L&S 39G

Health, Human Behavior, and Data

Prof. Ryan Edwards

Class 5

September 29, 2015

Today's agenda

- Some quick i>clicker questions about the readings
- Kyle on the reading
- Probability density distributions (pdf's)
- More in depth on the readings

Sep 8	Bhattacharya chaps 1-2	Alastair & Catherine	Oct 27	Ashenfelter & Ziliak	
Sep 15	Cutler et al. and Wachter	Eric & Natalie	Nov 3	Ruhm	
Sep 22	Bhattacharya chap 3	Catherine & Kyle	Nov 10	Small & Rosenbaum	
Sep 29	Bhattacharya chap 4	Kyle	Nov 17	Buckles & Hungerman	
Oct 6	Sutton and Bartholomew		Nov 24	Carpenter & Dobkin	
Oct 13	Aron-Dine et al.		Dec 1	Edwards & Mason	
Oct 20	Oster				

i>clicker question 5.1

In countries with universal health insurance and care, are there any disparities in health between rich and poor people?

A. Yes, and they're probably just as large as in the U.S. where health insurance isn't universal

B. Yes, but they're probably not as large

C. No, health disparities are unique to the U.S.

D. No, income and wealth inequalities are unique to the U.S.

i>clicker question 5.2

Who tends to have worsened health in a hierarchy? The leaders at the top or the followers down below?

A. The leaders because they get no exercise

B. The leaders because they get stressed out

C. The followers because they get stressed out

D. The followers because they started with poor health

i>clicker question 5.3

Is it good or bad to be *in utero* during a great cataclysm like a famine?

A. Good. You're just a fetus and don't have to "eat"

B. Good. There will be fewer surviving fetuses with whom to compete

C. Good. Whatever doesn't kill you makes you stronger

D. Bad. Your mother's body might make you a fat infant

E. Bad. Your body might adapt to a starvation diet

Normal a.k.a. Gaussian distributions & the Central Limit Theorem

- When you take an average (or sum) of independently distributed random variables …
- Like a six-sided dice roll

- The average (or sum) tends to be distributed normally when the number of those random variables gets sufficiently large
- Imagine health is the result of a bunch of dice rolls, kind of like the height of a tree based on weather

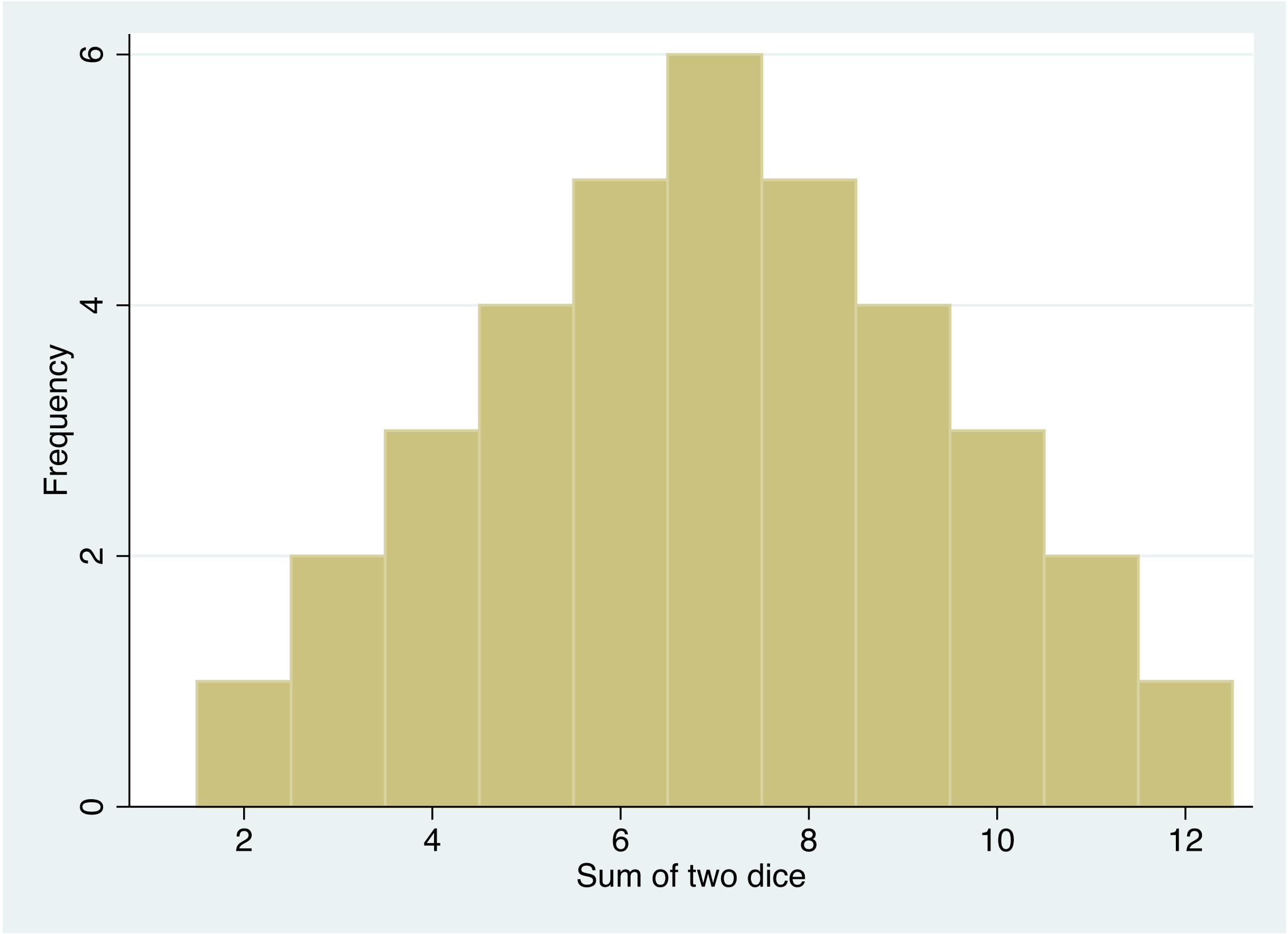
Rolling one dice

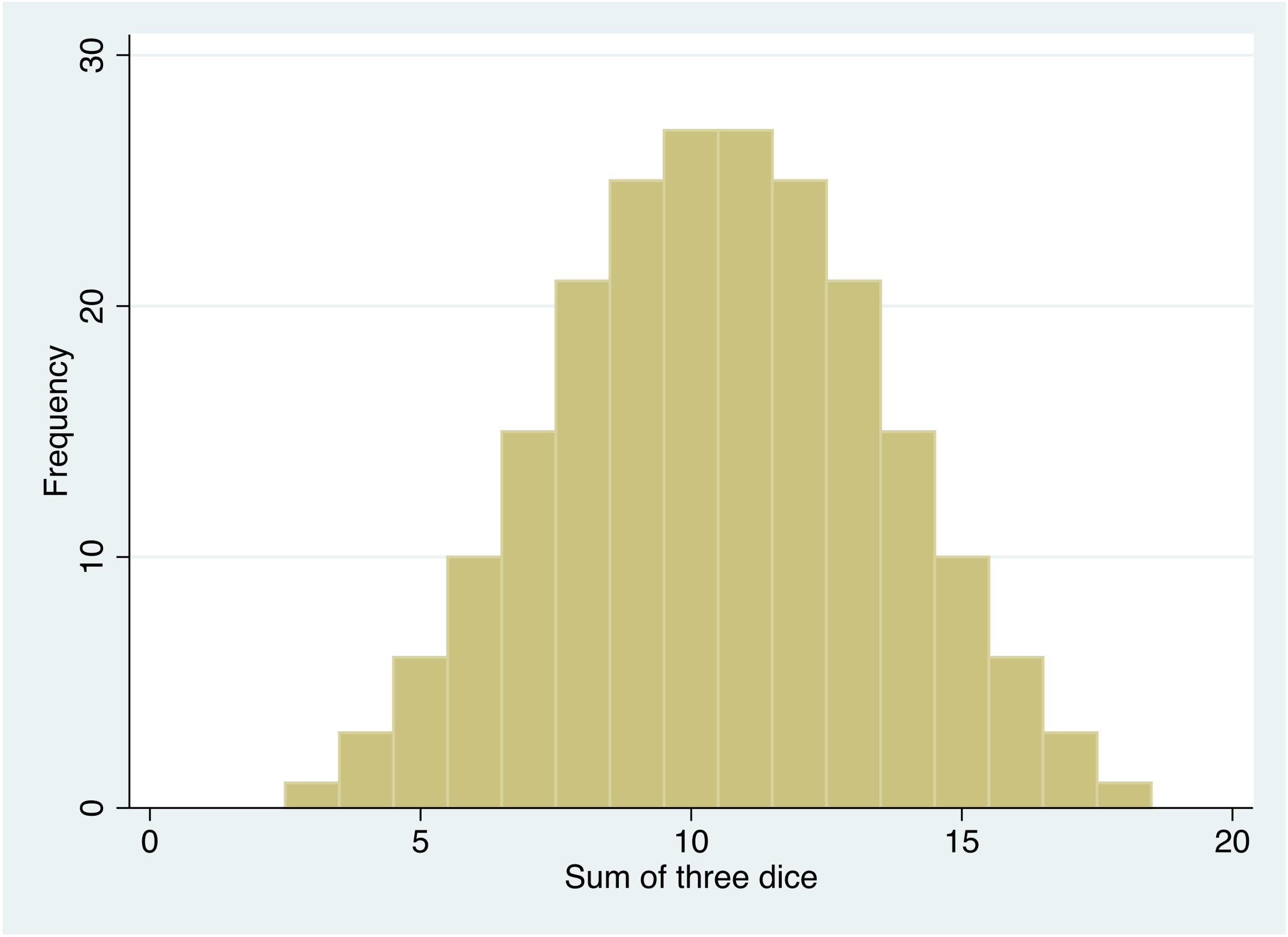
	1	2	3	4	5	6
sum	1	2	3	4	5	6
probability	1/6	1/6	1/6	1/6	1/6	1/6

