

# Introduction to Economic Evaluation

## Background: Importance of Program Evaluation



The success of a program or project is dependent upon the ability of those involved to demonstrate its [effectiveness](#).

A program may seem to be successful as a result of personal accounts, but without being subjected to a systematic evaluation process, the true impact of a program on its intended beneficiaries cannot be quantified.

That is why *ongoing* monitoring and evaluation (M&E) throughout the duration of a program is so important.

M&E specialists use the monitoring data to better understand the program's performance.

There are many [different types of evaluations](#) - each catering to a different audience or targeting specific objectives.

In this course, we will discuss the use of [economic evaluations](#) as a way to assess a program's effectiveness.

### Glossary Term:

[Effectiveness](#)

[Economic evaluation](#)

### Highlights

Efficient and effective programs:

- Improve decision making,
- Increase accountability, and
- Aid in planning.

## What is Economic Evaluation? Part I



Public health programs and interventions can be thought of as a production process (sometimes referred to as logic models or results frameworks) that transforms [inputs](#) (resources) into changes in health outcomes, as illustrated in the diagram above.

Decision makers responsible for allocating resources and implementing public health programs and interventions need to understand the relationship between resources used and health outcomes achieved by the program or intervention.

One analytical tool available to decision makers is economic evaluation.

In an economic evaluation, analytic techniques are applied to identify, measure, value, and compare the [costs](#) and

consequences of two or more alternative programs or interventions.

Source: CDC & HHS

**Glossary Term:**

[Costs](#)

[Inputs](#)

## Highlights

See the [M&E Frameworks for HIV/AIDS Programs course](#) to learn more about how to develop logic models and results frameworks.

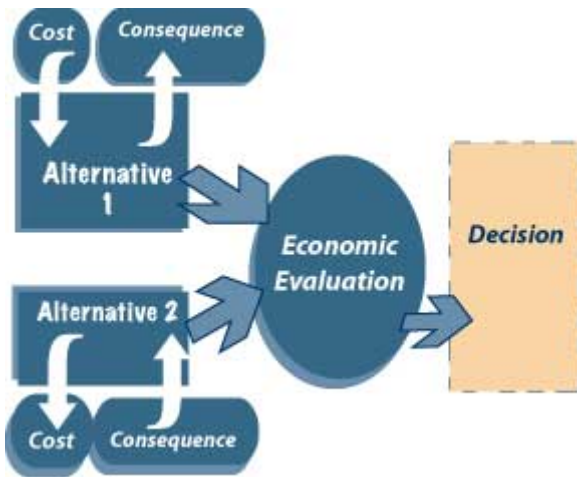
See the [Data Use for Program Managers course](#) to learn more generally on the process of using data for informed decision making.

## Did you know?

Economic evaluations use principles from multiple disciplines (e.g., biology, epidemiology, and economics).

Results are scientifically sound.

## What is Economic Evaluation? Part II



***Economic evaluation provides criteria for deciding between alternative strategies.***

Economic evaluation attempts to identify ways in which scarce resources can be employed efficiently.

In the field of public health, economic evaluation is used to analyze how resources have been allocated and how resources can generate maximum level of health outcomes given a fixed amount of resources.

When applied to public health programs, economic evaluation is concerned with the

- Amount of resources used by a program or intervention, and
- Corresponding level of health-related outcomes attributable to the program or intervention.

Economic evaluation is an effort to

- Analyze inputs (resources) and changes in health outcomes simultaneously, and
- Help decision makers assess whether a certain level of output is worth the amount of resources expended to produce it (given that resources are scarce and can be used for alternative purposes).

Source: CDC & HHS

## Highlights

"*Doing the right things.*"

**Allocative efficiency** focuses on choosing the optimal mix of interventions for a given level of expenditure - optimal in the sense that the interventions maximize health gains.

## Highlights

"*Doing things right.*"

Efficiency can also be measured in terms of **technical efficiency**, which is the effectiveness of producing an output with a given set of inputs. This is often difficult to measure in an economic evaluation.

## Core Principles

Every economic evaluation is based upon **two core principles**:

1. An economic evaluation assesses both the costs of an intervention and its outcomes or benefits.
2. Every economic evaluation has a perspective or point of view. For example, if you are evaluating from the perspective of an individual being treated, you will have different answers from what you will get from the perspective of a doctor or the Ministry of Health.

**IDEAS IN ACTION:** Now consider costs from these different perspectives.

- If you are a patient who becomes ill and visits a doctor, what are the costs that you incur?
- If you are an employer and your employee becomes ill, what are the costs that you incur as the employer?

