



Introduction to Pharmacoeconomics

Chapter 2

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Objectives

- Upon completing this chapter, you will be able to:
 - define pharmacoeconomics
 - discuss methods of pharmacoeconomics that can be applied to pharmacy practice
 - describe the elements of "full" pharmacoeconomic evaluations
 - compare and contrast the four pharmacoeconomic evaluation methods
 - explain the importance of pharmacoeconomics in healthcare decision making

Health Economics

- the study of how scarce resources are allocated among alternative uses for the care of sickness and the promotion, maintenance and improvement of health, including the study of how healthcare and health-related services, their costs and benefits, and health itself are distributed among individuals and groups in society

– Pharmacoeconomics

- is application of principles & methods of economics to drug therapy
- more specifically, pharmacoeconomics can be defined as:
 - the process of identifying, measuring, and comparing the costs, risks, and benefits of programs, services, or drug therapies and determining which alternative produces the best health outcome per money spent

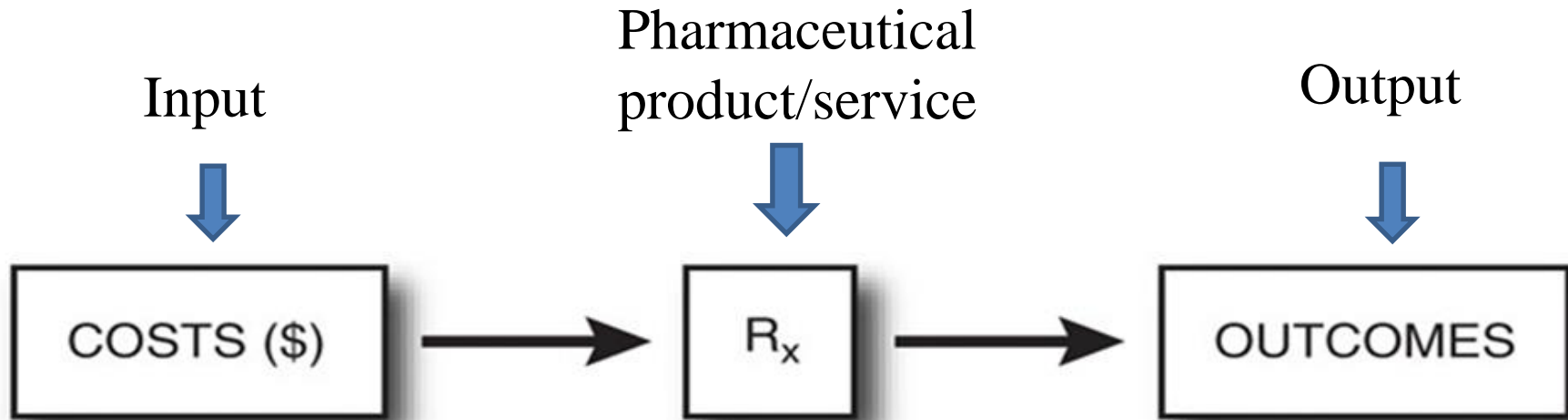
- the process of weighing the cost of providing a pharmaceutical product or service against the outcomes realized by using the product or service to determine which alternative yields the optimal outcome per money spent



- pharmacoeconomics is a combined analyses of **costs** and treatment **outcomes** among two or more alternative pharmaceutical products or services for the purpose of **decision-making**
- the primary objective of pharmacoeconomics is to maximize the net **health benefit** derived from the use of **finite healthcare resources**

- Economic aspects of the fields of pharmacy and pharmacology as they apply to the development and study of medical economics in rational drug therapy and the impact of pharmaceuticals on the cost of medical care
- Pharmaceutical economics also includes the economic considerations of the pharmaceutical care delivery system and in drug prescribing, particularly of cost-benefit values.

