JAMA | Special Communication

Recommendations for Conduct, Methodological Practices, and Reporting of Cost-effectiveness Analyses

Second Panel on Cost-Effectiveness in Health and Medicine

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IMPORTANCE Since publication of the report by the Panel on Cost-Effectiveness in Health and Medicine in 1996, researchers have advanced the methods of cost-effectiveness analysis, and policy makers have experimented with its application. The need to deliver health care efficiently and the importance of using analytic techniques to understand the clinical and economic consequences of strategies to improve health have increased in recent years.

OBJECTIVE To review the state of the field and provide recommendations to improve the quality of cost-effectiveness analyses. The intended audiences include researchers, government policy makers, public health officials, health care administrators, payers, businesses, clinicians, patients, and consumers.

DESIGN In 2012, the Second Panel on Cost-Effectiveness in Health and Medicine was formed and included 2 co-chairs, 13 members, and 3 additional members of a leadership group. These members were selected on the basis of their experience in the field to provide broad expertise in the design, conduct, and use of cost-effectiveness analyses. Over the next 3.5 years, the panel developed recommendations by consensus. These recommendations were then reviewed by invited external reviewers and through a public posting process.

FINDINGS The concept of a "reference case" and a set of standard methodological practices that all cost-effectiveness analyses should follow to improve quality and comparability are recommended. All cost-effectiveness analyses should report 2 reference case analyses: one based on a health care sector perspective and another based on a societal perspective. The use of an "impact inventory," which is a structured table that contains consequences (both inside and outside the formal health care sector), intended to clarify the scope and boundaries of the 2 reference case analyses is also recommended. This special communication reviews these recommendations and others concerning the estimation of the consequences of interventions, the valuation of health outcomes, and the reporting of cost-effectiveness analyses.

CONCLUSIONS AND RELEVANCE The Second Panel reviewed the current status of the field of cost-effectiveness analysis and developed a new set of recommendations. Major changes include the recommendation to perform analyses from 2 reference case perspectives and to provide an impact inventory to clarify included consequences.

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Supplemental content

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JAMA. 2016;316(10):1093-1103. doi:10.1001/jama.2016.12195

In 1993, the US Public Health Service convened a panel of 13 nongovernment scientists and scholars with expertise in economics, clinical medicine, ethics, and statistics to review the state of cost-effectiveness analysis and to develop recommendations for its conduct and use in health and medicine (a glossary of terms appears in the **Box**).[1] The primary goals were to improve the quality of cost-effectiveness analyses and promote comparability across studies.

In 1996, the original Panel on Cost-Effectiveness in Health and Medicine published its findings in a series of articles in *JAMA*,[2-4] and in a book.[1] The panel emphasized that the growing field of cost-effectiveness analysis provided an opportunity to rationalize health policy if the technique and its application were well understood and implemented.

During the 20 years since the release of the panel's report, the number of published cost-effectiveness analyses has increased substantially. Moreover, the field has advanced in many ways such as by strengthening its theoretical foundations; improving methods for evidence synthesis, modeling, and uncertainty analysis; considering more closely the ethical issues surrounding the use of cost-effectiveness analysis; and standardizing requirements for the reporting of results. During the same period, health care also has experienced substantial changes in terms of its use of technological advances and the organization, financing, cost, and delivery of care. New uses of cost-effectiveness analysis have also emerged in the United States and abroad. Examples from the United States include the use of cost-effectiveness analysis by the Advisory Committee for Immunization Practices, which establishes national immunization policy recommendations on behalf of the US Centers for Disease Control and Prevention.[5] A prominent example in the United Kingdom is the use of cost-effectiveness analysis by the National Institute of Health and Care Excellence, which is a nondepartmental public body created in 1999 that serves England and Wales.[6]

The need to deliver health care efficiently and the importance of using analytic techniques to understand the clinical and economic consequences of strategies to improve health have only increased. Health care spending in the United States comprised 13% of gross domestic product in 1995; in 2014, it approached 18%.[7] For these reasons, an update of the original panel's efforts is important.

Box. Glossary[a]

Cost-benefit analysis: An analytic tool for estimating the net social benefit of a program or intervention as the incremental benefit of the program minus the incremental cost, with all benefits and costs measured in US dollars.

Cost-effectiveness analysis: An analytic tool in which the costs and effects of a program and at least 1 alternative are calculated and presented in a ratio of incremental cost to incremental effect. Effects are health outcomes, such as cases of a disease prevented, years of life gained, or quality-adjusted life-years, rather than monetary measures as in cost-benefit analysis.

Disaggregated measures: Attribution of total costs or quality-adjusted life-years to intermediate categories associated with specific cost categories (eg, intervention-specific vs relating to the care of the condition, health care sector vs other sector) or intermediate health outcomes. A typical breakdown of costs into disaggregated measures would report intervention-specific and condition-related costs, along with more detailed categories as relevant (eg, hospitalization, outpatient visits). Other categories may be relevant depending on the decision context.

Discounting: The process of converting future dollars and future health outcomes to their present values.

Health care sector perspective: A viewpoint for conducting a cost-effectiveness analysis that includes formal health care sector (medical) costs borne by third-party payers and paid out-of-pocket by patients. These third-party and out-of-pocket medical costs include current and future costs, related and unrelated to the condition under consideration.

