Modern correlates of health

ECON 40447
Health Economics
Fall 2009

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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**

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- **Talk about the transformation of inputs into health**
- **Many types of inputs**
  - **Personal investments, purchased inputs, time, medical care**
- **For any particular input**
  - **How to measure outcomes (and how outcomes are difficult to measure)**
  - **How to measure the productivity of investments**

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Three things

- **How to measure outputs**
- **What are some important inputs**
- **How to measure the productivity of inputs**

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How to measure the productivity of inputs

- Health production function
- Health, measured in some fashion, is a function of a particular input
- Examples
  - Income, education, medical care, etc.
- H=f(M)
- Greater values of H are 'good'
- Functional form
  - Increases in M increase H
  - But at an decreasing rate

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Three measures

- Total productivity
  - H=f(M)
- Marginal productivity
  - $MP_m = \Delta H/\Delta M$
- Average productivity
  - $AP_m = H/M$

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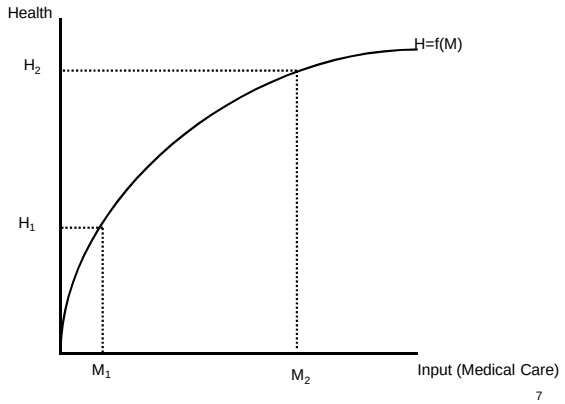

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- What is the average productivity?
  - Outcome divided by input
  - AP = M/H
- How to calculate? Slope of a line from origin to a point
- Line 1, goes from (0,0) to (M_1, H_1).
  - Slope is $\Delta Y/\Delta X = (H_1-0)/(M_1-0) = H_1/M_1$
  - slope of line 1 is the average productivity

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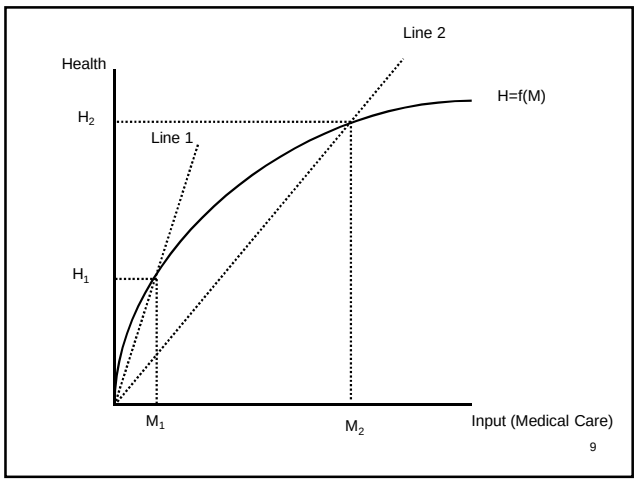

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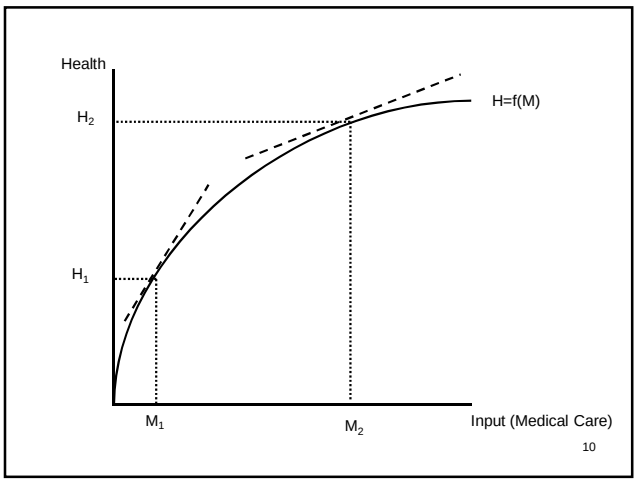

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- **Marginal productivity**
  - **RECALL: derivative of a function is equal to the slope of a line just tangent to the function**
- **Previous graph**
  - **Slope at M_1 > Slope M_2**
  - **Marginal benefit of more medical care declines throughout**
- **Next graph:**
  - **Notice that at M_2, slope of the AP line is greater than the slope of the MP line**
  - **Given the way I've drawn the graph, MP < AP**

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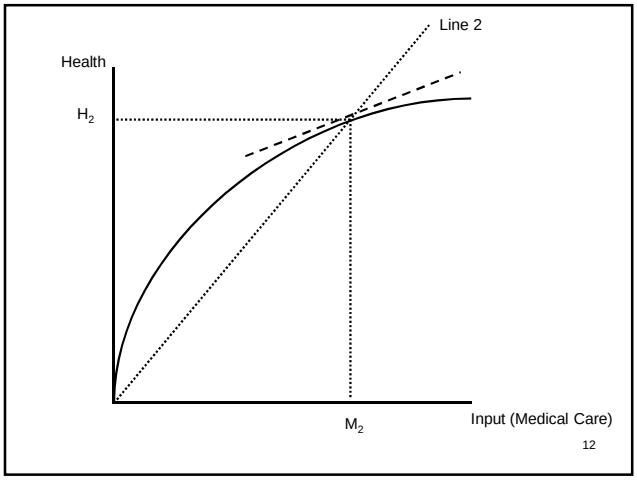

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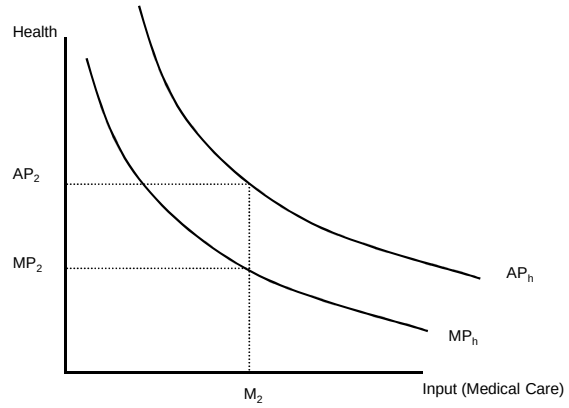

