

Physical Characteristics at the Midlife and Survival to Age 100: A Study of American Men

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Approach

To study “success stories” in long-term avoidance of fatal diseases (survival to 100 years) and factors correlated with this remarkable survival success

Centenarians represent the fastest growing age group in the industrialized countries

Yet, factors predicting exceptional longevity and its time trends remain to be fully understood

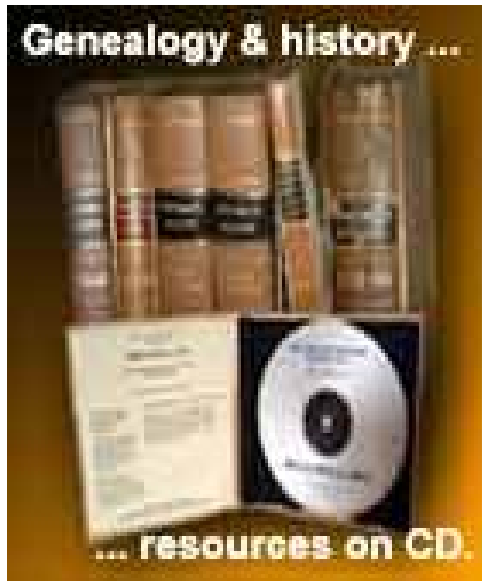
In this study we explored the new opportunities provided by the ongoing revolution in information technology, computer science and Internet expansion to explore adulthood predictors of exceptional longevity



Jeanne Calment
(1875-1997)

Revolution in Information Technology

What does it mean for longevity studies?



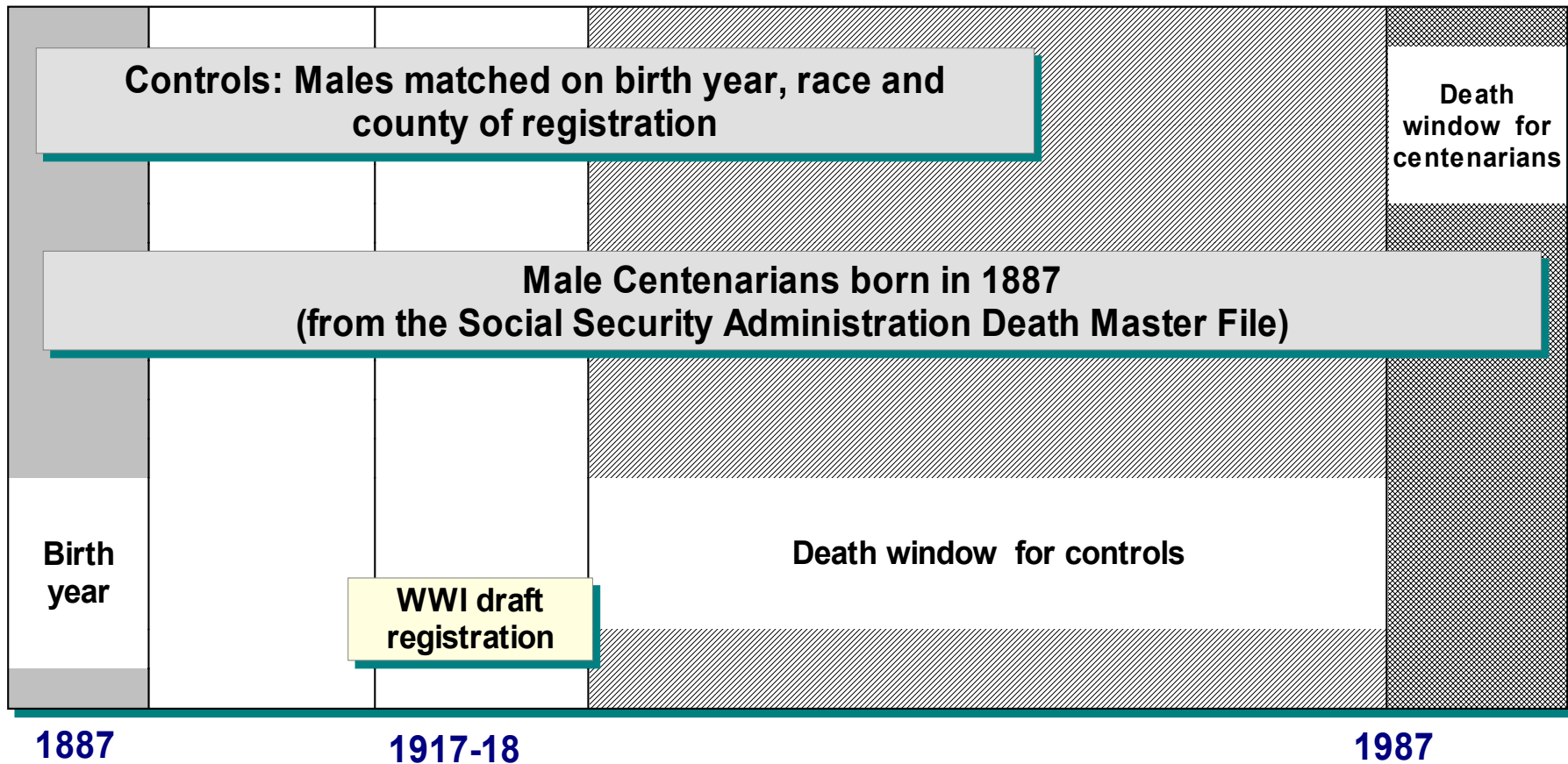
Millions of official census, birth, marriage, death and other records are available online now!

