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Session 6

Design and Analysis for Operations Research

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Professor

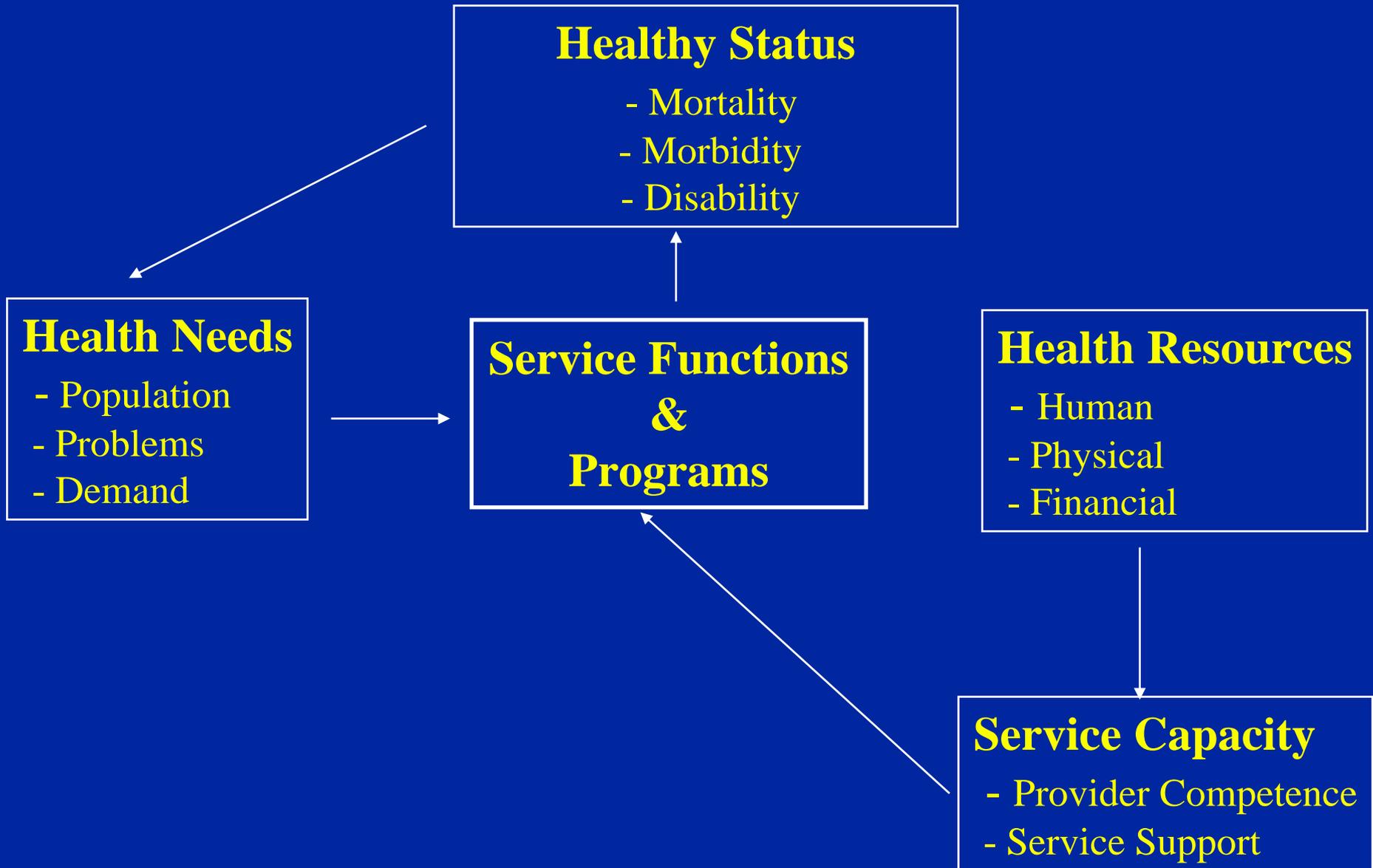
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Unique Features of Operations Research

