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Health Economics

The Basics

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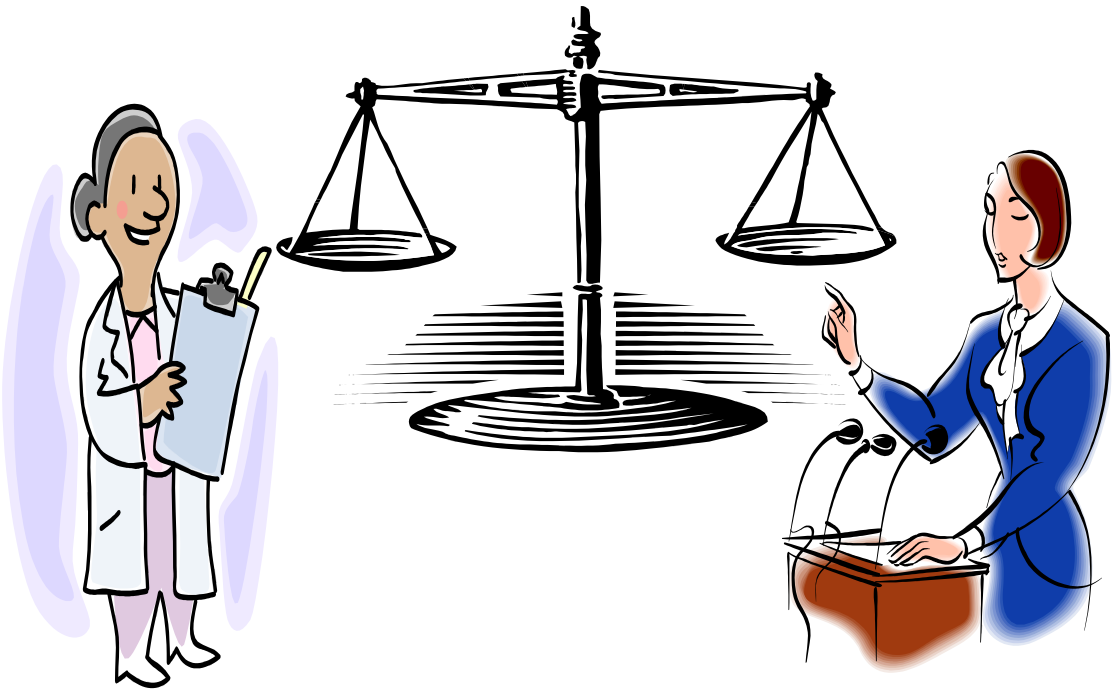
Fall 2015

Topics

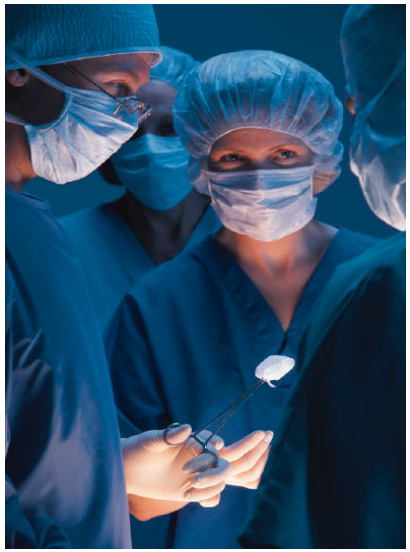
1) What is heath economics and why do we do it;
2) Types of health economic analyses;
3) Cost-effectiveness analysis;
4) The incremental cost-effectiveness ratio (ICER);
5) The quality adjusted life year (QALY);
6) Cost utility analysis;
7) The importance of choosing the right comparator;
8) Sourcing the data;
9) Additional resources.

What is Health Economics?



- Health economics is the study of the allocation of scarce healthcare resources.
- Health economists weigh the costs and benefits of healthcare interventions to help decision makers determine which to provide and which are too expensive for the public healthcare system.

Why do Health Economics?


- As a society we have an infinite number of places to spend resources but a finite budget. As a result choice is necessary. Health economics helps us make choices such that we allocate our resources in a reasonably **Efficient** manor.

- Health economics is less about saving money and more about spending money wisely.

