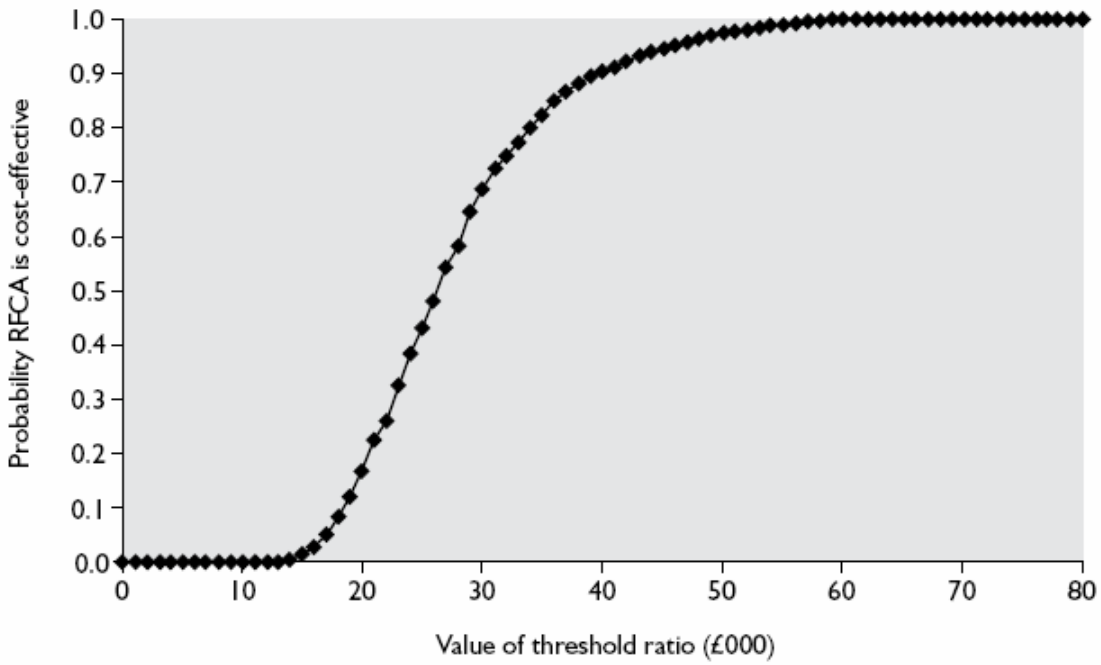
McKenna et al Health Technology Assessment 2008 Vol. 12 No. 34