Source: CDC 2008

## Ideas in Action

Types of costs:

- Cost of not feeling well, medicine, doctor's fees, transportation to the clinic, duration of the visit, and travel time to and from the doctor's office
- Cost of lost productivity at work due to sick leave

## What are Costs?

Produits	P.U	Produits	P.U	Produits
Amoxicilline 250/125	400	Poliject 0-20	100	Vita-A
1M2	220	" 040	150	" C
inj	175	Primperan inj	210	Lo-femen
Gite		Paracetamol cp	100	Condom
sp	600	" sp	600	Ovrette
cp	100	Quinine 600	150	Bande
cp	10	Spasfon cp	600	
semide cp	15	" inj	600	
	170	"	600	

Costs are the values of the resources used to produce a good or a service.

**Creating a comprehensive inventory of costs is necessary for the success of any economic evaluation.**

Cost of resources can be obtained in many different ways.

One example is obtaining the [market price](#) of all goods and services that are included in a program or intervention.

Market price is a convenient measure of cost in which all resources have readily available prices, and exchanges are based

on monetary value.

Because resources are limited, all interventions cannot be implemented.

When decision makers choose to implement a program, the resources expended for that program will not be available for other possible uses.

Source: CDC & HHS

**Glossary Term:**

[Market price](#)

### Did you know?

Costs can be attributed to the implementation of a program (*action*) as well as the failure to implement a program (*non-action*).

### Highlights

Costs can be calculated in a number of ways. See the Additional Resources under References for more information.

## What are Benefits?



Benefits, also referred to as consequences or [outcome measures](#), can be measured in:

- Monetary units,
- Quality-adjusted health outcomes, or
- Natural units (e.g., a case of HIV prevented).

Benefits that are measured in *monetary units* are generally classified in the following way:

- **Direct benefits** are the medical expenditures saved because of prevention or treatment of the disease or illness.
- **Indirect benefits** are the benefits associated with productivity gains because of prevention or treatment of the disease or illness.
- **Intangible benefits** include the values of psychological outcomes (e.g., reductions in pain and suffering), which cannot be evaluated from market data.

Source: CDC 2009

**Glossary Term:**

## [Why Should Economic Evaluations Be Conducted?](#)

In today's economically constrained environment, decisions need to be made regarding how to invest scarce resources.

An economic evaluation answers the following questions:

- How much does the program or intervention cost?
- How does the program compare with other programs in terms of costs and outcomes?

Source: CDC & HHS

### Glossary Term:

[Advantages to conducting an economic evaluation](#)

[Disadvantages to conducting an economic evaluation](#)

### Highlights

There are many [advantages](#) as well as [disadvantages](#) to conducting an economic evaluation.

## Summary

In this session, you were introduced to what economic evaluation is and its importance in the field of public health.

Throughout the remainder of this course, you will learn more about the common economic evaluation approaches and how to frame an economic evaluation, starting with defining the problem to be analyzed and deciding on a research strategy to analyze it.

Finally, a case study of a cost-effectiveness analysis will be presented.

The purpose of this course is to familiarize oneself with a basic understanding of economic evaluation. See the References & Links tab (denoted by 'R') for more resources on how to conduct and apply these concepts in your own work.

## [Main Methods of Economic Evaluation](#)

### [Partial Versus Full Evaluations](#)

There are two different general categories of economic evaluations - partial and full.

**Partial evaluations** assess either the cost or the outcome components of programs and possible alternative interventions, or they assess both costs and outcomes of a single intervention (program without comparative reference to one or more alternative interventions).

**Full evaluations** assess both costs and health outcomes of an intervention or program. They compare these across the possible implementation of possible alternative interventions.

Source: CDC 2008

### [Differences Between Full & Partial Evaluations](#)

## Types and Characteristics of Full and Partial Evaluations

Considers both costs and outcomes			
		NO	YES
		PARTIAL EVALUATION	PARTIAL EVALUATION
Compares one or more alternatives	NO	Outcome description	Cost-outcome description
		Cost description	
	YES	PARTIAL EVALUATION	FULL ECONOMIC EVALUATION
		Efficacy or effectiveness evaluation	Cost-outcome studies
		Cost analysis	Cost-effectiveness analysis
		Program cost analysis	Cost-utility analysis
Burden of disease analysis	Cost-benefit analysis		
		Cost-benefit analysis	

The graphic illustrates how to determine which analysis is a partial or full evaluation as well as which approach to use, depending on the data available:

### Considering costs and outcomes

- Is there only cost data? Or
- Is there cost and outcome data?

### Comparing one or more alternative interventions

- Are you looking at data from only one intervention? Or
- Are you comparing data from two or more interventions?