Predictors of Exceptional Longevity

Data Sources

- 1. Social Security Administration Death Master File**
- 2. WWI civil draft registration cards**
(completed for almost 100 percent men born between 1873 and 1900)

Design of the Study



WWI Civilian Draft Registration

In 1917 and 1918, approximately 24 million men born between 1873 and 1900 completed draft registration cards. President Wilson proposed the American draft and characterized it as necessary to make "shirkers" play their part in the war. This argument won over key swing votes in Congress.

WWI Draft Registration

Registration was done in three parts, each designed to form a pool of men for three different military draft lotteries. During each registration, church bells, horns, or other noise makers sounded to signal the 7:00 or 7:30 opening of registration, while businesses, schools, and saloons closed to accommodate the event.



Registration Day Parade



Attention!

ALL MALES between the ages of 21 and 30 years, both inclusive, must personally appear at the polling place in the Election District in which they reside, on

TUESDAY, JUNE 5th, 1917

between the hours of 7 A.M. and 9 P. M. and

Register

in accordance with the President's Proclamation.

Any male person, between these ages, who fails to register on June 5th, 1917, will be subject to imprisonment in jail or other penal institution for a term of one year.

NO EXCUSE FOR FAILURE TO REGISTER WILL BE ACCEPTED

Information Available in the Draft Registration Card

**age, date of birth, race, citizenship
permanent home address
occupation, employer's name
height (3 categories), build (3
categories), eye color, hair color,
disability**

1 Name James Harold Duchworth Age 30

2 Home address 1570 So. Front Alhambra Calif

3 BIRTH May 28 1887

4 Are you (1) a natural born citizen (2) a naturalized citizen (3) an alien (4) or have you declared your intention (specify which)? Naturalized Citizen

5 Where born? Bury, Manchester, Co. England

6 What is your present occupation, profession or business? Citizen

7 What is your present trade, occupation, or office? Chief Clerk to City Phone Chief

8 Where employed? So. Calif. Telephone Co. Los Angeles Calif

9 Have you a wife, mother, wife, child under 12, or a sister or brother under 12, wholly dependent on you for support (specify which)? Wife

10 Married or single (specify which)? Married

11 What military service have you had? None

12 Do you claim exemption from draft (specify grounds)? No Telephone Service

I declare that I have verified above answers and that they are true

James Harold Duchworth

REGISTRAR'S REPORT

1 Is subject of your country? Tall Slender

2 Color of hair? Brown Eyes? Light

3 Are present scars, by hand, cut, or burn, or a tattooed scar, any? No

I certify that my answers are true, that the person registered has read his answers, that I have witnessed his signature, and that all of his answers of which I have knowledge are true, except as follows:

No exceptions

4-4-24.A

Albert Melbourn

City of Alhambra
City or County Los Angeles Co
State Calif

June 5/17

Study Design

Cases: men centenarians born in 1887

(randomly selected from the SSA Death Master File) and linked to the WWI civil draft records. Out of 240 selected men, 15 were not eligible for draft. The linkage success for remaining records was 77.5% (174 records)

Controls: men matched on birth year, race and county of WWI civil draft registration

SAMPLE CHARACTERISTICS (%)

