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.
Intervention Cost Analysis in Public Health
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.
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.
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.
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.
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.
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.
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.
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.
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.
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.
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.
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.
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.
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.
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.
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.
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.

<table>
<thead>
<tr>
<th>Table 4: Sensitivity analysis of program cost of CoCo team, St. Johnsbury, Vermont, October 2010-September 2011</th>
</tr>
</thead>
<tbody>
<tr>
<td>Items</td>
</tr>
<tr>
<td>Personnel</td>
</tr>
<tr>
<td>Community health workers</td>
</tr>
<tr>
<td>Chronic integration coordinator</td>
</tr>
<tr>
<td>Management leadership</td>
</tr>
<tr>
<td>Volunteers</td>
</tr>
<tr>
<td>Subtotal</td>
</tr>
<tr>
<td>10% overhead</td>
</tr>
<tr>
<td>Total personnel cost</td>
</tr>
<tr>
<td>Operational</td>
</tr>
<tr>
<td>Startup</td>
</tr>
<tr>
<td>Direct program cost</td>
</tr>
<tr>
<td>Office space</td>
</tr>
<tr>
<td>Program operational activity</td>
</tr>
<tr>
<td>Training</td>
</tr>
<tr>
<td>Total operational cost</td>
</tr>
<tr>
<td>Total program cost</td>
</tr>
<tr>
<td>Percentage</td>
</tr>
<tr>
<td>Personnel</td>
</tr>
<tr>
<td>Training</td>
</tr>
</tbody>
</table>

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 $250 (about one-third), and training 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 for office space was decreased by $250 (about one-third).
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 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.
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.

**Resources for Further Learning**

- DHDSP’s Five-Part Webcast on Economic Evaluation

- NCEH’s Learning and Growing Through Evaluation guide, Module 6: Economic Evaluation for State Asthma Programs
  [https://www.cdc.gov/asthma/program_eval/asthma_program_guide_mod6.pdf](https://www.cdc.gov/asthma/program_eval/asthma_program_guide_mod6.pdf)

- VA’s Health Economics Resource Center webinars: Estimating the Cost of an Intervention by Todd Wagner

- **Books**
  - *Cost-Effectiveness in Health and Medicine, 2nd Edition* by Neumann, Sanders, Russell, Siegel, & Ganiats
Thank you for your participation!

As a reminder, all sessions are archived and the slides and script can be accessed at: [https://www.cdc.gov/dhdsp/pubs/webcasts.htm](https://www.cdc.gov/dhdsp/pubs/webcasts.htm)

If you have any questions, comments, or topic ideas send an email to: AREBheartinfor@cdc.gov

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