Elements of full pharmacoeconomic evaluations

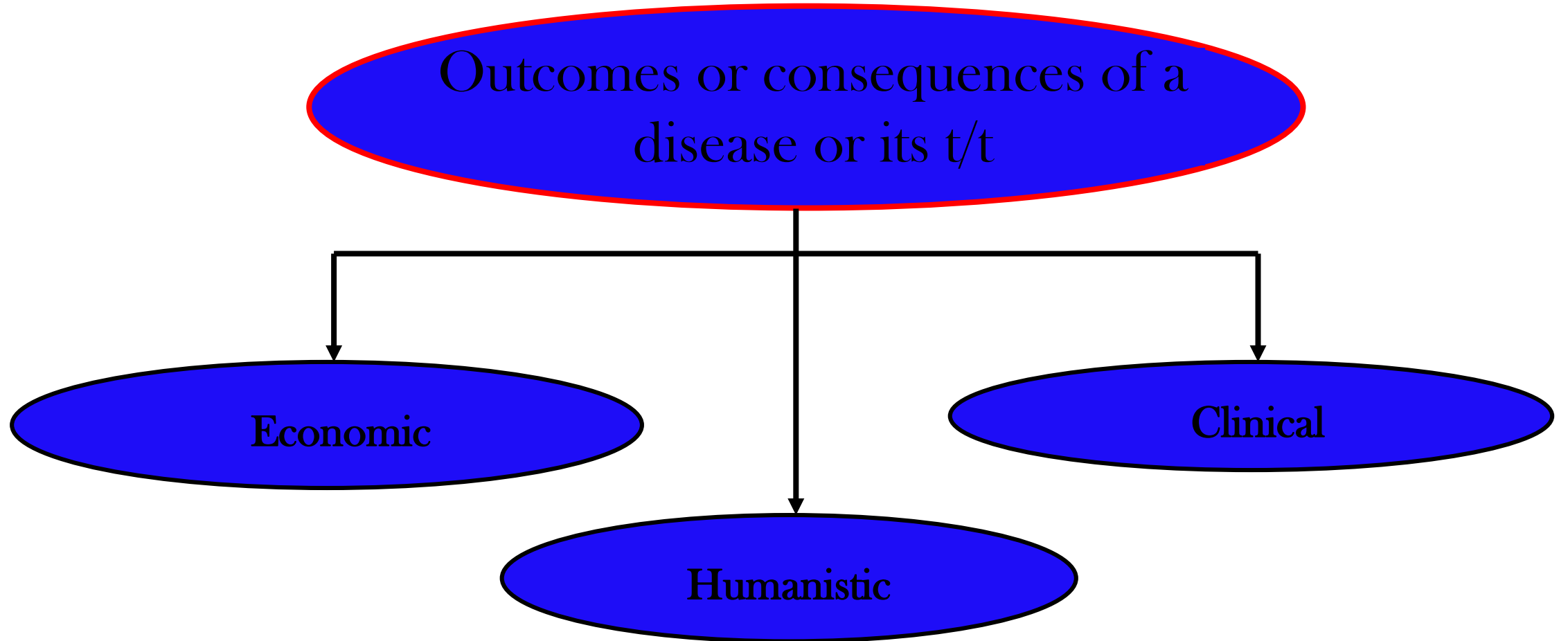


- Input
 - the value of the **resources consumed** to obtain and use the pharmaceutical product or service
 - cost
- treatment costs can be grouped into four categories:
 - direct medical
 - direct nonmedical
 - indirect nonmedical, and
 - intangible costs

(Discussed in chapter 3)

- Output
 - health-related outcomes produced by the pharmaceutical product or service
 - the effects or consequences of drug therapy or the intervention
 - t/t outcome
- sources of treatment outcome data: randomized controlled trials and observational data sets, such as registries, administrative databases, clinical series and long-term epidemiological studies
- like costs, outcomes of medical care also can be grouped in to 3 categories:
 - Clinical outcomes
 - Humanistic outcomes and
 - Economic outcomes (ECHO)

ECHO Model



Clinical outcomes

- are the biologic or physical manifestations resulted from treatment
- are the primary measure of effectiveness for **acute conditions** and **curative treatments**
- measured in natural units (traditional clinical trial end points)
- these outcomes consider clinical data alone
- Examples:
 - number of lives saved/ increased life expectancy
 - number of deaths averted/ decreased mortality
 - number of cases cured
 - laboratory values (such as reductions in hemoglobin A_{1c}, reduction in mm HG, reductions in LDL cholesterol levels etc.)

