

QUERI and the economics of implementation studies

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Abstract

BACKGROUND Decision makers need economic information when judging whether to adopt implementation programs. Cost-effectiveness analysis (CEA) is a well-developed method, but economic studies in implementation science are frequently marred by defects in methods or presentation. The field of implementation science is relatively new and still lacks guidance on how to carry out cost-effectiveness analyses of implementation projects. **METHODS** We enumerate the additional costs of implementation beyond those found in standard clinical trials and offer recommendations for selecting best practices for implementation. We introduce business case analysis (BCA) and contrast it with traditional CEA. Examples are provided from the VA Quality Enhancement Research Initiative (QUERI) program. **RESULTS** Traditional CEA and BCA differ fundamentally in time horizon and perspective. BCA provides information that is valuable to managers and should become a common adjunct to CEA of implementation programs. In the VA QUERI program, most economic studies conducted so far have focused on identification of best practices, the steps taken prior to implementation. Examples of QUERI implementation projects using both CEA and BCA include studies of depression treatment and HIV screening. **CONCLUSION** Economics should be considered throughout the process of implementation and regarded as part of the implementation strategy. Only highly cost-effective best practices should be part of implementation programs. It should become standard practice in implementation research to supplement traditional CEA with BCA.

Introduction

Quality improvement can prevent illness, slow the progress of chronic disease, avoid hospitalization, or reduce the length of hospital stays. Programs that implement quality improvements have the potential to be cost saving, yet most interventions that improve outcomes usually raise the total cost of care. A comprehensive review of economic evaluations of health care programs found that less than 11% of interventions reduce cost [1]. If few best practices are cost saving, then even fewer efforts to implement best practices will be cost saving, as the implementation program itself requires additional resources.

Managers must decide whether the benefit of an implementation program justifies its cost. There is general consensus about the appropriate methods of conducting cost-effectiveness analysis (CEA) [2] [3]. An advisory panel commissioned by the U.S. Public Health Service defined a standard method for U.S. researchers [3]. Known as the “reference case,” this method prescribes that health care innovations be compared to standard care, that all costs incurred by society over a lifetime time-horizon be counted, and that outcomes be valued in quality-adjusted life years (QALYs), a measure of morbidity-adjusted survival. Many cost-effectiveness studies have used \$50,000 per QALY as the threshold for judging new interventions as cost-effective [4], although there is justification for setting a much higher threshold [5].

An important advantage of a standard cost-effectiveness method is that different studies may be compared on an equal basis. When a standard method is used, the decision maker can compare interventions evaluated in different studies and know that results reflect genuine differences in the cost and value, not differences in methodology.

While CEA of clinical interventions has reached a comfortable middle age, cost analysis of implementation interventions is still experiencing growing pains. Grimshaw et al. [6] reviewed 120 economic evaluations of implementation programs as part of its systematic review of implementation interventions. They found significant shortcomings in methods or exposition in every case. These gaps must be addressed if cost-effectiveness is to become as widely accepted in implementation research as in clinical research.

This paper offers guidance to those who would undertake economic evaluation of implementation programs. Support and involvement of clinical and operations leaders have been identified as important determinants of implementation program success [7] [8]. Leaders' assessment of the feasibility and value of implementation programs requires more information than is provided in a traditional CEA. We argue that this need can be met with a business case analysis (BCA). We describe how economic analysts should respond to the unique features of implementation science when determining costs, creating decision-analytic models outside of the study, and conducting sensitivity analyses. We then describe the economic evaluations of the VA Quality Enhancement Research Initiative (QUERI) and conclude with recommendations.

Economic Evaluation in Implementation Research

Implementation programs consist of best-practice interventions and the implementation interventions designed to spread those best practices. For example, it is a best practice to give annual influenza vaccinations to persons with spinal cord injury. An implementation intervention to spread that practice could include physician education, electronic clinical reminders, or regular audit and feedback. The distinction between best practice interventions and implementation interventions is key because each aspect carries its own costs and benefits. Economic analyses must be designed to elucidate the costs and benefits of each and to present

this information in a way that clarifies what aspects of the implementation program are driving costs and outcomes.

