

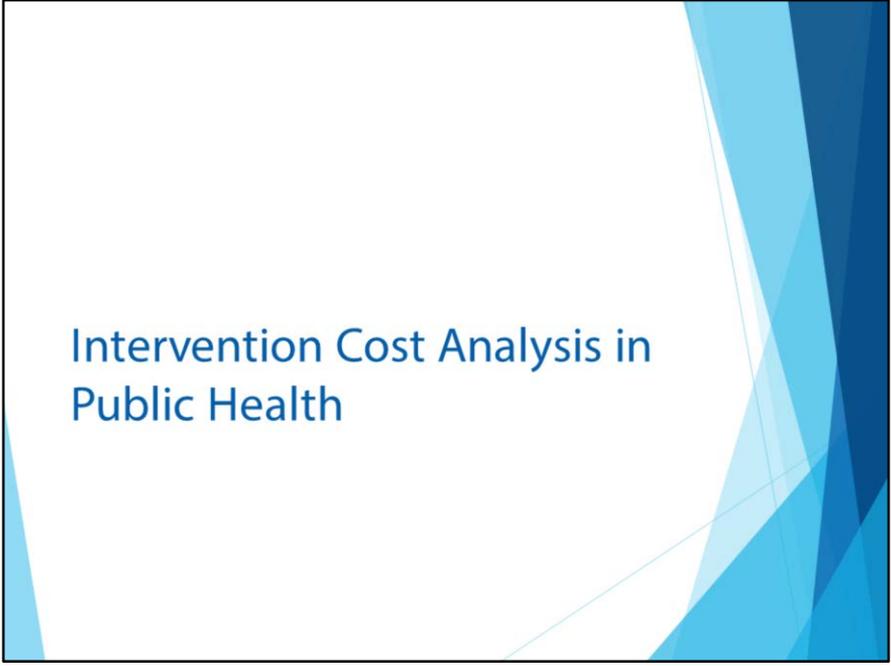
MODERATOR:

Welcome to today's Coffee Break presented by the Applied Research and Evaluation Branch in the Division for Heart Disease and Stroke Prevention at the Centers for Disease Control and Prevention.

We are fortunate to have **Jack Chapel** as today's presenter, he is a **ORISE Fellow** on **the Evaluation and Program Effectiveness Team and the Applied Research and Translation team**.

My name is Ashley Marshall and I am today's moderator. I am an Evaluator on the Evaluation and Program Effectiveness Team .

Disclaimer: The information presented here is for training purposes and reflects the views of the presenters. It does not necessarily represent the official position of the Centers for Disease Control and Prevention.

The background of the slide features an abstract design of overlapping, semi-transparent blue triangles and polygons in various shades, ranging from light sky blue to a deep navy blue. The shapes are primarily located on the right side of the slide, creating a modern, geometric aesthetic.

Intervention Cost Analysis in Public Health

Intervention Cost Analysis in Public Health

- ❑ **Economic evaluations (e.g., cost-effectiveness analysis) provide valuable information for resource allocation decisions**
- ❑ **Cost data forms the foundation of all economic analyses**
 - Without high quality cost estimates, evaluation results can be misleading
- ❑ **Proper cost analysis can enhance the usefulness of economic evaluation results and inform program replication and future planning**

Economic evaluations of public health interventions, such as cost-effectiveness analysis, can provide valuable information for resource allocation decisions and planning, and these types of analyses are increasingly requested by decision makers. Reliable cost data forms the foundation of all economic analyses, and without high quality cost estimates these analyses may be misleading. In addition, a well done cost analysis on its own can provide important information for future program planning. This presentation will give an overview of cost analysis and provide some practical considerations for conducting your own cost analysis of a public health intervention.