Humanistic outcomes

- are the consequences of treatment as perceived and reported by the patient
- are effects of treatment on patient's **health related quality of life** (HRQOL)
- HRQOL is a combination of a person's physical, mental and social wellbeing; not just the absence of disease
- Clinical outcomes are **clinician-assessed** end points and humanistic outcomes are **patient-reported** functioning and well-being

- HRQOL has several domains
- commonly measured domains include:
 - physical health and functioning
 - mental/emotional health and functioning
 - social and role functioning
 - pain and other symptoms such as nausea/vomiting
- Humanistic outcomes are the primary measure of effectiveness for **chronic conditions** and **palliative** treatments (i.e., reducing symptoms but not curing the underlying disease)

- humanistic outcomes are most commonly used as end points for asthma, cancer, schizophrenia, arthritis, HIV/AIDS, depression, anti-inflammatory, central nervous system, respiratory, and allergic conjunctivitis therapy areas

Economic outcomes

- include **reduction in resource use or savings** (cost avoidance) resulted from medical intervention
- Examples:
 - savings due to preventive strategy
 - increased productivity due to treatment

Outcome	Description
Clinical	Eradication of disease and physical survival
Humanistic	Quality of life, including physical, emotional, and social well being
Economic	Reduction in resource use or savings/cost avoidance

- outcomes can also be negative such as: treatment failure, ADRs, drug toxicity, or even death
- pharmacoeconomic evaluations should include assessments of both positive and negative outcomes

For example:

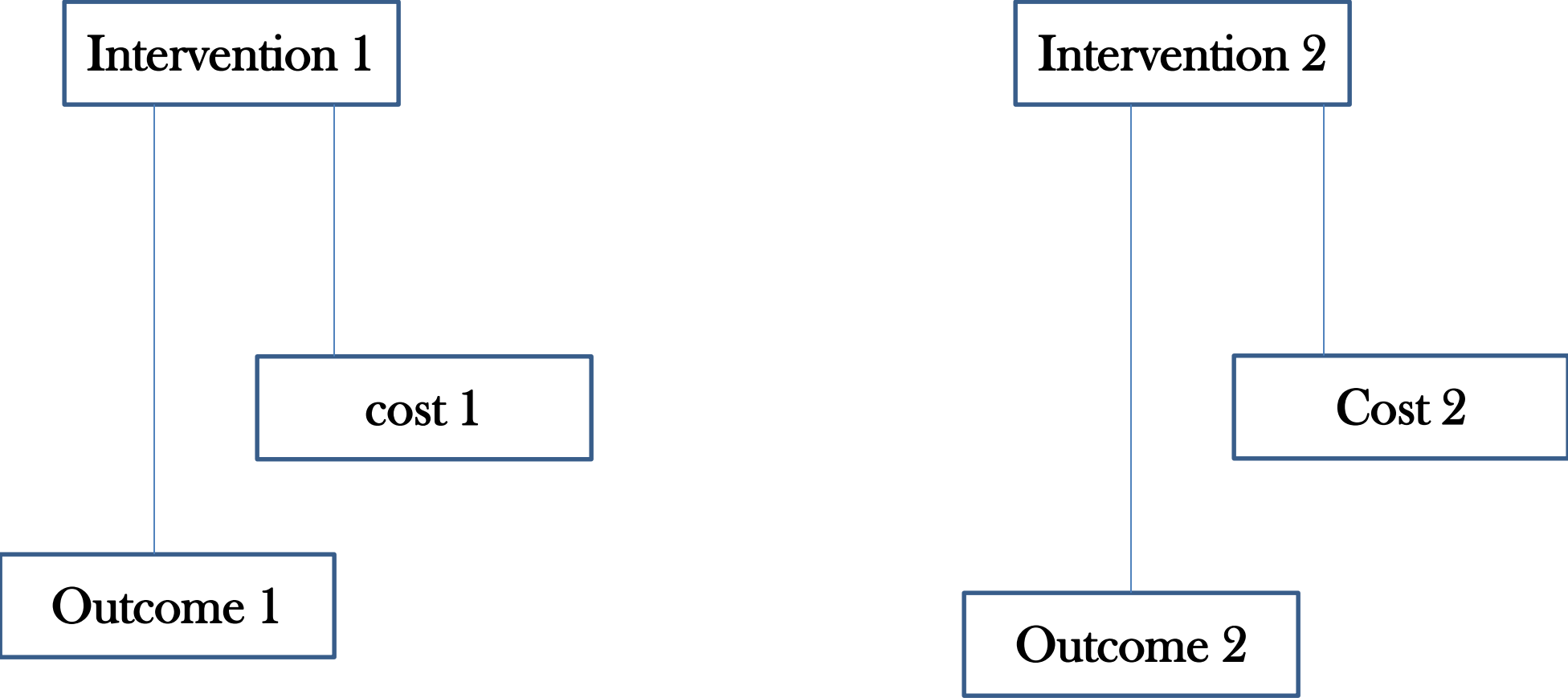
- population based pre-exposure smallpox vaccination will include health outcomes such as: averted medical costs, and reduced disability (blindness) and averted death from prevented cases of smallpox disease
- a program considering provision of diabetes screening for persons at increased risk of disease will include outcomes such as: decreased morbidity, increased life expectancy, and averted medical costs as a result of early detection and treatment of the disease