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- **Initial conditions can alter the placement of the graph**
- **Example: Low weight births**
  - **Defined as < 2500 grams**
  - **6% of births**
  - **Kids born low weight have**
    - **Higher incidence of diseases later in life**
    - **More medical costs**
    - **Higher learning disabilities**
    - **Higher mortality rates**

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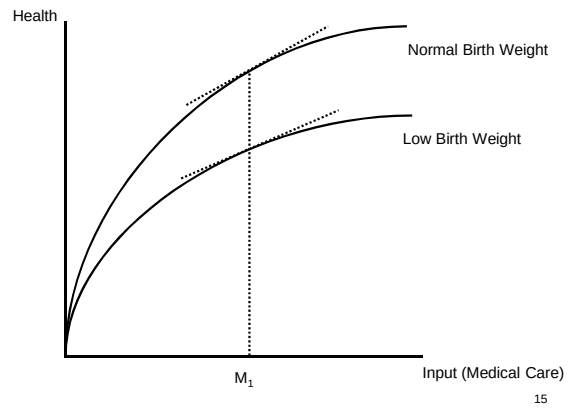

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Aggregate measures of health

- **Mortality rates**
  - **death per period/individuals alive at the beginning of period**
- **Infant mortality rate**
  - **deaths 1st year of life/births**
  - **Neonatal mortality: deaths 1st 28 days**
- **Life expectancy**
  - **At birth**
  - **Conditional on a particular age**

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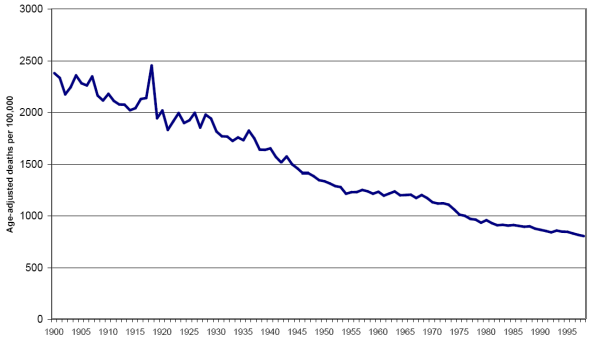
Fig. 1: All cause mortality[a]



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

Fig. 2: Life Expectancy at Birth

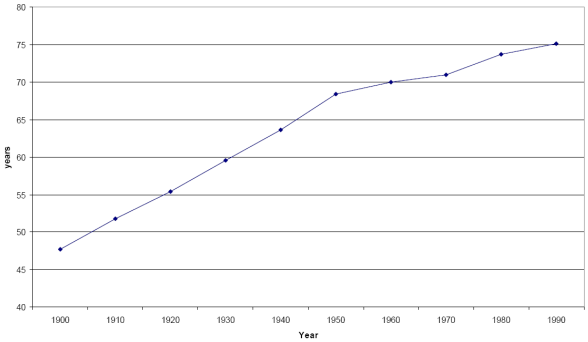


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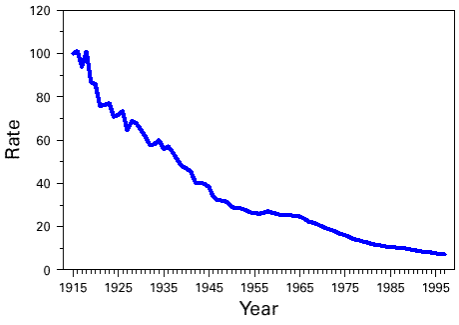
FIGURE 1. Infant mortality rate,* by year — United States, 1915–1997



*Per 1000 live births.

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Year	Years of life After age 65	Avg Years of Life after age 65
1950	13.6	
1960	14.3	10.4
1970	15.2	
1980	16.4	
1990	17.2	10.9
2000	18.0	11.4
2005	18.7	12.0

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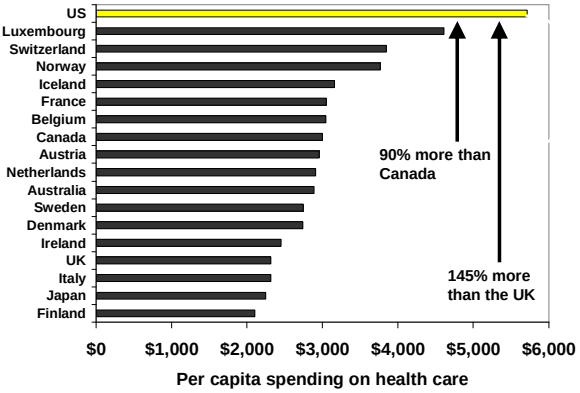
US
Luxembourg
Switzerland
Norway
Iceland
France
Belgium
Canada
Austria
Netherlands
Australia
Sweden
Denmark
Ireland
UK
Italy
Japan
Finland
90% more than Canada
145% more than the UK
$0
$1,000
$2,000
$3,000
$4,000
$5,000
$6,000
Per capita spending on health care

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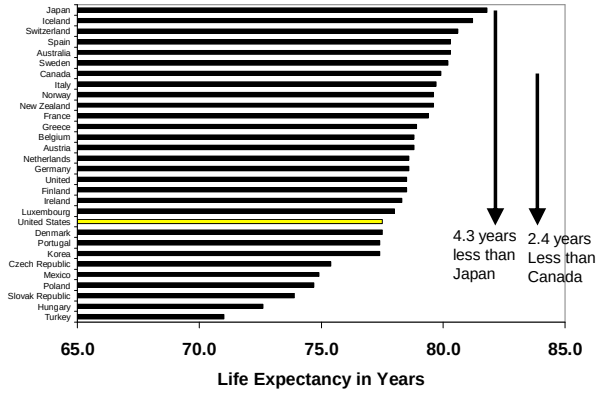
Japan
Iceland
Switzerland
Spain
Australia
Sweden
Canada
Italy
Norway
New Zealand
France
Greece
Belgium
Austria
Netherlands
Germany
United
Finland
Ireland
Luxembourg
United States
Denmark
Portugal
Korea
Czech Republic
Mexico
Poland
Slovak Republic
Hungary
Turkey
4.3 years less than Japan
2.4 years Less than Canada
65.0
70.0
75.0
80.0
85.0
Life Expectancy in Years

