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## *Measuring Cost Over Time*

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## *Section A*

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### Perspective and Basic Cost Calculations

- The Panel recommends the societal perspective
  - Most of the discussion will be from this perspective
- The societal perspective is not always used in policy considerations
  - Many issues cut across multiple perspectives

- Key terminology
  - Opportunity costs represent the value of what is foregone by using resources in a particular way
- Example of opportunity costs
  - Community health nurse and peer counselor for breastfeeding intervention
  - What are we losing?
    - ▶ Example, community-based diabetes management
- If you knew the exact alternative use of resources, the value of the alternative use is the opportunity cost

## *Simple Way of Measuring Costs*

- A researcher doesn't usually know the exact alternative use of the resources
- As a result, we usually use money spent on resources as a measure of value
- Economic theory can be used to demonstrate that in many cases the money spent on resources equals the value of the resources to the firm and the value to society

# *When Is It Not Acceptable to Use Dollars Spent*

- Market failure (inefficiency)

- Some health care markets are monopolies
  - Hospitals in rural settings
- If monopolies were to operate in a free, unregulated market, and maximize profits, the prices they charge would not represent true opportunity costs
  - They would be an overestimate

- Some health care markets are monopolies
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- If monopolies were to operate in a free, unregulated market, and maximize profits, the prices they charge would not represent true opportunity costs
  - They would be an overestimate
- Even in today's hospital system in the U.S., where there are fewer monopolistic markets, you still find charges higher than costs and a need to adjust

- Consumers don't have all the information
- Consumers can't make sense of all the information

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- Consumers can't make sense of all the information
- Doctors are making decisions for patients
- Not everything is insured

# *Pricing Items That Are Not On the Market*

- Is the cost of resources otherwise unemployed zero?
  - Using the resource does not sacrifice goods and services
  - However, unemployed individuals are doing something with their time
- Even if all of an unemployed individual's time is "leisure," this is valuable

- Use value of similar employed resources
  - Should it be adjusted downward for unemployed resources
- Value of non-market commodities
  - What one produces at home
- Panel recommends using a single wage for all workers (perhaps age-sex specific) regardless of their actual type of employment or their employment status



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## *Section B*

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Capital Costs, Indirect Costs, and Data Sources

- Large expenditures on things that will last a long time
  - Could be as big as a new hospital
  - Could be an expensive new piece of equipment
  - Could be a vehicle for a community health program
  - Don't just use accounting-based depreciation
- Change in market value and the alternative rate of return
  - Depreciation and return on riskless asset

# *Capital Cost Calculation Example*

- Suppose health department owns a clinic worth \$500,000
- Depreciation of \$25,000 per year
- Could invest the \$500,000 at 3% risk-free, so add \$15,000
- Total cost = \$40,000

- Depreciation is often based on accounting rules that do not always match the reality of depreciation
- Accounting rules use the original value of the asset to calculate changes rather than the current market value

- Direct costs are things for which money is actually needed
  - Health care
  - Transportation
- Indirect costs reflect the value of individuals' time that is lost because of receiving medical care or being sick
  - Different from the concept of overhead
    - Overhead costs are direct (they must be paid for in dollars)

- Administrative
  - Within a hospital or other provider
- Claims
  - From an enrollee or an insurer
- Survey
  - Ask individuals about quantity of services used or amount of money spent
- Micro-costing studies
  - Gather very detailed information about specific resources used during an intervention

- Use hospital billing records
- Have to worry about relationship between charges and costs
- If you have a multi-center clinical trial you have to worry about obtaining records from multiple hospitals
  - Worry about having data in a similar format

- IRB and HIPAA issues
- How does a hospital set prices for goods and services?
- Can we find and apply a standardized price and just use quantity information from hospital or other provider data

- May be easier to get claims data than billing records
  - Especially if all study subjects are with same insurer
    - ▶ For example, in a study of care for older adults you might be able to get Medicare data for all of them

- Know what is reimbursed as well as what was charged
  - May be more closely related to economic costs
- May be difficult to compare across payers

- Potential problem with recall bias
- Ask people not only the number of times they went to see a health care provider but what for
  - Even if the reason for a visit is known, how do you put a price on the visit
    - ▶ Will there be data about labs?
    - ▶ Will there be data about prescriptions?

- You can ask about things that are not provided by a physician or in insurance claims
  - Use of over the counter drugs or herbal products

- Measure exact amount of resources used
- You can look at variation within a procedure if you gather data on quantities of resources used in surgeries
- You can look at resources used for a community health intervention

- Allows for a separation of different activities
  - Community health care providers may have multiple roles or may be doing both research and service provision
- Balance between needing enough information, making a credible cost estimate, and overburdening provider with a need for information



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## *Section C*

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### Costs Over Time

- Inflation
  - Make sure all dollars are worth the same amount in terms of what they can purchase
- Discounting
  - Make sure that the dollar value is expressed in terms of the money that is needed at the present time rather than the total cash flow