Incremental cost-effectiveness ratio: The ratio of the difference in costs between 2 alternatives to the difference in effectiveness between the same 2 alternatives.

Net health benefit: Linear combination of costs and effects, expressed in effectiveness units.

Net monetary benefit: Linear combination of costs and effects, expressed in US dollars.

Perspective: The viewpoint from which a cost-effectiveness analysis is conducted.

Quality-adjusted life-year: A measure of health outcome that assigns a weight to each period (ranging from 0 to 1), corresponding to the health-related quality of life during that period, in which a weight of 1 corresponds to optimal health, and a weight of 0 corresponds to a health state judged equivalent to death; these are then aggregated across periods.

Reference case: A set of standard methodological practices that all cost-effectiveness analyses should follow to improve comparability and quality.

Societal perspective: A viewpoint for conducting a cost-effectiveness analysis that incorporates all costs and health effects regardless of who incurs the costs and who obtains the effects.

[a]Adapted from glossary in Gold et al.[1]

Methods

In 2011, members of the original panel began planning for an update to the 1996 recommendations. Over the next year, a leadership group was formed that included the eventual co-chairs (G.D.S. and P.J.N.) of the Second Panel on Cost-Effectiveness in Health and Medicine and coauthors of this article (L.B.R., J.E.S., and T.G.G.). This leadership group convened a new panel during the fall 2012 and developed a process for updating the original report.

The 13 individuals invited to join the Second Panel were invited by the leadership group (after consultation with members of the first panel and other advisors) and selected on the basis of their experience in the field to provide broad expertise in the design, conduct, and use of cost-effectiveness analyses. Three international members (D.F., M.K, and M.J.S.) reflected the perspectives and experiences of other countries that have used cost-effectiveness analysis. The group met as a full panel through regular teleconferences beginning in early 2013 and held 5 in-person meetings over the next few years to update the recommendations.

The Second Panel has updated and expanded the recommendations of the original panel in numerous ways. The panel considered each of the original recommendations and the need to modify

or expand them based on changes in the field. For new topic areas (decision modeling, evidence synthesis, ethics), panel members drafted recommendations de novo. Throughout the process, draft recommendations were circulated first among chapter authors and then more broadly among the panel as a whole for email, teleconference, and in-person discussion and consensus. If consensus was not possible, the plan was for the panel to vote, with an 80% majority required to pass and with the option for a minority report. Consensus was reached relatively easily on most recommendations. Two exceptions were recommendations about perspectives for the reference case (whether to recommend 1, 2, or more perspectives and how to define them) and on productivity (whether to include it in the numerator or denominator of the incremental cost-effectiveness ratio). After further discussion, consensus was reached on these and all other issues without the need for a formal vote and without any minority reports.

The Second Panel benefited from the active participation of some members of the original panel, and from review of its work by experts in the field through both an external review process and a public comment period (participants of this process are listed in the additional contributions section at the end of the article).

The objectives were to review the state of the field and provide recommendations to improve the quality and promote the comparability of cost-effectiveness analyses. The intended audiences are, in addition to students and researchers, government policy makers, public health officials, health care administrators, payers, businesses, clinicians, patients, and consumers.

The landscape and the set of challenges to cost-effectiveness analysis have changed since 1996. Cost-effectiveness analysis is no longer a nascent approach, and variation in published studies cannot be ascribed to the newness of its concepts or methods. Compared with the original panel, the Second Panel had the advantage of drawing on 2 decades of methodological and policy advances. However, the Second Panel also had the challenge of sifting through and trying to make sense of the diverse and sometimes contrasting opinions about and experiences with cost-effectiveness analysis.

Key Recommendations

Overview

Cost-effectiveness analysis can help inform decisions about how to apply new or existing tests, therapies, and preventive and public health interventions so that they represent a judicious use of resources. It also can help to fill gaps in the evidence about the estimated population-level public health effect of such interventions, and can support decisions to disinvest in older interventions for which there are more cost-effective alternatives. Cost-effectiveness analysis provides a framework for comparing the relative value of different interventions, along with information that can help decision makers sort through alternatives and decide which ones best serve their programmatic and financial needs.

The full set of recommendations are included in the eAppendix in the Supplement. The complete report will be published in book form in October 2016.[8] This Special Communication summarizes key recommendations regarding the reference case and study perspectives, as well as other important aspects of the report.

Reference Cases

The original panel recommended a reference case, which is a set of standard methodological practices that all cost-effectiveness analyses should follow to improve comparability and quality.[1] It further recommended that reference case analyses take a societal perspective to reflect the perspective of a decision maker whose intention is to make decisions about the broad allocation of resources across the entire population. In a cost-effectiveness analysis conducted from a societal perspective, the analyst considers all parties affected by the intervention and counts all significant outcomes and costs that flow from it, regardless of who experiences the outcomes or bears the costs. The original panel also noted that, to address specific decision contexts, analysts might also include narrower perspectives, such as that of the health care sector, to reflect the view of a decision maker whose responsibility rests only within that sector. The Second Panel endorses the reference case concept for the purposes originally intended, namely to improve the quality of cost-effectiveness analyses and promote comparability across studies.