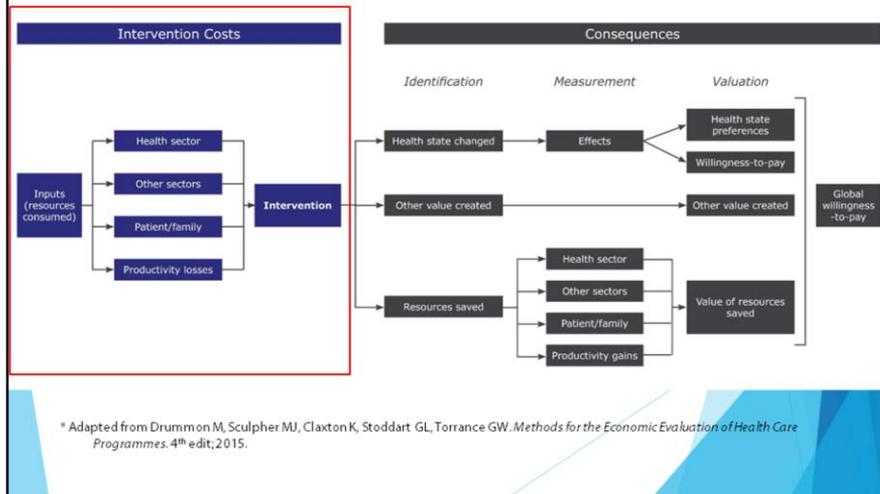
Presentation Outline

- ❑ Overview of intervention costs
- ❑ Steps for cost analysis method (micro-costing)
- ❑ Cost data collection tools for micro-costing
- ❑ Walk-through example of cost analysis
- ❑ Resources for further learning
- ❑ Q&A

Previous coffee breaks have discussed more general topics in economic evaluation, which are helpful for giving a higher level overview. Today, I'll be going into more detail about one topic, intervention costs.

In this presentation, I'll first give an overview of intervention costs and describe a method to estimate intervention costs called micro-costing. I'll describe different types of cost data collection tools that can be used for micro-costing. And finally, I'll walk through an example of a previously conducted cost analysis to show how these methods and tools can be applied in practice. And as always, I'll provide some additional resources and leave time for questions.

Conceptual Model: Components of economic evaluation for public health interventions*



To set the context, let's look at a conceptual model of the potential components of an economic evaluation. In a public health intervention, there are the costs of delivering the intervention and consequences resulting from that intervention, such as changing the health status of patients and saving resources. For example, the intervention cost of a hypertension self-management program could include the cost of having nurses deliver lifestyle coaching sessions, and the consequences could include increased quality of life from patients achieving blood pressure control, and savings in resources by avoiding hospitalizations that could have otherwise occurred.

In this presentation I will be discussing only intervention costs.

Key Concepts to Consider: Study Perspective, Opportunity Cost

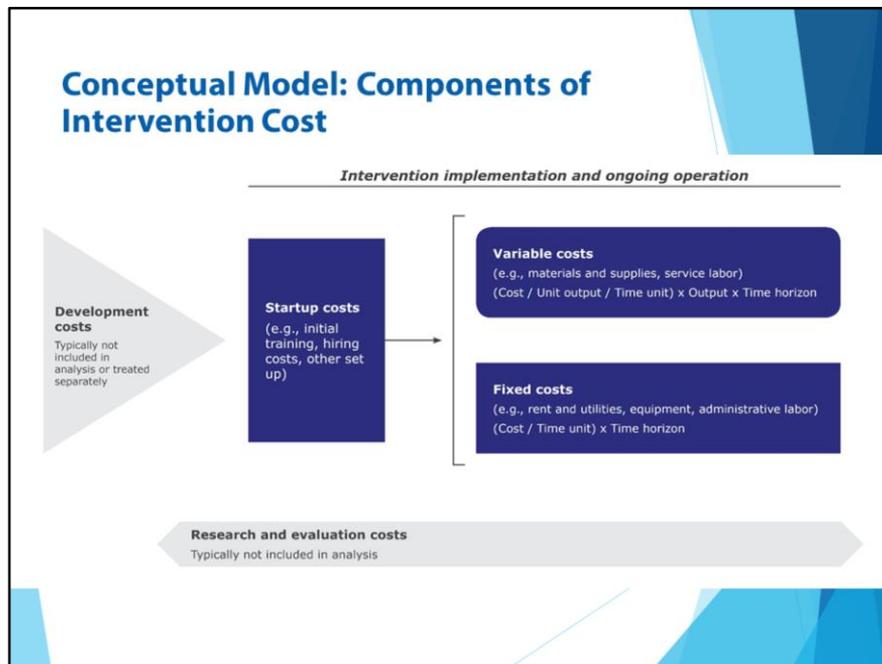
- ❑ **Study perspective determines what costs to include**
 - “Costs to whom?” Could be defined as:
 - Agency/site – only costs borne specifically by the providing agency implementing the intervention
 - Healthcare sector – costs borne anywhere in the healthcare sector
 - Patient/family – only costs for the patient or their family (e.g., time, transportation to the intervention)
 - Societal – includes all perspectives
- ❑ **“Cost” = opportunity cost**
 - The cost of forgoing the next best option
 - Market price of a resource can often be used
 - Some (e.g., volunteered time) may require other methods of valuation

I want to quickly note two important concepts that need to be considered when conducting a cost analysis.

