



Economic Evaluation for Asthma Programs

LEARNING
AND GROWING
THROUGH
EVALUATION

MODULE 6

2021 Updates

MODULE 6

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Chapter 1 Economic Evaluation for Asthma Programs

After reading Module 6, users should be able to:

- ② Identify benefits of economic evaluation.
- ② Understand the different types of economic evaluations.
- ② Select the appropriate type of economic evaluation for a particular program.
- ② Develop a plan for economic evaluation.
- ② Implement economic evaluation.
- ② Use economic evaluation results to inform stakeholders.

Resources available to public health programs are finite. Staff, time, facilities, equipment, and knowledge are all in short supply. As a result, decision makers are increasingly seeking information to help them allocate resources. Findings and recommendations from program evaluations can contribute important information about a program's effectiveness.

However, program effectiveness is only one aspect of decision making; program cost is also an important consideration. By adding **ECONOMIC EVALUATION** to your overall program evaluation portfolio, you can provide additional information that many decision makers require.

It is important to note that economic evaluation is not a stand-alone effort but, rather, a complement to other types of evaluations described in previous modules of *Learning and Growing through Evaluation*. While economic evaluation can provide useful information at any stage of a program's development, it is most commonly done once an evaluation has demonstrated that the program works (**EFFICACY**); that it works in your environment (**EFFECTIVENESS**); and that it is reaching those who need it (availability). Often, it is an add-on to evaluations that examine efficacy, effectiveness, or availability, expanding the scope of the evaluations and the types of information they can provide.

By adding an economic component to your evaluation portfolio, you are adding the ability to answer new questions, for example, "Do our stakeholders think a certain level of health outcome produced by our program is worth the amount of resources expended to produce it?"

This is the sixth module in the *Learning and Growing through Evaluation* series. As with the other modules in the series, the primary audience is asthma program personnel, though others in the broader public health community and beyond may also find it useful. This module is designed to provide a basic understanding of why and how to conduct economic evaluation as a complement to a program’s overall evaluation activities. Module 6 describes the major types of economic evaluation and covers the fundamental considerations involved in planning for and implementing them. We discuss the benefits and limitations of economic evaluation, the importance of considering the program’s stage of development during the pre-planning process, and basic steps for conducting economic evaluation using the six steps of the CDC’s Framework for Program Evaluation in Public Health.



- **Appendix A** provides **Chapter Notes** for all the words or concepts in blue bold, small cap text marked with the leaf icon in Chapter 1.
- **Appendix B** contains a **GLOSSARY** for all terms marked by green bold text in small caps.
- **Appendix C** contains a listing of useful resources on economic evaluation.
- **Appendix D** offers some useful tools and templates for managing cost data.
- **Appendix E** provides information on **RETURN ON INVESTMENT (ROI)**.

This module does not aim to cover all the possible methodologies for economic evaluation and the nuances behind them. For those interested in obtaining more in-depth information, we provide additional resources in the appendices.

Throughout this module, we refer to the programmatic element or subject of the evaluation as the “program.” Economic evaluation may be conducted on varied aspects of asthma programs, and its scope may vary from being a comprehensive evaluation of a major asthma intervention, service, or strategy to being a targeted evaluation of a single aspect of an activity. We use the generic term “program” to refer to any of these examples.

Economic evaluation, like every field, has its own terminology, which may be confusing to those not trained in health economics. Adding to the confusion, many commonly used terms have very specific definitions that may differ from how we typically use them in program evaluation or program management. For example, the term “analysis” may refer to the specific task of analyzing data sets that include economic measures, or it may be used more broadly to refer to types of design, data collection and management, analysis and interpretation (e.g., “cost-benefit analysis”).

As you read this module, and especially as you seek out other reference materials, be aware of possible differences in terms and be sure to understand them and explain them to your stakeholders, as appropriate. For example, if you choose to hire an economist to answer more complicated evaluation questions, be prepared to spend time translating between “evaluation speak” and “health economics lingo.” Ideally, you will find ways to describe it all in plain language, and we hope this module will get you started.

Why conduct an economic evaluation? An economic evaluation brings an additional lens to the discussion of a program’s value. Not only does the evaluation collect important financial information for managers and other decision makers to consider, it is an opportunity to assess the value of program benefits and tradeoffs for a particular set of stakeholders.

Economic evaluation can

- **Provide information that can be very persuasive to policy makers and other decision makers.** An economic evaluation provides information about the stakeholders' perceptions of a program's value or information about alternatives to a program through a systematic analysis and the accompanying interpretation of data. Such information is critical to making and defending decisions like whether to keep, expand, or eliminate a program, or how to choose among similar programs.
- **Promote fiscal responsibility and increase fiscal transparency.** When a program collects cost data on program inputs and outputs during implementation, program managers are able to incorporate fiscal aspects into their decision making. Additionally, managers are better equipped to address stakeholder queries about program costs such as how asthma dollars are spent (which groups get what services), the return on investments in asthma programs, and how changing investments in the program will impact the number of people a program might serve.
- **Help set priorities when resources are limited.** Program managers can use cost information in designing or redesigning programs as well as budgeting funds, so that the program realizes the greatest benefits at the lowest cost. When added to a process evaluation, a detailed **COST ANALYSIS** can determine the **COSTS** associated with various delivery steps to aid in assessing the efficiency of program delivery and operations. Findings from a cost analysis can also support outcome evaluation by delineating choices about a program or between program alternatives based on documented effects.

When is economic evaluation appropriate? Before you decide to take on any economic evaluation activities, consider the necessary conditions for successful economic evaluation. First, ensure that **sufficient interest** in or a need for conducting economic evaluation exists. Who needs this information and why do they need it? What do they want to know? In other words, ask, "What is the purpose of doing an economic evaluation or of adding economic evaluation questions and methods to our existing evaluation?" "How will the results be used and by whom?" These are fundamental questions since adding an economic evaluation typically requires a significant investment from a program.

Once sufficient need for the information is determined, assess the **resources available** for the economic evaluation. Can you assemble a team that is both willing and knowledgeable about how to obtain, analyze, and value relevant data? If you don't have the expertise or availability of appropriate resources in-house, is there willingness and a budget to engage outside resources?

Next, consider the **data you can access**. Although you may not have identified all the data you will need to collect, you should determine how much access to data you can anticipate. For example, if you know you will need work or school absenteeism data, is it available? Is it available to you or any member of your team? Is it in a format that you can analyze? Does the data reflect actual costs or charges? Will you have access to aggregated or individual-level data? Note that some data may come with a cost (e.g., data held by private sources) or may require you to establish a collaboration, partnership, or formal data sharing agreements. In addition, cost data are often considered sensitive information and may require additional activities to protect appropriately.

Finally, you will need to engage in some level of pre-planning with stakeholders to consider the aforementioned aspects. To meaningfully engage stakeholders in discussion about these aspects, you may need to train them and build their **capacity to understand the complexities of economic evaluation**. This may involve teaching them terminology, design options, data collection and analysis methods, and how to understand the evaluation results. Be sure you have a willing audience for this type of stakeholder education. Then build time for it into your evaluation management plan. Stakeholder input is essential to accurately estimate or determine costs that may be incurred in your program's specific context or setting. A program deemed cost-effective in one community may incur different costs in another.

Which type of economic evaluation is appropriate for my program? It depends. As with all evaluations, the types of evaluations you conduct and the methods you choose depend on the evaluation's focus—stakeholders' information needs balanced with evaluation resources.

Your evaluation focus drives the viewpoint or **PERSPECTIVE** of your evaluation. Options for perspectives include assessing costs and benefits from the **PROGRAM PERSPECTIVE**, from a client's or program's **PARTICIPANT PERSPECTIVE**, from the **PAYER PERSPECTIVE**, or from the **SOCIETAL PERSPECTIVE**. These viewpoints and their implications for the evaluation are defined in Step 2.

There are many types of economic evaluations to choose from, each designed to answer specific questions about a program's costs, consequences, or benefits. A **PARTIAL ECONOMIC EVALUATION** assesses either the costs or the outcomes of a program, but not both; a **FULL ECONOMIC EVALUATION** examines both.

The most basic type of analysis, **COST ANALYSIS**, looks at a single program and provides insights on the costs incurred and the savings realized by that program. It is the first step in any economic evaluation and goes in the partial economic evaluation category. Depending on stakeholders' information needs, other types of analysis may be appropriate (e.g., **COST-EFFECTIVENESS ANALYSIS** or a **BENEFIT-COST ANALYSIS**). These and other commonly used analyses are described in Step 4 of this module. Each analysis comes with its own needs for resources and expertise to implement and effectively use the information it produces.

Ideally, all evaluations, including economic evaluations, are conducted prospectively, while the program is operating, and data are collected in real time. However, evaluations can be done retrospectively, after the program is completed. Retrospective analysis is not ideal since the information will be dated and this may affect the consistency and accuracy of how the cost and outcomes data are captured. Still, these analyses can produce useful information on program cost, cost savings, cost-effectiveness, and benefits of programs for future decision making.

How do we get started? Economic evaluation is, fundamentally, just about evaluation. It involves asking good questions about the merit, worth, and value of a program (e.g., measurements in costs, consequences, and benefits), and then choosing the best method for answering them. It should incorporate the judgments of a group of stakeholders with varying perspectives. The rest of this module walks you through the different steps of economic evaluation. For additional resources on evaluation, see the other *Learning and Growing* modules. For more details on economic evaluation, consult **Appendix C** of this module.

Applying the CDC Evaluation Framework to Economic Evaluation

Now that you understand the purposes of economic evaluation and its basic concepts, we are ready to delve into the steps of developing a plan for economic evaluation. As a reminder, despite new terminology and concepts, economic evaluation is essentially “the formalization of an approach that we use in everyday life: assess the advantages (**BENEFITS**) and disadvantages (**COSTS**) of available options and choose the one which, on balance, is best” (Barnett, 1993, p.93).

We are applying the CDC Framework for Program Evaluation in Public Health to illustrate how planning economic evaluation is much the same as for any other program evaluation. The difference is that the focus for each step progressively leads you and your stakeholders toward accurately assessing program costs and benefits to support making sound judgments about the merit of the program. The **EVALUATION STANDARDS (UTILITY, FEASIBILITY, PROPRIETY, ACCURACY, and EVALUATION ACCOUNTABILITY)** are equally applicable in economic evaluation. Just as in evaluations that do not include an economic component, the standards are very useful references for when you are faced with decisions or alternatives in planning your evaluation.

Step 1 – Engaging Stakeholders in Your Economic Evaluation

Engaging stakeholders in economic evaluation. As with all evaluations, engaging stakeholders (also referred to as the **AUDIENCE**) in a meaningful manner is a critical first step and should continue throughout the evaluation. In economic evaluation, stakeholders help delineate costs and benefits and highlight factors that could influence both the evaluation and the program itself. Because economic evaluation can be complicated and generally requires use of certain conventions and terminology that are unfamiliar to many stakeholders, you may need to build evaluation capacity early in this step. As has been emphasized in the *Learning and Growing through Evaluation* series, creating an **EVALUATION PLANNING TEAM** at the outset of the evaluation produces buy-in, fosters a collaborative spirit, and builds understanding and capacity to implement the evaluation for an agreed-upon purpose.

One of the first important decisions that you and your stakeholders will make when conducting economic evaluation is deciding the viewpoint, or perspective, your evaluation will take. The choice of perspective drives decisions about the relevant costs and benefits to include in the evaluation, as well as those to exclude. Common perspectives in economic evaluation are program, program participant, payer, and societal.

For our purposes, the program perspective represents the point of view of an asthma program and explores specific costs and benefits that can be attributed to the program (Haddix, Teutsch, Shaffer, & Dunet, 1996). The program perspective is usually chosen when the results of economic evaluation will be used primarily by the program staff members. The program participant perspective, also called client perspective, focuses on the costs of participation borne by program participants, such as fees, transportation costs, or lost labor; it also typically includes the benefits the client receives from participation (Haddix et al., 1996). The payer perspective examines costs and benefits from the viewpoint of the person or entity ultimately responsible for the financial cost of the program, such as an insurance company or a foundation (Haddix et al., 1996). Finally, the societal perspective includes costs and benefits of everyone directly and indirectly affected by the program, including taxpayers (Haddix et al., 1996). It is the broadest possible perspective and is typically used when the intent is to share outcomes with policy makers or to resonate with wider audiences.

For example, the cost of travel for community health workers (CHW) in an asthma home-visit program is relevant to the asthma program and not to program participants, because the program incurs the travel cost. Therefore, economic evaluation conducted from the program perspective will include the cost of CHW travel, while an evaluation done from a participant perspective will exclude it. The choice of evaluation perspective will be influenced by the purpose and intended use of your evaluation, and it will, in turn, influence the stakeholders you involve.

The viewpoints within a given perspective may vary. For instance, some participants may take time off work to participate in a program. Consequently, the costs incurred by these participants may be higher than other program participants. It is imperative to be mindful of the potential diversity within a perspective and to establish a comprehensive understanding of the costs and benefits from multiple viewpoints.

Table 1 illustrates stakeholders you might expect to include in your economic evaluation of asthma programs. Who and to what extent you engage specific stakeholders, or their representatives, are discussed more fully in Module 1, *Learning and Growing through Evaluation*. As with any evaluation, not all stakeholders need to be engaged at the same level and in the same phases of the evaluation. When identifying stakeholder roles, consider their interest, availability, economic evaluation skills, experience, and historical knowledge of the program, including the associated costs and benefits, and the communities they serve. Remember to document these decisions in the overall evaluation management plan and update them periodically.

Table 1 Potential Stakeholders by Evaluation Perspective

Participant	Program	Payer (or Funder)	Societal
Program Participant	Program staff members & administrators	Insurance providers - Medicaid, private insurance, employers, or other funders of program	Program staff members & administrators
Caregiver	Program payer(s)	Program staff members & administrators	Program participants & caregivers
Program staff members & administrators	Program implementers	Program implementers ¹	Program implementers ¹
Patient advocacy groups	Program partners	Patient advocacy groups ²	Program partners
	Program volunteers	Program participant & caregivers	Program payer(s)
	Program participant & caregivers		Government—state & federal
			Taxpayers
			Private & public institutions affected by the program

Step 2 – Describing the Program for Your Economic Evaluation

Developing a program description for economic evaluation. A program description clearly articulates how the program’s activities will address the stated problem. It provides information about who does what, for whom, where, and how often. It also describes the expected results. A program logic model is an effective way to present this information and can identify activities that may have cost implications.

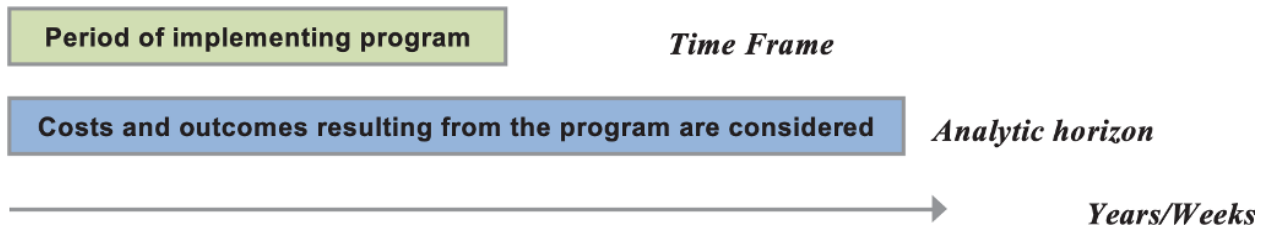
While clarity in description is important to all evaluations, in the case of economic evaluation, the description, including delineating the scope or boundaries of the program, must be clear to the stakeholders, especially those whose perspective is guiding the evaluation. The description should include information about the program’s stage of development—whether it is a pilot, a fairly new program, or a mature program. The description should also include any information about the program’s efficacy or effectiveness. These factors will have implications for the types of questions you will ask and the methods you will use to answer them. Refer to Module 5, *Evaluating Services and Health Systems Interventions* for more information.

In economic evaluation, a program description has two additional program components that have significant impact on program costs and benefits and should be included: the **TIME FRAME** and the **ANALYTIC HORIZON** (see **Figure 1**).

¹ Non-clinicians, clinicians, community health workers, social workers, volunteers, etc.

² Possibly to include a critic’s perspective.

