Evaluating Cost Outcomes Across Three Methods for Incorporating Time-to-Event Outcomes in Budget Impact Analyses

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INTRODUCTION

- Few budget impact analysis (BIA) guidelines report specific methods that should be used for modelling time to event (TTE) outcomes.
- While simple TTE methods may be preferred when costs are expected to be low, they may overestimate the true costs. This overestimation occurs because the calculations assume that each cohort remains on treatment for the same duration in the model, regardless of the time they enter the model.

OBJECTIVES

- To compare methods for assessing TTE outcomes in the context of BIA oncology modelling
- To identify when it is appropriate to use simple or more complex TTE incorporation methods

METHODS

- An incident cohort BIA was developed over five years, including pre- and post-progression treatment acquisition costs, disease management costs (which were applied to both the pre- and post-progression periods), and one-off end-of-life (EOL) costs.
- Median pre-progression survival (PPS) and OS times were extrapolated using exponential distributions to derive mean estimates.
- Three methods were compared, whereby pre- and post-progression times were incorporated based on different median durations of progression free survival (PFS) and overall survival (OS):

1. **Overall means method (OMM, Figure 1**): Five-year means applied, with time on treatment assumed to be the same for all cohorts, and lasts beyond the time horizon
2. **Incremental means method (IMM, Figure 1):** Time on treatment different for each cohort and capped by the time horizon
3. **Health state occupancy method (HSOM, Figure 2**): Time on treatment capped by the time horizon, but area under survival curve calculations separated within each cohort for each year of model

- Time on treatment was assumed to be equal to PFS for all methods. Median values were varied to assess yearly and cumulative difference of each cost type between the three TTE methods.

Figure 1: Overall means (solid lines) and incremental means (dashed lines) methods

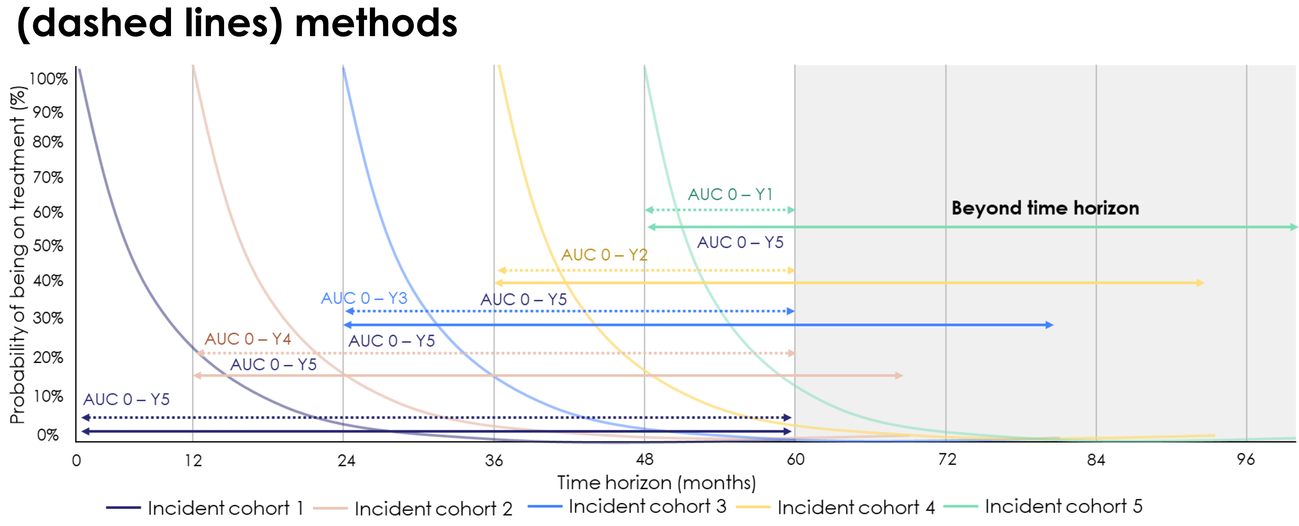
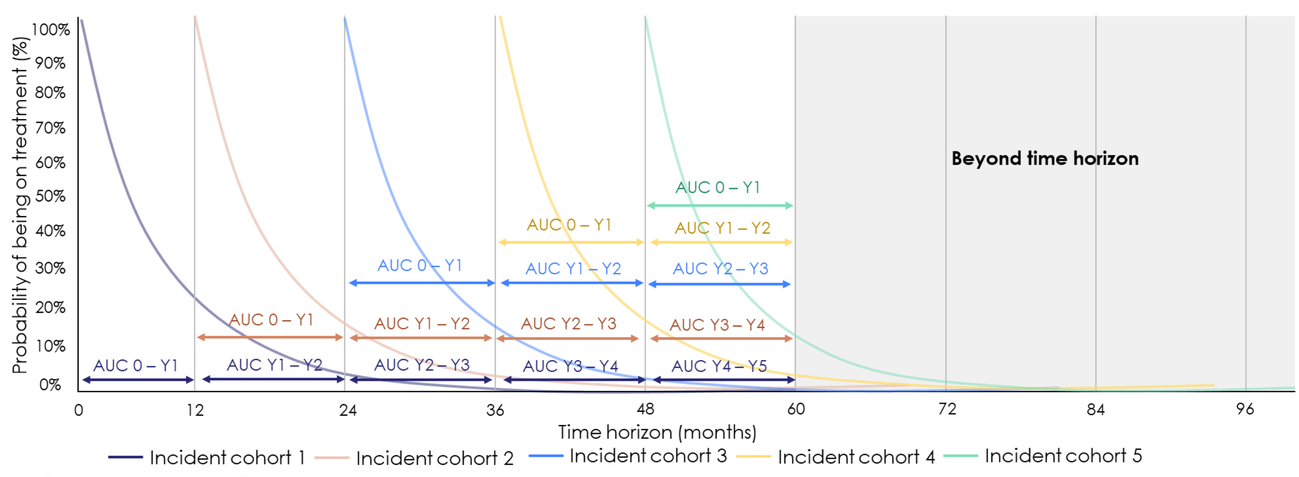


