ISPOR Distance Learning Program Module:
“Cost-Minimization (CMA) / Cost Consequence Analysis”

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Cost-Minimization Analysis (CMA)

Welcome to the Cost-Minimization Analysis / Cost-Consequence module of the ISPOR Distance Learning Program.

Learning Objectives

By the conclusion of the Cost-Minimization Analysis (CMA) / Cost-Consequence (CC) module, you will be able to:

- state the role of cost-consequence/cost-minimization analysis in medical decision making; contrast the price of a drug product and the cost of drug therapy; define the components of cost-consequence and cost-minimization analysis;
- understand the computations involved in cost-consequence/cost-minimization analysis;
- understand the concerns in attribution of cost components to a particular treatment arm; summarize the resources used in a therapy or service and assign monetary values to those resources; analyze the value for money from health technologies; use and apply sensitivity analyses and discounting techniques in cost-consequence and cost-minimization analysis; and lastly, explain how point of view and perspective affect cost-consequence and cost-minimization analysis.
Benefits from PE Analysis of Health Care Programs

There are multiple benefits that can be derived from pharmacoeconomic analyses and outcomes assessment. These include: intangible benefits (the value of health per se to individual consumers); the avoidance of future health costs; increased productive output due to improved health status; and the use of evidence-based medicine to make the best choices for the population and individual consumers.

Outcomes Assessment and Pharmacoeconomics

Pharmacoeconomic analyses or cost-effectiveness analyses are used for outcomes assessment to determine the end result of the use of health care technology. In cases where there are finite societal resources that require consideration of opportunity costs. Opportunity costs are the value of alternative uses of those resources. So for example, an opportunity cost might be what would be the cost of attending this lecture versus watching a show on TV – what would you get more out of? Depends what the show is I suppose. Health care reform has required methods to evaluate economic and societal value of goods and services, and therefore, pharmacoeconomics is used to evaluate value for money expended on health care technologies.

Objectives of Pharmacoeconomics

The objectives of pharmacoeconomics are to apply economic principles to drug therapy interventions – that is, to prevention and/or cure associated with these different interventions; to conduct research that identifies, measures, and compares the costs – that is, the resources consumed and the consequences of pharmaceutical products and services. This research is meant to improve individual and public health outcomes. In addition to providing for more rational decision making, in terms of formulary management, medication choice and system resource allocation.

Steps in Evaluating Type of Analysis

To evaluate health care technologies, we first have to determine what type of analysis will be performed. To do this, we have to determine the efficacy or effectiveness of the therapies or health care technologies to be evaluated. Efficacy is that which occurs under optimal circumstances, such as during a randomized controlled trial. In contrast, effectiveness of a therapy is that which occurs under usual used circumstances once a drug or device is in the public domain and in general use. A further concept is that of efficiency which incorporates elements of cost into the picture. A cost-effectiveness analysis or CEA is a comparison with an alternative therapy or therapies that requires consideration of costs, as well as specification of perspective, timeframe, effectiveness metric or measure, discount rate and assumptions. Varies disease endpoints that are affected by therapy such as risk markers, disease severity and death can be assessed by corresponding indices of therapeutic outcome such as millimeters of mercury blood pressure reduction, hospitalizations averted and life years saved, respectively.

Questions

The questions we are evaluating in a cost-effectiveness or pharmacoeconomic analysis include: is the treatment effective? What will it cost? How do the gains compare with the costs? Typically, one chooses the option with the
least cost per unit of measure gained. This is represented by the ratio of the cost to the effectiveness, shown here as “C” colon “E” and is called a cost-effectiveness analysis.

Types of Pharmacoeconomic Analysis

There are different types of pharmacoeconomic analyses based primarily on the unit of effectiveness. Cost-minimization analysis is used to assess therapies that have equivalent outcomes. So in effect, the denominator is inconsequential or not present. An example of use of this type of analysis is with equal potent antihypertensive agents. This type of analysis may be presented as a cost-consequence representation in which cost factors are presented individually rather than aggregated. Cost-benefit analysis measures benefit in monetary units. CBA may be thought of as the yield of an investment. There are three general approaches to the monetary evaluation of health outcomes: human capital, revealed preferences, and willingness-to-pay. The human capital approach for example, measures the value of an individual’s contribution to society via his or her earning capabilities discounted to a present value where the individual’s contribution is based on a salary or wage. However, this type of analysis is often not performed because it is difficult to value a life. Cost-effectiveness analysis measures benefit or effectiveness in terms of units, such as life year saved or complication-free episodes. And lastly, Cost-utility analysis incorporates a utility or quality of life adjustment into the effectiveness metric.

