# Sex differences in familial transmission of human longevity

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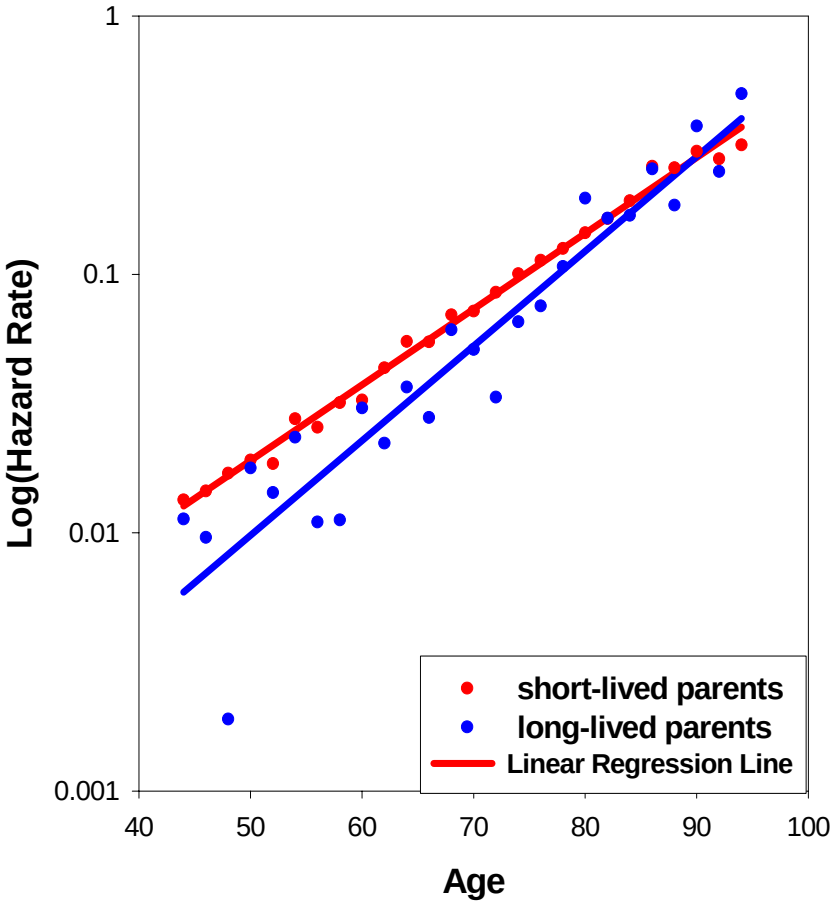
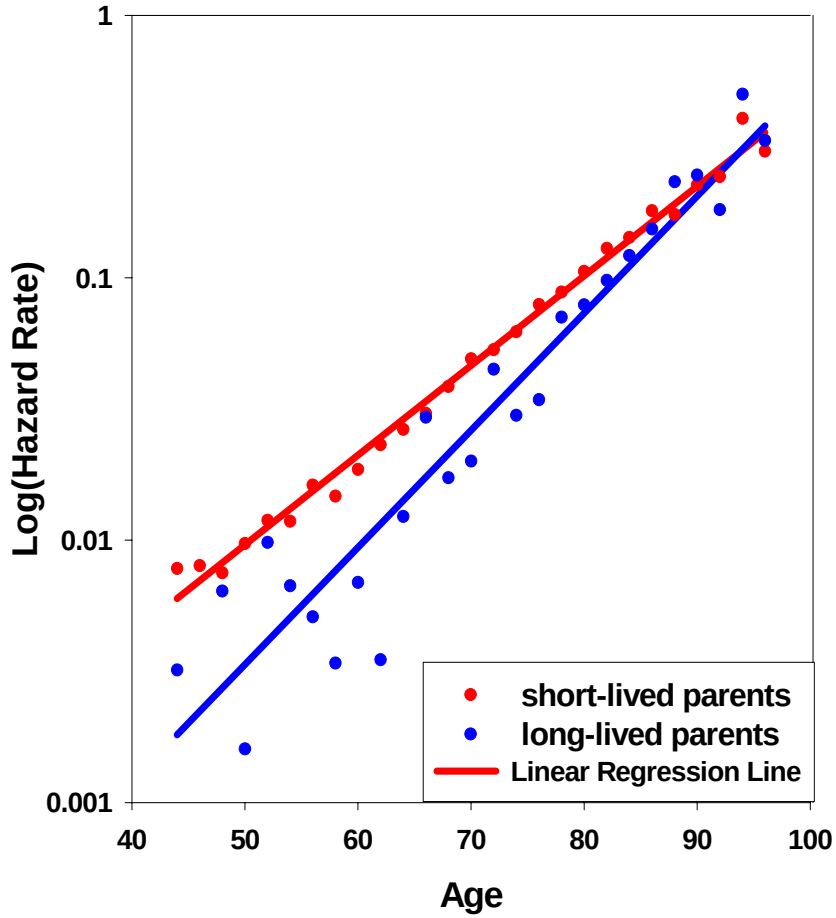
**Numerous studies showed that biological relatives of centenarians have substantial survival advantage compared to biological relatives of shorter-lived individuals.**