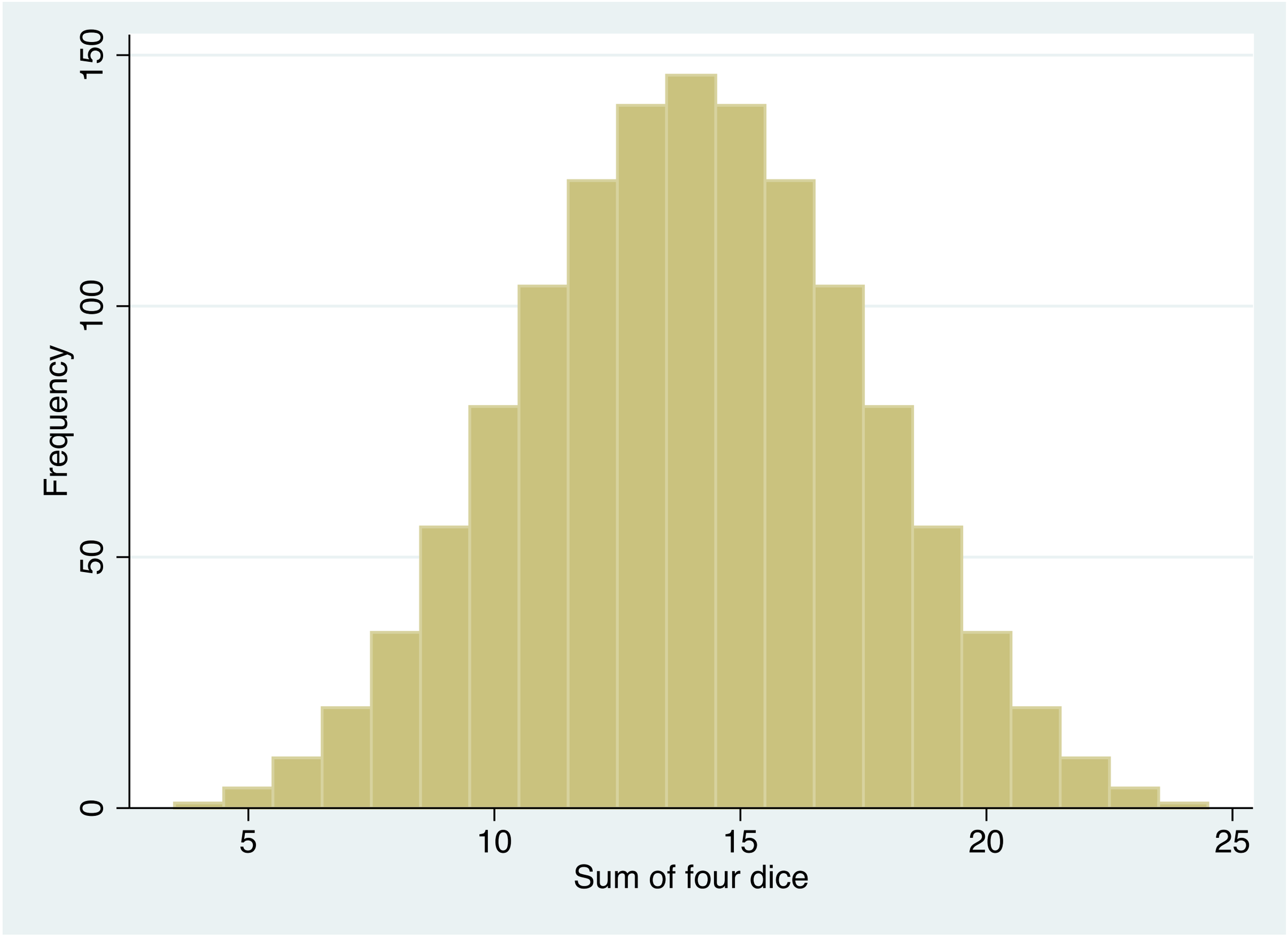
Pretty boring, what's called a **uniform** distribution

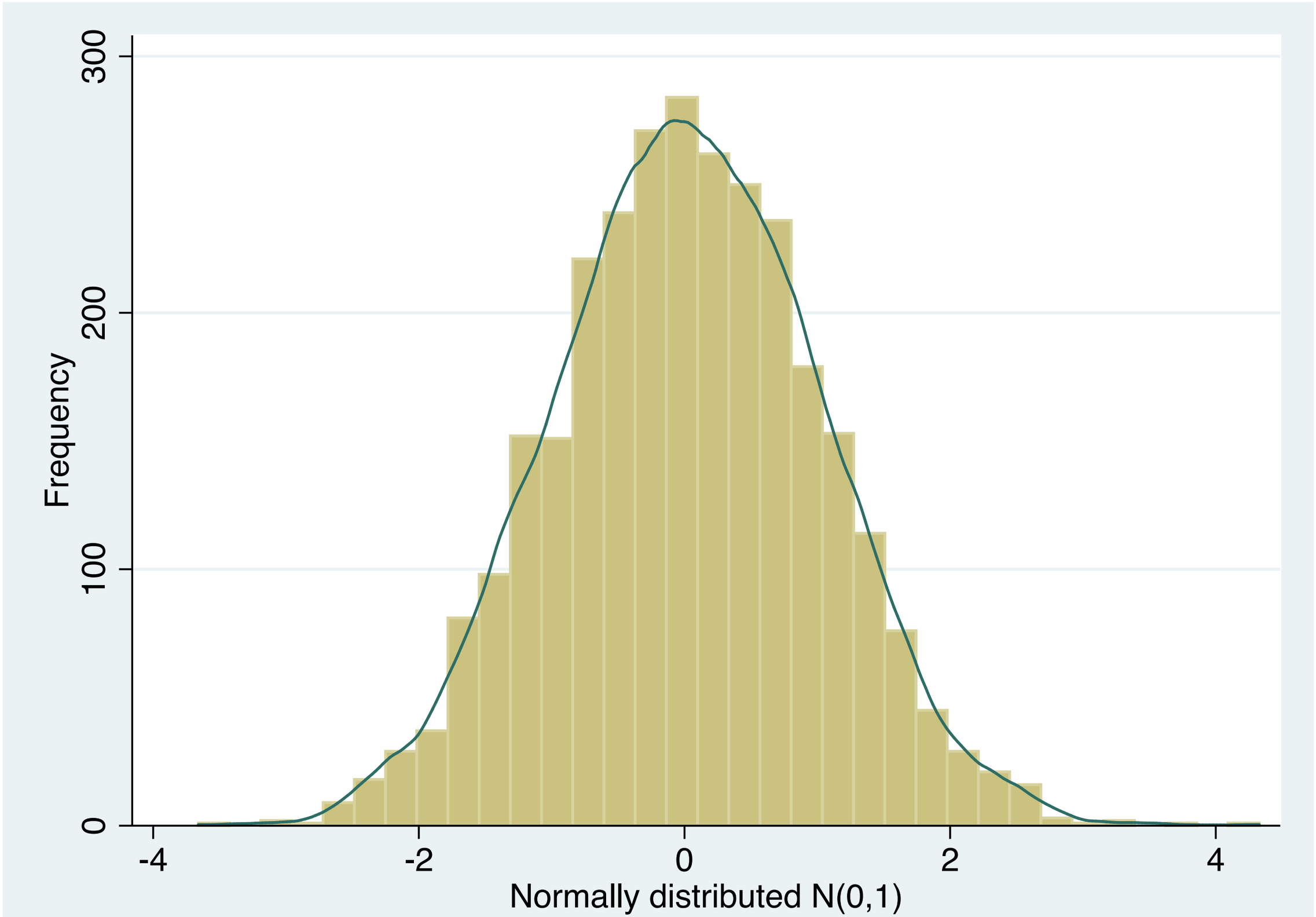
Rolling two dice and adding their results

