Costs II

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Cost-Effectiveness Analysis
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Outline

- Discounting
- Related and non-related costs
- Productivity losses
- Overhead costs
- Inflation
More on cost items

- From Haddix et al 2003, Prevention Effectiveness

**Program Costs**

Types of program costs that may appear in the cost inventory include the following:

- Personnel costs, including salary or hourly wages and fringe benefits, categorized by the following:
  - Direct-provider time for each type of service or activity by provider type
  - Support staff
  - Administrative staff
  - Volunteers
- Supplies and materials associated with each type of service provided
- Laboratory costs for each service provided, including tests and controls
- Drug costs
- Facilities, including rent and utilities
- Maintenance for facilities and equipment
- Equipment
- Transportation costs and travel expenses
- Educational materials
- Media expenses, including production, air time, and space
- Training costs
- Outside consultant services
- Evaluation costs
- Other direct costs of providing services (e.g., courier services, uniforms or badges, additional insurance or permits, and construction and maintenance of a computer database)
- Participant and employee.
More on cost items

- From Haddix et al 2003, Prevention Effectiveness

**DIRECT MEDICAL COSTS**
- Institutional inpatient care
- Terminal care
- Hospice
- Hospitalization (e.g., ICU, CCU)
- Nursing home
- Institutional outpatient services
- Clinic
- HMO
- Emergency room
- Home health care
- Physician services
- Primary care physicians
- Medical specialists
- Psychiatrists
- Ancillary services
- Psychologists
- Social workers
- Nutritionist
- Physical and occupational therapy
- Ambulance
- Volunteer
- Overhead allocated to technology
- Fixed costs of utilities
- Space
- Storage
- Support services: laundry, housekeeping, administration
- Capital costs (depreciated over life of equipment)
- Construction of facilities
- Relocation expenses

**Training in new procedures**
- Dispensing and administration
- Monitoring
- Devices and applications
- Prostheses, glasses
- Hearing aids
- Ostomy supplies
- Hypodermic needles, home urine and blood testing equipment
- Ordering and inventorying
- Drugs, supplies, devices provided by household
- Research and development
- Basic and applied research
- Diagnostic test
- Community screening program
- Consumable supplies, personnel time, equipment
- Imaging
- Laboratory testing
- Costs of false-positive and false-negative cases
- Treating sequelae of undetected disease
- Treatment services
- Surgery, initial and repeat
- Recovery room
- Anesthesia services
- Pathology services
- Acquisition costs for organ transplants
- Disease prevention in contacts of known cases
- Rehabilitation
- Training and education
- Health education
- Self-care training for patients
- Life-support skills for general population

**DIRECT NONMEDICAL COSTS**
- Public awareness programs
- Social services
- Family counseling
- Retraining, re-education
- Sheltered workshops
- Employment services
- Program evaluation
- Monitoring impact of program or technology
- Data analysis
- Repair of property destruction (alcoholism, psychiatric illness, drug addiction)
- Law-enforcement costs
- Care provided by family and friends
- Transportation to and from medical services
- Time spent by patient seeking medical services
- Childcare
- Housekeeping
- Modification of home to accommodate patient

**INDIRECT COSTS**
Main categories

- Useful guide to get organized and think about costs
The complicated parts

For today:

1. How do we discount costs and why?
2. Should health care costs unrelated to the program or intervention be included?
3. Should related or unrelated non-health care costs be included?
4. How should overhead costs be calculated?
5. A shortcut to calculate overhead costs
6. Inflation
7. How do we measure productivity changes?
Why do we have to discount costs?

- Using resources in one activity implies that we can’t use the same resources in another activity.
- Think of this as the **you-can’t-have-your-cake-and-eat-it-too principle**.
- Last class we learned to call this opportunity cost: if we invest $250,000 in a program, the opportunity cost is what we could have earned if we had used that money in some other way (the best available alternative).
- This implies that **costs incurred today are more important** than costs incurred in the future (why?)
- If instead of using the $250K in a program we invested safely at 3% per year, we would have $335,979 in 10 years ($250,000 \times (1.03)^{10}$).
Why do we have to discount costs?

- You can also think about it the other way around.
- If you need to invest $250K in 10 years, you need to set aside only $186,023 now ($\frac{250,000}{1.03^{10}}$).
- The bottom line is that the timing of costs matters. In EEs, the timing of costs could be different in different interventions but we need to compare them at the same time. In CEA, the “same time” is (by convention) the present.
- In the US, the Panel on Cost Effectiveness recommended using a rate of 3%, which was the real (protected from inflation) rate of return of US bonds.
- They also recommended using 0% (no discount) and 5% for comparability with other studies.
Why do we have to discount costs?

- Note that the opportunity cost argument is different from *inflation*.
- Even without inflation, there is an opportunity cost.
- Discounting is often framed in terms of *time preferences*.
- A person who is indifferent between receiving $100 today or $105 in one year has an annual rate of time preference of 5%.
- (A *positive* rate of return implies preferring the present over the future.)
What about benefits?

