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3 Pharmacoeconomic Evaluations

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Abstract

Cost analysis and cost-outcomes analysis are essentially two types of health economic analyses for pharmacoeconomic evaluations. Cost analysis includes cost of care, while cost-outcomes analysis includes cost-effectiveness, cost-utility, cost-benefit, cost-minimization, and cost-consequence analysis. The different methodologies for cost-outcomes analysis are essentially similar in that the endpoint is a ratio of the costs and outcomes. They differ in the way the outcomes are expressed.
Cost-Effectiveness Analysis (CEA) is the most common type of pharmacoeconomic analysis and compares two alternative treatments for a given condition in terms of their monetary costs per unit of effectiveness. The effectiveness of many medical treatments can be expressed by placing a value on the quality of life, and this can be obtained through the number of Quality-Adjusted Life-Years (QALYs). QALYs are very suitable as measure of health outcome since they simultaneously capture gains from reduced morbidity and reduced mortality. The measurement of humanistic endpoints, such as quality of life, in medicine is based on questionnaires.

3.1 Introduction

There are essentially two types of health economic analyses: cost analysis and cost-outcomes analysis.

In cost analysis, only the costs of providing healthcare products or services are considered, without regard to the outcomes experienced by the patient or providers. In a cost-outcomes analysis, the endpoint of the analysis is a ratio of the costs of providing healthcare and a measure of the outcomes of the care. The main types of analysis are listed in Table 3.1.

[1] The paragraph about multicriteria decision analysis was revised by Lucia Sara D'Angiolella, Fredrik Olof Laurentius Nillson, and Gabriel Tremblay

Method of analysis	Cost measure	Outcome measure
Cost analysis		
Cost of care	Currency	N/A
Cost-outcomes analysis		
Cost-effectiveness	Currency	Natural units, e.g., life-years saved
Cost-utility	Currency	Quality-adjusted life-years or other utility
Cost-benefit	Currency	Currency
Cost-minimization	Currency	Natural units or utilities
Cost-consequence analysis	Currency	Direct resource use (i.e., physician visits, hospital days, drug treatment, and paid caregiver time), indirect resource use (i.e., patient and family caregiver productivity loss, work time loss), and clinical or natural units (i.e., life expectancy and quality of life)

Table 3.1. Common pharmacoeconomic analyses and methodologies [Mauskopf, 1998; Campbell, 2014; Kalsi, 2006; Edwards, 2015; Al, 2010; Burri, 2013].

3.2 Cost Analysis

Cost of Care

A cost of care analysis is an enumeration of the healthcare resources consumed—in this case drugs, pharmacy services, etc.—and the dollar costs of providing care to a given patient population over a given time period. The outcomes resulting from the care are not considered.

Cost of Illness and Burden of Illness

A cost of illness analysis normally falls under the umbrella of outcomes research rather than of pharmacoeconomics. In classical cost of illness analysis, the total cost that a particular disease imposes on society is expressed as a single dollar amount. The costs of providing care for the illness (including drug therapy), the value of the lost productivity, and the monetary cost to society of premature death might be included in the calculation. In recent years, the classical cost of illness analysis has metamorphosed into the burden of illness analysis, which in essence is the same thing except that the emphasis is placed on the more tangible component costs rather than on an aggregate dollar figure. Thus, the total direct medical costs of treating an ill-

ness, the number of deaths, hospitalizations, lost work days, etc., are the variables of interest in a burden of illness analysis. The most infamous measure of cost of illness and burden of illness analysis is to be found in the opening paragraph of many medical economics articles, where future projections of the societal impact of the disease in question are delivered for their rhetorical effect [Jakovljevic, 2016].

3.3 Cost-Outcomes Analysis

The different methodologies for cost-outcomes analysis are essentially similar in that the endpoint is a ratio of the costs and outcomes; they differ in the way the outcomes are expressed (Table 3.1).