Societal Perspective: Experience Since the Original Panel

Since publication of the original panel's recommendations in 1996, there has been a substantial increase in the number of published cost-effectiveness analyses, and many have not used a societal perspective as defined by the original panel.[9-12] One study found, for example, that only 341 (29%) of 1163 cost per quality-adjusted life-year (QALY) analyses published through 2005 adopted a societal perspective.[11] Even when analysts have stated that they have used a societal perspective, they have often omitted potentially important elements, such as costs related to patient and caregiver time, or to transportation or non–health care sectors (eg, education), so that the perspective of the analysis is essentially a narrower one.[11,13-15] Moreover, since 1996, decision-making bodies primarily in Europe, Australia, and Canada have formally incorporated cost-effectiveness analysis into health technology assessment processes to inform coverage and reimbursement decisions, but generally have not adopted a societal perspective, preferring instead a more focused health system perspective. Others have highlighted the theoretical challenges associated with aggregating the costs and effects that fall on different sectors and individuals in a way that reflects a consensus position on social welfare.[16,17]

Panel's Reference Case Recommendations

The following recommendations are important to promote quality and comparability, while also recognizing (1) the different preferences, types of interventions, needs, and authorities of decision makers, (2) the importance of preserving flexibility for analysts in accommodating those factors, and (3) the value that stems from illustrating the consequences of decisions from different viewpoints.

Recommendation 1: Reference Cases and Perspectives

All studies should report a reference case analysis based on a health care sector perspective and another reference case analysis based on a societal perspective. The reference cases are defined by recommendations for components to consider for evaluation, methods to use, and elements for reporting. It is recommended that reference case analyses measure health effects

Figure 1. Impact Inventory Template

Sector	Type of Impact (list category within each sector with unit of measure if relevant)[a]	Included in This Reference Case Analysis From...Perspective?		Notes on Sources of Evidence
		Health Care Sector	Societal	
Formal Health Care Sector				
Health	Health outcomes (effects)			
	Longevity effects	☐	☐	
	Health-related quality-of-life effects	☐	☐	
	Other health effects (eg, adverse events and secondary transmissions of infections)	☐	☐	
	Medical costs			
	Paid for by third-party payers	☐	☐	
	Paid for by patients out-of-pocket	☐	☐	
	Future related medical costs (payers and patients)	☐	☐	
	Future unrelated medical costs (payers and patients)	☐	☐	
Informal Health Care Sector				
Health	Patient-time costs	NA	☐	
	Unpaid caregiver-time costs	NA	☐	
	Transportation costs	NA	☐	
Non–Health Care Sectors (with examples of possible items)				
Productivity	Labor market earnings lost	NA	☐	
	Cost of unpaid lost productivity due to illness	NA	☐	
	Cost of uncompensated household production[b]	NA	☐	
Consumption	Future consumption unrelated to health	NA	☐	
Social Services	Cost of social services as part of intervention	NA	☐	
Legal or Criminal Justice	Number of crimes related to intervention	NA	☐	
	Cost of crimes related to intervention	NA	☐	
Education	Impact of intervention on educational achievement of population	NA	☐	
Housing	Cost of intervention on home improvements (eg, removing lead paint)	NA	☐	
Environment	Production of toxic waste pollution by intervention	NA	☐	
Other (specify)	Other impacts	NA	☐	

[a] Categories listed are intended as examples for analysts.

[b] Examples include activities such as food preparation, cooking, and clean up in the household; household management; shopping; obtaining services; and travel related to household activity.[18]

NA indicates not applicable.

in terms of QALYs. Standardizing methods and components within a perspective is intended to enhance consistency and comparability across studies.

Recommendation 2: Health Care Sector Reference Case

Results of the health care sector reference case analysis should be summarized in the conventional form as an incremental cost-effectiveness ratio. Net monetary benefit or net health benefit may also be reported, and a range of cost-effectiveness thresholds should be considered. In addition, the health care sector perspective should include formal health care sector (medical) costs reimbursed by third-party payers or paid out-of-pocket by patients. Both types of medical costs include current and future costs both related and unrelated to the condition under consideration.

Recommendation 3: Societal Reference Case

Recommendation 3A: Inclusion of an Impact Inventory | Evaluation of the broader effects of interventions designed to improve health is strongly recommended. The societal reference case analysis should include medical costs (current and future, related and unrelated) borne by third-party payers and paid out-of-pocket by patients, time costs of patients in seeking and receiving care, time costs of informal (unpaid) caregivers, transportation costs, effects on future productivity and consumption, and other costs and effects outside the health care sector. To make this evaluation more explicit and transparent, inclusion of an "impact inventory" that lists the health and nonhealth effects of an intervention should be considered in a societal reference case analysis (described in more detail below and in the **Figure 1**). The main purpose of the impact inventory is to ensure that all consequences, including those outside the formal health care sector, are considered regularly and comprehensively, which has generally not been the case to date.

Recommendation 3B: Quantifying and Valuing Nonhealth Components in the Impact Inventory | Analysts should attempt to quantify and value nonhealth consequences in the impact inventory unless those consequences are likely to have a negligible effect on the result of the analysis.