- To ensure healthcare resources are allocated in an efficient manor, health economists rely on various types of economic analyses.

Types of Economic Analysis

Types of Economic Analysis		
Method	**Input(s)**	**Interpretation**
1. Cost minimization analysis	- Costs: measured in ($).	Identifying the least costly option, when all interventions are equally effective.
2. Cost benefit analysis	- Costs: measured in ($). - Benefits: measured in ($).	Convert all costs and benefits into $. An intervention should be adopted if the sum of all benefits exceeds the sum of all costs.
3A. Cost-effectiveness analysis	- Costs: measured in ($). - Benefits: measured in natural units (ex. lives saved).	How much more does it cost to gain an additional unit of benefit.
3B. Cost utility analysis (A specific type of cost-effectiveness analysis)	- Costs: measured in ($). - Benefits: measured using QoL.	How much more does it cost to gain an additional unit of benefit measured in HRQoL.

- Occasionally, cost minimization analysis is used. However, healthcare interventions are not often equally as effective.
- Rarely, cost benefit analysis (CBA) is used. CBA requires assigning $ values to human health. For moral and ethical reasons many people are uncomfortable with this.
- The bulk of modern health economic research is conducted using cost-effectiveness analysis (specifically cost utility analysis).

Cost-effectiveness Analysis

Cost-effectiveness/cost utility analysis in a nutshell **(5 Step Process)**:

1) Identify the new intervention and comparator to be analyzed.

2) To determine effectiveness, select a single clinical outcome (i.e. lives saved, cases cured, **Health Related Quality of Life**, etc.) and determine its value for both the new intervention and the comparator.

3) Identify, determine, and aggregate all costs associated with the new intervention and the comparator (separately). Both present and future costs should be considered.

4) Divide the difference in costs by the difference in effectiveness associated with both the new intervention and the comparator.

5) Compare the outcome from step 4) to the **Willingness-to-Pay** for the outcome of interest.

Cost-effectiveness Analysis

Possible Costs	Possible Effectiveness
- Pharmaceuticals	- # of successful treatments
- Additional staff	- # of life years gained
- New infrastructure	- Quality of life *
- Training	- Cases cured
- Patient side effects	- etc.
- Complications	
- Follow up care	
- Unsuccessful treatments	
- etc.	

Incremental Cost-effectiveness Ratio

- We refer to the outcome of a cost-effectiveness analysis (the change in cost divided by the change in effectiveness) as the **Incremental Cost-effectiveness Ratio** (ICER).

- Sometimes when referring to a cost utility analysis we use the term **Incremental Cost utility Ratio** (ICUR) but ICER is often used interchangeably.

- **Mathematically the ICER is given by:**

$$ICER = \frac{\Delta Cost}{\Delta Effectiveness} = \frac{Cost_{New} - Cost_{Comparator}}{Effectiveness_{New} - Effectiveness_{Comparator}}$$

Incremental Cost-effectiveness Ratio

1) What if the effectiveness is the same for each intervention?

- If the effectiveness is the same we do not want to do a cost-effectiveness analysis. We instead want to do a cost minimization analysis.

2) What if the ICER is negative?

- There are two instances when the ICER could be negative: 1) the new intervention is more costly and less effective (Comparator is superior reject new intervention); 2) the new intervention is less costly and more effective (New intervention is superior adopt new intervention).

3) What if the ICER is positive (The most common scenario)?

- There are two instances in which the ICER can be positive: 1) the new intervention is less costly and less effective; or 2) the new intervention is more costly and more effective. In this scenario you must compare the ICER to the willingness-to-pay for the outcome of interest. The majority of economic analysis concerns new interventions that are more effective and more costly.

Cost-effectiveness Analysis Example

Scenario: 100 people in the Lower Case Health Authority (LCHA) suffer from XYZ Disease, a non-fatal but painful condition. Currently, LCHA physicians recommend bed rest to patients but pharmaceutical and surgical treatment options exists. LCHA decision makers have determined that they are willing to pay up to $20,000 per additional case of XYZ Disease cured.