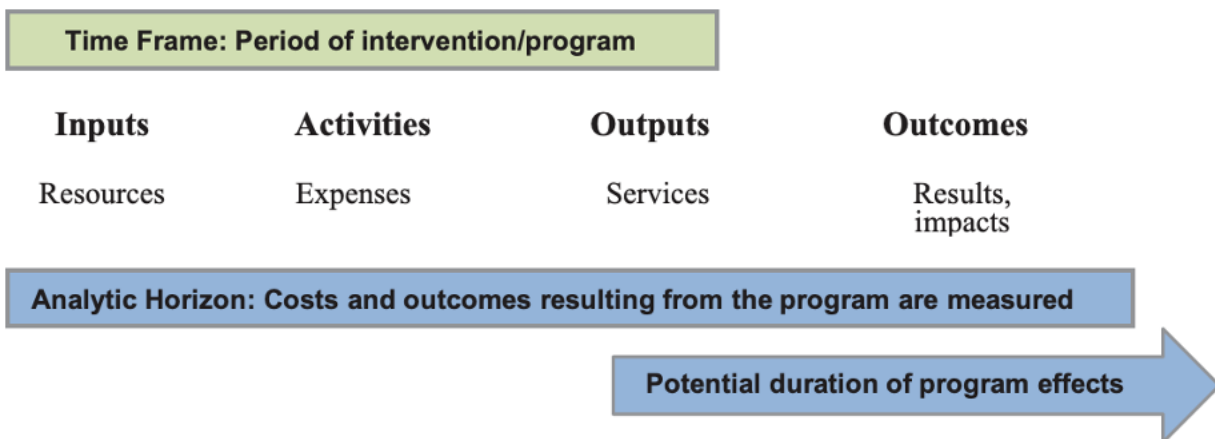
Figure 1 The Distinction Between Time Frame and Analytic Horizon



The **time frame** is a specified period during which all program activities are undertaken to produce all planned program outputs. Note that if a program’s time frame does not account for seasonal variations, it will misreport the costs that might be expected in a program for which the time frame spans a longer period. For example, if an asthma program is delivered during a period when emergency department visits for asthma exacerbations are typically low. Therefore, an indication of the program’s time frame in your program description is crucial not only for thinking about your evaluation design, but also for interpreting, communicating, and most importantly, replicating your results.

The **analytic horizon** is the period over which all program costs and outcomes of interest are measured and accounted for in the analysis. While the aim of the program is to achieve the long-term outcomes (e.g., reduced suffering and death), it is also important to consider intermediate outcome measures like increased symptom-free days or reduced medication use. These are often more immediately relevant to the program’s activities.³ Additionally, demonstrating a link between your program and the long-term outcomes is challenging, due to long lag periods between the intervention and the health outcome, lack of data, and other confounding influences. An analytic horizon that is long enough to encompass intermediate program outcomes is considered reasonable when evaluating most public health programs. **Figure 2** shows how a logic model may represent the concepts of time frame and analytic horizon. Remember that programs can incur costs before implementation (e.g., staff training), during implementation, and after implementation (e.g., staffing costs to collect data on program benefits).

Figure 2 Time Frame and Analytic Horizon Within a Logic Model Construct



³ See <http://www.cdc.gov/asthma/nacp.htm>

In practice, decisions about the time frame and analytic horizon are largely influenced by available resources and time constraints. You will need to work with your stakeholders to ensure they understand how decisions regarding the time frame and analytic horizon may impact your results.

Step 3 – Focusing the Evaluation Design of Your Economic Evaluation

At this stage, you and your stakeholders share a common picture of how the program intends to address a public health problem. The next step is for you and your stakeholders to focus the design of your economic evaluation, ensuring that it directly addresses the evaluation’s purpose and provides sufficient information for the stakeholders.

As discussed in Step 1, the perspective of your evaluation is determined by how the results will be used. For example, if the purpose is to help program administrators decide whether an intervention should be expanded, it would be appropriate to focus only on program costs and benefits of the intervention. If, however, the purpose is to help policymakers decide between two different interventions (e.g., two different models of school-based self-management education programs), then the evaluation needs to focus on the costs and benefits, not just to the program but to society as a whole, including costs and benefits to families, communities, and payers.

Developing economic evaluation questions. The first step in focusing your economic evaluation design will be to develop evaluation questions. As you make subsequent decisions, remember to return to the evaluation questions and make sure that your choices are appropriate.

As with all evaluations, engaging stakeholders to clearly articulate the evaluation questions is essential. Evaluation questions are generally three to five big picture questions whose answers will inform and guide stakeholders in their decision making.

A well-defined economic evaluation question specifies the perspective, identifies alternative options,⁴ and then makes a succinct statement about the purpose and use of the information that the evaluation will generate. For example:

“From the perspective of a Medicaid-managed care organization, is a home-based environmental program provided by CHWs more cost-effective than the currently available asthma disease management program provided by health care providers?”

It is typically best to limit the evaluation questions to a single perspective; mixing viewpoints could result in confusion and double counting.⁵ If varied perspectives are needed, you need to ensure the ramifications of such decisions are clearly understood by your stakeholders.

Guided by the perspective, purpose, and intended uses of the evaluation, your evaluation question may assist with decisions that are operational, managerial, or strategic in nature. Below is a list of sample questions that are generally encountered at project, program, or policy levels.

⁴ In many cases, the status quo, also called **DO-NOTHING**, may serve as an alternative option.

⁵ For more information about the complexities of using multiple perspectives, see Rossi and Freeman (1993).

Table 2 Sample Evaluation Questions

Evaluation Question	Possible Corresponding Economic Evaluation Question
To what extent are our initiatives equitably serving people with asthma in our priority population?	From the perspective of the asthma program, how are the program funds being expended across the jurisdiction's asthma population?
How well are program initiatives being directed to address disparities among children with asthma?	From the perspective of the asthma program, what portion of allocated funds is being expended to address disparities among children?
How can the CHW program be expanded to reach more families?	From the perspective of the asthma home-visit program, how many CHWs can be added to the program, without increasing the current fixed cost?
How can we increase the efficiency of the CHWs in our home visiting program?	From the perspective of the asthma home-visit program, would allowing CHWs to work from home (rather than the office) be cost-effective?
How does the number of symptom-free days among participants vary with changes in the level of home environmental remediation (minor, moderate, and major remediation)?	From the perspective of the program, how cost-effective is it to fund moderate- or major-level home environmental remediation over minor level?
How many symptom-free days did the adult patients experience in the six months after participating in the self-management education (SME) program provided by nurses in the hospital?	From the perspective of a payer, how cost-effective is offering an SME program to adults after an ED visit, as compared to not offering the program?
To what extent did schools realize reductions in student absences after they participated in an asthma management program?	From the societal viewpoint, what is the net benefit and program cost of having one fewer school day missed compared to nonparticipation in the program?
How many symptom-free days were reported by students after known triggers were removed from school?	From the viewpoint of a payer, what are the net benefits and program cost of having one additional symptom-free day as a result of the intervention?
How do symptom-free day outcomes compare in a self-management education program when it is provided by school nurses or by pharmacists?	From the societal viewpoint, which is more cost-effective self-management education in schools or in pharmacies?

Your questions will be influenced by the program's stage of development. For example, a pilot program may simply ask about the actual costs of a program. A new program that has been deemed effective may ask whether the cost-efficiency of the program varies by sub-population. A mature program, with evaluations already documenting its effectiveness, may choose to look at ways to reduce costs while maintaining program effectiveness.

Once your Evaluation Team has agreed on the evaluation question(s), you will need to revisit your decisions about the program time frame and analytic horizon to make sure they are appropriate for adequately answering the evaluation questions.

Next, you and your stakeholders need to make decisions about your evaluation design and analytic method.

Deciding on an evaluation design. In economic evaluation, part of the design step involves choosing analytic methods. When choosing the method, it is necessary to seek input from decision makers and those who will use the results of the evaluation. You may need to educate your stakeholders on the pros and cons of different design options. The design choice for any evaluation is invariably constrained by the availability of data, time, and other resources. It is prudent that your stakeholders be keenly aware of why and how you arrived at the design choice. Stakeholder buy-in on design decisions builds credibility for your evaluation findings.

Table 3 Pros and Cons of Design Options

	Pros	Cons
Prospective evaluation	More control over data	<ul style="list-style-type: none"> • Needs more time and resources • Possible observer bias
	Pros	Cons
Retrospective evaluation	Saves time and requires fewer resources	<ul style="list-style-type: none"> • Less control over quality and quantity of data • Possible selection bias • Need to employ more advanced statistical methods • May constrain range of possible evaluation questions

PROSPECTIVE EVALUATIONS occur when data are collected while the program is being implemented. Prospective evaluations give more control over how and what data are collected, but they are typically more costly. **RETROSPECTIVE EVALUATIONS** use available data to infer the costs incurred by the program and outcomes that were realized as a result. However, retrospective evaluations are advantageous because less effort is involved in data collection.

As an evaluator, you may be challenged with figuring out how different data types align with what's needed to answer the evaluation questions. For example, you may find that you have aggregate data available at a systems level regarding overall program effectiveness, but the corresponding cost data is available at the individual level for those being served by the program. In such cases, it is essential to understand the limitations of the data and interpretation of results to ensure these data are used appropriately.

All economic evaluations basically involve identifying, measuring, and valuing program costs or program consequences or benefits. However, to determine which specific type of evaluation is appropriate for your purposes, you may start with answering two questions: (1) Is there a comparison for two or more program alternatives? (2) Are both program costs (inputs) and program consequences (benefits) or program alternatives being examined? The selection of appropriate method(s) will also depend on the evaluation question, the primary stakeholders for the evaluation, and the availability of data.

Figure 3 may be helpful for you and your stakeholders in discussing and narrowing down the type of economic evaluation you would want to consider for your situation.

Figure 3 Distinguishing Characteristics of Economic Evaluation

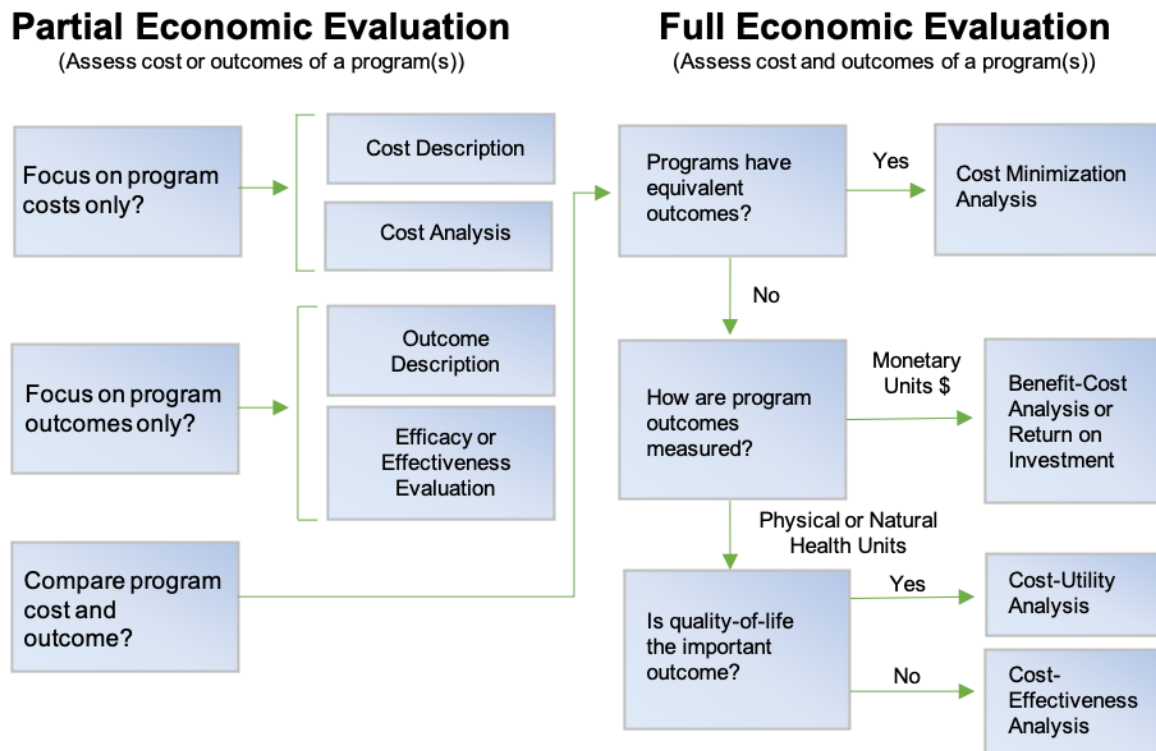


Figure 3 depicts the types of economic evaluation that are most widely used when evaluating public health programs. For a detailed description on efficacy or effectiveness evaluation, which is appropriate when an evaluation focuses on program outcomes only, refer to Module 1, *Learning and Growing through Evaluation*.

Table 4 below provides a brief discussion of common analytic methods identified in **Figure 3**. Terms used in the table will be defined further in Step 4 and can be found in **Appendix B**.

Table 4 Commonly Used Analytic Methods in Economic Evaluation and Description

Common Economic Analysis Methods	
Cost Description and Cost Analysis	COST DESCRIPTION and cost analysis are the most basic and common types of partial economic evaluation. Cost description involves systematic collection, categorization, and analysis of all program costs. Cost analysis helps with understanding the net program costs—costs that the program incurs (program costs) and costs that it saves or averts (program savings). Cost analysis is the first step in any full economic evaluation.
Cost Minimization Analysis	Cost-Minimization Analysis measures and compares input costs. It assumes outcomes to be equivalent.
Cost-Effectiveness Analysis (CEA)	COST-EFFECTIVENESS ANALYSIS relates net program costs to a quantifiable outcome measure(s) of program effectiveness. Cost-effectiveness evaluation can determine the net program cost of each unit of effectiveness, or the additional net program cost for each incremental unit of effectiveness.

Common Economic Analysis Methods	
Benefit-Cost Analysis (BCA)	BENEFIT-COST ANALYSIS (also referred to as cost-benefit) identifies and places dollar values on the costs of programs and weighs those costs against the dollar value of program benefits accrued over a defined period. ROI is a type of BCA.
Cost-Utility Analysis (CUA)	COST-UTILITY ANALYSIS compares net program costs and the net effectiveness of a program. The latter is measured in terms of health years, number of life years saved, or QUALITY ADJUSTED LIFE YEARS (QALYS) .

In summary, making decisions regarding evaluation design should be done with your stakeholders within the context of the perspective, purpose, and intended uses of the evaluation. **Table 5** illustrates common evaluation questions that may be of interest to varied stakeholders. The table also indicates analytic methods that may be appropriate for each situation.

Table 5 Sample Situations and Corresponding Analysis Method

Audience or Stakeholder	Question	Analysis Method
Insurer or payer	What is my return on dollars invested in a program? Or, what is my benefit for each dollar invested in a program?	ROI or BCA
School district superintendent	How many fewer days will a student miss?	CEA
Person with asthma	How many fewer workdays will I miss?	CEA
Legislator	What is the cost to society to increase the number of symptom-free days by 10 days per year per person with asthma in my state?	CEA
Asthma program manager	How is asthma funding expended across population types?	Cost Analysis
State minority health officer	What portion of allocated funds is being expended to address disparities among children?	Cost Description
Asthma program manager	There are two interventions that could or are perceived to satisfy unmet need. How do I estimate the strengths and weaknesses of both to assist with decision making?	BCA
Asthma program manager	An intervention is delivering expected outcomes. Adding a component or modifying an existing component may enhance the outcomes of my program. How do I decide if associated cost is worth the modification?	CEA
Legislator	Should we fund an asthma initiative or a heart health initiative?	Cost Utility

Deciding on whether a comparison group is needed. As noted in **Table 4**, for many types of economic evaluations, you will need to make a comparison between your program and another program or group, referred to as a **COMPARATOR**. The comparator may be a group receiving a different program (Program A or B in the table), no intervention, or a less intensive intervention. Two common evaluation designs used for economic analyses are randomized controlled trials and quasi-experimental designs. Each of these designs varies in its ability to establish the three necessary conditions for causality: a) eliminate other reasons for an observed program effect, b) the program effect occurs after exposure to the program, and c) a significant correlation between exposure to a program and the program outcome. The pros and cons of each design are described in **Appendix E** of Module 2, *Implementing Evaluations*.

It is highly likely that your economic evaluation is not a stand-alone evaluation but, rather, a component added on to a program effectiveness evaluation. In this case, assess the impact of evaluation design decisions if they have already been made, and ensure that your stakeholders understand the design and its implications and will accept the information as credible. You may also need to provide additional education to the stakeholders about the assumptions that undergird these designs and methods. In situations where consensus is not reached with stakeholders, the design decisions may need to be revisited.

