

## **Comment on: Systematic assessment of decision analytic models for the cost effectiveness of bariatric surgery for morbid obesity**

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A number of systematic reviews of economic evaluations of bariatric surgery have been previously published.[1-6] The most recent reviews have specifically contrasted methods for modelling long-term clinical outcomes (e.g., weight-loss and resolution of comorbidities) [5] and identified important knowledge gaps in the economic evidence base after conducting a comprehensive review of diverse types of economic evaluations.[6]

Key findings from these reviews highlight a number of important issues to be considered when conducting future economic evaluations of bariatric surgery. In terms of long-term modelling, three main approaches, each with their own limitations (see Wang et al. for details [5]), have been used (i.e., statistical regression models, Markov models and assumptions). Such approaches are an inevitable part of evaluating the cost-effectiveness of bariatric surgery given the chronic nature of obesity. What is more concerning is that the models identified relied on clinical data from only three to five years of follow-up, despite the average time horizon of the models being 50 years. Furthermore, no clear recommendations have been provided to ensure future evaluations conduct long-term modelling in a consistent manner. In addition, multiple reviews have indicated that out-of-pocket costs to individuals/family members (e.g., travel time and caregiving) and indirect costs due to lost productivity are largely ignored in most analyses [4, 6] as well as long-term costs incurred after surgery as a result of reoperations, complications and body contouring.[6] Together, these limitations potentially question the validity of existing estimates of the cost-effectiveness for bariatric surgery compared to non-surgical/medical management.

Reasonably, any new systematic review of cost-effectiveness analyses of bariatric surgery (specifically assessing decision analytic models or other types of economic evaluation methods, more generally) would look to further understand these already identified limitations. Both in terms of their specific influence on cost-effectiveness results, but also if and how any recently published evaluations, not included in the existing reviews,

have attempted to address these limitations. Furthermore, if these limitations have not been addressed, prescriptive advice as to how future analyses can account for these issues should be provided.

I therefore read, with much anticipation, the recently published review by Alsumali et al.[7] As data from recently completed trials,[8, 9] ongoing trials [10, 11] and longer follow-up periods becomes available,[12-14] it will be increasingly important understand how best to develop a decision model to assess the cost-effectiveness of bariatric surgery. This will ensure reliable estimates of the relative cost-effectiveness of different types of bariatric surgery (e.g., gastric bypass versus sleeve gastrectomy versus adjustable gastric banding) as well as compared to non-surgical/medical management are available to assist policy makers in resource allocation decisions.

I applaud Alsumali et al. in their efforts to form recommendations as to how to improve the quality of future decision analytic models as they have highlighted some general methodological short-comings of existing evaluations that should be considered moving forward. For example, the need to use a lifetime horizon when modelling, conduct comprehensive sensitivity analyses, perform model validation, use appropriate sources of health state utility values and consider patient heterogeneity. However, these short-comings are common methodological elements that should be considered in any economic evaluation of a healthcare intervention.[15, 16] What is lacking from the review conducted by Alsmali et al. is an in-depth synthesis and evaluation of the issues specifically related to the economic evaluation of bariatric surgery. As discussed above, the most pertinent issues have already been identified. Instead of building on the available syntheses, Alsmali et al. list the same limitations (e.g., lack of consideration of out-of-pocket/indirect costs, comorbidities and long-term complications in models and use of assumptions in long-term modelling) without providing any further insight into how exactly the evidence base could be improved. I

therefore highlight the missed opportunities in the synthesis of evidence provided by Alsmali et al. and, where possible, provide some brief insights as to how analysts conducting future economic evaluations of bariatric surgery may address regularly identified limitations.