Methods/Tools of Pharmacoeconomic Evaluation

- Pharmacoeconomic evaluation is a comparative analysis of alternative healthcare **interventions** in terms of both their **costs** and **outcomes**
 - costs: resources consumed
 - outcomes: clinical, economic, and humanistic
 - interventions: pharmaceutical products, pharmaceutical services, non-drug therapies, public health programs, ...

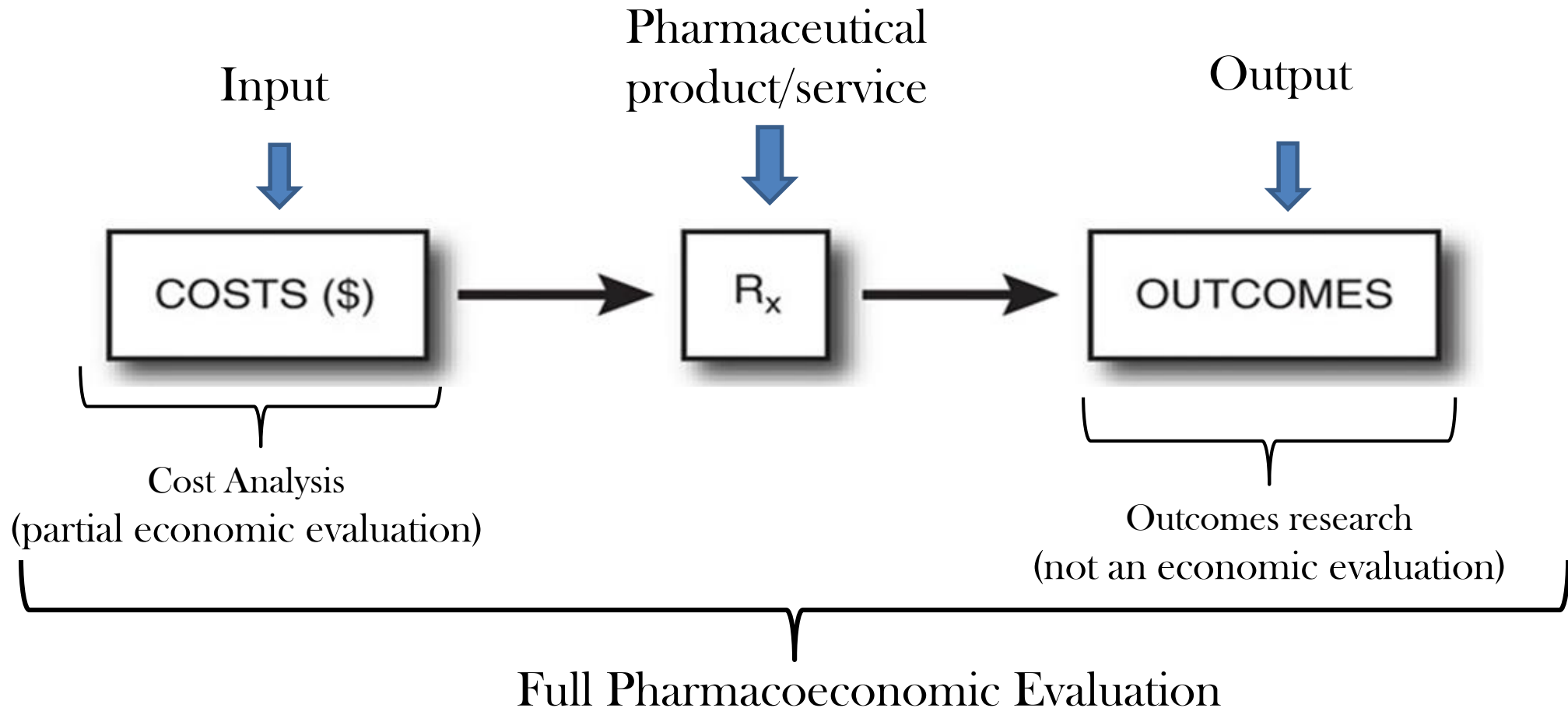
- Full pharmacoeconomic evaluation has two distinguishing characteristics:
 1. it compares **two or more** alternative choices of interventions
 2. it considers both the **outcomes** and **costs** of the interventions
- ▶ whereas **partial** evaluations consider costs and/or consequences, but which either do not involve a **comparison** between alternative interventions or **do not relate** costs to benefits
- ▶ Pharmacoeconomic evaluations conducted in today's healthcare settings can be either partial or full economic evaluations