A preliminary estimate of costs and benefits should be considered an essential element of implementation research. Economics must be considered at the outset, when the best practice is selected for an implementation intervention. The best practice must not only be cost-effective; it must be sufficiently cost-effective that when the additional expense of the implementation program is added, the total implementation program is likely to yield sufficient value.

Making a preliminary assessment requires a careful analysis of the patient population. Implementation interventions often seek to extend the benefit of a best practice to a subgroup of patients who may be refractory to treatment, have greater comorbidities, or have adherence problems. The best practice may be less effective among patients who do not meet the typical inclusion and exclusion criteria of clinical trials. Conversely the best practice may be more effective in particular subgroups but more expensive to deliver, for example due to greater severity or poor adherence. Subgroup analysis of trial data will provide important indications of likely cost and effect in different patient populations. Regardless of the population, the best practice must be highly cost-effective in the ideal group for an implementation program to have a reasonable chance of being cost-effective in a less select group.

Business Case Analysis

Health care managers in many organizations have made clear that short-term budget implications play an important role in determining whether a clinical intervention and associated implementation intervention are approved [9]. The cost and benefit impacts of a best practice

intervention and associated implementation intervention may be captured in a business case analysis (BCA).

Business case analyses have several noteworthy features. First, costs and benefits are tallied over a relatively short period, typically 1-5 years. The optimal horizon is the one of greatest interest to decision-makers. A second feature is the focus on provider's costs and benefits alone. Changes in patient-incurred costs such as copayments, deductibles, or home-based care expenses are not counted. Likewise, changes in patients' quality of life are not measured. A third aspect of business case analyses is that benefits are denominated in terms of money rather than in clinical units. This allows for straightforward calculation of the tradeoff between costs and benefits and enables the intervention to be treated as a potential investment, to be considered among competing uses for scarce finances. Nicholson et al. [10] illustrates the major methods, net present value (NPV) and return on investment (ROI), with hypothetical examples.

Identifying the Complete Cost of Implementation

Each stage in developing, disseminating, and initiating implementation of best-practice guidelines has a cost attached to it [6] [11]. We may delineate three separate components: engagement, other implementation activities, and the effect on health care utilization.

Implementation starts with engagement, the initial effort to persuade managers to undertake a program of implementing best practices. Engagement involves two parties, an advocate and a decision maker. Passive dissemination activities such as publishing journal articles or presenting findings at conferences are ordinarily considered research costs and are not counted as costs of engagement unless they would have been taken only because there was an active engagement effort.

The second element consists of direct costs of the implementation intervention strategy. It may feature a combination of elements presented all at once or in stages. Interventions aimed at providers may feature training, guidelines, audit and feedback, or electronic applications such as clinical reminders. Patient-oriented interventions could include telephone calls, mailed reminders, calendar stickers, written materials, and other forms of reminders and training.

In many cases the implementation begins with clinical and administrative staff time to tailor an existing implementation strategy to the new setting. The cost is sunk (unrecoverable) if it occurs prior to implementation. For example, programming an electronic clinical reminder would be considered a sunk cost: once done, its cost cannot be recovered if the implementation program does not begin or is stopped prematurely.

A unique consideration in implementation science is to identify the expected costs if the program is adopted elsewhere and used on a permanent basis. For example, in the initial implementation effort, outside trainers may be supported by research funding. If the program becomes permanent, internal staff must perform this job using operations funds.

The third source of costs is the effect of the best-practice intervention on health care cost. Implementation interventions are often aimed at encouraging utilization of a particular health service, for example, colorectal cancer screening, better diabetes monitoring, or preventive vaccines. Each of these services has a cost, and this cost may far exceed the cost of the implementation program itself. These costs may be offset by a reduction in future health care cost.