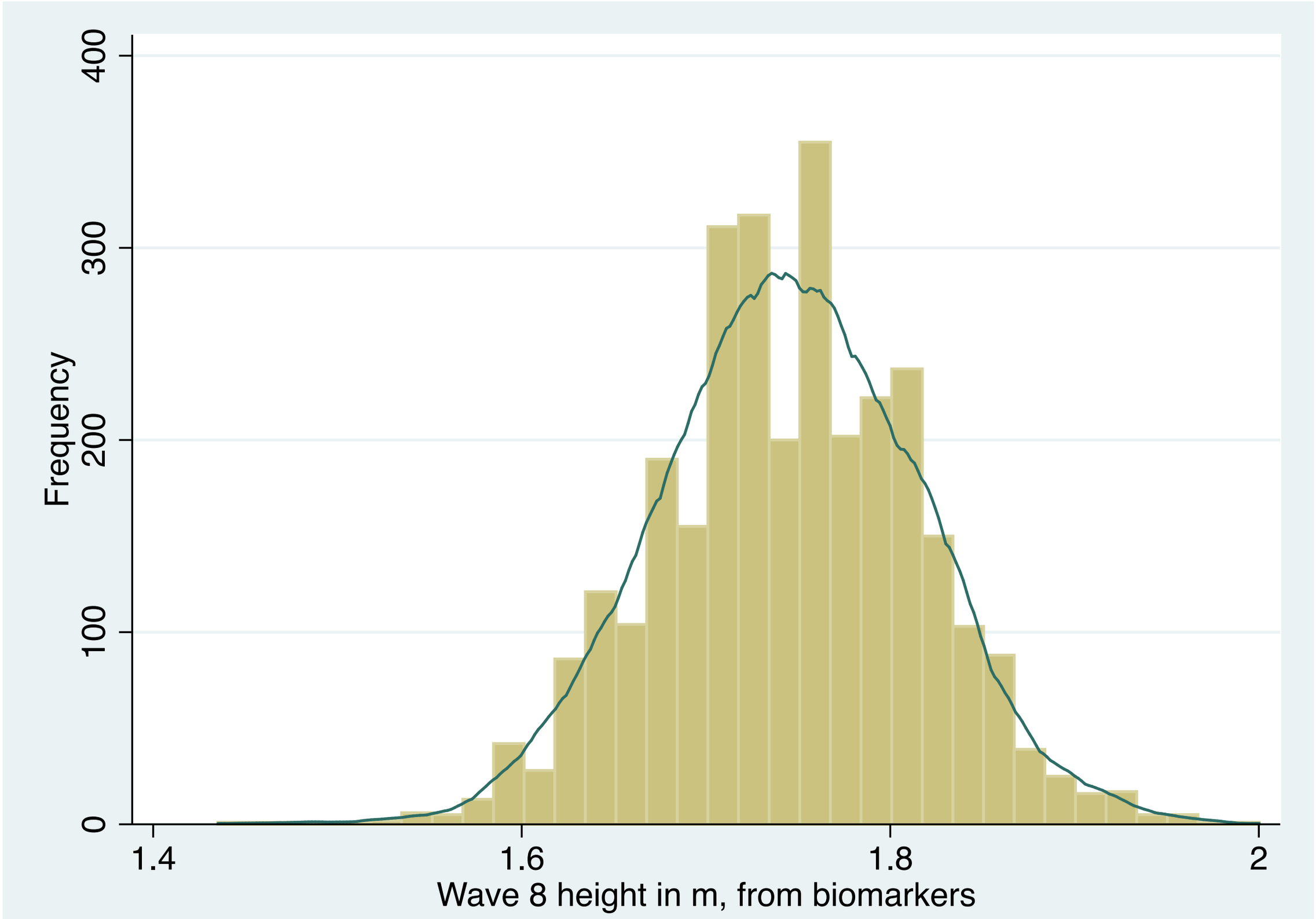
	1	**2**	**3**	**4**	**5**	**6**
1	2	3	4	5	6	7
2	3	4	5	6	7	8
3	4	5	6	7	8	9
4	5	6	7	8	9	10
5	6	7	8	9	10	11
6	7	8	9	10	11	12

