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Using Multicriteria Approaches to Assess the Value of Health Care

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ABSTRACT

Practitioners of cost-utility analysis know that their models omit several important factors that often affect real-world decisions about health care options. Furthermore, cost-utility analyses typically reflect only single perspectives (e.g., individual, business, and societal), further limiting the value for those with different perspectives (patients, providers, payers, producers, and planners—the 5Ps). We discuss how models based on multicriteria analyses, which look at problems from many perspectives, can fill this void. Each of the 5Ps can use multicriteria analyses in different ways to aid their decisions. Each perspective may lead to different value measures and outcomes, whereas no single-metric approach (such as cost-utility analysis) can satisfy all these stakeholders. All stakeholders have unique ways to measure value, even if assessing the same health intervention. We illustrate the benefits of this approach by comparing the value of five different hypothetical treatment choices for five hypothetical patients with cancer, each with different preference structures. Nine attributes describe each treatment option. We add a brief discussion regarding the use of these approaches in group-based decisions. We urge that methods to value health interventions embrace the multicriteria approaches that we discuss, because these approaches 1) increase transparency about the decision process, 2) allow flight simulator-type evaluation of alternative interventions before actual investment or deployment, 3) help focus efforts to improve data in an efficient manner, 4) at least in some cases help facilitate decision convergence among stakeholders with differing perspectives, and 5) help avoid potential cognitive errors known to impair intuitive judgments.

Keywords: multicriteria analysis, priority setting, systems analysis, value modeling.

Introduction

Standard approaches for evaluating health interventions use cost-utility analysis, most commonly with a societal perspective. All health-improving benefits and costs enter the cost-utility model (similar to the methods of cost-benefit analysis), which follows directly from a utility-maximizing framework [1,2]. Cost-effectiveness and cost-benefit analyses are closely related once a critical cutoff value is established for resource allocation in the cost-utility framework [3]. But this perspective seldom corresponds to the perspectives of most of the participants in the health enterprise: patients, providers, payers, producers, and planners—the 5Ps. Each of these 5Ps almost certainly will have multiple objectives when selecting, advising about, providing coverage for, investing in, or supporting research about health care options. Each of these decision makers has multiple goals, and therefore no single-metric approach (such as cost-benefit or cost-utility ratios) can accommodate any of their viewpoints. We need better, comprehensive frameworks to assess the value of health that can both accommodate different values and incorporate multiple attributes associated with health options. Any approach using only a single attribute and a single perspective is almost certainly inadequate and incomplete.

Others have acknowledged this challenge. For example, the International Society for Pharmaceutical Outcomes Research (ISPOR) Task Force on multicriteria decision analysis issued two reports in 2016 summarizing best practices for such approaches [4,5]. These reports—in addition to providing a state-of-the-art review—discuss the uses of the multicriteria models in health care, from supporting decisions of individual patients to a universal health care system. As their summaries show, use of multicriteria analysis in the United States has primarily focused on decision support for individual patients rather than on technology assessment or insurance coverage decisions (e.g., [6]).

Among the 5Ps, Patients are likely to focus on potential therapeutic benefits, risks, and side-effects, as well as travel time, net costs and out of pocket expense as they evaluate treatment options and other alternatives, including watchful waiting, palliation, treatment holidays, and continuous monitoring. Providers may consider their understanding of patient preferences, but may also consider the consequences for their own financial situation (including differential reimbursement

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and use of provider-owned facilities), and perhaps litigation risks. Payers (third-party insurers) may seek to minimize premium costs by bargaining with providers, perhaps choosing limited panels of preferred providers, and choosing which therapies to include as covered and at what co-payment rates (e.g., tiers within prescription drug plans). Producers (e.g., manufacturers of drugs, vaccines, and devices) may each have their own interests, ranging from profitability to perceived public good. Planners may focus on prioritizing research investments and possibly (for elected policymakers) even on enhanced re-election chances. Again, no single perspective can possibly represent these diverse interests.

Why Use Multifactorial Systems Analysis?

Multifactorial approaches approximate as well as expand the economic concept of a utility function with a goal of incorporating relevant parameters to make the models useful for decision support [7–11]. Each approach makes trade-offs between generalizability and usability. They also seek to consider competing attributes of various options, making the trade-offs explicit and transparent to others, thus excelling in comparison with single-attribute models such as cost-effectiveness analysis [12].

Multicriteria approaches may lead to two potentially conflicting situations. First, all users can create their own priority lists on the basis of their own values and preferences. Second, a consequence of the first, we may see the creation of potentially disparate lists of priorities. This is not a defect of multicriteria models, but rather represents the reality of the world: people with different perspectives have different priorities.