Pharmacoeconomic evaluation framework



Economic evaluation always involves a comparative analysis of alternative courses of action

Full pharmacoeconomic evaluation methods Vs. Partial evaluation methods



- There are four types of full pharmacoeconomic evaluation methods/tools used most commonly by healthcare practitioners:
 - ▶ Cost-minimization analysis (CMA)
 - ▶ Cost-effectiveness analysis (CEA)
 - ▶ Cost-utility analysis (CUA)
 - ▶ Cost-benefit analysis (CBA)

Cost-minimization analysis (CMA)

- used to evaluate two or more interventions which are therapeutically **equivalent**
 - only costs of intervention are compared
- objective: choose the **least costly** alternative among therapeutically **equivalent** alternatives
- argument: it is not appropriate to view CMA as a form of full economic evaluation



Cost- effectiveness analysis (CEA)

- used to compare treatment alternatives that have **different degrees of effectiveness** which have outcomes which are measured in natural units (clinical outcomes)
- **Examples:** heart attacks avoided, deaths prevented, life years gained, lives saved, cases cured, reduction in blood pressure, reduction in blood glucose level, number of symptom free days, etc.
- **CEA** is useful when a more effective intervention costs more

- Examples of the cost effectiveness studies:
 - the study by Price *et al.* (2013) on the cost-effectiveness of alternative asthma treatments (which used ‘number of patients who experienced severe exacerbations’ as the measure of outcome)
 - the study by Pukallus *et al.* (2013) on the cost-effectiveness of a telephone-delivered education programme to prevent early childhood caries (which used ‘reduced number of caries’ as the benefit measure)

Cost-utility analysis (CUA)