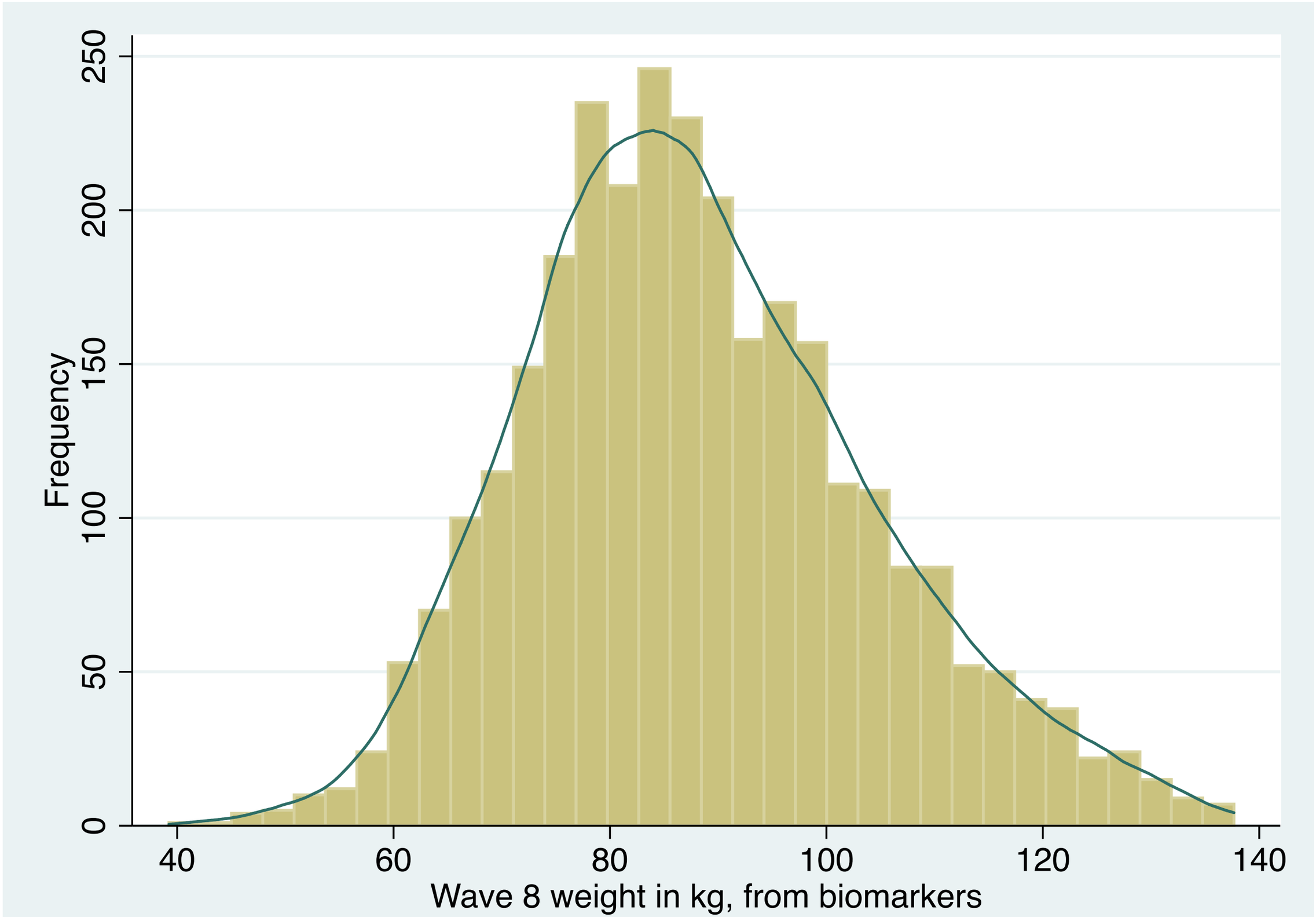

Frequency
0
2
4
6
2
4
6
8
10
12
Sum of two dice

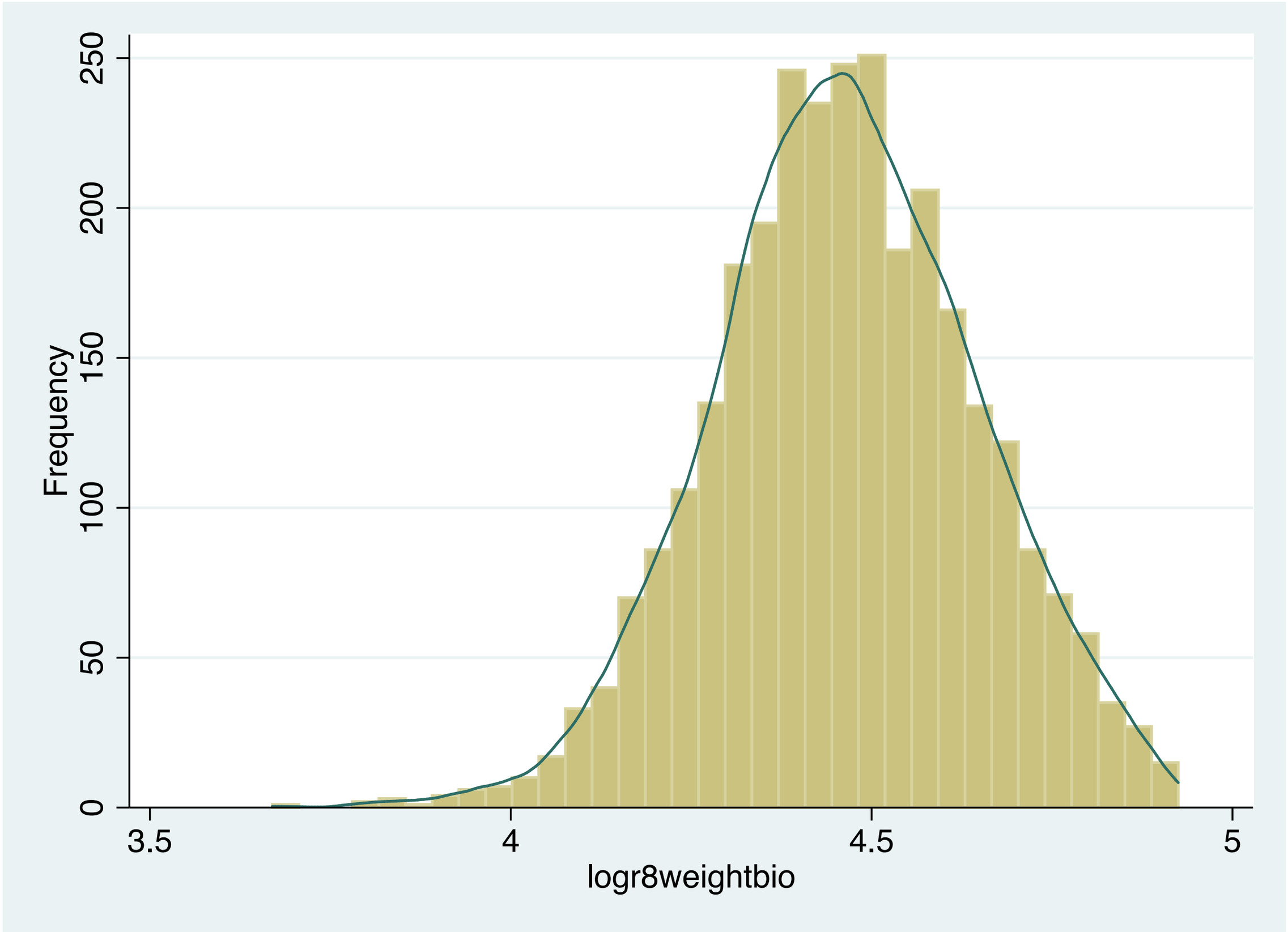

Frequency
0
10
20
30
0
5
10
15
20
Sum of three dice


Frequency
0
50
100
150
5
10
15
20
25
Sum of four dice


Frequency
0
100
200
300
-4
-2
0
2
4
Normally distributed N(0,1)


Frequency
0
100
200
300
400
1.4
1.6
1.8
2
Wave 8 height in m, from biomarkers


Frequency
0
50
100
150
200
250
40
60
80
100
120
140
Wave 8 weight in kg, from biomarkers


Frequency
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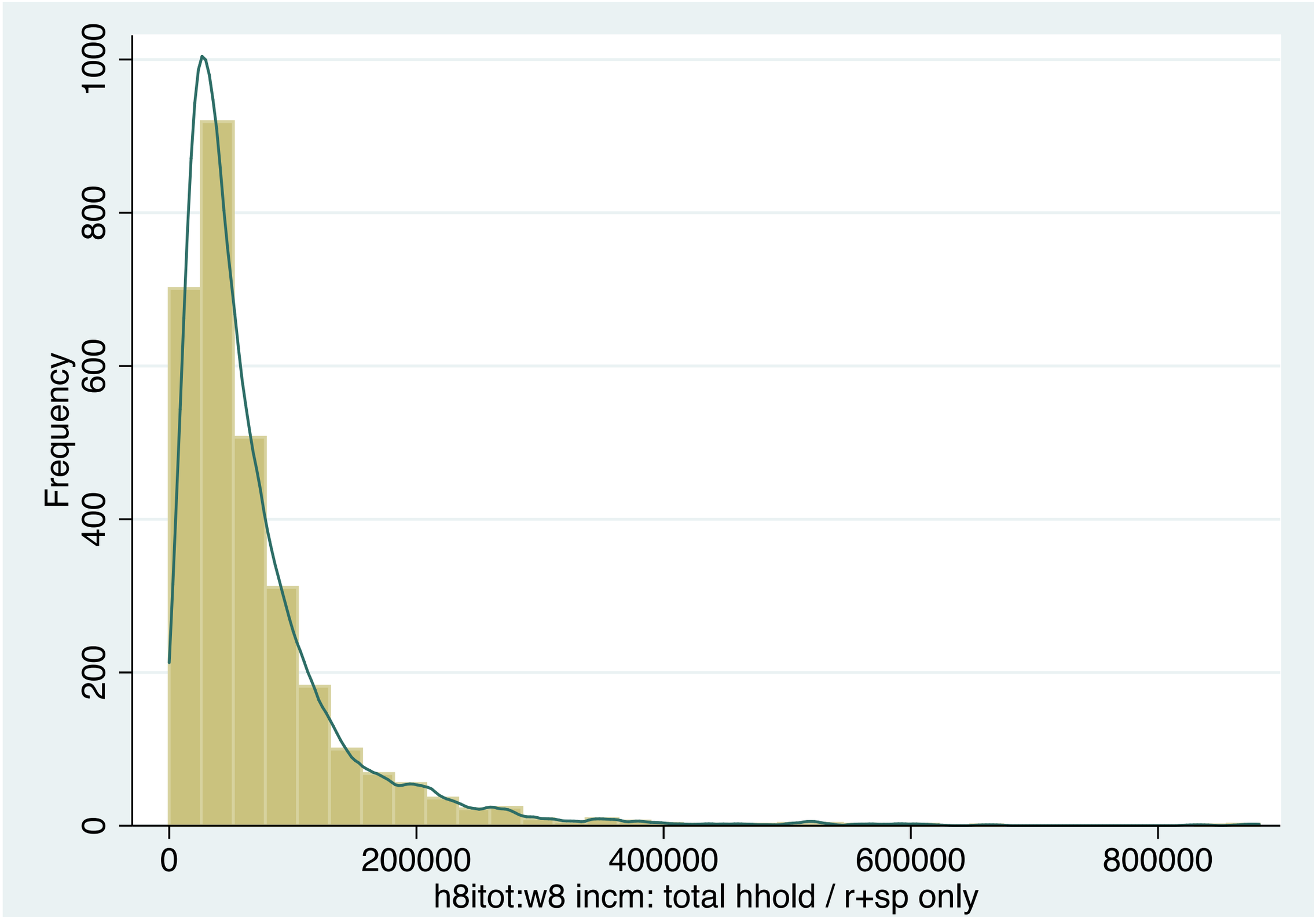
100
150
200
250
3.5
4
4.5
5
logr8weightbio