Definition

Cost-Minimization Analysis is a pharmacoeconomic tool for comparing all relevant costs and consequences of two or more therapeutic interventions that are equivalent. The objective is to choose the least costly alternative among equivalent or equally efficacious alternatives.

Definition (cont’d.)

Cost-Minimization Analysis aggregates all of the components into a total cost, whereas cost-consequence analysis disaggregates all of the costs and effects. Because the unit of measurement is discrete, and familiar to clinicians, CCA’s disaggregated approach to listing each component of the analysis separately may be easier to interpret than cost-effectiveness ratios. A disadvantage to the CCA approach is that it may be difficult for the decision-maker to consider so many individual numbers simultaneously, rather than one integrated value. Thus, the two approaches may be complimentary. Indeed, cost-consequence analysis may allow the decision-maker to delve into the drivers for the numerator and denominator of a cost-minimization analysis.

Direct and Indirect Cost

The components of a pharmacoeconomic or cost-effectiveness analysis include costs and consequences. Costs can be divided into direct and indirect costs. Direct medical costs are those related to providing medical services, such as a hospital stay, physician fees for outpatient visits, drug costs, and costs of adverse events, including the cost of the medication itself and any downstream adverse events that may arise as a result of drug administration. Direct nonmedical costs are those related to expenses such as transportation costs that are a direct result of the illness. Direct costs are most frequently included in a cost-effectiveness analysis, whereas indirect costs, those associated with changes of individual productivity are often not included in a cost-effectiveness analysis because they are difficult to obtain. Examples of indirect costs are lost time from work or absenteeism, and unpaid assistance from a family member. Lastly, intangible costs, such as pain and suffering, may be included in the analysis.
Effect of Perspective on Inclusion of Costs and Resources

The societal perspective typically includes indirect, as well as direct costs because these are costs to society, that is, as previously mentioned, lost time from work. The payer perspective typically includes only direct costs. Analyses may be done from one or several perspectives.

Consequences

Consequences are the denominator of the equation may be measured in terms of monetary benefits, effectiveness, such as years of life saved, hospitalizations averted, complication-free episodes, and the like. They may also be measured with the incorporation of utilities yielding quality-adjusted life years or QALYs.

Discounting

Future costs and effects are discounted to reflect the fact that in general, individuals and society have a positive rate of time and preference — that is, in general, they prefer desirable consequences to occur earlier and undesirable consequences to occur later. Thus, future benefits are discounted to reflect the fact that they are worth less simply because they occur in the future rather than now. Similarly, future costs are discounted to reflect the fact that we prefer them to accrue in the future rather than the present when the program extends over multiple years. The equation used to determine discount rate is seen here, where PV is present value, FC is future costs and DF is the discount factor which is dependent on the number of years into the future that expense is incurred characterized by N and the discount rate or R.

Sensitivity Analysis

Sensitivity Analyses are completed to test the feasible range of values for key variables in an analysis. This examines the robustness of the analysis in that if small changes in the values of key variables cause a decision to change the results, and therefore the usefulness of the analysis may be suspect.

Steps to CMA

To enable one to perform a cost-minimization analysis, we have to first determine if the interventions are therapeutically equivalent, and if so, establish equi-effective doses so that we derive a cost for an apple versus an apple, so to speak.

Example

An example for the need for cost-minimization analysis would be to comparing the branded and generic versions of the same product, a comparison of a different route of administration of the same drug, or use of the same drug in two different settings, such as in the use of total perennial nutrition in the hospital versus at home.

