Value of Information Report

My Model

28 October, 2014

1. Introduction

Welcome to the Sheffield Accelerated Value of Information (SAVI) application report. The results of your Value of Information analyses in SAVI are reported below. The results are presented in a standardised format to help with the interpretation of your results and future reporting.

In section 2 summary results for the probabilistic sensitivity analysis are presented. Summary statistics, and graphical illustrations are provided to verify the results against previous analysis of the data and illustrate the uncertainty in the model.

In section 3 the results of the Expected Value of Perfect Information (EVPI) analysis of the data are presented.

In section 4 the results of single parameter Partial Expected Value of Perfect Information (EVPPI) are reported. The results of the analysis of multiple parameter EVPPI, selected in the application are provided.

2. Exploring Current Uncertainty: Probabilistic Sensitivity Analysis Results

2.1 Probabilistic Sensitivity Analysis Summary

2.2 Cost-Effectiveness Plane

The cost-effectiveness plane shows the standardised cost-effectiveness plane per person based on 1 model runs in which uncertain model parameters are varied simultaneously in a probabilistic sensitivity analysis. The mean incremental cost of 99 versus 99 is 99 99. This suggests that strategy 1 is more/less costly over the 99 years time horizon. There is some uncertainty due to model parameters, with the 95% credible interal for the incremental cost ranging from (99 99 CI, 99 99 CI). The probability that 99 is cost saving (i.e. cheaper over the 99 years time horizon) compared to 99 is 99. The mean incremental benefit of 99 versus 99 is 99 99 . This suggests that 99 is more/or less beneficial over the 99 years time horizon. Again, there is some uncertainty due to model parameters, with the 95% credible interval for the incremental benefit ranging from (99 99 CI , 99 99 CI). The probability that 99 is more beneficial (i.e. provides more 99 over the 99 years time horizon) compared to 99 is 99.

The incremental expected cost per unit of benefit is estimated at 99 99 per 99. This is above/below the threshold of 99 99 per 99 that 99 would (not) be considered cost-effective at this threshold. There is uncertainty with a 99 probability that 99 is more cost-effective (99 % of the probabilistic model run 'dots' are below and to the right of the diagonal threshold line).

See section 5.1 in Briggs, Claxton, Sculpher. Decision Modelling for Health Economic Evaluation (Handbooks for Health Economic Evaluation). OUP Oxford; 1 edition (17 Aug 2006). ISBN-13: 978-0198526629

2.3 The Cost-Effectiveness Acceptability Curve

The Cost-Effectiveness Acceptability Curve (CEAC) shows the probability that all strategies are cost-effective at varying thresholds. The results show that at a threshold value for cost-effectiveness of 99 99 per 99 the strategy with the highest probability of being most cost-effective is 99, with a probability of 99.

More details for how to interpret CEACs are available from the literature

Fenwick & Byford. (2005) A guide to cost-effectiveness acceptability curves. The British Journal of Psychiatry. 187: 106-108.

2.4 Net Benefit of Each Strategy

Net benefit (NB) is a calculation to put the costs and the 99s onto the same scale. This is done by calculating the monetary value of the 99s using a simple multiplication i.e. 99s * lambda, where

and lambda=99 99 per 99

This is particularly useful when comparing several strategies because the analyst and decision maker can see in one single measure the expected net value of each strategy, rather than looking at many comparisons of incremental cost-effectiveness ratios between different options. Under the rules of decision theory, the strategy with the highest expected net benefit is the one which a decision maker would choose as the optimal startegy.

The graph shows the expected net benefit of the 99 strategies. The strategy with highest expected net benefit is estimated to be 99, with an expected net benefit of 99 99 (equivalent to a net benefit on the effectiveness scale (using 99 valued at lambda) of 99 99s. The 95% credible interval suggests that the net benefit of 99 could range from 99 99 to 99 99.

2.5.1 Incremental Net Benefit of compared with usual care/base comparator

Incremental Net benefit (NB) is a calculation to compare strategies with the costs and the 99s on the same scale. Analysis of the expected incremental net benefit helps to visualise whether particular strategies are better than others and how certain a decision maker can be about the differences.

The graph shows the incremental expected net benefit of the strategies compared with 99.

2.5.2 Incremental Net Benefit of compared with the optimal comparator

The graph shows the incremental expected net benefit of the strategies compared with 99.

2.6 Absolute Net Benefit Density Plot

The absolute monetary net benefit density is calculated for each of the 99 strategy comparators. The absolite Net Benefit density plot illustrates the overlaid densities for the 99 simulation runs in the Probabistic Sensitivity Analysis. This graph illustrates how much overlap their is in the simulated Net Benefit of all strategies. However, the overlap between densities may be due to correlation in simulated outcomes, therefore it is necessary to examine the incremental differences between strategies (Naveršnik K).

