

Income and Health I: Health, income, causation, and correlation Hurley: parts of Chapters 5 and 6

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Economics 318

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A production function for health

- ▶ It is useful to model a person (or a population's) health as a function of the causes of health
- ▶ A stylized health production function

$$HS = f(HC, L, E, G) \quad (1)$$

where HS is health status, HC health care, L is lifestyle, E is environment, and G is genetics.

- ▶ A person's income is an important determinant of their lifestyle, environment, and possibly health care quality and quantity.

Personal income and health

- ▶ A possibly important cause of health is income:
- ▶ Buy health-improving stuff, e.g., pharmaceuticals, good housing and food, uncovered treatments, gym memberships.
- ▶ Higher labor income increases investment demand for health (Grossman).
- ▶ Higher income may directly cause better health through reducing stress.

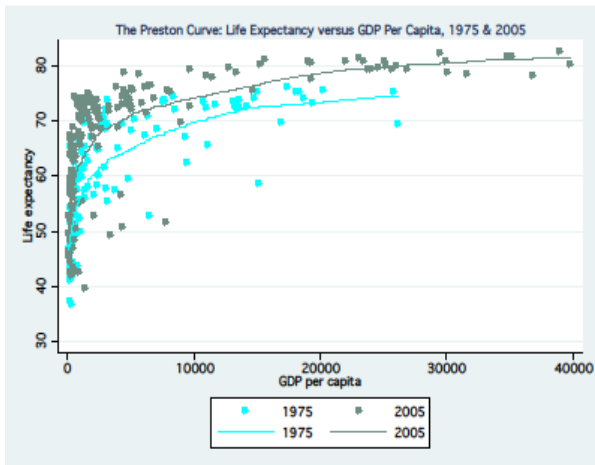
Policy implications.

- ▶ If increasing someone's income leads to better health, economic policies indirectly affect health.
- ▶ Income distribution and related policies in particular may be important in determining population health.
- ▶ If, however, income does not **cause** health, then changing people's incomes will not affect their health.

Correlation and causation.

- ▶ We are most interested in finding out how the **causal effect** of income on health.
- ▶ We may also be interested in the “reverse” effect of health on income.
- ▶ It is relatively easy to show statistically that income and health are positively **correlated**, but this correlation tells us nothing about causal effects.

Figure 6.5: Relationship between GDP-per-capita and Life-Expectancy, Selected Countries, 1975 and 2005



Source: Data sources: (United Nations Statistics Division 2009); curves based on author's calculations.

Figure 6.5. These data document two features of the relationship between GDP-per-capita and life expectancy: the highly non-linear relationship among countries at a given point in time, with rapid gains in life expectancy at low incomes followed by a flattening of the curve; and the gradual shift up in the relationship over time.

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Figure: Income category and self-reported general health
(1=excellent, 2=very good, 3=good, 4=fair, 5=poor). BRFSS
2007.

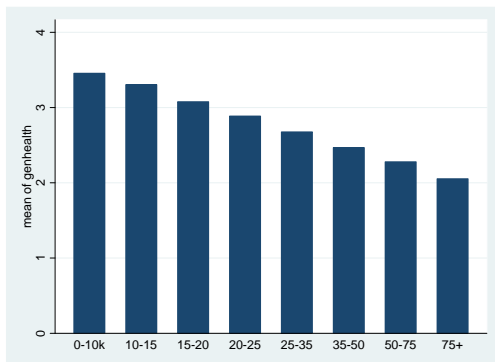


Figure: Source: Case and Deaton, 2005.

Fig. 6.1 Self-reported health status by age and sex, NHIS 1986–2001

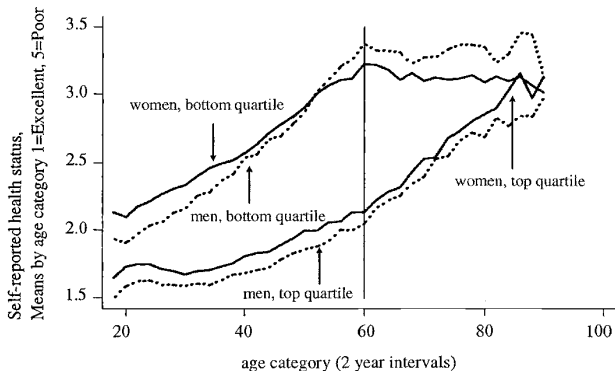


Fig. 6.2 Self-reported health status by age, sex, and income quartile, NHIS 1986–2001

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Figure: Income category and poor mental health days per month. BRFSS 2007.