Frequency
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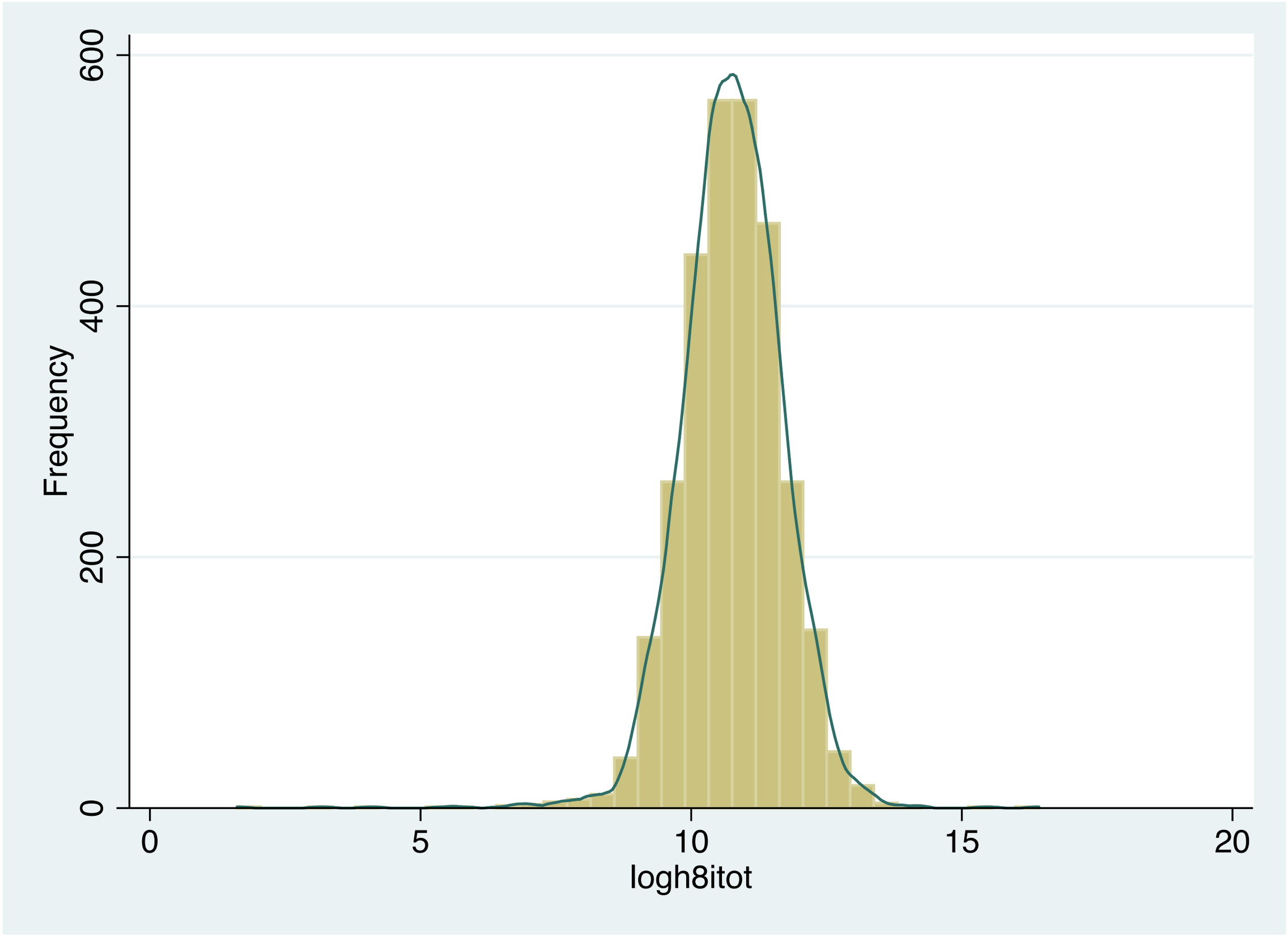
600
800
1000
0
200000
400000
600000
800000
h8itot:w8 incm: total hhold / r+sp only


Frequency
0
200
400
600
0
5
10
15
20
logh8itot

From the reading, *survivorship* differences by education

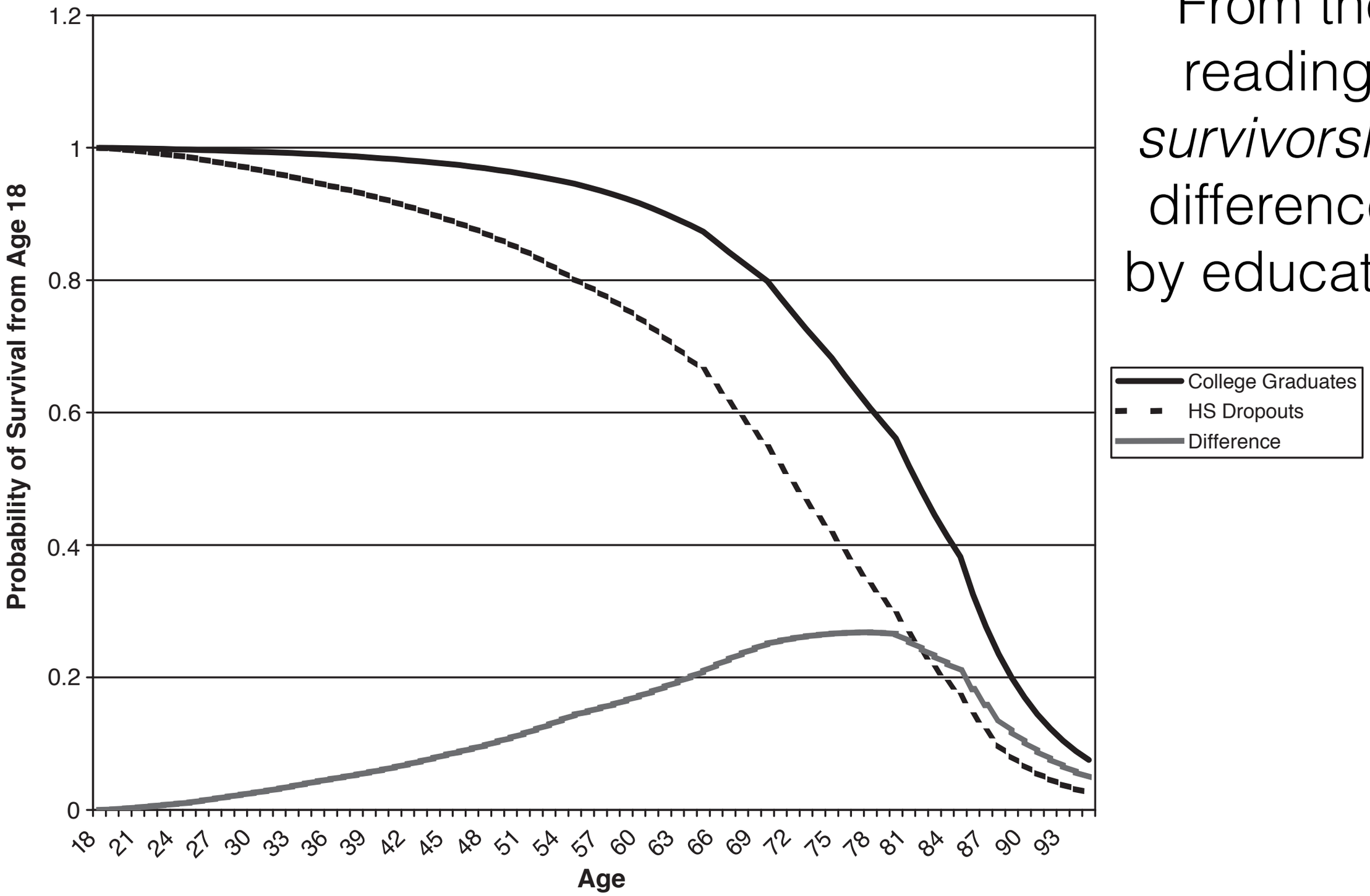
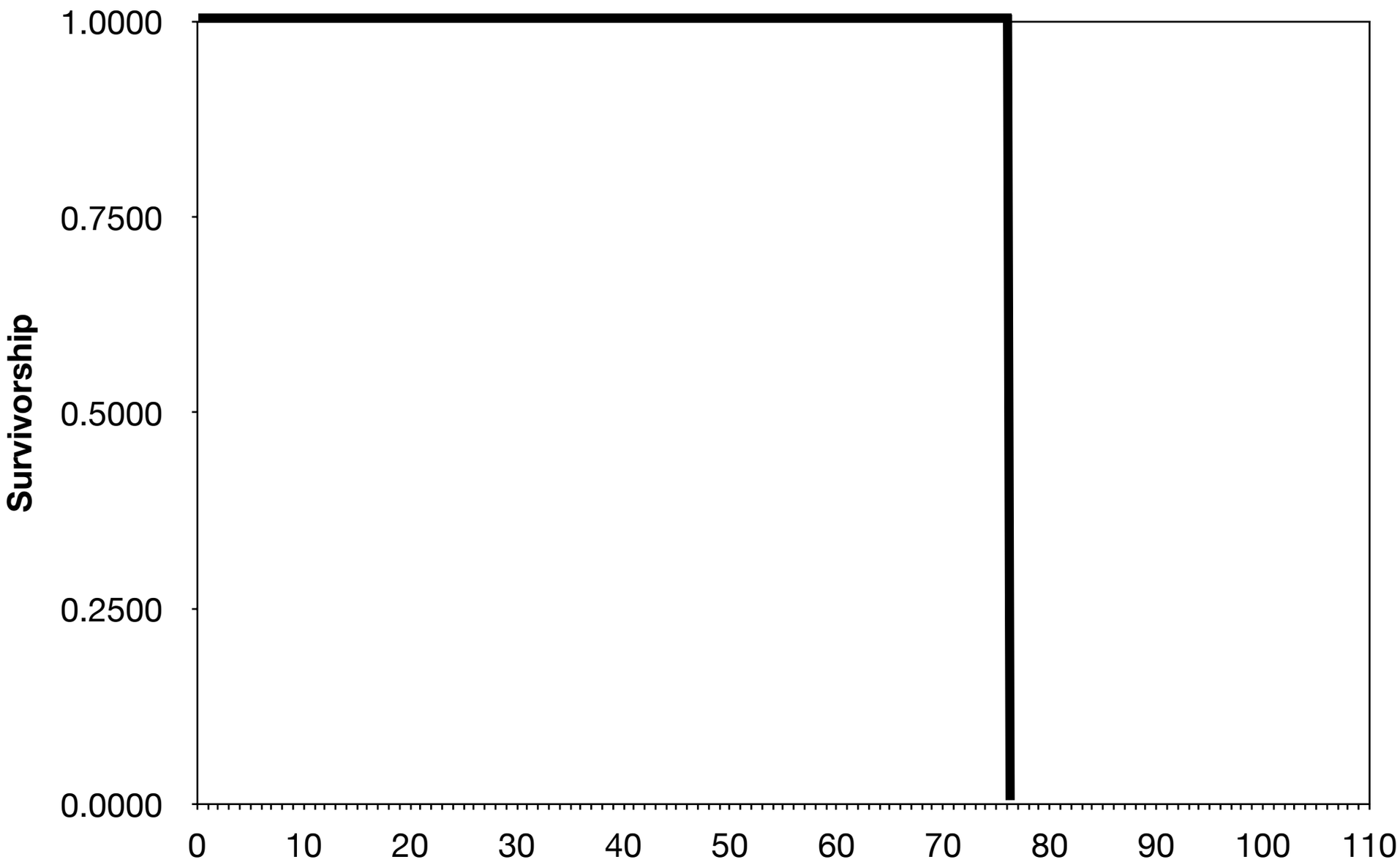
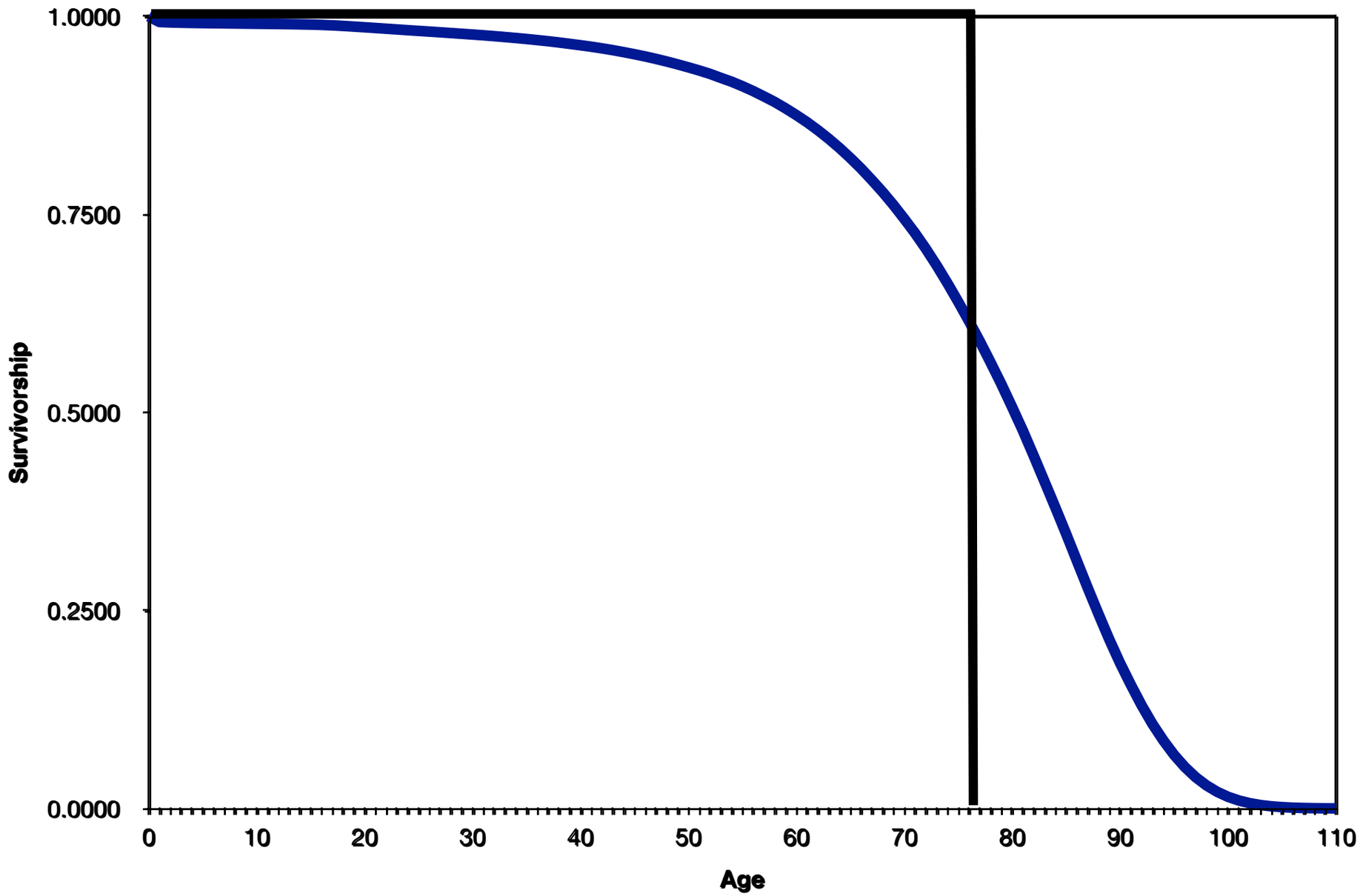