Lifetime analysis



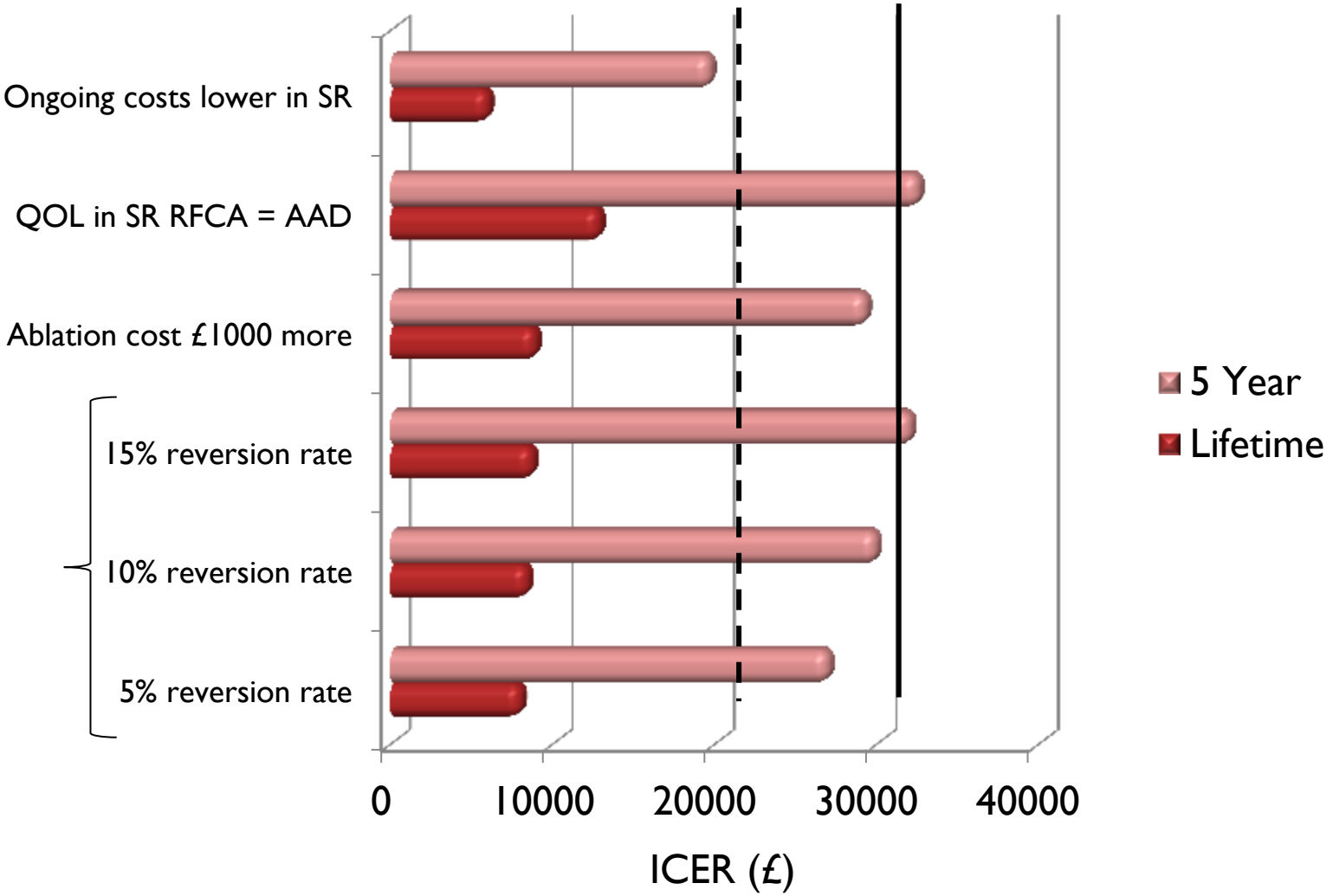
McKenna et al Health Technology Assessment 2008 Vol. 12 No. 34

5 year analysis



McKenna et al Health Technology Assessment 2008 Vol. 12 No. 34

Sensitivity analysis: selected aspects



McKenna et al Health Technology Assessment 2008 Vol. 12 No. 34

Limitations

- Multiple unrelated data sources
- Quality of life data uncertain
  - Little good data on QoL after AF ablation
- Predominantly paroxysmal AF
- Assumes study outcomes replicated in 'real world'
  - Impact of repeat procedures not modelled
- Ignores impact of 'partial success'
  - Model based on freedom from AF at 12 months

McKenna et al: Conclusions

- AF ablation cost effective as long as health benefits maintained for 5 years or more
- Dependent on:
  - Duration of benefit
  - Prognostic impact
  - Late recurrence rate of AF

