The potential of early modeling of new technologies to help inform decision-making

A case-study of the evaluation of health technologies for the treatment of simple snoring

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Decision-making in healthcare is a challenge

" A hospital bed is a parked taxi with the meter running"

Groucho Marx

NHS TREATMENTS

One in, one out?

Maynard et al
2004

Modeling is not the solution but it may help

Role of modeling studies

- Synthesis of data from various sources to:
  - Estimate health outcomes
  - Estimate resource use and costs
  - Compare the clinical and cost effectiveness

- Multiple options and consequences over time can be considered

- Long-term outcomes can be estimated

Hypothesis

- Modeling can provide
  - information on the likelihood of the new technology being beneficial to patients and the NHS
  - an indicator as to whether the evidence is strong enough to justify widespread diffusion of the new technology.

The case-study

- **NICE IPP guidance**
  - Radiofrequency ablation for **simple snoring** should be introduced under special arrangements in 2005

- **Clinical context**
  - Snoring is a symptom
  - Most familiar physiological phenomena
  - United Kingdom: **2 million people** → **underestimated**
  - Risk factors: Gender, Age

Q **Could the modelling of this new health technology inform whether its use would be a cost-effective use of resources before its introduction?**

Treatment scenarios

- Standard modelling methods were used to construct and assemble data

- 1x Uvulopalatopharyngoplasty (UPPP)   1994
- 2x Laser-assisted uvulopalatoplasty (LAUP)   1997
- 2x Radiofrequency ablation (RFA)   1998

Results: strengths of modeling

- Estimation of cost-effectiveness

Table 1: Deterministic and probabilistic analysis results

Strategy	Cost (£)	QALYs	Yrs symp free	ICER	£10,000	£20,000	£30,000	£40,000
RFA 2x	892	15.49	1.75		67.8%	25.9%	14.3%	9.8%
UPPP	1339	15.49	1.64	Dominated	1.5%	0.6%	0.3%	0.3%
LAUP 2x	1772	15.55	4.00	£15448	30.6%	73.5%	85.3%	89.9%

Results: strengths of modeling

1. Estimation of cost-effectiveness

2. Explicit consideration of value of further research

    –   Identify whether future trials should be against a particular competitor

    –   Future trials should collect data on specific parameters

    –   Identify the lack of key data

3. Development of a framework for further evaluation

4. Implications for policy-makers – uncertainties in the decision become more explicit

5. Prevent the wide introduction of ineffective technologies as disinvestment of low value treatments is a problem for health systems

Results: limitations

- Paucity of evidence based on treatment effectiveness

- Ill defined care pathways for care

- Can this be repeated for other technologies?

- Additional research costs are not trivial

  - 58 days in researcher time, costing approx 10,900 GBP

Conclusions

- Proof of concept
  - Data on cost-effectiveness can be produced at the time when judgments are made on safety and efficacy
- Further work to explore whether findings are generalisable

"All models are wrong but some are useful."

George Box

Thank you!