Recommendation 3C: Summary and Disaggregated Measures | It would be helpful to inform decision makers through the quantification and valuation of all health and nonhealth effects of interventions, and to summarize those effects in a single quantitative measure, such as an incremental cost-effectiveness ratio, net monetary benefit, or net health benefit. However, there are no widely agreed on methods for quantifying and valuing some of these broader effects in cost-effectiveness analyses. Analysts should present the items listed in the impact inventory in the form of disaggregated consequences across different sectors. It is also recommended that analysts use 1 or more summary measures, such as an incremental cost-effectiveness ratio, net monetary benefit, or net health benefit, that include some or all of the items listed in the impact inventory. Analysts should clearly identify which items are included and how they are measured and valued, and provide a rationale for their methodological decisions.

Recommendation 4: Reporting the Reference Cases and Other Perspectives

Recommendation 4A: Stating the Perspective | Analysts should clearly state the perspective of every analysis reported.

Recommendation 4B: Presenting Other Perspectives | When specific decision makers have been identified, such as a particular public or private payer, analysts may want to present results from that decision maker's perspective in addition to the 2 reference case perspectives. In these cases, analysts should indicate who the primary decision makers were whose deliberations are intended to be informed by the analysis.

Recommendation 4C: Importance of Transparency and Sensitivity Analysis | The items included in a cost-effectiveness analysis and the manner in which they are valued involve numerous choices. Analysts should be transparent about how they have conducted the analyses, and convey how the results change with alternative assumptions. Sensitivity analysis should describe the assumptions to which the results for different perspectives are sensitive.

Other Recommendations Regarding the Design and Conduct of Cost-effectiveness Analyses

It is important to focus on relevant research questions, maintain the focus as the study progresses, and avoid analytic pitfalls. A written protocol at the outset of an analysis that details key aspects of the design and conduct of the cost-effectiveness analysis is recommended (eg, the study objective; the intervention, comparators, and populations under consideration; the time horizon; sources of data; a list of key assumptions).

In terms of valuing health outcomes, the Second Panel (in agreement with the original panel) recommends that (1) the reference case cost-effectiveness analyses should measure health effects in terms of QALYs (including QALYs accruing to patients and to any other affected parties such as caregivers); (2) quality weights should be preference based and interval scaled; and (3) community preferences for health states are the most appropriate source of preferences for reference case analyses. The use of generic preference-based measures is recommended to enhance comparability across studies, but it is emphasized that the instrument used should be fit for purpose in the sense that its measurement properties are adequate to measure the differences and changes in health across the interventions under consideration. Although generic preference-based measures should be used for the reference case analyses, analysts may also want to present estimates based on scores obtained from patients or from other sources.

Table 1. Cost Components Included in the 2 Recommended Reference Case Perspectives

Cost Component	Reference Case Perspective	
	Health Care	Societal
Formal Health Care Sector[a]		
Costs paid by third-party payers	Yes	Yes
Costs paid out-of-pocket by patients	Yes	Yes
Informal Health Care Sector		
Patient-time costs	No	Yes
Unpaid caregiver-time costs	No	Yes
Transportation costs	No	Yes
Non–Health Care Sectors		
Productivity	No	Yes
Consumption	No	Yes
Social services	No	Yes
Legal or criminal justice	No	Yes
Education	No	Yes
Housing	No	Yes
Environment	No	Yes
Other (eg, friction costs)	No	Yes

[a] Includes current and future costs related and unrelated to the condition under consideration.

In a departure from the original panel, the Second Panel observes that, in general, effects on productivity are unlikely to have been captured by most preference-based measures, and that evidence is not definitive that the effects of morbidity on leisure are necessarily reflected in the utility scores or quality-of-life weights.[19-25] Therefore, it is recommended that the productivity consequences related to changes in health status be reflected in the numerator of cost-effectiveness ratios for reference case analyses conducted under the societal perspective, while recognizing the possibility that the uncertainty about how productivity and the effects of morbidity on leisure activities are captured in preference-based measures could lead to double counting. Research recommendations are made to develop improved quality-of-life weights that would avoid such double counting.

In terms of estimating costs for cost-effectiveness analyses, a key departure from the original panel is the consideration of cost categories from the 2 reference case perspectives. It is now recommended that some components (eg, current and future medical costs and patients' out-of-pocket costs) should be included in both perspectives, while others (eg, time costs for patients and caregivers, transportation costs, productivity benefits, consumption costs, and other non–health-care sector costs) should be included only in the societal reference case perspective (**Table 1**). The new recommendations also suggest inclusion of future costs (ie, that cost-effectiveness analyses account for related or unrelated health care

costs that occur during the additional life-years produced by an intervention). The original panel discussed this issue but did not reach consensus (noting that analysts could use their discretion) due to the lack of a developed theoretical basis for including future costs at the time of its report.[26-34]

It is important to interpret, adjust, and synthesize evidence in a cost-effectiveness analysis, drawing on recent guidance regarding systematic reviews and meta-analyses. Among the recommendations, analysts should (1) provide a qualitative description and critique of the evidence base, (2) be explicit about whether and how bias in each study and across studies in the evidence was handled, (3) produce bias-corrected estimates, and (4) be explicit about whether and how estimates were adjusted for transferability.

Costs and health effects should be discounted at the same rate in cost-effectiveness analyses. Furthermore, given available data on real economic growth and corresponding estimates of the real consumption rate of interest and to promote comparability across studies, 3% is the most appropriate real discount rate for cost-effectiveness analyses. However, the panel recommends conducting sensitivity analyses that allow for a reasonable range of rates, along with more research on the topic of using different discount rates for costs and health effects in cost-effectiveness analyses.

