Introduction

When making decisions about the allocation of scarce healthcare resources it is not only important to consider the estimated cost-effectiveness (CE) with current evidence, but also the value of additional research designed to reduce uncertainty.¹

Expected value of perfect information (EVPI) is the amount a decision maker should be willing to pay to eliminate uncertainty surrounding the decision about which option is optimal for different levels of willingness to pay (WTP).² Further research is potentially cost-effective only when the EVPI exceeds the expected research costs.³

With an increased interest in EVPI analysis from reimbursement agencies around the world, there is a need to highlight the interpretation of EVPI curves. The typical textbook example represents just one of the possible shapes that the curve can take.

Objectives

The objective of this study is to explore and explain different shapes of EVPI curves based on the position of alternative treatment choices on the incremental cost-effectiveness plane.

Methods

A hypothetical probabilistic decision model was developed in which two treatments were compared. Key input parameters were varied to force the model outcomes into different quadrants on the incremental CE plane, keeping the parameter uncertainty the same.

The population EVPI, based on the number of future patients and the estimated lifetime of the technology was then plotted. With a view to increase the understanding of how to interpret the EVPI curve the cost-effectiveness acceptability curve (CEAC) was added to the chart.

Results

In figure 1 the textbook example is illustrated with a treatment that is more effective but more costly than its comparator. Hence, the majority of the PSA outcomes are located in the northeast quadrant in the CE-plane.

Figure 1. The textbook curve

The EVPI is low when the treatment has a low probability of being cost-effective (low WTP threshold in this example). Consequently, there is no incentive for undertaking additional research as we are certain that the treatment is not going to be cost-effective at this WTP. But as the WTP threshold increases the EVPI increases. Its maximum can be found where the optimal option is changed, i.e. where we are most uncertain which option to adopt (the probability of a wrong decision is high). For higher WTP threshold values the EVPI will decrease until very high values are reached, then the EVPI will increase again as decision uncertainty is falling at a declining rate whereas the threshold increases (opportunity losses) at a constant rate and will ultimately offset the decrease in uncertainty.

If the treatment instead is a less costly and less efficient alternative (southwest quadrant), the EVPI curve might take a different shape. In figure 2 we see a curve in which the characteristic EVPI peak is absent.

Figure 2. The continuously increasing curve

The EVPI increases as expected when the decision uncertainty increases. But at the ICER there is only one point of inflection after which the curve subsequently increases. This is because the loss associated with the wrong decision still increases. If the reduction in decision uncertainty does not outweigh the increased value of opportunity loss, the EVPI curve will continue to increase. As anticipated the EVPI will be much higher than in the previous example. However, when the CEAC reaches one the EVPI curve will drop to zero.

For a treatment option which dominates its comparator (southeast quadrant) the curve will yet again take a different form as shown in figure 3 below.

Figure 3. The dominant curve

The peak of the EVPI curve will be at a very low WTP threshold (close to zero) and decrease rapidly when the probability of cost-effectiveness increases. The EVPI is much lower than in previous examples where we are more certain that one of the treatments dominates the other. In the corresponding example (figure 4), when a treatment is dominated, we see that the EVPI curve will look similar but the CEAC will move with the EVPI curve. Note that in both examples the EVPI curve will eventually decrease due to the reason previously mentioned.

Figure 4. The dominated curve

Conclusions

The result of this study shows that a number of different scenarios exist when the EVPI curve takes a different form compared to the one illustrated in the textbook example. The most striking example is when the EVPI increases beyond the point of greatest uncertainty (a CEAC of 50%).

References


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