At this stage, you and your stakeholders have a common picture of what the health problem is and how your program is going to address the problem. You also have a shared understanding of the perspective, purpose, and intended uses of the evaluation. You have decided on your evaluation questions, chosen a design for the evaluation, and decided on analytic methods. You are ready to move on to the next step: gathering credible evidence for your economic evaluation.

Step 4: Gathering Credible Evidence for Your Economic Evaluation

Once your stakeholder team has articulated the evaluation question(s) and agreed upon a design to answer the question(s) appropriately, you and your Evaluation Team will begin the task of gathering evidence. Since the type of analysis is intrinsic to the design of economic evaluation, you will need to ensure that data collected fit the analysis method. Please read this section and Step 5 as a unit.

Identifying the most appropriate indicators to include in your evaluation. As with any evaluation, deciding on the indicators that will provide the answers to your questions will direct your data collection efforts. For economic evaluation, indicators are referred to as **SUMMARY MEASURES**, and the analytic method used for analysis dictates which summary measures are used. **Table 6** illustrates summary measures for program cost, cost-effectiveness, cost-benefit, and cost-utility of programs that you may consider. The most useful measures will depend on stakeholders' information needs. **Table 6** also shows how the measures will be calculated later in the analysis. Although the actual calculations won't be done until data are collected, they are presented here to help you understand and define what data are needed. Terms used in the calculations will be defined throughout this section and in **Appendix B**.

Table 6 Analytic Methods and Associated Summary Measures

Analytic Method	Summary Measure(s) to Consider...	Description or Calculation ⁶
Cost Description	Program Cost	<i>Program cost = TOTAL COST of all resources used by the program</i>
	Marginal Program Cost	<i>Marginal Program Cost = Additional program cost of adding one additional participant to the program</i>
	Average Program Cost	<i>Average Program Cost = Program Cost ÷ Number of Program Participants</i>
Cost Analysis	Net Program Cost	<i>Net Program Cost = Program Cost + Change in Medical Cost¹ + Change in Productivity Costs²</i>

⁶ Some definitions are specified for asthma programs.

	Average Net Program Cost	$Average\ Net\ Program\ Cost = \frac{Net\ Program\ Cost}{Number\ of\ Program\ Participants}$
	Incremental Net Program Cost (of Program A over Program B)	$Incremental\ Net\ Program\ Cost = Net\ Program\ Cost_A - Net\ Program\ Cost_B$
Cost-Effectiveness Analysis	Cost-Effectiveness Ratio (of Program A over Program B)	$Cost-Effectiveness\ Ratio^2 = \frac{Net\ Program\ Cost}{Outcomes}$ $Incremental\ Cost-Effectiveness\ Ratio = \frac{(Net\ Program\ Cost_A - Net\ Program\ Cost_0)}{(Total\ Outcomes_A - Total\ Outcomes_0)}$
	Incremental Cost-Effectiveness Ratio (of Program A over Program B) (ICER)	$Incremental\ Cost-Effectiveness\ Ratio = \frac{(Net\ Program\ Cost_B - Net\ Program\ Cost_A)}{(Outcomes_B - Outcomes_A)}$
Cost-Benefit Analysis	Net Present Value of the Program	$Net\ Present\ Value = Present\ Value\ of\ Benefits - Present\ Value\ of\ Program\ Costs$
	Incremental Net Present Value (of Program A over Program B)	$Incremental\ Net\ Present\ Value = (Present\ Value\ of\ Benefit_A - Present\ Value\ of\ Benefit_B) - (Present\ Value\ of\ Program\ Cost_A - Present\ Value\ of\ Program\ Cost_B)$
	Benefit-Cost Ratio	$Benefit-Cost\ Ratio = \frac{(Present\ Value\ Benefit_A - Present\ Value\ Benefit_0)}{(Present\ Value\ Cost_A - Present\ Value\ Cost_0)}$
	Incremental Benefit Cost Ratio (of Program A over Program B)	$Incremental\ Benefit\ Cost\ Ratio = \frac{(Present\ Value\ of\ Benefit_B - Present\ Value\ of\ Benefit_A)}{(Present\ Value\ of\ Program\ Cost_B - Present\ Value\ of\ Program\ Cost_A)}$
	ROI	$Simple\ ROI^3 = \frac{(Benefit - Program\ Cost)}{Program\ Cost}$ $Discounted\ ROI = \frac{(Present\ Value\ of\ Benefit_0 - Present\ Value\ Program\ Cost)}{Present\ Value\ Program\ Cost}$
Cost-Utility Analysis	Net QALYs (of Program A over Program B)	$Net\ QALYs\ Program\ A\ over\ B = QALY_{SA} - QALY_S$
	Incremental Cost Utility Ratio (of Program A over Program B) (ICUR)	$Incremental\ Cost\ Utility\ Ratio = \frac{(Net\ Program\ Cost_A - Net\ Program\ Cost_B)}{(QALY_{SA} - QALY_{SB})}$

Abbreviations used in calculations & supporting notes:

CE = Cost-Effectiveness

AVG = Average

INC = Incremental

NPV = Net Present Value

PV = Present Value

QALY = Quality Adjusted Life Years

A = Program A

B = Program B

0 = No program

¹*Changes in cost as a result of the program, calculated as (cost after the program – cost before the program). Some changes can be positive, some negative, and some zero.*

²*The denominator considers harmful health outcomes prevented by the program, such as Asthma Symptom Days. If you were considering beneficial health outcomes added, such as symptom-free days, the denominator would have to be adjusted.*

³*Used for short term, typically, less than one year of investments and benefits.*

Table 6 may seem complicated, and the calculations may be confusing. If you have an economist on your team, their help will be invaluable. If you do not, contacting your evaluation technical advisor (ETA) and CDC economists may be helpful. References located in **Appendix C** can help you as well.

Other decisions that the team will need to make during Step 4 are what data sources to use, how much data are feasible to collect and manage, and what data and level of accuracy are sufficient to satisfy stakeholders' expectations. **Appendix H** of Module 2, *Implementing Evaluations*, discusses sampling methods to help you decide on the amount of data to be collected. Appendix H discusses data sources generally. Below, we discuss considerations regarding data sources specifically related to costs and benefits. To help you organize and manage cost and benefit data, templates are provided in **Appendix D**. **Appendix E** provides information about ROI.

Identifying Relevant Costs of the Program. In developing a **COST INVENTORY**, the perspective of your analysis is your primary criteria for deciding whether a cost is relevant to your analysis. For example, the travel cost to a medical appointment incurred by an individual with asthma is relevant if the evaluation is being done from the client's perspective but is not included if the evaluation is from a payer's, or funder's, perspective.

Collecting cost data is often time consuming, and, therefore, prudence is required when deciding which costs to include and which may safely be excluded from the analysis. Below are some practical tips to consider:

- If a cost is known or assessed to be of relatively small magnitude and, therefore, not significant to your result, it may be dropped.⁷
- If your evaluation question seeks to compare two programs, a cost that is common to both programs may be dropped.⁸
- If the inclusion of a cost requires considerable added effort and is not likely to impact decision making by your stakeholders, it may not be worthwhile to collect. Again, your stakeholders will need to understand the implications of their decision regarding costs that should be included in (or excluded from) the analysis.

Document the decisions you make about the costs to include, as well as any assumptions you make. This transparency is important for maintaining the trust of your stakeholders. It will also be important when you begin to share your evaluation findings.

⁷ Because it is unlikely to significantly affect the results of the economic evaluation and decisions of stakeholders.

⁸ If the manager of a state health department is spending 10 percent of her time on each program then the cost of her employment in these two programs can be dropped.

When discussing costs, you will find the need to use specific jargon, particularly regarding different types of costs. It is highly beneficial to spend time early on, with your evaluation team and stakeholder group, to create a basic understanding of the types of costs that are frequently discussed in economic evaluations of public health programs. These include

- **Fixed and variable costs**

FIXED COSTS are items that remain constant, within a relevant range, based on volume of program activities. **VARIABLE COSTS** are items that respond proportionately to the volume of program activity.

For example, if an asthma program rents an office at \$1,500 per month as its permanent workplace, $\$1,500 \times 12 = \$18,000$ is its fixed cost. On the other hand, the expense for providing a booklet with asthma control recommendations to each participant (e.g., \$0.10/booklet) is a variable cost—the higher the number of participants served, the higher the total variable cost.

- **Direct and indirect costs**

DIRECT COSTS are resources **CONSUMED** by a program. Direct costs include management, operations, cost of delivery, cost of participation, and the cost of any unintended effects of the program. **INDIRECT COSTS** are costs related to changes in resources that do not occur directly because of the program. Indirect costs include pain and suffering, losses in productivity, and premature death because of illness. **Note that these terms are used differently in budgeting and accounting than they are in economics.** In budgeting and accounting, direct costs are costs that are easily traced to projects, such as personnel and materials, while indirect costs are costs that benefit more than one project and, therefore, require an estimate of the proportion of cost that benefits each project, such as utilities and administration.

- **Startup and operational costs**

STARTUP COSTS are one-time costs incurred to initiate the program. Such expenses include fees for infrastructure services, such as telephone and internet service, initial recruiting and hiring costs for program personnel, and costs of purchasing furniture and equipment. These costs are incurred once, typically when a program is started (Donaldson, Mugford, & Vale, 2002). **OPERATIONAL COSTS**, on the other hand, are incurred on a regular basis through the duration of the program. These include staff members' salaries, monthly fees for infrastructure services, and routine maintenance of equipment (Donaldson et al., 2002).

- **Opportunity cost**

In economics, cost is synonymous with **OPPORTUNITY COST** and refers to the sacrifice of benefits made when something is consumed by a program (CMS, 2006). Consider how a program resource may have been used elsewhere had it not been used by this program.

For example, the time to participate in a program could be spent working or relaxing; this is referred to as the opportunity cost.

- **Average cost**

AVERAGE COST, also referred to as average unit cost or simply unit cost, is the total cost divided by the number of participants in the program. For example, the cost of an asthma program per participant or cost of an asthma program per household (Donaldson et al., 2002).

- **Incremental cost**

INCREMENTAL COST refers to all the additional costs associated with the decision to begin a new program or to substantially expand a program (e.g., add new staff members or a new site).

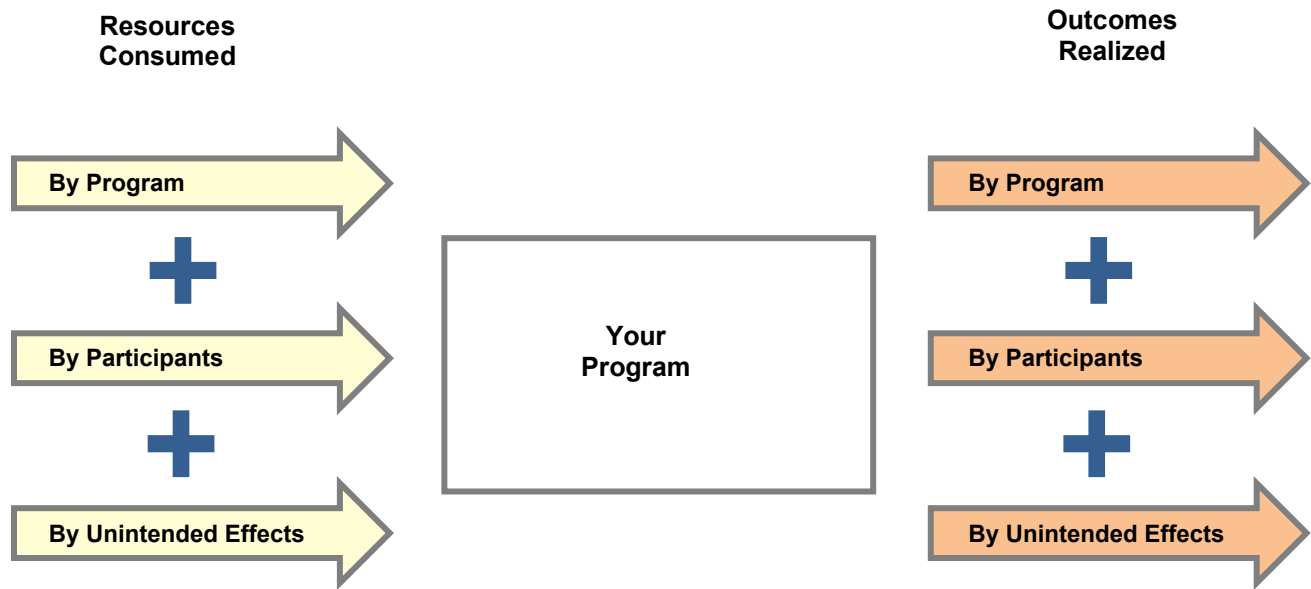
- **Marginal cost**

MARGINAL COST is the cost associated with producing one additional unit of output in the same program (Donaldson et al., 2002). For example, a marginal cost is the cost of adding one more participant to the program. This cost may vary based on the circumstances of the addition. For example, suppose an asthma home visiting program is contemplating expanding their service area. An additional 10 eligible clients live in homes close to the office of the program. However, another eligible client lives in a house that is located much farther away. The marginal cost of adding one of the first 10 clients will be lower than adding the one living farther away.

As was noted in Step 2, program logic models and budgets are valuable documents to help identify relevant costs. Consider and include every possible input, even if measuring or valuing some inputs is difficult or potentially not feasible. Include the seemingly “**free**” **resources**, like donations or volunteered time, in the list of inputs. They may be free in this particular instance of program implementation, but if it is a required input for the program, it may be an expense when the program is implemented at another time.

To organize information about costs and benefits, **Figure 4** shows a simplified relationship between the resources used or consumed by your program and its outcomes. Again, the categories of costs and benefits you include and the ones you ignore will depend upon your evaluation’s perspective.

Figure 4 Components of Resources Consumed and Outcomes Realized in a Public Health Program



In principle, the cost of a program may be conceptualized in three different categories—resources consumed to implement a program including adverse program effects, resources consumed to participate in the program, and resources consumed as a result of unintended program side effects. The third category of costs referred to as **UNINTENDED EFFECTS** are situations where unanticipated costs are incurred. For example, a policy to reduce indoor pollution in schools may result in decreases in the cost of cleaning supplies but increases in time to obtain and prepare green solutions.

There are three categories of benefits, or outcomes, of a program. Health outcomes refer to changes in participants' physical, social, or emotional health status because of the program. Non-health outcomes are benefits that the program yields in other sectors (e.g., quality of environment, property values). Intangible outcomes include benefits that are key to the analysis but are hard to estimate (e.g., reduced pain and suffering).

Collecting Information on Program Costs. A simple technique to itemize the resources consumed by your asthma program is the **INGREDIENTS METHOD**—create a detailed listing of ingredients, or the inputs, of your program (Levin & McEwan, 2001). This method is guided by the evaluation perspective, so a broader perspective (e.g., societal) will include more cost items than a narrower one (e.g., client or program). Materials to reference when identifying program costs include program budgets, program proposals, and financial statements.

The list of program ingredients or inputs is typically broken down into four functional categories, similar to the ones typically found in program budgets:

- Staff costs including salary or hourly wages and fringe benefits
 - Cost of service provider
 - Cost of support staff members
 - Cost of administrative staff members
 - Cost of volunteers

- Cost of external consultant
- Equipment, supplies, and materials
 - Equipment cost, including rent or ownership and maintenance
 - Educational materials
 - Media resources, including production time, airtime, and space
- Facilities or space, including rent or ownership, maintenance, and utilities
- Other costs (any other expenses incurred by the program for providing services).
 - Mail, telephone, internet
 - Insurance or permits
 - Database development and maintenance
 - Program incentives
 - Training costs
 - Evaluation costs

Once you have identified all ingredient types, or program costs, the next step is to measure and value the cost of line items individually.

To assess the cost of anything, you need two elements: (1) the measurement of quantities of resource used and (2) the assignment of unit cost or price per unit of resource used. The total cost for each line item will then be calculated as

$$\text{Resource cost} = \text{Quantity of resource used} \times \text{Price per unit of resource}$$

The way you measure the quantity of resource used may depend on whether the evaluation is prospective or retrospective. For example, when measuring costs associated with staff time, if data are being collected prospectively, you may request that staff members keep a time diary as the program is being implemented. Evaluators may also choose direct observation of services or random observation of proportion of services (e.g., randomly picking a few sessions delivered by different educators in different communities, at different times of the day). For retrospective data collection, such costs may be estimated by asking program participants and staff members to remember what occurred and triangulating it with records or other interview data.