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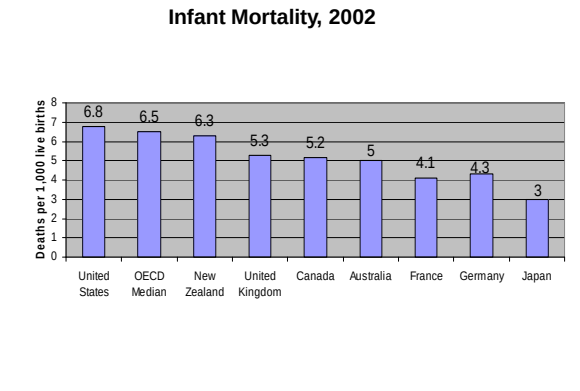
Infant Mortality, 2002
Deaths per 1,000 live births
0
1
2
3
4
5
6
7
8
6.8
6.5
6.3
5.3
5.2
5
4.1
4.3
3
United States
OECD Median
New Zealand
United Kingdom
Canada
Australia
France
Germany
Japan

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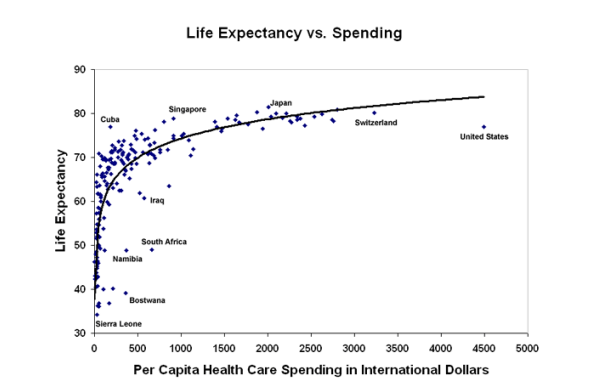
Life Expectancy vs. Spending
Life Expectancy
30
40
50
60
70
80
90
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
Per Capita Health Care Spending in International Dollars
Cuba
Singapore
Japan
Switzerland
United States
Iraq
South Africa
Namibia
Bostwana
Sierra Leone

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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**

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- **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**

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- **New drugs**
  - **Prevent virus from replicating in patients**
  - **Work very well**
    - **Increase CD4 counts**
    - **Suppress viral load to zero for many patients**
- **Immediate results**
  - **Drugs released in Nov 1995 – June 1996**
  - **Mortality rates fell 70% in a three-year period**

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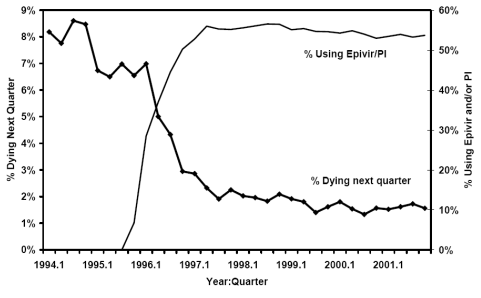
Figure 5: Quarterly Mortality Rate and Use of PI/Epivir



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NICU

- Specialty wards of hospitals that provide "constant nursing and continuous cardiopulmonary and other support for severely ill infants"
- Developed in late 1950 early 1970s
- Growth has been rapid
  - NICU beds increased by 150% 1980-1995

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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

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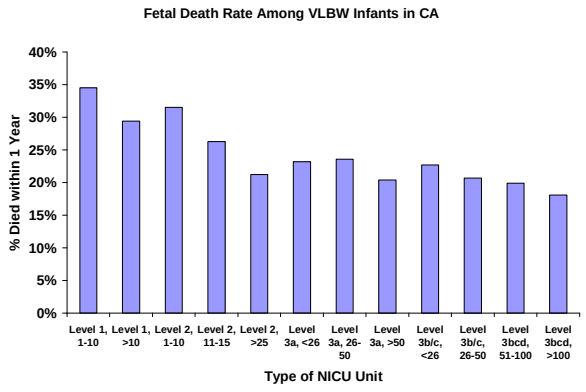

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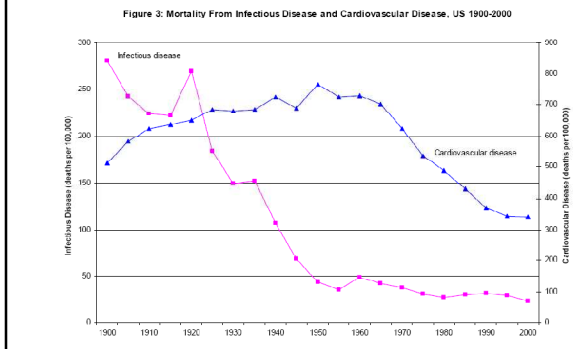

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What is accurate picture of US?

- **Innovator to the world – tremendous gains to new advances**
- **Wasteful spender of tremendous resources with little return**

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TABLE 1-3
COMPARISON OF HEALTH OUTCOMES RELATIVELY INSENSITIVE TO HEALTH CARE SYSTEM CHARACTERISTICS, 2000

	Homicide	Transport
United States	7.3	15.3
White	3.2	n/a
Black	26.1	n/a
Canada	1.4	9.3
Germany	0.9	10.1
Japan	0.6	8.3
Sweden	1.2	4.9
United Kingdom	0.7	6.0

SOURCES: World Health Organization (2004); U.S. Department of Health and Human Services (2002a).
NOTE: Death rate per 1,000.

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TABLE 1-5
MEAN LIFE EXPECTANCY AT BIRTH, OECD COUNTRIES, ACTUAL AND STANDARDIZED BY OECD MEAN FATAL INJURY RATES, 1980–99

	Actual Mean	Standardized Mean	Ratio (Std/Act)
United States	75.3	76.9	1.022
Switzerland	77.6	76.6	0.988
Norway	77.0	76.3	0.991
Canada	77.3	76.2	0.986
Denmark	75.1	76.1	1.014
Germany	75.4	76.1	1.009
Iceland	78.0	76.1	0.975
Sweden	77.7	76.1	0.979
Japan	78.7	76.0	0.967
Australia	76.8	76.0	0.990
France	76.6	76.0	0.992
Belgium	75.7	76.0	1.004
Austria	75.3	76.0	1.008
Netherlands	77.0	75.9	0.987
Italy	76.6	75.8	0.989
United Kingdom	75.6	75.7	1.002

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

	5-year survival rate (%)	
Site	United States	Europe
Prostate	99.3	77.5
Skin melanoma	92.3	86.1
Breast	90.1	79.0
Corpus uteri	82.3	78.0
Colorectum	65.5	56.2
Non-Hodgkin lymphoma	62.0	54.6
Stomach	25.0	24.9
Lung	15.7	10.9
All malignancies (men)	66.3	47.3
All malignancies (women)	62.9	55.8