	Centenarians	Controls
Foreign born	20.5	22.2
Married	68.4	63.7
Had children	52.6	42.1
Farmers	31.6	23.4
African Am.	5.3	5.3

Physical Characteristics at Young Age and Survival to 100



A study of height and build of centenarians when they were young using WWI civil draft registration cards

Height – What to Expect

- 1. Height seems to be a good indicator of nutritional status and infectious disease history in the past.**
- 2. Historical studies showed a negative correlation between height and mortality.**
- 3. Hence we may expect that centenarians were taller than average**

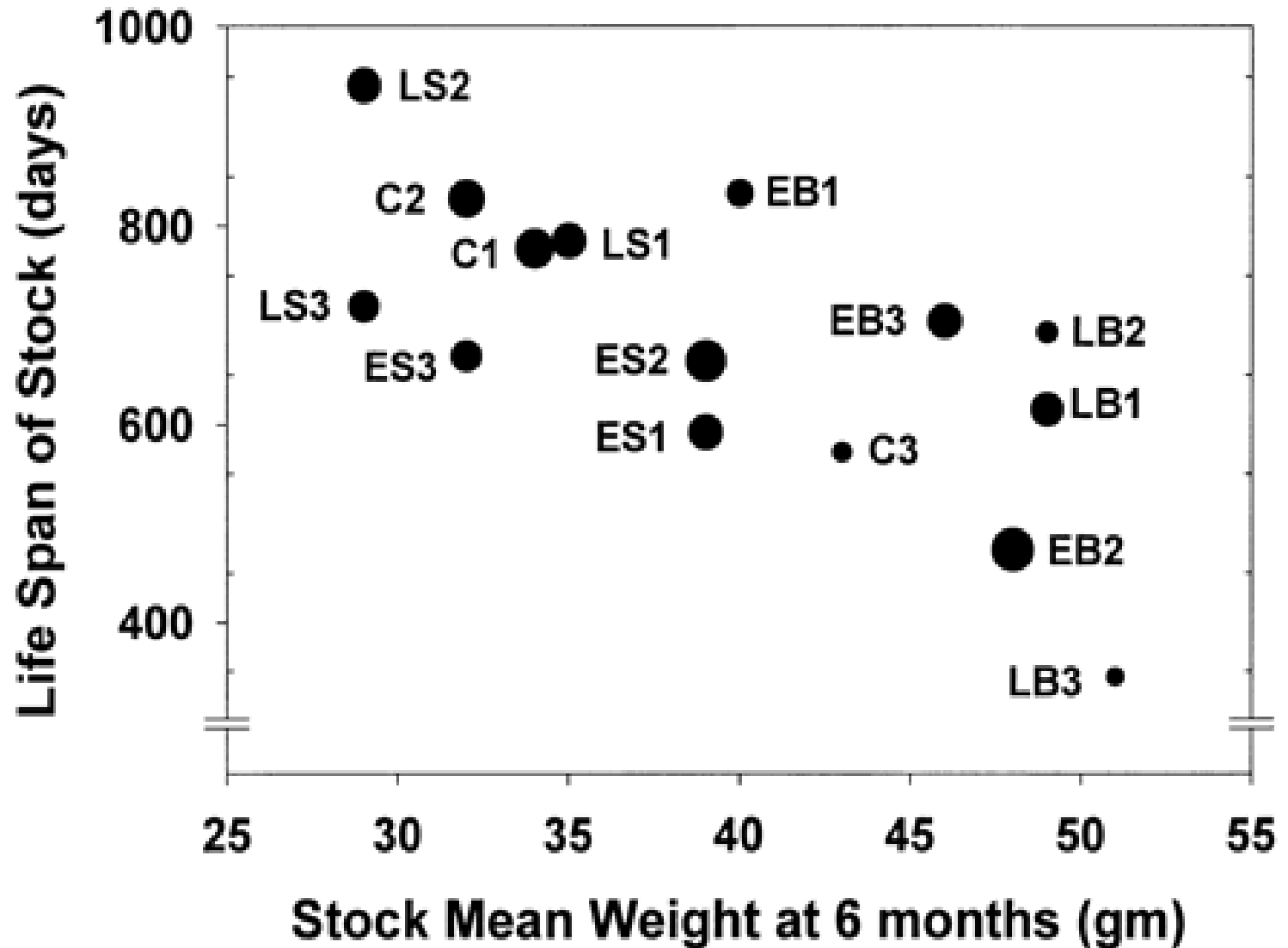
Build – What to Expect

- 1. Slender build may suggest a poor nutrition during childhood. We may expect that centenarians were less likely to be slender when young.**
- 2. On the other hand, biological studies suggest that rapid growth may be harmful and somewhat delayed maturation may be beneficial for longevity.**

