Would a cohort-level approach to cost-effectiveness modelling have led to a different decision in an important NICE appraisal for obesity patients?

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Key message: Cohort-level approach in modelling obesity (NICE TA494) could have led to similar recommendations, however our recreation indicates that the flexibility of the patient-level approach used in the submission was valuable in capturing patient heterogeneity and time-dependency, though reimplementation in a non-DICE framework was necessary for acceptable model execution speed.

Introduction and objectives

In 2017, the National Institute for Health and Care Excellence (NICE) appraised naltrexone-bupropion (NB32) + standard management (SM) versus SM alone for the treatment of adult obesity (TA494) based on a patient-level model originally implemented as a discretely integrated condition event (DICE) simulation[1].

The Evidence Review Group (ERG) had concerns with how the implementation of the model affected its run time, limiting the ERG's ability to simulate sufficient patients and probabilistic sensitivity analysis (PSA) iterations. This may have contributed to the NICE appraisal committee not recommending NB32 as an appropriate use of National Health Service (NHS) and Personal Social Services (PSS) resources, though a reimplemented version of the model in a non-DICE (within VBA) framework was accepted and used to inform Final Appraisal Determination.

This study aims at examining the impact of modelling the same decision problem using a (non-DICE) cohort-level approach.

Methods

Conceptual modelling and literature reviews were conducted to develop a cohort-level model structure (**Figure 1**).

The model was a non-DICE, 40-state, probabilistic, cohort-level Markov model and was specified and constructed in Microsoft Excel®.

Data inputs and assumptions matched the NICE committee preferred approach based on available materials at time of replication.

Main model assumptions

Upon model entry, no patients had a history of angina and/or diabetes other than Type 2 Diabetes Mellitus (T2DM).

A 4-week cycle length was applied (based on treatment administration).

Change in body weight curves from the COR-I and COR-DM trials (the two main NB32 trials conducted in non-diabetic and diabetic population, respectively) were digitised to quantify the benefit from treatments at each cycle in terms of reductions in weight and body mass index (BMI).

BMI was linked to the risk to CV events via published time-to-event models by Ara *et al.*, (2012)[2], consistent with TA494.

Results

The mean PSA incremental cost-effectiveness ratio (ICER) from the cohort-level model (£47,729) was higher than both the committee's preferred ICER (£23,750), and the £30,000 upper limit of the NICE willingness-to-pay threshold range for technologies that are neither *end of life* nor *highly specialised*[3].

For both models, results were highly sensitive to changes in the small estimated incremental health benefit (0.0195 versus 0.0434 quality-adjusted life-years [QALYs] for the cohort- and patient-level models, respectively).

Cohort- and patient-level model drivers were generally consistent, with monitoring and morbidity costs constituting the majority of overall costs, and treatment acquisition comprising the bulk of the incremental costs.

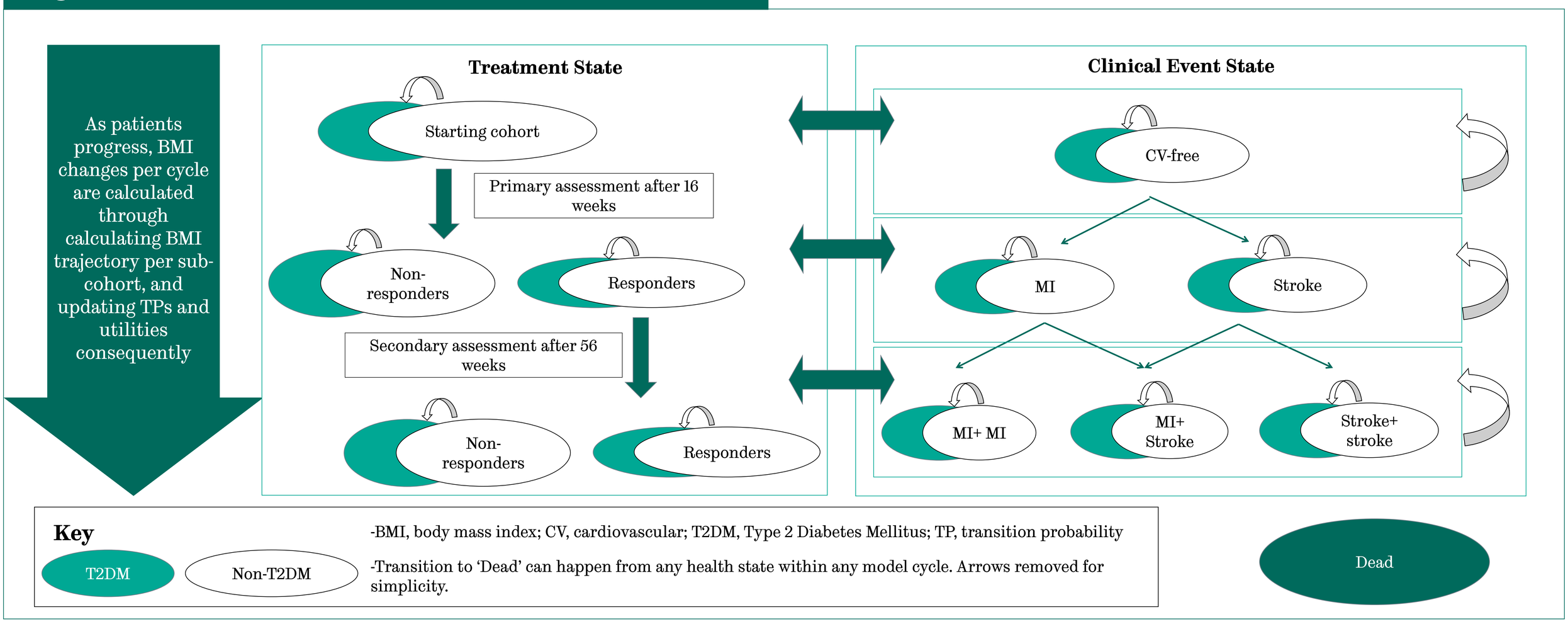
Discussion

Intrinsic differences between both modelling approaches contributed to differences in the model results (both in terms of total costs and QALYs, and hence the estimated ICERs).

The cohort-based probabilistic model was able to consider the main assumptions and inputs from the original model, however, an even more complex structure would be required to better capture patient heterogeneity in the *memoryless* Markov framework.

Data availability limited replication efforts, and so the findings of our study should be considered with caution.

Figure 1: *De novo* model schematic



References: **(1)** NICE. Naltrexone-bupropion for managing overweight and obesity [TA494]. 2017. Available at: https://www.nice.org.uk/guidance/ta494/documents/appraisal-consultation-document-2 (accessed 2018 Sep 5); **(2)** Ara R, Blake L, Gray L, et al. What is the clinical effectiveness and cost-effectiveness of using drugs in treating obese patients in primary care? A systematic review. Health Technol Assess. 2012;16(5); **(3)** NICE. Guide to the methods of technology appraisal. 2013. Available from: https://www.nice.org.uk/process/pmg9/chapter/the-appraisal-of-the-evidence-and-structured-decision-making (accessed 2018 Sep 1).

Disclaimer: Metry completed the dissertation module of his MSc Health Economics and Decision Modelling on placement at BresMed Health Solutions Ltd, under joint supervision with the awarding institution, University of Sheffield. Part of the work presented here was completed on placement and used in Metry's MSc dissertation.

Presented at ISPOR Europe 2019, 2 – 6 November 2019, Copenhagen, Denmark (Poster PDB32). To view poster online/contact author, scan the code.