



Costing in Economic Evaluation

Parts I

Lucy Cunnama

Health Economics Unit and Division,
School of Public Health and Family Medicine,
University of Cape Town

This lecture

- In this lecture we will cover some of the basics
 - What are costs?
 - Financial and Economic costs
 - Opportunity cost
 - Total costs
 - Costing approaches and methods
 - Perspectives



What are costs?

- Economists define costs as the value of the resources used to produce something.
- Costing: *identification, measurement and valuing* of resources consumed by intervention
 - **quantities of resource** used: interviewing staff, observing consultation time, or following patients
 - and the unit costs or **prices**: market price - the **current replacement value**, the price paid for an item or a **shadow price** (average of multiple estimates of local market price)



Financial costs

- Financial costs represent the *actual expenditure* (monetary) on goods and services purchased. We need to know the price and quantity or total expenditure of all the resources used
- For example, the private costs incurred by patients, providers, government, etc. (individual payers) for a medication



Economic costs

- Economic costs reflect opportunity costs of an input or resource, and not merely costs in the strict financial sense – includes the estimated value of goods and services for which there were no financial transactions (e.g., donated goods, and volunteered time). Think of duplicating the intervention:
 - Community health care workers included in programme, but volunteer their time
 - Donated medications from another country

What is an opportunity cost?

- Opportunity costs refer to **the value or benefits** that you could have had if you had made a different choice i.e., the value if **resources** (staff time, buildings, equipment etc.) are used elsewhere
- For example, if resources are used for a PMTCT programme they cannot be used for an additional ART coverage. The opportunity cost is that we **miss out on the benefits** of the additional ART coverage



Total costs

- Total cost is the entire cost of producing the service (the greater the scale of provision, the larger the total costs will be)
- **Option 1: Total cost = Fixed + Variable costs**
 - Fixed costs – don't vary with scale of production (e.g., buildings and vehicles)
 - Variable costs – vary with scale of production. Costs increase as a function of the increases in output (e.g., consumables, drugs, hospital meals, diagnostics, etc). More patients, higher costs



Total costs

- Option 2: Total cost= Capital + Recurrent costs
- Types of costs
 - Capital costs – more than one year such as training, buildings (annuitised based on estimated life years or useful life and discount rate e.g., 2 for training, 30 for buildings)
 - Recurrent costs – over one year such as salary, transport

Costing approaches/ methods

- **Real world costing:** as you see it in the health facilities
- **Guideline costing/normative best practice costing:** according to National (or WHO) guidelines

Costing approaches/ methods

- **Full Costing**
 - This involves calculating the costs of producing a good or service, using the ingredients approach, where all resources involved in the production are evaluated appropriately and included in the cost
- **Incremental costing**
 - This involves calculating only the changes in usual costs of production incurred, that are associated with the provision of a service or upgrading an existing program. I.e. you cost only the changes to the routine service, and do not include 'baseline' costs

Costing approaches/ methods

- **Bottom- up costing (micro-costing):**
 - Detailed approach to costing which involves detailed measurement of all resources used in the provision of a specific health service/intervention. Thus, using the “ingredients” approach
 - **Ingredient's approach:** where all resources (i.e., inputs) utilised/consumed in the production of a service are costed separately. Usually involves costing and/or allocation of line items.

Costing approaches/ methods

- **Top-down costing (gross-costing/ step down costing)**
 - More aggregative method which involves estimating the cost of an event (e.g., a hospitalisation for a TB patient) using a national average figure. It usually considers the costing of relatively large resources used
 - **Step down costing** approach involves the step-wise allocation of expenditure by various departments (usually of a complex organization) to specific cost centres of interest

How do we think about costs?

- ***Perspective***
 - **Health care providers**
 - Costs of providing the specific service (infrastructure, staff salaries, equipment diagnostics, medication, overheads etc.)
 - **Patient/ household perspective**
 - Include cost of accessing/ seeking and consuming health care

How do we think about costs?