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TABLE 1-6
FIVE-YEAR AGE-ADJUSTED CANCER SURVIVAL RATES,
UNITED STATES[1] AND SELECTED EUROPEAN COUNTRIES[2]

	Breast (Female)	Cervical (Female)	Colon (Male)	Lung (Male)	Prostate (Male)	Thyroid (Female)
United States	82.8	69.0	61.7	12.0	81.2	95.9
White	83.9	71.8	62.5	12.0	82.7	95.7
Black	69.2	55.6	52.6	12.0	69.2	93.0
England	66.7	62.6	41.0	7.0	44.3	74.4
Denmark	70.6	64.2	39.2	5.6	41.0	71.7
France	80.3	64.1	51.8	11.5	61.7	81.0
Germany	71.7	64.1	49.6	8.7	67.6	77.0
Italy	76.7	64.0	46.9	8.6	47.4	77.0
Sweden	80.6	68.0	51.8	8.8	64.7	83.7
Switzerland	79.6	67.2	52.3	10.3	71.4	78.0

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Infant health comparisons

	USA	Aust	Canada	UK
IMR (deaths/1K)	7.1	4.3	5.3	5.5
% low birth BW	7.8%	6.1%	5.7%	7.2%
% very low NW	1.45%	1.02%	0.96%	.097%
% births teens	12.5%	5.2%	5.7%	7.2%
OBs /10K births	100	42.2	45.3	24.3
ICU/1K births	3.3	NA	NA	0.7
IMR < 500g	868	915	920	881
IMR 500-999g	317	336	357	405
IMR 1000-1500 g	59.9	49.5	76.3	70.1
IMR >2500g	2.6	1.3	2.3	2.1

IMR = infant mortality rate, deaths within a year per 1,000 births

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SRHS

- **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"**

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% Reporting Health Status, Males

Health	Age 30-44	Age 45-64	Age 65-74
Excellent	**43.7%**	**30.6%**	**18.1%**
Very good	**30.3%**	**26.9%**	**22.5%**
Good	**19.8%**	**26.1%**	**31.6%**
Fair	**4.7%**	**10.6%**	**18.5%**
Poor	**1.5%**	**5.8%**	**9.3%**

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5-Year Mortality Rate, Males

Health	Age 30-44	Age 45-64	Age 65-74
Excellent	0.7%	2.4%	8.6%
Very good	0.9%	2.9%	10.9%
Good	1.6%	5.2%	16.7%
Fair	2.9%	11.7%	25.2%
Poor	10.4%	22.8%	42.9%

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5-Year Mortality Rate, Females

Health	Age 30-44	Age 45-64	Age 65-74
Excellent	0.3%	1.7%	5.6%
Very good	0.4%	1.9%	6.3%
Good	0.9%	2.9%	8.8%
Fair	1.8%	6.2%	14.1%
Poor	7.1%	15.6%	32.2%

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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

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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 ($kg's/cm^2$)
  - Increased risk of diabetes
  - High BMI correlated w/ increased mortality

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Stress biomarkers

- Cortisol
- Hormone produced by adrenal cortex
- Returns the body to normal in time of stress/anxiety
- Increases BP, blood sugar, reduces immunity to disease
- High levels good during stress, but high levels in every day live lead to problems.

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Describing determinants of mortality in a cross section

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Vital Statistics, 2002

- 280 million people
- 4 millions births
- 2.4 million deaths

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Leading Causes of Death, 2002

• Heart disease	696,947
• Cancer	557,271
• Stroke	167,677
• Chronic lower resp. diseases	124,742
• Accidents	106,742
• Diabetes	73,249
• Influenza/Pneumonia	65,681
• Alzheimer's	58,866
• Nephritis	40,974
• Septicema	33,865

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Distribution of Deaths by Age

Age	Fraction of deaths
<1	1.1%
1-14	0.5%
15-24	1.4%
25-34	1.7%
35-44	3.7%
45-54	7.1%
55-64	10.4%
65-74	17.3%
75-84	28.9%
85+	27.9%

74.1% of deaths are to people aged 65+

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Leading causes of death, 2002

Top 3	15-24 years of age	45-54 years of age	65+ years of age
1	Unintentional Injury	Cancer	Heart Disease
2	Homicide	Heart Disease	Cancer
3	Suicide	Unintentional Injury	Stroke

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Actual Causes of Death

Cause of death	# (% of deaths) 1990	# (% of deaths) 2000
Tobacco	400,000 (19%)	435,000 (18%)
Diet/inactivity	300,000 (15%)	400,000 (17%)
Alcohol	100,000 (5%)	85,000 (5%)
Micorbial agents	90,000 (4%)	75,000 (4%)
Toxic agents	60,000 (3%)	66,000 (3%)
Motor Vehicles	25,000 (1%)	43,000 (2%)
Firearms	35,000 (2%)	29,000 (1%)
Sexual Behavior	30,000 (1%)	20,000 (<1%)
Illegal drugs	20,000 (<1%)	17,000 (<1%)
Total	1,060,000 (50%)	1,060,000 (48%)

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% that Died in Next 5 Years, Adults, 40-64 Years of Age, NLMS

- 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
  - < $25K 6.0%
  - $25-$50K 3.4%
  - >$50K 2.7%

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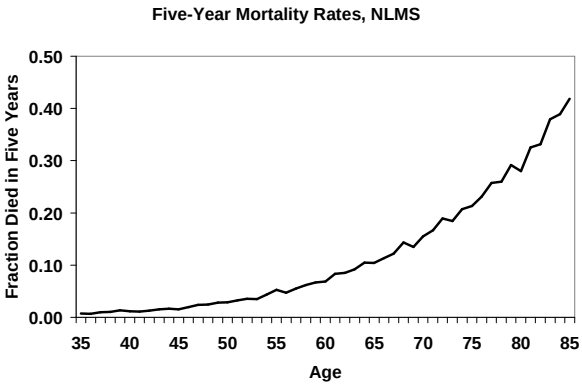

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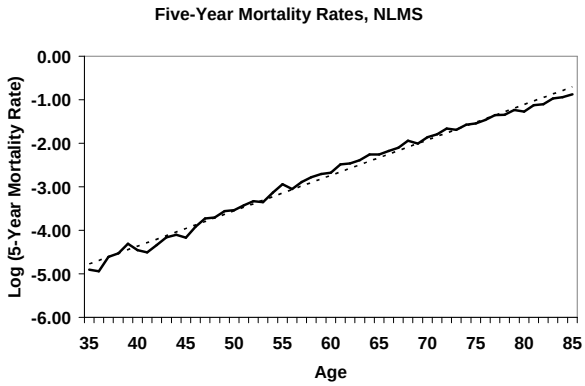