The first is study perspective, or in other words, the costs to whom? The perspective of the study will determine what costs are considered in the analysis. A variety of perspectives can be taken, such as the healthcare sector, the patient, or society as a whole. For example, from a healthcare sector perspective, all healthcare related costs involved in delivering the intervention would be included, but the cost of a participating patient’s lost time or the cost they paid for transportation to the intervention site would not.

The second concept to note is opportunity cost. When economists talk about cost they often mean opportunity cost, which is the cost of forgoing the next best option. This can be contrasted with accounting or financial cost, which is strictly referring to actual financial payments incurred. Often times, the market price that was paid for a certain good can represent the opportunity cost, but sometimes a market price is not applicable. For example, while a staff member’s compensation can usually be used to represent the cost of their time, a volunteer’s time has no compensation associated with it. In this case, even though the volunteer was not directly paid, the time they

spend still represents a cost because they could have spent that time doing some other productive activity or have given up valuable leisure time. There are many ways to impute value for unpaid time or other resources that I won't get into in this presentation, but the concept of opportunity cost is important to keep in mind.



Now let's look in more detail the components of intervention costs.

Intervention costs refer to the costs of inputs for the intervention. Or in other words, the resources used to operate and deliver the intervention. Intervention costs can be described as fixed or variable.

Fixed costs are costs that do not depend on the quantity of output and remain fixed (in the short-run) with varying levels of output, such as rent and utilities, which depend only on the duration of the intervention. Startup costs could also be described as fixed and represent the one time initial investments required at the beginning of an intervention, such as hiring costs or initial training.

Variable costs are costs that depend on the quantity of output, such as clients served, and change in relation to changes in this volume of output, like supplies and materials or some labor. In the long-run, fixed costs can become variable. For example, rent and facilities costs might be fixed in the short-run, but in the long-run they could change or facilities may require renovations.

Other costs that could be related to an economic evaluation of a public health intervention include intervention development costs or research and evaluation costs,

but these often are not included in a cost analysis.

Micro-Costing

- ❑ **Also known as activity-based costing or ingredients approach**
 - Essentially, all mean measuring costs “from the bottom-up”
- ❑ **Involves measuring and valuing each resource consumed in the process of operating and delivering the intervention**
- ❑ **Prospective data collection is ideal, but retrospective can work too**
 - Prospective is more accurate and should be done when possible
 - Retrospective is more prone to recall errors, limits the control over specificity of data available to collect
 - But sometimes retrospective data collection is the only feasible option, and this alone should not prohibit a cost study from being conducted

Now that we have a good idea of what intervention costs are, how can they be measured?

There are numerous techniques for estimating the cost of an intervention, but the method that is likely to be the most accurate and precise that we’ll be talking about today is called micro-costing. You might have also heard the terms activity-based costing or an ingredients approach, but these all refer to essentially the same basic method of measuring costs from the bottom up. This means measuring and valuing each individual resource that is consumed in the process of operating and delivering the intervention. This approach can be contrasted with a top-down, gross-costing approach.

Micro-costing studies are most accurate when data are collected prospectively through the intervention, whereas collecting data retrospectively is more prone to recall errors or can limit the control you have over the data available to collect. However, collecting data retrospectively is sometimes the only feasible option, and this should not prohibit a cost study from being conducted.

Steps for Conducting a Micro-Costing Study

- ❑ **1) Define intervention processes and identify inputs (component enumeration)**
 - What are the main components of/activities involved in the intervention, and what types of resources are consumed for each of them?
- ❑ **2) Quantify inputs**
 - How much of each type of resource is consumed in the intervention components/activities?
- ❑ **3) Value inputs and aggregate (unit cost x unit quantity)**
 - What is the value of a unit of each resource and what is the total when all are added together (total intervention cost)?
- ❑ **4) Conduct sensitivity analysis**
 - How do cost estimates change when assumptions influencing the quantity and value of resources consumed change?

There are 4 major steps for conducting a micro-costing study.