To determine unit cost or cost per unit of resources, you will typically use market rates. When market prices are not available, you may estimate what a competitive market price would be. This is referred to as a shadow price. Quantities of items (e.g., materials, supplies, tests, and services associated with the program) may be obtained from the program budget (program officer) or financial statements (financial officer) of the program. If used, costs for program incentives for participants can be calculated in a similar manner.


Following these methods, you can calculate the cost of your program by adding up the following costs:

Cost of staff members (including volunteers) = (Time spent to set up service + Service delivery time + Travel time + Wait time) × Hourly wage

Cost of all transportation = Number of miles used for the program × Price for one mile

Cost of material or supplies (including donated materials) = Quantity of material in units × Price of one unit of material

Cost of a program incentive = Unit cost of specific incentive × Number of program participants

 Multiple programs often share resources (e.g., space, administrative services). When **programs incur fixed costs**, information can serve as reasonable criteria to allocate the appropriate proportion of fixed costs to the program (e.g., number of employees involved in the program, number of square feet used by the program, proportion of time spent on the program). Stakeholders can assess whether selected criteria pass the test of being reasonable and, once agreed upon, the criteria should be used consistently to allocate costs. Accounting for fixed costs remains a common omission in economic evaluations!

Finally, evaluation itself has costs associated with it. These costs include the proportion of evaluator's time spent on your program plus the cost of materials and supplies used for evaluation activities. Materials and supplies used for evaluation activities are often tied to the program activities and services, and, therefore, may change based on the volume of program services. These costs should be accounted for, based on the setup of your program. Fixed costs for the evaluation must also be considered.

Collecting Participant Costs. Participant costs are resources consumed by participants and their families to participate in your program. The perspective of your analysis will guide your decision on whether these costs should be included. Come to an agreement with your evaluation team and stakeholders on whether participant costs will be included and, if so, how they will be valued.

Participant costs, in general, include two types of costs: (1) **OUT-OF-POCKET EXPENSES** (e.g., fees or co-pays, transportation costs, childcare costs) and (2) **OPPORTUNITY COSTS** or lost wages and time. Opportunity costs refer to activities that participants could be doing if they were not participating in the program. These data can be collected through participant interviews or observations or estimated by the Evaluation Team. While your analysis may not require consideration of participant costs, being aware of opportunity costs—lost wages, lost school days, lost leisure time—can be relevant to decision making in some cases. For example, in a school-based intervention, time spent by teachers and students away from regular classroom activities might not be a relevant cost from a program or payer perspective, yet it may become a decision making criteria from a participant or societal perspective.

The value of time for participants in the program can be estimated as follows

- The patient or family lost wages could be calculated using average earning figures for the U.S. population or earning figures for a particular population of clients receiving the program. Wage information may be found through the Census Bureau.⁹
- The patient or family leisure time can range from zero to market wage rate to overtime pay rate. The generally accepted standard is to value it as zero and estimate the impact of other assumptions on the results of economic analysis through **SENSITIVITY ANALYSIS**. We discuss sensitivity analysis on page 1-30.

The participant costs can then be calculated by adding the total out-of-pocket costs and the total value of time spent on the participation in the program:

$$\text{Participant costs} = \{\text{Sum of out-of-pocket costs accrued by participants for participation}\} \\ + \{\text{Sum of the values of time spent by participants or caregivers}\}$$

Collecting Other Costs. The Evaluation Team should carefully think about any other resources that may be consumed by unintended program effects or program side effects. Could program activities result in costs incurred by anyone or any entity, related or unrelated to the program, in the near term or in the future? The Evaluation Team will need to assess what data to collect and how to collect or estimate it. If a determination is made that risks are insignificant, the evaluation should document the decision and discuss it when reporting the findings.

⁹ <https://www.census.gov/topics/income-poverty/income/data.html>

Vignette 1 – Cost Analysis

Members of the asthma coalition in District 1 were concerned when they discovered that schools located in an area known for high asthma rates were not included in the Asthma-Friendly Schools Initiative. They wanted to know if this popular program could be expanded to reach additional schools. However, some members of the coalition questioned if expansion would be possible, given the limited resources of the program. The coalition asked for an economic evaluation to help them learn if it would be possible to increase the reach of the program by adding schools to the program; if so, at what additional cost?

To find an answer, the Evaluation Team planned for a cost analysis of the initiative, adopting a program perspective and using a single school year as the time frame. Working with program personnel and contacts at three of the schools currently implementing the Asthma-Friendly Schools Initiative, they gathered budget information and interviewed the staff members implementing the initiative. Using the cost templates (see **Appendix D**) to guide them, they created a list of all program resources used by the program and allocated appropriate costs for each resource on the list. From this information, the team was able to determine the total cost of providing the program in these schools. To estimate the marginal cost (the additional cost of adding one more school), the evaluator categorized costs into categories of startup, fixed, and variable cost components. Later, the team assessed changes, if any, to the start-up and fixed-cost components with additional programs and considered changes in variable cost. With these calculations completed, the cost of adding one more school (estimated marginal cost) to the Asthma-Friendly Schools Initiative in District 1 was determined by comparing the difference between current costs and any new costs associated with adding one more school.

Results of the evaluation were shared with the coalition, program managers and personnel, school staff members who had participated in the evaluation, and leaders from the schools they hoped would adopt the Asthma-Friendly Schools Initiative in the next school year. The coalition used this information to develop a grant request for a major employer in the community. Local PTAs also used the information to set targets for fundraising activities.

Table 7 provides a useful checklist for conducting a program cost analysis.

Table 7 Checklist for Program Cost Analysis

Steps	Check When Complete
Stakeholder generated or vetted documentation	
A. Program description that includes a list of program activities	<input type="checkbox"/>
B. Decision on the evaluation's perspective	<input type="checkbox"/>
C. Program time frame	<input type="checkbox"/>
D. Other appropriate program documents (budget, financial statements, etc.)	<input type="checkbox"/>
Implementation	
1. Create a cost inventory for the program and decide on approaches to determine the cost of non-financial and capital resources.	<input type="checkbox"/>
2. Calculate the total variable cost of the program. <ul style="list-style-type: none"> • Estimate the quantity used within the time period for each resource included in the cost inventory. • Identify the unit cost for each resource. • Multiply the unit cost of resource by the quantity of resource used to calculate the resource cost. • Sum up all variable cost items. 	<input type="checkbox"/>
3. Calculate the total fixed costs of program. <ul style="list-style-type: none"> • Estimate appropriate portion of costs used by the program for the time period using the selected approach in Step 1. • Calculate the resource cost for each item by accounting for the estimated portion used by the program. • Sum up all fixed cost items. 	<input type="checkbox"/>
4. Calculate total participant cost, if required, based on perspective. <ul style="list-style-type: none"> • Calculate total out-of-pocket cost <ul style="list-style-type: none"> ○ Collect all out-of-pocket costs for participant ○ Sum up all out-of-pocket costs • Calculate total cost of time spent <ul style="list-style-type: none"> ○ Estimate amount of time spent by participant ○ Reach an agreement with the Evaluation Team and stakeholders on the unit cost of time spent ○ Multiply amount of time spent by unit cost of time spent • Add total out-of-pocket cost to total cost of time spent 	<input type="checkbox"/>
5. Add total fixed cost, variable cost, and participant costs to determine your total program cost	<input type="checkbox"/>

Identifying benefits of interest. So far, we have focused on the need to identify and assess the varied costs of your program correctly and comprehensively. We will now shift our focus to identifying program benefits—what is anticipated or achieved as a result of implementing the program.

If you are conducting a partial evaluation focusing on program costs only, you may not need to analyze program benefits. However, when you do investigate program outcomes, you will need to remember where your analytic horizon is set, and which outcomes are most relevant.¹⁰

Similar to program costs, program outcomes or benefits can be conceptualized in three categories:

The **health-related outcomes** of your program are those benefits realized because of the improved health of program participants. These outcomes include symptom-free days, increased life expectancy, decreased morbidity, reduced disability, improved quality of life, averted medical costs or health care savings, and increased worker productivity.

Common health-related outcomes considered in various asthma programs are

- Averted medical costs of
 - Emergency department visits
 - Time spent in the emergency department
 - Hospitalizations
 - Medication use
 - Visits to physician clinics
- Reduced disability
 - Frequency of asthma symptoms
 - Occurrence of severity of recent symptoms
 - Symptom days or symptom-free days
- Increased productivity
 - Workdays missed
 - School days missed
- Improved quality of life
 - **QALYs** represent a health outcome that combines longevity and quality of life in one measure. It is the most widely used measure for quality of life.

Non-health outcomes are the benefits realized by program participants in domains other than health, such as environment, education, and property values.

Common non-health outcomes considered include

- Academic performance
- Increased productivity at work
- Better social life
- Better physical performance (at a sport or exercise)

¹⁰ <https://www.cdc.gov/asthma/nacp.htm>

- Better ambient and indoor environment
- Increased property value (as a result of remediating mold or other triggers)
- Increased status in community

Intangible outcomes are benefits such as reduced pain and suffering and increased physical activity and improved social life. These outcomes may be hard to put a price tag on but are important to include in your evaluation because they may be relevant to the stakeholders and influence their decisions.

Collecting data on program effects. The way you collect data will depend on whether the analysis is prospective or retrospective. If you are conducting your evaluation retrospectively, you could use existing data to identify and estimate program effects. In case your program is based on a national model, you may use the findings, if available, of formal impact evaluations for useful information on valid outcome measures. You may also find a source of useful information from local, state, or federal survey databases, as well as relevant public or private agency records.

After identifying program outcomes, depending on the analysis method you are using, your next task may be to estimate the appropriate monetary value for each outcome. This is often controversial as it necessitates that a dollar value be put on health and wellness-related outcomes. However, many resources provide standardized costs for health outcomes (see **Appendix A**). Additionally, if you need additional resources, your ETA can put you in contact with appropriate CDC resources.

Vignette 2 – Cost-Effectiveness Analysis

A state asthma program has coordinated a self-management education asthma intervention for families with a child with asthma for several years. A previous evaluation has shown that this asthma intervention has been successful with increasing the number of symptom-free days. A new managed care organization (MCO) has moved into the community and is interested in expanding effective asthma programs to help market its health plans to new members and reduce costs. The MCO representative, asthma program personnel, and the asthma coalition agree this is a good idea, but the MCO representative says she needs to know if the intervention is cost-effective before committing.


From discussions with the MCO, the Evaluation Team assumes that they need to approach this inquiry from the payer's perspective and drafts an evaluation plan. The MCO representative reviewing the plan notes that she would want the economic evaluation to include benefits to their potential customers, particularly additional symptom-free days, and to understand participant costs, particularly missed work hours as a result of the time spent attending program activities. The Evaluation Team regroups after this discussion and determines that a societal perspective, rather than a payer perspective, will be more appropriate to provide the requested information.

Together, the stakeholders decide that the analytic horizon will be one year, and a retrospective cost effectiveness analysis will be completed to get the MCO information quickly. The team revises the plan and begins collecting a wide range of data. For cost, the team gathers program budgets and financial statements, interviews the program manager to estimate time spent by program participants during work hours, and interviews key informants from the existing payer to identify other payer costs incurred to implement the program. For effectiveness, the team gathers data on symptom-free days by reanalyzing data collected during earlier evaluations. The team also collects community-level estimates for hospital rates to estimate changes in ED visits, hospitalizations, outpatient visits, and prescription medication use. These varied data are used in the analysis, with the stakeholder group's approval.

The evaluation found that the cost to implement the program for the payer (MCO) was on average \$220 per family per year, and as a result of the intervention, the total cost of asthma on average was reduced by \$180 per family per year. To calculate cost to program participants (only time spent was included in the analysis), the team decided that (a) since the program targeted children with asthma, a caregiver was assumed to be present for all program activities, and (b) the team decided to add 30 minutes of travel per session to the three in-person program session of 90 minutes duration, to accurately estimate time spent by caregivers. The workdays missed by caregivers were estimated at six hours, rounded to one day, or \$80 per family. For the number of asthma symptom-free days, based on the analysis, the team estimated an average increase of two days per family per year. Thus, the annual cost of the intervention to society is \$220 plus \$80, or \$300, and the net cost of the intervention is \$300 minus \$180, or \$120. Using the calculation for an incremental cost-effectiveness ratio (ICER), the team found and reported that the ICER of the intervention to society is $\$120 \div 2 = \60 for each symptom-free day. To better understand the distribution of costs within the estimate, similar calculations were repeated to assess cost to payer and cost to participant. For payer, the net cost is $\$220 - \$180 = \$40$, yielding an ICER of \$20 per symptom-free day. For participants, the net cost of \$80 yielded an ICER of \$40 per symptom-free day. The Evaluation Team noted that the participant estimations do not include out-of-pocket costs, which should be minimal. On the benefit side, the estimate does not account for reduction in school days missed and intangibles to patients, such as improved physical activity, academic scores, etc.

Vignette 2 – Cost-Effectiveness Analysis (continued)

The stakeholders, including the MCO representative, reviewed the findings and decided that \$20 per additional asthma symptom-free day per child per year is a good value for them, and that the self-management education program should be adopted within the health system's offerings. They did, however, ask the state asthma program to find efficiencies in program design to minimize the workdays missed by caregivers. Further, evaluation information provided ideas for how to reduce costs, such as offering classes for participants in the evening and offering childcare.

 **Valuing program outcomes**, like program costs, can be done based on market prices, where they exist. In cases where a market price does not exist, other techniques may be used.

If you are collecting medical costs, be mindful of **ACTUAL COST** versus **CHARGES**. In the health care sector, the charge of a service may not be its true cost for many different reasons: discounted prices negotiated by an influential buyer, redistribution of a charge by a supplier to offset less profitable services, and inclusion of unrelated services. If possible, it is best to include resource costs, rather than charges when estimating health care costs averted as a result of your program.¹¹

Steps to estimate program benefits:

1. Identify outcomes of interest.
2. Reach agreement with your Evaluation Team and stakeholders on the outcomes to include and how these outcomes will be valued.
3. Use your analytic horizon to determine the duration over which the program benefits are considered.
4. Estimate monetary value of benefits.
5. Calculate total monetary value of all benefits, whenever necessary (for example, for cost-benefit or ROI analyses).

¹¹ Some analysts suggest that the cost of medical service is about 2/3 of the charge.

Vignette 3 – Benefit-Cost Analysis

A recent outcome evaluation concluded that a comprehensive home-based asthma intervention resulted in reducing the numbers of hospitalizations, emergency department visits, missed school days, and missed workdays for participants with poorly controlled asthma. Impressed, Partners for Asthma coalition members decided that the information should be used to convince the Medicaid program to reimburse for the home-based services. To complete their proposal, the coalition charged the Evaluation Team with conducting a benefit-cost analysis to determine the specific monetary values for the program. To focus on Medicaid's concerns, the evaluation was to use a payer's perspective.

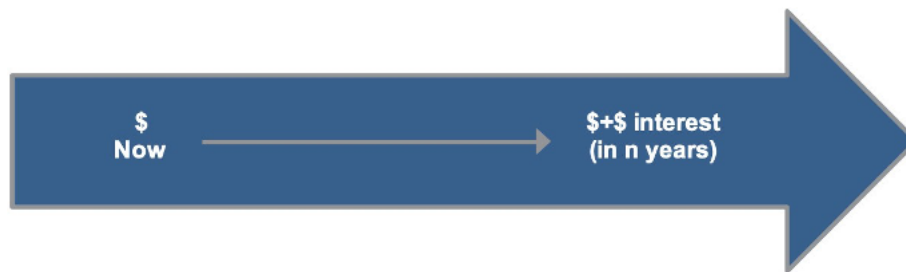
The team created a comprehensive list of all costs and benefits, and prospectively used logs, interviews, and program records to measure the quantity or proportion of each identified cost and benefit. The analytic horizon was two years. These findings were compared with the costs and benefits associated with not having an intervention. Although some stakeholders expressed reservations about "putting a cost on human suffering," an agreement was reached on costs and benefits to include and the analysis continued.

Evaluation results indicated significant reductions in hospital stays, urgent care costs, and emergency department visits, and only minimal increases in the cost of prescription medication and outpatient clinics. After subtracting all costs to the payer, the analysis showed that the home-based intervention resulted in an overall net benefit of \$120 per household served. Further analysis showed that if the program focused exclusively on children with persistent asthma, the overall net benefit increases to \$400 per child served. A fact sheet citing these dollar amounts was presented to Medicaid representatives at a recent meeting, and reimbursement by Medicaid looks promising.