- This lecture is about costs but in EEs benefits are also discounted.
- Contrary to money, we can’t invest health. So what is the opportunity cost of health today versus health tomorrow?
- Actually... we can trade health over time, too. We do invest on health care, which produces health.
- You can decide to invest $300 now in prevention (gym, dentist visits, screening) or use those $300 in something else and invest on health care later.
What about benefits?

- There is consensus in the literature that benefits need to be discounted.
- The debate has been mostly about what discount rate to use (no US bonds for health), or alternatively, why benefits should be discounted at the same rate as costs.
- Two related arguments:
  1. **Consistency**: In CEA, we compare costs to benefits. If we discount costs in each period we must discount benefits; otherwise the comparison of C/E would be distorted. It follows that we need to use the same discount rate (Weinstein and Stason, 1977).
  2. **Paradox of Keeler and Cretin**: K&C set up a problem in which identical cohorts will use resources that need to be allocated now. They show that if different discount rates are used for cost and benefits, paradoxes result. In particular, if health is valued more in the future, the decision is postponed forever.
What about benefits?

- However... some argue that benefits of prevention programs should be discounted differently.
- In this view, the discount rate for benefits should be lower or zero because otherwise health gains that occur in the future would be devalued (more on this in a second; see Excel file on discounting).
- This view is not followed in the US but prevention studies often use sensitivity analyses with different discount rates (including 0%).
Mechanics of discounting

- The basic formula is fairly easy to derive
- Imagine that you deposit $100 at the beginning of the year and you earn 3% of interest. How much do you have at end of the year?
- One way: $100 \times 0.03 = 3$, so at the end of the year $100 + 3 = 103$
- Same as $100 \times (1 + 0.03)$ because $100 + (100 \times 0.03)$
Discounting

- What about if you deposit the $100 for three years?
  1st year: $100 \times (1 + 0.03)$
  2nd year: $[100 \times (1 + 0.03)](1 + 0.03) = 100 \times (1 + 0.03)^2$
  3rd year: $[100 \times (1 + 0.03)(1 + 0.03)](1 + 0.03) = 100 \times (1 + 0.03)^3$

- So looks like we can write: $100 \times (1 + 0.03)^n$, where $n$ is the number of years.

- Now call the $100$ the present value, or $PV$, and call the money that we have after depositing the $PV$ the future value, or $FV$, of the $100$. $r$ is the interest rate.

- $FV = PV(1 + r)^n$. Solving for $PV$:

- $PV = \frac{FV}{(1+r)^n}$
Discounting

- From your textbook:
  \[ PV = \sum_{n=1}^{3} FV_n (1 + r)^{-n} = \frac{FV_1}{(1+r)} + \frac{FV_2}{(1+r)^2} + \frac{FV_3}{(1+r)^3} \]

- Just an application of the general formula \( PV = \frac{FV}{(1+r)^n} \). Now we are bringing three different values to the present and adding them up. That’s all.

- The above equation assumes that costs happen at the end of the year (so you need to bring them to the beginning of the year). If you assume that costs happen at the beginning of the year, no need to discount the first year and the second year is the first cost discounted:
  \[ PV = \sum_{n=0}^{2} FV_n (1 + r)^{-n} = FV_1 + \frac{FV_2}{(1+r)} + \frac{FV_3}{(1+r)^2} \]

- \( X^0 = 1 \)
Example

<table>
<thead>
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<th>Year</th>
<th>2000</th>
<th>2001</th>
<th>2002</th>
<th>2003</th>
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<tbody>
<tr>
<td>Intervention 1 costs</td>
<td>2500</td>
<td>4500</td>
<td>6200</td>
<td>22000</td>
</tr>
<tr>
<td>Intervention 2 costs</td>
<td>25000</td>
<td>10000</td>
<td>200</td>
<td>0</td>
</tr>
</tbody>
</table>

- Assume a discount rate of 3% and cost happening at the beginning of the year
- What is the present value (PV) of costs for each intervention?
Example

- \( PV_1 = 2500 + \frac{4500}{(1+0.03)} + \frac{6200}{(1+0.03)^2} + \frac{22000}{(1+0.03)^3} = 37486.5 \)
- \( PV_2 = 25000 + \frac{10000}{(1+0.03)} + \frac{200}{(1+0.03)^2} = 34920.9 \)

- Notice how the **discount factor** works (see Excel file in the Files folder)
- Discount factor by year: 1.00, 1.03, 1.06, 1.09,...
- After about 25 years, 2.032
- If a prevention intervention saves a total of 100 years of life in 25 years, because of discounting, the benefits are reduced by about half today
- With a discount rate of 5%, that happens in about 15 years
Overhead costs