Reynolds 2009

- Paroxysmal AF only
- Markov decision analysis
- QALY projection over 5yrs

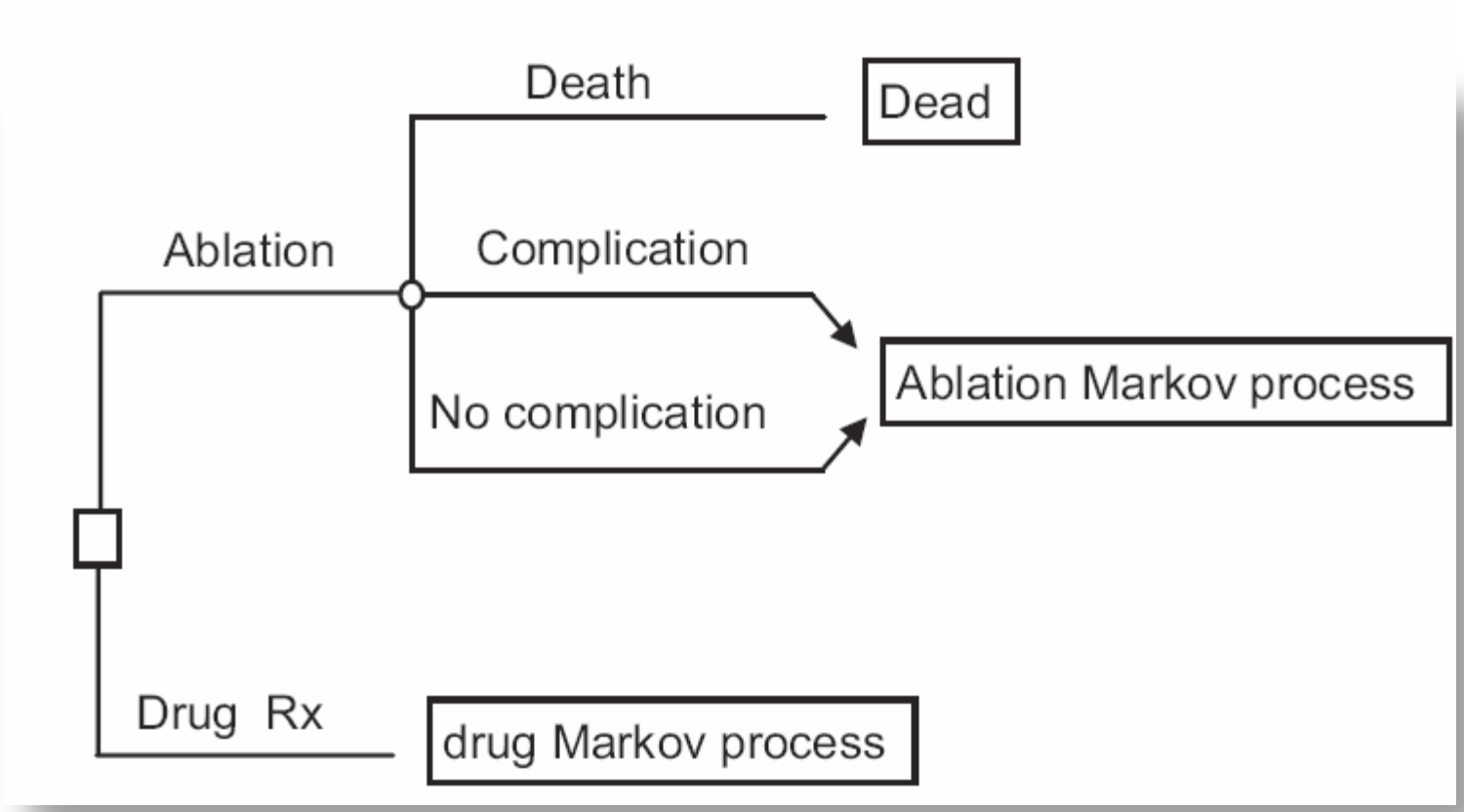
Reynolds *et al* 2009 Circ. Arrh. EP. 2:362-369

Reynolds 2009: Assumptions

- No effect on mortality, stroke or heart failure
- Previously failed ≥ 1 drug
- Single procedure success 60%
- 25% redo rate, up to 2 procedures allowed
- 90% overall success