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Gompertz Equation

- 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"

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- $M_a = ce^{ba}$
- M_a = mortality rate at age a
- a = age
- c = initial mortality rate
- b = Gompertz parameter – exponential rate of change in mortality with age

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

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- dln(M)/da = b
- dln(M) = dM/M = percentage change in M
- dln(M)/da = % change in M for a one year increase in age
- In the model above
  - ln(c)=-7.62
  - b=0.081
- Mortality increases by 8.1% per year of age

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- b=(dM/M)/da,
- b(da) = dM/M
  - If a=10 years, mortality is predicted to increase 81% over 10 year period (same regardless of the starting age)
  - $M = ce^{ba}$
  - C=exp(-7.61) = 0.000495
- $M = 0.000495e^{0.081a}$
- Given a, one can predict the mortality rate for this group

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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

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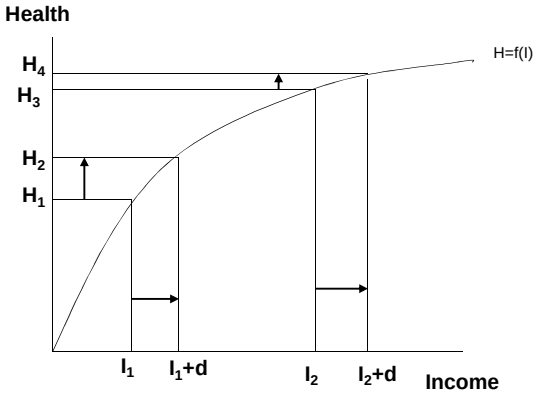

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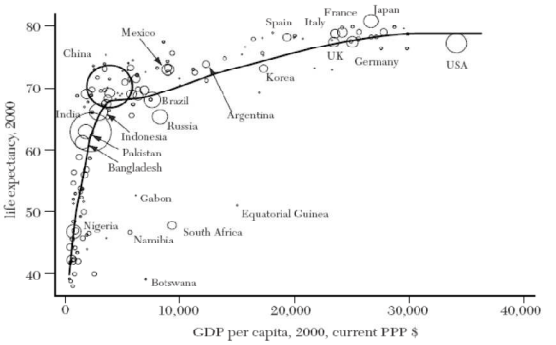

Figure 1. The Preston Curve: Life Expectancy versus GDP Per Capita

Percent Died within 5 years of Survey, Males NLMS

Income Group	35-54 years of age		55-64 years of age		65-74 years of age	
0 to $25,000	3.1	-42%	10.8	-37%	20.6	-25%
$25,001 to $50,000	1.8	-22%	6.8	-25%	15.3	-19%
$50,001 +	1.4		5.1		12.3	

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Percent Died within 5 years of Survey, Males NLMS

Education Group	35-54 years of age	55-64 years of age	65-74 years of age
Less than high school	3.8	11.7	22.1
High school graduate	2.4	8.5	18.7
College graduate	1.4	6.5	13.7

63

Percent Died within 5 years of Survey, Females NLMS

Education Group	35-54 years of age	55-64 years of age	65-74 years of age
Less than high school	2.0	6.0	11.7
High school graduate	1.3	4.3	9.7
College graduate	0.9	4.0	8.0

64

30-55 year olds, BRFSS 2004 (% answering yes)

Income Level	Fair or poor health	No exer in past 30 days	Current smoker	Obese	Binge drink in past 30
<$25K	34.5%	40.5%	35.3%	31.4%	13.7%
$25K – $50K	12.3%	24.7%	27.3%	28.1%	16.0%
>$50K	5.0%	13.4%	15.6%	21.4%	16.6%

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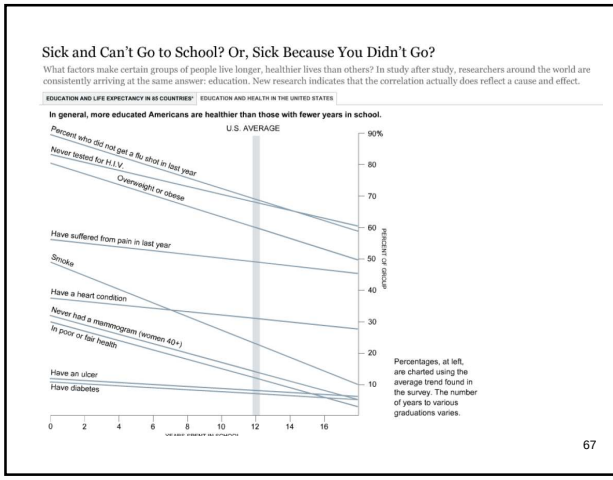
30-55 year olds, BRFSS 2004 (% answering yes)

Educ Level	Fair or poor health	No exer in past 30 days	Current smoker	Obese	Binge drink in past 30
<12 years	39.1%	47.8%	35.1%	30.8%	15.1%
12-15 years	14.8%	25.3%	28.7%	28.7%	16.5%
16+ years	5.2%	12.7%	11.3%	18.0%	13.8%

66



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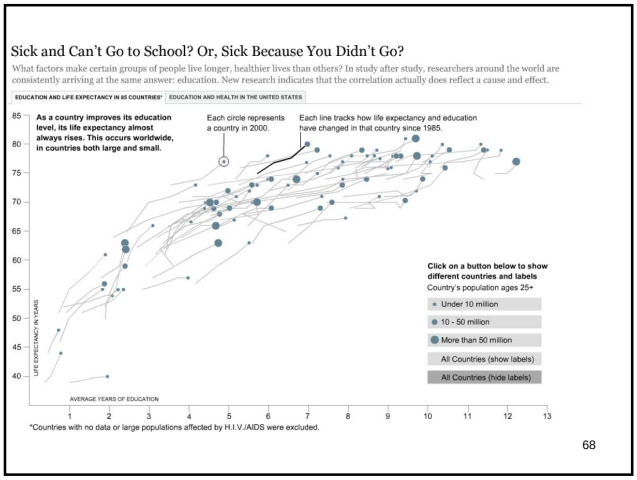

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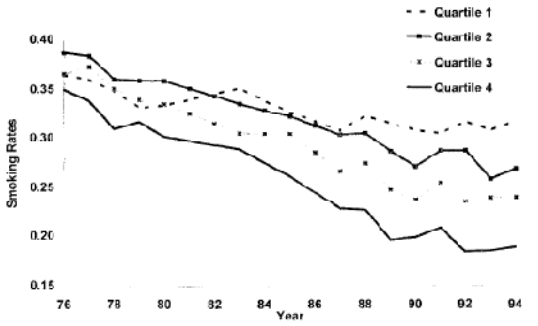