Cost-Effectiveness

Cost-Effectiveness Analysis (CEA) compares two (or more) alternative treatments for a given condition in terms of their monetary costs per unit of effectiveness. The unit of effectiveness can be any "natural" unit—e.g., percent

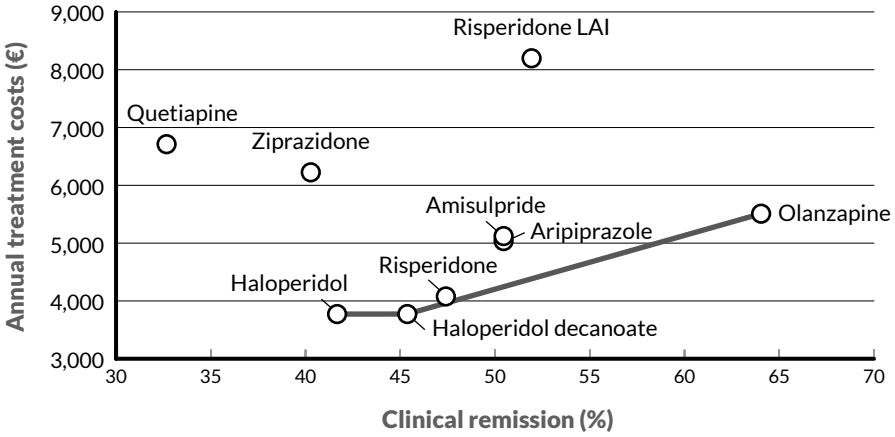

Figure 3.1. Annual cost of antipsychotic treatment strategies versus percent clinical remission. Scatter plot using data of Obradovic et al. [Obradovic, 2007]. The line connects drugs that lie on the "efficient frontier" of least cost for any degree of effectiveness.

LAI = long-acting injectable

lowering of LDL-C, major coronary events, number of lives saved, or years of life saved. The units of cost (currency and year) and effectiveness must be the same for the treatments compared. Cost-effectiveness analysis is used to decide among two or more treatment options. The definition of "cost-effectiveness" is discussed in more detail below.

The cost-effectiveness ratio may be given as a single number, but it may be more illuminating to present cost-effectiveness data graphically as a plot of costs versus effects.

Figure 3.1 shows a plot of the annual costs of treating schizophrenia with different antipsychotic treatment strategies (i.e., medication, ambulatory visits, hospitalization, and adverse event costs) versus the effects of antipsychotic treatment (expressed as clinical remission). The line connecting haloperidol, haloperidol decanoate, and olanzapine represents the "**efficient frontier**" that includes strategies not eliminated by absolute or extended dominance. Absolute dominance occurs when a treatment is both more effective and less costly than the alternative (e.g., quetiapine and ziprasidone are absolute dominated by haloperidol). Extended dominance occurs when a treatment is less effective and has a higher incremental cost-effectiveness ratio than the alternative (the slope of the line connecting two strategies). All strategies more effective than haloperidol decanoate and above the efficient frontier are extendedly dominated by olanzapine.

Decision Analysis

Decision analysis provides the basic framework for cost-effectiveness analysis, which is the most common type of pharmacoeconomic analysis. Decision

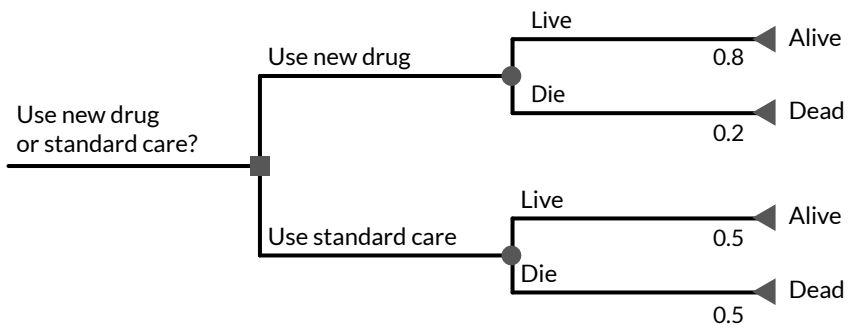

Figure 3.2. Hypothetical decision tree. The tree consists of branches (lines) and nodes: a decision node (square), chance nodes (circular), and terminal nodes (triangular).

analysis is a systematic, quantitative approach to assess the relative value of one or more alternatives.