Multicriteria approaches provide a number of direct benefits related to decision making. First comes transparency. These models illuminate the key values driving priorities and choices [13].

Second, this approach allows the assessment of the implications of adopting a particular option (and multiple variations thereof) before actually spending resources to implement the choice, similar to a flight simulator in aviation engineering. This advance testing capability uniquely builds on the multicriteria evaluation processes of these models. In appropriate settings, it can also allow reverse engineering to improve the specifications or characteristics of diagnostic or treatment interventions (e.g., considering trade-offs between cost, discomfort, radiation exposure, and accuracy in diagnostic protocols).

Third, multicriteria models can help guide efforts to systematically improve data. Often, at least some of the data entering the model are imperfect. Using sensitivity analysis within the model can show which variables importantly contribute to the final rankings and which do not matter, allowing users to focus their efforts on improving those data that matter most [14].

Fourth, multicriteria models can potentially assist competing interests in reaching negotiated decision convergence. Prices in markets perform a similar function by providing information to buyers and sellers about how other participants in the market value things. Similarly, values specified in multicriteria models provide information that can assist various parties in negotiating agreements by showing what is more important and less important to various stakeholders. Clearly, in some settings, various bargaining parties may not wish to reveal such information, but in some other settings, it can pave the way to a mutually agreeable negotiated agreement, just as market prices help to facilitate exchanges.

Fifth, multicriteria approaches can help bypass at least some cognitive biases that are now well understood to adversely affect decisions. These models ask humans to do tasks for which they are best suited (specifying values) and then ask computers to do what they do best (numerical synthesis of information). These cognitive biases include those relating to framing of issues, anchoring, time inconsistency, estimation of probabilities, making choices in the presence of uncertainty, overconfidence, and many others [15].

These five considerations—transparency, advance testing of alternatives, efficiency in data improvement, supporting decision convergence, and alleviation of cognitive biases in real-world decision making—all point to the value of using multicriteria models. Most previous assessments of multicriteria models have primarily emphasized the value of transparency in the decision process, although we believe that the other considerations listed here create similar benefits.

Present Limitations of Multicriteria Approaches

A key limitation of multicriteria models is the lack of consensus on the best method to balance costs and benefits because benefit measures in these models purposefully include a wider array of attributes than do standard narrow measures such as quality-adjusted life-years (QALYs). A recent ISPOR Task Force report discussed three ways to approach these issues using multicriteria analysis [5]. The first uses direct inclusion of cost as a “negative” attribute with its own weight. The second involves finding other health care interventions (with known costs) that could be eliminated and assessing the multicriteria value of those as a benchmark. The third approach divides the multicriteria scores of each option by its cost (akin to using the ratio of cost per health benefit). The task force found none of these approaches perfectly persuasive, and urge further research on the matter. A fourth available alternative assumes an exogenous investment budget, without suggesting how to set its level [16]. We suggest a new alternative here.

Cost-benefit analysis recommends adopting every alternative choice with positive net present value. This method, however, requires analysts to assign a specific value to human life, a task many resist. To solve this concern, cost-utility analysis calculates the incremental cost-effectiveness ratio (ICER), and the decision maker chooses the critical cutoff value for acceptable ICERs.

We suggest a similar approach for use in multicriteria models. Suppose that in any multicriteria model, health-related measures (such as QALYs) accounted for a share S of the total value, and all other attributes accounted for a share of $1 - S$. Then, if the ICER cutoff was \$100,000/QALY, the measured scores for each choice in the multicriteria model would be evaluated against a cutoff of \$100,000/S. This would provide a direct method, comparable with that of cost-utility analysis when using an ICER cutoff to guide resource allocation in the broader framework of multicriteria decision analysis.

Other concerns about multicriteria models are specific to particular applications. For example, the weight-setting protocol in the analytic hierarchy process allows internal inconsistencies and rank-reversal with different decision options [11]. The swing weight approach in the multi-attribute utility theory requires analysts to create standardized 0 to 100 scales for each attribute, which interact with the weights in potentially unforeseen ways [9]. These and other technical issues can and should be resolved to bring multicriteria models to their greatest potential.

Choices and Scenarios

To illustrate key features of the multicriteria systems approach, consider a patient faced with choosing among available cancer therapies. Clinicians would specify the quantitatively measurable therapeutic and side-effect profiles of each option. Patients would specify the levels of any subjectively determined attribute associated with each choice, for example, distaste or fear of a