# Compensation Law of Mortality (Parental Longevity Effects)

## Mortality Kinetics for Progeny Born to Long-Lived (80+) vs Short-Lived Parents




Sons




Daughters

**Little is known about effects of centenarian's sex on longevity of relatives**

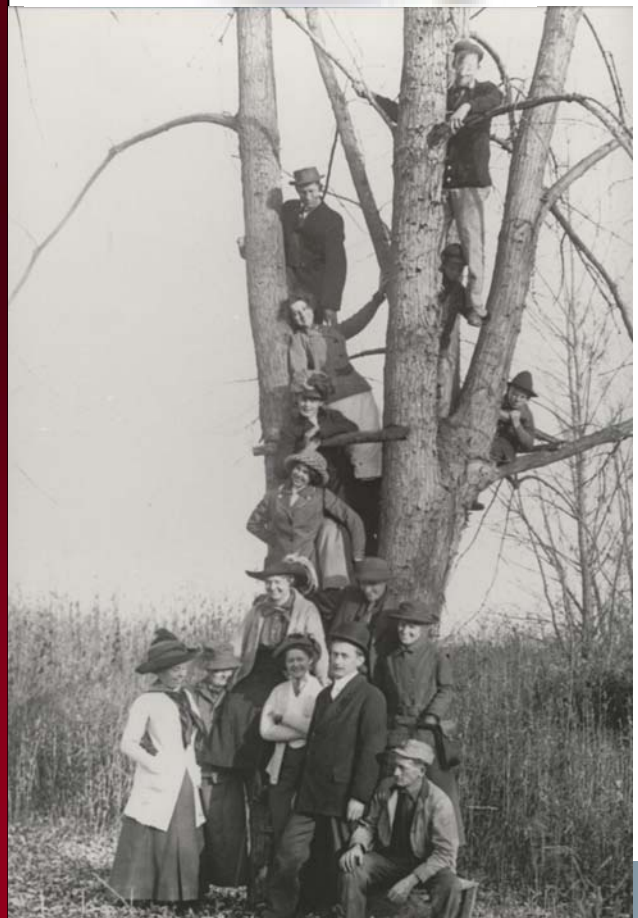
# Methods

**We have developed and analyzed a new computerized database on 1,711 validated centenarians born in 1880-1895 in the the United States, their parents and 13,185 shorter-lived siblings.**

# Methods

Student t-test was used to compare mean life spans. Gompertz regression models were used to model survival time between age 50 and death for centenarian siblings. Models for brothers and sisters were analyzed separately





**Computerized genealogies is a promising source of information about potential predictors of exceptional longevity: life-course events, early-life conditions and family history of longevity**