Decision Modeling and Sensitivity Analyses

Medical decision models are a common feature of cost-effectiveness analyses. Their purpose is to estimate the costs and benefits of a clinical intervention through the end of life, consistent with the lifetime horizon of standard CEAs.

Studies of implementation programs are of limited duration and do not include all patients who may ultimately be affected by an intervention. A medical decision model is usually needed to evaluate cost-effectiveness over the lifetime horizon of CEA and to model costs and outcomes in new populations or subgroups of the study population. A model can also be designed to estimate the costs and benefits of implementation at other facilities or in different settings. Consider an intervention that featured patient counseling on nutrition and exercise. In practice it would likely be provided by physicians in solo practices, by nurse practitioners or registered nurses at moderate-sized specialty practices, and by nutritionists at large multi-specialty practices, health maintenance organizations (HMOs), or in a federal system such as VA. The cost of implementation in these settings will reflect the differences in the cost of employing these professionals.

Modeling is a complex undertaking because costs and benefits can change over time for a variety of reasons [12] [13] [14]. Incorporating an implementation intervention to a best-practice intervention adds another layer of complexity. Not only are there extra costs to consider, but formative evaluation may lead to significant program changes over time with a resulting impact on cost. Formative evaluation attempts to discern which elements of an implementation intervention were most critical to adoption of a best practice [15]. This evaluation results in modification of the implementation program, which will likely affect cost.

With so many factors potentially changing, how can one devise a meaningful model? Sensitivity analyses can identify the factors that have the most influence on cost and cost-

effectiveness, and whether findings are robust to alternate assumptions. Discussions with clinicians and operations staff should reveal a relatively small set of likely alternatives for implementation. Since it is not possible to study all of these changes, modeling and sensitivity analyses can provide information about their consequences. For example, a model may test whether the additional benefit of better adherence justifies the cost of more intensive implementation.

Comparing Business Case Analysis and Cost-Effectiveness Analysis

CEA and BCA represent alternative and potentially complementary approaches to valuing an implementation program. This section contrasts them, revealing how the assumptions of each are likely to affect which types of best-practice and implementation interventions are found to be economically acceptable.

A fundamental difference between the two methods lies in their perspectives. BCA takes the provider's perspective and therefore counts only those costs incurred by the provider. CEA follows a societal perspective that values costs borne by the provider, the patient (including informal and formal caregiving at home), insurers and other payers. More detailed information on what is included and excluded under alternative perspectives is available in Luce et al. [16] and Barnett and Smith [17]. The more an intervention relies on the time of patients and their private caregivers, rather than the time of the provider, the less expensive that intervention will be in a BCA relative to a CEA.

A second major difference concerns the time horizon. CEA estimates costs and benefits over the patient's lifetime, whereas a BCA typically uses a time horizon of one to five years. To be cost-effective over a shorter period necessarily requires a faster payoff or a greater effect size. Some interventions that are typically cost-effective over a lifetime horizon may not be cost-

effective when the horizon is shortened to a few years. This can occur when costs accrue up front but benefits come much later, as for smoking cessation. Another cause is high start-up costs. There are often unrecoverable one-time costs in the early stages of implementation. BCA and CEA will ignore these sunk costs if similar expenses would not be required to extend the same implementation program to another population. If they would be required at other sites, however, then they will be counted. Over the lifetime horizon of a standard CEA the value of low to moderate sunk costs is likely to be close to zero when averaged over a large number of patient encounters. If sunk costs are high, they may actually make the intervention financially unattractive overall.

The methods also differ in their treatment of overhead (indirect) costs. A new program does not typically require a medical center to hire additional administrative staff in the short term. Over many years, however, managers have greater opportunities to shape administrative staffing patterns, and in some cases administration of the implementation programs will shift from operations staff to regular overhead departments. The impact of these changes can be considerable. In VA over 30% of hospital costs consist of overhead departments such as administration, research, and teaching [18].