Source: CDC 2008

## Summary of Economic Evaluations

	Economic analysis	Cost measure	Health benefit measure	Example in HIV context
Partial evaluation	Cost analysis	Monetary units	Not applicable	The calculation of how much it will cost to introduce or scale-up HIV treatment programs. This analysis provides no information on the health outcome.
Full evaluation	Cost-effectiveness analysis	Monetary units	Natural units (Cases of disease or deaths averted)	The number of HIV cases averted by a female condom distribution program to sex workers (SWs) in South Africa.
	Cost-utility analysis	Monetary units	QALY or DALY averted	Cost-utility of tuberculosis prevention among HIV-infected adults in Kampala, Uganda.
	Cost-benefit analysis	Monetary units	Monetary units (US\$, Tanzania Shilling (TShs), etc.)	Cost-benefit analysis of female primary education as a means of reducing HIV/AIDS in Tanzania.

**The summary table illustrates at a glance how the analyses differ in terms of outcome measures.**

There is one common partial economic evaluation approach used in public health. It is:

- Cost analysis

There are three common full economic evaluation approaches used in public health. These are:

- Cost-effectiveness analysis
- Cost-utility analysis
- Cost-benefit analysis

The following pages will provide more details about each of these approaches.

Sources: AIM 2009; CDC & HHS

## Highlights

For a larger view of the summary table, click [here](#).

## Cost Analysis

Although there are many types of partial evaluations, **cost analysis is the most basic and common**. It answers the most commonly asked question when considering introducing a new intervention: **How much will it cost?**

[Cost analysis](#) is a form of economic evaluation that involves the systematic collection, categorization, and analysis of the net costs of a program.

A *cost analysis*:

- Examines the costs of an intervention/program, not the outcomes of such a program;
- Includes the costs for only one program;
- Determines which parts of a program are responsible for costs; and
- Can be used to project resources for future programming.

Cost analysis can stand alone but is often nested within other full economic evaluations.

Sources: CDC 2008; CDC & HHS

**Glossary Term:**

[Cost analysis](#)

## Highlights

An example of the use of cost analysis is in the determination of the costs associated with a health education and condom distribution program.

## Cost-Effectiveness Analysis

[Cost-effectiveness analysis](#) is used to compare the costs of alternative intervention strategies that produce a common health outcome.

Such outcome measures are often expressed in physical or natural health units and can include final outcomes (e.g., life years saved or number of cases prevented) as well as intermediate outcomes (e.g., number of condoms distributed).

The incremental cost-effectiveness ratio (ICER) is the ratio of [incremental cost](#) of the intervention per unit of health outcome (e.g., cost per life years saved).

In cost-effectiveness analysis, the researcher computes an ICER for each intervention analyzed, and then compares the ICER across interventions.

Source: CDC & HHS; Primer 2000

**Glossary Term:**



## Ideas in action

Cost-effectiveness analysis could be used to compare a newly developed HIV vaccine with no vaccine in terms of cost per case of HIV prevented in the target population.

## Highlights

For more information on how to compute an ICER, click [here](#).

## [Cost-Utility Analysis](#)

[Cost-utility analysis](#) uses an outcome indicator that combines quality of a given health status and duration of time in that state.

It is a form of cost-effectiveness analysis that attempts to capture timing and duration of disease and disability by comparing the [utility](#) associated with different health outcomes.

Cost-utility analysis typically measures outcomes in [quality-adjusted life years \(QALYs\)](#) and [disability-adjusted life years \(DALYs\)](#).

It is measured by the cost-utility ratio and can be expressed as the dollar value per QALY or DALY saved.

Source: CDC & HHS

### Glossary Term:

[Cost-utility analysis \(CUA\)](#)

[Utility](#)

[Quality adjusted life years \(QALYs\)](#)

[Disability Adjusted Life Years \(DALYs\)](#)

## Ideas in action

Cost-utility analysis could be used to compare the cost per QALY from a HIV vaccination program with the cost per QALY from no vaccination.

## [Cost-Benefit Analysis](#)

[Cost-benefit analysis](#) is a form of economic evaluation that measures both costs and benefits in dollars and provides a list of all costs and benefits accrued during a period.

A project has multiple costs and benefits that accrue over several years.

In order to make these costs and benefits comparable, they need to be [discounted](#) so that there is a standardized point of reference.

Discounting is used in other types of economic evaluations as well. See the [article](#) presented in Session 5 for an example of discounting being applied to a cost-effectiveness analysis.

The summary measure for a cost-benefit analysis is expressed as net benefits, which is benefits minus costs.

Source: CDC & HHS

### Glossary Term:

[Cost-benefit analysis \(CBA\)](#)

[Discounting](#)

## Ideas in action

Cost-benefit analysis could be used to compare the net benefits of a HIV vaccination program targeting population subgroups at risk with the net benefits of a program targeting the entire population.



## Test Your Knowledge

What type of economic analysis compares a condom distribution program with a prevention-of-mother-to-child-transmission program in terms of HIV infections averted?

- [ANSWER](#)

What type of economic analysis compares life without an HIV infection to life with an HIV infection that is being treated?

- [ANSWER](#)

What type of economic analysis should a company conduct to decide whether or not to provide workplace HIV treatment to its HIV-positive employees?