Question: Are either the pharmaceutical or surgical treatment options cost effective in this hypothetical situation? Assume treatments are mutually exclusive.

cost-effectiveness example

Option	Description	Cost per person	Total cost	Effectiveness (% cured)	# of cases cured	ICER
Standard care	Bed rest	$0	$0	25%	25	NA
Option A	Pharmaceutical treatment	$5,000	$500,000	50%	50	$20,0000
Option B	Surgical treatment	$10,000	$1,000,000	80%	80	$16,667

Limitations to Cost-effectiveness Analysis

Limitations to cost-effectiveness analysis

1. Tough to compare across interventions, when outcomes are not the same. (Cancer vs. Heart disease)

2. Not always ideal, when outcomes are not black and white. (50% reduction in symptoms)

3. Can be difficult to account for side effects, if they do not influence costs.

4. Not all outcome measurements are easily assigned a $ value. (standard deviations)

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Quality Adjusted Life Years (QALY)

- To deal with these issues health economists developed the concept of the **Quality Adjusted Life Year** (QALY).

- QALY are a measure of disease burden, including both the quality and the quantity of life of a person in a specific health state.

- Mathematically: QALY = $\sum(U_i T_i)$ where i denotes time periods.

QALY Explained

$$QALY = \Sigma(U_i T_i)$$

- QALY's have two components utility scores and time periods.
- Time periods are straight forward. They are just an interval of time (ex. day, week, month, year, etc.).
- A utility score is a measurement of health related quality of life corresponding to a single time period. To measure HRQoL for a 10 week period post Surgery X, we could obtain utility scores once a week for 10 weeks. Summing the 10 utility scores will tell us the QALY generated by this surgery.
- We have multiple methods for determining utility scores.

What are Utility Scores?

4 Methods of Calculating Utility Scores

1. Visual Analogue Scale.
2. Standard Gamble.
3. Time Trade Off.
4. Health Utility Index (Ex. EQ-5D-5L).

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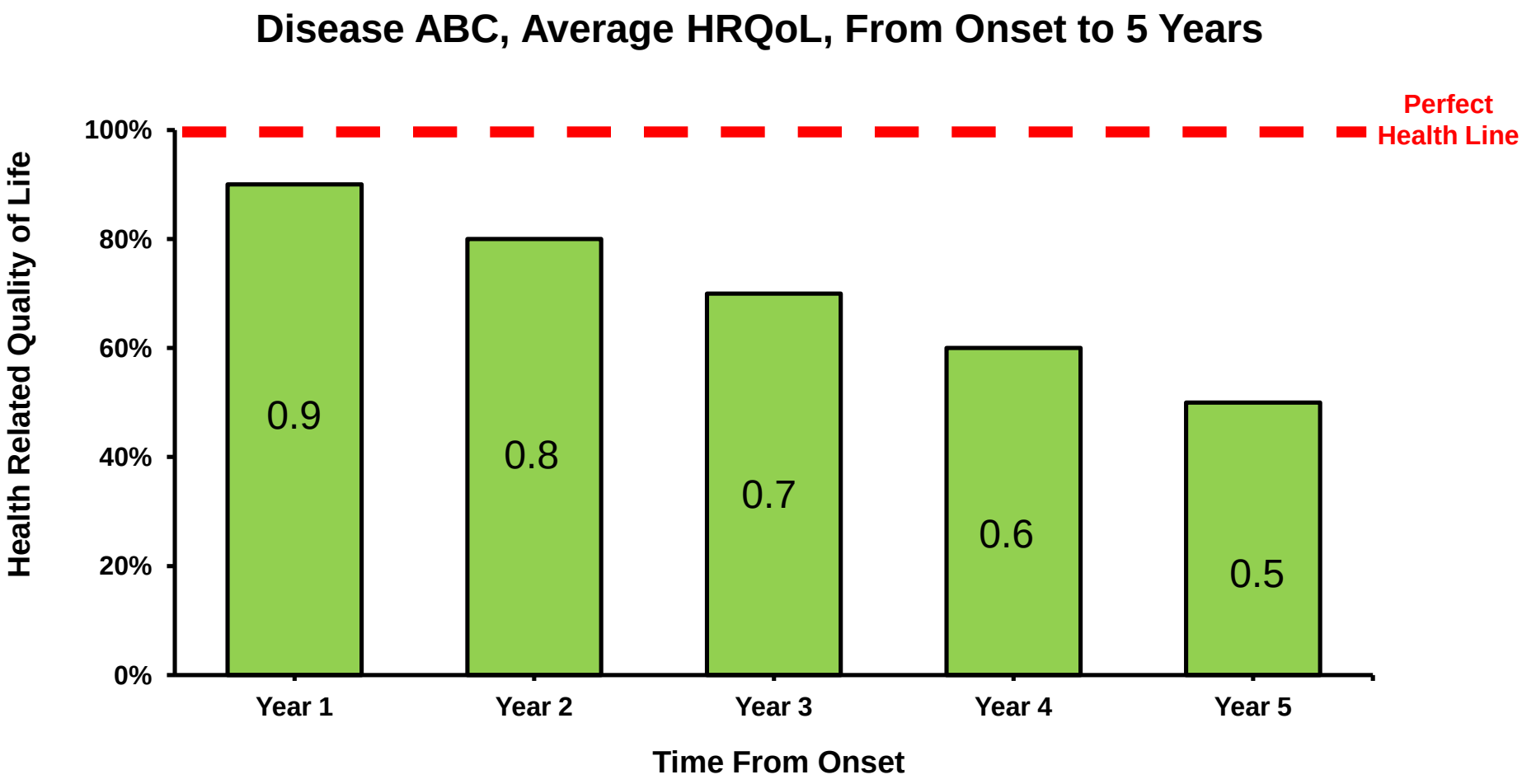
Calculating the QALY