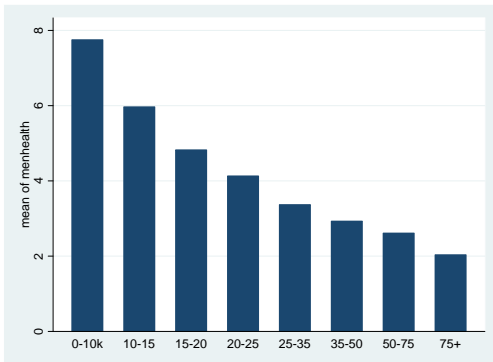


Figure: Income category and proportion daily smokers. BRFSS 2007.

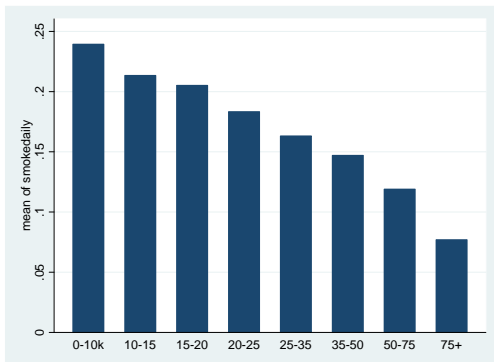
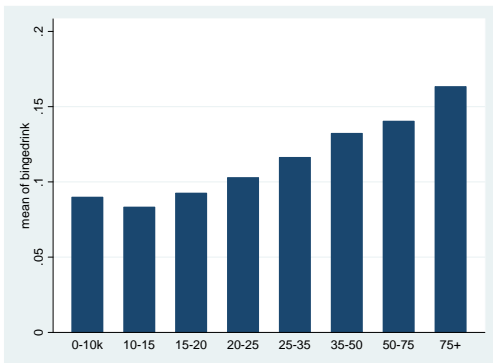


Figure: Income category and proportion who binge drink. BRFSS 2007.



Correlation does not imply causation.

- ▶ Suppose we find that A and B are positively correlated. What can we conclude?
 - ▶ It could be the case that A causes B.
 - ▶ It could be the case that B causes A.
 - ▶ It could be the case that neither A causes B nor B causes A, but rather A and B have a common “third” cause (aka “unobserved confounders,” “omitted variables,” “unobserved heterogeneity.”)

- ▶ In our income and health problem, correlated because:
 - ▶ Higher incomes cause health, through better living standards?
 - ▶ Higher health causes higher incomes, since poor health leads to lower wages and chances of employment?
 - ▶ Third variables, such as education or genetic factors, lead to both higher income and better health?

Why do we care?

- ▶ Almost all interesting problems in economics (and in medicine) require we understand the underlying causal mechanisms.
- ▶ Here: **if and only if** income causes health, then income redistribution and other policies which affect income will also affect health.
- ▶ The fact that income and health are correlated does not allow us to conclude that changing people's incomes would change their health.

Direction of causality?

- ▶ Either a positive effect of A on B **or** a positive effect of B on A will lead to (other things equal) a positive correlation between A and B.
- ▶ Here: maybe giving people more income causes their health to rise, or maybe more health causes people to earn higher incomes?
- ▶ Getting the direction wrong can lead to serious errors, e.g., aspirin causes headaches.



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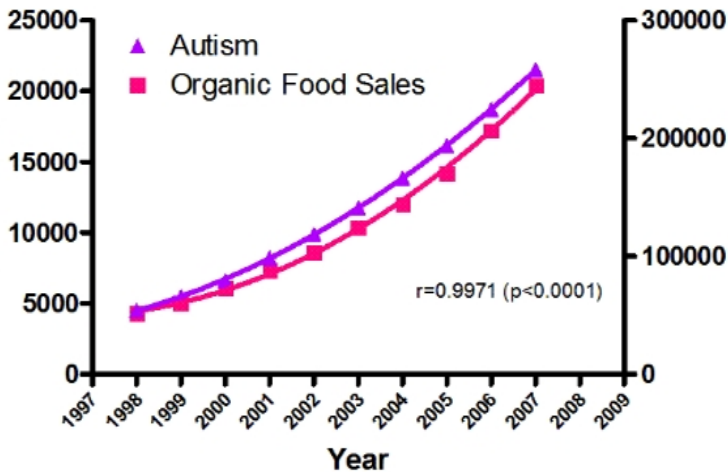
[Hold the Diet Soda? Sweetened Drinks Linked to Depression](#)

New research suggests that drinking sweetened beverages, especially diet drinks, is associated with an increased risk of depression in adults while drinking coffee was tied to a slightly lower risk.

The study was released today and will be presented at the [American Academy of Neurology's](#) 65th Annual Meeting in San Diego, March 16 to 23, 2013. "Sweetened beverages, coffee and tea are commonly consumed worldwide and have important physical—and may have important mental—health consequences," said study author Honglei Chen, MD, PhD, with the National Institutes of Health in Research Triangle Park in North Carolina and a member of the American Academy of Neurology.