- [ANSWER](#)

**Glossary Term:**

[Test Your Knowledge: Answer #1](#)

[Test Your Knowledge: Answer #2](#)

[Test Your Knowledge: Answer #3](#)

## Framing an Economic Evaluation: Planning Phase

### Introduction to Framing an Economic Evaluation



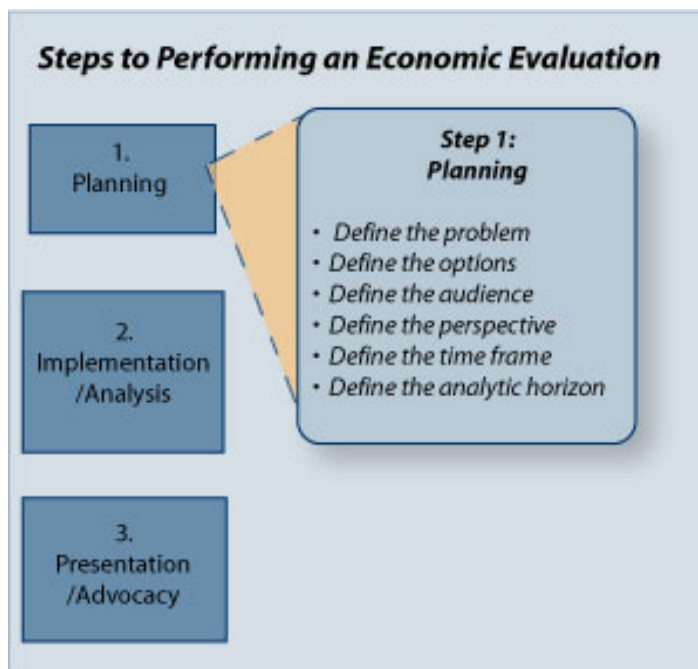
***Conducting an economic evaluation can be both time- and resource-intensive.***

If the purpose of the study is to provide information to policymakers facing a deadline, the analyst must be able to provide results in a timely manner.

Therefore, to produce the most useful and timely study results, it is important that the analyst be methodical and thorough.

Source: CDC & HHS

## How to Perform an Economic Evaluation



The process of performing an economic evaluation is categorized into three broad steps.

- Planning
- Implementation/Analysis
- Presentation/Advocacy

This session will focus on the components in the **planning phase**.

## Define the Problem

The first step in an economic evaluation is to frame the study. Decisions made at this stage will determine directly which costs and outcomes are considered relevant and which should be included in the analysis. Therefore, choices made in framing will have an impact on the final results of an analysis.

**The challenge is to identify and define the problem.** Three main questions should be asked:

- What is the health outcome of interest?

*A problem might be a rising prevalence of sexually transmitted infections (STIs).*

- Why is this problem important?

*This problem is important because STI prevalence increases in a society, the burden of illness associated with STIs increases along with the susceptibility to HIV.*

- What aspects of the problem need to be explained? And more specifically, what questions need to be answered?

*If a mass media campaign was implemented to reduce the incidence of STIs among adolescents, the following issues might be useful:*

- Explaining current STI levels and rates of condom use among adolescents,
- Analyzing adolescents' ability to access and purchase condoms, and
- Determining adolescents' familiarity with existing pro-condom media messages.

*The specific study question might be: How does the cost effectiveness of a mass media campaign compare with the cost effectiveness of a targeted campaign designed to decrease the incidence of STIs among adolescents?*

Source: CDC & HHS

## Ideas in action

In Ahmedabad, Gujarat, India, a targeted commercial sex worker (CSW) intervention was developed to combat the rising HIV prevalence rate among CSW.

The objective was to evaluate the intervention's effectiveness in reducing HIV infections and DALYs.

To read more, click [here](#).

(Source: Fung et al. 2007)

## Define Options

After the study problem has been identified and defined, a research strategy must be adopted that can direct an analyst through all the plausible options.

The first task is to define with precision the program(s) or intervention(s) to be evaluated.

For each program or intervention included in the study, identify the following elements:

- **The nature of the intervention(s)** (e.g., a mass media campaign to increase condom use),
- **The target population(s)** (e.g., general population, adolescents, and men specifically),
- **The delivery site(s)** (e.g., radio, television, and community-based outreach),
- **The personnel delivering the service** (e.g., radio and television personalities along with community outreach workers),

- **The technology to be used** (e.g., radio, television, dramas, dance, posters), and
- **The timing of the intervention** (e.g., June-August 2010).

Source: CDC & HHS

## Define Audience



The **audience** includes all persons or institutions that will be using the results of the study to make decisions.

The audience might be key decision makers interested in choosing between alternative interventions or programs.

Defining the study's audience also involves

- Defining the information needs of the audience, and
- Considering how the audience will use the study results.