Supplementary slides

Supplementary slides

special arrangements

"Notify clinical governance leads, ensure patients understand the uncertainties referred in the guidance, and audit and review clinical outcomes of all patients having the procedure"
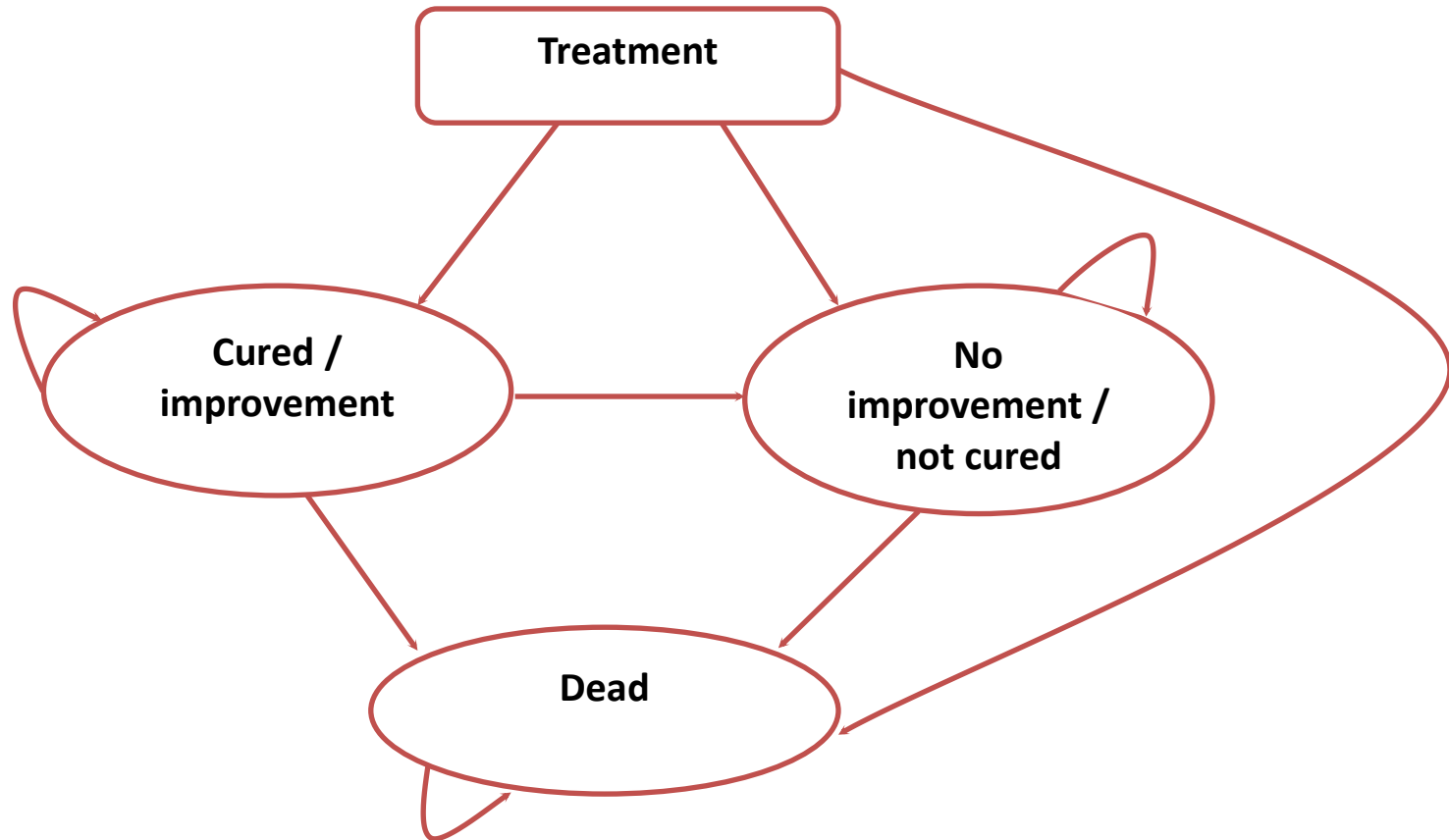
Decision-making in healthcare is a challenge