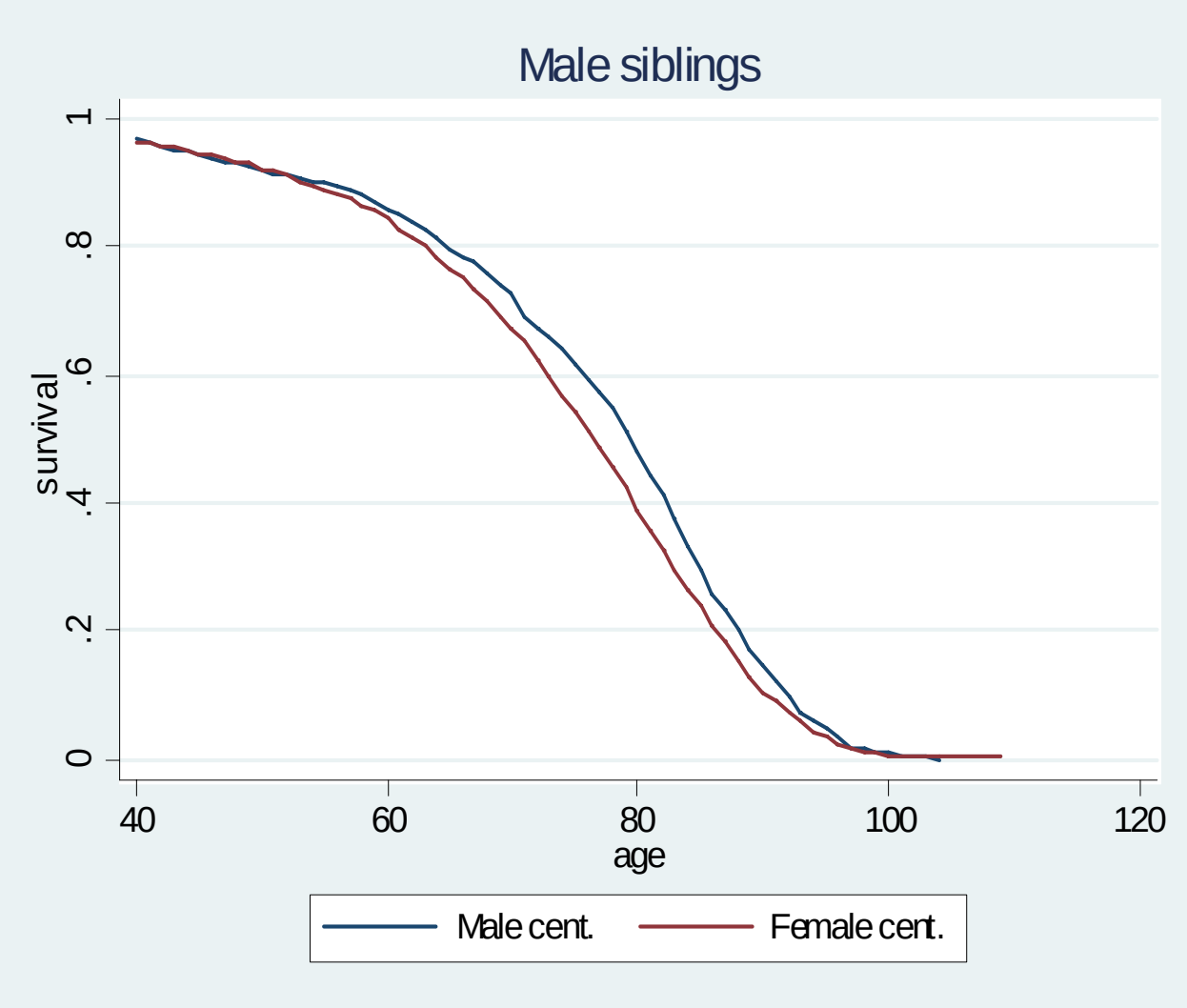
# Steps of the study

- 23,127 records of centenarians born in 1880-1895 with known information about parents were identified using the Rootsweb genealogical website
- 2,834 centenarians having detailed information on their 21,893 siblings were selected
- 1,711 centenarians with their death dates verified using the Social Security Death Index were used for further analyses

# Life expectancy of siblings at age 50 depending on the sex of centenarian

| | Male centenarians | | Female centenarians | | P-value |
|---|---|---|---|---|---|
| | N | LS50 | N | LS50 | |
| Brothers | 1254 | 29.01 | 4018 | 26.86 | <0.001 |
| Sisters | 1029 | 31.26 | 3666 | 31.72 | 0.241 |

# Survival of male siblings of centenarians



# Life expectancy of fathers and mothers at age 50 depending on the sex of centenarian

| | Male centenarians | | Female centenarians | | P-value |
|---|---|---|---|---|---|
| | N | LS50 | N | LS50 | |
| Fathers | 419 | 27.22 | 1364 | 25.97 | 0.043 |
| Mothers | 402 | 28.26 | 1341 | 27.28 | 0.143 |

