Introduction

• Most of this class we will examine markets for medical care
  – How they operate
  – What are economic issues
• Medical care is however only interesting in that it is an intermediate product – used to produce what people care about – health
• This section – discuss what inputs can be transformed into health outputs

Modern correlates of health

ECON 40565
Health Economics
Fall 2016

• Many types of inputs
  – Personal investments, purchased inputs, time, medical care, socioeconomic status
• Unknown causation – unknown pathways
  – Health is better among those with more income
  – Why? Could this be omitted variable bias?
• How to measure outputs
  – Many measure of health
  – Some are objective but not useful in particular contexts

Aggregate measures of health

• Mortality rates
  – Death per period among a defined population
• Infant mortality rate
  – Deaths 1st year of life/births
  – Neonatal mortality: deaths 1st 28 days
• Life expectancy
  – At birth
  – Conditional on a particular age
### Table

<table>
<thead>
<tr>
<th>Year</th>
<th>Avg years of life after age 65</th>
<th>Avg years of life after age 75</th>
</tr>
</thead>
<tbody>
<tr>
<td>1950</td>
<td>13.6</td>
<td></td>
</tr>
<tr>
<td>1960</td>
<td>14.3</td>
<td>10.4</td>
</tr>
<tr>
<td>1970</td>
<td>15.2</td>
<td></td>
</tr>
<tr>
<td>1980</td>
<td>16.4</td>
<td></td>
</tr>
<tr>
<td>1990</td>
<td>17.2</td>
<td>10.9</td>
</tr>
<tr>
<td>2000</td>
<td>18.0</td>
<td>11.4</td>
</tr>
<tr>
<td>2005</td>
<td>18.7</td>
<td>12.0</td>
</tr>
</tbody>
</table>
Health Care Spending Per Capita, 2010
87% more than Canada
150% more than UK
296% more than Slovak Rep
585% more than Chile

Life Expectancy, 2010

Infant Mortality Rates, 2010

Life Expectancy vs. Spending

Deaths per 1000 births

Country
Health Care Spending Per Capita, 2010

Country
Life Expectancy at Birth, 2010

Country
Infant Mortality Rates, 2010

Country
Deaths per 1000 births
Example: AIDS Drugs

- Through 2003
  - 929,000 people diagnosed with AIDS
  - Over half have died
- AIDS caused by HIV
  - About 1 million people HIV+
  - Infection that weakens resistance to infection by reducing CD4 counts
- Before mid 1990s,
  - 30% of AIDS patients died each year

- Treatment prior to mid 90s
  - Treat opportunistic infections caused by weakened immune system
  - 4 drugs that were designed to reduce spread of virus in host (e.g., AZT)
  - Not particularly effective
- Mid 1990s
  - Major advances in pharmaceutical treatments
  - Epivir (nucleoside reverse transcription inhibitor)
  - Protease inhibitors

- New drugs
  - Prevent virus from replicating in patients
  - Work very well
    - Increase CD4 counts
    - Suppress viral load to zero for many patients
- Immediate results
  - Mortality rates fell 70% in a three-year period
NICU

• Specialty wards of hospitals that provide “constant nursing and continuous cardiopulmonary and other support for severely ill infants”

• Developed in late 1950s early 1970s

• Growth has been rapid
  – NICU beds increased by 150% 1980-1995

Costs, 2001 CA

• NICU discharge $50,000

• Non-NICU, $4,500

• In CA, 10% of births are for a NICU

• Therefore, more than half the hospital cost of childbirth are attributable to NICUs

Fetal Death Rate Among VLBW Infants in CA

Table 1. Five-Year Relative Survival Rates for Cancer of Different Sites, US and Europe