The basis of decision analysis is the decision tree. Figure 3.2 illustrates the components of a decision tree: nodes (decision, chance, and terminal) and branches. A series of chance nodes and branches connect a decision node with terminal nodes, which represent the outcomes of interest in the analysis. The tree is structured from left to right. The tree in Figure 3.2 begins with a decision node and two branches representing alternative courses of action, i.e., to use either a new drug or standard care to treat disease X. Both courses lead to a chance node that diverges into branches representing the possible outcomes of survival or death following treatment. These branches end in terminal nodes, representing the outcomes of interest in this decision analysis, i.e., life or death. Chance nodes identify points at which two (or more) possible events may occur. Which event will occur cannot be predicted with certainty, and so the chance nodes are associated with a probability for each emergent branch.

In this case, the probability of survival following treatment with the new drug is 0.8 and the probability of death is 0.2; these probabilities must sum to unity and the branches exiting the chance node must exhaust the possible outcomes. Following standard care, the probabilities of surviving and dying are both 0.5.

In this explanatory example, it is easy to see that the new drug is superior to standard care in terms of the number of surviving patients.

Definition of Cost-Effectiveness

Decision trees such as the hypothetical example shown in Figure 3.2 are a basic step in cost-effectiveness analysis. Suppose that in the example shown in Figure 3.2 the cost of providing the new drug therapy to 100 patients was $1,000.

This includes the cost of the new drug and the cost of the physician's services for diagnosing the condition and prescribing the treatment. Since 80 of the 100 patients given the new drug lived, the cost-effectiveness ratio is $1,000 divided by 80, or $12.5 per life saved. This ratio is referred to as the average cost-effectiveness ratio.

The cost-effectiveness ratio of interest is not the average cost-effectiveness ratio but the Incremental Cost-Effectiveness Ratio (ICER) of the new drug relative to standard care. Suppose that, in the example shown in Figure 3.2, the cost of providing standard care to 100 patients was $300. Standard care is thus less costly than the new drug, but also less effective. The incremental cost-effectiveness of the new drug relative to standard care is the difference in costs divided by the difference in effects.

$$ICER = \frac{\Delta C}{\Delta E} = \frac{C_{new\ drug} - C_{standard\ care}}{E_{new\ drug} - E_{standard\ care}}$$

In this case, the difference in costs is $1,000 minus $ 300, or $ 700, and the difference in effects is 80 minus 50 lives, or 30 lives. The incremental cost-effectiveness ratio is thus $700 divided by 30, or $23.33 per life saved.

The ICER has to be always compared to a pre-specified Willingness To Pay (WTP) threshold λ, i.e., the new drug is preferable to the standard care if ICER < λ. The threshold λ is country- and disease-specific, generally [Shiroiwa, 2010].

Net Monetary Benefit

Given a WTP threshold λ, the net monetary benefit of a pharmacoeconomic intervention (e.g., a new drug) that provides a benefit E with a cost C is defined as:

$$NMB = E \times \lambda - C$$

If two drugs are compared, drug a is preferable to drug b if $NMB_a > NMB_b$ or equivalently ΔNMB > 0. Using the example described in Figure 3.2 with a threshold λ of $ 1,000 per life saved, the NMB of the new drug is 80 × 1,000 − 1,000 = 79,000, while the NMB for the standard care is 50 × 1,000 − 300 = 49,700.

Mathematically, the decision rule based on ICER (ICER = ΔC/ΔE < λ) is equivalent to that based on NMB (ΔNMB = ΔExλ − ΔC > 0). However, ICER, by definition, has an incremental nature and it can be used only for pairwise comparison, while NMB can be calculated for a single treatment in absence of any comparison or can be used for ranking more than two treatments.

3.4 Multicriteria Decision Analysis

Multi-Criteria Decision Analysis (MCDA) methods has been promoted as an alternative approach to monetary economic valuation for supporting complex decision-making situations with multiple and often conflicting objectives that stakeholder groups and/or decision-makers value differently [Saarikoski, 2016]. Generally, the decision is made by multiple individuals with different preferences and needs [Frazao, 2018].

The MCDA process can be summarized into 3 phases:

1. Defining the decision problem;
2. Selecting the criteria that reflect relevant values;
3. Constructing the performance matrix, i.e., an assessment of each technology considered against each of the criteria included in the analysis, using descriptive information as number of deaths, targeted age group, or QALY (Table 3.2 in the example).