Most costs beyond direct staffing are fixed in the short run, and thus a BCA must take current costs and organizational structures as given. The long-term horizon of a CEA allows the researcher to assume that all inputs are variable, including staffing, equipment and supplies, and land. The long-run marginal cost of the intervention – the cost of extending it to one additional person – can be different in the long run because inputs can be varied as necessary. Thus the cost of an implementation program in a BCA is much more reliant on the exact mix of staffing, equipment and supplies, and land that are present at the start of the intervention.

Economic Analysis in QUERI: Moving beyond Traditional CEA

The VA Quality Enhancement Research Initiative (QUERI) funds a portfolio of projects to develop guidance that facilitates efforts to make VA care more concordant with treatment guidelines. The implementation efforts of QUERI began with single-site pilot projects. They have now grown to multi-site studies, in some cases regional or national in scope. As more and more QUERI projects move into the implementation phase, assessing cost effectiveness has become a significant concern.

Economics has been an ongoing part of the QUERI program. Researchers with experience in health economics were engaged in the creation of QUERI in the late 1990s. Guidelines for QUERI economics research (www.herc.research.med.va.gov/files/MPDF_303.pdf) were developed by the VA Health Economics Resource Center (HERC) in 2004 as QUERI Centers progressed from single-site and small-scale studies to larger projects addressing operational implementation and system-wide acceptance. An economist member of the QUERI Research and Methodology Committee reviews implementation-study funding applications and annual progress reports from QUERI centers.

The designers of the QUERI program identified six steps in the design, implementation, and evaluation of quality improvement programs [19]. The first three QUERI steps involve selection of a best practice. The last three steps involve implementation.

The first step is to identify high-risk, high-volume health problems. The subjects of QUERI research were chosen in part because they offered the opportunity for substantial gains in quality-adjusted life years. The second QUERI step identifies best practices. Only practices that are deemed cost-effective by commonly accepted standards are considered for implementation. The third QUERI step considers whether there is sufficient variation from best practices to

justify intervention. This involves implicit judgments about the cost-effectiveness of potential implementation interventions supporting the clinical best practice.

Economic analyses have figured in more than 50 projects across all QUERI centers. Most QUERI economic analyses to date have occurred in the pre-implementation steps. They include reviews of the literature on costs and cost-effectiveness [20] [21], a cost-effectiveness analysis alongside a clinical trial [22], and a number of decision-analytic models that characterize cost and cost-effectiveness of best practices [23] [24] [25] [26].

There are only a few examples of economic evaluation of QUERI implementation efforts. This is not surprising, as it has taken many years to identify best practices and develop implementation programs. We now describe two QUERI economic evaluations that are undertaking economic evaluations, including business case analyses.

Collaborative Depression Care

The Mental Health QUERI center is conducting a program to implement the best practice of collaborative treatment for depression. The TIDES project (Translating Initiatives for Depression into Effective Solutions) implemented the model at seven locations in three regional networks (VISNs). This program was revised using formative evaluation and expanded into a larger regional (Phase III) version, labeled ReTIDES. This new program has been implemented at the original seven sites plus additional clinics in a fourth network. Data are being gathered for a reference case CEA to study the impact of the clinical intervention on patient outcomes. The staff are also analyzing system-level economic outcomes: the costs of engagement, shifts in funding allocation between primary care and specialty mental health clinics as a result of ReTIDES, and the cost of improving performance on VA-wide targets for depression care.

A nearly unique aspect of the TIDES economic evaluation is careful measurement of time spent on engagement. Costs included time spent writing and reading email messages, in telephone calls, and in face-to-face meetings. The staff also tracked the elapsed time between initial contact with local administrators and the kick-off date of collaborative care. The results revealed a considerable variation in elapsed time and staff time-costs [27].

The study team is also conducting a BCA. Using the perspective of a VA manager at the facility level, it is identifying the new costs attributable to the program, primarily the depression case managers, and the extent to which these costs are offset by reductions in other costs, including primary care visits for depression and depression-related somatic ailments, and reductions in appointment no-shows. The BCA will examine the effect of the TIDES program on performance standards for depression treatment. These standards are used by VA to evaluate managers.