### **Inclusion of out-of-pocket and indirect costs**

Reviews of economic evaluations of bariatric surgery,[4, 6] including Alsmail et al.[7] have consistently identified a lack of consideration of out-of-pocket and indirect costs in existing analyses. However, no review has looked to understand why this is the case or identify how studies have collected this data in order to offer suggestions as to how such information could be obtained to inform future evaluations. One potential reason for the lack of considering this data could be in part due to the difficulties in collecting this information in patients with severe and complex obesity. Commonly, resource use questionnaires or diaries [17] are administered to participants in randomised controlled trials to obtain information on out-of-pocket and indirect costs. However, a poor understanding of the importance and reasons for collecting this data by trial participants and potentially lower numeracy skills in high body mass index (BMI) individuals [18] can lead to low response rates and large amounts of missing data, limiting the availability of accurate data. There is therefore a need to ensure questionnaire/diaries used to collect this information are easy to complete, participants fully understand the importance of providing the information and the potential for participants to feel embarrassed or stigmatised by its collection minimised (e.g., when asking about employment status, benefit payments received, money spent on food or time exercising). Another method to collect this information would be through focus groups in a select group of patients before and after bariatric surgery. However, information collected in this manner may lack generalisability to other bariatric surgery patients. To ensure a range of different levels of out-of-pocket and indirect costs are captured the preferred method for data collection would be through questionnaires/diaries.

## **Cost of surgical and long-term complications**

Previous reviews have also indicated that existing economic evaluations do not comprehensively assess all the direct costs associated with bariatric surgery, specifically the costs of reoperations, reversal surgeries, complications (e.g., gastric prolapse or leaks) and cosmetic procedures that may be incurred in the longer term.[6] Alsmail et al. again echo this sentiment, but provide no additional insight. More recently conducted evaluations, however, seem to be including some of these costs, as three out of the four decision models published in 2017 have accounted for long-term surgical related complications.[19-21] What is not clear, is what specific complications have been considered, what sources of evidence have been used to populate the models and how appropriate is the evidence for the populations being modelled. These insights would have been valuable for guiding future economic evaluations of bariatric surgery, rather than providing a generic recommendation that expert opinion can be used to populate these model parameters when limited data is available. Consideration of these long-term costs will become even more important for evaluations comparing the relative cost-effectiveness of different types of bariatric surgery and therefore analysts should look to better understand the evidence used in recently conducted decision models [19-21] and the wider evidence base before populating models or reverting to the use of expert opinion.

## **Modelling of long-term clinical outcomes**

Another missed opportunity was to build on the findings of a previous review that contrasted methods for modelling long-term clinical outcomes.[5] Instead, Alsmail et al.[7] simply reiterate previous findings indicating that the majority of the models do not use long-term clinical data and rely on extrapolations, requiring “extensive amount of assumptions”. More importantly, it is not clear if longer-term data has been used in more recently published models and what recommendations can be made concerning the use of consistent methods for

modelling long-term outcomes in future evaluations. When looking at three of the decision models published in 2017 [19, 20, 22] (note the fourth study [21] published in 2017 was not in an adult population so was not assessed) long-term data used to model changes in BMI after surgery relied on follow-up periods as long as 15 years (assuming stable BMI thereafter),[20] a median duration of analysis time of 5.6 years (interquartile range, 2.3-10.3 years) [22] and results from a meta-regression of BMI reductions 5-years post-surgery (assumed no changes beyond first year, but tested weight regain scenarios in sensitivity analyses).[19] With the exception of the latter study, more recently published decision models seem to be relying on longer-term follow-up data collected in a real-world setting to model long-term changes in BMI, as was recommended in the original review assessing long-term modelling methods.[5]

In addition, Alsmail et al. extracted information on health state descriptions used in existing models, approaches to modelling surgical efficacy (i.e., changes in body weight or recurrence/remission of comorbidities) and complications as well as assumptions used in extrapolations and were therefore well placed to make recommendations concerning what elements are essential to model moving forward. This knowledge gap was outlined in the comprehensive review published by Campbell et al.,[6] who suggested that the most relevant events for decision models of bariatric surgery should be identified so they can be consistently and appropriately accounted for in economic evaluations. A concept similar to the core set of important outcomes related to bariatric surgery recently identified from a clinical perspective.[23] However, yet again this opportunity was missed leaving analysts little guidance to improve the consistency of future decision analytic models of bariatric surgery.

Overall, it is apparent that it is extremely important to understand previous efforts to synthesise the evidence-base before committing to any further syntheses. A lack of

understanding of what is already known will only risk additional efforts providing a minimal contribution to the body of evidence, when the potential for much greater insight was possible. Only through such a robust approach to reviewing the evidence will more appropriate economic models of bariatric surgery be developed, producing accurate measures of cost-effectiveness that can assist policy makers in making difficult resource allocation decisions.

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