- Make sure to convert all time periods to the same units. (days, weeks, months, years, etc.)

Cost Utility Analysis Example

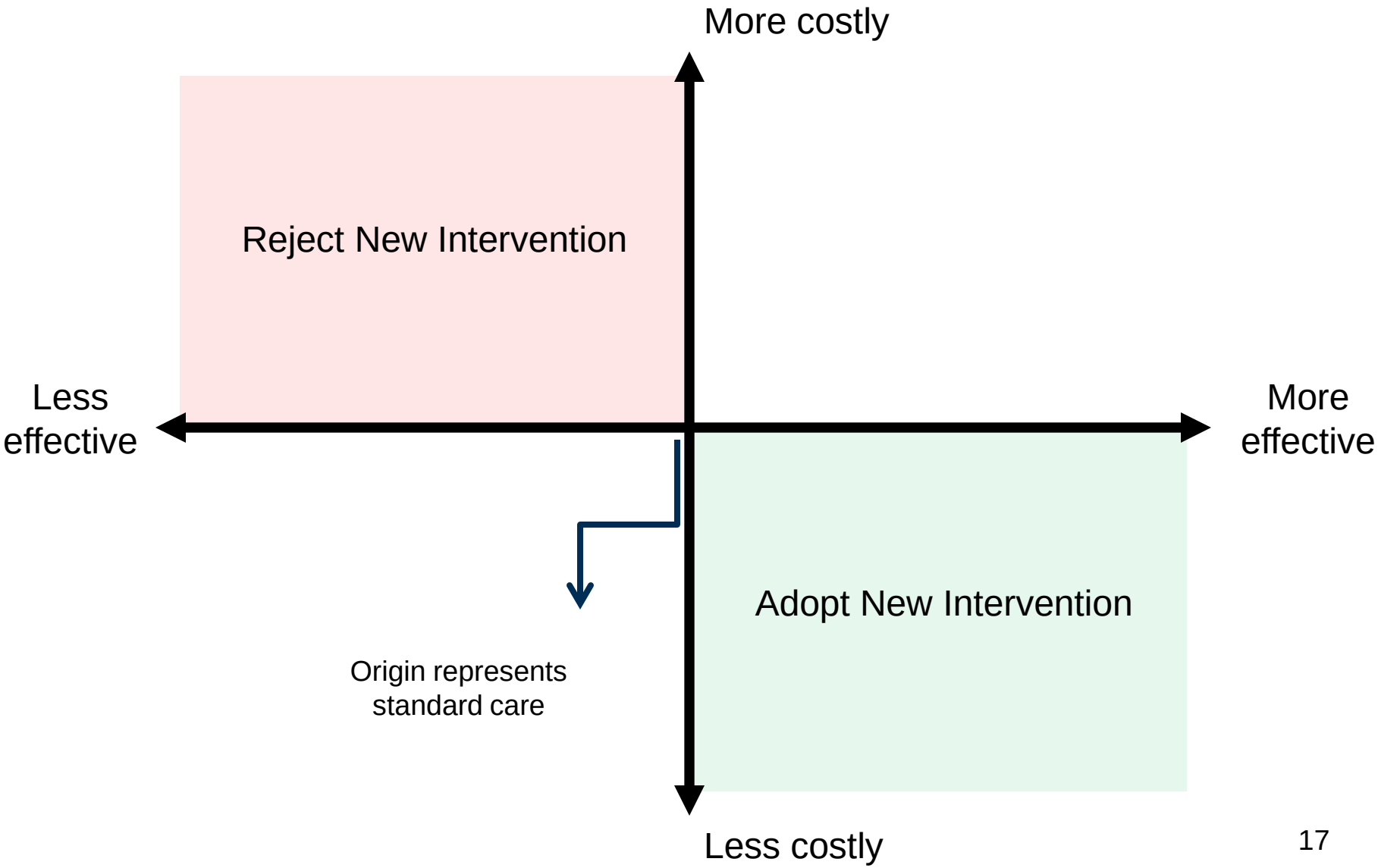
Scenario: 100 people in the Lower Case Health Authority (LCHA) suffer from XYZ Disease, a non-fatal but painful condition. Currently, LCHA physicians recommend bed rest to patients but surgical and pharmaceutical treatment options exist. LCHA decision makers have determined that they are willing to pay up to $1,500 per Quality Adjusted Life Year.