Step 1 involves defining the intervention processes and identifying the types of resources that are used in carrying out those processes. This step could include reviewing documents or literature, conducting a site visit, or talking to staff. The purpose is to gain a detailed understanding of how the intervention operates and to identify an inventory list of what resources are involved and how they are used, which will be the foundation of the following steps.

Steps for Conducting a Micro-Costing Study

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Step 2 requires the systematic measurement of the unit quantity of each type of resource consumed. So for each type of resource identified in step 1, how many are used.

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In step 3, each type of resource is assigned a unit cost, and for each resource type the unit cost is multiplied by the unit quantity and aggregated to find total cost.

Steps for Conducting a Micro-Costing Study

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- ❑ **4) Conduct sensitivity analysis**
 - How do cost estimates change when assumptions influencing the quantity and value of resources consumed change?

And finally in step 4, adjustments are made to any assumptions, such as the value of a certain resource or assumptions that might influence the estimated quantity of resources consumed, to test the robustness of the estimates and show how it might change under different sets of assumptions.

Micro-Costing Data Collection Tools

- ❑ **Numerous tools can be applied**
 - Each have their own strengths and weaknesses
 - Often a combination or hybrid of tools are used
- ❑ **Standardized cost data collection templates**
 - Usually Excel-based or other similar table format (e.g., web-based)
 - Collect unit quantity and cost info for most or all aspects of the intervention
 - Usually completed by one primary user (e.g., operations manager) or the researcher
- ❑ **Questionnaires or surveys**
 - Can take various forms, usually tailored specifically for the intervention
 - Could survey multiple staff, patients
 - Data depend on effort by respondents, may be less accurate when used retrospectively

Numerous data collection tools can be used in the process of systematically collecting resource quantity data and costs, but I will go over 5 major categories of data collection tools that are commonly used. Before I get into this list, it should be noted that the use of these tools is not mutually exclusive. In fact, in practice, multiple tools or hybrids of tools can often be used in a single study. Different tools have different strengths and weaknesses, and depending on the study priorities and the intervention being studied, different tools or combinations of tools may be more appropriate than others.

Standardized cost collection templates are often Excel-based, or other similar table format, and collect resource quantity and cost data for most or all aspects of the intervention. They are usually completed primarily by one user, like an operations manager or the researcher themselves, who might use a variety of data sources to fill out the template, such as financial records, program documents, and consulting with other staff.

Questionnaires and surveys can take various forms and are often tailored to the intervention studied. They can be used to collect information on a variety of aspects of an intervention's costs, such as estimating labor time or surveying intervention participants. They are usually fairly low burden. However, the resulting data depends on

the effort of the respondents to provide accurate answers and they can be prone to recall error.

Data Collection Tools (cont.)

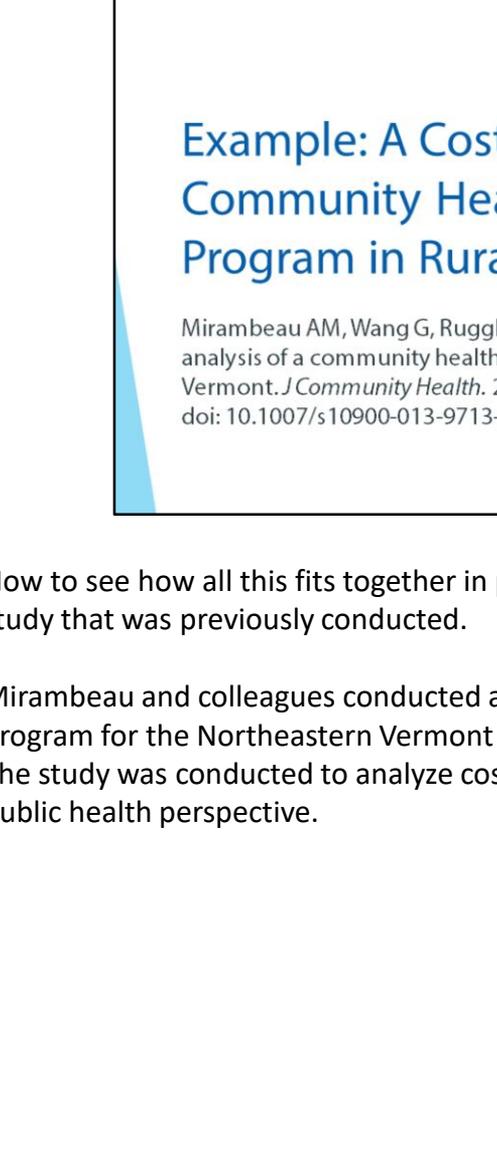
- ❑ **Activity logs (e.g., time diaries)**
 - Used by staff prospectively to record how their time is spent
 - Usually used for time, but could include recording other resources
 - Can be administered for a sample of days or other shorter period rather than throughout the entire study period
- ❑ **On-site administrative databases**
 - Can collect resource use information for some or all aspects of an intervention
 - Sometimes already in place (e.g., time reporting system, financial accounting system)
 - If not already in place, can be expensive to implement or tailor to fit the needs of the study
- ❑ **Direct observation**
 - Researcher observes the operation of the intervention and records all time and resources consumed
 - Accurate, but burdensome method → could lead to high research cost
 - May not be appropriate in certain settings, privacy concerns
 - Can be done for a sample of time, similar to activity logs

