

Learning module script for World Bank course (by GHCC), 8.29.2018

1. Many thanks to our partner, the World Bank, for inviting the Global Health Cost Consortium to participate in the applied skills building program for big data, artificial intelligence and decision science in health and nutrition. And a very warm welcome to all participants for this module that will explore “Best practice in understanding and interpreting cost data: Utilizing the Global Health Cost Consortium Reference Case and Unit Cost Study Repository.” **(Click)**
2. Through this module, we hope to answer common questions raised by people seeking to understand and interpret cost data such as:
 - What do we mean when we refer to cost and costing?
 - What do we use cost data for?
 - What makes a good quality and appropriate cost estimate? This can help you answer questions like, “I have seen cost estimates in several published studies and I also have some unpublished estimates from local sources - which should I use?”
 - We will also provide you with a way to assess quality and help you understand if the analysis of the cost estimate was done properly for your purpose.
 - We will explain what is meant by a Reference Case for costing
 - There has also been substantial effort in previous years to make cost data accessible, and we will also demonstrate how you access and use the Unit Cost Study Repository for HIV and TB interventions.
 - And finally, we will address the question of: where can I find more detailed information to supplement this module? We will provide links to other reference materials at the end of the presentation. **(Click)**
3. So, to get started, let’s first define what we mean by cost.... **(Click)**
4. We use the term “costing” as a short way to describe the estimation of the cost of *producing* health services. Costing places a value on the total resources used to produce a good or service. It requires measurement of the AMOUNT of each resource used as well as information about the PRICE of each resource. Costs can vary by context, so when costing it is important to gather information about location, time period, population, and other factors that influence costs discussed later. As the figure shows, the types of resources used to produce a health service include human resources, drugs and supplies, and medical or non- medical equipment. **(Click)**
5. There are different types of cost; in this module we will focus on two types: financial and economic costs. Financial costs represent the actual expenditure on goods and services purchased. They are used for budgeting, for some cost projections, in the review of expenditures, and for analyses on affordability and budget impact. Economic costs, on the other hand, are defined as the opportunity cost of all of the resources used to produce something; and can include the value of resources that may not have been paid for. Since all of the resources used to provide a health service could be used to produce other health services,

they all have an 'opportunity cost'. Economic cost therefore can include the value of donated goods, including donated physical space or air space, donated airtime, all labor (including volunteer time) and subsidies. Economic costs are used for efficiency analyses, economic evaluation, and may still be useful for budgeting services across contexts, where funders and conditions change. **(Click)**

6. Let's examine the difference between these two types of cost in practice. TB active case finding is a strategy that has been promoted to increase the detection rate of TB cases. Rather than waiting for people to come forward to clinics with TB symptoms, various methods might be used to reach out into the community to identify people with symptoms and to recommend they come forward for testing. Some of the resources involved in active case finding could be nurses who live in nursing accommodation, volunteers, consumables such as syringes, a donated computer for monitoring purposes and the Xpert diagnostic kit. This table indicates which might be a financial cost for the Ministry of Health and then what the economic cost of each of those resources might be. For example, the financial cost of the nurse is their salary plus a possible transport allowance. The *economic* cost of the nurse, however, is the value of their time (which would be the market price or salary at the national level) as well as their transport allowance. In addition, the economic cost would include the value of the accommodation. Next, a volunteer would not incur a financial cost, but the value of their time would be included as an economic cost. The financial cost of the syringe is most likely the same as the economic cost, unless it is donated or subsidized. For patients coming into the clinic, their financial costs would include transport and meal costs, along with childcare costs, while the opportunity cost of their time would be added to these costs to calculate economic costs. And so on....

You can see the importance of this difference in the following example: IF you were projecting what the cost of the TB active case finding would be for the next FIVE years, and you didn't take into account that volunteer labor would become PAID health staff when the intervention scaled up, your projection would be off by a significant amount. **(Click)**

7. Now, before we go into exploring costs further, it is important to get some terminology right. In addition to types of cost, there are also different measures of cost. Being clear about what each means will help you understand and interpret cost information better. Here are four different costing terms that you are probably familiar with.... but what do they actually mean? The first is **Total cost**, which is the total cost of producing a service. In healthcare this is often presented as an annual cost, for example the total annual cost of active TB case finding at clinic A. The second term is **Average or unit cost**. This is the total cost per **unit** of output. Notice that units of output can be measured in different ways even within the same service, for example: Cost per person contacted, or cost per person tested. This concept will be discussed later on in more depth. The third term is **Marginal cost**, which is a concept that is used frequently in economics and is critical to efficiency analyses; it is the additional cost producing one more unit of output, for example, the cost of testing one more person or the cost of carrying out one more test. The final term is **Incremental cost**, which also examines change. In this case, however, the focus is on the cost of adding a completely new level or type of service, rather than adding one more

unit of output to an existing service, for example, the additional cost of **adding** active case finding to the current level of services. **(Click)**