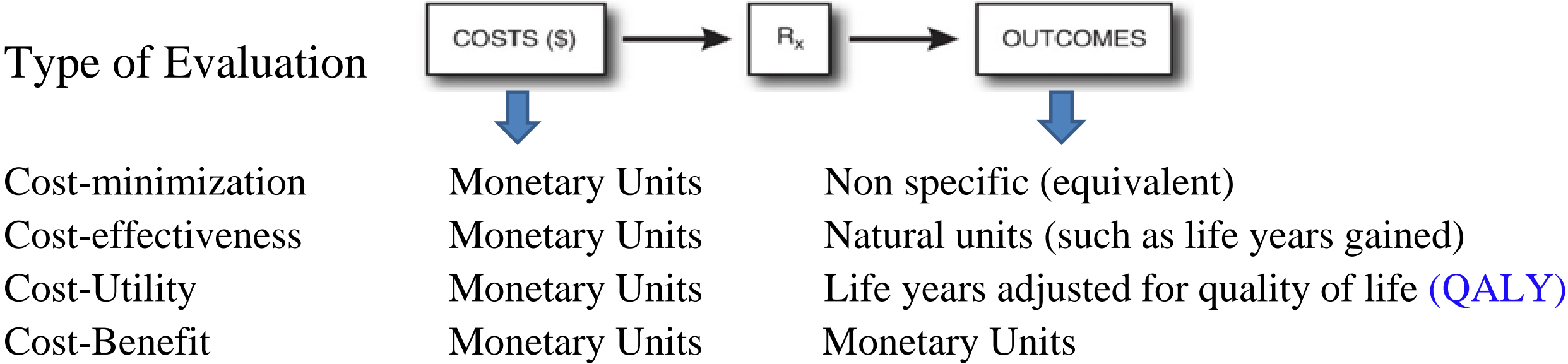
- a special form of cost-effectiveness analysis
- used to compare treatment alternatives that have **different degrees of effectiveness** which involve humanistic outcomes
- difference between CEA and CUA - the nature of the **outcomes used**
 - Natural units Vs. **QALYs**



Cost-benefit analysis (CBA)

- compares cost of treatment to monetary benefits of treatment
 - both costs and outcomes expressed in **monetary** value
 - compares monetary value of inputs with monetary value of outputs
 - determines
 - whether the monetary benefits $>$ cost or
 - which intervention provides the highest monetary benefit per money spent

The difference between the four pharmacoeconomic evaluation methods is **how outcomes are measured/quantified**



Partial Evaluations

- partial evaluations constitute a number of economic study types which consider costs and/or consequences, but which either do not involve a comparison between alternative interventions or do not relate costs to benefits
- the full pharmacoeconomic evaluation methods are all similar in the way they measure costs and different in their measurement of outcomes

- although a full economic evaluation generally provides higher quality and more **useful information**, the time, resources, and effort employed are also great
- partial evaluations require a minimum of time and effort
- there are two common types of partial economic evaluations that involve the measurement of costs:
 - ▶ cost –consequence analysis (CCA)
 - ▶ cost of illness analysis (COI)

Cost -consequence analysis (CCA)

- in this analysis only a list of costs and outcomes (consequences) of an intervention are presented, with **no direct comparisons** with other alternative intervention
- includes simple descriptive tabulations of costs and outcomes
- describes costs and outcomes of an intervention, but doesn't compare to alternative options

Cost of illness analysis (COI)

- determines the total **economic burden** of an illness
- also known as **burden of illness analysis**
- the costs included in COI analysis are:
 - direct costs -- the costs associated with providing **treatment** or **prevention**
 - indirect costs -- the costs attributable to **loss of productivity** of patients with that **disease** or **premature death**
- provides an estimation of the financial burden of a disease, but does **not compare** competing intervention alternatives



- COI is used to compare:
 - the economic impact of one disease versus another or
 - the economic impact of a disease on one country compared with another
- by determining the cost of illness of a particular disease to a society, one can determine the value/benefit of a t/t or preventive strategy

- Example: Suppose you are conducting from a societal perspective a cost of illness analysis to estimate the economic burden of influenza outbreak in Dessie town. You are provided with the information below from a representative sample:
 - average direct cost of treating each case is 100 Eth birr
 - average indirect cost for each case is 150 Eth birr
 - the sample yields an incidence rate of 1.5% for influenza
- the population of Dessie town is assumed to be 130,000.
 - a. determine the cost of illness of influenza outbreak in Dessie town.
 - b. if the cost of influenza prevention strategy is 750,000 Eth. Birr, determine the value/benefit of implementing this preventive strategy