Fig. 1. Male survival curves by education.

If life span were certain, then survivorship would be "rectangularized," falling off a cliff at life expectancy, e_0

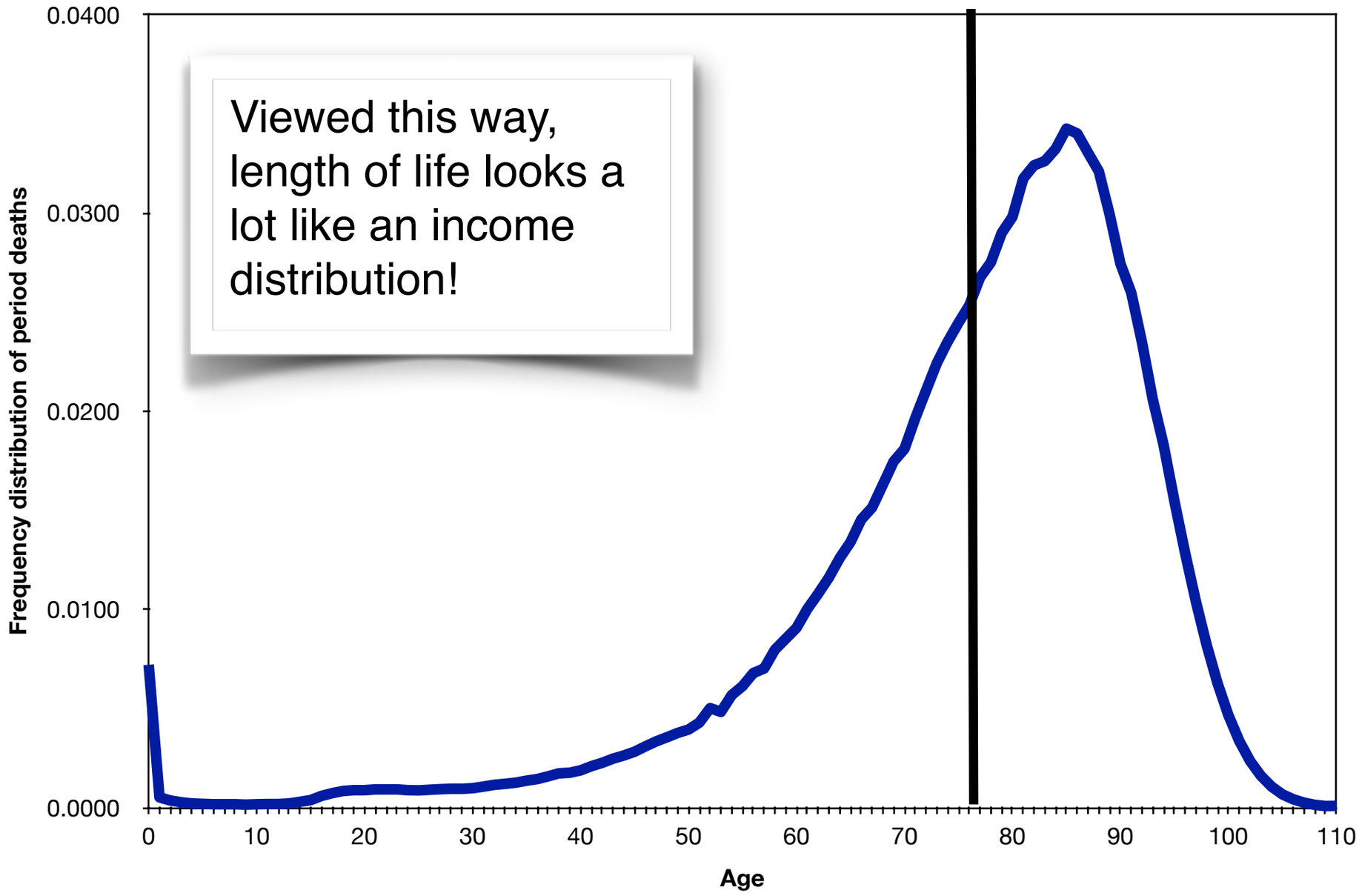


In reality, survivorship (the cdf) slopes gently, reflecting uncertainty in length of life: early death or “winning the lottery”