- Inflation adjustments converts dollar values to the same scale
  - Analogy—Fahrenheit and Celsius are both measures of temperature but you need to convert to the same scale to make a comparison
  - 1994 and 2004 dollars both measure prices, but you need to convert to the same scale to make a comparison

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- End up with calculation in real dollars
  - Easier to think of a constant value of effects and changes in effects

- Look up consumer price index or medical care consumer price index numbers ([www.bls.gov](http://www.bls.gov))
  - Index is set to 100 at some point in time
  - Index is available monthly or annually
  - Multiply by index value for time converting to divided by index value for time converting from
    - ▶ 2000 average—172.2
    - ▶ 2003 average—184.0
    - ▶ Conversion—2000 Costs x (184.0/172.2)
- Use “inflation calculator” at Bureau of Labor Statistics web site for general inflation

## *Relative Price Change Is Not Inflation*

- Suppose we have a sudden run on community health nurses and the cost of hiring a community health nurse increases to 110% of its current value
- Changes the results of the cost outcome analyses substantially

- Costs and benefits are accrued at present and in the future
  - Need to calculate value of costs and benefits now
- Examples
  - Think corrective cosmetic surgery (cleft palate)
    - ▶ Benefit from surgery over your entire life
    - ▶ Costs are incurred at a single point in time
  - Dysfunctional uterine bleeding surgery
  - Elimination of a blinding condition in developing countries
  - Investment in averting low birth weight

- Idea of present value (PV)
  - What's the value of \$1 received today?
- If \$1 will not be received until next year, is the value higher or lower?
  - Lower because you have to wait
    - ▶ Interest rate
    - ▶ General impatience
    - ▶ Not because of inflation in this case

# *Sum of Payments is Not the Present Value*

- Elaboration on reasons for non-equality
  - Basic impatience
    - ▶ People don't want to wait for benefits and are willing to pay in order to get benefits sooner rather than later
  - Behavior reflected in money markets
    - ▶ Cost to borrowing and a reward for lending
    - ▶ People have uses for money now
    - ▶ For money markets the degree of impatience is quantified by the interest rate,  $r$

- Want to know present value now for \$1 received every year for five years?
- Each value is in present dollars
  - Dollars measured at time zero (assume that the adjustments for inflation have already been made)
  - Value at start of year 1 = \$1.00
  - Value at start of year 2 = \$0.97
  - Value at start of year 3 = \$0.94
  - Value at start of year 4 = \$0.92
  - Value at start of year 5 = \$0.89
  - Total value = \$4.72

## *How We Actually Calculate Present Value*

- The concept of present value is the concept of value at time zero
- We use “r” to denote the interest rate
- Return to PV of \$1 received each year for five years with a constant r?
  - PV of \$1 at start of year 1 = \$1
  - PV of \$1 at start of year 2 =  $\$1/(1+r)$
  - PV of \$1 at start of year 3 =  $\$1/(1 + r)^2$
  - PV of \$1 at start of year 4 =  $\$1/(1 + r)^3$
  - PV of \$1 at start of year 5 =  $\$1/(1 + r)^4$
- Decision rule does not change—adopt programs with a positive net benefit based on present value

- Rate on money lent now in exchange for payment at the end of a pre-specified period of time
  - Usually an annual rate in cost-effectiveness calculations
  - Panel recommended 3% (divide by 1.03) as it was thought to represent an average real rate of return for risk free investments in the United States

- Prevention is different
  - No reason to say they should be valued more or less but, if you feel a need to make an adjustment, change the value
- Inflation
  - Adjust for inflation and discount

- Adjust discounting for uncertainty
  - Use expected discount rate
- A paradox suggesting that without discounting, effects policy would always imply waiting to implement is irrelevant
  - Rarely have to spend money in limited time and would like to avoid complexities of non-discounting

- Proportional discounting ( $b/(b+t)$ )
  - Time preferences change as time advances
- Real value of health benefits may not be constant
  - Change threshold but leave discounting alone
- Real cost of producing health changes over time
  - Adjust cost stream
- Individual discount rates
  - Use market rate because CEA's purpose is prescriptive rather than descriptive

- Policy deferral
  - If same costs and results in a year, then invest smaller amount now if not discounted
- Affluence
  - Always wait for effects as will be more highly valued by those with more money in the future
- Technological change
  - Always makes sense to wait for it if not discounted

- Look at what people receive for differential mortality risk at work
  - Discounting at rates of 1-14.2 percent
  - This includes rate of return in financial markets
- One method
  - Observe people's choices of jobs
  - Know probability of mortality and wage
  - Assume functional form for utility
  - Solve for implicit discount rate
    - ▶ People don't necessarily think this way, but behavior is consistent

- Suppose we have a health program with \$1.2M in benefits and \$700,000 in costs each year
  - Suppose we spend and get benefits at the start of each year with a net benefit of \$500,000/year
    - ▶ Net benefit = \$1,456,735
- Suppose all benefits occur at end of year
  - $(-\$0.7\text{ M}) + [\$/0.5\text{ M}/1.03] + [\$/0.5\text{ M}/1.03^2] + \$1.2\text{ m}/1.03^3$ 
    - ▶ Net benefit = \$1,354,905