Small Dogs Live Longer



Small Mice Live Longer

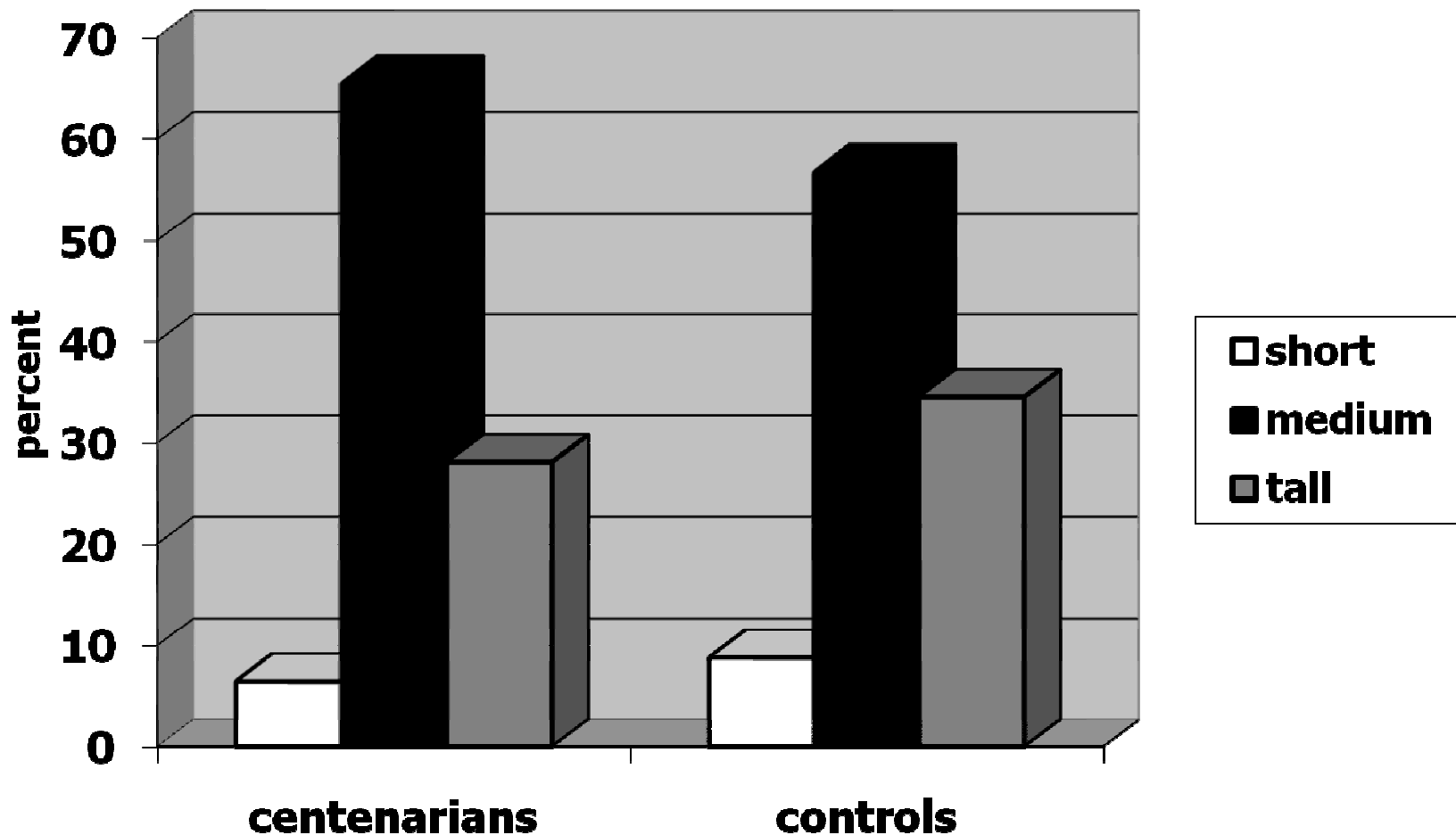


BODY HEIGHT AND BODY BUILD DISTRIBUTIONS (%)