For each criterion, stakeholder's preferences are translated into a score (e.g., between 0 and 100) [Baltussen, 2019], and relative importance of criteria are measured according to criterion weights. Typically, scores are multiplied by the relative weight of that criterion and summed up to obtain an overall value for each technology. Technologies are ranked on the basis of this overall values.

More sophisticated statistical models can be used to elicitate preference and take into account uncertainty.

Example: MCDA in Communicable e Non-Communicable Disease

We refer to the example developed by Baltussen and Niessen [Baltussen, 2006], which considers four interventions that can be relevant in policy making. For each intervention, the Authors valued four criteria: Cost-effectiveness, severity of disease, whether a disease has greater prevalence

Technologies	Criteria			
	Cost-effectiveness	Severity of disease*	Greater prevalence among the poor	Age
Antiretroviral treatment in HIV/AIDS	€200 per QALY	****	Yes	≥ 15 years
Treatment of childhood pneumonia	€20 per QALY	****	Yes	0-14 years
Inpatient care for acute schizophrenia	€2,000 per QALY	**	No	≥ 15 years
Plastering for simple fractures	€50 per QALY	*	No	Any

Table 3.2. Performance matrix. Adapted from [Baltussen, 2006].

* The severity of disease is measured over a 4-star scale (4 stars indicating the greatest severity of disease).

QALY = Quality-Adjusted Life-Year

Technologies	Scoring per option				Total score
	Cost-effectiveness	Severity of disease*	Greater prevalence among the poor	Age	
Antiretroviral treatment in HIV/AIDS	50	100	100	0	70
Treatment of childhood pneumonia	100	100	100	100	100
Inpatient care for acute schizophrenia	0	50	0	0	5
Plastering for simple fractures	100	25	0	50	47.5
Relative importance of each criterion	40%	10%	40%	10%	

Table 3.3. Scoring per option. Adapted from [Baltussen, 2006].

*The severity of disease is measured over a 4-stars scale (4 stars indicating the greatest severity of disease).

among the poor, and age. The resulting preference matrix is presented in Table 3.2.

The expected consequences of each option are assigned a numerical score reflecting the strength of preference scale of each option for each criterion (Table 3.3).

In the example:

1. Preference score for "cost-effectiveness" is 0 if higher than 300 euro per QALY, 50 if between 100 and 300 euro per QALY, 100 if below 100 euro per QALY;
2. "Severity of disease" is scored between 0 and 100 proportionally to the number of stars;
3. "Prevalence among poor" is scored 100 if "yes", 0 otherwise;
4. Preference score for "age" is 100 if the technology involves pediatric population, 0 otherwise.

The relative importance of each criterion is estimated on the basis of group discussion, for example, and weights are calculated to sum up to 100%.

Finally, the technologies are ranked according to the total score, "Treatment of childhood pneumonia" resulting the first preferred technology according to all the criteria included in the analysis.

Cost-Utility

A Cost-Utility Analysis (CUA) is performed in the same way as a cost-effectiveness analysis except that the unit of effectiveness is Quality-Adjusted Life-Years (QALYs) or another measure of utility. Consider that the outcome of a treatment may be a prolonged life but with a degree of disability, or a reduced probability of disability without prolongation of life. The value or "utility" that individuals or society place on different life outcomes can be quantified using a number of techniques.

Since the endpoint is in practice always expressed as cost per quality-adjusted life-year saved, cost-utility analysis can, in principle, be used to compare not just alternative therapies for the same disease but therapies for different diseases, and rankings of the cost-utilities can be drawn up. Such rankings can be useful in selecting policies when, for example, a government wants to choose among installing highway guard rails, hiring additional food inspectors, or vaccinating seniors for flu.

An example of cost-utility analysis is provided in Chapter 4.

Cost-Minimization

A cost-minimization analysis is a cost-effectiveness analysis in the special case in which the effectiveness of the treatments is the same. Once the effectiveness (expressed in whatever natural units are appropriate) has been determined to be equivalent for the alternative treatments, it is not considered further and the analysis focuses entirely on the costs, with the aim of determining which treatment minimizes costs. A cost-minimization analysis is, in effect, a cost-of-care analysis in which alternative treatments are compared. Unlike a true cost-of-care analysis, however, the outcomes are taken into account and must be shown to be equivalent.

