Advantages of Visualizing Net Loss Curves in Cost Effectiveness Analyses: An Example Comparing Opioid Use Disorder Treatment Alternatives

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OBJECTIVES

Within cost effectiveness analyses (CEAs), descriptions of decision uncertainty often rely on cost effectiveness acceptability curves (CEACs). The CEAC is a valuable visualization tool as it reports the probability that each alternative is cost-effective. However, the CEAC does not inform the decision maker about the magnitude of consequences should a non-optimal alternative be selected. An extension of decision uncertainty analysis is in the form of net loss curves, as described in seminal contributions to the literature by Eckermann.[1] Though not commonly reported in CEAs, net loss curves offer distinct advantages and may be utilized as a results reporting tool supplementary to the CEAC. We demonstrate the advantage of net loss curves in an example of a CEA examining treatment alternatives for opioid use disorder (OUD).

HIGHLIGHTS

- Net loss curves are a useful visualization tool to supplement conventional CEACs
- Per-patient net loss may be calculated for each alternative given the PSA results
- Net loss is a function of WTP
- The vertical distance between respective alternatives' net loss curves indicates additional expected net loss from using one alternative over another
- The lower envelope of net loss curves is also the estimate for expected value of perfect information (EVPI)

METHODS

We perform a probabilistic sensitivity analysis for a CEA comparing office-based methadone (MO), clinic-based methadone (MC), and office-based buprenorphine (BO) to treat patients with OUD. This CEA adopts inputs from a previously published cost study[2] that compared the same three alternatives. We calculate net loss for each alternative across a range of willingness to pay (WTP) thresholds ($0 - $10,000 per additional patient retained in treatment). We are thus able to report not only the probability of alternatives' cost effectiveness via the CEAC but also quantify and report, across the WTP range, the per-patient net loss that is incurred conditional on the adoption of each respective treatment alternative.

NET LOSS CALCULATION

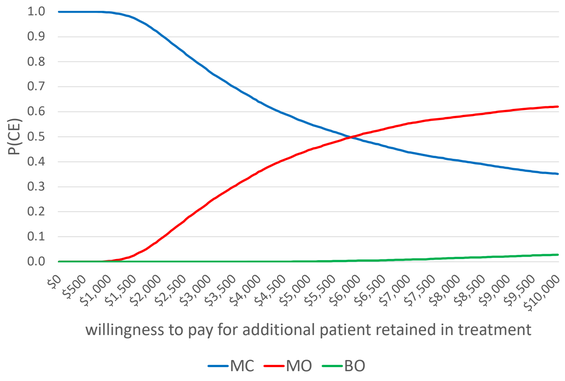
A breakdown of the basic steps to calculate net loss follows.

- The net loss is calculated for each alternative given net monetary benefit (NMB) derived from PSA results
- Where, in this example, NMB = patients retained × WTP – cost
- Net Loss = [average of maximum NMB across PSA iterations, at a given WTP] – [average of alternative's NMB across iterations, also at the given WTP]
- Perform this calculation across the relevant range of WTP and for each alternative to produce the set of net loss curves

RESULTS

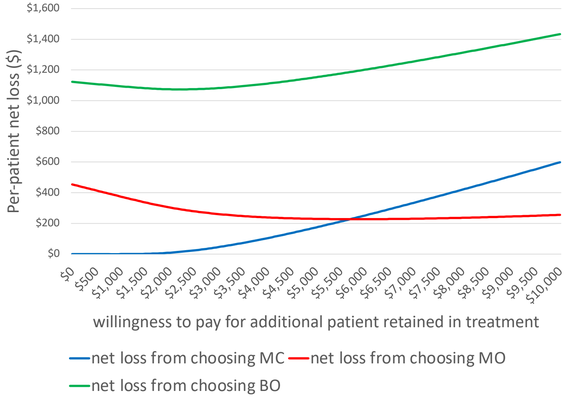
The conventional CEAC for this decision problem, indicating the probability that each alternative is cost effective across a range of WTP, is shown below.

FIGURE 1. COST EFFECTIVENESS ACCEPTABILITY CURVE



Net loss curves serve to supplement rather than replace the CEAC. The net loss calculations performed for each alternative across a range of WTP values may be plotted on a single plane to produce a set of net loss curves as shown below.

FIGURE 2. NET LOSS CURVE



Given a WTP of $7,000 per additional patient retained in six-month treatment, MO has the lowest expected net loss at $230/patient, followed by MC at $334/patient and BO at $1,255/patient. Choice of a non-optimal alternative (MC or BO) thus implies additional losses of $104 or $1,025, respectively, per patient - and much larger if projected to population levels.

CONCLUSION

At the stipulated WTP here, net loss curves illustrate the substantial additional expected magnitude of loss (i.e., foregone net benefit) associated with choosing alternatives other than MO. Particularly BO has a substantial additional net loss relative to MO, observable by noticing the vertical distance between the green (BO) and red (MO) net loss curves in Figure 2.

This example demonstrates the potential for net loss curves to serve as an impactful visualization tool to emphasize the value of the cost-effective alternative over ranges of WTP by quantifying not just the probability of error but the magnitude of consequences when implementing suboptimal alternatives. This quantification of consequences is absent when the analysis is limited to CEACs; thus, net loss curves serve to build a stronger case for the cost-effective alternative.

REFERENCES

1. Eckermann S, Willan AR. Presenting evidence and summary measures to best inform societal decisions when comparing multiple strategies. Pharmacoeconomics. 2011 Jul;29(7):563-77.
2. Jones ES, Moore BA, Sindelar JL, O'Connor PG, Schottenfeld RS, Fiellin DA. Cost analysis of clinic and office-based treatment of opioid dependence: results with methadone and buprenorphine in clinically stable patients. *Drug Alcohol Depend*. 2009;99(1-3):132-140.