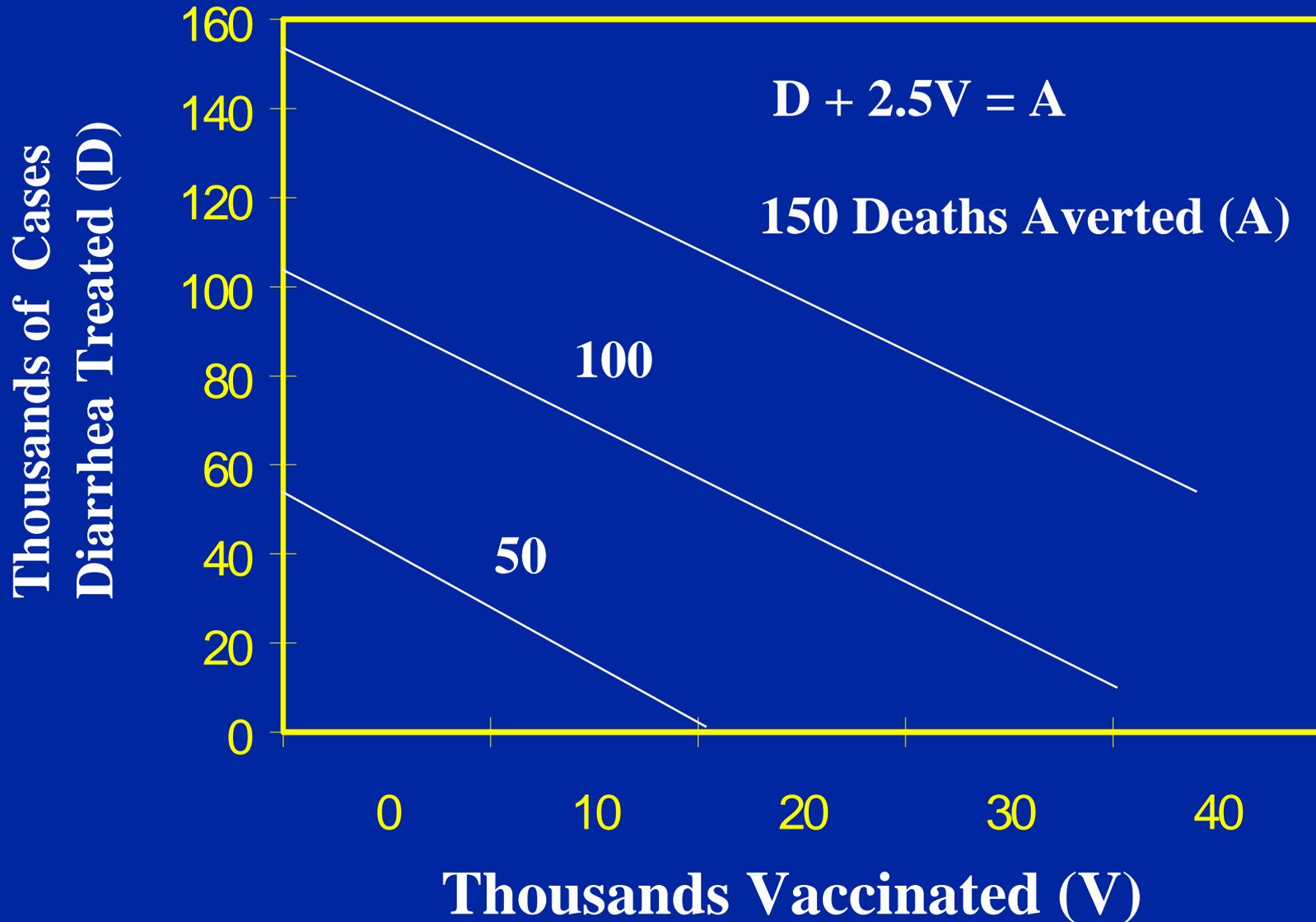
- **Multiple Factors Affect Results**
- **Many Factors Not Subject to Control**
- **Places Emphasis on Analysis of Variation More Than its Control Through Study Design**