Cost-Benefit

Like cost-effectiveness analysis, cost-benefit analysis compares the costs and outcomes of alternative therapies; unlike cost-effectiveness analysis, however, the outcomes in a cost-benefit analysis are expressed in monetary

terms. For example, the outcome of the treatment in question is first expressed in terms of life-years saved or quality-adjusted life-years saved, and this is then translated into an equivalent monetary amount under the human capital approach. This amount is the present value of a person's lifetime productivity [Grossman, 1972; Jakovljevic, 2020]. Since both the costs and the effects of the treatment are expressed in the same (monetary) units, they can be directly compared. Any cost-benefit ratio of less than 1.0 is cost-beneficial. A ratio of 1:6 means that one receives $6 of value for $1 of investment.

Cost-Consequence Analysis

A particular and more complex type of cost-outcomes analysis, which encircles a variety of outcomes and costs, is cost-consequence analysis. This kind of analysis is useful for that decision-maker that has a narrower or broader perspective and needs flexibility to assess and evaluate those outcomes and costs that are of particular relevance to his/her perspective.

3.5 Utility

The effectiveness of many medical treatments can be expressed in terms of prolongation of life, e.g., as the (average) number of years of life saved. Some treatments, however, may prevent a worsening in the quality of life without actually extending it. Similarly, a treatment may extend life but with the presence of significant disability that reduces the quality of life. These situations are dealt with by placing a value on the quality of life, i.e., its utility.

The utility of normal health is given a value of 1, while the utility of not being alive is set at 0; a state of reduced health has a value between 0 and 1. This utility (U) is multiplied by the number of years of life (Y) associated to the treatment in order to arrive at the number of QALYs:

$$QALY = Y \times U$$

QALYs are very suitable as measure of health outcome since they simultaneously capture gains from reduced morbidity (quality gains) and reduced mortality (quantity gains). Figure 3.3 displays individual's health-related quality of life deterioration with and without intervention. QALY gained is represented by the gray area between the two curves that can be divided

into two parts: area A is the amount of QALY gained due to quality improvement and area B is the amount of QALY gained due to quantity improvement.

A related concept is the Disability-Adjusted Life-Year (DALY). The DALY was developed to quantify the burden of disease and injury on societies (as in the Global Burden of Disease Study [Murray, 1997]) and represents the reduction in the number of years of life due to disease, weighted by the quality of life due to the presence of the disease. The DALY is obtained from the sum of two components: Year of Life Lost (YLL) and Years Lived with Disability (YLD) at the population level, hence reflects the burden of disease in the population [Jakovljevic, 2021].

3.6 Psychometrics

The measurement of humanistic endpoints, such as quality of life, in medicine is based on questionnaires (see also Chapter 6). While a simple questionnaire might collect descriptive data such as the respondent's gender, favorite color, etc., the questionnaires used in the health sciences are grounded in

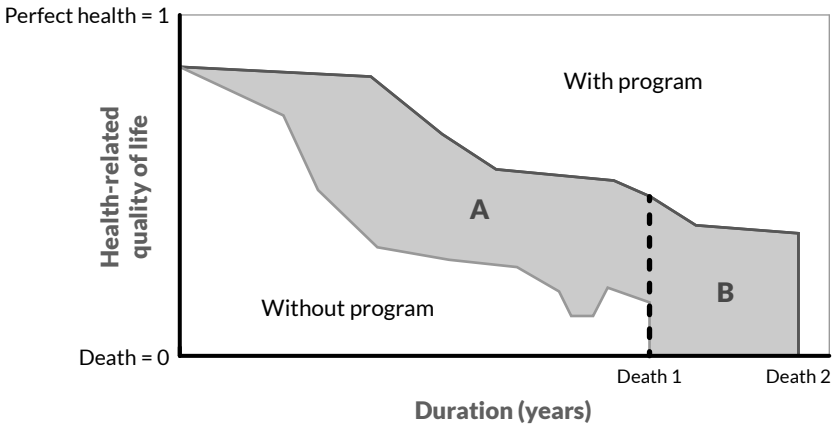

Figure 3.3. Quality-adjusted life-years gained from an intervention [Drummond, 1997]. Gray area represents QALY gained: Area A is the gain in health-related quality of life during the time that the person would have otherwise been alive anyhow while area B is the amount of life extension, factored by the quality-of-life extension.