<table>
<thead>
<tr>
<th>Site</th>
<th>5-year survival (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>United States</td>
</tr>
<tr>
<td>Prostate</td>
<td>69.3</td>
</tr>
<tr>
<td>Stomach</td>
<td>50.2</td>
</tr>
<tr>
<td>Brain</td>
<td>60.1</td>
</tr>
<tr>
<td>Cervix</td>
<td>82.3</td>
</tr>
<tr>
<td>Colon/rectal</td>
<td>65.5</td>
</tr>
<tr>
<td>Non-Hodgkin lymphoma</td>
<td>62.6</td>
</tr>
<tr>
<td>Melanoma</td>
<td>27.0</td>
</tr>
<tr>
<td>Lung</td>
<td>15.7</td>
</tr>
<tr>
<td>All malignancies (men)</td>
<td>66.7</td>
</tr>
<tr>
<td>All malignancies (women)</td>
<td>62.9</td>
</tr>
</tbody>
</table>
Heart Attack Treatment, Canada vs. US

- Category
  - Angioplasty: Canada 11.4%, US 30.5%
  - Bypass: Canada 4.0%, US 11.4%
  - 5-year mortality: Canada 21.4%, US 19.6%

Self-reported health status

- Benefits
  - Easy/low cost variable to collect
  - Predicts other measures of health that are difficult to collect

- Shortcomings
  - No way to compare people
  - No way to compare aggregate data across countries
  - May be difficult to compare groups over time
    - Rise in disability
    - “Harvesting”
% Reporting Health Status, Males

<table>
<thead>
<tr>
<th>Health</th>
<th>Age 30-44</th>
<th>Age 45-64</th>
<th>Age 65-74</th>
</tr>
</thead>
<tbody>
<tr>
<td>Excellent</td>
<td>43.7%</td>
<td>30.6%</td>
<td>18.1%</td>
</tr>
<tr>
<td>Very good</td>
<td>30.3%</td>
<td>26.9%</td>
<td>22.5%</td>
</tr>
<tr>
<td>Good</td>
<td>19.8%</td>
<td>26.1%</td>
<td>31.6%</td>
</tr>
<tr>
<td>Fair</td>
<td>4.7%</td>
<td>10.6%</td>
<td>18.5%</td>
</tr>
<tr>
<td>Poor</td>
<td>1.5%</td>
<td>5.8%</td>
<td>9.3%</td>
</tr>
</tbody>
</table>

5-Year Mortality Rate, Males

<table>
<thead>
<tr>
<th>Health</th>
<th>Age 30-44</th>
<th>Age 45-64</th>
<th>Age 65-74</th>
</tr>
</thead>
<tbody>
<tr>
<td>Excellent</td>
<td>0.7%</td>
<td>2.4%</td>
<td>8.6%</td>
</tr>
<tr>
<td>Very good</td>
<td>0.9%</td>
<td>2.9%</td>
<td>10.9%</td>
</tr>
<tr>
<td>Good</td>
<td>1.6%</td>
<td>5.2%</td>
<td>16.7%</td>
</tr>
<tr>
<td>Fair</td>
<td>2.9%</td>
<td>11.7%</td>
<td>25.2%</td>
</tr>
<tr>
<td>Poor</td>
<td>10.4%</td>
<td>22.8%</td>
<td>42.9%</td>
</tr>
</tbody>
</table>

5-Year Mortality Rate, Females

<table>
<thead>
<tr>
<th>Health</th>
<th>Age 30-44</th>
<th>Age 45-64</th>
<th>Age 65-74</th>
</tr>
</thead>
<tbody>
<tr>
<td>Excellent</td>
<td>0.3%</td>
<td>1.7%</td>
<td>5.6%</td>
</tr>
<tr>
<td>Very good</td>
<td>0.4%</td>
<td>1.9%</td>
<td>6.3%</td>
</tr>
<tr>
<td>Good</td>
<td>0.9%</td>
<td>2.9%</td>
<td>8.8%</td>
</tr>
<tr>
<td>Fair</td>
<td>1.8%</td>
<td>6.2%</td>
<td>14.1%</td>
</tr>
<tr>
<td>Poor</td>
<td>7.1%</td>
<td>15.6%</td>
<td>32.2%</td>
</tr>
</tbody>
</table>

Biomarkers

- Mortality limited for some populations
- SRHS difficult to compare across people
- Objective way to measure health status across people?
- Biomarkers
  - Clinical markers of physiology
  - Predictive of future health outcomes
  - Measurable across people
  - Easily collect
Examples