Figure 2: Health state occupancy method



AUC: Area Under the Curve

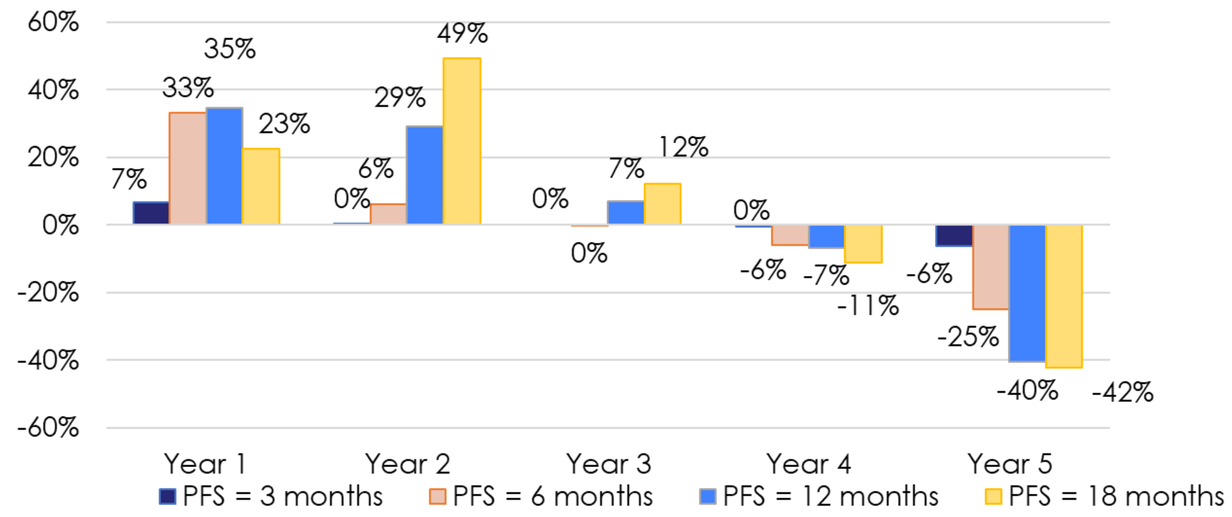
RESULTS

- The **OMM overestimated cumulative pre-progression costs by +7%** compared to the HSOM when **the median PFS was six months**, and by up to **+17% when PFS was 18 months** (Table 1). **Post-progression costs were also overestimated** compared to HSOM, from **+9% to +32% across various PFS and OS times. Management costs were consistently overestimated** using OMM, and **EOL costs deviations varied within each scenario**, suggesting a high level of inaccuracy. Reducing the time horizon to **three years produced similar results**.
- Although **five-year cumulative costs were the same** for the IMM and HSOM, **yearly estimates of pre-progression costs were found to differ by more than 40%** (Figure 3). In the first three years, pre-progression costs were overestimated using IMM, while in the final two years costs were underestimated.

Table 1: Five-year cumulative costs: % variation of OMM vs. HSOM

PFS (months)	OS (months)	Pre-progression	Post-progression	Management	One-off EOL
3	6	1%	14%	7%	8%
3	12	1%	19%	13%	-3%
6	12	7%	21%	13%	-3%
6	18	7%	26%	17%	5%
12	18	13%	32%	17%	5%
12	24	13%	23%	16%	-17%
18	24	17%	9%	16%	-17%

Figure 3: Impact of IMM vs. HSOM on pre-progression acquisition costs as a function of PFS



CONCLUSIONS

- **OMM should not be used when post-progression costs are similar to pre-progression costs**, or if they **depend on the pre-progression treatment** received.
- **OMM should only be used when OS is expected to be** short, while HSOM should be used for longer OS profiles.
- **EOL costs were incorrectly modelled with OMM**, and therefore are associated with high uncertainty when using this approach.
- **HSOM should be used for longer PFS profiles**. In addition, although **IMM is a suitable alternative when estimating cumulative five-year costs**, this approach is **not suitable when annual costs need to be interpreted**, and in such scenarios HSOM should be used.

DISCLOSURES

Authors have no conflict of interest to declare

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