Recommendations Regarding Reporting and Interpreting Cost-effectiveness Analyses

Organization and clarity in reporting cost-effectiveness analyses[35] are important and there are expanded recommendations to improve and standardize reporting (**Figure 2**). Analysts should document cost-effectiveness analyses in both a journal article and in a technical appendix.

All of the elements included in the reporting checklist should be briefly covered in the journal article, with additional detail provided within the technical appendix. There are no specific recommendations on which elements are of the highest priority because this may depend to some extent on the specifics of the analysis. Typical elements often covered primarily in the technical appendix include detailed reporting of intermediate outcomes and disaggregated results, uncertainty and secondary analyses, modeling assumptions, evidence synthesis, model validation, and information on sources of data regarding effectiveness, cost, and preferences.

Inclusion of a structured abstract for journal articles, incorporation of an impact inventory to aid analysts in providing a complete and transparent account of the reference cases, reporting of intermediate end points and disaggregated results, and disclosure of potential conflicts of interest are recommended.

Structured Abstract

Although each journal may have its own requirements, it is recommended that a structured abstract specifically designed for cost-effectiveness analyses should be included in the journal article whenever possible (**Table 2**).

Impact Inventory

As noted, the new reference case recommendations mean reporting of results from both the health care sector perspective and the societal perspective. Analysts should clearly delineate the results from the 2 reference case perspectives and identify differences using the impact inventory (Figure 1). Analysts should consider the decision context when determining if one reference case perspective is to be presented in greater detail than the other. The discussion section of the journal article should address qualitative and quantitative differences between the 2 reference case perspectives. It is important to highlight the components of the impact inventory most affected by the condition or those that differ between the 2 perspectives.

For interventions that have substantial effects beyond the formal health care sector, such as those that address public health programs or children's health, it is important to highlight differences between the health care sector and societal perspectives. If a sector or consequence within a sector is identified but excluded from a cost-effectiveness analysis, analysts should provide a brief rationale in the accompanying text or in the "Notes on Sources of Evidence" section of the impact inventory. The impact inventory should be completed and reported for all analyses, even those restricted to the health care sector to highlight any effects or costs not fully addressed.

For all analyses, the impact inventory should identify the sectors affected and list the specific types of impacts within each sector. If the results in the societal reference case differ substantially from those in the health care sector reference case, all identified effects should ideally be quantified, valued if possible, and reported in the results section. Items in categories not estimated quantitatively should be named in the impact inventory and addressed in the discussion section, the technical appendix, or both. Analysts should initially consider the elements of the impact inventory as part of the design exercise for an analysis and then include the completed impact inventory in the journal article (or in the technical appendix if space limitations preclude inclusion in the journal report).

Reporting of Intermediate End Points and Disaggregated Results

Incremental cost-effectiveness ratios provide a concise summary of the results. The panel recommends that information on intermediate outcomes and disaggregated results should also be included in the journal article with more detail provided in the technical appendix. Intermediate outcomes such as diagnoses, test outcomes, health events, or hospitalizations provide readers with an opportunity to assess the effectiveness of the interventions in more familiar terms, and to compare the results with other analyses that may have used similar outcomes. The reporting of disaggregated results, which refers to the attribution of total costs or QALYs to specific categories, can help audiences understand the different magnitudes of economic and health consequences.

Interpreting Results for Decision Makers

Because few decision makers in the United States or elsewhere use strict cost-effectiveness thresholds for decision making, conclusions about the cost-effectiveness of an intervention should be framed with respect to the decision context and how the specific set of results can aid and inform decision making.[36] Comparison with 1 specific threshold should be avoided (unless appropriate for the decision context); analysts should instead highlight how clinical or policy recommendations might change with consideration of a range of thresholds.[37] Comparing cost-effectiveness results with those of similar interventions is also recommended. The discussion section of the journal article is the appropriate place to consider these issues.

Figure 2. Reporting Checklist for Cost-effectiveness Analyses

Element	Journal Article	Technical Appendix
Introduction		
Background of the problem		
Study Design and Scope		
Objectives		
Audience		
Type of analysis		
Target populations		
Description of interventions and comparators (including no intervention, if applicable)		
Other intervention descriptors (eg, care setting, model of delivery, intensity and timing of intervention)		
Boundaries of the analysis; defining the scope or comprehensiveness of the study (eg, for a screening program, whether only a subset of many possible strategies are included; for a transmissible condition, the extent to which disease transmission is captured; for interventions with many possible delivery settings, whether only one or more settings are modeled)		
Time horizon		
Analytic perspectives (eg, reference case perspectives [health care sector, societal]; other perspectives such as employer or payer)		
Whether this analysis meets the requirements of the reference case		
Analysis plan		
Methods and Data		
Trial-based analysis or model-based analysis. If model-based:		
Description of event pathway or model (describe condition or disease and the health states included)		
Diagram of event pathway or model (depicting the sequencing and possible transitions among the health states included)		
Description of model used (eg, decision tree, state transition, microsimulation)		
Modeling assumptions		
Software used		
Identification of key outcomes		
Complete information on sources of effectiveness data, cost data, and preference weights		
Methods for obtaining estimates of effectiveness (including approaches used for evidence synthesis)		
Methods for obtaining estimates of costs and preference weights		
Critique of data quality		
Statement of costing year (ie, the year to which all costs have been adjusted for the analysis; eg, 2016)		
Statement of method used to adjust costs for inflation		
Statement of type of currency		
Source and methods for obtaining expert judgment if applicable		
Statement of discount rates		
Impact Inventory		
Full accounting of consequences within and outside the health care sector		
Results		
Results of model validation		
Reference case results (discounted and undiscounted): total costs and effectiveness, incremental costs and effectiveness, incremental cost-effectiveness ratios, measures of uncertainty		
Disaggregated results for important categories of costs, outcomes, or both		
Results of sensitivity analysis		
Other estimates of uncertainty		
Graphical representation of cost-effectiveness results		
Graphical representation of uncertainty analyses		
Aggregate cost and effectiveness information		
Secondary analyses		
Disclosures		
Statement of any potential conflicts of interest due to funding source, collaborations, or outside interests		
Discussion		
Summary of reference case results		
Summary of sensitivity of results to assumptions and uncertainties in the analysis		
Discussion of the study results in the context of results of related cost-effective analyses		
Discussion of ethical implications (eg, distributive implications relating to age, disability, or other characteristics of the population)		
Limitations of the study		
Relevance of study results to specific policy questions or decisions		