- ***Perspective***
 - **Societal perspective**
 - This is the broadest perspective and most preferred by economists. Costs incurred by all actors involved in providing or using a service are included
 - Includes both the provider and patient costs



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Part II

Lucy Cunnamo

Health Economics Unit and Division
School of Public Health and Family Medicine,
University of Cape Town



This lecture

- With some of the basics of costing in mind, this lecture goes into:
 - Situating a cost analysis
 - Cost measures
 - Steps in a costing project



Cost analysis

- Costing of health services and/or interventions can be undertaken to answer questions around costs of, and **efficiency** in provision of specific health services.
- Costing can also be done as *part of* an economic evaluation, where one would be seeking to evaluate **change in costs** related to the introduction of an intervention. Costing feeds into economic evaluations, here the methods do not change for the different economic evaluation approaches.



Cost analysis

- Provides an overview of the **resources needed to start up** a project or an intervention
- Can be used for **planning and budgeting**
- Cost analysis can be used by managers and policy makers in various ways, such as to:
 - Determine overall resource use within a facility
 - Assess efficiency/performance within a facility or between a group of similar facilities.
 - Identify departments/facilities that need to scale up or down provision of specific services.
 - Informing planning and budgeting within an organization.

How do we think about costs?

- ***Perspective***

- **Health care providers**

- Costs of providing the specific service (infrastructure, staff salaries, equipment diagnostics, medication, overheads etc.)

- **Patient/ household perspective**

- Include cost of accessing/ seeking and consuming health care

- **Societal perspective**

- This is the broadest perspective and most preferred by economists. Costs incurred by all actors involved in providing or using a service are included
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Types of costs

- **Direct Costs:** actual costs (expenses) incurred by either *providers, individuals/households* in relation to a specific health intervention. They include the value of all resources that are consumed in the provision of an intervention
- **Indirect Costs:** productivity losses related to illness and inability to work (morbidity costs) and lost economic productivity due to death (mortality costs)
- **Intangible Costs:** describe the drawbacks of illness, such as pain, depression or loss of quality of life. They cannot be directly quantified in monetary terms

Cost measures

- **Average costs:** The total cost of producing a good or service, divided by the number of units of service produced ($AC = TC/Q$)
- **Unit costs** – average costs with output being measured in different ways
 - Cost per patient
 - Cost per test
 - Cost per ...diagnostic, treatment, retention...
- **Marginal cost** – additional cost to produce one extra unit (change in total cost when one extra unit is produced)

Steps in a costing project

1. Define the purpose of the cost analysis
2. Develop a protocol and gain ethical approval
3. Negotiate access to facilities and cost records
4. Ensure manager and facility acceptance and understand purpose
5. Develop a relevant costing tool
6. Budget enough time for your work
7. Understand processes/how the facility operates, i.e., laboratory workflow
8. Identify the full cost for each input
9. Allocate costs
10. Calculate total and unit costs
11. Report and disseminate results



Data collection

- Bottom-up: observation-based costs
 - More accurate in terms of processes, but do not capture underutilization (often used for budgeting)
- Top-down: total expenditures allocated (shared costs)
 - Capture underutilization of fixed resources such as buildings (but also staff)
- *Economic costs (not just financial)*

Shared costs

- Definition: infrastructure/resources jointly used or shared between different departments within a health system/program or facility (such as administration, maintenance, transport, electricity, etc.) are known as *overheads*. In a cost analysis shared costs are *allocated* accordingly to various departments or activities

Handling different resource inputs (1)

- Personnel costs
 - Use actual gross salaries (& benefits) paid to employees. If jointly employed, calculate proportion of time spent in the laboratory (health facility)
- Drugs & medical supplies
 - This can be calculated as price x quantity for each drug, or as expenditure on drugs (if such data are available)
- Donated goods
 - If by local or foreign donor, the full cost of the items must be included in cost analysis. Donated capital items should be treated as other capital items

Handling different resource inputs (2)

- Maintenance
 - Expenditure on maintenance
- Transport/Fuel
 - Either expenditure on transport/fuel or estimate kms traveled and multiply by relevant cost/km
- Delayed payments
 - In circumstances where laboratories/health facilities order services or supplies and then make payments later, it is important to estimate the cost of services/inputs utilised within the analysis period

Generalisability of cost analysis

- Costs are context-specific:
 - need to consider:
 - way an intervention works (e.g., nature of activities, level of staff, protocols)
 - the target group
 - the setting (e.g., economic factors such as price structures; epidemiological factors such as HIV prevalence; social factors such as level of poverty)