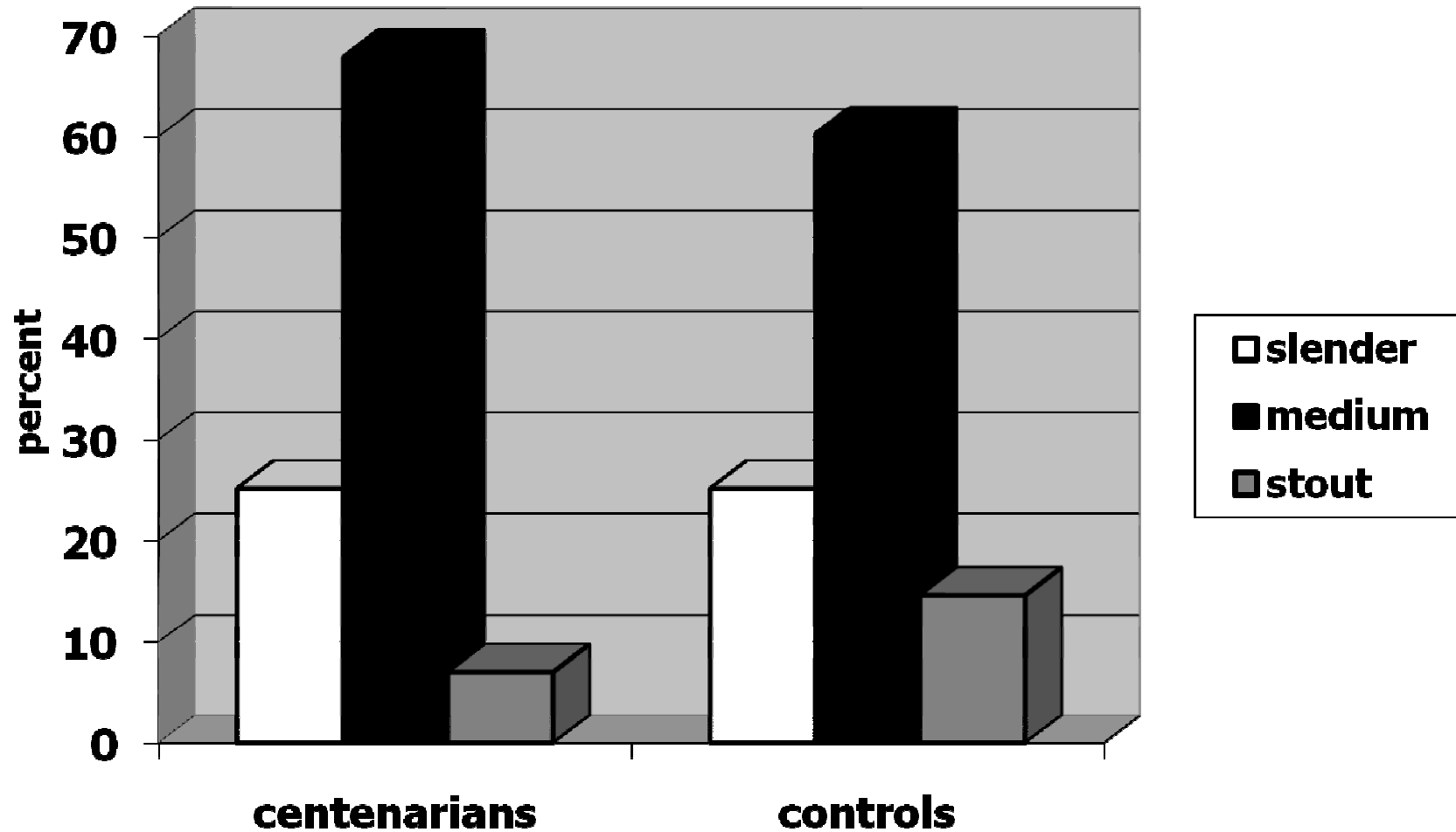
171 pairs of men born in 1887

	Centenarians	Controls
Body Height		
short	6.4	8.8
medium	65.5	56.7
tall	28.1	34.5
Body Build		
slender	25.2	25.2
medium	67.8	60.2
stout	7.0	14.6

Height Distribution Among Centenarians and Controls



Body Build Distribution Among Centenarians and Controls



Multivariate Analysis

Conditional multiple logistic regression model for matched case-control studies to investigate the relationship between an outcome of being a case (extreme longevity) and a set of prognostic factors (*height, build, occupation, marital status, number of children, immigration status*)