Disclosure of Potential Conflicts of Interest

Disclosure policy for authors of cost-effectiveness analyses should follow the standards formulated by the International Committee of Medical Journal Editors.

Worked Examples

Within the full report of the Second Panel,[8] 2 new worked examples (one focusing on alcohol use disorders and another on end-of-life care) are included. These worked examples demon-

Table 2. Elements Recommended for Inclusion in a Structured Abstract for Cost-effectiveness Analyses

Element	Suggested Content
Objective	Succinctly state the research question specific to the analysis.
Interventions	List all interventions included in the analysis, including the comparators. Identify the time frame of the interventions.
Target population	Identify the age ranges, clinical characteristics, and other characteristics for all subgroups evaluated in the analysis.
Perspectives	Identify whether the analysis uses the reference case perspective and any alternative perspective presented.
Time horizon	Specify the time horizon for the analysis. This may differ from the time frames of the interventions and the comparators.
Discount rate	Specify the discount rate used in the analysis.
Costing year	Specify the costing year used in the analysis.
Study design	Describe whether this is a trial-based or model-based analysis. If it is a model-based analysis, briefly describe the model type (eg, decision tree, state transition, microsimulation, discrete event) and the size and characteristics of the simulated population. Indicate whether the analysis meets the reference case requirements.
Data sources	Describe the types of data used to derive inputs for the analysis (eg, primary data, secondary data from the published literature, administrative data, unpublished trial data).
Outcome measures	List primary and secondary outcome measures (eg, incremental cost-effectiveness ratio in dollars per quality-adjusted life-year, dollars per life-year, or dollars per clinical end point; total costs; total quality-adjusted life-years for a specified cohort; or population-level outcomes).
Results of analysis	
Base case	Briefly describe the results for the primary outcome measures, as well as the notable results for intermediate outcomes and disaggregated results (eg, deaths averted, hospitalizations averted, specific subcategories of costs). Identify any substantial changes in non-health-care-sector consequences.
Uncertainty	Briefly describe whether the results are robust to changes explored in the uncertainty analyses.
Limitations	Describe important limitations of the analysis such as controversial assumptions.
Conclusions	Summarize the key clinical or policy conclusions.

strate how to report results for both reference case perspectives, use of the impact inventory, sample methods for displaying cost-effectiveness analysis results, uncertainty analyses, sensitivity analyses, and examples of intermediate outcomes and disaggregated results.

Discussion

The goal of the Second Panel was to promote the continued evolution of cost-effectiveness analysis and its use to support judicious, efficient, and fair decisions regarding the use of health care resources. Comparability across cost-effectiveness analyses is highly desirable if the technique is to help decision makers evaluate tradeoffs. Inclusion of standardized components, and standardization of methods within a perspective, is intended to enhance consistency and comparability across studies.

Differentiating between the health care sector perspective and the societal perspective will provide more clarity to consumers of cost-effectiveness analyses than has been the case in recent years. The common practice of presenting an analysis from the health care sector perspective and labeling it a societal perspective has created the impression that these 2 perspectives are the same when they are not. Clarity about perspective is further emphasized by the recommendations that analysts should identify any specific decision maker whose decisions are intended to be influenced by the analysis, and conduct additional analyses from perspectives specific to that decision maker if those analyses will provide useful information. Many challenges remain, such as valuation of effects outside the health care sector and coordination with other methods already used to evaluate those effects, such as cost-benefit analysis. Addressing these challenges will continue to provide opportunities to advance the field of cost-effectiveness analysis.

These reporting recommendations highlight the reference case perspectives and delineation of the impact inventory. A review of existing reporting recommendations was conducted and included a discussion of the possible adoption of the Consolidated Health Economic Evaluation Reporting Standards (CHEERS)[38] for endorsement (one of the panel members and one of the leadership group were involved with the Delphi process for the CHEERS guidelines). However, specific reporting requirements for the reference case precluded the direct adoption of CHEERS or other available reporting guidelines. The recommendations from the Second Panel share many elements with the CHEERS recommendations, which, in turn, reflect elements of the original panel's recommendations.