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ources: Organic Trade Association, 2011 Organic Industry Survey; U.S. Department of Education, Office of
ication Programs, Data Analysis System (DANS), OMB# 1820-0043. *Children with Disabilities Receiving
ication Under Part B of the Individuals
Disabilities Education Act

Third causes.

- ▶ Fires to which more firemen respond tend to cause more \$ damage. Does this mean more firemen cause more damage?
- ▶ People who watch more TV are, on average, not as smart as people who watch less TV. Evidence that watching TV makes you dumb?
- ▶ Adolescents who play more violent video games are more likely to be violent. Causal at all? Causal direction?

A simple example of a “third cause”:

- ▶ Suppose we live in a world where health (H) is determined only by income (Y) and by IQ. Generally,

$$H = f(Y, IQ) \quad (2)$$

In the interest of simplicity, assume this relationship is linear,

$$H = aY + bIQ \quad (3)$$

Example cont.

$$H = aY + bIQ \quad (4)$$

This equation says:

- ▶ A one-unit increase in Y causes an a unit increase in H , holding IQ constant.
- ▶ A one-unit increase in IQ causes a b unit increase in h , holding Y constant.

Suppose we have data on health and income, but we do not observe IQ , which varies across people.

If $a = 0$, so that there is by assumption no causal effect of income on health, does that imply we will find no association in the data between income and health?

Example cont.

- ▶ Suppose this process drives health,

$$H = 0(Y) + 2(IQ). \quad (5)$$

- ▶ Increasing income by one unit, holding IQ constant, causes health to rise by **zero** units.
- ▶ Increasing IQ by one point, holding income constant, causes health to rise by 2 units.

- ▶ Suppose further that income is also caused by IQ:

$$Y = 3(IQ) \quad (6)$$

- ▶ So in this world, income does **not** cause health, but income and health are both caused by IQ.
- ▶ What will we see in data on income and health?

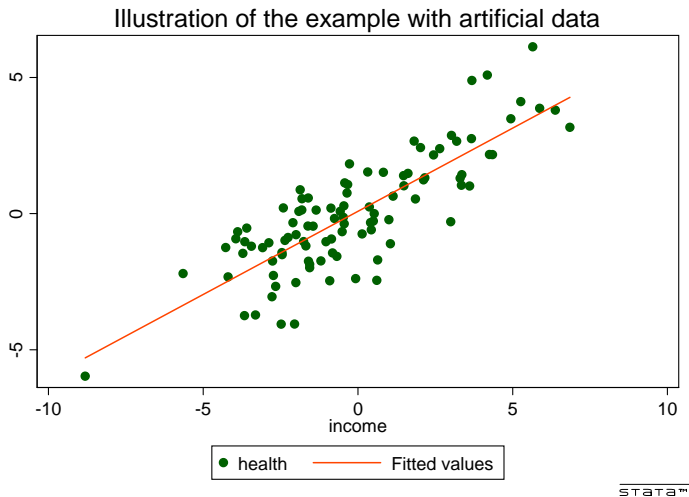


Illustration of the numerical example. There are 100 simulated people, the causal effect of income on health is **zero**, and some noise has been added to make the graph look more realistic.

- ▶ We have

$$H = 2(IQ) \quad (7)$$

$$Y = 3(IQ) \quad (8)$$

$$\rightarrow H = (2/3)Y \quad (9)$$

so in our data we will see that health and income are **positively correlated**.

- ▶ But what happens to health in this world if a person's income goes up? Nothing!

Health econometrics.

- ▶ In the example, if we observe IQ, statistically holding IQ constant would make the correlation between health and income go away. (“Regression” techniques.)
- ▶ Most research in health economics is econometric: Research using statistical methods to try to uncover causal relationships.
- ▶ Usually we have to go beyond just holding other things constant, because we can rarely observe all “third causes.”

When can we claim to have found a causal relationship?

- ▶ Suppose we could determine people's incomes by flipping a coin: if heads we make their income high, if tails we make income low.
- ▶ If we find that income and health are correlated in this world, we know income causes health.
- ▶ Why? We know that health does not “reverse” cause income, because health does not affect the coin.
- ▶ And we know that there can not be “third variables” (like IQ) correlated with income, because the coin flips are uncorrelated with everything.

Causation in health econometrics.

- ▶ Shows importance of experimental randomization—Randomized Controlled Trials (RCTs).
- ▶ Often stuff just happens which is for our purposes is as good as a controlled experiment, but it isn't controlled:
 - ▶ Are lottery winners healthier than lottery losers?
 - ▶ Do changes in cigarette **taxes** lead to changes in wages?
 - ▶ Is a kid forced by law to stay in school until age 15 healthier than one who can drop out at 13?