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Layout & Distribution: Valéria Kozakova

Medical Technology Adoption, Uncertainty, and Irreversibilities

Joshua Graff Zivin

Basic Concern

- There is an element of irreversibility to most medical decisions
  - Once exercised, they affect what can be done in the future
- Part of value of any technology should relate to this influence
  - Known as “option value”

Shrinking Options

- In some cases, use of intervention today means less interventions available in future
  - Kidney removal makes future use of drugs with renal toxicities less attractive
  - Chest radiation makes future use of drugs with cardio-toxicities less attractive
  - Drug resistance
- Option value decreases value of intervention

Expanding Options

- In some cases, use of intervention today means more interventions available in future
  - Continue to improve after technology adopted
  - Learning-by-doing
  - Implantable LVAD
- Option value increases value of intervention

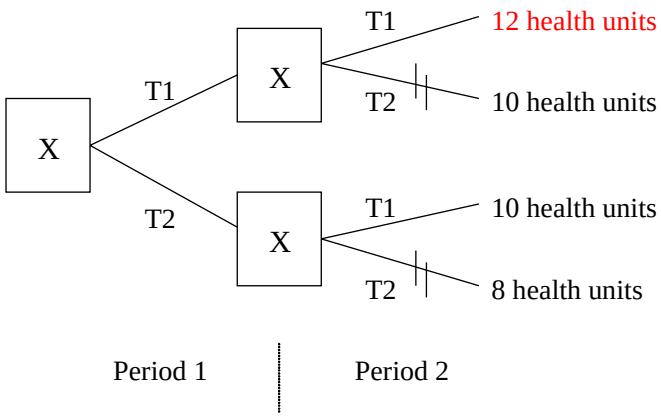
Importance for Medicine

- Rise in treatment for chronic conditions
  – More possibility for interactions
- Rise in life expectancy
  – More possibility for disease
- Many treatments, but few mechanisms
  – More interdependencies
- Politics of social adoption
  – Difficult to limit use after authorized

Basic Illustration

- Consider simple 2-period model
- Patients have chronic disease X
- Treatment 1 provides 6 health units
- Treatment 2 provides 4 health units
- Treatment costs are equal

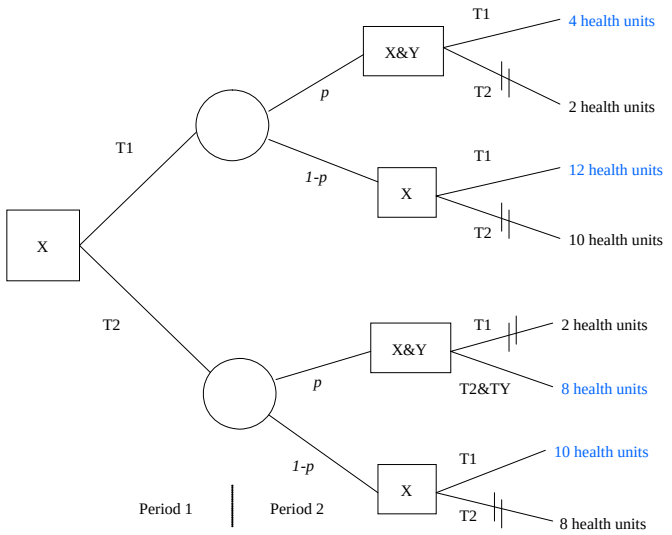
CEA for Disease X



Basic Illustration (cont.)

- Now consider acute disease Y
- Patients with Y lose 8 health units
- Only treatment for Y recovers all units
- Patients given Treatment 1 for disease X cannot tolerate treatment for Y
- Probability of developing disease Y is p

CEA for Disease X and Y



Value of Treatment 2

- Treatment 2 has value for two reasons
  - Effectiveness in treating X
  - Preserving option to treat Y

- Incremental value of T2 (relative to T1)

$$p*[8-4]+(1-p)*[10-12]$$

Partial Irreversibility

- Treatment for new disease after cooling off period
- Option value falls for high-risk patients
  - Can start them on option-preserving tx later
- Option value rises for low-risk patients
  - Now find it worthwhile to use for a spell
- Net effect depends on distribution of patient types
- Results magnified when introduce learning

General Lessons

- Size of option value depends on
  - Relative effectiveness of treatments
  - Likelihood that diseases arrive in future
  - Degree of irreversibility
  - Discount Rate

Policy Implications

- Need to think about future when evaluating new medical technologies
- Value in investments that transform complete to partial irreversibility
- Value in research to deepen understanding of disease evolution over time