Element	Description
Item	A single question or statement paired with its response options
Domain (dimension)	A concept measured by a group of items
Scale	Items representing domains combined to produce a score
Profile	Several different domains displayed as separate scores
Index	An aggregate score of several domains
Battery	Several instruments combined to provide a comprehensive understanding of a disease or intervention

Table 3.4. The elements of questionnaires [Anonymous, 1996].

psychometric theory and are used to quantify various dimensions of health; they are referred to as "instruments".

The elements of an "instrument" are listed in Table 3.4.

The typical instrument consists of a set of scales or "domains". A domain is designed to measure a particular "construct" or concept, such as social functioning or mental health. Each domain typically consists of several questions (or "items"), each item relating to a slightly different aspect of the construct. The options for response to each item might be a simple yes or no. These responses might be scored as 1 or 0 and an average score for the responses to all the items in the domain can be computed.

A more sensitive way to structure the responses is to provide more than two options. For example, the items could be phrased as statements and the response options could be the following: strongly agree, agree, neutral, disagree, or strongly disagree.

Example 1

A domain in an instrument contains three items, each with the response options of yes or no, scored as 1 or 0, respectively. The maximum score for the domain is 3 and the minimum score is 0. Intermediate scores of 1 or 2 are possible. These five response options could be scored, for example, 4, 3, 2, 1, and 0, respectively. Items with the responses structured in this way are known as Likert scale.

Example 2

A domain in an instrument contains three items, each with the response options structured as Likert scales with five options, scored from 0 to 4. The maximum score for the domain is 12 and the minimum score is 0. Intermediate scores from 1 to 11 are possible.

The domains in Examples 1 and 2 are "scales", because they generate a range of scores that measure the constructs represented by the domains. We have discussed multi-item scales, but a scale (or domain) might also contain only a single item.

In the world of health-related questionnaires, psychometric instruments are not simply designed and used: They must be subjected to a series of tests to determine their reliability and validity. First, it is necessary to determine whether the different items in a scale reliably measure a common construct. This measure of reliability is called "internal consistency". Internal consistency is computed by calculating an aggregate of the correlations among the different items of the scale.

Another common test of reliability is called "test-retest reliability". It measures the extent to which the answers are the same when the questionnaire is given to the same people on two different (but closely spaced) occasions. If the scores on the instrument are very different on the two occasions, the wording of the questions should be re-examined.

In addition to reliability, the validity of the instrument should be assessed. The distinction between reliability and validity can be seen if we think about the analogy of measuring skull diameter in order to assess intelligence. We could measure skull diameter using a variety of different methods that might vary in their accuracy and reproducibility, such as a visual assessment, a tape measure, or a CAT scan: These methods vary in their reliability. No matter how reliable the measurement method, however, the skull diameter is not a valid way of estimating human intelligence because there is no demonstrable relationship between the two.

There are various approaches to the validity of psychometric instruments. One common measure, construct validity, assesses the relationship between the instrument and the construct it is designed to measure. Construct validity is determined by comparing instrument scores with some other measure of the construct.

Questions

1. **Tick the correct sentence**
   A. In both cost and cost-outcomes analysis, the endpoint is a ratio of the costs of providing healthcare and a measure of the outcomes of the care
   B. Cost of care, cost-utility, cost-effectiveness, and cost-benefit analyses are grouped together as cost-outcomes analysis
   C. Cost-consequence analysis is useful for decision-makers that have a narrower or broader perspective and need flexibility
   D. The outcome measure of cost-benefit analysis are natural units or utilities

2. **Tick all that apply**
   A. A cost of care analysis is an enumeration of the healthcare resources consumed and the dollar costs of providing care to a given patient population over a given time period
   B. The cost of illness analysis normally falls under the umbrella of pharmacoeconomics
   C. In the burden of illness analysis the emphasis is placed on an aggregate dollar figure
   D. The variables of interest in a burden of illness analysis are, for example, the total direct medical costs of treating an illness, the number of deaths, hospitalizations, lost work days

