Economics of Health and Health Care
Econ 131

The Health Production Function: What does Medical Care Do, And Is It Worth it?

Professor Martin Hackmann
Office hours today:

• 3:40-4:50PM (9357 Bunche Hall)
Outline

• Right level of care?
• Health Production
• What do we get for our money today (or recently)?
• Health Care Production
Right level of care in Theory:

Consider very simple health care economy:

• Assume a quantity of services (M) provides additional healthy days according to the (strictly concave) function \( Q = f(M) \)

• Society values each additional healthy day at $100

• The price of M is $100
HEALTHY DAYS PER CAPITA

HEALTH (LEFT SCALE)

EXPENDITURES (RIGHT SCALE)

$ PER CAPITA

QUANTITY OF MEDICAL CARE
Assume units of care cost $100 each. Want to stop using care short of the “summit.”

If a day was worth $100, M* is the optimal amount of medical care at M*, slope of cost line (= price per unit) equals slope of health benefit curve (= marginal benefit of healthcare (in $)).

The “efficient” quantity of M is where MB=MC, and not where health is maximized.

• In an efficient outcome, some good is always left undone

• This fact tends to be more frustrating for medical care than for other goods
The Romantic Fallacy

• All care is of infinite value or priceless.
  – But scarcity exists! The more medicine, the less butter.
• So we ought to avoid “shallow (and flat) of the curve” medicine.
• Hard message #1: There is (often) no such thing as “medical necessity”
• Hard message #2: Efficiency = leaving some good undone
• Hard message #3: We don’t always want “quality care.”
Gloomy Implications for Policy

• People shouldn’t get everything they and their doctor agree on when it is free.

• Solutions?
  – Impose positive prices
  – Restrict choices
  – Both
A Closer Look at the Concept of “Efficiency”

• Based on welfare economics which focuses on how the world “should be”

• An efficient outcome is one in which no one can be made better-off without making someone else worse-off (Pareto optimum)

• Often not equitable → alternate welfare functions
  – Extreme case: One has all and one has none; Efficient, but not equitable
A Closer Look at the Concept of ‘Efficiency’

• Efficiency will be achieved in a perfectly competitive market (and equity can be improved with income redistribution)

• BUT, are health care markets perfectly competitive?
  – Probably not! Uncertainty, Information, Externalities, etc...
  – Promoting competition may or may not improve outcomes
Evaluating Policy: Efficiency vs. Equity

- Law prohibits the sale of human organs
  - Efficiency sacrificed for equity or fairness
- Providing health care or health insurance to the poor
  - Equitable, but may also be efficient due to the presence of externalities.
Is US Health Care Expenditure Level Too Much?

• What can the level tell us about the “right” amount of spending
  – Rely on cross country comparisons but then you face the problem of differences in culture, lifestyle, other unobserved factors

• Focus on cost growth and health growth to measure returns
  – If the social returns in improved health were greater than the increase in cost may still be room to grow (or at least we haven’t gone too far)
Outline

• Right level of care?
• **Health Production**
• What do we get for our money today (or recently)?
• Health **Care** Production
Changes in Health Over Time

World Population (in billions)
The Secular Trends in Mortality Rates in England and France

PART A
England: 1553-1975

Source: Fogel, Robert
Fig. 1: All cause mortality

Source: Cutler and Meara 2001

a - Death rates shown are adjusted to standard population of U.S. in 1940
Health Production

Numerous factors are crucial to health – many of them “outside” of formal medical care

- Nutrition
- Income (correlated with health expenditure, education, ambiguous effects)
- Education (direct or indirect effects)
- Lifestyle
- Environment / Sanitation
Nutrition and Health Production

• Better nutrition $\rightarrow$ improved health
• Technology allowed increased caloric production beginning in the mid-19th century (Robert Fogel)
• Can’t measure nutrition precisely $\rightarrow$ look at height
PART B

Relative Rejection Rates for Chronic Conditions in a Sample of 4,245 Men Aged 23-49, Examined for the Union Army

Income and Health

FIGURE 3

The Mean Height of Boys Aged 14-16 From Families of London Laborers Compared with Tucker's Index of the Real Wage of London Artisans 1770-1865

Source: Fogel, et al. NBER WP 890
Income and Health (Country Level)

Source: Angus Deaton (NBER, 2004); Note: Circular areas reflect relative population sizes.
Life Expectancy in Lowest Income Quintile in the US