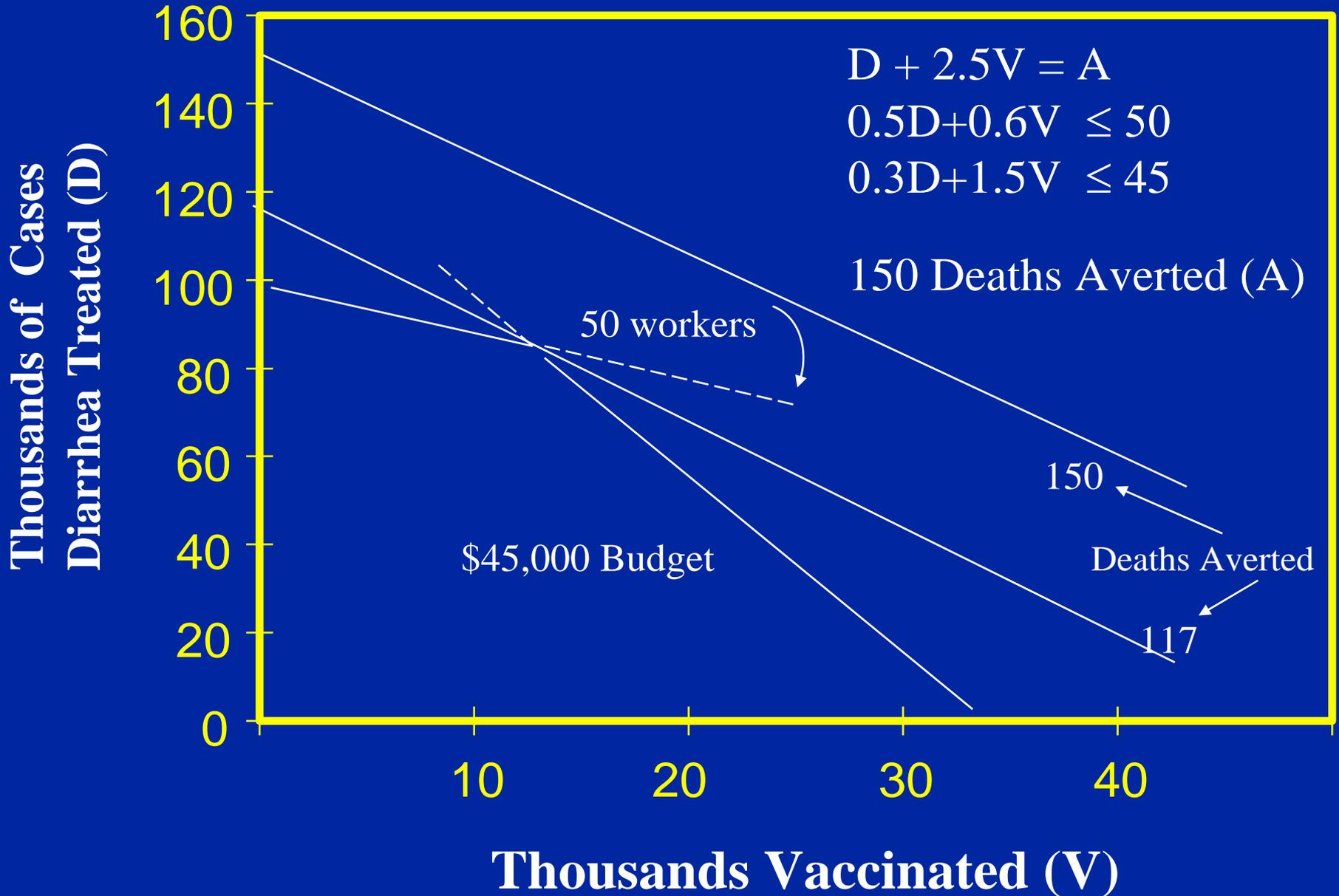
Forms of Health Systems Research

- **Prescriptive**
 - **Explicit Mathematical Model**
 - **Associated Quantitative Data**
- **Descriptive**
 - **Indicators Regarding Factors Subject to Manipulation**
 - **Indicators Regarding Population Groups for Targeted Services**

Potential Outcomes



Linear Programming Model



Unit of Analysis

Compared to

Unit of Observation

- *Unit of Analysis*
 - Cases of Diarrhea in Past Two Weeks
 - Prevalence Approximately 20% in Children Under 5
 - Children Approximately 16% in Population
- *Unit of Observation*
 - Household
 - Approximately 5 Persons per Household

Sample Calculation Based on Measure of Interest

Use of Oral Rehydration
Expected to be About 50%
Precision Required + 5%

$$n = \frac{4 p (1 - p)}{D^2}$$

$$= \frac{(4)(.5)(.5)}{(.05)^2}$$

$$= 400$$

$$\frac{400}{(.2)(.16)} = 12,500 \text{ Persons}$$

$$\frac{12,500}{5} = 2,500 \text{ Households}$$

Needs Assessment

Health Needs

- Population
- Problems
- Demand

WHO

Entire Population in Defined Area
Selected Target Groups
Specific High Risk Traits
Service Users

WHAT

Biological Need
Consumer Wants
Willingness to Pay
Effective Demand

HOW EXPRESSED

Attitudes and Beliefs
Behavior

Resources and Services

Service Coverage

Technical Quality

Provider Knowledge
and Skills
Availability of Service Support
Appropriate Application
of Competence