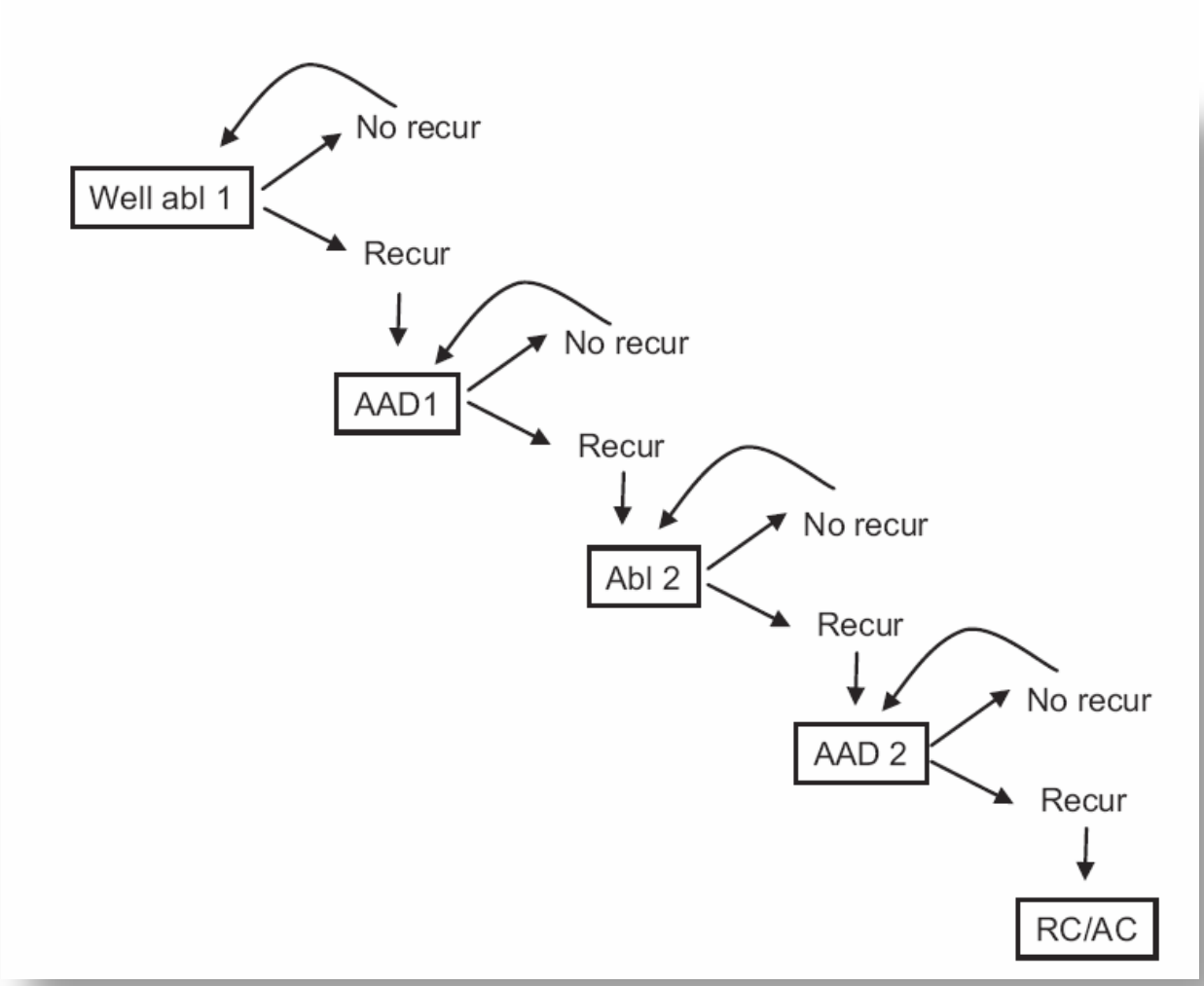
Reynolds *et al* 2009 Circ. Arrh. EP. 2:362-369