Questions: Are either the pharmaceutical or surgical treatment options cost effective in this hypothetical situation? Assume treatments are mutually exclusive and life expectancy is 30 additional years.

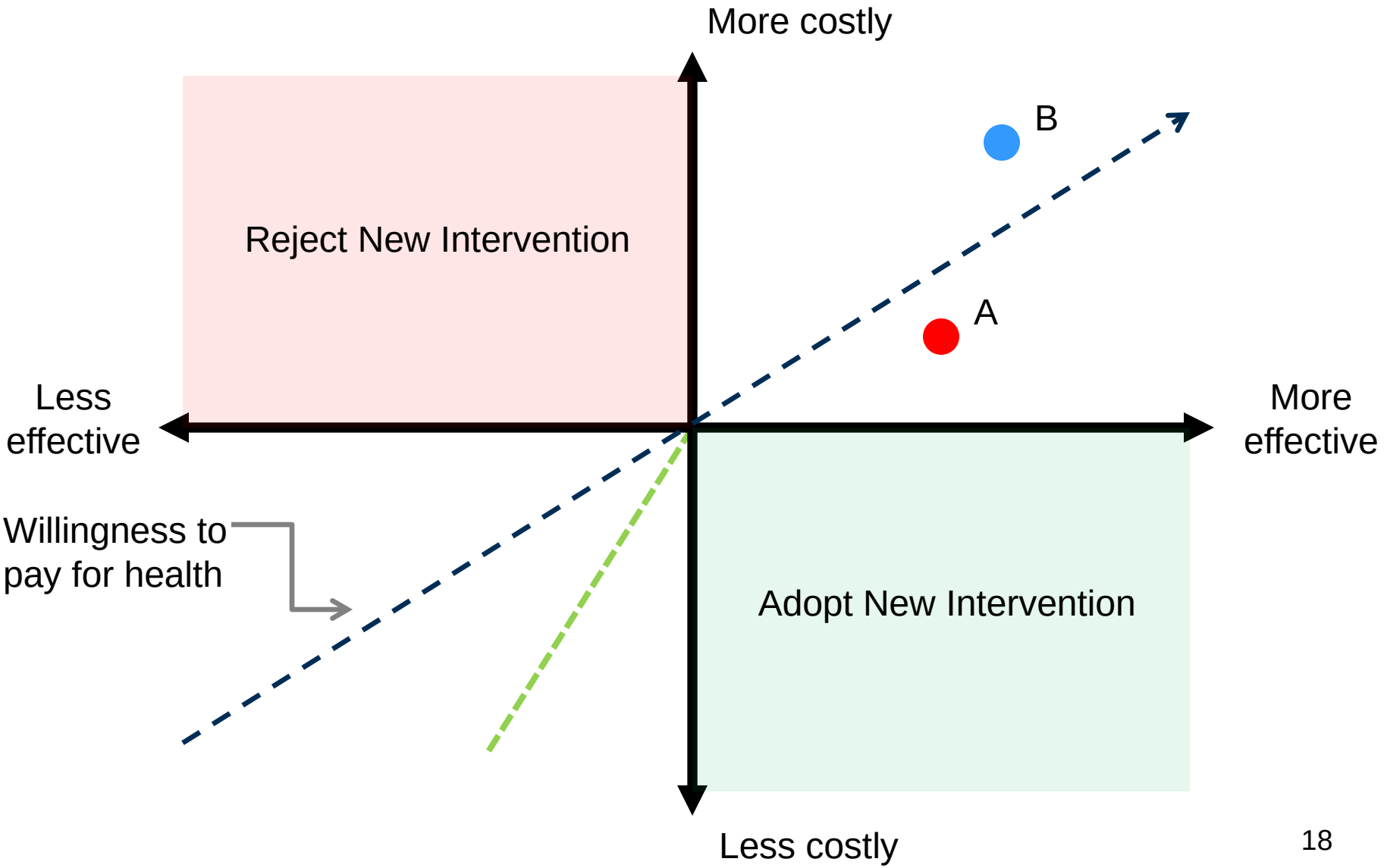
cost-effectiveness example

Option	Description	Cost per person	Total cost	Avg. utility score per year	QALY	ICER
Standard care	Bed rest	$0	$0	0.40	1,200 QALY	NA
Option A	Pharmaceutical treatment	$5,000	$500,000	0.50	1,500 QALY	$1,667
Option B	Surgical treatment	$10,000	$1,000,000	0.80	2,400 QALY	$833

Cost-effectiveness Plane



Cost-effectiveness Plane



Choosing the Right Comparator

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Choosing the Right Comparator

Intervention	Description	Cost
Excavator	Requires fuel, an operator, and rental fees. No personal time required but will take an operator 5 minutes. Cumbersomely large clears 75% of snow.	$2,000
Shovel	Requires one hour of time and must purchase shovel. Clears 95% of snow.	$50
Spoon	I already have a spoon but this will required 25 hours of time. The spoons small size allows me to get into every nook and cranny and remove 99.9% of snow.	$600

- The shovel is both more effective and less costly than the excavator. Therefore we can immediately reject the excavator. The decision boils down to whether the additional 4.9% of effectiveness is worth the additional $550.

- However if we did not include the shovel as a comparator we would have concluded that the most effective method for shoveling snow is the spoon.