Adjusting the value of costs and outcomes for time. Your analytic horizon may include multiple years of cost data. If so, these cost values will need to be adjusted (**DISCOUNTING**) to compare across years. Among economists, there is a broadly accepted concept of time-value-of-money, which is based on the fact that the purchasing power of a dollar changes with time. Purchasing power refers to what you can buy with money. The basic idea is that money you have now is worth more today than an identical amount you may receive in the future, for at least three reasons:

1. **Interest rate.** The money you have now and are about to spend on consumption can be, in principle, invested to gain interest between now and the future time (n years), as depicted in **Figure 5** below.

Figure 5 Time Value of Money



2. **Risk.** Money you have now is not at risk. Money predicted to arrive in the future is less certain.
3. **Inflation.** Money that you have today will very likely buy you more than the same amount in the future. Increases in the price of goods and services over time, referred to as inflation in economic terms, reduces the buying power of money.

The average discount rate for public health programs is 3%. Work with your Evaluation Team to assess if this discount rate is appropriate for your cost and benefit estimates over time. For more information about discount rates, see **Appendix A**.

Conducting a sensitivity analysis. This quantitative assessment helps you answer the question—*if my assumptions regarding uncertain variables in my analysis, such as minimum wage, discount rate, or the value of a school day, were to change, would it change my conclusion immediately, or is there some leeway?* Sensitivity analysis is often used when cost data are based on estimates, rather than actual costs or market values (e.g., when data are missing), or the value has never been considered before. In other words, sensitivity analysis helps you test the extent to which your conclusion depends upon a specific assumption and the extent to which your conclusion would vary if your assumption changes. If you find that the outcome of your analysis is highly dependent on an input value, that varies considerably, you may need to put in additional effort to increase accuracy.

Sensitivity analyses are highly valued by decision makers because they identify and account for the variability, or risk, in assumptions and, hence, the recommendations put forth. The following variables are most commonly tested with sensitivity analysis in health-related programs:

- Patient acceptance of or adherence with the program
- Risk of disease or injury
- Discount rate
- Direct cost of the program
- Other costs
- Value of benefits or outcomes

You can complete the economic evaluation without a sensitivity analysis, but you should see these data as preliminary. For more information about sensitivity analysis, see **Appendix A**.

Vignette 4 – Cost-Utility Analysis

A state public health department received \$10 million from a private donor to improve health. The department administrators know both the asthma education program and the diabetes prevention program are equally popular and effective in reducing the burden of disease.

To help them decide in which program to invest these funds, they request an economic evaluation be added to the ongoing program evaluation work. Since the programs being compared have very different health outcomes, a cost-utility analysis is deemed appropriate. A societal perspective is chosen, and an analytic horizon of five years is selected.

The Evaluation Teams add collection of costs to their data collection, and then assess the program benefits using standard Quality of Life methods, in which the net benefits are expressed in life-years saved, with quality-of-life adjustment. Typically, the effectiveness measure used to compare alternative programs is QALYs.

The Evaluation Teams find the intervention net cost for one additional QALY for the asthma program is lower than the net cost of one additional QALY for the diabetes program. Based on this analysis, the teams recommend the state public health department invest in the asthma program.

Step 5: Justifying the Conclusions of Your Economic Evaluation

As you may have noted, the process of calculating summary measures involves analysis, which is typically done in Step 5 of most evaluations. It is always preferable to engage relevant stakeholders in doing some preliminary analysis, reviewing the initial findings in real time, and discussing interpretations of the data while data are being collected. Don't wait until the very end to begin analyzing your data. Analyzing data earlier provides an opportunity to work with your stakeholders to determine whether other types of analysis need to be done to give them needed information. For example, you may want to re-run analyses to highlight different subpopulations or different program sites in different communities.

By periodically reviewing the data, you allow time to modify and improve data collection procedures. This ensures that the data meet stakeholders' information needs and are less likely to surprise stakeholders. Periodic review of data along the way is also a good way to continuously build evaluation capacity across your team and with your stakeholders.

Interpreting results, making judgments, and forming recommendations in economic evaluation. When you have completed the analysis, you will engage your stakeholders in interpreting results, making judgments typically regarding the value of program, and forming recommendations or drawing conclusions that make sense to stakeholders and respond to their questions. Earlier *Learning and Growing* modules provide information and techniques that may help you in this process. For economic analyses, the following three questions may facilitate value judgments. You may also consider them a useful guide for organizing your information (O'Brien, Heyland, Richardson, Levine, & Drummond, 1997):

1. What are the results (O'Brien et al., 1997)?
 - What were the costs and outcomes of program alternatives (if appropriate)?
 - Do costs and outcomes differ between different groups of program participants?
 - How much does the variation of uncertainty change the results?
2. Are the results of the economic evaluation valid (Drummond, Richardson, O'Brien, Levine, & Heyland, 1997)?
 - (if appropriate) Did the analysis provide full economic comparison of program alternatives?
 - Were the costs (and outcomes) properly measured and valued?
 - Were appropriate assumptions made for uncertainties in the analysis?
 - Are the estimates of cost (and outcomes) for participants sufficiently accurate?
3. Will the results help me with fulfilling my priorities (O'Brien et al., 1997)?
 - Are the program benefits worth the costs and harms?
 - Could I reasonably expect similar outcomes in the population I serve?
 - Could I expect similar costs in my operating environment?

The economic evaluation literature may be helpful to explain and justify methods used in your analysis. Appendix C offers numerous articles and resources to help develop your knowledge of evaluation designs, viewpoints, populations, and programs.

As part of the process of interpreting the findings, you will need to discuss key assumptions made with regards to measurement, the inclusion and exclusion of costs, and the valuation of costs and outcomes. A clear discussion on the methodological approaches you took in the analysis to account for uncertainties is also very important because it forms the basis for judgment about the **ROBUSTNESS** of results. The results of the sensitivity analysis will complement the discussion. You will want to fully discuss the limitations of the data and analysis strategies with the Evaluation Team and your stakeholders.

When discussing results, you will return to the analytic horizon—the period over which you measured program costs and benefits. Be precise with stating net versus incremental costs and outcomes for program alternatives. Depending on your evaluation questions and the guidance received from stakeholders during analysis, you may want to discuss additional costs. These costs may include startup or upfront costs, operational costs, or the marginal cost of outcomes for any program alternatives considered. Another aspect to include in your discussion of results is robustness, in other words, by how much and how quickly do the results change with variation in variables used to introduce uncertainty in the analysis (e.g., discount rate). Presenting the findings of the sensitivity analysis will help your discussion.

You will also need to discuss any **QUALITATIVE RESIDUALS**. These are things that cannot be quantified or given a monetary value. These issues may carry a lot of weight from a perspective that is not considered for the analysis but may be relevant when communicating results. A good example is the cost of pain and suffering from acute asthma attacks. While it is hard to measure or assign a monetary value, it is an important factor in decision making for the asthma program.

When discussing results, be sure to describe, to the extent possible, any distributional effects related to the program—“who pays the most” and “who receives the most benefit.” This is related to the viewpoint of your analysis, because in some cases, one party’s benefit is another party’s loss. Should this be the case, it is essential that you ensure all stakeholders understand the implications of the results and have an equitable say in decision making.

All these discussions will reinforce trust in the process and the results and enable objective discussions regarding the validity of assumptions and the analysis. It is possible that stakeholders will disagree, and it may be that additional information or greater accuracy is needed to develop a shared understanding. Resolving disagreements among stakeholders when interpreting findings is discussed in **Appendix C** of Module 2, *Implementing Evaluations*.

Making Recommendations. Finally, you will need to help the stakeholders understand how the economic evaluation results mesh with their other priorities and what to recommend from the evaluation.

Figure 6 highlights nine possible scenarios that may arise when comparing a program with another or with the status quo. You may find the matrix to be a helpful tool for facilitating discussions with stakeholders about results.

Figure 6 Decision Making Scenarios

		Incremental <u>Effectiveness</u> (of program A compared to program B or status-quo)		
		More	Same	Less
Incremental <u>Costs</u> (of program A compared to program B or status-quo)	More	No Clear Decision	Reject	Strongly Reject
	Same	Accept	No Clear Decision	Reject
	Less	Strongly Accept	Accept	No Clear Decision

Decision Making Scenarios

Strongly Reject refers to situations where results show higher costs at lower effectiveness.

Reject refers to situations that would probably lean towards rejection because the results indicate that incremental effectiveness is lower for the same cost or incremental cost is higher for the same effectiveness.

Accept refers to situations that would lean towards acceptance because the incremental effectiveness is higher for the same cost or incremental effectiveness is the same for a lower cost, unless there are other reasons to accept the program.

Strongly Accept refers to situations where results show lower costs at higher effectiveness.

No Clear Decision refers to three possible situations where incremental cost and effectiveness of alternative options being compared are the same, or incremental effectiveness comes with added cost, or reduced effectiveness also reduces costs. The question posed by these three situations are:

- Q1 – Is increasing effectiveness worth the added cost?
- Q2 – Are there other reasons to accept the program, considering the program is neutral on cost effectiveness?
- Q3 – Are reduced program effects acceptable given reduced cost?

In situations where the results of an economic evaluation conducted in a pilot setting or different environment (e.g., another state) are being used to convince other stakeholders to support the expansion or scaling of a program, you will want to include any reasons for why the results that you are presenting may not be completely transferable to your stakeholders’ environment in your discussion.

A key role of the Evaluation Team is to ensure that the evaluation information is accurate, credible, and meaningful to stakeholders. Part of this role includes considering the diversity of perspectives among stakeholders when developing conclusions and recommendations. When justifying conclusions, remember the importance of carefully considering the context of the information generated from the economic evaluation. Economic findings may interest those with more structural power (e.g., funders) and be of higher priority than other considerations. However, your role is to ensure that all stakeholder perspectives are addressed, and that their values are acknowledged and respected.

Step 6: Ensuring Use and Sharing Lessons Learned From Your Economic Evaluation

The ultimate aim of evaluation is to learn from the findings and to apply those findings when making program decisions. Communicating evaluation findings to those who will use the information to make decisions and those who will be affected by such decisions is necessary for the evaluation to be useful. The many types of communication strategies you can select from are applicable to any evaluation, including your economic evaluation. Please refer to Module 1, *Learning and Growing through Evaluation*, for options regarding communication strategies.

Two particular considerations to keep in mind when reporting economic evaluation results are (1) the validity of data and results from the viewpoint of a stakeholder, and (2) the applicability of the economic evaluation, which may include transferability of results from the evaluation's setting to other settings (Drummond, Sculpher, Claxton, Stoddart, & Torrance, 2015). Validity incorporates the methods of analysis, source of data, methods for time adjustment, and methods for valuing costs or benefits. Applicability addresses the issues of population variation, such as variation in demography and epidemiology, variation in practice, variation in incentives, variation in resource availability, and relative prices or costs.

When considering what to report or present to different audiences, consider including the following

- The background and importance of the evaluation questions.
- The viewpoint (perspective) of analysis.
- The reasons for selecting a particular type of analysis.
- The population to which the analysis applies.
- The comparators included in the analysis (if used) and how they were selected.
- The sources and quality of evidence.
- The range of costs and their measurement (in physical and monetary terms).
- The measure of effectiveness selected (if appropriate).
- The methods used to adjust for timing of costs and benefits.
- The methods for dealing with uncertainty.
- The **INCREMENTAL ANALYSIS** of costs and benefits.
- The overall results of the evaluation and its limitations.

Remember that differing audiences will have differing knowledge of economic analysis and practice. Your reports and presentations may need to include capacity building to ensure that the audiences are able to understand the evaluation, its findings, and conclusions and recommendations.

Developing an action plan. After findings are disseminated, conduct action-planning sessions with stakeholders and the Evaluation Team. An action plan template is provided in **Appendix K** of Module 2, *Implementing Evaluations*, to assist you in this process. During the planning sessions, review and discuss the conclusions and articulate the lessons learned. In preparation for action planning, consider asking yourselves the following questions:

- Did the economic evaluation accomplish what we intended?
- Are there other stakeholders who should receive these data and findings?
- What resources do we need to advance our action steps? Do we have buy-in and from whom? If not, how can we gain this?
- What timeline is reasonable and appropriate for turning the findings into action steps? Six months? One year?
- How frequently should we meet to track our progress through the action steps and ensure that we complete all identified steps?

One of the advantages of conducting an economic evaluation is that information collected during the evaluation can often be used to anticipate the costs or savings expected as a result of making the changes you outline in your action plan. This information can be useful for budgeting and assessing the feasibility of the proposed actions.

Documenting lessons learned. Document the lessons learned from the evaluation, such as learnings around economic evaluation (e.g., which analysis methods resulted in the most useful information for stakeholders). Also, document learnings around conducting the evaluation (e.g., which data sources were difficult to obtain) and what evaluation participants learned through their experience with the evaluation. The discussions, disagreements, and decisions may be important to include in lessons learned. You will also need to include such documentation to meet the evaluation standard of Evaluation Accountability.

Remember, this module of the *Learning and Growing through Evaluation* series introduces planning and implementing economic evaluation. Many helpful resources are available—books, websites, and tools—to help you further develop your understanding and skills in planning and implementing economic evaluation. A list of resources is included in the **Appendix C**.

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Appendix A. Chapter Notes

 **Considering “free” resources—volunteer time and donated items**—is often needed for a valid estimation of your program costs.

To **estimate volunteer time**, two methods are commonly used. One is premised on a volunteer valuing their volunteer time like their leisure time. This method values volunteer time as one-half of the volunteer’s wage rate. Another option estimates the value of work done by the volunteer. The value of a volunteer’s work can be calculated based on your organization’s wage rates, what the sector pays, or what a comparable program would pay for the type of work that is performed by the volunteer.

Often, when **estimating costs of donated goods and services**, the current market value of the donated resource is used. To foster the validity of the analyses and generalizability of the results when reporting results, the cost of donated goods and services should be included, along with volunteer time. These costs indicate the extent to which the economic evaluation results of a program may depend on donated or other non-financial inputs.

 **Estimating a program’s fixed costs**, such as the cost of the space or overhead and administrative services, can be complicated, especially when items are shared by multiple programs. Common line items for fixed costs are

Facilities cost, which includes the cost of space and utilities. It is typically shared by many programs and paid in total. How you allocate a proportion of this cost to your program will depend on the criteria you choose. Sometimes programs choose to ignore some facilities cost. For example, if they have a permanent office, they don’t include rental, utilities, computer and internet, or phone use. Although it may save time and effort to ignore some of these costs, like volunteer time and donated resources, it is vital to include these costs for validity and generalizability reasons. Below are ways of estimating facilities resources:

Total cost of space and utilities = Cost of rent, taxes, insurance, maintenance, and utilities

Program cost for space and utilities = Square footage used by your program for the time of the program’s existence × (Total cost of space and utilities for the time of the program’s existence ÷ total square footage of space)

Or,

Program cost for space and utilities = Facility time used by your program × (Total cost of space and utilities ÷ total facility time used by all programs)

Or,

Program cost for space and utilities = # of FTEs used by your program × (Total cost of space and utilities ÷ total FTEs used by all programs)

Consider a situation where a school-based asthma intervention uses a room in the local school for one hour on two days. Even though it is possible that the school will not charge the organizers of an asthma intervention for the public health event, it is still useful for future implementations to estimate the cost of the room and highlight it in your program cost. Here is one way of doing it: If the monthly rent of an equivalent sized room is \$1,785, the hourly rate for

renting the room is simply the monthly rate \div (number of days in a month \times number of hours in a day). In our example, it is:

$$\begin{aligned} \text{Per hour facility cost} &= \$1785 \div (30 \text{ days} \times 24 \text{ hours}) = \$2.48 \text{ per hour total facility cost to} \\ \text{program} &= 2 \times \$2.48 = \$4.96 \end{aligned}$$

This is the cost of use of two hours of the facility for the program.

While the facilities cost in our example turns out to be minimal, it may be significant in a different scenario. The point to note here is that there is a cost to a program for using a facility, even if it is donated space, and it must be estimated appropriately.

Capital equipment and real estate are fixed costs that typically occur once during the life of a program (e.g., construction or the purchase of land, a building, or equipment). Allocating a proportion of this cost to your program will involve two steps:

1. Compute the equivalent annual cost of equipment or real estate
2. Allocate a proportion of the annual cost based on your criteria

A simple way to compute an equivalent annual cost of equipment or real estate is to use the market rate of renting a comparable building or leasing comparable equipment. Two other ways that are more rigorous but also considered more accurate are (1) to annuitize the initial cost over the useful life of the asset, or (2) to subtract the value of the asset at the end of the program to get the scrap value. Identify what you can sell at the end of the program, from the original purchase prices; convert this amount into its present value; and then apply the annuity factor (Richardson & Gafni, 1983).