FIGURE 6. *Smoking Rates by Family Quartiles—NHIS*

69

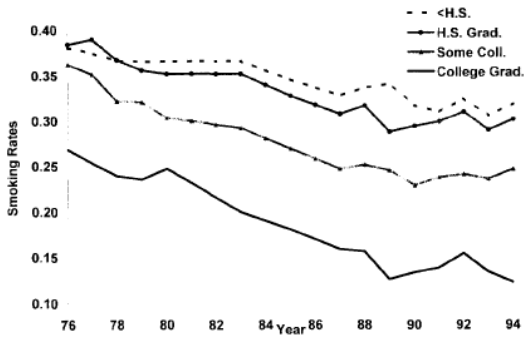

FIGURE 7. *Smoking Rates by Education Groups—NHIS*

70

Deaton and Marmot Papers

- **Questions to consider 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**

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What do we mean by causal pathway?

- **If causal, we assume that health is determined by income**
  - **For example, H=f(Income)**
- **Therefore, dH/dI>0**
  - **An exogenous change in income will alter health**
- **Example: Suppose we change social security benefits – if income is causal, should alter mortality of the elderly**

72

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

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What can explain the income/health relationship

- Insurance?
- Maybe explained by poor health habits
- Work/neighborhood characteristics?
- Just explaining education/health relationship
- Could be reverse causation – low income is caused by poor health?

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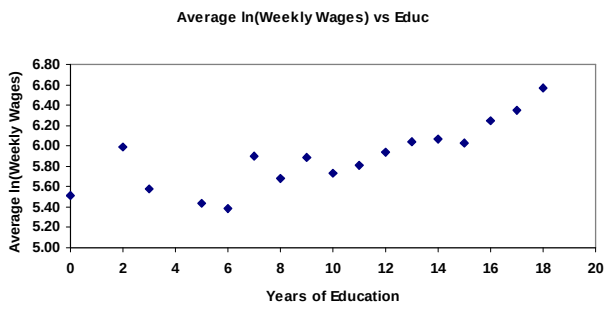

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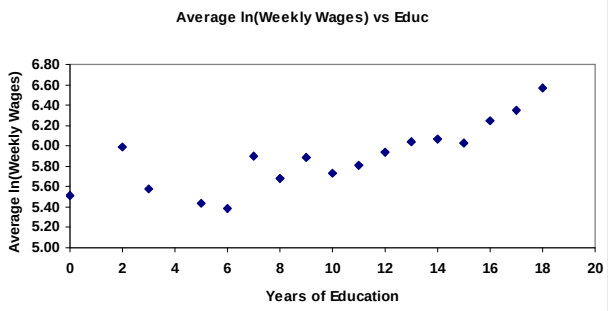

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It is not just missing education

	Difference in mortality compared to people with >$50K in income	
Income	Do not control for education	Control for education
<$5000	5.3 % points higher	4.7% points higher
$5K - $10K	3.3	2.7
$10K-$15K	2.3	1.9
$15K-$20K	1.3	1.0
$20K-$25K	0.9	0.7
$25K-$50K	0.7	0.6

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Uninsurance Rates, 2003

- By age
  - 18-34 25%
  - 35-54 15%
  - 55-64 11%
- By labor income
  - <$20K 34%
  - $20K - $40K 17%
  - >$40K 6%
- Poverty status
  - <100% FPL 50%
  - 100-200% FPL 41%
  - 200-300% FPL 22%
  - 300-400% FPL 13%
  - >400% FPL 6%
- By work status
  - Full time/full year 15%
  - Full time/part year 29%
  - Part time/full year 23%
  - Part time/part year 24%

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Why is it not insurance?

-
-
-

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Poor health habits

- Definitely true – the poor have worse health habits than the rich
- Poor have
  - Higher smoking, lower exercise, higher obesity, higher fat diets, eat less fiber, higher cholesterol levels, etc.
- Once you control for poor health habits, does not dampen the income/health relationship much

80

Reverse causation

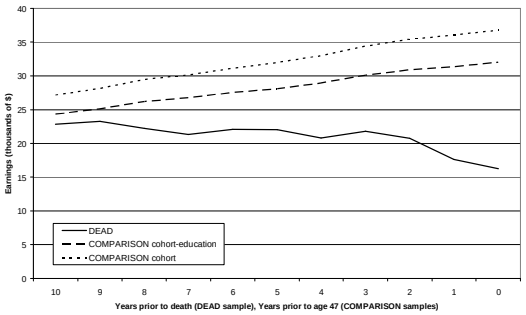
- **Could also be the case that poor health impacts income**
- **Health shocks reduce ability to work, lowering income**
- **Therefore, much of the observed relationship could be due to reverse causation.**

Table 3

Economic Effects of New Health Onset

	Wealth	*OOP Expenses*	*Total Medical Expenses*
HRS			
Mild onset	−3,620	635	2,555
Severe onset	−16,846	2,266	28,963
AHEAD			
Any onset	−10,481	1,026	NA
HRS severe onset only			
With health insurance	−17,417	1,912	26,957
Without health insurance	−17,282	4,576	42,166
HRS severe onset only			
Below median income	−11,348	2,439	29,829
Above median income	−25,371	2,014	28,085
AHEAD any onset			
Below median income	−4,427	915	NA
Above median income	−17,040	1,101	NA

Earnings in 10 years prior to death for individuals that died while aged 45-49 (DEAD sample) and for ages 37-47 for comparable individuals that survived to age 47 (COMPARISON samples)



Note: the COMPARISON samples were constructed computing average annual earnings for ages 37 to 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.

Why might education be causal?