Source: CDC & HHS

### Highlights

National governmental officials, international public health officials, program managers, health providers, the media, and the general public might all be part of a study's audience.

## Define the Perspective: Part I

The **perspective** of an economic evaluation is the viewpoint from which it is conducted.

The selection of the perspective is crucial, because it determines which costs and outcomes are considered relevant and are included in the analysis.

The analysis must reflect the perspective of persons or institutions who are affected by the outcome of interest and who bear certain costs associated with the program or intervention being evaluated.

The choice of a study perspective might also be constrained by the context of the study. The persons or institutions sponsoring the study might want the analysis to reflect their own perspective and demand it. Therefore, the choice of a study perspective must be consistent with the audience choice.

Source: CDC & HHS

## Define the Perspective: Part II

An economic evaluation can be conducted from many different perspectives. Below are some examples (in order from the narrowest to the broadest).

- **Patient or client** - The term patient or client refers to the person targeted by the health intervention under consideration. [Example](#)
- **Provider** - The term provider refers to all categories of persons and institutions providing health-related services. Examples of providers include doctors, hospitals, nursing homes, health centers, and health posts. [Example](#)
- **Payer** - The term payer refers to the person, entity, or institution ultimately responsible for the financial cost of a program, intervention, or medical procedure. In most developing countries, this is the Government unless a private insurance program is available. [Example](#)

- **Health care system** - The health care system perspective is broader than the perspective of the health care provider. The health care system perspective considers the costs and outcomes associated with providing care without differentiating between categories of providers or payers. [Example](#)
- **Society** - The societal perspective is the broadest possible perspective, because it includes all costs (no matter who incurs them) and all consequences (both good and bad), regardless of who experiences them. [Example](#)

Source: CDC & HHS

#### Glossary Term:

[Example of patient's/client's perspective](#)

[Example of provider's perspective](#)

[Example of payer's perspective](#)

[Example of the health care system's perspective](#)

[Example of a societal perspective](#)

### **Define the Time Frame**

The time frame corresponds to the period during which the intervention or treatment is delivered. The study time frame should take the following factors into account:

**Seasonal variation in program activity level** - Program activity can increase or decrease during certain periods of the year. For example, demand for influenza immunization increases during fall and winter. When program costs and outcomes are measured only at peak times or only during periods of low activity, over- or under-estimates might result.

**Life cycle of the intervention** - Costs and outcomes might differ depending on how long a program has been in operation. Intervention costs and outcomes must be tracked during a period long enough for such variations in costs and outcomes to stabilize so that valid estimates can be obtained.

**Future advances in technology** - Technology changes can lead to the obsolescence of the program or intervention within a limited period. The time frame chosen should take into account the assumptions made concerning the technology that will be used in the time period considered.

Source: CDC & HHS

### **Define the Analytic Horizon**

The analytic horizon corresponds to the entire period during which costs and benefits related to the impact of the program or intervention of interest are measured.

Therefore, the analytic horizon is relevant in studies in which the effectiveness of a program is considered:

- Cost-effectiveness analysis,
- Cost-utility analysis, or
- Cost-benefit analysis.

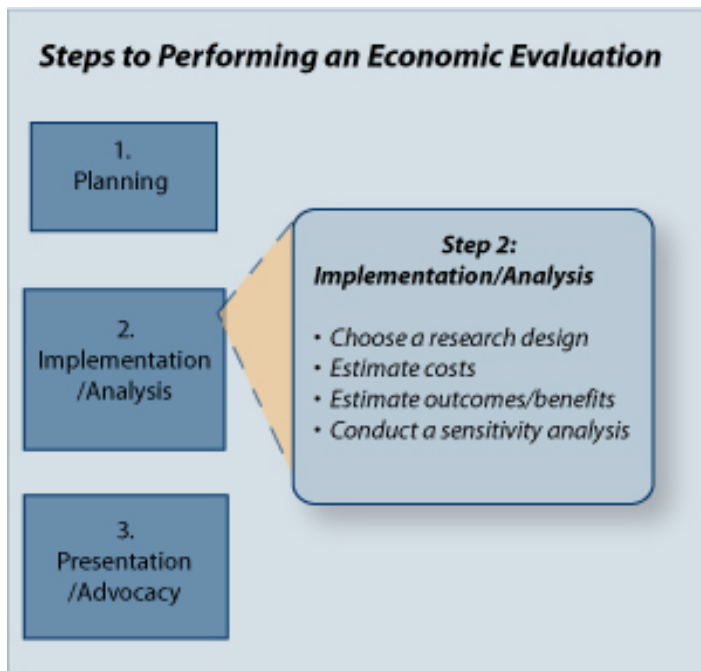
The analytic horizon is usually longer than the time frame, particularly in the case of prevention programs.

Benefits associated with these interventions can be realized for a substantial period after the intervention has concluded.