Substantial attention has been focused on ethical issues in cost-effectiveness analyses, reflecting the importance of the topic and developments in the field. Consideration of the opportunity cost of an intervention is ethically justified. Without such consideration, decision makers would not know if there were better uses of the resources at hand. These recommendations also reaffirm the principles that cost-effectiveness analysis is not by itself a sufficient decision-making standard and that it does not capture all relevant concerns. Maximizing the total quantity of health benefits will rarely be the only concern for decision makers. Who receives the benefits—the distributive concern—also matters. Such decisions involve tradeoffs between effects and costs for some patients vs different effects and costs for other patients.

The use of QALYs in cost-effectiveness analysis raises possible ethical and other concerns. A key advantage of QALYs is that they reflect effects on both morbidity and mortality and provide a basis for broad comparisons of the health effects of various interventions and policies. But there are a number of disadvantages associated with the QALY framework. For instance, QALYs may not accurately reflect the burden of short-lived but intense experiences. Thus the benefits of interventions that reduce the incidence of such

experiences may be undervalued. Furthermore, in the standard approach to estimating QALYs, the QALYs gained due to an intervention that generates marginal gains for many people may be approximately equal to the QALYs gained by an intervention that generates substantial gains for a small number of people, yet society may favor the latter. Similarly, some have argued that treating those who initially experience highly impaired health is more valuable than treating those with good baseline health. These and other issues are explored further in the forthcoming book.

Numerous policy questions related to the use of cost-effectiveness analysis were considered. Even though cost-effectiveness analyses have been published widely in the United States, and have been used to inform policy in selected areas, the application of cost-effectiveness analysis has also encountered resistance. For example, the Medicare program is barred from considering cost-effectiveness analysis in its decisions about whether to pay for new therapies and diagnostics. Notably, the Patient Protection and Affordable Care Act[39] prohibited the Patient-Centered Outcomes Research Institute from developing or using a dollars-per-QALY metric as a threshold to establish what type of health care is cost-effective or recommended, and stated that the "Secretary shall not utilize such an adjusted life year (or such a similar measure) as a threshold to determine coverage, reimbursement, or incentive programs…."

Reasons for the resistance to cost-effectiveness analysis are likely multifaceted and complex but suggest an inclination on the part of many individuals in the United States to minimize the underlying problem of resource scarcity and the consequent need to explicitly ration care. Experience shows that when policy makers have incorporated cost-effectiveness analysis into decision-making processes, they have not applied it as the sole decision criterion.[40,41] In practice, multiple factors are brought to bear on resource allocation decisions. Cost-effectiveness is only 1 element among many, including patient's expectations; legal, ethical, equity, cultural, and political concerns; and pragmatic issues of logistics and feasibility. Most health organizations involved in resource allocation decisions give the greatest weight and deepest consideration to the clinical evidence. Cost-effectiveness analysis can play an important role, however, particularly when it is recognized that costs are effectively opportunities for health improvement that other patients forgo.

Updating the original panel's work provided an opportunity to reflect on the evolution of cost-effectiveness analysis and to develop guidance for the next generation of practitioners and consumers. Similar to any consensus panel, these recommendations reflect an effort by a selected group of individuals to achieve a sensible and workable arrangement. Other groups may have developed different recommendations.

Some key areas for future research include (1) the use of multicriteria decision analysis and group decision making; (2) the use of cost-effectiveness analysis in value-based pricing; (3) estimation of cost-effectiveness thresholds; (4) the link between cost-effectiveness analysis and incentives for innovation; (5) the role of cost-effectiveness analysis within health plans or guideline development; and (6) the effect of the 2 recommended reference case perspectives on the cost-effective analysis and its findings. The field would also benefit from further research on QALYs, including topics such as whether and to what extent respondents consider productivity effects in their evaluations of health states, the relationship of community preferences to patient preferences for different health states, the elicitation of preference scores for path states, the sequence of states that patients experience, and the methods for measuring health-related quality-of-life effects on family members of ill individuals (family spillover effects).

Conclusions

The Second Panel reviewed the current status of the field of cost-effectiveness analysis and developed a new set of recommendations. Major changes include the recommendation to perform analyses from 2 reference case perspectives and to provide an impact inventory to clarify included consequences.

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Author Contributions: Drs Sanders and Neumann had full access to all of the data in the study and take responsibility for the integrity of the data and the accuracy of the data analysis.
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Obtaining funding: Sanders, Neumann, Ganiats.
Administrative, technical, or material support: Neumann, Krahn, Ganiats.
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Conflict of Interest Disclosures: The authors have completed and submitted the ICMJE Form for Disclosure of Potential Conflicts of Interest. Dr Neumann reported serving on advisory boards for Merck, Bayer, Pacira, Novo Nordisk, Shire, Amgen, and the Congressional Budget Office; serving as a consultant to Boston Health Economics, Purdue, Vertex, and Precision Health Economics; and receiving funding from the CEA Registry sponsors. Dr Feeny reported having a proprietary interest in Health Utilities Incorporated, which owns the copyright to the Health Utilities Index. Dr Meltzer reported serving on a formulary committee for CVS. Dr Sculpher reported serving as a consultant on the methods of cost-effectiveness for various pharmaceutical and medical device companies. The Second Panel will not be receiving royalities from the book. No other disclosures were reported.