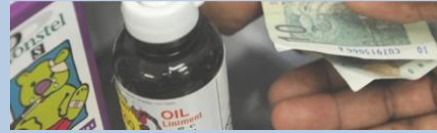
In summary

- Empirical costing is a time-consuming process that requires diplomacy and perseverance
- Think through the necessary cost items and relevant outcomes early on and develop a costing tool before you start
- Keep good notes on your experience and understanding of the processes involved
- Costing can be undertaken for its own sake or to feed into economic evaluations
- The methods for calculating costs are the same for all EE approaches, within costing for EE, it is important to note that ECONOMIC costs are what should be measured
- Costing is a quantitative tool used to calculate resource use within an organization.



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Part III

Lucy Cunnama

Health Economics Unit and Division
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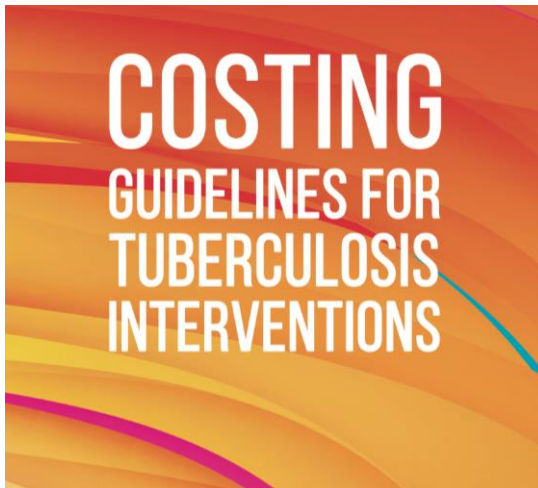
This lecture

- Here we briefly go over how one should:
 - Amortize (annuitize) capital items
 - Look at adjusting inflation
 - Touch on Purchasing Power Parity (PPP)

Principles and methods reporting checklist

Principle 12 – Capital costs should be appropriately annuitized or depreciated to reflect the expected life of capital inputs

Principle 13 – Where relevant an appropriate discount rate, inflation and exchange rates should be used, and clearly stated.



Reference Case for Estimating the Costs of Global Health Services and Interventions

Anna Vassall, Sedona Sweeney, James G. Kahn, Gabriela Gomez, Lori Bollinger, Elliot Marseille, Ben Herzel, Willyanne DeCormier Plosky, Lucy Cunnam, Edina Sinanovic, Sergio Bautista, GHCC Technical Advisory Group, GHCC Stakeholder Group, Kate Harris, Carol Levin



Amortizing capital items

- In order that capital and recurrent costs can be combined in a substantial way, capital cost should be amortized (annuitized) or depreciated to reflect the expected life years of capital inputs (for instance this may be 30 years for a building, 10 years for laboratory equipment, 2 years for training etc.)
- If the effects of the training provided last longer than one year would be considered a capital item and would need to be amortized (annuitized) as would the capital assets of buildings, equipment, furniture and vehicles
- The usual interest rate used in South Africa (and other countries) is 3%

Worked example: amortizing a building price

Step 1 is to estimate the life expectancy of the capital item

Building, estimated life expectancy of 30 years

Step 2 is to establish the current replacement value or 'price' of the capital item

Current replacement value
\$300 000

Step 3 is to use an amortization table to read off the amortization factor based on the number of expected life years and the desired interest rate – 3%

30 years at 3% = 19.600

Step 4a is to divide the current replacement value by the amortization factor to get the amortized cost