Source: CDC & HHS

### **[Framing an Economic Evaluation: Analysis-Advocacy](#)**

### **[How to Perform an Economic Evaluation: Analysis Phase](#)**



The **implementation / analysis phase** is illustrated by the graphic.

The following pages will provide an in-depth look at the various steps involved in this phase.

### [Choose a Research Design: Part I](#)

Choosing a research design depends on data, time, and resources that are available to the study researcher.

Decision makers and those who will use the study results might impose constraints on the study that might favor one research design over another.

Whatever design is chosen, assessing and being aware of the advantages and disadvantages of that particular design can improve the credibility of the study.

Source: CDC & HHS

### [Choose a Research Design: Part II](#)

	<b>Advantages</b>	<b>Disadvantages</b>
<b>Prospective studies</b>	<ul style="list-style-type: none"> <li>• More control over data quality</li> </ul>	<ul style="list-style-type: none"> <li>• Time and resource consuming</li> <li>• Possible observer bias</li> </ul>
<b>Retrospective studies</b>	<ul style="list-style-type: none"> <li>• Time-saving</li> </ul>	<ul style="list-style-type: none"> <li>• Less control over quantity and quality of the data</li> <li>• Possible selection bias</li> </ul>
<b>Models</b>	<ul style="list-style-type: none"> <li>• Less reliance on direct data</li> <li>• More flexible</li> </ul>	<ul style="list-style-type: none"> <li>• Validity of underlying assumptions questionable</li> </ul>

The graphic illustrates the advantages and disadvantages of three possible research designs:

- [Prospective study](#)
- [Retrospective study](#)
- [Model](#)

**Glossary Term:**

[Prospective study](#)

[Retrospective study](#)

[Model](#)

**Did you know?**

Models can be used in prospective and retrospective studies.

**Estimate Costs**

Costs are the values of the resources used to produce a good or a service.

**Creating a comprehensive and explicit inventory of all costs is necessary for the success of any economic evaluation.**

Costs can be classified in a number of ways.

A common method is based on whether or not costs are [tangible](#) or intangible.

**Tangible costs** include:

- *Direct costs* are those resources used specifically for medical treatment or for producing an intervention. Click [here](#) for examples.
- *Indirect costs* are any costs incurred as a result of an intervention or illness that are not directly related to the medical care itself. Click [here](#) for examples.
- *Productivity losses* are resources foregone by the patient or caregiver as results of participation in the intervention or of the health condition itself. Click [here](#) for examples.

**Intangible costs** are those emotional costs associated with pain, suffering, and anxiety. These costs are often difficult to quantify and therefore are typically excluded in an economic evaluation.

Source: CDC & HHS

**Glossary Term:**

[Direct costs](#)

[Indirect costs](#)

[Examples of productivity losses](#)

[Tangible costs](#)

**Highlights**

For more information on computing cost, click [here](#) and see the Additional Resources under the *References* page.

(Source: Forsythe S 2006)

**Estimate Outcomes: Part I**

An outcome measure (sometimes referred to as a benefit measure) is an indicator used to assess the impact of the program or intervention.

More than one outcome measure can be used in an economic evaluation.

Estimating outcomes often involves collaboration with epidemiologists, physicians, and others. As mentioned earlier, research involving economic evaluation is often interdisciplinary.

The selection of the most appropriate outcome measure(s) is based primarily upon available data and how the outcome measure(s) will be used.

After the study developer decides that sufficient evidence exists to support the outcome measure(s) chosen, the other components of the study need to be checked to ensure that the outcome(s) can be placed inside the prescribed framework.

In addition to the kind of data that can be reasonably collected, the policy question to be answered and the analytic method used should also guide the selection of outcome measure(s).

### Did you know?

A lack of data to conduct a particular type of analysis might necessitate selecting another analytic method and another, perhaps less preferable, outcome measure.

## Estimate Outcomes: Part II

<b>Economic Evaluation</b>	<b>Summary Measures</b>
Cost-effectiveness analysis (CEA)	Cost-effectiveness ratio (Incremental costs per cases averted)
Cost-utility analysis (CUA)	Cost-utility ratio (Incremental costs per QALY)
Cost-benefit analysis (CBA)	Net benefits (Benefits – costs)

*This table provides a synopsis of the outcome measures used for each type of full economic evaluation.*

### Highlights

Here is an example of the framing of an economic evaluation for the [Antigua Health Education and Condom Distribution \(HECD\) Program](#).

(Source: CDC & HHS)

## Conduct Sensitivity Analysis

**Sensitivity analysis** isolates study variables or parameters, changes their values, and recalculates the study results.

It is used to determine how sensitive the results of a study are to changes in how it was done.

For example, sensitivity analysis can be used to assess how robust the results are to uncertain decisions or assumptions about the data and the methods (i.e., discount rate, measures of effectiveness, etc.) that were used.