Statistical package Stata-10, command *clogit*

Results of multivariate study

<i>Variable</i>	<i>Odds Ratio</i>	<i>P-value</i>
Medium height vs short and tall height	1.35	0.260
Slender and medium build vs stout build	2.63*	0.025
Farming	2.20*	0.016
Married vs unmarried	0.68	0.268
Native born vs foreign b.	1.13	0.682

Results of multivariate study

Significant predictors only

<i>Variable</i>	<i>Odds Ratio</i>	<i>P-value</i>
'Slender' body build reference: stout build	2.54	0.040
'Medium' body build reference: stout build	2.64	0.017
Farming	1.99	0.025

Other physical characteristics

<i>Variable</i>	<i>Odds Ratio</i>	<i>P-value</i>
Blue eye color	1.62	0.069
'Short' body height reference: tall height	1.02	0.967
'Medium' body height reference: tall height	1.43	0.212

Other variables include body build and farming

Having children by age 30 and survival to age 100

**Conditional (fixed-effects) logistic regression
N=171. Reference level: no children**

Variable	Odds ratio	95% CI	P-value
1-3 children	1.62	0.89-2.95	0.127
4+ children	2.71	0.99-7.39	0.051

Conclusion

The study of height and body build among men born in 1887 suggests that obesity at young adult age (30 years) has strong long-lasting effect in preventing longevity

Other Conclusions

Both farming and having large number of children (4+) at age 30 significantly increased the chances of exceptional longevity by 100-200%.

The effects of immigration status, marital status, and body height on longevity were less important, and they were statistically insignificant in the studied data set.

Acknowledgments

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thanks to:**

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the Society of Actuaries**

**For More Information and Updates
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Scientific and Educational Website
on Human Longevity:**

<http://longevity-science.org>

**And Please Post Your Comments at
our Scientific Discussion Blog:**

<http://longevity-science.blogspot.com/>

Multivariate Analysis: Conditional logistic regression

For 1:1 matched study, the conditional likelihood is given by:

$$\prod_i (1 + \exp(-\beta(x_{i1} - x_{i0})))^{-1}$$

Where x_{i1} and x_{i0} are vectors representing the prognostic factors for the case and control, respectively, of the *ith* matched set.

IDEAS & TRENDS

For Centenarians, It All Begins at Birth

By HENRY FOUNTAIN

CENTENARIANS are different from the rest of us, and it's not just that they are so older. They are a select group, having passed off through wars, diseases, disasters and accidents that kill tens of millions of ordinary mortals every year.

It's looking at what makes a 100-year-old special — fewer than 1 in every 10,000 accomplish life to that age or older — those who truly aged out before the genetic (particularly having two X chromosomes, as 45 percent of centenarians are women) and environmental influences like good nutrition and health habits.

Not a statistical study of centenarians by researchers at the University of Chicago has found some other potential predictors of extreme longevity. Women and men who meet the first, both in large families, the study found, were two to three times more likely to make it to 100 than singletons did. Also, those named at the start who had a lower chance of surviving that age, non-episcopal advanced age who were born in Scotland and Massachusetts had longer life expectancy than those born in April through June.

Will you see a full life, the first child of a family, evolve from God, are you a safe