# Multivariate survival analysis

## Gomperz hazard regression model for survival of centenarian brothers after age 50

N=5,287. Controlled for month of birth and paternal age (NS)

| Covariate | Hazard ratio | 95% CI | P-value |
|---|---|---|---|
| Father lived 80+ | 0.889 | 0.841-0.939 | <0.001 |
| Mother lived 80+ | 0.930 | 0.881-0.983 | 0.009 |
| Sibship size | 0.993 | 0.983-1.004 | 0.220 |
| Female sex of centenarian | 1.177 | 1.105-1.255 | <0.001 |

# Multivariate survival analysis

## Gomperz hazard regression model for survival of centenarian sisters after age 50

N=4,849. Controlled for month of birth and paternal age (NS)

| Covariate | Hazard ratio | 95% CI | P-value |
|---|---|---|---|
| Father lived 80+ | 0.976 | 0.921-1.033 | 0.396 |
| Mother lived 80+ | 0.932 | 0.880-0.987 | 0.015 |
| Sibship size | 1.012 | 1.001-1.023 | 0.038 |
| Female sex of centenarian | 1.012 | 0.945-1.084 | 0.726 |

# Hypothesis 1

**Male and female centenarians have different survival threshold to reach age 100**

# Compare siblings of male centenarians to siblings of females survived to age 103

**Probability of survival to 103 for females is even lower than the same probability to reach age 100 for males (according to the 1900 U.S. cohort)**

# Life expectancy of siblings at age 50 depending on the sex of centenarian

| | Male centenarians | | Females survived to age 103 | | P-value |
|---|---|---|---|---|---|
| | N | LS50 | N | LS50 | |
| Brothers | 1254 | 29.01 | 974 | 27.23 | 0.0002 |
| Sisters | 1029 | 31.26 | 887 | 32.27 | 0.053 |
| Fathers | 419 | 27.22 | 369 | 25.81 | 0.085 |
| Mothers | 402 | 28.26 | 369 | 27.68 | 0.504 |

# Hypothesis 2

**Male centenarians and their brothers share living conditions favorable for men**

# Using siblings-in-law as a control group

**Siblings-in-law do not share genetic background and living conditions with centenarians**

**On the other hand, they usually come from the same socio-economic background**

# Life expectancy of married siblings and siblings in law at age 50 depending on the sex of centenarian

| | Male centenarians | | Females centenarians | | P-value |
|---|---|---|---|---|---|
| | N | LS50 | N | LS50 | |
| Brothers | 784 | 29.53 | 2437 | 27.12 | <0.001 |
| Sisters | 650 | 31.36 | 2378 | 32.40 | 0.045 |
| Brothers in law | 492 | 24.95 | 1857 | 25.06 | 0.846 |
| Sisters in law | 611 | 29.22 | 1796 | 29.55 | 0.539 |

# Life expectancy of centenarian spouses and spouses of centenarian siblings at age 50

| | Centenarian spouses | | Siblings in law | | P-value |
|---|---|---|---|---|---|
| | N | LS50 | N | LS50 | |
| Men | 876 | 25.38 | 2349 | 25.04 | 0.442 |
| Women | 283 | 31.40 | 2407 | 29.46 | 0.007 |