Sensitivity analysis can

- Identify variables with the most influence, and
- Test robustness of the results

Testing the robustness of the results enhances the credibility of the study.

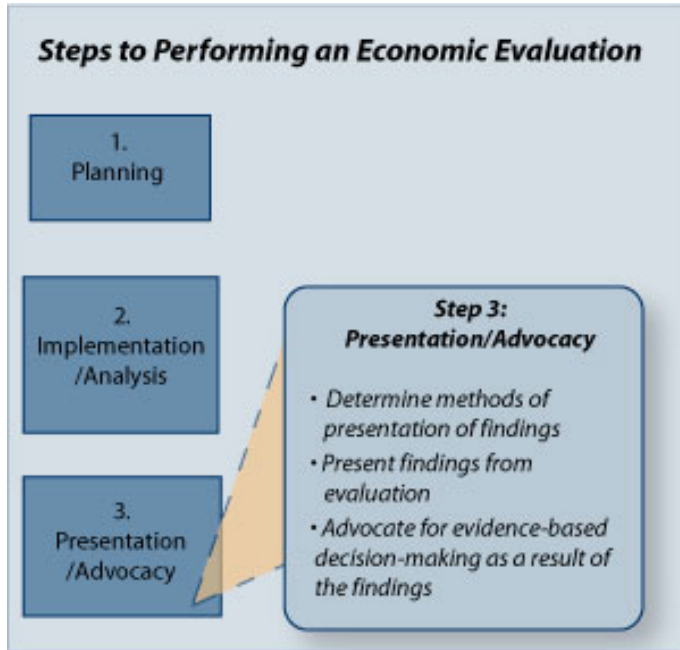
Source: CDC & HHS



## Highlights

The results of a study are robust if they do not change statistically significantly when the study parameters are varied within reasonable bounds. Robust results lead to increased credibility of conclusions drawn from the evaluation.

## Present Findings & Advocacy Phase



The final phase in performing an economic evaluation is referred to as the **Presentation of Findings and Advocacy phase**.

The steps involved are presented in the graphic.

## Cost-Effectiveness Case Study

### Introduction

The purpose of this session is to present a case study on a cost-effectiveness analysis of male circumcision in Rwanda.

This session discusses the specific analysis conducted by Agnes Binagwaho and colleagues.

The analysis was recently published in *PloS Med* journal in 2010. For the full-text of the article, click [here](#).

Source: Binagwaho A et al. 2010

### Background



There is strong evidence showing that male circumcision (MC) reduces HIV infection and other sexually transmitted infections (STIs).

In Rwanda, where adult HIV prevalence is 3%, male circumcision is not a traditional practice.

The study authors felt that ***a cost-effectiveness study on MC for infants and adolescents was needed given the fact that the MC debate in Southern Africa has focused primarily on MC for adults.***

Further, this was the first time, to the study authors' knowledge, that a cost-effectiveness study on MC has been carried out in a country where HIV prevalence is below 5%.

The various elements of an economic evaluation research design for the Rwanda male circumcision study are defined in the following pages.

Source: Binagwaho A et al. 2010

## Highlights

In Rwanda, it is estimated that only about 15% of men are circumcised.

## Define the Problem



### Hypothesis

The study authors hypothesize that a strategy combining infant and adult/adolescent circumcision would be more cost-effective and a more sustainable HIV prevention strategy than circumcising only adult men.

Source: Binagwaho A et al. 2010

## Define the Audience, Perspective & Timeframe



The study was undertaken by the Rwanda National AIDS Commission to inform policy and programmatic decisions in relation to introducing male circumcision.

The intended **audience** is national government officials.

The study adopts the **perspective** of the Government of Rwanda as a health care payer.

The model uses **timeframe** estimates from 2008.

Source: Binagwaho A et al. 2010

## Research Design

A cost-effectiveness **model** was developed and applied to three hypothetical cohorts in Rwanda: infants, adolescents, and adult men.

### *Model Assumptions*

Although only 38% of births occur in health facilities, 97% of infants go to a health facility within the first month of birth to get childhood immunizations (Vaccination program Rwanda/PEV, December 2007).

This visit to a health facility provides an opportunity to circumcise the infant, thus making it feasible to offer circumcision to nearly all male infants, of which the study authors estimate at least 70% are likely to undergo the procedure.

Acceptance of male circumcision in Rwanda is expected to be high since there are no cultural barriers to it, demand is already on the rise (MOH, Rwanda), and the intervention is expected to be accompanied by an intense national promotion campaign.

The numbers of circumcisions would be about 150,000 male children annually. To facilitate comparisons for this study, a similarly sized cohort of adolescents and of adults is considered.

In addition, the study authors assume that infants are circumcised at birth, adolescents at age 15 years old, and adults at age 30 years old.