Top 5 Cities: New York City NY, Santa Barbara CA, San Jose CA, Miami FL, Los Angeles CA
Bottom 5 Cities: Tulsa OK, Indianapolis IN, Oklahoma City OK, Las Vegas NV, Gary IN
Life Expectancy and Income in the US

![Graph showing life expectancy at age 40 (race-adjusted) by household income for different cities. The graph indicates a trend of higher life expectancy with higher household income.]
Education and Health
(Country Level)

Preston Education Curves for 138 Countries, 1960-1985

Source: Cutler and Lleras-Muney (NBER, 2006)
Education and Health

Debate about the causal pathway

- Education $\rightarrow$ Health (Direct) (psychological?)
- Education $\rightarrow$ Income $\rightarrow$ Health (Indirect)
- Education $\rightarrow$ Lifestyle $\rightarrow$ Health (Indirect)
- Ability $\rightarrow$ Education and Income $\rightarrow$ Health
- …several other potential confounders and pathways
Education and Mortality Risk

• Completed Grades and Mortality Risk

NOTE: Analysis controls for race and gender only (not income); Source: Cutler and Lleras-Muney (NBER, 2006)
Education and Health Status

• Completed Grades and Poor Health

NOTE: Analysis controls for race and gender only (not income); Source: Cutler and Lleras-Muney (NBER, 2006)
Education and Health Decisions

• Completed Grades and Smoking

NOTE: Analysis controls for race and gender only (not income); Source: Cutler and Lleras-Muney (NBER, 2006)
Education and Health Decisions

- Completed Grades and Seat Belt Use

NOTE: Analysis controls for race and gender only (not income); Source: Cutler and Lleras-Muney (NBER, 2006)
Education and Health Prevention

• Completed Grades and Cancer Screening

NOTE: Analysis controls for race and gender only (not income); Source: Cutler and Lleras-Muney (NBER, 2006)
Lifestyle and Health: The Tale of Two States


<table>
<thead>
<tr>
<th>Age Group</th>
<th>Males</th>
<th>Females</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;1</td>
<td>42%</td>
<td>35%</td>
</tr>
<tr>
<td>1-19</td>
<td>16%</td>
<td>26%</td>
</tr>
<tr>
<td>20-29</td>
<td>44%</td>
<td>42%</td>
</tr>
<tr>
<td>30-39</td>
<td>37%</td>
<td>42%</td>
</tr>
<tr>
<td>40-49</td>
<td>54%</td>
<td>69%</td>
</tr>
<tr>
<td>50-59</td>
<td>38%</td>
<td>28%</td>
</tr>
<tr>
<td>60-69</td>
<td>26%</td>
<td>17%</td>
</tr>
<tr>
<td>70-79</td>
<td>20%</td>
<td>6%</td>
</tr>
</tbody>
</table>

Lifestyle and Health: The Tale of Two States

Excess Death Rates in Nevada compared to Utah for Cirrhosis of Liver and Respiratory Malignant Neoplasms (1966-1968)

<table>
<thead>
<tr>
<th>Age Group</th>
<th>Males</th>
<th>Females</th>
</tr>
</thead>
<tbody>
<tr>
<td>30-39</td>
<td>590%</td>
<td>443%</td>
</tr>
<tr>
<td>40-49</td>
<td>111%</td>
<td>296%</td>
</tr>
<tr>
<td>50-59</td>
<td>206%</td>
<td>205%</td>
</tr>
<tr>
<td>60-69</td>
<td>117%</td>
<td>227%</td>
</tr>
</tbody>
</table>

Public Health and Health Improvement

• Arguments that public health has driven demographic transition since the industrial revolution
• Improvements in sanitation, environment and treatment for communicable diseases
• Question of timing relative to mortality declines
Public Health

John Snow and the Broad Street Pump Handle: Cholera in London (1850s)

“Germ theory of disease” replaces “miasma ‘bad air’ theory”
Environment vs. Technology

Environmental / Public Health initiatives preceded technological innovation and accounted for a greater share of the absolute reduction in mortality rates (FGS, Chapter 5)

- Measles (Vaccine ~1960)
- Scarlett Fever (Penicillin, ~1945)
- TB (Izoniozid, ~1950)
- Typhoid (Chloromphenicol, ~1950)
Mortality Reduction - US