- Cost of resources that serve many departments: administration, cleaning, electricity, security, etc
- In many cases, the alternatives will use the same resources so there is no need to worry about overhead costs (not the same as sunk costs!)
- If this is not the case, we need a way to figure out what share of the overhead costs are part of the intervention costs
- Accounting to the rescue: there are different methods, which are based on different ideas of allocation (not exact science)
- Direct allocation, step-down allocation, step-down allocation with iterations, simultaneous allocation...
Overhead costs: shortcut

- An example of shortcut for hospital costs

1. Figure out the total costs that you can for sure allocate to intervention: nurse or doctor time, medications, labs, training, and so on. These are (direct allocatable) costs

2. Figure out the total hospital operating expenses and subtract the costs that are already included in 1) and costs from departments that are not part of the interventions

3. After subtracting (call the result net hospital expenditure), divide it by total number of hospital-patient days. The results are the remaining costs that need to be allocated per patient-day

4. Figure out hospital patient-days attributable to the intervention
Overhead costs: shortcut

\[ \text{Hospital cost of the programme} = \text{Directly allocatable costs} + \frac{\text{Net hospital expenditure}}{\text{Total number of hospital patient-days}} \]

- In other words, based on volume, estimate the operating costs per patient-days
- Do a sensitivity analysis
Unrelated **health care** costs

- An intervention extends lifespan (for example, because it prevents heart disease)
- In their extra years of life, some people may get cancer instead of an MI. Should we consider the costs of treating cancer when doing a CEA of the program that prevents heart disease?
- In economics, **partial equilibrium** versus **general equilibrium**
- If the costs are far away in time, it may be reasonable to ignore them
- The consensus is to think if the unrelated health care costs are a **direct consequence** of the intervention
- Mostly ignored (partial equilibrium)
Related and unrelated **non-health care** costs

- This has been debated a lot in the literature
- Meltzer (1997) model shows that all future costs (and gains), including productivity and consumption, should be included
- Example: people living longer will use more funds from Social Security but they will also live longer and contribute more in taxes and will earn more income
- It may make a difference (from a societal perspective) to include these costs in practice and
- The conclusions are unsavory (why?)
If we include all productivity and consumption costs (and gains), then interventions that add years of life to the young are more valuable than interventions that add years of life to the old.

- If people die prematurely, costs are saved.
- Example: cost study of smokers.
- A debate mostly in theory.
What about inflation?

- Some costs need to be adjusted for inflation. For example, if an intervention will use physician and nurse time in the next 10 years, we need to take into account that the wages for physicians and nurses will go up every year.

- More common: you use older data and need to take into account that the current price is higher.

- Adjusting for inflation is often called “inflating prices”.


- Historically, inflation for medical items has been a lot higher than other goods and services (an average of 4% to 5%). That’s a lot: $100 \times (1.05)^{10} = 163$.

- You can use the same formulas for FV to adjust for inflation.
Valuing productivity changes

- Suppose that a new intervention keeps patients out of the hospital for a long period of time by providing outpatient treatment instead of the usual treatment which implies more disable time (think of a mental health intervention)
- The community health care costs are more expensive than the usual treatment
- From the perspective of the payer (say, insurance company), the program may not be cost-effective
- But from the point of view of the society, it may be. There is value created when people can work
- (Remember, there is always a comparison; implicitly we are also calculating gains from working more)
- How do we calculate the cost of time not working?
Productivity changes

Two ways:

1. **Human capital approach**: Use wages or earnings lost (same as valuing non-market items like volunteer time)
2. **Friction costs**: What is the replacement cost of those workers?

The friction method requires some estimation of the **time** that it takes employers replace workers.

- Econ term: **frictional unemployment**: the time period between jobs when a worker is searching for a job or transitioning from one job to another.

The friction method usually result in lower estimates but depends on economic conditions.
Ethical concerns

- We haven’t talked much about ethical issues in this class (health equity, disparities, etc)
- But think about the implications of the previous example. If the same program involved, say, investment bankers instead of uneducated individuals, the “value” to society would be higher for the investment bankers (nothing wrong with investment bankers by the way)
- EEs in general are only one aspect of the decision; there should be other considerations
- Go back to the sunk costs example. Nothing wrong with the reasoning that signing up for a race gives you an incentive to actually do (and train) for the race
- An alternative could be to use 1) average national wages or 2) simply present the difference in work days between the programs and let the decision maker judge
Ethical concerns

Your textbook has useful advice:

1. Report productivity changes separately
2. Report quantities separately from prices (wages)
3. Consider using the friction method (I’d ignore this one)
4. Consider ethical factors. Conduct sensitivity analyses using different wages
5. Consider double counting (we will talk about this when we cover cost-utility)
6. Follow official guidelines (we will talk about this later; the Panel on CEA sort of punted)

One more think: time horizon may matter
Big picture

- Three steps for dealing the cost side of EEs
  1. Figure out the items that you need to include, which depend on perspective, time horizon and relevance of the costs
  2. Count units
  3. Value units
- Valuation tends to be the hardest part, although there are conventions that make your life easier
- Be aware of theoretical issues and ethical concerns
- Understand the logic of discounting and its effects, particular when it comes to discounting benefits