- **Educated may better understand the production of health**
  - **That exercise is good, smoking is bad, high fiber is good**
  - **Everyone knows smoking is bad for you, yet low educated still smoke at very high rates**
- **Educated may also better able to invest in health**

- **Patience is an important characteristic for predicting future income**
  - **Patience=high discount rate**
  - **A patient person will invest now for return in the future**
  - **The inpatient will not**
  - **Without investments in skill, wages will be low**
- **The same can be said for in health**
- **Patient may invest more in health**
- **Maybe education is simply picking up patience**

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1. SS recipients

- **Enrolled in SS prior to May 1997,**
  - **Paid on 3rd of the month**
  - **Or previous Friday if 3rd was weekend/holiday**
- **Enroll in SS May 1997 and after, checks distributed on**
  - **2nd Wednesday for birthdays 1-10**
  - **3rd Wednesday for 11-20**
  - **4th Wednesday for 20-31**

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Data

- **Daily mortality counts for groups of seniors**
- **Control for weekday, month, year, and special days**
- **Add variables that identify the**
  - **2 weeks before checks arrive**
  - **1st 7 days after checks arrive,**
  - **next 7 days**
  - **Remaining days**

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Old SS Schedule
Aged 65-69, 1995-96
Coefficient on Payweek dummy

Week #	Payweek
-2	0.0105
	(0.0078)
1	0.0207
	(0.0071)
2	0.0041
	(0.0092)
3	-0.0002
	(0.0083)

88

New SS Schedule Aged 65-69, 2005-06 Coefficient on Payweek

Week #	New Payweek
-2	0.0071
	(0.0041)
1	0.0111
	(0.0035)
2	0.0023
	(0.0057)
3	-0.0188
	(0.0110)

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Military pay day

- **Paid on 1st and 15th of the month or previous weekday**
- **Active duty large in number**
- **Equal number of civilian employees**
- **Military concentrated around bases**
- **Very young (93% < 40) and in good health**
- **But – have a history of liquidity issues**

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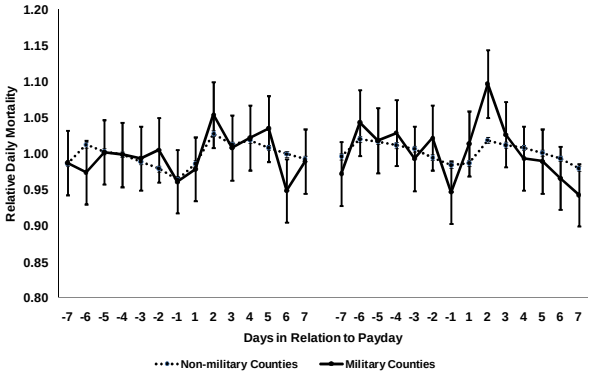
Figure 3:
Daily Mortality Counts in Military and Non-Military Counties, Those Aged 17-64, 1973-1988 MCOD



2001 Tax Rebates

- **Econ. Growth Tax Relief Act, May 2002**
- **↓ tax rate on lowest bracket 15-10%**
- **Applied to 2001 income**
- **In advance of tax cut, households w/ taxable income in 2001 sent rebate checks**
- **Rebates**
  - **$300/$600 for single/married couples**

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Rebate checks

- **Aggregate statistics**
  - **2/3rds of households received a check**
  - **$38 billion**
  - **1.5% GDP**
- **Sent in summer of 2001 - 10 week period**
- **Checks sent based on last 2 digits of SSN of name on 2000 tax form**
- **Last 3 digits determined sequentially within local office – functionally random**

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- $\ln(y_{iw}) = u_i + v_w + \text{Payweek}_{iw} + e_{iw}$
  - **y is counts for week/group cell**
  - **i indexes group, w indexes week**
  - **Control for week effects, group effects**
  - **Dummy for the week checks arrive**
  - **Week effects key due to Sept 11**

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Ln(Mortality Counts) models

	All Deaths	All Deaths	Non-Sub Abuse
Rebate1	0.0269	0.0227	0.0243
	(0.0097)	(0.0098)	(0.0105)
Rebate2		-0.0157	-0.0161
		(0.0098)	(0.0105)
Rebate3		-0.0221	-0.0233
		(0.0098)	(0.0105)
Rebate3		-0.0085	-0.0029
		(0.0098)	(0.0105)
P-value	0.813	0.806	0.829

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Alaska Permanent Fund

- **Started in 1976**
- **Annual dividend payments stated in 1982**
  - **Every resident (at least 1 year)**
  - **Must apply**
  - **Range from $331 (82) to $2068 (08)**
- **Direct deposit start in 1982**
- **By 2000, 2/3 by DD, checks sent same time**

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Ln(Mortality Counts) models

Year	$	% DD	Date DD	Date Chk	% Check That day
2000	$1964	64%	10/4 W	10/5	92%
2001	$1850	66%	10/10 W	10/17	94%
2002	$1541	70%	10/9 W	10/16	93%
2003	$1108	72%	10/8 W	10/15	94%
2004	$920	72%	10/12 T	10/19	92%
2005	$846	73%	10/12 W	10/21	91%
2006	$1107	76%	10/4 W 10/19 T	11/14	98%

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Data

- **Aggregate data to the state/week level**
  - **Alaska and all other states**
- **Construct weekly mortality counts**
- **Weeks start on Tuesday**
- **Start 15 days after labor day**
- **12 weeks of data**
- **12 weeks*2 groups*7 years = 168 observations**

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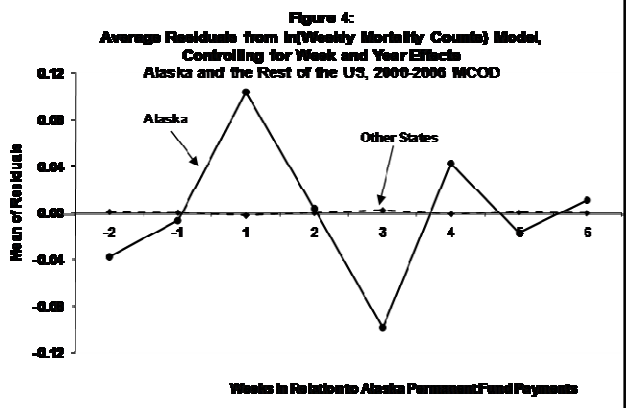

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Ln(Mortality Counts) models Urban Residents

Alaska x	All Deaths	All Deaths
Dividend 1	0.1220	0.1273
	(0.0789)	(0.0732)
Dividend 2		0.0250
		(0.0732)
Dividend 3		-0.0843
		(0.0732)
Dividend 4		0.0810
		(0.0732)

100

Paradox

- At the individual level, income appears to be 'protective'
  - Those with higher incomes have lower mortality
- At the country level, once income passes a certain threshold, appears to be little benefit to more income
- Why?

101

- How might there be a reverse causation between health and income? Might it be the case that poor health reduces income?
- What psycho-social factors does Marmot argue explain the income/health relationship?

102

Two facts

- Within country, strong relationship between income/health, education/health
  - True at all levels of income
  - Even when income is at a high level, mortality falls with higher incomes
- Between countries, once income crosses certain threshold, little relationship
  - Marmot places that number at $50K
  - Look at Graph, somewhere around $30K/capita
- What can explain these facts?