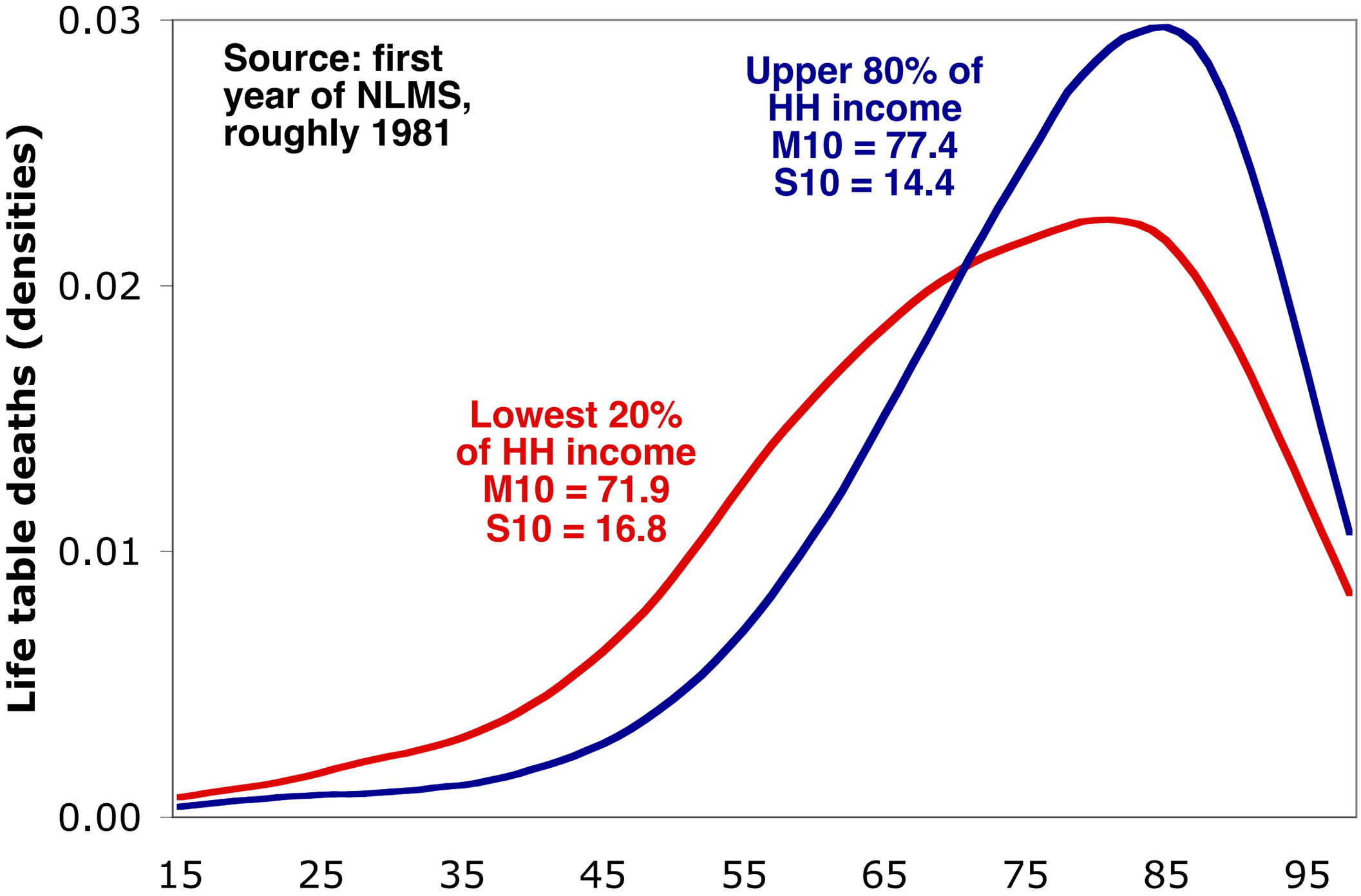
Data: U.S., both sexes combined, 1999

Life table deaths (the pdf) show variance in length of life around the mean, e_0

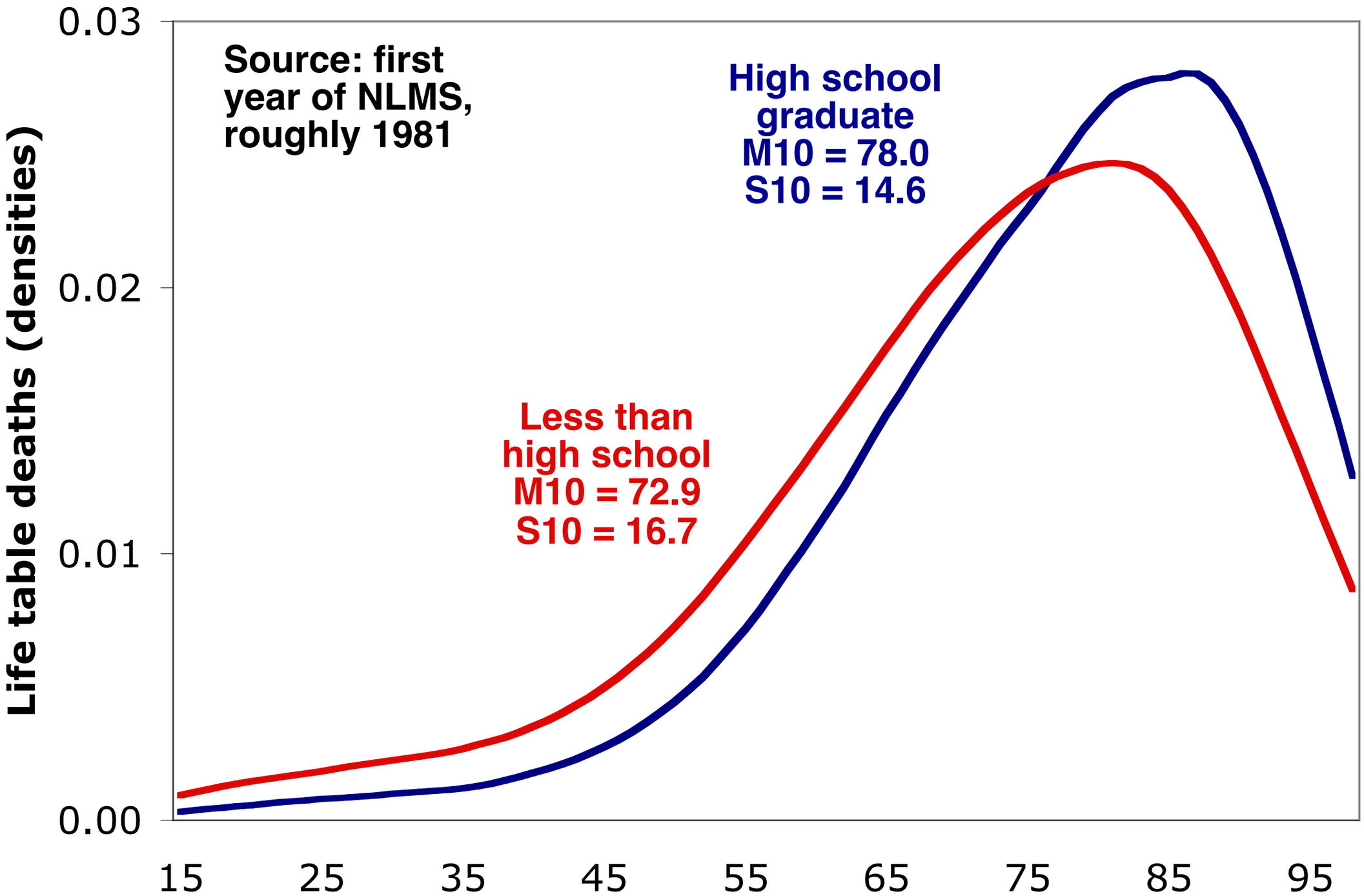


Data: U.S., both sexes combined, 1999

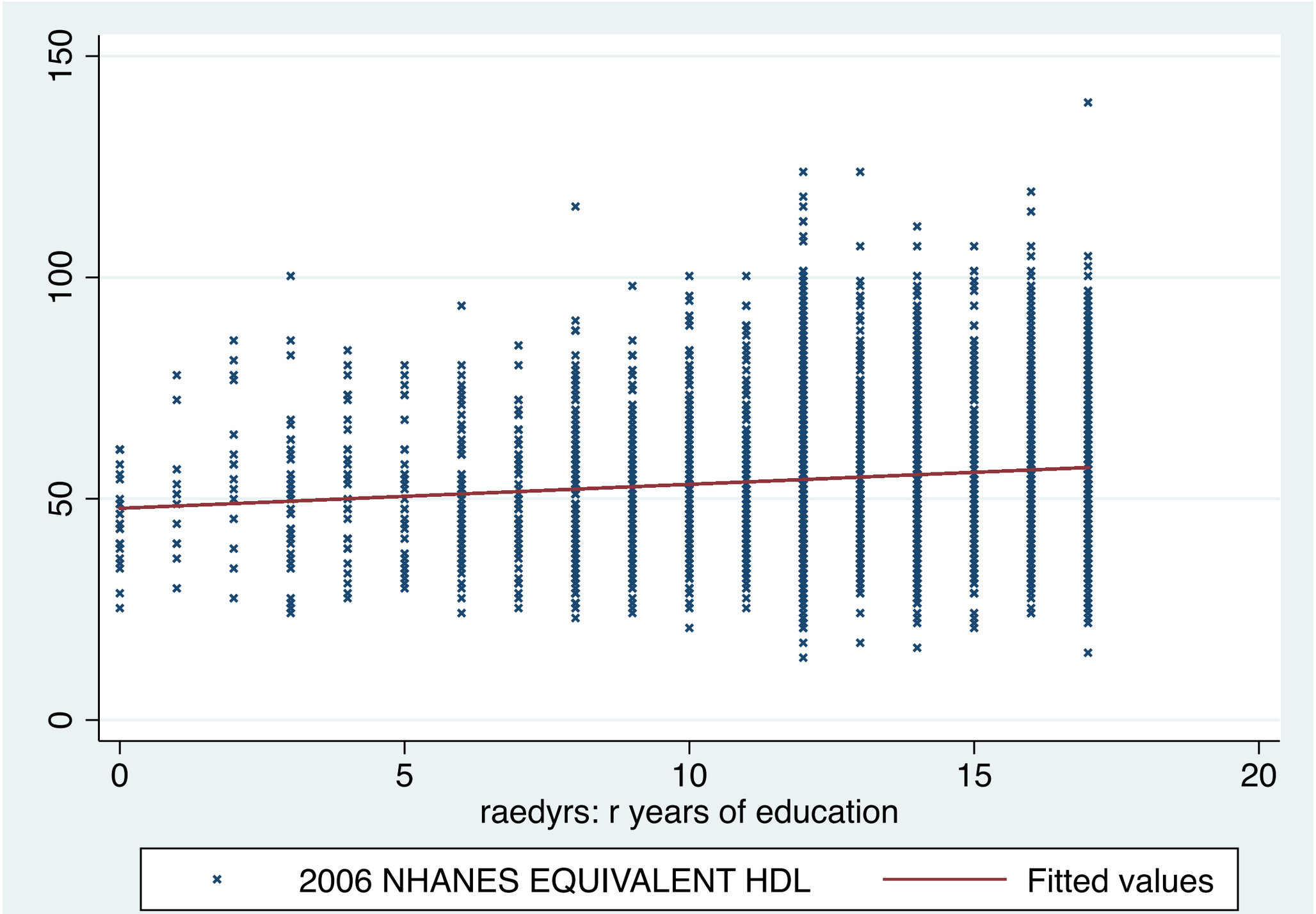
Within the U.S., low-income groups suffer lower average length of life AND higher variance



Less educated groups also suffer lower mean life span and higher variance



There are educational gradients in lots of things; Here, HDL cholesterol, protective against heart disease



Historically, disparities since the late Enlightenment

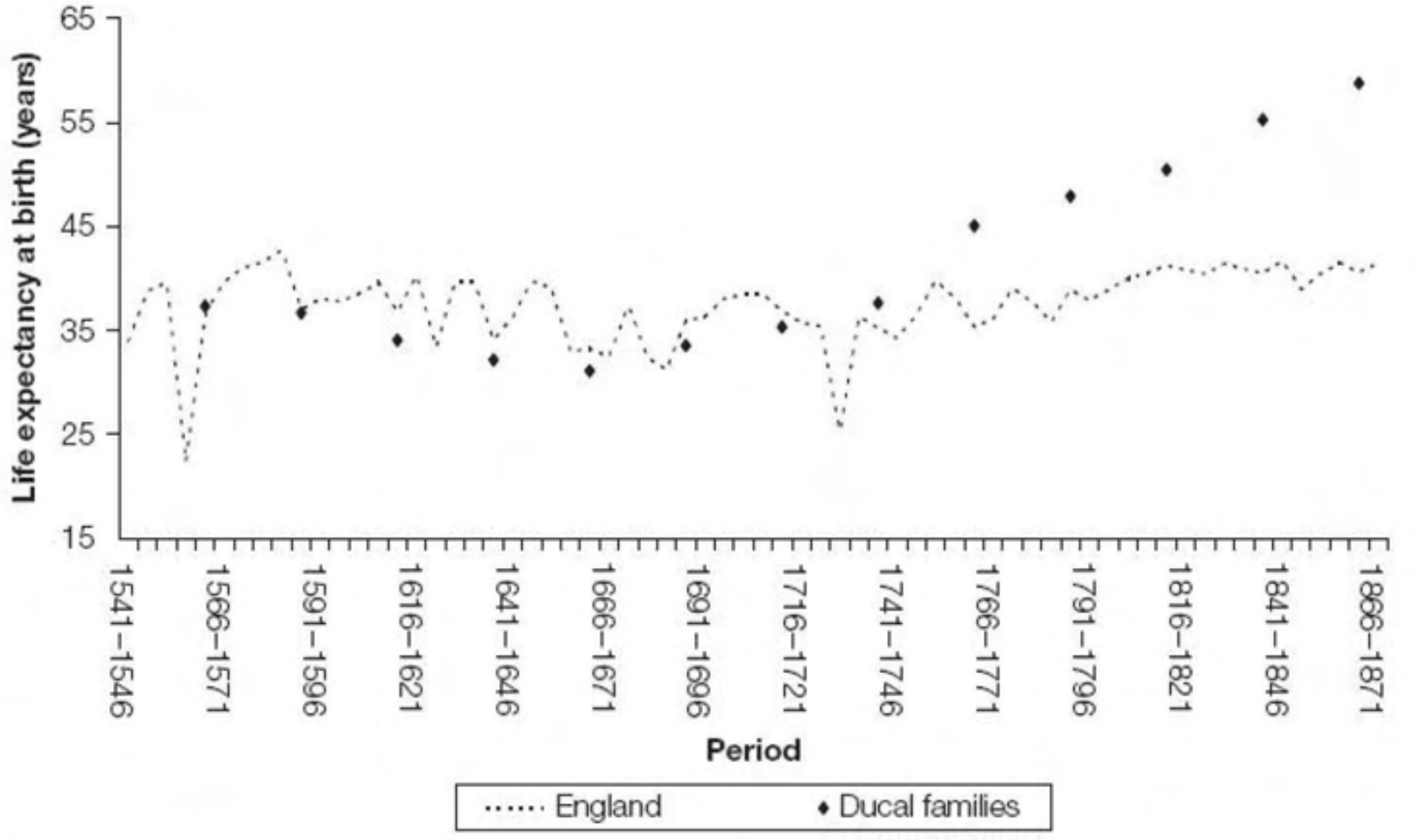


Figure 4.3. *Mortality rate among British ducal families and commoners.*

Source: Reproduced from B. Harris (2004). Public health, nutrition, and the decline of mortality: the McKeown thesis revisited, *Social History of Medicine*, 17(3): 379–407, by permission of Oxford University Press. Original data from T. H. Hollingsworth (1965) and Wrigley et al. (1997).

A persistent wealth gradient in health, with changes in wealth that track earlier health

1984 health status	1984 wealth	1994 wealth
Excellent	$68,300	$127,900
Very Good	$66,300	$90,900
Good	$51,800	$64,900
Fair or Poor	$39,200	$34,700

Hypotheses

- Efficient producer hypothesis
  - Those with more education might be more efficient producers of health
  - Adhering to treatment regimens isn't easy
  - Doctors can't know everything, not at doctors are equally skilled, and patients can play a big role
  - Goldman and Smith (2002) explore an intervention to promote diabetes treatment adherence
    - It benefited all groups, but helped the less-educated more

- “Thrifty phenotype” or Barker hypothesis