Administrative and staff support is the cost of administrative and support staff member's time spent on your program or intervention.

$$\begin{aligned} \text{Annual administrative and staff support cost} &= \{ \text{Annual salary and benefits of administrator} \\ &\times \text{Proportion of time spent by that administrator on your program} \} + \{ \text{Annual salary and benefits} \\ &\text{of support staff member A} \times \text{Proportion of time spent by support staff member A on your} \\ &\text{program} \} + \{ \text{Annual salary and benefits of support staff member B} \times \text{Proportion of time spent by} \\ &\text{support staff member B on your program} \} \end{aligned}$$


Let's say an administrator spends 25% of their time and a support person spends 50% of their time on our program. The annual salaries and fringe benefits of the administrator and the support person are \$72,000 and \$36,000 respectively. Our program duration is six months from start to finish. Below are the simple steps we would take to calculate the administrative and support cost for the program:

$$\begin{aligned} \text{Monthly administrative and support cost for program} &= \\ (\$72,000 \div 12 \text{ months} \times 25\%) + (\$36,000 \div 12 \text{ months} \times 50\%) &= \$1,500 + \$1,500 = \$3,000 \\ \text{Total administrative and support cost for 6-month program duration} &= 6 \times \$3,000 = \$18,000 \end{aligned}$$

The administrative and support cost for the program, in this case, is \$18,000!

 **Improved Quality of Life:** In addition to QALYs, two other measures used for quality of life in economic analysis are

- Healthy-year equivalents (HYE) – The number of years of perfect health (followed by death) that has the same utility as the lifetime path of health states under consideration (Gold, Siegel, Russel, & Weinstein, 1996). For example, one year of life with frequent severe asthma attacks may be equivalent to only three months of life with perfect health. In other words, HYE of one year with asthma attacks is 0.25.
- Disability adjusted life years (DALYs) – The number of healthy years of life lost owing to death or disability.

 **Valuing program outcomes:** Commonly used techniques are briefly described below. Other techniques may be found in *Prevention Effectiveness: A Guide to Decision Analysis and Economic Evaluation* (Haddix, Teutsch, & Corso, 2003).

- Cost-of-illness (COI) approach: Determines the cost of disease by summing up the medical, non-medical, and productivity losses or gains due to the disease.
- Willingness-to-pay (WTP) method: Attempts to measure the value an individual places on a program outcome. This approach is typically used when the intervention is evaluated from a societal perspective and when the market prices for the goods or services are not available. The idea behind the WTP method is that each member of society can place a certain value on the benefit, if asked. For example, a person is asked “how much would you pay to not have a child have an asthma attack?” A special survey to elicit answers to these types of questions and determine willingness-to-pay for the program is called a contingent valuation method.

Valuation of missed workdays: A missed workday due to illness is a resource that is spent on dealing with the illness by the person with the illness. Let’s think about the opportunity cost for this resource. What would the person with asthma rather be doing? In many cases, the answer is working. So, the follow-up question is, what is the value of a day at work? Of course, it is a daily wage. Even though some people may have paid leave, it is still a loss to the adult with asthma who could have spent the day on vacation or in other ways. A missed workday is a loss to both the person and to society.


In situations where the adult with asthma is unemployed, the minimal daily wage for that particular region is used to estimate the cost of a missed workday and is highlighted in cost estimates, where appropriate, based on perspective.

Valuation of missed school days: When a child misses a day from school, there is an assumption that one of the parents or caregivers will also stay at home and forgo their usual activities to take care of the child. If the child lives with both parents, we assume that the parent with lower pay will stay with the child, and the daily wage of that parent will be considered as the cost of the missed school day. If one of the parents is outside of the labor force, it is assumed that this parent will stay at home to take care of the child with asthma, so the minimum daily wage for that region and for the time to participate in program services will be the cost of the missed school day.

Additionally, missed school days may impact school budget and allocated finances in a school district. Depending on the perspective of your evaluation, you may need to work with your

Evaluation Team and stakeholders to (a) understand how average daily attendance (the average attendance rate of students in a school year) affects the allocation of funding to school districts, and (b) appropriately estimate the likely dollar impact of missed school days due to asthma on school or school district funding.

Mortality costs: In recent years, there has been a decline in asthma deaths. Recorded deaths went from 4,260 in 2002 to 2,288 in 2009. However, premature mortality due to asthma still occurs (CDC, 2020). To measure the cost of mortality caused by asthma, loss of life is expressed in monetary terms. The monetary value of life, calculated in terms of productivity losses due to premature mortality, can be estimated using productivity tables from Grosse, Krueger, and Mvundura (2009).

 **Discounting future costs and benefits:** The process of converting future costs and benefits to their present value is called discounting. Present value, in simple terms, provides the dollar value of what future costs and benefits are worth today. In most cases, while the cost of a program is usually paid today, its benefits are received later, maybe even over a period of several years. For a fair comparison of today's costs with future benefits—comparing apples to apples—the costs and the benefits must be valued similarly, as if they were incurred within the same time period. Similarly, when comparing two or more programs, the costs and benefits of the options must be converted to their present value for the comparison to be valid.

Let's say an intervention is conducted in 2014 and it is expected to generate benefits B1 in year 1, B2 in year 2, and so on for the next 10 years; starting in 2015, with r as the discount rate, the formula for the present value of all benefits over 10 years is:

$$PV = \sum_{t=1}^{10} \frac{B_t}{(1+r)^t} = \frac{B_1}{1+r} + \frac{B_2}{(1+r)^2} + \dots + \frac{B_{10}}{(1+r)^{10}}$$

If the discount rate is 3%, the value of \$100 one year from today will be $\$100 \div (1+0.03) = \97.09 . In other words, \$97.09 today = \$100 one year from now, or the present value of \$100 one year from now is equal to \$97.09.

Let's consider an example. Assume that a person with asthma will save \$670 in 2016 and \$630 in 2017, as a result of reduced numbers of ER visits and hospitalizations attributed to an asthma intervention in 2014. The present value, PV, of those savings will be equal to:

$$PV = \frac{\$670}{(1+0.03)} + \frac{\$630}{(1+0.03)^2} = \$651 + \$594 = \$1,245$$

If we were to ignore discounting, we would overestimate future savings in making our choices today.

The percentage of decreased value of \$1 over one year the discount rate normally ranges from 1% to 11% and is dependent upon many economic factors. The Panel on Cost-Effectiveness in Health and Medicine, under the auspices of the Public Health Service, recommends that cost-effectiveness analyses of health interventions use a 3% discount rate (Gold et al., 1996). A Guide to Decision Analysis and Economic Evaluation recommends that any benefits or costs that occur after the first year of a program be adjusted by discounting (Haddix et al., 2003). Furthermore, it suggests that the analysis use either a 3% or a 5% discount rate and that a sensitivity analysis be performed by varying this rate from 0% to 8% (Haddix, Teutsch, Corso, & Dunet, 1996).

Adjusting for Inflation: In our everyday life we observe that the prices of goods and services tend to change over time, and typically, they increase. If we currently pay, let's say, \$700 for some pre-determined list of goods and services, it is likely that the same collection of goods and services will cost more than \$700 in one year due to inflation. The Bureau of Labor Statistics (BLS; <http://www.bls.gov>) monitors how different prices in the country change every month; their website regularly publishes Consumer Price Index (CPI) tables. CPI is the price of a well-described basket of goods and services that is purchased by an average U.S. consumer, and it is the principal measure of the inflation rate in the country.

In some sectors of the economy, prices can change at different rates. This is particularly true for the health care sector where, in recent decades, the prices of services and goods have grown at a higher rate than in other sectors. For that reason, the BLS also publishes the Medical Consumer Price Index (MCPI), which measures the price of the most common health care services and goods. In economic evaluation, a decision needs to be made about whether to use CPI or MCPI for a particular output.

When conducting economic evaluation of public health programs, data on costs and benefits are invariably collected from years beyond just the year of the evaluation—referred to as the base year. A base year can be any year, but it is usually the year a program is evaluated. To ensure that all costs are comparable, and that costs and benefits occur in the same period, the dollar values must be adjusted for inflation using the formula below:

$$Y_B = Y_P (D_B / D_P)$$

Where:

Y_B = base year value

Y_P = past year value

D_B = index value in base year

D_P = index value in past year


Let's consider an example. Assume that we have two interventions A and B that were conducted in 2002 and in 2012, and that the cost of the intervention per patient per year was \$190 and \$210, respectively. To make a valid comparison and to adjust for inflation, we need to convert these different-year dollars into base-year dollars. Let's consider 2013 to be the base year in this case. Using the CPI table, we find that index values for 2002, 2012, and 2013 were 179.9, 229.6, and 233.0.

Distinguishing between discounting and inflation adjustment is important. Discounting is a subjective concept, similar to the interest that a bank will charge you for a loan. To come up with the interest rate on your loan, the bank looks at an individual's credit scores, and income, as well

as some common economic conditions, and then makes a decision based on their assessment of risk. It is possible for an individual to get different interest rates from different banks. Adjusting for inflation, on the other hand, is a completely objective concept and based purely on the BLS data.

Table A-1 Adjusting Costs for Inflation

	2002	2012	2103
Price Index	179.9	229.6	233.0
Cost of Intervention A	\$190	$\$242.5 = \$190 \times (229.6 \div 179.9)$	$\$246.1 = \$190 \times (233.0 \div 179.9)$
Cost of Intervention B	$\$164.5 = \$210 \div (229.6 \div 179.9)$	\$210	$\$213.1 = \$210 \times (233.0 \div 229.6)$

 **Sources to determine cost of health care:** Several sources of data can be used to determine the cost of various kinds of asthma care and services. Below is a list of commonly used sources:

Charges: Despite their limitations, charges billed can still provide an approximation for the cost of health care. To use the charges, determine the cost-to-charge ratio for the year for the region where the evaluation is taking place. To determine this ratio, consider accessing the Healthcare Cost and Utilization Project (HCUP), a family of health care databases and related software tools sponsored by the Agency for Healthcare Research and Quality (AHRQ) <http://www.hcup-us.ahrq.gov/db/state/costtocharge.jsp>.

Marketscan data: These data are similar to Medicare data and provide information about actual payments made by big employer-based health insurance companies to managed care and fee-for-service health providers. The database contains integrated patient-level data from commercial insurance enrollees and Medicare supplemental and Medicaid populations. The data reflect yearly patterns of health care utilization, prescription medication use, and productivity losses due to various illnesses. To learn more about the kinds of data included in the Marketscan database and ways to access it, including the access fee, refer to <https://marketscan.truvenhealth.com/marketscanportal/>.

Medicaid data: A state's Medicaid organization is a good source of information for medical reimbursements that are used in the state for people using Medicaid. However, state and Medicaid rules and regulations can create challenges in accessing these data. A good partnership with state Medicaid can facilitate access to Medicaid data for the purposes of your evaluation.

Medicare Reimbursement Data: Unlike small payers, Medicare can use its size to negotiate with health care providers and adjust original charges closer to the true economic costs. Medicare Provider Charge Data are a collection of charges for the 100 most common inpatient services and 30 most common outpatient services, along with the average payment for each charge. These can be accessed at <https://data.cms.gov/Medicare/Medicare-Provider-Charge-Data/s99v-duw6>.

Literature: Another possible source for cost data is published or unpublished studies or reports that have been reviewed by experts. If you use cost data from the literature, be sure to adjust it based on the current time. Refer to the earlier discussion on adjusting for inflation.

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Appendix B. Glossary

Definitions included in the glossary can be found in the sources referenced at the end of the appendix. Note that glossary terms are often close paraphrases or excerpts from sources. Words highlighted in **GREEN, BOLD, SMALL** indicate cross-references to other terms included in the Glossary.

Accuracy	One of the program EVALUATION STANDARDS developed by the Joint Committee on Standards for Educational Evaluation. The extent to which an evaluation is truthful or valid in what it says about a program, project, or material (Yarbrough, Shulha, Hopson, & Caruthers, 2011). See also FEASIBILITY, PROPRIETY, UTILITY, EVALUATION ACCOUNTABILITY .
Actual Cost	See COSTS .
Analytic Horizon	The duration of time into the future during which COSTS and effects that accrue from an intervention are considered (Haddix, Teutsch, Shaffer, & Dunet, 1996).
Audience	The individuals (such as your stakeholders and other evaluation users) with whom you want to communicate the results of an evaluation (Salabarría-Peña, Apt, & Walsh, 2007).
Average Cost	See COSTS .
Benefit	The sum (usually expressed in money terms to make it commensurate with cost) of the effects on well-being (positive or negative), which a particular program contributes to society. These are difficult to quantify but attempts have been made to value them using, for example, QALYs, or the willingness-to-pay approach (Donaldson, Mugford, & Vale, 2002).
Benefit-Cost Analysis	An economic evaluation (also known as COST-BENEFIT ANALYSIS) in which all COSTS and consequences of a program are expressed in the same units, usually money. Results are expressed as either the net present value or the dollars of benefits per dollars expended (CDC, n.d.).
Charge	The amount asked for a service by a health care provider. It is contrasted with the cost, which is the amount the provider incurs in furnishing the service. It is difficult to determine precise COSTS for many services, and charges are substituted for costs in many reimbursement or payment formulas (often with the stipulation that the hospital's

	bookkeeping follows certain rules) (Donaldson et al., 2002).
Comparator	A group not exposed to a program or treatment. Sometimes referred to as control group or comparison group (CDC, 2011).
Consumed	Used by a program (Drummond, Sculpher, Claxton, Stoddart, & Torrance, 2015).
Cost Analysis	Analysis of the comparative COSTS of alternative interventions or programs. Does not include consequences (Drummond et al., 2015).
Cost-Benefit Analysis	See BENEFIT-COST ANALYSIS .
Cost Description	Examines the COSTS of a single intervention or program. Does not include the consequences of the intervention or comparison with an alternative intervention (Zarnke, Levine, & O'Brien, 1997).
Cost-Effectiveness Analysis	An ECONOMIC EVALUATION in which all COSTS are related to a single, common effect or outcome. Results are usually stated as additional cost expended per additional health outcome achieved (CDC, n.d.).
Cost Inventory	A catalog of cost items relevant to a program.
Cost-Utility Analysis	Type of analysis that measures both cost and outcomes, where the latter is usually expressed in terms of quality-adjusted life-years (QALYs; CMS, 2006).
Costs	<p>The economic definition of cost (also known as OPPORTUNITY COST) is the value of opportunity forgone, strictly the best opportunity forgone, as a result of engaging resources in an activity (Donaldson et al., 2002; Kovner & Jonas, 1999). [Note: There can be a cost without the exchange of money. Also, the economist's notion of cost extends beyond the cost falling on the health service alone (e.g., includes costs falling on other services and on patients themselves)].</p> <ul style="list-style-type: none"> • Average costs - equivalent to the average cost per unit; (i.e., the total costs divided by the total number of units of production) (Donaldson et al., 2002). • Direct costs - costs borne by the health care system, community, and patients' families in

addressing the health problem or illness.
(Donaldson et al., 2002).

- **Fixed costs** - costs that, within a short time span do not vary with the quantity of production (e.g., heating and lighting) (Donaldson et al., 2002).
- **Incremental costs** - the extra costs associated with expanding an activity of a given service or offering or implementing one intervention over another (Donaldson et al., 2002).
- **Indirect costs** - mainly productivity losses to society caused by the health problem or illness. (Donaldson et al., 2002).
- **Marginal costs** - the cost of producing one extra unit of a service (Donaldson et al., 2002).
- **Operational costs** - costs incurred on a regular basis through the duration of the program. These include staff member salaries, monthly fees for infrastructure services, and routine maintenance of equipment (Donaldson et al., 2002).
- **Opportunity costs** - the notion of cost used in economics. In economics, cost is synonymous to opportunity cost and refers to the sacrifice (of benefits) made when it is **CONSUMED** by a program (CMS, 2006).
- **Out-of-Pocket costs** - expenses incurred by an individual to participate in a program (Haddix et al., 1996).
- **Startup costs** - one-time costs incurred to initiate a program. Such expenses include fees for infrastructure services, such as telephone and internet; initial recruiting and hiring costs for program personnel; costs of purchasing furniture and equipment. These types of costs are incurred once, typically, when a program is started (Donaldson et al., 2002).
- **Total costs** - all costs incurred in the production of a set quantity of services (Donaldson et al., 2002).
- **Variable costs** - costs that vary with the level of production or service and are proportional to quantities produced or serviced (Donaldson et al., 2002).