Activity logs, such as time diaries, can be kept by intervention staff to record a daily log of their time spent on intervention related activities, and could also record materials or supplies. Logs could be administered in a paper-based form, on a computer, or through a smart phone app. Activity logs might not be required to be kept for each day throughout the study period or for each individual staff member; a sample of days and/or sample of staff members representing different staff types could be sufficient. Activity logs can provide precise data. However, they can add administrative time burden for both the actual use of the logs and any required staff training for their use.

On-site administrative databases refer to systems that are housed on-site to collect resource use information, like a financial accounting system. Databases can be set up specifically for a study or may be already in existence for a site's normal operations. They can be developed or customized to record information specific to a study's interests. When in operation, they can provide reliable and precise data. Still, if they are not already in normal operation these databases can be costly to develop or customize and require technical skills and staff training to do so.

Direct observation involves researchers recording intervention resource use through in-

person observation of the intervention processes. Similar to activity logs, direct observation throughout the entire study period is unnecessary and observations conducted on a sample of time periods is often sufficient. Direct observation, when conducted properly, can provide high quality, reliable data. However, the research time burden and cost of this method can limit its practical use.



Example: A Cost Analysis of a Community Health Worker Program in Rural Vermont

Mirambeau AM, Wang G, Ruggles L, & Dunet DO. A cost analysis of a community health worker program in rural Vermont. *J Community Health*. 2013;38(6):1050-1057.
doi: 10.1007/s10900-013-9713-x

Now to see how all this fits together in practice, let's walk through an example cost study that was previously conducted.

Mirambeau and colleagues conducted a cost analysis of a community health worker program for the Northeastern Vermont Regional Hospital service area in rural Vermont. The study was conducted to analyze costs for one year, from 2010 to 2011, from the public health perspective.

Example Cost Analysis: Step 1 Describe intervention processes and identify inputs

□ **In order to describe the intervention processes and identify types of inputs, the authors:**

- Visited the site
- Conducted in-person and telephone interviews with staff
- Reviewed program documents
- Scanned literature

Cost categories

Salaries/fringe benefits
Overhead
Travel
Program costs
Mailings
Print materials
Incentives
Operational costs
Rent/workspace
Office equipment/supplies
Employee mileage
Medical spending/health care utilization
Medical supplies

In order to describe the intervention processes and identify types of resources used in the program, the authors visited the site, conducted in-person and telephone interviews with staff, reviewed program documents, and scanned literature. Through this process, the authors created an inventory list of the types of resources used and organized them in the cost categories shown here.

Example Cost Analysis: Step 2 Quantify inputs

- **Used information from step 1 to inform the development of a cost data collection template**
 - Hospital administrator used the template to compile data by examining hospital financial records and talking to staff members
 - Data collection team met to discuss the data obtained with the template and resolve any discrepancies or issues
- **Created an activity log to collect data on CHW time spent on the program**
 - Each CHW used an activity log for a 2-week period
 - Prospectively throughout the 2-week period, the CHW checked off the activity (from a list of job duties) that reflected how their time was spent for each 30-minute increment of their workday

Using the information they had gathered in the previous step, the authors created a standard cost data collection template to be used for the study, which was tailored to reflect the resources they had identified in step 1. The hospital administrator then used the template to compile the data by examining financial records and speaking to relevant staff.

To allocate labor cost to the program, the authors created an activity log to be used to track CHWs' time spent on the program. For a 2-week period, each CHW used the form to record the activity that reflected their time spent for each 30-min increment of their workday.