3. **Tick all that apply to cost-effectiveness analysis**
   A. It is used to decide among two or more treatment options
   B. The units of cost and effectiveness may differ among the treatments compared
   C. The unit of effectiveness can be any "natural" unit
   D. Absolute dominance occurs when a treatment is more cost-effective by far than the alternative

4. **Tick all that apply to decision analysis**
   A. Decision analysis is a systematic, quantitative approach to assess the relative value of one or more alternatives
   B. In a decision tree, decision nodes are circles, chance nodes are squares, and terminal nodes are triangles
   C. Terminal nodes represent the outcomes of interest in the analysis
   D. The chance nodes are associated with a probability for each emergent branch

5. Tick all that apply to cost-effectiveness

A. The ICER of the new drug relative to standard care is the difference in costs divided by the difference in effects
B. The ICER has to be always compared to a pre-specified WTP threshold
C. The cost-effectiveness ratio of interest is the average cost-effectiveness ratio
D. The incremental cost-effectiveness of the new drug relative to standard care is the difference in effects divided by the difference in costs

6. Tick all that apply

A. The Given a WTP threshold λ, the net monetary benefit of a pharmacoeconomic intervention that provides a benefit E with a cost C is defined as: $NMB = C \times \lambda - E$
B. ICER can be used only for pairwise comparison
C. NMB can be calculated for a single treatment in absence of any comparison or can be used for ranking more than two treatments
D. NMB can be used only for pairwise comparison

7. Choose the correct order of the phases of multicriteria decision analysis

A. Constructing the performance matrix; selecting the criteria that reflect relevant values; defining the decision problem
B. Selecting the criteria that reflect relevant values; constructing the performance matrix; defining the decision problem
C. Selecting the criteria that reflect relevant values; defining the decision problem; constructing the performance matrix
D. Defining the decision problem; selecting the criteria that reflect relevant values; constructing the performance matrix

8. Tick the correct sentence about multicriteria decision analysis

A. For each criterion, stakeholder's preferences are translated into a score between 0 and 100
B. For each criterion, stakeholder's preferences are translated into a score between 0 and 10
C. Scores are divided by the relative weight of that criterion and sum up to obtain an overall value for each technology
D. Scores are multiplied by the relative weight of that criterion and multiplied together to obtain an overall value for each technology

9. Tick all that apply

A. Cost-utility analysis cannot be used to compare therapies for different diseases
B. In the cost-utility analysis the unit of effectiveness is QALYs or another measure of utility
C. A cost-minimization analysis is a cost-effectiveness analysis in the special case in which the cost of the treatments is the same
D. A cost-minimization analysis is a cost-of-care analysis in which alternative treatments are compared

10. Tick all that apply

A. In cost-benefit analysis, the outcomes are expressed in monetary terms
B. In cost-benefit analysis, the costs and the effects of the treatment cannot be directly compared
C. A cost-consequence analysis is useful for that decision-maker that has a narrower or broader perspective and needs flexibility to assess and evaluate those outcomes and costs that are of particular relevance to his/her perspective
D. Cost-consequence analysis is a simpler analysis compared with classic cost-outcomes analysis

11. Tick all that apply

A. The utility of normal health is given a value of 1, while the utility of not being alive is set at 0; a state of reduced health has a value between 0 and 1
B. The utility of normal health is given a value of 0, while the utility of not being alive is set at 0; a state of reduced health has a value between 0 and 1
C. QALYs are very suitable as measure of health outcome since they simultaneously capture gains from reduced morbidity (quality gains) and reduced mortality (quantity gains)
D. The disability-adjusted life-year represents the reduction in the number of years of life due to disease, weighted by the quality of life due to the presence of the disease

12. **Tick all that apply to psychometrics**
    A. The questionnaires used in the health sciences are used to quantify various dimensions of health
    B. Domains are measured by groups of items
    C. Psychometric instruments are not simply designed and used: They must be subjected to a series of tests to determine their reliability and validity
    D. Internal consistency is computed by calculating an aggregate of the correlations among the different items of the scale

Answers

1. **C**
2. **A, D**
3. **A, C**
4. **A, C, D**
5. **A, B**
6. **B, C**
7. **D**
8. **A**
9. **B, D**
10. **A, C**
11. **A, C, D**
12. **A, B, C, D**

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