Direct Costs

See **COSTS**.

Discounting	The process of applying negative weights to COSTS and BENEFITS that occur in the future to express them in terms of a present value (CMS, 2006).
Do-nothing	See COMPARATOR (Holtgrave & Pinkerton, 1997).
Economic Evaluation	The systematic appraisal of COSTS and BENEFITS of projects, normally undertaken to determine the relative economic efficiency of programs (Levin & McEwan, 2001).
Effectiveness	A measure of how well a technology achieves its objectives under conditions that apply in routine practice (CMS, 2006).
Efficacy	A measure of how well a technology achieves its objectives under experimental conditions (CMS, 2006).
Evaluation Accountability	One of the program EVALUATION STANDARDS developed by the Joint Committee on Standards for Educational Evaluation. This standard encourages increased transparency in planning and implementing evaluation, as well as conclusions drawn through documentation and meta-evaluation (Yarbrough et al., 2011). See also ACCURACY, FEASIBILITY, PROPRIETY, and UTILITY .
Evaluation Planning Team	As used in this guide, this term refers to a small group of evaluation stakeholders convened by an asthma program to develop and implement a strategic evaluation plan or individual evaluation plan.
Evaluation Standards	Developed by the Joint Committee on Standards for Educational Evaluation, evaluation standards are the criteria upon which the quality of program evaluations can be judged (Yarbrough et al., 2011). See also ACCURACY, FEASIBILITY, PROPRIETY, UTILITY, and EVALUATION ACCOUNTABILITY .
Feasibility	One of the program EVALUATION STANDARDS developed by the Joint Committee on Standards for Educational Evaluation. The feasibility standards are intended to ensure that an evaluation will be realistic, prudent, diplomatic, and frugal (Yarbrough et al., 2011). See also ACCURACY, PROPRIETY, UTILITY, and EVALUATION ACCOUNTABILITY .
Fixed Costs	See COSTS .

Full Economic Evaluation	Full economic evaluations are studies in which a comparison of two or more interventions or care alternatives is undertaken and in which both the COSTS and outcomes of the alternatives are examined (Drummond et al., 2015).
Incremental Analysis	An analysis that compares the effects of alternative programs (Haddix et al., 1996).
Incremental Cost	See COSTS .
Indirect Costs	See COSTS .
Ingredients Method	A technique that can be used to itemize resources consumed by a program. It is a detailed listing of the resources or inputs of a program (Levin & McEwan, 2001).
Marginal Cost	See COSTS .
Opportunity Cost	See COSTS .
Operational Costs	See COSTS .
Out-of-pocket Costs	See COSTS .
Partial Economic Evaluation	Economic studies which consider COSTS or consequences but which either do not involve a comparison between alternative interventions or do not relate costs to benefits (Drummond et al., 2015).
Payer Perspective	See PERSPECTIVE .
Perspective	<p>The viewpoint of the AUDIENCE vis-à-vis the evaluation (Haddix et al., 1996).</p> <ul style="list-style-type: none"> • Program perspective - the point of view of a program. It explores specific COSTS and BENEFITS that can be attributed to the program. Usually chosen when the results of ECONOMIC EVALUATION will be used primarily by program personnel (Haddix et al.). • Program participant perspective - (also known as client perspective) focuses on the costs of participation borne by program participants, such as fees, transportation costs, or lost labor; it also typically includes the benefits the client receives from participation (Haddix et al.). • Payer perspective - examines costs and benefits from the viewpoint of the person or entity

ultimately responsible for the financial cost of the program, such as an insurance company (Haddix et al.).

- **Societal perspective** - includes costs and benefits of everyone directly and indirectly affected by the program, including taxpayers (Haddix et al.).

Program Perspective

See **PERSPECTIVE**.

Program Participant Perspective

See **PERSPECTIVE**.

Propriety

One of the program **EVALUATION STANDARDS** developed by the Joint Committee on Standards for Educational Evaluation. The extent to which the evaluation has been conducted in a manner that evidences uncompromising adherence to the highest principles and ideals, including professional ethics, civil law, moral code, and contractual agreements (Yarbrough et al., 2011). See also **ACCURACY, FEASIBILITY, UTILITY, and EVALUATION ACCOUNTABILITY**.

Prospective Evaluation

Evaluation that is conducted while the program is operating; data are collected in real time (Levin & McEwan, 2001).

Qualitative Residual

A term that refers to those outcomes that are difficult to quantify or express in monetary units. The term was created for those cost-effectiveness analyses that might not have clear, consistent measures of **EFFECTIVENESS**, given the multiple objectives that are often associated with a human service program (Barnett, 1993).

Quality-Adjusted Life-Year

Units of measure of utility (also known as QALYS) which combine life years gained as a result of health interventions or programs with a judgment about the quality of these life years. A common measure of health improvement used in cost-utility analysis, it is a measure of life expectancy adjusted for quality of life (CDC, n.d.).

Retrospective Evaluation

Evaluation that is conducted after the program is completed. This is not ideal, since the information will be dated and may potentially affect how consistently and accurately cost and outcome data are captured (Levin & McEwan, 2001).

Return on Investment

Assessment of the business case model for prevention; similar to a **BENEFIT-COST ANALYSIS (BCA)**, except only the **PERSPECTIVE** of the entity paying for the intervention

	is considered, rather than assessing the BENEFITS and COSTS of the intervention from the societal perspective. [See Appendix E.]
Robustness	In economics, robustness is the ability of an economic model to remain valid under different assumptions, parameters, and initial conditions (Drummond et al., 2015).
Sensitivity Analysis	A technique which repeats the comparison between inputs and consequences, varying the assumptions underlying the estimates. In so doing, sensitivity analysis tests the robustness of the conclusions by varying the items around which there is uncertainty (Drummond et al., 2015).
Societal Perspective	See PERSPECTIVE.
Startup Costs	See COSTS.
Summary Measures	Summary ratios that are reported in an economic evaluation. Examples of summary measures include incremental net present value of benefits (BCA), the incremental cost-effectiveness ratio (CEA), and the incremental cost-utility ratio (CUA) (Haddix et al., 1996).
Time Frame	The specified period over which the intervention strategies are actually applied or implemented (Haddix et al., 1996).
Total Cost	See COSTS.
Unintended Effect	An unintentional, unplanned change or consequence due directly or indirectly to an intervention (Haddix et al., 1996).
Utility	One of the program EVALUATION STANDARDS developed by the Joint Committee on Standards for Educational Evaluation. The extent to which an evaluation produces and disseminates findings that inform relevant AUDIENCES and have beneficial impact on their work (Yarbrough et al., 2011). See also ACCURACY, EVALUATION ACCOUNTABILITY, FEASIBILITY, and PROPRIETY.
Variable Costs	See COSTS.

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Appendix C. Resources for Planning and Implementing Economic Evaluations

Books

- Agresti, A., & Finlay, B. (2008). *Statistical options for the social sciences* (4th ed.). Upper Saddle River, NJ: Prentice Hall.
- Cresswell, J.W. (2007). *Qualitative inquiry & research design: Choosing among five approaches*. Thousand Oaks, CA: Sage Publications.
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Papers

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Relevant Web Resources

CDC’s Introduction to Economic Evaluation Tutorials: These tutorials teach the basics of economic evaluation, why they should be conducted, forms of economic evaluations, and how to determine which forms to use. http://www.cdc.gov/dhds/pubs/docs/CB_January_10_2012.pdf

Economic Reviews (The Community Guide): This website outlines the methodology used by the Community Guide in conducting economic reviews of health-related issues and interventions. <https://www.thecommunityguide.org/about/economic-reviews>

Five-Part Webcast on Economic Evaluation (Division for Heart Disease and Stroke Prevention): Economic evaluation is a process to identify, measure, value, and compare the costs and outcomes of programs and policies. This webcast series is designed to help you understand the value of economic evaluation and how to incorporate these methods into your programs. The five-part webcast will assist you in choosing the appropriate economic analysis for your heart disease and stroke prevention program or policy. https://www.cdc.gov/dhds/evaluation_resources/economic_evaluation/index.htm

The Cost of Firearm Violence (Children’s Safety Network): Estimated based on the latest injury data from the Centers for Disease Control and unit costs from the Pacific Institute for Research and Evaluation’s (PIRE) widely cited injury cost model. The resource provides an example of estimating cost to society and breaking it down to a narrower perspective; in this case, the government’s. <https://www.childrensafetynetwork.org/publications/cost-firearm-violence>

Self-paced Web Courses on Economic Evaluation

Concepts in Economic Evaluation, Johns Hopkins School of Public Health Open Courseware: This course describes how economic theory is linked to economic evaluation techniques like cost-benefit and cost-effectiveness analysis and introduces learners to many concepts that are specific to economic evaluation. Learners are introduced to the many varieties of economic evaluation to establish a common terminology. The course explores recommendations on performing economic evaluations that are conducted in the United States with a focus on how these are related to underlying economic theory and other concepts. <http://ocw.jhsph.edu/index.cfm/go/viewCourse/course/ConceptsEconomicEvaluation/coursePage/index/>

Economic Evaluation Basics, Global Health eLearning (GHeL) Center: After completing this course, learners will have a more complete understanding of the issues considered in conducting economic evaluations and the role of economic evaluations in policy and program decision making. <http://www.globalhealthlearning.org/course/economic-evaluation-basics>

Health Economics Information Resources, National Information Center on Health Services Research and Health Care Technology (NICHSR): The purpose of this self-study course is to provide an overview and discussion of important sources of health economics information so that course participants can (1) develop more systematic and effective approaches to its identification and retrieval, and (2) gain greater understanding about its quality and role in health policy formulation and decision making. <http://www.nlm.nih.gov/nichsr/edu/healthecon/index.html>

Appendix D. Templates for Managing Cost Data

Overview

This appendix provides several worksheets and tables that may be used for program cost analysis. The Checklist for Program Cost Analysis, introduced in the discussion on Step 4 - Gathering Credible Evidence for your Economic Evaluation, is reused in this appendix to serve as the table of contents, for ease of reference, and for suggesting templates that may be used to complete each step included in the checklist.

Directions to users

Users should be mindful of the following when using the templates in this appendix:

1. The list of resources included in these worksheets is not comprehensive. Users should add additional resource categories and line items, as appropriate, to complete the step.
2. Categorization of program resources in these worksheets may not exactly match with how they are categorized in program budgets. What is important is to ensure all program resources are accounted for in a cost category.
3. Most templates have line items in italics that are meant to serve as a helpful example to users. The dollar values assigned in the examples may not be realistic. Users should delete the example line item when using the template.

Table of Contents

Checklist for Program Cost Analysis—with reference to worksheets and tables in this appendix

Tasks	Check When Complete	Reference to Worksheets and Tables in the Appendix
Stakeholder generated or vetted documentation:		
Program description that includes list of program activities		
Decision on the evaluation's perspective		
Program time frame		
Other appropriate program documents (budget, financial statements, etc.)		
Implementation:		
1. Create a cost inventory for the program and decide on approaches to determine the cost of non-financial and capital resources		Worksheet 1: Listing Program Cost Ingredients Table 1: Donated Resources Table 2: Participant Resources Table 3: Capital and Equipment Resources Table 4: Facilities Resources
2. Calculate the total variable cost of the program <ul style="list-style-type: none"> • Estimate the quantity used within the time period for each resource included in the cost inventory • Identify the unit cost for each resource • Multiply the unit cost of resource by the quantity of resource used to calculate the resource cost • Sum up all variable cost items 		Worksheet 2: Calculating Personnel Costs Worksheet 3: Calculating Materials & Supplies Costs Worksheet 4: Calculating Cost of Program Incentives Worksheet 7: Calculating Other Costs
3. Calculate the total fixed cost of the program <ul style="list-style-type: none"> • Estimate appropriate portion of cost used by the program for the time period • Calculate the resource cost for each item by accounting for the estimated portion used by the program • Sum up all fixed cost items 		Worksheet 2: Worksheet for Personnel Costs (Administrative and support personnel) Worksheet 5: Calculating Facilities Costs Worksheet 6: Calculating Capital Equipment and Real Estate Costs

Checklist for Program Cost Analysis—with reference to worksheet and tables in this appendix

Tasks	Check When Complete	Reference to Worksheets and Tables in the Appendix
Implementation (continued):		
<p>4. Calculate total participant cost, if required based on perspective</p> <ul style="list-style-type: none"> • Calculate total out-of-pocket cost <ul style="list-style-type: none"> ○ Collect all out-of-pocket costs for participant ○ Sum up all out-of-pocket costs • Calculate total cost of time spent <ul style="list-style-type: none"> ○ Estimate amount of time spent by participant ○ Reach an agreement with Evaluation Team and stakeholders on the unit cost time spent ○ Multiply amount of time spent by unit cost time spent • Add total out-of-pocket cost to total cost of time spent 		Worksheet 8: Calculating Program Participation Costs
<p>5. Add total fixed cost, variable cost, and participant cost to come up with your total program cost.</p>		Worksheet 9: Calculating Total Program Cost and Average Cost per Participant

Worksheet 1: Listing Program Cost Ingredients

Worksheets 1A, 1B, and 1C may be used to create a cost inventory, or ingredient list, of program resources. As a reminder, the list of resources included in these worksheets is not comprehensive. Users should add additional resource categories and line items, as appropriate, to identify all resources consumed to implement and participate in the program and resources consumed by any unintended program effects.

Worksheet 1A: Listing Program Cost Ingredients: Resources Consumed to Implement Program

List of Resources	Consumed to Implement the Program? (Y or N)	Donated or In-kind?	Not Sure Yet
PERSONNEL			
<i>Administration & Support</i>			
Principal investigator			
Program manager			
Evaluator			
Epidemiologist			
Communications lead			
Consultants			
Volunteers			
Program support			
<insert other line items, as appropriate>			
<i>Program implementers (Service providers)</i>			
Community health workers			
Social workers			
Local health department staff			
Nurses			
Asthma educators			
Volunteers			
<insert other line items, as appropriate>			
FACILITIES¹²			
Rent or existing			
New purchase			
Maintenance & insurance			
Utilities			
<insert other line items, as appropriate>			

¹² May be included in your indirect cost rate agreement.

Worksheet 1A (Cont.): Listing Program Cost Ingredients: Resources Consumed to Implement Program

List of Resources	Consumed to Implement the Program? (Y or N)	Donated or In-kind?	Not Sure Yet
TRANSPORTATION			
Mileage reimbursement			
<insert other line items, as appropriate>			
MATERIALS, SUPPLIES, and EQUIPMENT			
<i>Office supplies & equipment</i>			
Stationary			
Computers			
Maintenance & insurance			
<insert other line items, as appropriate>			
<i>Education materials</i>			
Content development and design			
Printing			
Miscellaneous			
<insert other line items, as appropriate>			
...continued			
<i>Trigger reduction supplies & equipment¹³</i>			
Pillowcases			
Mattress covers			
Air filters			
Vacuum cleaners			
Integrated pest management supplies			
<insert other line items, as appropriate>			
<i>Medical supplies & equipment</i>			
Spacers			
Peak flow meters			
<insert other line items, as appropriate>			
PROGRAM INCENTIVES			
Gift card			
<insert other line items, as appropriate>			

¹³ Funding restrictions may apply for use of funds for trigger reduction supplies and equipment.

Worksheet 1A (Cont.): Listing Program Cost Ingredients: Resources Consumed to Implement Program

List of Resources	Consumed to Implement the Program? (Y or N)	Donated or In-kind?	Not Sure Yet
OTHER			
Training			
Postage			
Service providers' cellphone expense			
Miscellaneous			
<insert other line items, as appropriate>			

Worksheet 1B: Listing Program Cost Ingredients: Resources Consumed by Program Participants

List of Resources	Consumed to Implement the Program? (Y or N)	Donated or In-kind?	Not Sure Yet
TIME SPENT			
Wait time			
Program participation time			
Travel time			
<insert other line items, as appropriate>			
OUT-OF-POCKET EXPENSE			
Childcare			
Transportation			
Other			
<insert other line items, as appropriate>			

Worksheet 1C: Listing Program Cost Ingredients: Resources Consumed by Unintended Program Effects¹⁴

List of Resources	Entity Bearing the Unintended Program Effect
<insert other line items, as appropriate>	

¹⁴ Generally applicable to policy initiatives.

Specifying Approaches for Determining the Cost of Non-Financial and Capital Resources

Tables 1, 2, 3, and 4 below may be used to document the approach being taken to estimate the economic cost of non-financial and capital resources consumed for implementing or participating in the program. Users are encouraged to capture relevant discussion points and the rationale behind the selected approach. This information would be useful when analyzing or justifying results.