- Research is not timely

- Researchers don't answer policy-makers' questions

- Lack of straight answers
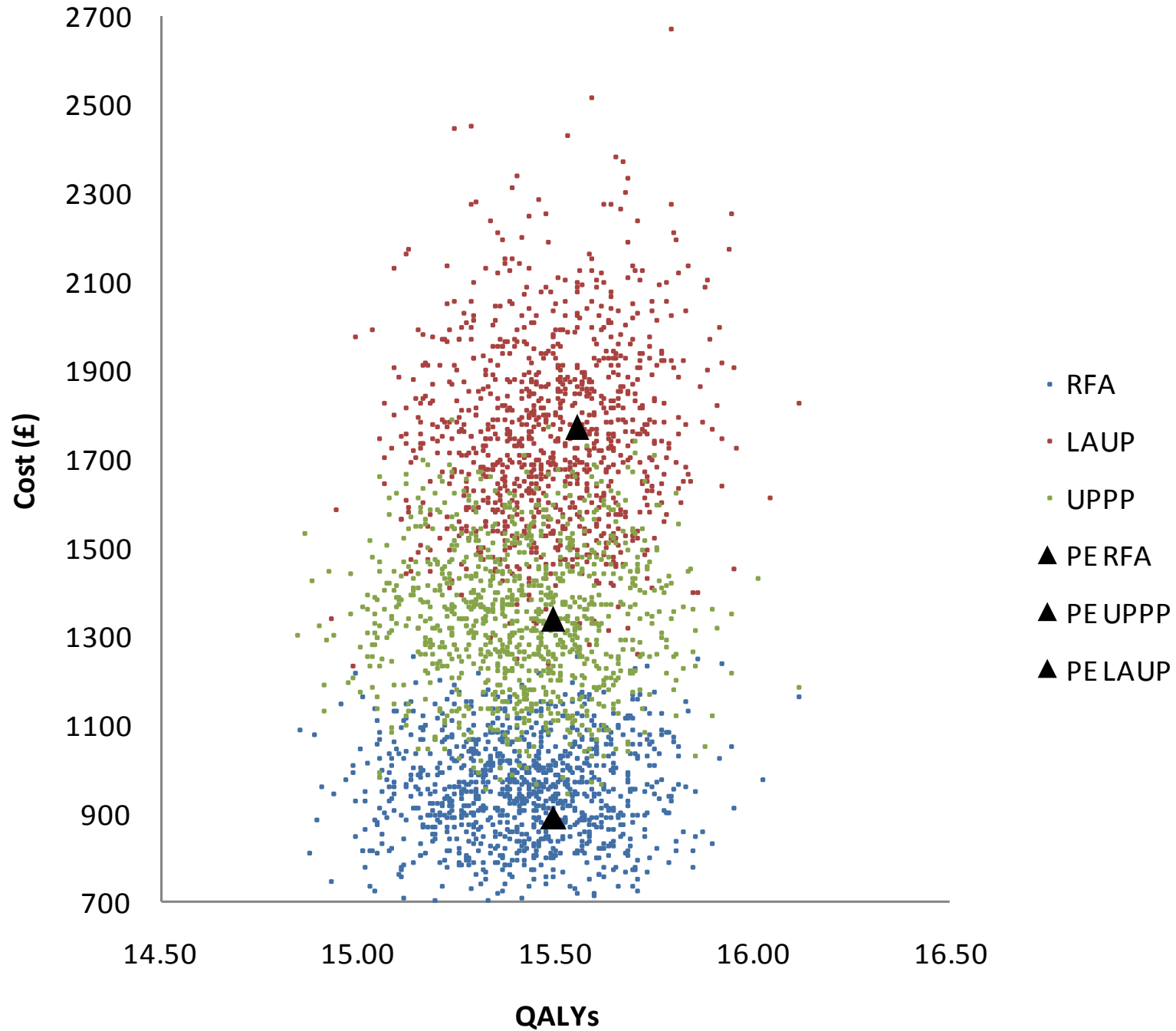
- Multiple options

Lack of information

Markov model

Data

- Cure rate, relapse rate
- Resource use and unit costs
- NHS perspective
- Costs expressed in 2004/05 pound sterlings
- Benefits expressed in
  - Time spent symptom free
  - Partner quality adjusted life years (QALYs)
- 3.5% discount rate for both costs and benefits

