Half-Cycle Correction: It's Time to Let it Go

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INTRODUCTION

In economic models that use Markov-type processes, it is generally recommended that a 'half-cycle correction' be built into the analysis to account for the fact that events can occur at any point during the cycle.

The process assumes that instead of the transition/event happening at the beginning or end of the cycle, they occur in the middle of the cycle. Figure 1 demonstrates how a half-cycle correction works.

However, the importance of half-cycle correction is not widely discussed, and building this step into economic models increases the risk of errors.

This study aimed to explore the theoretical, practical and mathematical implications of the half-cycle correction, explore the impact on results, and determine if half-cycle correction adds any value to health economic models.

METHODS

A review of existing health economic models was undertaken to determine the impact of half-cycle correction.

The incremental cost-effectiveness ratios (ICERs) from five economic models were extracted, and the models' calculations were adapted to remove the half-cycle correction.

Economic models with varying interventions, cycle lengths and disease areas were selected. We also present how half cycle correction works (Figure 1).

RESULTS AND DISCUSSION

The removal of the half-cycle correction had varying impacts on each of the included economic models. However, this impact did not change the direction of results (see Table 1).

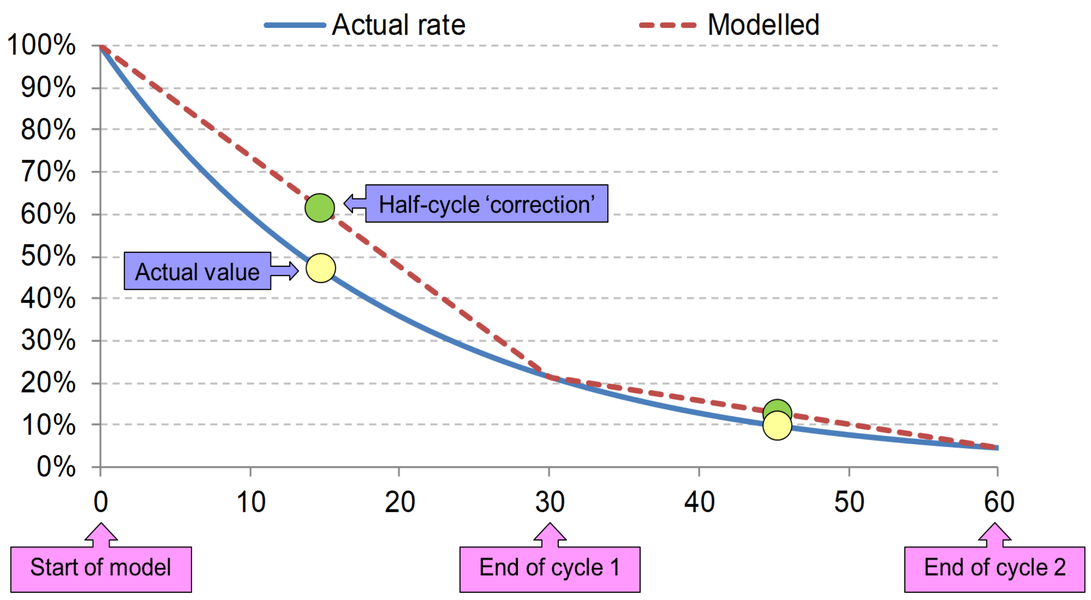
The results demonstrate that removing the half-cycle correction led to an ICER difference of between £7 and £6,608. This equates to a percentage difference ranging from 0.14% to 4.32% (see Figure 2).

However, these results raise the question of whether the half-cycle correction is needed. For instance, in oncology models, when a patient progresses from the stable disease state to the progressive disease state, it is generally assumed that their quality of life and resource use would change midway through that cycle. In reality, monitoring of patients may be undertaken routinely at regular intervals and, as such, the change in the patient's health state may not be known until that routine investigation has taken place. Therefore, the change in resource use and healthcare management may not be observed until the next cycle.

In many situations, adding a half-cycle correction does not correct an error. In fact, it involves making an assumption that the events occur at the cycle's midpoint, which may be incorrect and could introduce uncertainties or inaccuracies to the model results.

Furthermore, programming a half-cycle correction using any coding software may introduce errors due to misapplication, with what appears to be little benefit to decision making.

Figure 1: How does half-cycle correction work?



In economic models that use Markov-type processes, it is generally recommended that a 'half-cycle correction' be built into the analysis, to account for the fact that events and transitions can occur at any point during the cycle, not necessarily at the start or end of each cycle.