Applications of Pharmacoeconomics

- One of the primary applications of pharmacoeconomics in clinical practice today is to aid **clinical and policy decision making**
- Pharmacoeconomic data can be a powerful tool to support various clinical decisions, ranging from the **level of the patient** to the level of an **entire healthcare system at the facility and national level**

- The various applications of pharmacoeconomics include:
 - ▶ clinical decisions for individual patient treatment -(CEA & CUA)
 - ▶ justification/evaluation of clinical services/programs - (CBA)
 - ▶ formulary decision making - (CEA & CUA)
 - ▶ to support drug policy - (CEA & CUA)
 - ▶ resource allocation - (CEA , CUA & CBA)

Clinical decisions for individual patient treatment

- One of the primary applications of pharmacoeconomics in clinical practice today is to aid clinical decision making
 - it can guide clinicians in making cost effective drug selection decisions for specific categories of patients
- how do the different interventions impact a patient's HRQOL?
- for example: comparing two different cancer treatments: one may offer longer survival, but the other a higher quality of life (CUA)

- is the **added benefit** of one intervention worth its **added cost**?
- if there is an intervention which is both more effective and more costly, pharmacoeconomics helps to determine whether the **added benefit of the more costly intervention** worth its added cost _(CEA & CUA)

- For example: Patients who have the cardiac arrhythmia atrial fibrillation are often prescribed an anticoagulant to help prevent secondary stroke. For years, warfarin (Coumadin) was the drug of choice
- Recently, three new oral anticoagulants (dabigatran, rivaroxaban, apixaban) have been approved for patients with atrial fibrillation
- These are more effective and more expensive than warfarin and each have their own set risks for adverse events
- pharmacoeconomic analysis can help compare the additional costs and additional benefits of each of the new anticoagulants to warfarin, and also to each other

Justify or evaluate clinical services/programs

- Pharmacoeconomics is used to determine the **potential worth** of a **new** healthcare service or the **value** of an **existing** one (CBA)
- should a new pharmacy service be implemented?
 - example: anticoagulation clinic, diabetes management clinic, asthma management clinic, etc.
- is an immunization or vaccine program cost-beneficial?
 - example: do the benefits, measured in monetary units, of the vaccine for the Human Papillomavirus (HPV) outweigh the costs?

- For example, suppose you want to implement a pharmacy-based therapeutic drug monitoring program. It is hypothesized that this service will improve quality of patient care and save money for the healthcare system. After negotiating with hospital administrators, the funding for this service is approved for a 1-year trial basis, after which you must document and [justify the value](#) of this practice.

Formulary decision making

- formulary is list of drugs approved for use in specific health care setting
- should a medication be added to the formulary?
- issues considered during formulary development:
 - clinical considerations: efficacy and safety
 - humanistic considerations: quality of life and
 - costs
- pharmacoeconomics is a preferred tool to determine which drugs should be included on the formulary as it takes into **account all these issues**

- pharmacoeconomic data can influence the following formulary decision options:
 - ▶ **inclusion** of newly marketed or other target drugs
 - ▶ **deletion** of drugs from the formulary
- pharmacoeconomics is applied in formulary decisions when one intervention demonstrates a better efficacy and safety profile but at a higher cost _ (CEA & CUA)

To support drug policy

- one of the three objectives of NDP is to ensure access to EMs
- access encompasses equitable availability and affordability of EMs
- one way of achieving this objective is improving efficiency
- globally, CEA is being used to **set public policies regarding the use of pharmaceutical products** in countries such as Australia, New Zealand, and Canada
- these countries, along with others, including Spain, the United Kingdom, Italy, and the United States, even have their own guidelines for conducting pharmacoeconomic evaluation

Healthcare resource allocation decision making

- resource allocation - societal or individual decisions about the equitable distribution of available resources
- pharmacoeconomics can help to make decisions on **efficient allocation** of limited resources among competing alternative medications and services — (CEA, CUA & CBA)
 - to **spend more** on more valuable programs or services and less on less important programs or services
 - in this way, scarce financial resources are used as efficiently as possible