8. We now move to the next question posed at the outset of this module: what do we use cost data for? **(Click)**
9. Costing is used in a wide range of research, evaluations, programme and planning. Primarily it is in the areas of financial planning and budgeting and priority setting that cost data is most visible. For example, cost data are used to evaluate the cost-effectiveness of an intervention, such as using Xpert for TB diagnosis. Another example is understanding the efficiency of health care delivery – what are the cost drivers? And how do these vary over time (such as in ART) or across different settings? Models used in strategic planning also utilize cost data, such as the **Goals/Resource Needs modules** in Spectrum and the **Asia Epidemic Model** for HIV, and the **Optima TB model** for TB. These models often have default cost data, but the default values can be changed. So, users often ask, should I change the data? And to what? **(Click)**
10. Cost data are also used in efficiency analyses, for example to examine how costs vary with different levels of service delivery. Understanding how unit costs at different coverage levels change is very important to predicting costs as programs scale up, and can be explored through the use of cost functions. Here, charts show the dynamic relationship between scale and unit cost for community-based health worker services and voluntary male medical circumcision. Note that, the relationship is not linear, making it important to estimate cost functions and then utilize different unit costs for different levels of coverage. **(Click)**
11. Remember that, although there are a wide range of different analyses that need cost data, they don't all use or need the same types of data. The purpose of the analysis dictates the type of cost data that is required, so it is vitally important that the purpose be identified at the outset.

When **budgeting** – **(Click)** the analyst is in most cases thinking about expenditures – how much will be spent to deliver a programme. They will therefore likely use financial costs to make their calculations.

For **forecasting or longer term financial planning**, an analyst might use economic costs if the value of all resources need to be captured; but if the programme is predicted to remain fairly stable and unchanging then financial costs might also be used. The cost data used must help answer the questions of **(Click)** – what will be the financial requirements in the future? Or, what resources are required and what is the value of those resources? in this case economic costs would probably be used.

In **efficiency analyses and priority setting**, the standard procedure is to use economic costs which provide the value of the full range of resources used in any programme or health service. **(Click)** The analyst can then describe how resources are being used and compare different input combinations or different input-output relationships to obtain the best value for money.

Mathematical models help address these purposes using cost data (either unit, or marginal, or incremental costs) together with epidemiologic and program data. **(Click)**

12. All of these analyses rely on good quality cost data that meets the purpose of the analysis. Understanding what makes a good quality cost estimate therefore will improve our critique of the information available and in turn help decision-making. The next few slides take a look at what makes a good quality estimate. **(Click)**
13. To know what makes a good cost estimate we need to define 'good quality'. In the case of cost data, we want to make estimates that are as useful as possible, and so we want estimates that are generalisable, transferable, and consistent. More generally, estimates should be as precise and accurate as possible. If you want to be clear about the difference between these, have a look at the link provided at the bottom of the slide to a short youtube video by Matt Parker after the lecture. In general, all estimates should be transparent. For example, if you are given a figure on what it costs to carry out one TB test, as a decision maker you need to know with complete **Transparency** where that information came from and how the number was calculated. This will help you understand whether the cost is **Reliable** – in other words, does it reflect the actual cost or is it misleading in any way? For example, has someone used price data from 10 years ago or from another country that is not applicable? You will also want to know if the cost data is consistent – that is, if you used the same methods to obtain that cost figure, would you get the same result? Each time? Sometimes it is not possible to achieve all these properties simultaneously and we need to find a balance between generalizability, transferability, and consistency to obtain as good an estimate as possible. No matter the approach taken to achieving this balance, the reporting of the estimates should be made transparently so that the estimate can be reproduced. **(Click)**
14. To improve this situation, the Global Health Cost Consortium has now produced a Reference Case to provide guidelines specifically for costing. It describes best methodological practices to support a cost estimation process that is fit for purpose and efficient given the funding and data available. It also sets minimum reporting standards to improve the transparency of cost estimation. Let's now take a closer look at these principles and how to achieve better costing. Although this module is not targeted to those collecting cost data, by understanding the process you can better evaluate the quality of cost data before you. **(Click)**
15. The Reference Case principles are categorised into 4 major categories relating to **(Click)** study design, **(Click)** measuring resource use, **(Click)** valuing the resources used, and **(Click)** analysing and presenting the results. We'll look at each of these categories in turn starting with **(Click)** study design. **(Click)**
16. As discussed before, it is important at the outset to be clear about the purpose: who is the study for and what questions are being asked? This will provide the answer to critical study design questions such as which perspective to take, whether to do a financial or economic cost analysis, what the scope of the analysis should cover, and what time frame to consider. **(Click)**