Table 1 Donated Resources and Approach to Determine Costs
(List of all ingredients marked as donated in the Ingredient List Worksheet 1A)

Donated Resources	Approach to Determine Cost	Other Relevant Information (Relevant comments, pertinent data, etc.)
Ex. Volunteer time	Hourly wage in the state for similar work	\$10/hour

Table 2 Participant Resources and Approach to Determine Costs
(List of all ingredients in the Ingredient List Worksheet 1B)

Resources Used to Participate in Program	Approach to Determine Cost	Other Relevant Information (Relevant comments, pertinent data, etc.)
Ex. Time spent	Hourly wage in the state	\$10/hour

Table 3 Capital Resources and Approach to Determine Costs
(List of ingredients having one-time costs whose benefit accrue over their useful life, likely continuing after the program is completed)

Capital Resources	Approach to Determine Cost	Other Relevant Information (Relevant comments, pertinent data, etc.)
Ex. Laptops or comp	Annuitized cost over five years	Per department policy, laptops are recycled every 5 years.

Table 4 Facilities and Approach to Determine Costs
(List of ingredients whose cost is likely shared among many programs)

Facilities Resources	Approach to Determine Cost	Other Relevant Information (Relevant comments, pertinent data, etc.)
Ex. Rent	Value of square footage used by program resources	Suggested by the Finance Director as the standard approach used by the State Health Department.

Worksheet 2: Estimating Personnel Costs

This worksheet divides personnel into three types—salaried, hourly, and volunteer. Because they are compensated differently, they may require slightly different information and calculation steps to accurately account for the cost to the program.

Worksheet 2: Calculating Personnel Costs

Program time frame = n months

Personnel Type	Number	Wages		Proportion of Time or Hours Spent per Day on Intervention	Monthly Cost to Program	Total Cost to Program
A. Salaried		<i>Salary + Fringe, if any</i>	<i>Hourly (H), Monthly (M), or Annual (A)</i>			
<i>Ex. Evaluator</i>	1	\$48,000	A	10%	$\$4800/12\text{months} = \400	$\$400 \times n$
B. Hourly		<i>Hourly rate+ Employer taxes</i>				
<i>Ex. CHW</i>	6	\$25	H	5 hrs. twice a week	$(\$25 \times 6\text{CHWs} \times 5\text{hrs.} \times 2 \text{ per week}) \times 4\text{wks/ month} = \$60,000$	$\$60,000 \times n$
C. Volunteers		<i>Rate based on Table 2</i>				
<i>Ex. Program support</i>	1	\$10	H	2 hrs. once a week	$(\$10 \times 2\text{hrs/wk} \times 1) \times 4\text{wks/ month} = \80	$\$80 \times n$
Total Personnel Cost (A+B+C)						

Worksheet 3: Estimating Materials and Supplies Costs

This worksheet lists commonly expected categories for materials and supplies in asthma programs—office supplies, education materials, medical supplies and equipment, and trigger reduction supplies and equipment. Users should change the categories to accurately reflect the materials and supplies resources used by the program.

Worksheet 3: Calculating Materials and Supplies Costs

Program time frame = n months

Materials and Supplies	Single Payment Amounts	Or, Payment by Units: # of Units	Or, Payment by Units: Unit Cost	Total Cost to Program (# of units × unit cost or Single payment amount)
A. Office supplies & equipment*				
<i>Ex. Paper</i>		<i>\$5 reams/month</i>	<i>\$12</i>	<i>5 x 12 = \$60 x n</i>
B. Education materials				
<i>Ex. Content development or design</i>	<i>\$5000</i>			<i>\$5000</i>
C. Trigger reduction supplies & equipment				
<i>Ex. Pillowcases</i>		<i>50</i>	<i>\$15</i>	<i>\$50 x \$15 = \$750</i>
D. Medical supplies & equipment				
<i>Ex. Spacers</i>		<i>50</i>	<i>\$40</i>	<i>\$50 x \$40 = \$2000</i>
Total Cost of Materials and Supplies (A+B+C+D)				

*If Office Materials & Supplies are listed as a single expense for the entire office, you may estimate the program proportion of expense to determine cost to program (see worksheet for calculating facilities).

Worksheet 4: Estimating Cost of Program Incentives

If program incentives are donated, use the approach selected to determine the cost of donated items for this analysis, noted in **Table 1**.

Worksheet 4: Calculating Cost of Program Incentives

(Unit cost of donated resource is calculated based on the approach identified in Table 1)

Program Incentives	# of Units	Unit Cost of Donated Resource	Purchase Price (per unit)	Cost to Program (# of units × unit cost or purchase price)
A. Purchased				
<i>Ex. Grocery cards</i>	100		\$10	\$1000
B. Donated				
<i>Ex. Gas cards</i>	100	\$5		\$500
Total Cost of Program Incentives (A+B)				

Worksheet 5: Estimating Facilities Costs

This worksheet requires a pre-calculation, which is based on the approach selected to determine facilities cost for this analysis, noted in **Table 4**.

Worksheet 5: Calculating Facilities Costs¹⁵ (Costs of these resources are shared by many programs)

Program time frame = n months

Calculate appropriate program proportion of expense

Ex. If using proportion of employees – Program Proportion = # of program employee ÷ total # of employees housed in the facility

Ex. If using proportion of space – Program Proportion = sq. footage used by program ÷ total facility sq. footage

Facilities	Monthly Cost	Cost of Program (= Total Cost x Program Proportion)
A. Office Space		
<i>Ex. Rental</i>	\$5,000	(Assuming Program Proportion = 10%) $\$5,000 \times 0.1 = \$500/\text{month} \times n$
B. Utilities		
<i>Ex. Telephone or internet</i>	\$1,000	(Assuming Program Proportion = 10%) $\$1,000 \times 0.1 = \$100/\text{month} \times n$
C. Maintenance		
<i>Ex. Building maintenance</i>	\$2,000	(Assuming Program Proportion = 10%) $\$2,000 \times 0.1 = \$200/\text{month} \times n$
D. Other		
Total Facilities Cost (A+B+C+D)		

¹⁵ Facilities cost may be included in the indirect rate.

Worksheet 6: Estimating Capital Equipment and Real Estate Costs

This worksheet requires an additional calculation, which is based on the approach selected to determine capital cost for this analysis, noted in **Table 3**. For detailed steps on how to calculate annualized cost, you may refer to **Appendix A**.

Worksheet 6: Calculating Capital Equipment and Real Estate Costs

(Costs of these resources occur one time, but benefits accrue over their useful life, likely after the program is completed.)

Program time frame = n months

Capital and Equipment Resources	Purchase Price	Annualized Cost (use Table 3)	Cost of Program (Annualized Cost + Program Time Frame)
A. Real Estate			
<i>Ex. Office building</i>	\$10,000,000	(Assuming 20-yr property) \$5,000	$\$5,000 \times n/12$
B. Capital Equipment			
<i>Ex. Laptops</i>	\$3,000	(Assuming 5-yr property) \$600	$\$600 \times n/12$
Total Capital Cost (A+B)			

Worksheet 7: Estimating Other Costs

If additional program costs not captured in the worksheets above, you should account for them in this worksheet.

Worksheet 7: Worksheet for Calculating Other Costs

(Unit cost of donated resource is calculated based on the approach identified in Table 1.)

Program time frame = n months

Other Costs	Single Payment Amount (\$)	Or, Payment by Units: # of Units	Or, Payment by Units: Unit Cost	Cost to Program (# of units × unit cost)
A. Training				
<i>Ex. CHW orientation</i>	400			\$400
B. Postage				
<i>Ex. Shipping</i>		10/month	\$0.55	10 × n × \$0.55 = \$5.5 × n
Total Other Cost (A+B)				

Worksheet 8: Estimating Program Participation Costs

This worksheet lists typical expense categories related to program participation: time spent for program activities and participants' out-of-pocket costs. To estimate the cost of time spent by participants, users would use the approach selected for determining the cost of participant time for this analysis, noted in **Table 2** above.

Worksheet 8: Calculating Program Participation Costs

(Based on the decision for the approach to calculating economic cost for program participation)

Program time frame = n months

Participation Resource	Units (Hrs.)	Unit Cost	Cost of Program Participation (# of units x unit cost price x # of participant sessions)
A. Time Spent			
<i>Ex. Wait time</i>	0.5	\$10/hr.	<i>(Assuming 3 participant sessions)</i> <i>0.5hrs. x \$10/hr. x 3 = \$15</i>
B. Out-Of-Pocket			
<i>Ex. Childcare</i>	3hrs	\$10/hr.	<i>(Assuming 3 participant sessions)</i> <i>3hrs. x \$10/hr. x 3 = \$90</i>
Total Cost for Program Participation (A+B)			

Worksheet 9: Calculating Program Cost and Average Cost per Participant

This table summarizes data from the preceding tables, categorizing it as start-up costs, fixed costs, and variable costs. Such categorization is often sought by decision makers when considering program expansion or replication.

Worksheet 9: Calculating Program Cost and Average Cost per Participant

Program time frame = n months/years/weeks

Perspective of analysis: _____

List of Resources (Based on Perspective)	Quantity	Cost/Unit	Total Cost
START UP COSTS			
<i>Hiring costs</i>			
<i>Orientation training</i>			
<i>Other</i>			
FIXED COSTS			
Personnel			
<i>Program manager</i>			
<i>Evaluator</i>			
<i>Epidemiologist</i>			
<i>Communications lead</i>			
Facilities			
<i>Rent</i>			
<i>Maintenance</i>			
<i>Utilities</i>			
Supplies & Materials			
<i>Office supplies & printing</i>			
Equipment			
<i>Laptops</i>			
VARIABLE COSTS			
Personnel			
<i>CHW</i>			
<i>Consultant</i>			
<i>Volunteer</i>			
Transportation			
<i>Mileage reimbursements</i>			

Worksheet 9: Calculating Program Cost and Average Cost per Participant (continued)

List of Resources (Based on Perspective)	Quantity	Cost/Unit	Total Cost
Supplies & Materials			
<i>Education materials</i>			
<i>Trigger reduction supplies & materials</i>			
Participant Incentives			
<i>Gift card</i>			
Other Costs			
<i>Postage</i>			
<i>Service provider cell phone</i>			
Participation Cost Reimbursement			
<i>Session time</i>			
TOTAL PROGRAM COST			
# of participants	N		
Average cost per participant	Total Program Cost / N		

Appendix E. Return on Investment

Return on investment (ROI) is an important way to assess the value of a program. ROI answers the question “what is the payback for the investment made to implement the program over a defined period?” (Buzachero, Phillips, Phillips, & Phillips, 2013). A variation of benefit-cost analysis, ROI is often preferred when the focus is on understanding direct program costs and monetized benefits, and when the parameters of the program and the evaluation outcomes are clearly defined (Buzachero et al., 2013).

ROI is the ratio of net benefits (total benefits – program cost) expressed in monetary terms divided by the program cost of the intervention.

$$ROI^1 = \frac{\text{Total Benefits-Program Cost}}{\text{Program Cost}}$$

Using this formula, you will obtain a ratio. If the ratio is 0, then total benefits equal the program cost, and the program is said to break even or be cost-neutral. If the ratio is greater than 0, then total benefits outweigh the program costs, and the program is considered to have a positive ROI. If the ratio is less than 0, then program costs exceed the total benefits and the program said to have negative ROI. However, stakeholders may have other values that justify the investment. You may want to discuss this possibility with them early in the economic evaluation.

Often, ROI is shown in terms of a percentage, for example, program X provides a 34% ROI. To obtain ROI as percentage, you simply multiply original ROI by 100:

$$ROI = \frac{\text{Total Benefits-Program Cost}}{\text{Program Cost}} \times 100$$

Using this formula, you will obtain a percentage (see below). The value of ROI as a percentage is interpreted in the same way as the value of ROI as a ratio: 0% indicates that the program is cost-neutral; greater than 0% suggests that the program has a positive ROI, and less than 0% indicates that the program has a negative ROI. Note that even if the program has a negative ROI, it may still be considered a good value for the money invested by the payer based on the cost-effectiveness of the program (refer to Cost-Effectiveness Analysis discussed in main chapter, p. 1–14).

As a variation of benefit-cost analysis, all the steps noted throughout this module apply. ROI is commonly used for building business cases—a justification for a program or intervention that is intended to convince a decision-maker to approve some kind of action, typically funding. Because of this, you will typically use the payer’s perspective for the analysis. As an example, when using a payer’s perspective, you may exclude some of the benefits, such as decrease in missed school and workdays, improving quality of life, or reducing pain and suffering, as these are not costs borne by the payer. You would include only costs and benefits specific to the payer, such as decreased hospitalizations or emergency department visits. Working with your stakeholders, you should determine which benefits and costs are considered relevant to the perspective you choose and include only those costs in the analysis.

You will need to discuss the timeframe for the ROI. Typically, ROI analysis does not include benefits and costs for more than a year; however, your stakeholders may opt for other periods (please see page 9 for more information).

ROI of Comprehensive Asthma Initiative Model

Services strategy: Home-based, multi-component, multi-trigger intervention

Participant group: Children age 2 to 18 years living in four urban zip codes showing a high prevalence of asthma

Intervention components:

1. Nurse case management and coordination of care with primary care and referral services
2. Nurse or nurse-supervised community health worker (CHW) home visits for asthma education, environmental assessment, remediation materials (HEPA vacuum, bedding encasements, and integrated pest management (IPM) materials tailored to the needs of the family), and connection to community resources
3. Referral to an IPM exterminator when indicated

Results: The program provided services to 283 children. Twelve-month data show a significant decrease in asthma emergency department visits and hospitalizations and days of physical activity limitation, patient missed school, and parents missed work.

Costs: The cost of the clinical program for the intervention group was \$2,529 per child and the savings for the intervention group was \$3,827 per child over two years of follow-up.

ROI Calculation: Inserting the amounts for cost and savings in the formula:

$$ROI = \frac{\$3827 - \$2529}{\$2529} \times 100 = 0.51 \times 100 = 51\%$$

In other words, for every dollar invested in this asthma intervention, the payer will save 0.51 dollars in health care cost in two years. In business language, a one-dollar investment brings a 51% return in two years.

Social Return on Investment

To many, judging a public health service by its monetary value seems inadequate, and even inappropriate. In the last decade, Social Return on Investment (SROI) has emerged to address these concerns and account for the social value of a program. SROI explores value in a broader sense, beyond cost, prices, and investments, taking into account social, economic, and environmental factors (Nicholls, Lawlor, Neitzert, & Goodspeed, 2012). SROI takes a systematic and holistic perspective on whether a project is beneficial and profitable. While ROIs may be presented as a sole outcome measure, SROI must be considered as an additional piece of information to provide to stakeholders. You will use other information generated through an evaluation to tell the complete story for the program.

An SROI analysis inherently takes a societal perspective and typically a bottom up approach (Better Evaluation, n.d.). It begins with identifying groups, such as service users, caregivers, health care providers, and state or national insurance agencies, who are affected by or affect the organization's activity. The goal of the analysis is to identify and understand how a particular service makes a difference to those involved. The differences identified for each of the groups are labeled as positive or negative outcomes, which are then valued using financial proxies (estimates of financial value where it is not possible to know an exact value) or monetization of outcomes (refer to Benefit-Cost Analysis discussed in Chapter 1). Determining financial proxies often requires working creatively with stakeholders. For example, you may need to ask them directly what they are willing to pay for the benefit they receive, or you may need to estimate what a similar service might sell for. You will use the financial value for the outcomes to calculate a return on investment ratio. The same technical rules apply to SROI as they do for any benefit-cost economic evaluation. Like all evaluations, SROIs require active stakeholder engagement and a full understanding of a program, its effects, and its contexts. For example, in the ROI model described earlier, the SROI could have also included benefits such as improved family relationships and the benefits of the additional employment of community members. When you report your SROI, you will need to include more context regarding the initiative and the community served than is typically provided for ROI reporting. Your narrative will also need to explicitly document how proxies and values were established.

References

- Better Evaluation. *Social return on investment*. Retrieved from <http://betterevaluation.org/approach/SROI>
- Buzachero, V., Phillips, J., Phillips, P., & Phillips, Z., (2013). *Measuring ROI in healthcare*. McGraw Hill: New York.
- Nicholls, J., Lawlor, E., Neitzert, E., & Goodspeed, T. (2012). *A guide to social return on investment*. Retrieved from <http://www.socialvaluelab.org.uk/wp-content/uploads/2016/09/SROI-a-guide-to-social-return-on-investment.pdf>