The model projects HIV infections averted until death.

Source: Binagwaho A et al. 2010

## Costs

The costs included in the model are **mostly direct costs**.

The direct costs are based on interviews with experienced health care providers to determine inputs involved in the procedure (from consumables to staff time) and their prices.

Health care providers were asked to base their estimates on actual cases in which they participated.

Costs included:

- The materials necessary for performing circumcisions,
- Staff time,
- Associated staff training,
- Patient counseling,
- The treatment of adverse events, and
- Related promotion campaigns

Adjustments were made for the averted lifetime cost of health care (antiretroviral therapy [ART], opportunistic infection [OI], laboratory tests) due to protection from HIV.

Unit costs from a recent costing exercise carried out in Rwanda were used for nonmedical inputs, such as the implementation of a nationwide promotion campaign.

Source: Binagwaho A et al. 2010

## Highlights

A summary of costs is provided in [Table 2](#).

(Source: Binagwaho A et al. 2010)

## Outcome



The *main outcome measure* is **number of HIV infections averted**.

This is calculated as the product of the number of people susceptible to HIV infection in the cohort, the HIV incidence rate at different ages, and the protective effect of male circumcision; discounted back to the year of circumcision and summed over the life expectancy of the circumcised person.

The analysis of effectiveness is limited to those adolescents and adults who are HIV negative.

Source: Binagwaho A et al. 2010

## Findings

### ***For infant MC***

Total costs (US\$2,250,000) are lower than discounted total savings (US\$3,808,523).

Infant MC is less expensive than adolescent and adult MC (US\$15 instead of US\$59 per procedure).

The incremental cost-effectiveness ratio (ICER) for infant MC is negative and appears to be [cost-saving](#), although the savings will not be realized until later in time.

The fact that MC of infants in Rwanda is a cost-saving intervention means that for each MC performed, the government of Rwanda will save money.

### ***For adolescent and adult MC***

The cost per infection averted is US\$3,932 for adolescent MC and US\$4,949 for adult MC.

The higher cost of MC in adolescents and adults is due to several reasons including the higher cost of imported consumables involved in this more complex surgical procedure (the single most expensive item being local anesthetic), laboratory tests, amortization costs for the surgical kits, the cost of HIV testing and counseling, the increased staff and staff time necessary, and the need for infrastructure scale-up.

The costs per infection averted for adolescent and adult MC are both competitive with other HIV prevention interventions.

Source: Binagwaho A et al. 2010

### **Glossary Term:**

[Cost saving](#)

## Highlights

Remember the calculation for a [ICER](#).

## Did you know?

Given that this study does not quantify the indirect benefits of MC (such as the benefits to his sexual partners and offspring), the cost-effectiveness estimates are conservative.

## Sensitivity Analysis

Studies that model the future, like this one, approximate a reality that does not yet exist, and this requires making a number of assumptions about the future (for instance on what will happen to HIV incidence rates, on the effectiveness of

large-scale circumcision, and on the costs of HIV treatment in the future).

Given the uncertainty embedded in the input values of the base case scenario, the study authors conducted a [one-way sensitivity analysis](#) and explored a wide range of values in order to identify thresholds.

The study authors report the threshold at which the procedure costs more than one [GDP/capita/life year](#) gained ([WHO criteria for cost-effectiveness](#)).

For infant MC, the study authors also report the threshold at which the intervention is no longer cost-saving.

*Results from sensitivity analysis:*

- Infant MC remains highly cost-effective across a reasonable range of changes in the base case scenario.
- Infant MC is cost-saving up to a cost per procedure of US\$25.
- Infant MC would still be highly cost-effective if the lifetime cost of treatment and care (savings per infection averted) fell to US\$900.

Source: Binagwaho A et al. 2010

**Glossary Term:**

[One-way sensitivity analysis](#)

[Gross domestic product \(GDP\)](#)

[WHO criteria for cost-effectiveness](#)

## Highlights

See [Table 5](#) for more information on the threshold analysis.

(Source: Binagwaho A et al. 2010)

## Advocacy



The study suggests that Rwanda should focus on scaling up male circumcision of infants.

Infant MC can be integrated into existing health services (i.e., neonatal visits and vaccination sessions) and over time has better potential than adolescent and adult circumcision to achieve the very high coverage of the population required for maximal reduction of HIV incidence.

In the presence of infant MC, adolescent and adult MC would evolve into a "catch-up" campaign that would be needed at the start of the program but would eventually become superfluous.

Source: Binagwaho A et al. 2010

## [What to Consider in Reviewing an Economic Evaluation](#)

In summary, it is important to consider the following questions when you are assessing the quality of an economic evaluation analysis.

- Is more than one intervention being compared? Are the interventions feasible?
- What is the quality of the costs and effectiveness (or outcome) data?
- From whose perspective is the analysis taken?