Decision Analysis Model



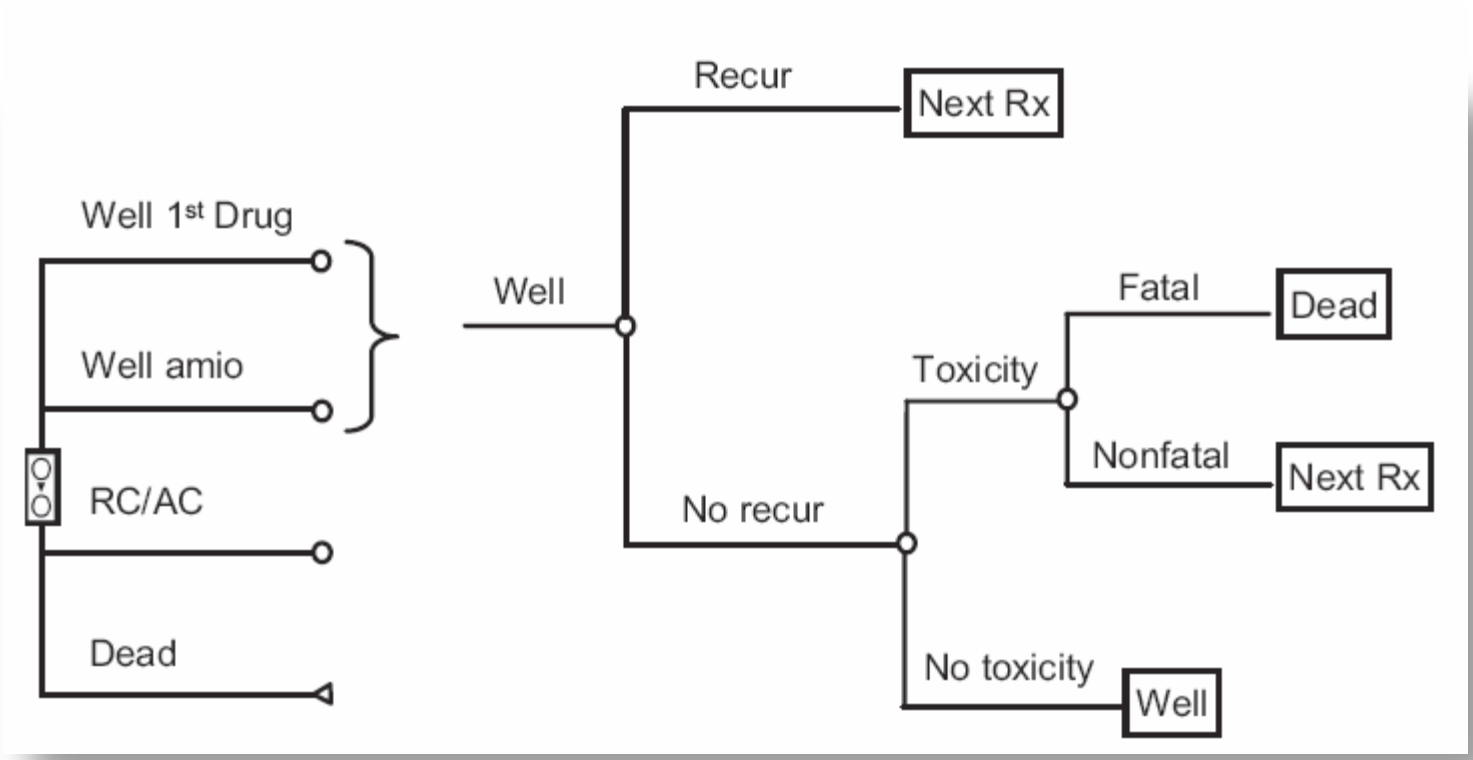
Reynolds *et al* 2009 Circ. Arrh. EP. 2:362-369