Results

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Results

CEACs showing society's willingness to pay for a QALY for the comparison of RFA with LAUP and UPPP
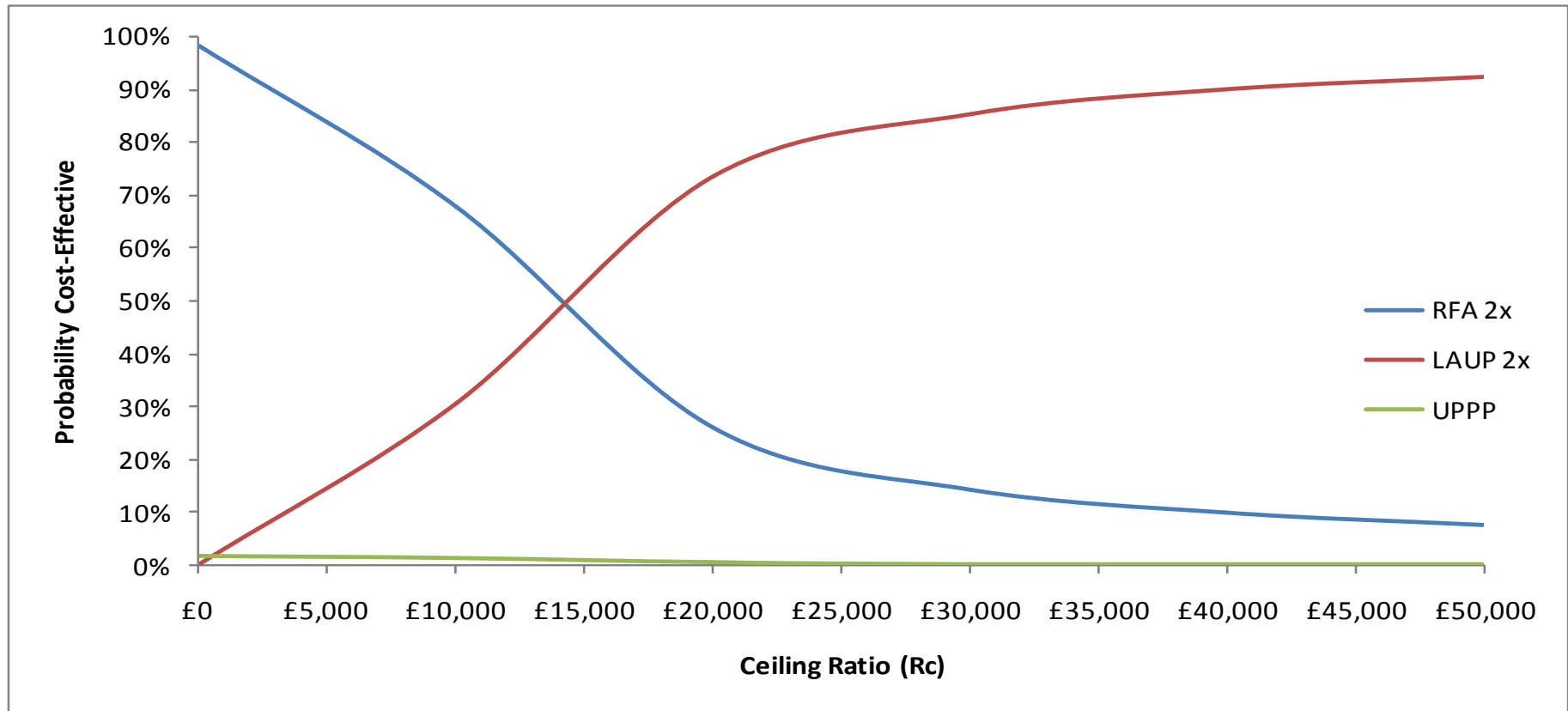
Results: do nothing scenario

Table 2: Deterministic analysis results

Strategy	Cost (£)	QALYs	ICER
Do nothing	106	15.45	
RFA 2x	960	15.49	£19,199
UPPP	1339	15.49	Dominated
LAUP 2x	1772	15.55	£14,255