17. Let's look at two examples of different study designs suited to purpose. The cost-effectiveness of testing family members for HIV is under consideration for a new health care strategy. Most Ministries of Health would demand that the economic evaluation take a societal perspective, one that captures all costs incurred by an intervention, regardless of who pays the costs. Economic costing would be required to ensure that we capture the true opportunity cost (including lost income due to time spent traveling to get a test or waiting for a test), and real world costing would be preferable to avoid any systematic bias. As with the majority of economic evaluations, an incremental cost would be used. The time frame needs to be sufficient to evaluate the intervention costs accurately.

In a second example, when assessing the costs of ART over the next two years, a provider perspective would be used for informing the budget. Only financial costs – actual expenditures – would need to be included. Real world costs would be the most accurate way to budget, but guidelines may provide sufficient guidance to estimate the full costs of the service needed. The time frame will be dictated by the budgetary timeframe. **(Click)**

18. With the study design in place we can then move on to thinking about resource use measurement. **(Click)**

19. Measuring the resources used in an intervention is at the heart of any costing exercise. Essentially, it is the process of documenting all the inputs and activities and the respective quantities that go into the intervention. Before doing so it is critical to define the scope of the costing and describe the intervention or programme fully.

For example, if costing active case finding for TB diagnosis, you need to describe how this will take place: how many people will be recruited and trained and at what level, how much training will take place, what will be the activities of the staff – for example, travel, counselling, dispensing of prescriptions, and routine administration. Each of these activities are comprised of inputs which need to be identified (such as human resource time, medicines, and transport) and measured. The GHCC has provided a framework to think about this. **(Click)**

20. This is the basic outline of the GHCC framework. The intervention (for example, PMTCT) is broken down into a set of direct service and support activities (like building blocks). Each of these activities is then described in terms of the inputs required to carry these out. **(Click)**

21. This next slide shows how to apply the framework to a particular intervention – here, a simplified example of TB active case finding. First, the intervention and the corresponding unit of analysis needs to be defined. In this case, for TB active case finding, the unit cost is cost per person tested. This intervention is made up of a set of services – those directly related to the intervention, and also support services that facilitate the intervention.

Services may include household visits by medical or layworker staff to recruit patients, as well as the outpatient or inpatient visits of those who have been diagnosed with TB. Ancillary services

may include community outreach type services and laboratory services. Each of these individual service activities can be made up of standardised sets of inputs – personnel, infrastructure, transport, consumables, drugs and equipment. For the standardized GHCC input classification list, you can go to Appendix 3 in the Reference Case. **(Click)**

22. The next step in measuring resource use is to think about the sampling method to collect these data. This can be done at the individual level, in which a sample of individuals exposed to the same intervention are tracked for their health care resource use – this is the gold standard for understanding individual level costs. Sampling can also be done at the facility level. This might be more appropriate for establishing the costs of outpatient visits or inpatient stays in a particular health system or area or type of provider.

Remember that estimates of cost can be biased if the sampling method is inappropriate. Many cost studies, in the past, have reported data from single sites or service delivery platforms and are therefore unlikely to be representative given the heterogeneity of health facilities. In the example of Active Case finding for TB, a sample that includes only fixed facilities would not well represent the cost of a program that also needs outreach or mobile platforms to serve hard to reach populations such as migrants or people who inject drugs.

Another issue is that resource use data is sometimes extracted from a clinical trial. It is recognised that these costs are unlikely to reflect costs in the “real world”; sampling for the trial might reflect what is needed to gain a robust health outcome estimate but this may be insufficient for resource use and the full variation is therefore not captured. Although these data are not necessarily “wrong”, the sampling frame needs to be documented and accounted for in some way.

The sampling frame will be dictated by the level of precision required; currently there is very little guidance on this so the GHCC recommends considering each element of sampling in line with good practice and transparency in the final methods. **(Click)**

23. When measuring resource use, it is important to think about how to collect this data and at what level of detail. This is particularly true where there are no routine cost data collection systems. It may only be possible to measure total expenditures for an organisation. This information can be used to conduct gross costing. The gross costing method involves top-down allocations – allocating the total resources across different the service unit levels, and sometimes to different types of services. For example, to measure resource use associated with service 3, one would need to allocate total inputs amongst departments, and then allocate from the departments down to the service level. Methods for allocation include patient load, proportional area utilized of the building, and time spent.