Client Satisfaction

Perceived Benefit
Perceived Cost and
Inconvenience

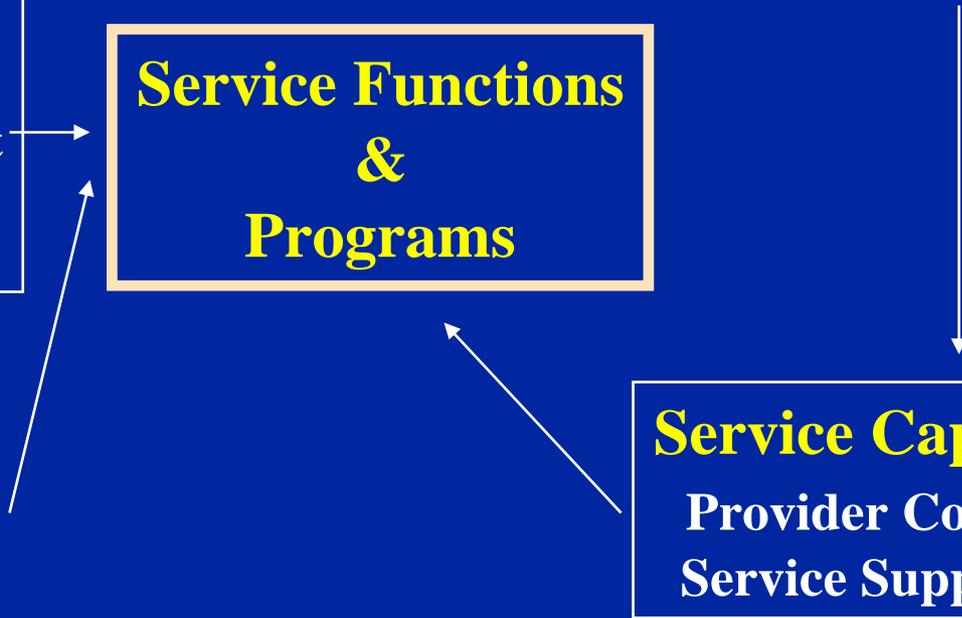
Service Functions & Programs

Health Resources

Human
Physical
Financial

Service Capacity

Provider Competence
Service Support



Outcomes

Effectiveness

- Benefits Level
- Cost: Affordability

Cost-effectiveness

- Tangible
- Intangible

Equity

- Distribution of Benefit

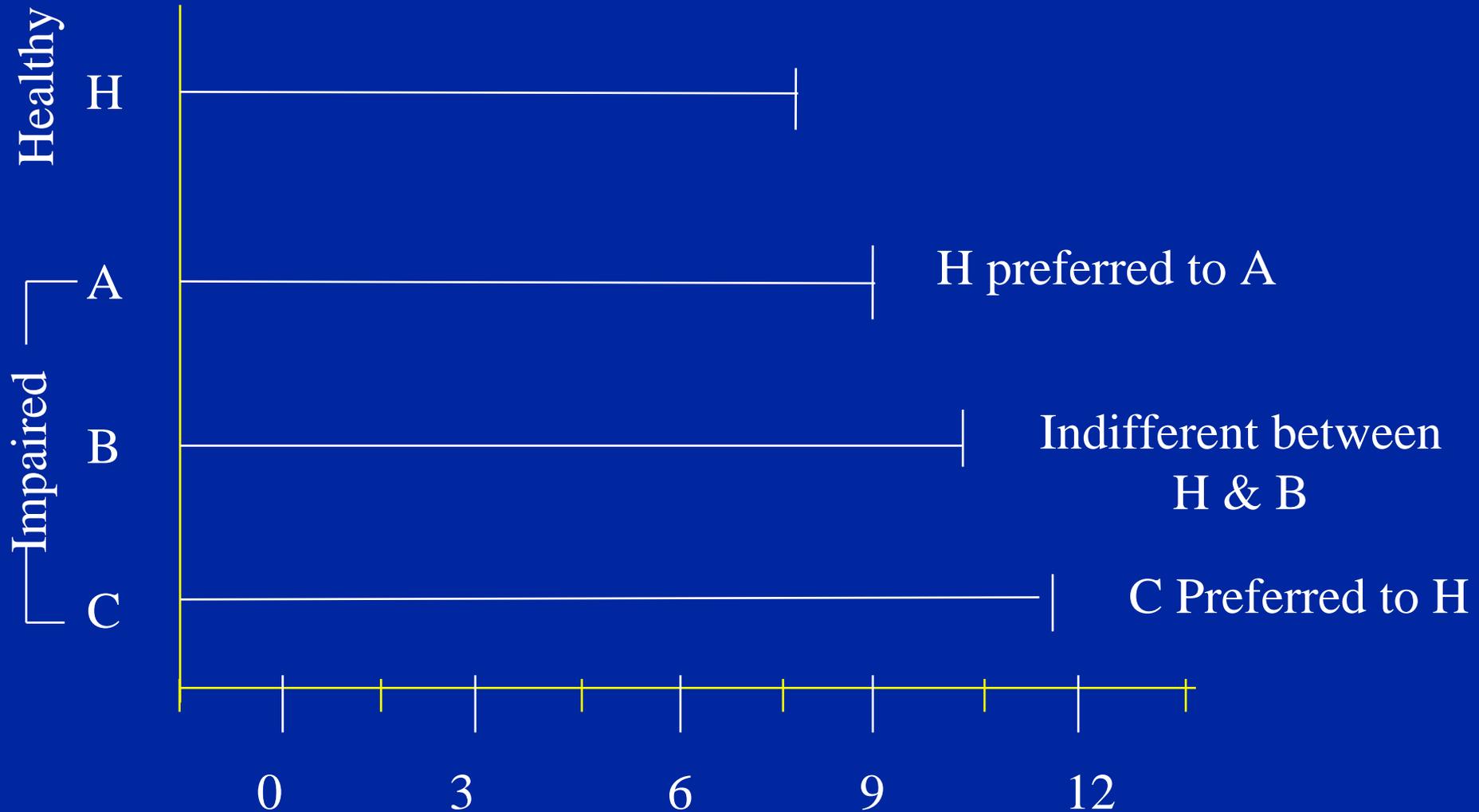
Health Status

- Mortality
- Morbidity
- Disability

Service Functions & Programs

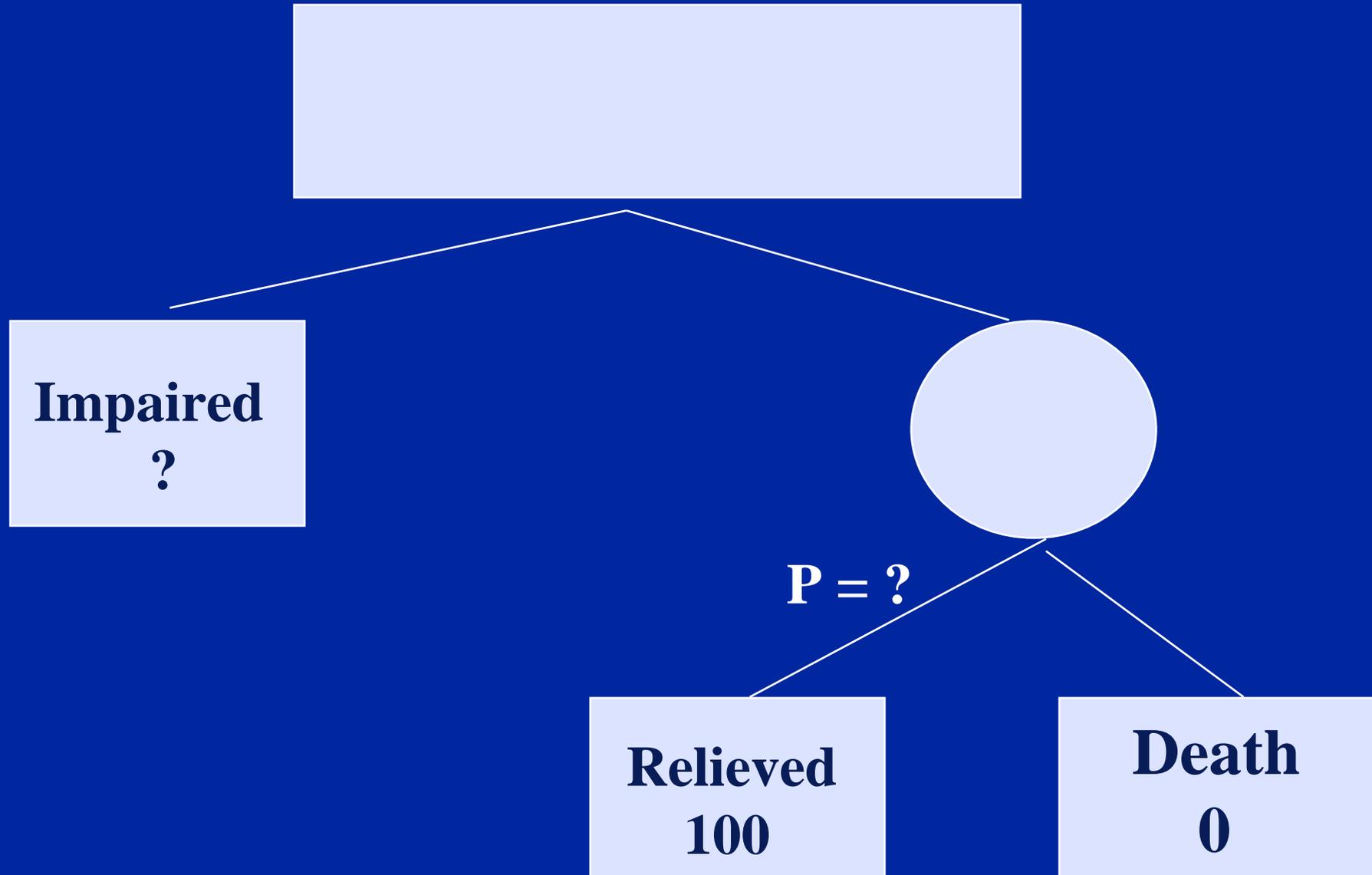