For example, if we know that 100 people are alive at month ten, and that 90 people are alive at month eleven, we do not necessarily know at what point those 10 patients died between months ten and eleven.

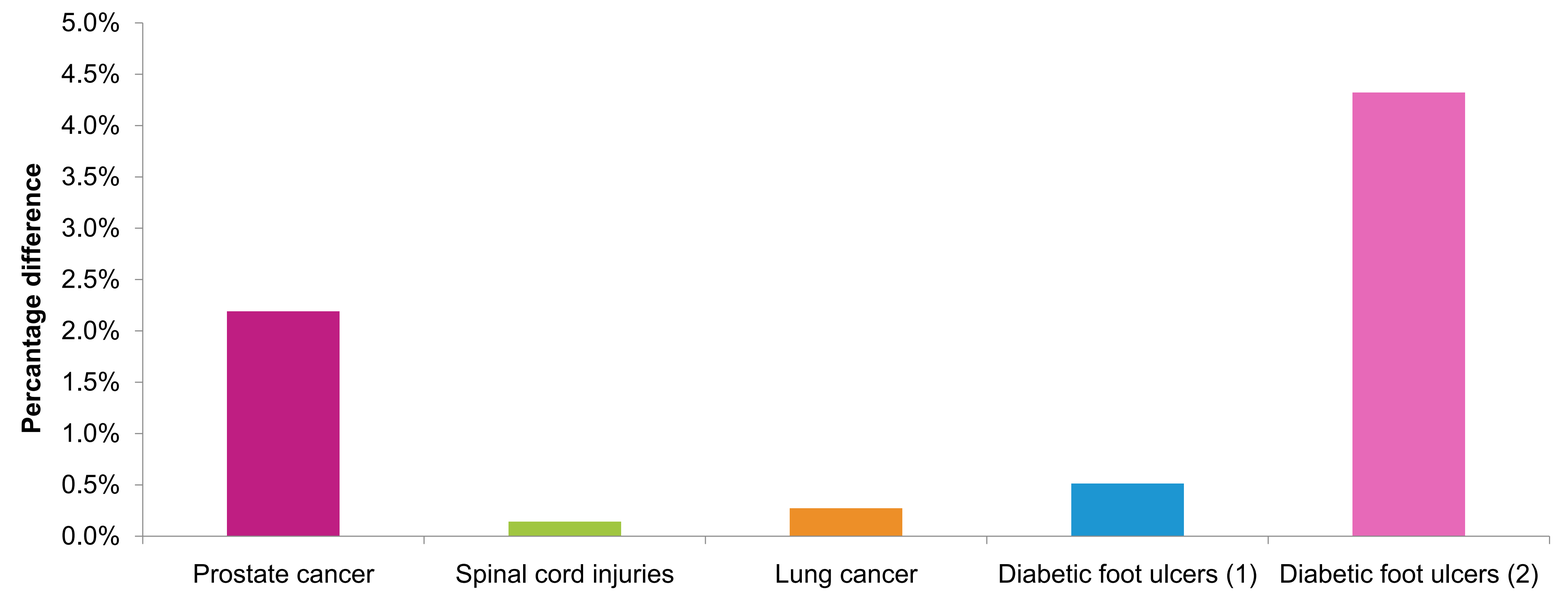
In such cases, it is usual to assume that the event occurred at the mid-point of the cycle

Table 1: Impact of half-cycle correction on ICERs

Model type	Disease area	Intervention type	Cycle length	Original ICER*	Adjusted ICER	Change in ICER
DT to Markov	Prostate cancer	AI diagnostic tool	1 year	£2,938	£3,003	+£65
Markov	Spinal cord injuries	Electrical stimulation device	1 month	-£1,680,710	-£1,679,376	+£1,334
Partitioned survival model	Lung cancer	Smoking cessation	1 month	£2,606	£2,613	+£7
Markov	Diabetic foot ulcers (1)	Topical oxygen therapy	1 month	-£26,657	-£26,793	-£136
Markov	Diabetic foot ulcers (2)	Wound patch	1 week	£149,630	£156,238	£6,608

Note: *The original ICER is where half-cycle correction has been applied.

Figure 2: Percentage difference in ICERs



CONCLUSION

We believe that the value of the half-cycle correction being used in models does not outweigh the risk of errors that can be introduced from using this method. We, therefore, recommend that half-cycle correction should not be routinely conducted in health economic analysis. Half-cycle correction may likely have more of an impact in situations where the cycle length is already mis-specified, in which case, it is likely that the cycle length should be reviewed, rather than demonstrating the value of half cycle correction.

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