Source: National Center for Health Statistics (NCHS), Year 2000 Reference Population
Recent Past: Another Story about Technology

Source: CDC, NCHS, CV is abbreviation for cardiovascular
Measuring MHP

1) Goal: Measure Marginal Health Product (MHP) (Output=Health Measure; Inputs=Health Inputs)

\[
\frac{\Delta Health}{\Delta Input} : \text{Marginal Health Product for Medical Care}
\]

2) Pick a unit of analysis (usually geographic area: country or state, sometimes individual)

3) Pick a measure of health (age-adjusted mortality rate, life expectancy, sick days/year)

4) Try to appropriately account for all relevant inputs (Income, HC spending, alcohol consumption: proxy for lifestyle)

5) Include control variables (% Urban, Race measure)
Measuring MHP

A few issues:
1) “Health” is difficult to measure
   Time lags for outcomes such as life expectancy
   Mortality is clear measure (but what about morbidity?)
   Morbidity measures (lack quality of life)
2) Inputs are correlated (e.g. Education and Income)
3) Direct and indirect effects (e.g. Education may influence the efficiency of Medical Care)
4) Unobserved factors
   Each issue may lead to biased results!
Policy and Marginal Health Product

- $H=Q(M, Z)$: $M =$ Medical Care services, $Z =$ Other services (e.g. spending on environment)
- Efficiency condition

\[
\frac{MP_M}{P_M} = \frac{MP_Z}{P_Z}
\]

- Is the marginal dollar best spent on non-$M$ (medical care intervention (e.g. clear air which may address asthma “epidemic”) or MC intervention (pharmaceuticals for treatment of asthma)
- But can we separate marginal from average?
Technology and Health Spending

• Cost increases over the past 30-40 years are largely driven by technology
• Is it “worth” it?
  – What is the “right” level of expenditure?
Outline

• Right level of care?
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Valuing Health Costs and Gains

• Measure total change in health
  – Valued by Quality Adjusted Life Years (QALYs - $100k per)

• Measure total change in expenditure
  – Optimum is reached when marginal conditions hold
  – Average can tell us whether we are getting a good deal overall

• Concerns that a large share of improvements come from non-health care inputs

• Focus on specific areas of care
# Technology Specific Costs and Benefits

## Exhibit 3
Summary of Research on the Value of Medical Technology Changes

<table>
<thead>
<tr>
<th>Condition</th>
<th>Years</th>
<th>Change in Treatment Costs</th>
<th>Outcome Change</th>
<th>Value</th>
<th>Net Benefit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Heart attack&lt;sup&gt;a&lt;/sup&gt;</td>
<td>1984–98</td>
<td>$10,000</td>
<td>One-year increase in life expectancy</td>
<td>$70,000</td>
<td>$60,000</td>
</tr>
<tr>
<td>Low-birthweight infants&lt;sup&gt;b&lt;/sup&gt;</td>
<td>1950–90</td>
<td>$40,000</td>
<td>Twelve-year increase in life expectancy</td>
<td>$240,000</td>
<td>$200,000</td>
</tr>
<tr>
<td>Depression&lt;sup&gt;c&lt;/sup&gt;</td>
<td>1991–96</td>
<td>$0</td>
<td>Higher remission probability at some cost for those already treated</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cataracts&lt;sup&gt;d&lt;/sup&gt;</td>
<td>1969–98</td>
<td>$0</td>
<td>Substantial improvements in quality at no cost increase for those already treated</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Breast cancer&lt;sup&gt;e&lt;/sup&gt;</td>
<td>1985–96</td>
<td>$20,000</td>
<td>Four-month increase in life expectancy</td>
<td>$20,000</td>
<td>$0</td>
</tr>
</tbody>
</table>

**Sources:** Authors’ own work and summary of other studies; see below.

<sup>a</sup> See Note 7 in text.
<sup>c</sup> See Note 16 in text.
<sup>e</sup> D.M. Cutler and M. McClellan, “The Productivity of Cancer Care” (Unpublished paper, 2001).

Source: Cutler, D.M and McClellan, M., 1997
So are we spending too much?

1) Cost has grown but it has produced an output of improved health

2) Health improvements are generally greater than the cost increases that produced them
   - Two treatment technologies alone, neonatal and cardiac care, have made the entire growth in spending since the 1960’s worth it
   - Most of the technologies studied had an ROI of at least 6:1 → May be able to spend more and still get a good deal!