- Blood pressure
  - High BP can lead to stroke, AMI, heart failure, kidney failure
- Cholesterol
  - HDL, LDL and total
  - High chol. can lead to heart attack
- Resting heart rate
- Glycated hemoglobin
- Body mass index (kg's/cm²)
  - Increased risk of diabetes
  - High BMI correlated with increased mortality

Describing determinants of mortality in a cross section

Vital Statistics, 2011

- 312 million people
- ~4 million births
- ~2.5 million deaths

Leading Causes of Death, 2011

- Heart disease 596,339
- Cancer 573,313
- Chronic lower resp. diseases 143,382
- Stroke 128,931
- Accidents 122,777
- Alzheimer's 84,691
- Diabetes 73,282
- Influenza/Pneumonia 53,667
- Nephritis 45,731
- Suicide 38,285
Distribution of Deaths by Age

- Age Fraction of deaths • Age Fraction of deaths
  <1 1.0% 55-64 12.9%
  1-14 0.3% 65-74 16.5%
  15-24 1.1% 75-84 24.9%
  25-34 1.7% 85+ 31.3%
  35-44 2.8% 72.7% of deaths are to people aged 65+
  45-54 7.3%

Leading causes of death

<table>
<thead>
<tr>
<th>Top 3</th>
<th>15-24 years of age</th>
<th>45-54 years of age</th>
<th>65+ years of age</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Unintentional Injury</td>
<td>Cancer</td>
<td>Heart Disease</td>
</tr>
<tr>
<td>2</td>
<td>Suicide</td>
<td>Heart Disease</td>
<td>Cancer</td>
</tr>
<tr>
<td>3</td>
<td>Homicide</td>
<td>Unintentional Injury</td>
<td>Chronic resp. dis.</td>
</tr>
</tbody>
</table>

Actual Causes of Death

<table>
<thead>
<tr>
<th>Cause of death</th>
<th># (% of deaths)</th>
<th># (% of deaths)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tobacco</td>
<td>400,000 (19%)</td>
<td>435,000 (18%)</td>
</tr>
<tr>
<td>Diet/inactivity</td>
<td>300,000 (15%)</td>
<td>400,000 (17%)</td>
</tr>
<tr>
<td>Alcohol</td>
<td>100,000 (5%)</td>
<td>85,000 (5%)</td>
</tr>
<tr>
<td>Micorbial agents</td>
<td>90,000 (4%)</td>
<td>75,000 (4%)</td>
</tr>
<tr>
<td>Toxic agents</td>
<td>60,000 (3%)</td>
<td>66,000 (3%)</td>
</tr>
<tr>
<td>Motor Vehicles</td>
<td>25,000 (1%)</td>
<td>43,000 (2%)</td>
</tr>
<tr>
<td>Firearms</td>
<td>35,000 (2%)</td>
<td>29,000 (1%)</td>
</tr>
<tr>
<td>Sexual Behavior</td>
<td>30,000 (1%)</td>
<td>20,000 (&lt;1%)</td>
</tr>
<tr>
<td>Illegal drugs</td>
<td>20,000 (&lt;1%)</td>
<td>17,000 (&lt;1%)</td>
</tr>
<tr>
<td>Total</td>
<td>1,060,000 (50%)</td>
<td>1,060,000 (48%)</td>
</tr>
</tbody>
</table>

% that Died in Next 5 Years, Adults, 40-64 Years of Age, NLMS (late 1970)

- By sex
  - Males 6.9%
  - Females 3.6%
- By race
  - Black 7.1%
  - White 4.9%
- By ethnicity
  - Non-hispanic 5.2%
  - Hispanic 4.2%
- By marital status
  - Not married 7.0%
  - Married 4.6%
- By education
  - < HS 6.9%
  - HS 4.4%
  - College 3.6%
- By income
  - < $23K 6.0%
  - $23-$50K 3.4%
  - > $50K 2.7%
Gompertz Equation

- 1825 British actuary Benjamin Gompertz
- “the number of living corresponding to ages increasing in arithmetical progression, decreased in geometrical progression.”
- geometrical decrease in survival with age existed because of a geometric increase in the “force of mortality”

\[ M_a = c e^{ba} \]
- \( M_a \) = mortality rate at age \( a \)
- \( c \) = initial mortality rate
- \( b \) = Gompertz parameter – exponential rate of change in mortality with age