  - Deprivation in very early life (*in utero*) may cause particular genes to activate

  - Thrifty genes may be good at managing deprivation, but they might be bad at operating during good times

  - Children *in utero* during famines, influenza, maybe even fasting, appear to suffer worsened adult health

  - (As we will discuss later, parents who have kids during such times *might* be different than those who don’t)

- Direct income hypothesis

  - More cash helps you buy better stuff. Lottery winners appear to have reduced mortality (Lindahl, 2005)

- Allostatic load hypothesis

  - Stress response in humans was useful in life-or-death preindustrial circumstances

  - Now, stress response just erodes health by producing stress hormones by weakening the immune system and aging the brain

  - British civil servants appear to suffer worse health outcomes when they have lower rank

- Productive time hypothesis
  - *More a story of health causing socioeconomic status than the reverse*
  - Several studies suggest that health disadvantages early in life lead to reduced working and poor health
- Time preferences and the Fuchs hypothesis
  - *A story of a third variable that causes health and SES*
  - Ability to resist temptation (the marshmallow experiment) in childhood is associated with better test scores in adolescence
  - But controlling for time preferences *does not* remove the SES gradient in health!

Does x or z cause y?

- Suppose there are two interventions that are themselves correlated

  x = education

  z = belonging to a peer group

  y = smoking, a function of these plus an error ε
  $y = f(x,z,\varepsilon) = a + b\,x + c\,z + \varepsilon$

- How would we know whether it's x or z that is causing y?