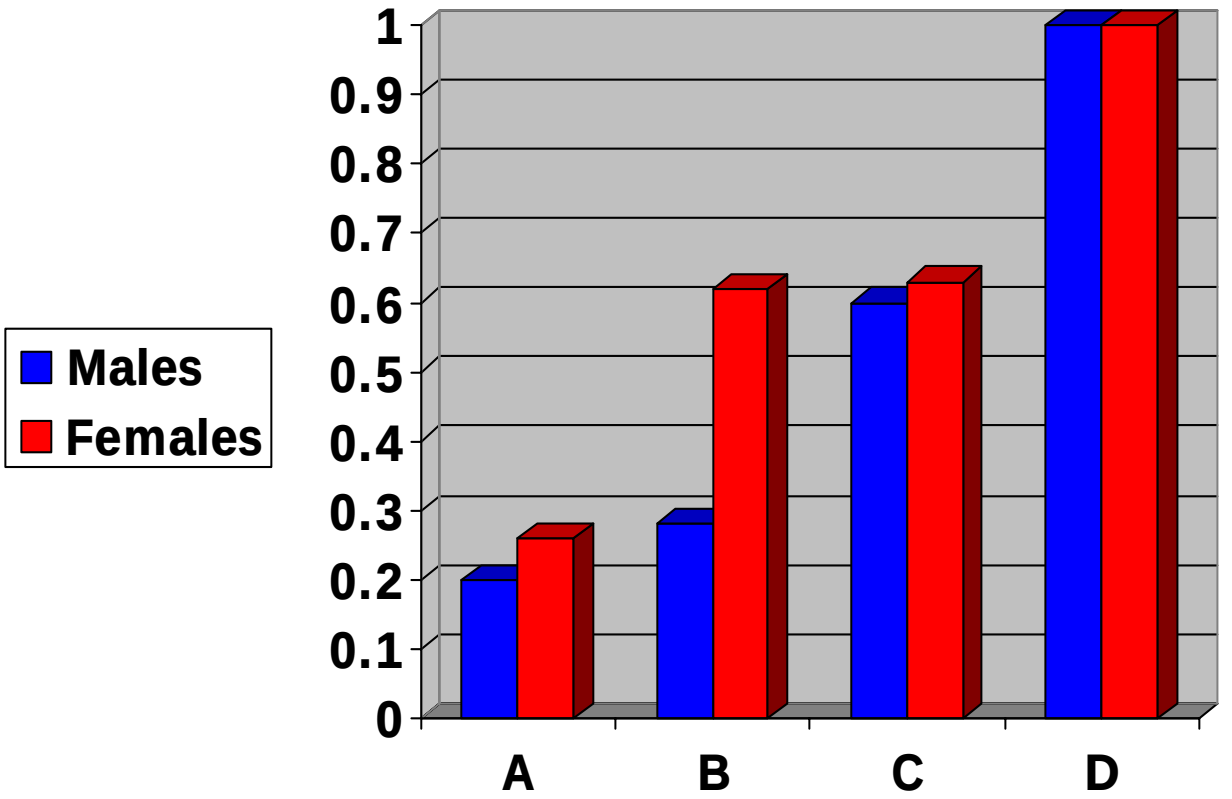
# Possible explanation

**Men often continued to live in the place of their childhood while women more often left parental household.**

**Favorable living conditions and/or lifestyle of male centenarians could be more likely shared by their brothers rather than sisters as well as by their spouses**

# Household Property Status During Childhood and Survival to Age 100

## Odds for household to be in a ‘centenarian’ group




A – Rented House

B – Owned House

C – Rented Farm

D – Owned farm (reference group)

# Conclusion

**Study of centenarian gender effects on survival of relatives suggests that environmental conditions and lifestyle may play more significant role in exceptional longevity than it was thought before**

# Exceptional longevity in a family of Iowa farmers

- Father: Mike Ackerman, Farmer, lived 1865-1939 lived 74 years
- Mother: Mary Hassebroek 1870-1961 lived 91 years

1. Engelke "Edward" M. Ackerman b: 28 APR 1892 in Iowa **101**
2. Fred Ackerman b: 19 JUL 1893 in Iowa **103**
3. Harmina "Minnie" Ackerman b: 18 SEP 1895 in Iowa **100**
4. Lena Ackerman b: 21 APR 1897 in Iowa **105**
5. Peter M. Ackerman b: 26 MAY 1899 in Iowa 86
6. Martha Ackerman b: 27 APR 1901 in IA 95
7. Grace Ackerman b: 2 OCT 1904 in IA **104**
8. Anna Ackerman b: 29 JAN 1907 in IA **101**
9. Mitchell Johannes Ackerman b: 25 FEB 1909 in IA 85

# Acknowledgments

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- http://longevity-science.org

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

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

# Final Conclusion

- **The shortest conclusion was suggested in the title of the *New York Times* article about this study**

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 a lot older. They are a select group, having persevered through wars, disasters, disease and accidents that kill tens of millions of ordinary mortals every year.

Looking at what makes a 100-year-old so special — fewer than 1 in every 10,000 Americans live to that age or older — those who study aging cite factors like genetics (particularly having two X chromosomes, as 85 percent of centenarians are women) and environmental influences like good nutrition and health habits.

But 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 were the first born in large families, the study found, were two or three times more likely to make it to 100 than later-born children. Those raised in the rural West had a better chance of reaching that age. And people of advanced age who were born in October and November had longer life expectancy than those born in April through June.

So if you are a tall baby, the first child of a farming couple from Boise, are you a safe

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