Note that if \( y = e^x \)
- Then \( \ln(y) = bx \)
- And then \( \ln(M_a) = \ln(c) + ba \)
- Log mortality rates are linear in age

\[ \frac{d\ln(M)}{da} = b \]
- \( d\ln(M) = \frac{dM}{M} \) = percentage change in \( M \)
- \( d\ln(M)/da \approx \% \) change in \( M \) for a one year increase in age

- In the model above
  - \( \ln(c) = -7.75 \)
  - \( b = 0.0816 \)
- Mortality increases by 8.2% per year of age
• $b = (dM/M)/da$
• $b(da) = dM/M$
  
  - If $a=10$ years, mortality is predicted to increase 82% over 10 year period (same regardless of the starting age)
  
  $M = ce^{ba}$
  
  $C = \exp(-7.75) = 0.000495$
  
  $M = 0.00043e^{0.081a}$
  
  - Given $a$, one can predict the mortality rate for this group

---

**Income/Health Relationship**

• Health improves with income
• But at a decreasing rate
  
  - $dH/dI > 0$
  - $d^2H/dI^2 < 0$

• Relationship is true for
  
  - Nearly all measures of health
  - For all subgroups (by sex, race, age, etc)
  - For nearly all populations
  - For nearly all time period
  - For nearly all countries

• Similar relationship with education

---

[Graph showing Health vs Income]
### Percent Died within 5 years of Survey, Males NLMS

<table>
<thead>
<tr>
<th>Income Group</th>
<th>30-49 years of age</th>
<th>50-64 years of age</th>
<th>65-79 years of age</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 to $25,000</td>
<td>3.1</td>
<td>10.8</td>
<td>20.6</td>
</tr>
<tr>
<td>$25,001 to $50,000</td>
<td>1.8</td>
<td>6.8</td>
<td>15.3</td>
</tr>
<tr>
<td>$50,001 +</td>
<td>1.4</td>
<td>5.1</td>
<td>12.3</td>
</tr>
</tbody>
</table>

### % Died in 6 Years, NLMS 6c

<table>
<thead>
<tr>
<th>Income Group</th>
<th>30-49</th>
<th>50-64</th>
<th>65-79</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;$20K</td>
<td>2.14</td>
<td>7.52</td>
<td>18.4</td>
</tr>
<tr>
<td>≥$20K,&lt;$40K</td>
<td>1.15</td>
<td>4.37</td>
<td>14.6</td>
</tr>
<tr>
<td>≥$40K,&lt;$60K</td>
<td>0.85</td>
<td>3.12</td>
<td>13.4</td>
</tr>
<tr>
<td>≥$60K,&lt;$75K</td>
<td>0.82</td>
<td>2.41</td>
<td>12.8</td>
</tr>
<tr>
<td>≥$75K</td>
<td>0.71</td>
<td>2.35</td>
<td>10.8</td>
</tr>
</tbody>
</table>

### % Died in 6 Years, NLMS 6c

<table>
<thead>
<tr>
<th>Education Group</th>
<th>35-54 years of age</th>
<th>55-64 years of age</th>
<th>65-74 years of age</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; High school</td>
<td>1.78</td>
<td>6.77</td>
<td>19.37</td>
</tr>
<tr>
<td>HS graduate</td>
<td>1.46</td>
<td>4.96</td>
<td>15.48</td>
</tr>
<tr>
<td>Some college</td>
<td>1.18</td>
<td>3.95</td>
<td>14.65</td>
</tr>
<tr>
<td>College</td>
<td>0.66</td>
<td>2.46</td>
<td>12.47</td>
</tr>
</tbody>
</table>