Funding/Support: Funding was provided by the Robert Wood Johnson Foundation and the Bill and Melinda Gates Foundation to support in-person meetings, the services of a medical editor (Rebecca Gray, DPhil), and research for 2 new worked examples (one focusing on alcohol use disorders and another on end-of-life care), which will appear in *Cost-Effectiveness in Health and Medicine*.[8] In addition, the panel received a conference grant from the Agency for Healthcare Research and Quality, which funded a 3-day in-person meeting in spring 2014 and parts of 2 subsequent meetings; support from the University of California, San Diego, Health Services Research Center, which funded part of the first in-person panel meeting; and in-kind support from the Society for Medical Decision Making.

Role of the Funder/Sponsor: The funders played no role in the design and conduct of the study; collection, management, analysis, and interpretation of the data; and preparation, review, or approval of the manuscript or decision to submit the manuscript for publication. Some material from this article and the complete report from the Second Panel on Cost-Effectiveness in Health and Medicine will appear in *Cost-Effectiveness in Health and Medicine*.[8]

Disclaimer: The individual contributions to this article are expressed in a personal capacity and are not presented on behalf of or as the views of the individual parties' employers.

Additional Contributions: We acknowledge the support and guidance of members of the original panel throughout the process of producing this update: Norman Daniels, PhD, Dennis G. Fryback, PhD, Alan M. Garber, MD, PhD, Marthe R. Gold, MD, David C. Hadorn, MD, PhD, MA, Mark S. Kamlet, PhD, Joseph Lipscomb, PhD, Bryan R. Luce, PhD, MBA, Jeanne S. Mandelblatt, MD, PhD, Willard G. Manning Jr, PhD, Kristine L. McCoy, MPH, Donald L. Patrick, PhD, Louise B. Russell, PhD (co-chair), Joanna E. Siegel, ScD, George W. Torrance, MBA, PhD, and Milton C. Weinstein, PhD (co-chair). We also thank Rebecca Gray, DPhil (Duke Clinical Research Institute, Duke University, Durham, North Carolina), for editorial assistance; Julie Lannon, BS (Center for the Evaluation of Value and Risk in Health, Institute for Clinical Research and Health Policy Studies, Tufts Medical Center, Boston, Massachusetts) for logisitical support; and David Kim, PhD (University of Washington, Seattle), and Ba' Pham, MSc, PhD (University of Toronto, Toronto, Ontario, Canada), for their efforts on the worked examples. The efforts of Dr Gray, Ms Lannon, Dr Kim, and Dr Pham were supported through the grant funding listed in the Funding/Support section. No other participants (including the panel members or leadership group) received compensation for their work on this project. We also acknowledge the following individuals who reviewed 1 or more chapters of the book, which provided the template for this summary report: Paul Barnett, PhD (VA Palo Alto Health Care System), Andrew Briggs, DPhil (University of Glasgow), Karl Claxton, PhD (University of York), Joshua T. Cohen, PhD (Tufts Medical Center), Phaedra Corso, PhD (University of Georgia), Michael Drummond, PhD (University of York), Nir Eyal, DPhil (Harvard University), Dennis Fryback, PhD (University of Wisconsin), William Furlong, MSc (McMaster University), Afschin Gandjour, MD, PhD (Frankfurt School of Finance and Management), Louis Garrison, PhD (University of Washington), Marthe Gold, MD (City University of New York), Dan Greenberg, PhD (Ben-Gurion University of the Negev), Scott Grosse, PhD (US Centers for Disease Control and Prevention), James Hammitt, PhD (Harvard T. H. Chan School of Public Health), Neil Hawkins, PhD, MBA (University of Glasgow), Mark Helfand, MD (Oregon Health & Science University), Don Husereau, BScPharm (Institute of Health Economics), Emmett Keeler, PhD (RAND), Paul Krabbe, PhD (University of Groningen), William Lawrence, MD, MS (Patient-Centered Outcomes Research Institute), Joseph Lipscomb, PhD (Emory University), Daniel Mullins, PhD (University of Maryland), Erik Nord, PhD (University of Oslo), James O'Mahony, PhD (Trinity College Dublin), Donald Patrick, PhD (University of Washington), Mike Paulden, MSc (Toronto Health Economics and Technology Assessment Collaborative), A. Simon Pickard, PhD (University of Illinois at Chicago), Michael Pignone, MD, MPH (University of Texas at Austin), Daniel Polsky, PhD (University of Pennsylvania), K. V. Ramanath, MBA (SAC College of Pharmacy), Dennis Revicki, PhD (Evidera), Mark Roberts, MD, MPP (University of Pittsburgh), Lisa Robinson, MPP (Harvard T. H. Chan School of Public Health), Steven Teutsch, MD, MPH (University of California, Los Angeles), George Torrance, PhD, MBA (McMaster University), Joel Tsevat, MD, MPH (University of Cincinnati), Todd Wagner, PhD (Stanford University), Evelyn Whitlock, MD, PhD (Patient-Centered Outcomes Research Institute), Milton Weinstein, PhD (Harvard T. H. Chan School of Public Health), John Wong, MD (Tufts Medical Center), and Beth Woods, MSc (University of York). We are grateful to several dozen individuals who commented on the publicly posted draft chapters during fall 2015.

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