Results

CEACs showing society's willingness to pay for a QALY for the comparison of RFA with LAUP and UPPP (do nothing scenario incorporated into the base-case model)
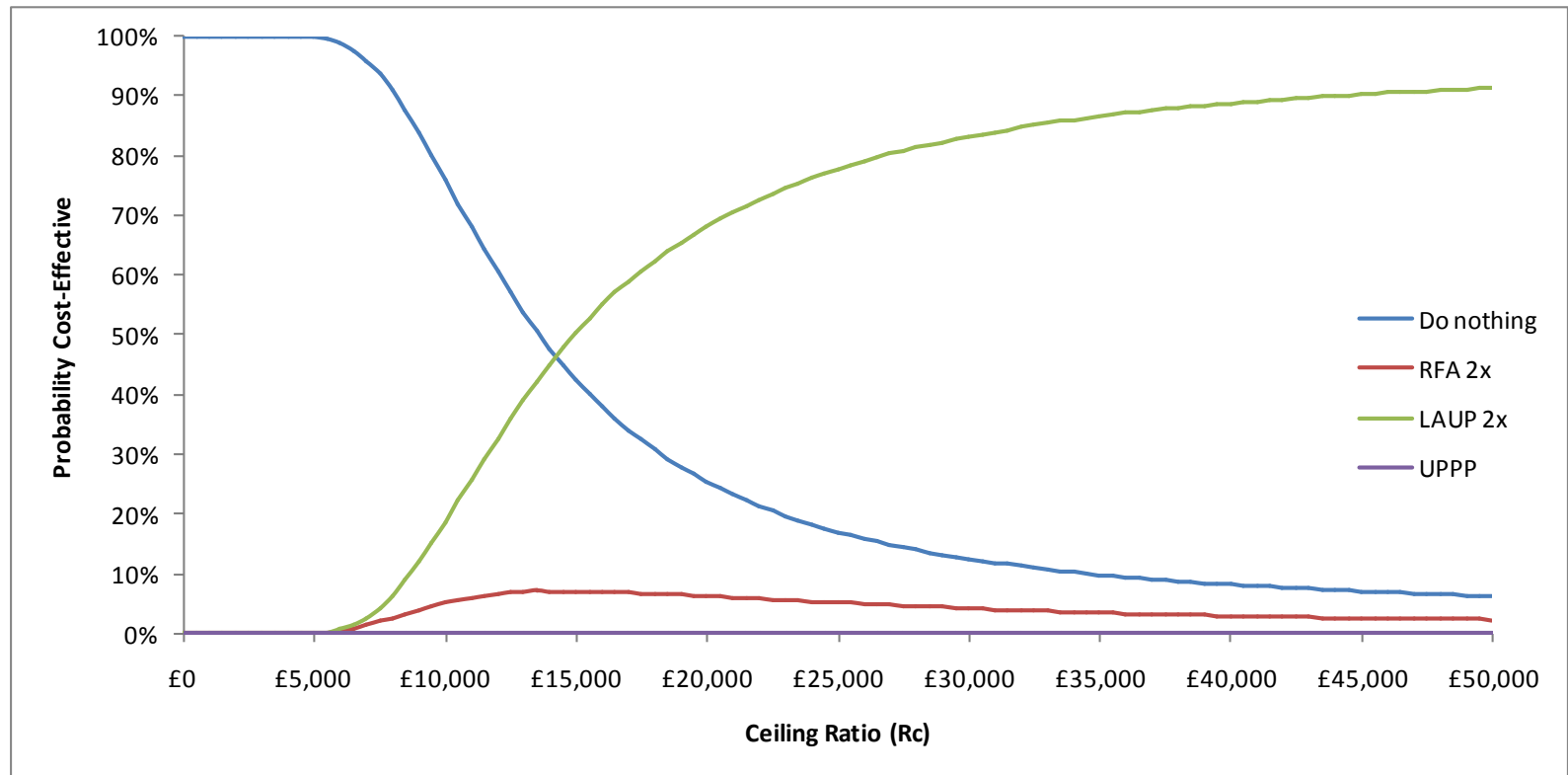
VOI

- The low values obtained from the EVPI and EVPPI analyses (Tables 9.14 to 9.17) suggest that conducting further research in order to remove all parameter uncertainty is perhaps not worthwhile as conclusions might not be changed.

- In more detail, in this case-study it is clear that the value of further research depends not only on the uncertainty surrounding estimates of costs and effects but also on the effective technology lifetime and on the willingness to pay threshold values. For a threshold value of society's willingness to pay for a QALY of £30,000 and assuming that the effective technology lifetime was 10 years the maximum amount society is willing to pay to eliminate all uncertainty within the model associated with the decision is approximately £1.7m. Currently trials funded by the NIHR HTA programme typically cost in excess of £1m, with many closer to £2m[185] and these trials only remove part of the uncertainty. Then this suggests that additional research is potentially not worthwhile if the assumptions underpinning the analysis hold. Even under more favourable assumptions regarding the technology lifetime, conducting further research also appears not to be worthwhile.

- If further research were to be conducted, then the results of the expected value of perfect information for parameters (EVPPI) are useful to determine what types of additional evidence would be most valuable so that future research can be more focused on those types of evidence that appear most important. In this case-study, the parameters for which more precise estimates would be most valuable are a bundle of cure and relapse rates for an expected lifetime of the technology of 10 years and a willingness to pay of £30,000. When considering each parameter, one at a time, utilities appear to be the type of parameter for which more precise estimates would be most valuable. However, such low values of approximately £350,000 and £176,000 suggest that conducting further research would not be useful to overturn the conclusions based on the current evidence.

- The findings from this value of information analysis should however be interpreted with caution as it is limited by the model structure and respective parameters adopted for this evaluation. Due to the lack of data, several assumptions were made regarding for example the functional forms used to estimate cure and relapse rates. It is possible that if different functional forms were adopted, or a more sophisticated model structure was employed, the value of information might have been higher. Another limitation of value of information analysis is that the values presented are for the removal of all uncertainty. In reality further research would only reduce the amount of uncertainty; it would not remove it entirely.