Micro costing measures each input separately and may use a combination of top-down allocation for costs such as overheads and bottom-up observations of resource use. In a micro costing exercise, the inputs are identified, and their use observed at the service level. Inputs at

the support or ancillary levels may also be observed or, in some cases, the support costs are allocated using a top-down method. **(Click)**

24. Outputs need to be measured for the estimation of unit costs at each level of analysis. So, thinking back to our TB active case finding example... at the intervention level, the output measure is case diagnosed; at the service level, there are several outputs – tests carried out; outpatient visits; monitoring visits completed. These data can be collected through routine information systems; often patient surveys are used to document resource use. To ensure comparability these units need to be standardised across studies. The GHCC reference case is developing standard units in both TB diagnosis and treatment as well as HIV prevention and care. This is important as this allows analysts to compare costs across settings or service delivery units **(Click)**

25. Once the resource use data have been collected, these inputs need to be valued. **(Click)**

26. Valuing resource use requires some simple calculations using various adjustment methods. It is important to remember that financial costing uses the actual price paid to value a good or service, while economic costing uses market prices or, where there is no expenditure or a subsidy, a shadow price. A shadow price is the estimated price of a good or service for which no market price exists. For example, a new drug, that doesn't have a market price, may be donated for a clinical trial, so it has to be assigned a shadow price.

All costs should be converted to constant prices and local currency and/or international dollars depending on the setting. Capital costs are usually amortized, or annualized. The GHCC provides information and references on how to do these adjustments to the cost data. Importantly all adjustments need to be documented along with the sources of data used. **(Click)**

27. The data have been collected, resources used have been measured and valued; now the last step is to analyse the data and present the results. **(Click)**

28. When analysing the results, there are 3 key things to remember: Has any potential heterogeneity been explored? Has any uncertainty been characterised? And are the results communicated transparently? **(Click)**

29. The first thing to explore is the degree of heterogeneity in the results. If only one cost figure is presented, underlying differences are masked, such as different technologies, different service delivery platforms, different target populations, different geographic areas, and seasonality. Here we see examples of how disaggregated costs vary by type of hospital, in the chart, while the table shows how a unit cost varies by population reached, down the rows; by year, across the columns; and by geography, in the two different panels. **(Click)**

30. It is also important that those using cost estimates understand the extent of uncertainty around those estimates. Much costing and economic evaluation literature is devoted to uncertainty analysis and providing ways to present the uncertainty in estimates. Uncertainty results from a

number of different sources – it may be sampling; it could be completeness of the data or it could be related to the data collection methods. It may be possible to address the uncertainty through assumptions, or techniques such as missing data analysis. Where cost data comes from samples, it is important that confidence intervals are presented to understand how precise the estimate is. In addition, there are a number of different analyses that can assess bias and other sources of uncertainty. Some of these methods are complex, but even if not conducted it is generally important that the characteristics and direction of any bias are reported. And finally, cost data reporting needs transparency, so that the data may be interpreted correctly. **(Click)**

31. The Reference Case is not a standalone document and there are multiple resources available that complement its use and can support both producers and users of cost data. The newest addition to the website is the Unit Cost Study Repository, which is found under the data section. **(Click)**

32. The Unit Cost Study Repository, or UCSR, was created to be a centralized source that houses standardized cost data drawn from the published and grey literature. The structure of the UCSR is based on the principles, methods, and reporting standards described in the Reference Case.

The UCSR fulfills the need for users to be able search for and sort data by key characteristics such as region, country, type of intervention, platform, and health technology. In that way users can quickly find the data that meets their needs, and readily identify why multiple cost estimates for the same intervention may vary significantly.

At present, the UCSR includes over 2,500 unit costs from 340 studies up until mid-year 2016 in HIV and TB. An updated systematic review and data extraction process of studies published since then is now being conducted. **(Click)**

33. Once you choose the intervention in Step 1 that you would like cost data for, you can then view your search results. Step 2 allows you the opportunity to further refine your search. If you would like more detailed information about a specific cost estimate, you can simply click anywhere in that row, and another screen will appear. Notice that the filters and display fields align with the principles of the Reference Case. **(Click)**

34. Thank you for joining us for this presentation on “Best practices in understanding and interpreting cost data”. You can find both the Reference Case and the UCSR on the GHCC website, including a Methodology description and User Guide for the UCSR. Your feedback is welcome, and there are online links in both the Reference Case and the UCSR for you to submit your comments. Finally, you are also welcome to send questions to the email address listed on the slide.