Specifics

Other specific examples might be oral or injectable antibiotics having similar outcomes, in terms of treatment success or failure, or the evaluation of equal potent doses of antihypertensive agents.
Examples

One factor causing patient compliance to diminish may be adverse events, thereby reducing the efficacy of an agent.

Differential Outcomes

Other types of pharmacoeconomic evaluations are necessary when outcomes are measured along a continuum or quantitatively. For example, if we are comparing non-equal potent doses of a beta blocker with a calcium channel blocker in the treatment of hypertension, the effectiveness or outcomes measured may be millimeters of mercury decrease in blood pressure.

Antibiotics

This study that we completed several years ago illustrates the use of cost-minimization analysis in a comparison of antibiotics used to treat patients with lower respiratory tract infection or LRTI, which is defined as pneumonia, or acute exacerbation of chronic bronchitis.

LRTI

In this study, since the populations were comparable, with respect to age, infecting organism, severity of illness, response rates, and the clinical outcomes elicited for each study, data from the 12 randomized controlled trials comprising a total of 2,377 patients were polled and analyzed. 1,102 patients had acute exacerbation of chronic bronchitis or AECB, 591 had pneumonia, 201 had either, and 483 had sinusitis. Only safety, that is, adverse event data, were taken from the sinusitis trials. The antibiotics compared were, amoxicillin/clavulanate, ampicillin, cefaclor, cefixime, cefuroxime, clarithromycin, and erythromycin.

Outcomes

Costs that were evaluated were those required to achieve a clinical response, the cost of the medication, and the costs of adverse events, or AEs. The results ranged from $137 to $267 for the total cost of each antibiotic, which encompass costs of all of these components. We also evaluated cost-effectiveness as complication-free cure or cost for a cure, without an adverse event, but for the purposes of this cost-minimization analysis module, we will focus on cost only.

Potential Clinical Response Outcomes

Potential Outcomes that we considered for clinical response included success, failure, relapse, recurrence or indeterminate response. We also looked at the need to switch to another antibiotic due to lack of total success.

Assumptions

Since the study did not specify, we assumed that patients responding to antibiotic therapy required 2 clinic visits, whereas those who experienced a treatment failure, relapse, or recurrence, required 3 clinic visits and a switch to
second generation cephalosporin, such as cefaclor. We further assumed that patients who were switched to another agent were treated successfully with the new agent.

**Adverse Events**

For adverse events that could be treated on an outpatient basis and not require discontinuation of the antibiotic, the costs included those for one clinic visit or telephone call, and the medications required for symptomatic relief. If the adverse event could be managed as an outpatient, but required discontinuation of the antibiotic, the costs of a course of the second generation cephalosporin was added to those for the office visit or telephone call and additional medication costs. Costs for hospital-managed adverse events included the cost of hospitalization, cost of medications required to manage the adverse event and the cost for a course of an orally-administered second-generation cephalosporin.

**Discounting**

Neither costs nor benefits were discounted since this was not a multiyear analysis.

**Sensitivity Analyses**

We used sensitivity analyses to test the stability of our results to changes in costs and outcomes, that is, we varied values for key variables over clinically feasible ranges. In particular, we focused on the effects of altering resistance rates, incidence rate of atypical organism, and acquisition costs of the antibiotics since we felt that these would be of most likely of interest to the payer, a managed care organization.

**Implications**

10 to 30% of patients developed adverse events, which contributed in average of $41.08 per patient in additional care costs. 7% of patients required hospitalization due to adverse events. And the costs for adverse events comprised the second largest proportion of cost factors in this analysis.

**Summary**

In summary, cost-minimization analyses are appropriate where the two therapies being compared are considered equal in efficacy and safety. Although ideally, clinically equivalent should be based on well conducted equivalence studies, in reality, it is often taken from superiority trials that failed to show any significant difference.

**Summary**

Although on the surface cost-minimization analysis appears to be most straightforward of the four common types of economic analysis, careful consideration must be given to establishing equi-effective dose, the appropriate comparator and the inclusion of costs other than drug therapy alone. Although I refer to drug during many instances throughout this module, these types of analyses apply equally to devices, and even to therapeutic pathways.

Thank you for your attention to this module. A list of references follows.