Example Cost Analysis: Step 3 Value inputs

Table 2 Cost categories, data sources, and cost assignments for the cost analysis of the CoCo program, St. Johnsbury, Vermont

Cost category	Data source	Cost assignment
Personnel		
CHWs	NVRH general ledger	Actual salary, time study
Supervisory staff	NVRH general ledger	Actual salary, time study
Volunteers	N/A	Bureau of Labor, time study
Administrative support (e.g., human resources, payroll, technology support)	NVRH general ledger	Standard NVRH overhead rate
Operational		
Start-up		
Office telephones	NVRH general ledger	Actual
Furniture (e.g., desks, chairs, tables)	NVRH general ledger	Actual
Computer equipment	NVRH general ledger	Actual
CHW recruitment	NVRH general ledger	Actual
Direct program cost		
Office space	NVRH floor plan	Commercial real estate averages
Program operational activities—mileage, promotional material, participant transportation, educational material, office supplies, utilities, IT support, and other miscellaneous costs	NVRH general ledger and subsidiary journal	Actual
Training/professional development	Training records	Local rate, national averages

CHWs community health workers, NVRH Northeastern Vermont Regional Hospital, N/A not applicable

Once resource quantity data was collected, the authors assigned value to those resources. You can see in this table that for most resources, the authors used the actual cost they had paid for that resource, which was already being recorded in the hospitals general ledger as a standard practice. But for some resources, other methods were used to assign cost. For volunteer time, they used standard wage rate data that can be found on the Bureau of Labor Statistics website. And for office space, they used commercial real estate averages for that area.

Example Cost Analysis: Results

Table 3 One-year program cost (in dollars) of CoCo team, St. Johnsbury, Vermont (October 2010–September 2011)

Personnel	Wages	Benefits	Total
Community health workers (n = 3)	106,995	40,658	147,653
Chronic integration coordinator (n = 1, 70 %)	53,475	20,320	73,795
Management leadership (n = 1, 20 %)	19,600	7,447	27,047
Volunteers (n = 2)	5,085	1,932	7,017
Subtotal	185,155	70,357	255,512
10 % overhead			25,551
Total personnel cost			281,063
Operational	Description	Cost	
Start-up	CHW recruitment, furniture, computer, etc.	5,089	
Direct program cost			
Office space (1,500 sf)	Rental fee	113,625	
Program operation activities	Mileage, promotional material, participant transportation, education/marketing material, office supplies, utilities, IT support, etc.	16,801	
Training (n = 4)	Registration fee and travel/lodging costs for attending training, conferences, networking, etc.	4,062	
Total operational cost		139,577	
Total program cost			420,640

(1) Total program cost: \$420,640 [\$281,063 for labor (66.8 %), \$139,577 for capital (33.2 %)]

(2) The cost of volunteer labor was calculated using the 2011 minimum wage of \$8.15 in Vermont. Office space was valued at the average commercial lease rate (\$75.75/sf) in the area in 2011

(3) A real-world scenario based on no payment for volunteers and free in-kind support (no overhead for personnel, time of volunteers, and no payment for office space) indicated that the 1-year program cost (actual funds needed) could be just \$274,447 [\$248,495 for labor (90.5 %) and \$25,952 for capital (9.5 %)]

IT information technology, CHW community health worker

After assigning a unit cost to each resource, unit costs were multiplied by unit quantities and aggregated to find the total costs shown in this table. You'll note that when presenting their main results, the costs presented are still shown in a somewhat disaggregated form rather than just presenting to total cost figure. It's often useful to present this level of cost detail, or even take it one step further by showing the unit quantity, unit cost, and total cost for each resource. These details can be very helpful for other researchers or to inform future planning and replication of an intervention because the information can then be more easily adjusted to fit other contexts, whereas if just the total cost is presented it could be hard to figure out how that might be generalized.

