Using Decision-Analytic Models Wisely

In this issue, Fairman and Motheral address an aspect of validation of decision-analytic models. In their research, Fairman and Motheral first replicated 2 published decision-analytic models of Helicobacter pylori eradication, and subsequently reran the models replacing original model assumptions with empirical data from a multipayer claims database. They found that key assumptions of the original models were not consistent with the empirical data from the database, which consequently led to different conclusions being supported when the models were rerun.

In the face of these results, one might question the value of the original models. Unfortunately, some degree of discordance between the assumptions used to populate decision-analytic models and subsequently collected empirical data is to be expected. In other words, as noted by Sculpher et al., all models developed at time \( t \) will be “wrong” (in terms of their predictions) at time \( t+1 \). This does not mean that original models are of little value. Models are usually constructed in response to a situation where there is incomplete empirical data available at time \( t \) in order to inform a decision that must be made at time \( t \) (i.e., cannot be deferred). And, in doing so, the model that is constructed should make explicit the gaps in the knowledge base at time \( t \) as well as the sensitivity of the model to the assumption(s) made in lieu of the missing empirical data. To the extent that the ensuing model is very sensitive to the value of the assumption(s) made, this suggests the need for follow-up data collection after implementation of the decision at time \( t \).

In clinical practice and health policy settings, decisions will be made regardless of the availability of a model. However, when available, models provide the means “... to structure evidence on clinical and economic outcomes in a form that can help to inform decisions about clinical practices and healthcare resource allocations” (p.9). In the case of the published models of Helicobacter pylori eradication, it is evident that these models were sensitive to the assumptions made about eradication rates and patterns of care for retreated and successfully treated patients. By collecting empirical data on these parameters, Fairman and Motheral have provided the basis for updating the model parameterization when the time will come to revisit the decision on Helicobacter pylori eradication at time \( t+1 \).

A necessary condition for a successful revisit, however, is the clear and unambiguous construction of the initial models with sufficient transparency for a qualified analyst to replicate the models. Transparency is one of the key attributes of a “good” decision-analytic model, more so than predictive accuracy. Indeed, the Consensus Conference on Guidelines on Economic Modelling in Health Technology Assessment concluded that the main 5 properties of a “good” decision-analytic model were: transparency, interpretability, and exploration of uncertainty.

Decision-analytic models are now a required component of the Academy of Managed Care Pharmacy’s guidelines for the submission of clinical and economic data to support formulary listing in health plans. In evaluating and using such decision-analytic models, it is important for managed care decision makers to consider the following:

(a) Models cannot make a decision—all they can do is provide a structured and explicit look at the costs and consequences that would then need to be considered by the decision maker. Simply put, models inform decision making at a particular point in time by making explicit the relationships between assumptions and outcomes—however, the veracity of the assumptions underlying the model need to be carefully considered by the decision makers in evaluating the trustworthiness of any model.

(b) Models and their results should not be considered as claims about the facts or as predictions about the future; model outputs are always contingent on the inputs, which is why it is imperative that model inputs be as transparent and accessible as possible. This principle is very effectively illustrated by the Fairman and Motheral article, wherein it was shown that the original models were highly sensitive to the assumptions made about eradication rates and patterns of care for retreated as well as successfully treated patients.

(c) The principle of transparency in modeling suggests that the simpler the model the better it is (all else being equal); “black boxes” are usually less desirable. For instance, the transparency of the original models facilitated their replication by Fairman and Motheral.

(d) When model predictions are evaluated, it is more important to focus on the modeled relationship between inputs and outputs than on the outputs only. This is also illustrated effectively by Fairman and Motheral, wherein they show that one of the key assumptions that did not hold in the original models was the one relating to whether patients are treated as inpatients or outpatients for hospital care.

(e) Models should never be regarded as complete, but should be repeatedly updated and/or replaced as new evidence becomes available regarding their structure or inputs. Indeed, as Weinstein et al. note, the ability of models to adapt to new evidence should be regarded as a strength, not as a weakness. The original models of Helicobacter pylori eradication can be updated for future use with the data from the Fairman and Motheral study, at least for the use of the organizations represented in this dataset.

A more detailed list of questions for assessing quality of decision-analytic models is provided by Sculpher et al., while excellent reviews are also provided in references 3 and 4. Decision-analytic models are playing an increasingly important role in health care decision making, and more such research needs to be conducted and published on testing model assumptions, parameters, and structure in the course of determining the quality of decision-analytic models. The work by Fairman and Motheral provides an important illustration of how such research can proceed in organizations with access to medical
and pharmacy claims databases.

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REFERENCES