Quality of Life Determination



Conclusion: A Year of Impaired Life is Equivalent to 0.8 Year of Healthy Life

Framework for Standard Gamble



Relationships Among Specified Variables

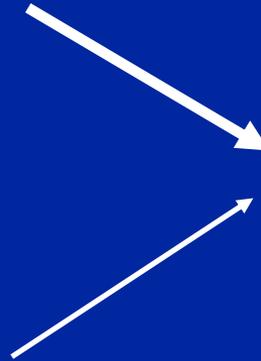
Independent Variables

Experimental Interventions



Intervening Variables

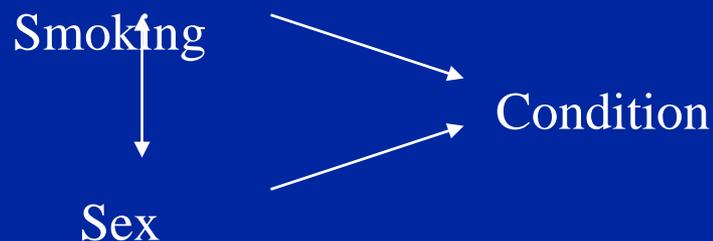
**Additional Factors Present
that Could Affect Outcome**



Dependent Variables
Result of Interest

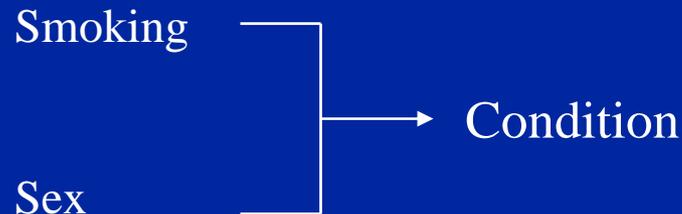
Effects of Confounding

		Persons		Prevalence(%)		Cases		% with Conditions
		M	F	M	F	M	F	
No Confounding	Smokers	30	30			15	21	60
	Non-Smokers	70	70	50	70	7	21	Diff. 20
Confounding	Smokers	40	20	10	30	20	14	57
	Non-Smokers	60	80			6	24	Diff. 21
Overcoming Confounding	Smokers	50	50			25	35	60
	Non-Smokers	50	50			5	15	Diff. 20



Effects of Interaction

		Persons		Prevalence (%)		Cases		% with Conditions
		M	F	M	F	M	F	
Proportional Sample	Smokers	40	20			16	16	53
		60	80					33% diff.
	Non-Smokers					12	16	20
				50-10=40	70+10=80			
				10+10=20	30-10=20			
Equal Sample	Smokers	50	50			20	40	60
	Non-Smokers	50	50			10	10	20