### Percent Died within 5 years of Survey, Females NLMS

<table>
<thead>
<tr>
<th>Education Group</th>
<th>30-49 years of age</th>
<th>55-64 years of age</th>
<th>65-74 years of age</th>
</tr>
</thead>
<tbody>
<tr>
<td>Less than high school</td>
<td>2.0</td>
<td>6.0</td>
<td>11.7</td>
</tr>
<tr>
<td>High school graduate</td>
<td>1.3</td>
<td>4.3</td>
<td>9.7</td>
</tr>
<tr>
<td>College graduate</td>
<td>0.9</td>
<td>4.0</td>
<td>8.0</td>
</tr>
</tbody>
</table>
### 18-64 year olds, BRFSS 2005-2009 (% answering yes)

<table>
<thead>
<tr>
<th>Education Level</th>
<th>Fair or poor health</th>
<th>No exer. in past 30 days</th>
<th>Current smoker</th>
<th>Obese</th>
<th>Any bad mental hlth past 30 days</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;12 Years</td>
<td>40.9</td>
<td>45.8</td>
<td>37.8</td>
<td>43.6</td>
<td>43.7</td>
</tr>
<tr>
<td>12-15 years</td>
<td>17.8</td>
<td>27.3</td>
<td>26.5</td>
<td>34.7</td>
<td>38.4</td>
</tr>
<tr>
<td>16+ Years</td>
<td>7.2</td>
<td>13.5</td>
<td>10.8</td>
<td>24.8</td>
<td>34.2</td>
</tr>
</tbody>
</table>

### Income Level

<table>
<thead>
<tr>
<th>Income Level</th>
<th>Fair or poor health</th>
<th>No exer. in past 30 days</th>
<th>Current smoker</th>
<th>Obese</th>
<th>Any bad mental hlth days past month</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;$25K</td>
<td>41.0</td>
<td>41.5</td>
<td>36.4</td>
<td>41.8</td>
<td>52.0</td>
</tr>
<tr>
<td>$25-75K</td>
<td>13.6</td>
<td>24.0</td>
<td>23.1</td>
<td>32.6</td>
<td>37.4</td>
</tr>
<tr>
<td>&gt;$75K</td>
<td>5.0</td>
<td>12.7</td>
<td>11.8</td>
<td>23.8</td>
<td>30.2</td>
</tr>
</tbody>
</table>

---

**Contact data**

**. tab died if age<64**

<table>
<thead>
<tr>
<th>died within 6 years of followup</th>
<th>Freq.</th>
<th>Percent</th>
<th>Cum.</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>327,199</td>
<td>97.83</td>
<td>97.83</td>
</tr>
<tr>
<td>1</td>
<td>7,256</td>
<td>2.17</td>
<td>100.00</td>
</tr>
<tr>
<td>Total</td>
<td>334,455</td>
<td>100.00</td>
<td></td>
</tr>
</tbody>
</table>

**. tab died if age>64**

<table>
<thead>
<tr>
<th>died within 6 years of followup</th>
<th>Freq.</th>
<th>Percent</th>
<th>Cum.</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>6,209</td>
<td>24.05</td>
<td>24.05</td>
</tr>
<tr>
<td>1</td>
<td>8,851</td>
<td>15.95</td>
<td>100.00</td>
</tr>
<tr>
<td>Total</td>
<td>15,060</td>
<td>100.00</td>
<td></td>
</tr>
</tbody>
</table>
The image contains a page from a document, which appears to be a statistical analysis or a report. The text is in English, and it seems to be discussing statistical data, possibly related to demographics or survey results. The page includes tables and figures, indicating a detailed examination of various variables and their distributions. The content is technical and requires a background in statistics to fully understand. Without the context or the ability to interpret the specific data, it's challenging to provide a clear summary or translation of the information. The page is labeled with page numbers 7, 58, and 59, indicating it continues over several pages.
Questions for class

• What are the possible mechanisms through which income (or education) can improve health?

• What data supports or refutes each of these hypotheses?
  – List possible explanations
  – Give some evidence for and against
  – Decide whether the pathway is a causal mechanism

What do we mean by causal pathway?

