Improving Transparency in Decision Models: Current Issues and Potential Solutions

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Decision-analytic models have become an essential tool used to inform health technology assessments (HTAs). These models provide a mathematical framework to synthesize data from various sources to support predictions of the economic and health impact of new and existing health technologies. They tend to be complex and are rarely fully validated against external data; yet, use of their forecasts requires trust in their accuracy and lack of bias. Thus, decision makers and other stakeholders want to be able to review their structure, inputs, and assumptions fully, and this necessitates that these models be available and transparent enough to permit adequate review. While most would agree that model transparency is a highly desirable goal, the drive towards its achievement has led to concerns with the disincentives, potential loss of control, harmed intellectual property rights, and additional efforts demanded. In this special issue of *PharmacoEconomics* we have gathered an impressive and diverse collection of papers addressing many aspects of this important topic in our field.

Sampson et al. [1] provide a detailed introduction to the topic with a careful review of the ongoing discussion and issues; the role of stakeholders and their incentives; and the hurdles and concerns in terms of quality assurance, processes, funding, mechanisms of access, intellectual property, legal matters, and many other important aspects. Their comprehensive primer starts us off on an excellent footing. This is complemented by Wu et al.'s [2] take on the issues, but particularly by the solutions they propose: use of digital identifiers to uniquely tag models, which permit their

tracking and licensing and would open up the possibility of direct academic credit for their creators; model repositories and requirements for registration and release; and masking of input data to meet confidentiality requirements—all complemented by more extensive training in modeling, inclusive of clinical and other stakeholders.

In a nuanced and thoughtful article, Carlson et al. [3] acknowledge the potential benefits of enhancing model efforts, but express the serious concerns held by academic modelers. They illustrate these with an example drawn from the work of the Institute for Clinical and Economic Review (ICER) and emphasize that if models are to be freely accessible, then such initiatives must ensure adequate funding of the additional efforts required and protect the academic rewards to be obtained from their research contributions. The reluctance to openly post a model's code was evident in the responses to the survey undertaken by Emerson et al. [4].

Drawing on their two decades of experience promoting transparency of diabetes models, the group from the Mount Hood Challenge describe their further efforts to establish a registry of models in their area, with provision of full technical and non-technical documentation, including the methods and outcomes of validation efforts [5]. To support the efforts of others in this regard, they highlight the challenges they have faced so far in setting up the registry and those they expect to encounter through its ongoing maintenance. Perhaps to avoid some of the issues delineated in the previous paper, they explicitly state that this does not necessarily require that the model code be made available for open access.

Moving to provide some evidence of the impact of impeding transparency, Bullement et al. [6] detail their review of the redactions imposed on submissions made to the National Institute for Health and Care Excellence (NICE) in England. They found that large amounts of commercially and academically sensitive information were censored and this significantly impaired understanding of what the models are doing and how. Although they recognize that there may

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be strong reasons to suppress data, at least at the time of the adoption decision, they point out that these redactions remain in place for many years, without clear justification.

Three of the papers in this special issue focus on more applied aspects of model transparency, particularly with respect to the software or approach used to implement decision-analytic models. Alarid-Escudero et al. [7] set out the Decision Analysis in R for Technologies in Health (DARTH) coding framework—a high-level approach for implementing health economic models in R, including recommendations for conceptualizing, modularizing, and coding the model, with the intention of allowing these to be more easily scrutinized and understood by other model users. In a more applied setting, Jansen et al. [8] describe their experiences and challenges to date in the development and release of open-source R models in rheumatoid arthritis and non-small cell lung cancer by the Innovation and Value Initiative Open Source Value Project. The authors highlight the important role of freely available models in maximizing transparency and collaborative model development, and the difficulties associated with tailoring the models for different audiences and ensuring effective communication between multiple stakeholders involved in iterative model development. Möller [9] discusses the importance of transparency in model implementation and how Discretely Integrated Condition Event (DICE) simulation might help in achieving this objective. Facilitated by an analogy to a cooking recipe, Möller [9] explains how a DICE model can be transparently and flexibly implemented.

Moving from model implementation to verification, Buyukkaramikli et al. [10] present an extensive checklist for identifying and avoiding errors in health economic models, with the ultimate intention of improving the level of confidence that can be placed in the results of health economic models. The five-domain TECH-VER checklist tool is presented with reference to a wide range of examples of alternative types of model errors. On a related topic, McManus et al. [11] explore how we might define ‘success’ in the context of model replication exercises. The authors highlight the absence of workable definitions in the literature and how this leads to difficulties in assessing whether published health economic models are currently meeting transparency and reporting standards.

As can be seen from the breadth of topics covered in this special issue, the topic of model transparency is multifaceted, complex, and has numerous implications for the range of stakeholders involved in HTA processes. Whilst addressing the issue from a variety of different perspectives, the papers included in this special issue highlight that

the achievement of model transparency may bring with it a number of problems, challenges, and costs. As such, it is likely that questions regarding the appropriate level of model transparency, and how this can and should be achieved, will remain a matter of relevant debate for many years to come.

Compliance with Ethical Standards

Conflict of interest J. Jaime Caro and Paul Tappenden have no conflicts of interest directly relevant to this editorial.

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