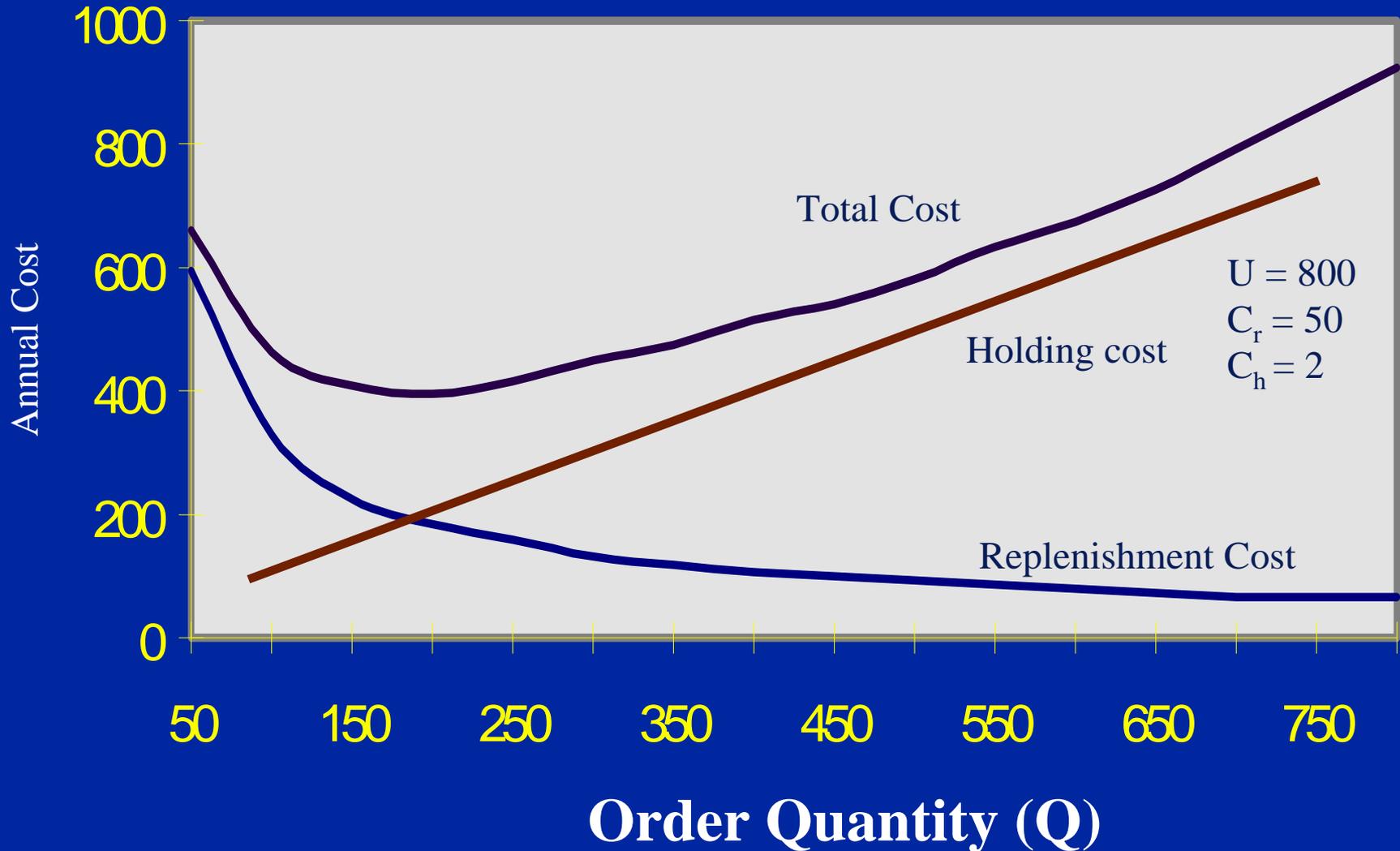


Common Techniques of Operations Research

- **Linear Programming**
- **Inventory Models**
- **Queuing Models**

Economic Order Quantity

$$Q_o = \sqrt{\frac{2U C_r}{C_h}}$$



Traditional Techniques of Statistical Analysis

- **Univariate Analyses**
 - Frequency Distributions
 - Average
 - Standard Deviations
 - Proportions, Rates and Ratios
- **Bivariate Analyses**
 - t-tests
 - X^2 Analyses
- **Multivariate Analyses**
 - Analysis of Variance (ANOVA)
 - Multiple Linear Regression
 - Logistic Regression
 - Discriminant Analysis