- Having chosen the wrong comparator is usually not as obvious in healthcare but the implications can be severe.

Where Does the Data Come From?

Inputs/Outputs Data	
Inputs/Outputs	**Where to find?**
1. Cost ($)	Cost data can be obtained through external databases (CIHI or Health Data Nova Scotia), Bottom up costing (labor intensive), Costs can also be estimated via survey (case dependant) or from literature.
2. Benefits (Natural units)	Natural units usually come from clinical trials and/or literature.
3. Benefits (Quality Adjusted Life years *(QALY))*	Utility scores can be taken from literature or surveyed directly.
4. Incremental cost-effectiveness Ratio *(ICER)*	This is generally the objective of economic analysis and are calculated oneself. They can also be taken from literature.

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Additional Resources

- Guidelines for the economic evaluation of health technologies: Canada [3rd Edition]. Ottawa: Canadian Agency for Drugs and Technologies in Health; 2006.

- Drummond, Michael F., Mark J. Sculpher, George W. Torrance, Bernie J. O'Brien, and Greg L. Stoddart. "Methods for the economic evaluation of health care programmes." *OUP Catalogue* (2005).

Acknowledgements

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The Research Methods Unit is a joint initiative of the Discovery and Innovation for Health Partnership between:

- Capital Health
- IWK Health Centre
- Dalhousie University

Capital Health

IWK Health Centre

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