Ablation Markov process



Reynolds *et al* 2009 Circ. Arrh. EP. 2:362-369

AAD Markov Process



Reynolds *et al* 2009 Circ. Arrh. EP. 2:362-369

Reynolds 2009

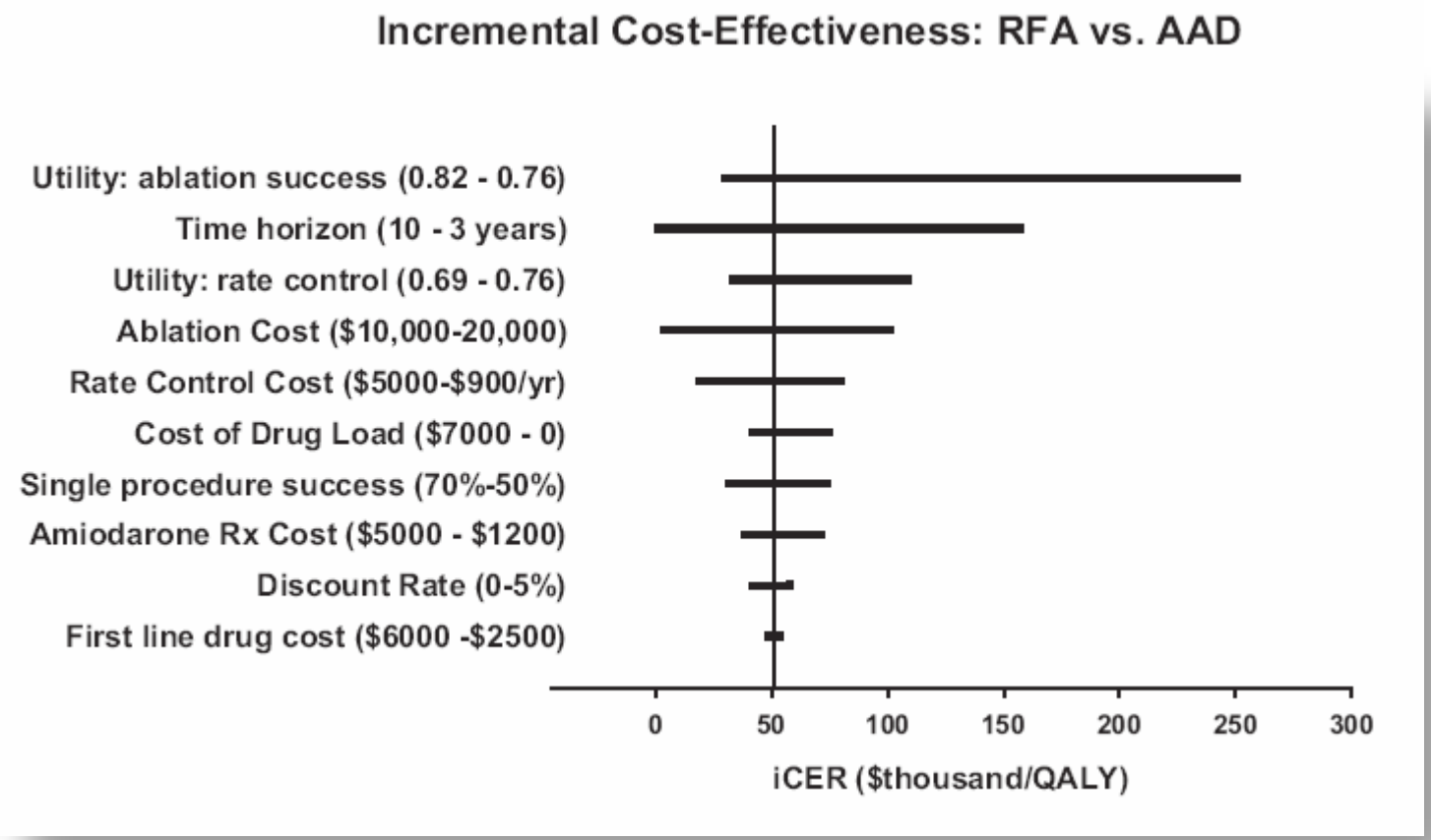
	Cost	QALYs
RFA	$26584	3.51
AAD	$19898	3.38

ICER: $51,431

~ £33,000 per QALY

Reynolds *et al* 2009 Circ. Arrh. EP. 2:362-369

Sensitivity Analysis



Reynolds *et al* 2009 Circ. Arrh. EP. 2:362-369

Reynolds et al: Summary

- Just about cost effective
- Highly contingent on
  - quality of life benefit
  - duration of benefit

  - Unless morbidity and mortality benefit proven

McKenna vs Reynolds

McKenna et al	Reynolds et al
• Assumed lower RFA utility	• Assumed higher RFA utility
• Prognostic benefit required if QOL benefits not sustained	• No prognostic benefit assumed. All benefit via improved QOL
• Assume relatively lower success rates from RFA	• Assume very high RFA success rates

Conclusions

- Consistency between studies
- Ablation for PAF conventionally cost effective, as long as:
  - Published outcomes maintained in real world
  - Benefits prove to be maintained over the long term
- Clear need for good quality QOL data
- A stroke reduction or mortality benefit will clinch the deal
- The data may not extend to persistent AF

Thanks to

Prof Steve Palmer
Dr Nerys Woolacott

University of York