• If causal, we assume that health is determined by income
  – For example, \( H = f(\text{Income}) \)

• Therefore, \( \frac{dH}{dI} > 0 \)
  – An exogenous change in income will alter health

• Example: Suppose we change social security benefits – if income is causal, this should alter mortality of the elderly

Why is it hard to determine whether the income/health relationship is causal

• Many factors that determine high income
  – Drive/ambition/intelligence/risk taking/luck/background

• Many of these same factors can also impact health

• Therefore, we do not know whether income is causing better health, or some third factor that is unmeasured
### Table 3
Economic Effects of New Health Onset

<table>
<thead>
<tr>
<th></th>
<th>WUSA</th>
<th>OOP Expense</th>
<th>Total Medical Expense</th>
</tr>
</thead>
<tbody>
<tr>
<td>HRS</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mild onset</td>
<td>-3,620</td>
<td>655</td>
<td>2,565</td>
</tr>
<tr>
<td>Severe onset</td>
<td>-16,886</td>
<td>7,216</td>
<td>29,963</td>
</tr>
<tr>
<td>AHEAD</td>
<td>-10,001</td>
<td>1,014</td>
<td>NA</td>
</tr>
<tr>
<td>Any onset</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>HRS severe onset only</td>
<td>-17,941</td>
<td>1,810</td>
<td>56,827</td>
</tr>
<tr>
<td>With health insurance</td>
<td>-17,902</td>
<td>4,516</td>
<td>42,566</td>
</tr>
<tr>
<td>Without health insurance</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>HRS severe onset only</td>
<td>-11,346</td>
<td>5,459</td>
<td>29,826</td>
</tr>
<tr>
<td>Below median income</td>
<td>-25,371</td>
<td>5,014</td>
<td>28,085</td>
</tr>
<tr>
<td>Above median income</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>AHEAD any onset</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Below median income</td>
<td>-4,497</td>
<td>915</td>
<td>NA</td>
</tr>
<tr>
<td>Above median income</td>
<td>-17,046</td>
<td>1,161</td>
<td>NA</td>
</tr>
</tbody>
</table>

Note: the COMPARISON samples were constructed computing average annual earnings for ages 37-47 for individuals that survived up to age 47 in the COMPARISON cohort sample. Individuals were weighted in order to match the distribution by cohort in the DEAD sample. In the COMPARISON cohort-education sample, individuals were weighted to match the distribution by cohort and education in the DEAD sample.

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Clark and Royer

- Examines education/health link using shock to education in England
- 1944 law
  - Raised age of comp. schooling from 14-15
  - Went into effect April 1, 1947
  - Raised comp years of schooling to 9
  - Gave Minister of Ed power to increase to 16 under certain conditions
  - Did so in Sept 1, 1972
    - Raised comp. years of schooling to 10
- Produce large changes in education across birth cohorts
- Changes in education and health are “smooth” over birth cohorts
- If education alters health, should see a structural change in outcomes across cohorts as well
- What assumptions have to be true for this to generate an unbiased estimate of the impact of schooling on health?
This figure is not in the paper but in a previous version. It shows birth cohorts versus Ln(gross weekly earnings). What does this graph show and why is this informative?
Gardner and Oswald: Income and Health

- Question: will more income improve health?
- Problem: OLS estimates are contaminated
- Solution: utilize lottery winners—income receipt is random

British Household Panel Survey

- Survey of 5K households, 10K people
- “Panel” data – follow this group over time
- Re-surveyed annually since 1991
- Adults interviewed every year, children starting at age 16
- Look at winners over 1998-2001 period

General Health Questionnaire

- Used to identify minor psychiatric disorders
- Ask 12 questions
  - Lost sleep over worry?
  - Felt constantly under strain?
  - Unhappy and depressed?
  - Feel worthless?
- Respond:
  - less than usual, no more than usual, rather more than usual, or much more than usual
- 0-3 points – 36 point maximum
Some questions about the sample

• Analysis restricted to lottery players  
  – Why?
• What does that imply about the analysis?
• A key question is income/mortality link? Why is this not considered?
• Why is mental health used as the outcome of interest?
• What is important piece of data is missing from the paper?

Note: only 137 winners overall – very small sample
Sullivan and von Wachter

- Consider the opposite of Gardner and Oswald – what happens when someone loses income
- Lost income due to job loss
- Focus on displacement?
  - What is displacement?
  - Why displacement and not job loss?