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Whitehall study

- Longitudinal data of British civil servants
  - High income, stable employment, good neighborhoods, universal health insurance
- Even in this incredibly homogenous, well to do group, relative standing matters
- Mortality is correlated with employment grade

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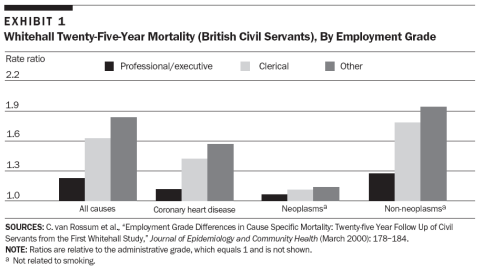

105

What might explain this relationship?

- **Social standing matters – that is – relative position within a community**
- **Why?**
  - **Stress of being left behind, not keeping up with the Jones, not being in control of your destiny**
  - **Maybe take comfort in cigarettes, alcohol, dish of ice cream**
- **Income is a measure of social standing. No picking up causal impact of income, but rather, social standing**

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This may explain cross-country/within country results

- **Within a country, income is measuring relative social standing**
- **We should expect to see a strong + relationship between income and health**
- **However when comparing across countries income means little since people in US compare themselves to people in the US, people in Korea use Koreans as their frame of reference**

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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"**

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Example

- **Suppose all income in a country is increased by 10% over a 10 year period**
- **If income is causal, then mortality for all people should fall**
- **Suppose relative standing matters**
- **Then there should be little change in mortality since relative ranking has not changed**

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Table 1. Baseline Characteristics*

Characteristic	Winners (n = 235)	Nominees (n = 527)	Controls (n = 887)
	← % →		
Birth year			
Before 1900	14	15	17
1900–1919	33	18	28
1920–1939	28	34	30
1940–1959	19	24	19
1960–1979	6	8	6
1980–1999	0	0	0
Male sex	50	51	56
White ethnicity	97	96	97
Birth in the United States	69	69	74
Change in birth name	29	23	9
Age at making of first film			
<10 y	2	3	2
10–19 y	15	18	11
20–29 y	51	50	45
30–39 y	26	21	29
40–49 y	5	6	8
≥50 y	1	2	4

* Data may not add to 100% because of rounding.

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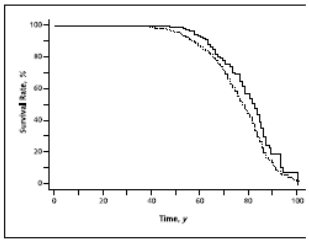
Figure. Survival in Academy Award–winning actors and actresses (*solid line*) and controls (performers who were never nominated) (*dotted line*), plotted by using the Kaplan–Meier technique.



Analysis is based on log-rank test comparing 235 winners (99 deaths) with 887 controls (452 deaths). The total numbers of performers available for analysis were 1122 at 0 years, 1096 at 40 years, 762 at 60 years, and 240 at 80 years. $P = 0.003$ for winners vs. controls.

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Table 3. Analysis of Death Rates

Analysis	Relative Reduction in Mortality Rate (95% CI), %*
Winners compared with controls	
Basic analysis	28 (10–42)
Adjusted for birth year	27 (9–41)
Adjusted for sex	27 (10–42)
Adjusted for ethnicity	27 (10–42)
Adjusted for all 3 demographic factors	26 (8–40)
Adjusted for birth country	27 (10–42)
Adjusted for possible name change	27 (8–41)
Adjusted for age at first film	26 (7–40)
Adjusted for total films in career	27 (9–42)
Adjusted for all 4 professional factors	25 (5–40)
Adjusted for all 7 factors	23 (2–38)
Winners compared with nominees	
Basic analysis	25 (5–41)
Adjusted for birth year	24 (4–40)
Adjusted for sex	27 (7–42)
Adjusted for ethnicity	25 (5–41)
Adjusted for all 3 demographic factors	26 (6–42)
Adjusted for birth country	26 (6–41)
Adjusted for possible name change	26 (6–42)
Adjusted for age at first film	25 (5–41)
Adjusted for total films in career	23 (2–39)
Adjusted for all 4 professional factors	24 (3–40)
Adjusted for all 7 factors	22 (0–38)

* Proportional hazards analysis.

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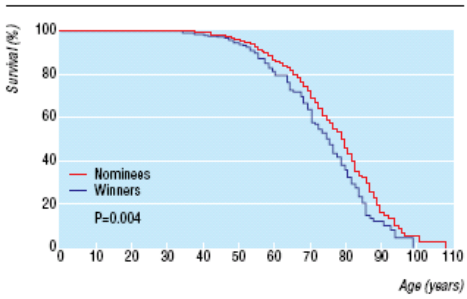

Survival of winners and nominees of academy awards for screenwriting. The graph shows the percentage of each group alive, plotted by using the Kaplan-Meier technique. Primary statistical analysis is based on a log rank test comparing winners to nominees (n=185, deaths=112 and n=610, deaths=316, respectively)

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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**
  - **Compete 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)**

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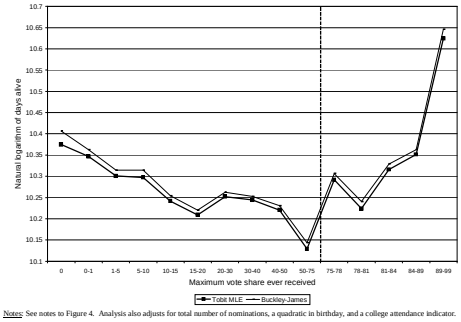
Sample

- **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)**

115

Adjusted life duration by maximum vote share

Log-days alive adjusted for additional variables, including # of "close losses" & veterans induction



Notes: See notes to Figure 4. Analysis also adjusts for total number of nominations, a quadratic in birthday, and a college attendance indicator.

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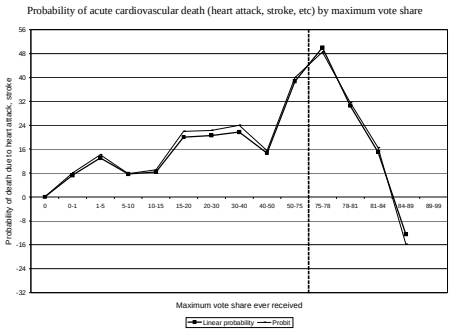
Cause of death by maximum vote share



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