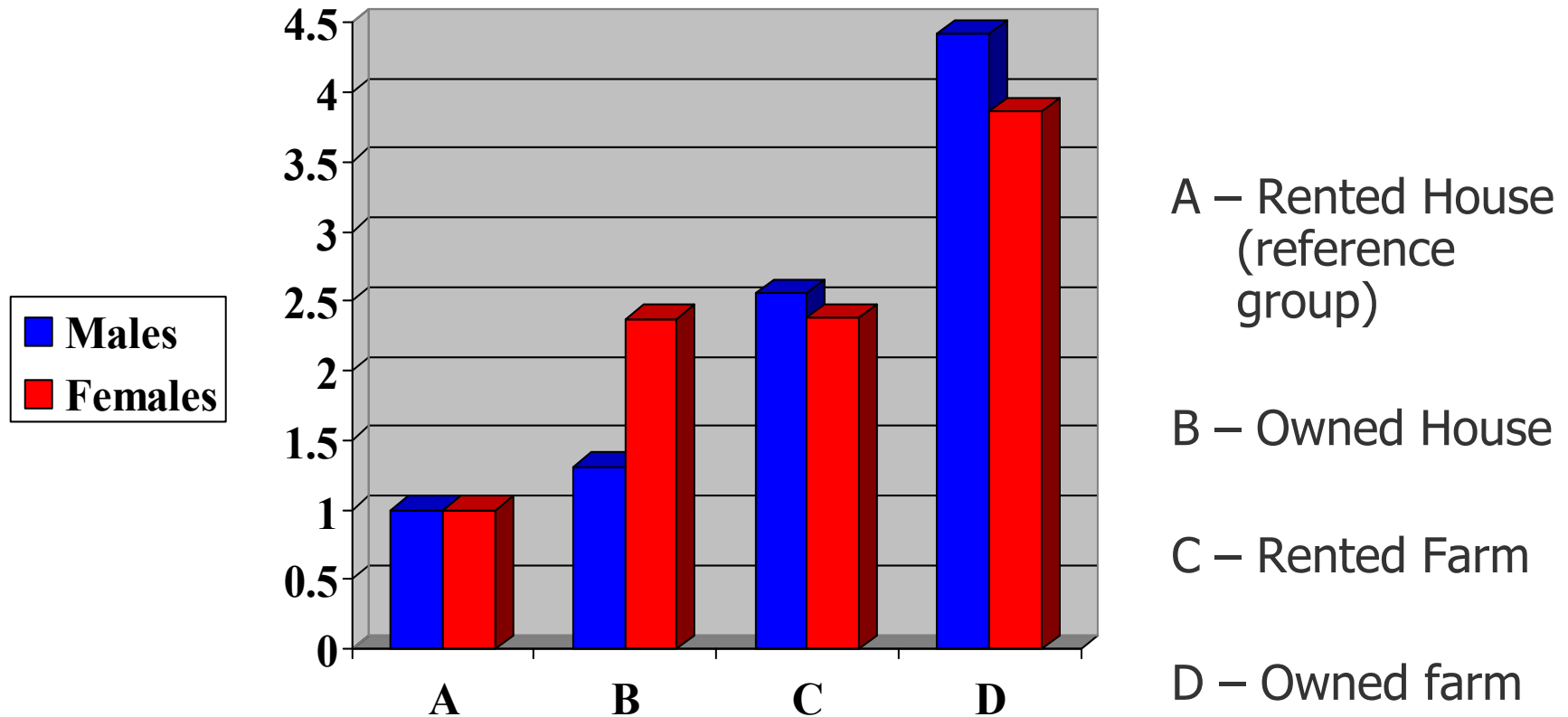


Jeff Fausel

Genes and environment still rule when it comes to living an ultralong life.

Household Property Status During Childhood (1900 census) and Survival to Age 100

Odds for household to be in a 'centenarian' group



Source: Gavrilova, Gavrilov, NAAJ, 2007

World War I Draft Registration Card A—(5 June 1917)

Form 1	REGISTRATION CARD	No. _____
1	Name in full _____ <small>(Given name) (Family name)</small>	<small>Age in Years</small>
2	Home Address _____ <small>(No.) (Street) (City) (State)</small>	
3	Date of birth _____ <small>(month) (day) (year)</small>	
4	Are you (1) a natural-born citizen, (2) a naturalized citizen, (3) an alien, (4) or have you declared your intention (specify which)? _____	
5	Where were you born? _____ <small>(town) (state) (nation)</small>	
6	If not a citizen, of what nation are you a citizen or subject? _____	
7	What is your present trade, occupation, or office? _____	
8	By whom employed? _____ Where employed? _____	
9	Have you a father, mother, wife, child under 12, or a sister or brother under 12, solely dependent on you for support (specify which)? _____	
10	Marrried or single (which)? _____ Race (specify which)? _____	
11	What military service have you had? Rank _____ branch _____ years _____ Nation or State _____	
12	Do you claim exemption from draft (specify grounds)? _____	

REGISTRAR'S REPORT	
1	Tall, medium, or short (specify which)? _____ Slender, medium, or stout (which)? _____
2	Color of eyes _____ Color of hair _____ Bald _____
3	Has person lost arm, leg, hand, foot, eye, or both eyes or is he otherwise disabled (specify)? _____
<p>I certify that my answers are true, that the person registered has read his own answers, that I have witnessed his signature, and that all of his answers of which I have knowledge are true, except as follows:</p> 	
_____ (Signature of Registrar)	
Precinct _____ City or County _____ State _____	
_____ (Date of Registration)	