Data

- 5% random sample of unemployment records in PA 1974-1991
- Have quarterly earnings
- Select sample of workers with the same employer 1974-1979 (firms > 50 workers)
- Identify people who have been “displaced”
  - Lose job 1980-1986
  - And when firm size falls by 30% or more

Impact of displacement on earnings

\[ y_i = \alpha_i + \lambda_t + x_{it} \beta + \sum_{k=1}^{20} D_k \delta_k + \epsilon_i \]

- \( i = \) person, \( t = \) quarter
- \( y_i = \ln(\text{quarterly earnings}) \)
- \( \alpha_i = \) person effect
- \( \lambda_t = \) quarter (time) effect
- \( x_{it} = \) time-variant characteristics
- \( D_k = 1 \) if person \( i \) was displaced \( k \) quarters ago (after)
- \( \delta_k = \) effect of displacement
Impact of displacement on mortality

\[ y_{it} = \alpha_i + \lambda_t + x_{it} + D_i \delta + \epsilon_{it} \]

\( i = \text{person}, \quad t = \text{year} \)

Sample: people alive 1/1/1980

\[ y_{it} = 1 \text{ if person dies in period } t, = 0 \text{ otherwise} \]

\( D_i = 1 \text{ if person } i \text{ was displaced in the year} \)

\( \delta \) = effect of displacement

7.1/1000 = 0.007 mortality risk among non-displaced workers

0.0012/0.007 = 0.17 = 17% increase in mortality risk
Stress as an explanation for the SES/Health Gradient

- Usual suspects don’t explain gradient
- Leading candidate is Stress
- Low SES face more persistent stress
- Body reacts to stress
HPA Axis

- Hypothalamic-pituitary-adrenal axis
- Put into work when the body faces stress
- Regulates many body functions including digestion, immune, mood, emotions, energy storage
- Concern: activation of system is “good” under stress, but it does come at a cost. Therefore, persistent stress generates more permanent damage to the body’s systems

Cortisol

- Circadian rhythm. Rises when awake, in late afternoon
- Regulates many activities
- Under stress, more cortisol is produced
  - Increases availability of glucose
  - Suppresses energy available to other systems like immune
  - Cortisol reduces after the stress subsides
- Problems
  - Constant stress leads to dysregulation of HPA
  - Stress in early life can generate dysfunction of HPA

Cortisol

- Stress increases cortisol
  - Higher among residents
  - Higher among accountants near April 15th
- Poor have elevated cortisol at all times

Primate research

- Observational studies show worse health among subordinate male baboons
  - Elevated stress hormone (glucocorticoid) levels, worse cholesterol profile
- Experimental manipulation of status provides more compelling evidence
  - Causal effects of subordination and harmful effects of “status competition”
### Baseball Hall of Fame

- **Baseball Writers Association of America**
  - Annual voting held since 1936
  - Eligibility: >10 seasons in MLB, retired 5+ years, max of 15 ballot appearances
  - Voting: ~450 voters, mail-in ballot, can name up to 10 players
  - Induction: Must be named on 75% of total ballots cast
  - Complete voting results are reported to public (newspapers)

- **Committee on Baseball Veterans (Veterans)**
  - Select former MLB players not chosen by BBWAA
  - Historically voting was held annually
  - Much smaller committee (~15), but similar 75% required for induction
  - Voting results not publicly disclosed and accusations of cronyism
  - Major reforms in 2001 (expanded voting pool, public disclosure)

### Sample

- All players alive while appearing on at least one ballot between 1945-2006
- Restrict analysis to pre-1946 births to reduce censoring (N=597)
- Key derived variables:
  - Indicators of induction status (BBWAA and veterans)
  - Maximum vote share ever received (categorical: <1, 1-2, …, 51-74, 75-78…)
  - Number of “close losses” (defined as vote share ≥ 50 but <75)

### Adjusted life duration by maximum vote share

Log-days alive adjusted for additional variables, including # of “close losses” & veterans induction
Cause of death by maximum vote share

Probability of acute cardiovascular death (heart attack, stroke, etc) by maximum vote share

- Linear probability
- Probit