2.7 Incremental Net Benefit Density compared with usual care/ base comparator

Densities for the incremental net benefit of each strategy compared with 99 (the strategy identified as the usual care/ base comparator setting) are presented. The graph illustrates which strategies have simulated Net Benefit less than or greater than the usual care comparator.

2.8 Incremental Net Benefit Density Compared with Optimal Strategy

Densities for the incremental net benefit of each strategy compared with 99 (the strategy with maximum expected net benefit) are presented. In this graph it is possible compare strategy densities with correlation removed. It is possible to observe which strategies have simulated Net Benefit greater than the optimal strategy. If there are several strategies with 'overlapping' densities, then several strategies are close in terms of their expected value to a decision maker, and given the relatively large decision uncertainty it might be valuable to consider further research to reduce uncertainty. The value of reducing uncertainty to the decision maker by undertaking further research is the subject of the analyses using expected value of information calculations. These calculations can consider all decision uncertainty (the overall expected value of perfect information – overall EVPI) or for particular uncertain parameters within the PSA (expected value of perfect parameter information – EVPPI).

More information about illustrating uncertainty for multiple strategies with correlated output are available in the literature.

Naveršnik K (2014) Output correlations in probabilistic models with multiple alternatives. Eur J Health Econ. 2014 Jan 4.

3. Putting a value on the decision uncertainty: Overall Expected Value of Perfect Information Calculation

3.1 Understanding the EVPI

The calculation begins with the existing confidence intervals (or credible intervals) for the model parameters as used in the probabilistic sensitivity analysis. We then imagine a world in which we become absolutely (perfectly) certain about all of the model parameters i.e. the confidence interval for every single parameter is 'shrunk right down to zero.' The decision maker would then be absolutely certain which strategy to select and would choose the one with highest net benefit. One can visualise this idea by imagining that instead of seeing the cloud of dots on the cost-effectiveness plane (representing current uncertainty in costs and benefits) and having to choose, the decision maker now knows exactly which 'dot' is the true value (because all of the uncertainty is removed) and so can be certain to choose the strategy which gives the best net benefit. In a two strategy comparison of new versus current care, if the 'true dot' turns out to be below and to the right of the threshold lambda line, then the decision maker would select the new strategy. If the 'true dot' is above and to the left, then current care would be selected. Under the current uncertainty, the decision maker will choose the strategy based on the expected costs and benefits (essentially on whether the 'centre of gravity' of the cloud is above or below the threshold line).

3.2 Overall EVPI

The overall EVPI per person affected by the decision is estimated at 99 99 per person. This is equivalent to 99 per person's worth of decision uncertainty on the 99 scale.

Assuming an annual number of people affected by the decision of 99, the overall EVPI per year is 99 99 for 99.

When thinking about the overall expected value of removing decision uncertainty, one needs to consider how long the current comparison will remain relevant e.g. if new treatments of options or even cures are anticipated to become available for a disease. For the specified decision relevance horizon of 99 years, the overall expected value of removing decision uncertainty for 99 would in total be 99 99.

Research or data collection exercises costing more than this amount would not be considered cost-effective use of resources. This is because the return on investment from the research – as measured by the health gain and cost savings of enabling decision makers ability to switch and select other strategies when evidence obtained reduces decision uncertainty – is expected to be no higher than the figure of 99 99.

The EVPI estimates in the table below quantifies the expected value to decision makers within the jurisdiction of removing all current decision uncertainty at a threshold of 99 99 per 99. This will enable comparison against previous analyses to provide an idea of the scale of decision uncertainty in this topic compared with other previous decisions. The EVPI estimate for varying willingness to pay threshokds are illustrated in the figures below.

4. Which parameters are causing most of the decision uncertainty and what is the potential value of reducing uncertainty by collecting more data: Partial Expected Value of Perfect Information

4.1 Single parameter EVPPI

```
##                [,1]
## theta1    0.00000000
## theta2    0.00000000
## theta3    0.00000000
## theta4    0.00000000
## theta5   37.62163687
## theta6  642.93953859
## theta7   20.33092652
## theta8    0.00000000
## theta9    0.00000000
## theta10   0.03089159
## theta11   0.00000000
## theta12   0.00000000
## theta13   0.00000000
## theta14 261.33771443
## theta15 281.13277508
## theta16 471.83108751
## theta17   0.00000000
## theta18   0.00000000
## theta19   0.00000000
```