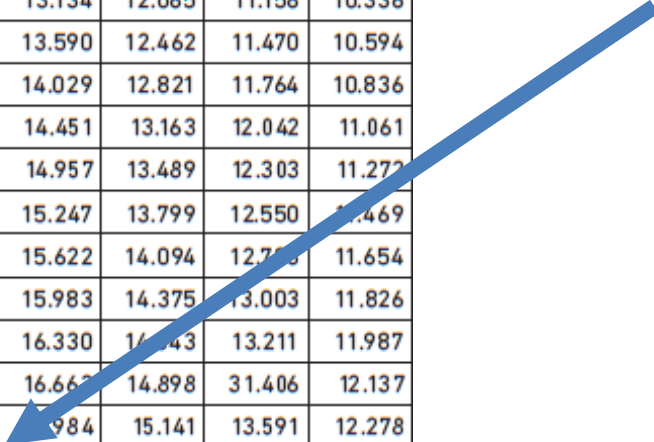
$\$300\,000 / 19.600 = \$15\,306$



n	1%	2%	3%	4%	5%	6%	7%
1	0.990	0.980	0.971	0.962	0.952	0.943	0.935
2	1.970	1.942	1.913	1.886	1.859	1.833	1.808
3	2.941	2.884	2.829	2.775	2.723	2.673	2.624
4	3.902	3.808	3.717	3.630	3.546	3.465	3.387
5	4.853	4.713	4.580	4.452	4.329	4.212	4.100
6	5.795	5.601	5.417	5.242	5.076	4.917	4.767
7	6.728	6.472	6.230	6.002	5.786	5.582	5.389
8	7.652	7.325	7.020	6.733	6.463	6.210	5.971
9	8.566	8.162	7.786	7.435	7.108	6.802	6.515
10	9.471	8.983	8.530	8.111	7.722	7.360	7.024
11	10.368	9.787	9.253	8.760	8.306	7.887	7.499
12	11.255	10.575	9.954	9.385	8.863	8.384	7.943
13	12.134	11.348	10.635	9.986	9.394	8.853	8.358
14	13.004	12.106	11.296	10.563	9.899	9.295	8.745
15	13.865	12.849	11.938	11.118	10.380	9.712	9.108
16	14.718	13.578	12.561	11.652	10.838	10.106	9.447
17	15.562	14.292	13.166	12.166	11.274	10.477	9.763
18	16.398	14.992	13.754	12.659	11.690	10.828	10.059
19	17.226	15.678	14.324	13.134	12.085	11.158	10.336
20	18.046	16.351	14.877	13.590	12.462	11.470	10.594
21	18.857	17.011	15.415	14.029	12.821	11.764	10.836
22	19.660	17.658	15.937	14.451	13.163	12.042	11.061
23	20.456	18.292	16.444	14.957	13.489	12.303	11.272
24	21.243	18.914	16.936	15.247	13.799	12.550	11.469
25	22.023	19.523	17.413	15.622	14.094	12.785	11.654
26	22.795	20.121	17.877	15.983	14.375	13.003	11.826
27	23.560	20.707	18.327	16.330	14.643	13.211	11.987
28	24.316	21.281	18.764	16.662	14.898	13.406	12.137
29	25.066	21.844	19.188	16.984	15.141	13.591	12.278
30	25.80	22.396	19.600	17.292	15.372	13.765	12.409

Amortization table

19.600





- One then uses this annual equivalent cost of \$15306 when working out the cost of space for instance by saying 30% of the building is used exclusively for outpatient TB visits, therefore the estimated annual cost of space for outpatient TB visits is \$4592. If 100 outpatient TB visits are made in the year then the cost per TB outpatient visit for space only is \$45.92.
- Further examples are given in the book by Drummond MF, Sculpher MJ, Torrance GW, Claxton K, and Stoddart GL (2015). *Methods for the Economic Evaluation of Health Care Programmes*, Chapter 7. Oxford: Oxford University Press.

Adjusting for Inflation

- Inflation – measures changes in prices over time, within a country
- Use CPI (consumer price indices) or MPI (medical price indices) to calculate inflation factor
- Inflation = $\frac{\text{CPI (year to which you want to convert)}}{\text{CPI (year being converted)}}$
- Then multiply costs figures with inflation
- E.g.. R797.40 in 2013 ZAR to 2015 ZAR = $R797.40 * 1.10928433$
- = R884.54

CPI 2015	CPI 2013	2015/2013
114.7	103.4	1.10928433
CPI 2015	CPI 2014	2015/2014
114.7	109.7	1.04557885

- CPI South Africa: www.statssa.gov.za

Adjusting for Purchasing Power Parity (PPP)

- PPP – ‘measures’ the differences in prices and exchange rates between different countries, at a given time
- PPP – based on the Law of One price; that is, all countries’ price levels are equal when measured in terms of the **same currency**. It has major drawbacks, e.g., does not take into consideration transport costs, barriers to trade, etc.
- To adjust for PPP, divide costs with PPP factor to convert costs into one international numeraire (usually US \$)