Example Cost Analysis: Step 4 Sensitivity Analysis

- **Authors changed cost assignments for certain resources that may vary depending on context**
 - CHW compensation, volunteer time cost, office space cost, training costs
- **Calculated total costs for more-expensive and less-expensive scenarios**

Table 4 Sensitivity analysis of program cost of CoCo team, St. Johnsbury, Vermont, October 2010–September 2011

Items	Most-expensive case (\$)	Least-expensive case (\$)
Personnel		
Community health workers	163,613	137,779
Chronic integration coordinator	73,795	73,795
Management leadership	27,047	27,047
Volunteers	13,247	0
Subtotal	277,702	238,621
10 % overhead	27,770	23,862
Total personnel cost	305,472	262,483
Operational		
Start-up	5,089	5,089
Direct program cost		
Office space	151,125	76,125
Program operational activity	16,801	16,801
Training	6,886	4,062
Total operational cost	179,901	102,077
Total program cost	485,373	364,560
	62.9 %	72.0 %
	37.1 %	28.0 %
	operational	operational

For the most-expensive case we used the highest salary for CHWs, volunteers got paid at the same wage rate as CHWs, rental for office space was increased by \$25/sf (about one-third), trainings with no expenses (n = 7) were assigned a cost equal to the average expenses of those with expenses (\$406). For the least-expensive case, we used the lowest salary for CHWs, volunteers got no pay, and the rental fee for office space was decreased by \$25/sf (about one-third).

Finally, the authors conducted sensitivity analysis to check the robustness of their estimates and see how they might change under different assumptions. Specifically, they altered cost assignments for CHW compensation, volunteers' time cost, the cost of office space, and training costs, which could all vary depending on the context or where the program was implemented. With these adjustments, the authors calculated a most-expensive scenario and least-expensive scenario, which could be considered like an upper and lower bound for their main point estimate of total intervention cost.

Summary

- ❑ **Intervention costs form the foundation of economic evaluation and inform planning**
- ❑ **Micro-costing is the most accurate method to derive cost**
- ❑ **Numerous micro-costing data collection tools exist, each with their own merits and limitations**
 - Tools are often applied in combination
- ❑ **Properly applying cost data collection tools will improve cost estimates and enhance the usefulness of economic evaluation results**

In summary, intervention costs form the foundation of economic evaluations and inform future planning.

Micro-costing is the most accurate method used to derive intervention costs.

Numerous micro-costing data collection tools exist, each with their own sets of merits and limitations. Often, tools are applied in combination when conducting a study.

Properly applying these tools will improve cost estimates and enhance the usefulness of economic evaluation results to inform decision making and planning.

Resources for Further Learning

- ❑ DHDSP's Five-Part Webcast on Economic Evaluation
https://www.cdc.gov/dhdsp/evaluation_resources/economic_evaluation/index.htm
- ❑ NCEH's Learning and Growing Through Evaluation guide, Module 6: Economic Evaluation for State Asthma Programs
https://www.cdc.gov/asthma/program_eval/asthmaprogram_guide_mod6.pdf
- ❑ VA's Health Economics Resource Center webinars: *Estimating the Cost of an Intervention* by Todd Wagner
https://www.hsr.d.research.va.gov/for_researchers/cyber_seminars/archives/video_archive.cfm?SessionID=2398
- ❑ **Books**
 - *Cost-Effectiveness in Health and Medicine*, 2nd Edition by Neumann, Sanders, Russell, Siegel, & Ganiats
 - *Methods for the Economic Evaluation of Health Care Programmes*, 4th Edition by Drummon, Sculpher, Claxton, Stoddart, & Torrance
 - *Prevention Effectiveness: A Guide to Decision Analysis and Economic Evaluation* by Haddix, Teutsch, & Corso

And before we conclude, I want to provide some additional resources. While I hope this presentation has given you a quick and helpful overview of the steps involved in estimating intervention costs, you may wish to seek out some more detailed information before conducting a cost analysis yourself. The first three resources are available for free online. And if you'd like to get more in the weeds, I'd recommend any of the three books listed, which contain much more information on conducting economic evaluations.

Reminders!

All sessions are archived and
the slides and script can be accessed at:

<https://www.cdc.gov/dhdsp/pubs/webcasts.htm>

If you have any questions, comments, or topic
ideas send an email to:

AREBheartinfo@cdc.gov

Thank you for your participation!

As a reminder, all sessions are archived and the slides and script can be accessed at our Division website. Today's slides will be available in 2-3 weeks.

If you have any ideas for future topics or questions, please contact us at the listed email address on this slide.

Next Coffee Break

When: August 14 at 2:30pm

Topic: The CDC Health Care Systems Assessment Tool

Presenter: Joanna Elmi



National Center for Chronic Disease and Health Promotion
Division for Heart Disease and Stroke Prevention



MODERATOR:

Our next Coffee Break is scheduled for Tuesday, August 14 and is entitled “The CDC Health Care Systems Assessment Tool”.

Thank you for joining us. Have a terrific day everyone. This concludes today’s call.