HIV Screening

Staff of the HIV QUERI center participated in research showing that more widespread HIV screening is cost-effective [26]. Taking HIV screening to be a clinical best practice, the center is now attempting to improve HIV screening rates among VA patients through audit and feedback, provider activation, and removal of systemic barriers.

The HIV team is developing a business case analysis. It features a mathematical decision model that allows managers to input local costs, staff time, HIV prevalence, and anticipated effect sizes. Costs and outcomes from the ongoing implementation project will be used to validate a business case for improving HIV testing performance in VA. The intended audience for the BCA includes both VA network (VISN) managers and academic colleagues, and thus separate but overlapping presentations will be developed based on the interests of each group.

Conclusion

As implementation studies have become more common, attention has turned to assessing the costs and benefits of particular implementation interventions in conjunction with clinical best practices. A recent review revealed, however, that the economic analyses alongside implementation studies often have methodological shortcomings [6]. We believe this stems in part from a lack of guidance for researchers who are used to performing standard cost-effectiveness analyses. Economists in the VA QUERI program have been involved at every step of the implementation research process: identifying best practices, developing implementation strategies, designing economic studies, judging individual proposals, carrying out research, and disseminating findings. On the basis of these experiences, we conclude with several recommendations for researchers embarking on a cost-effectiveness analysis or business case analysis of an implementation research project.

Include economic evaluation from the outset

To provide an adequate evaluation, economic assistance should be obtained at the outset. Economic considerations affect the choice of best practice and the implementation strategy. An evaluation strategy needs to be designed before the implementation begins, as post hoc evaluation may not be possible. For example, it may be not be possible to measure the cost of engagement retrospectively.

Implement only highly cost-effective best practices

Implementation of a best practice will entail additional costs for implementation strategies and dissemination. Only highly cost-effective best-practice interventions will have a good chance of being cost-effective when all implementation costs are included. There is little

point developing an implementation program for a best-practice intervention that is only marginally cost-effective.

Go beyond traditional CEA

Although BCA and CEA have many notable differences, each could play an important role in supporting decisions about implementation programs. We therefore propose that economic studies of implementation use a two-pronged approach. The first is to develop a cost-effectiveness analysis according to standard methods, with special attention to the attributes that distinguish implementation projects from pre-implementation clinical trials. An economic evaluation of implementation has a broader audience and will be most useful when it extends beyond CEA to include a business case analysis. The BCA should provide managers with information on the short-term costs and benefits of the program from the payer's perspective.

Measure all implementation costs

The full cost of implementation includes engagement, additional implementation activities that coincide with a clinical trial, and the cost of the best-practice intervention. Each of these should be assigned an appropriate cost.

Model the full impacts and provide sensitivity analyses

Build a model and use sensitivity analyses to estimate the economic impact of adopting a combination of implementation and best-practice interventions under varying assumptions about practice patterns and input costs. Consider how the program might evolve and how costs and effectiveness might change over time and across locations.

Use economics in the formative evaluation

Make economics part of the formative evaluation. If initial estimates indicate that an implementation program is not cost-effective, consider whether a different intensity of

implementation is needed. Less intensive implementation may save cost, for example, by using lower-cost staff or by undertaking a less labor-intensive intervention. Conversely, higher intensity implementation may be needed to achieve sufficient adoption of the best practice to realize the full potential of cost offsets and health gains.

Use economic analysis as an implementation strategy

View economic analyses from the start as a tool for engaging managers in the spread of the best practice intervention. Design economic analyses to reflect the needs of end users at a variety of levels. Policymakers at local, regional, and national levels are likely to view cost burdens differently and may have differing thresholds for cost-effectiveness. Plan and develop all needed cost elements with them in mind, as well as the elements that are needed to conduct a reference-case CEA. As Prosser et al. [9] note, clinicians and managers have many doubts about CEA and its place in their decision-making. Education about CEA will be key to overcoming uncertainty.

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Both authors participated in the conception, drafting, and revising of the manuscript.

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The authors declare that they have no competing interests.

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