Exceptional Longevity: Are Socioeconomic Conditions in Childhood Important?
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Study Background

Longevity has a strong familial component that can be attributed in part to genetic background and to the shared environment early in life. There are multiple mechanisms through which conditions in early life may affect one’s health and mortality.

Research Questions

1. Do early-life socioeconomic conditions influence longevity in the general population as well as in families of centenarians?
2. Does the effect of socioeconomic conditions in childhood change over the lifespan?

Data Collection and Sample Selection

This research project relies on 806 centenarians and their siblings.

Validation process:
Linking birth and death certificates

806 centenarians - French Canadian Catholics - At least one sibling
CASEx - 5338 siblings of centenarians - Average birth year: 1895
CASES - 2954 siblings from whom we found the date of death (≥40 years of age)

Start:
- 900 centenarians
- Born: 1890-1900
Source: Institut de la statistique du Québec

General Population:
Canadian Families Project
Start: CONTROLS - 8204 siblings
Canadian Censuses
Controls - 8204 siblings
Deaths Index
TOTAL SAMPLE Cases: - 1541 men - 1413 women Controls: - 1878 men - 1906 women

Survival advantage of longevity has a strong genetic background.

Gompertz Proportional Hazards Models of Mortality Risks after Age 40 Accounting for Unobserved Heterogeneity

We modeled the risk of mortality after age 40 in which our estimated hazard is:

\[ \mu(t, Z_i, X_{ij}) = Z_i \mu_0(t)e^{X_{ij}} \]  

where \( X_{ij} \) is a vector of variables and \( \mu_0(t) \) is the baseline hazard which is of the Gompertz form. The frailties \( \{Z_i(t = 1, ..., n_i)\} \), represent combined effects of genetic or environmental unobserved characteristics at the family scale and follow a gamma distribution.

We also ran logit models that measured the effect of father’s literacy, father’s occupation and urban/rural status, on the odds of surviving, first from age 40 to age 75 and then, from age 75 to age 90.

Key Findings

There is a protective effect of farming, mainly experienced by men of the general population.

- In the Gompertz models, men whose father was not a farmer experienced an overall higher risk of mortality after age 40. The effect is stronger for controls than for siblings of centenarians.
- Having a father who was a farmer increases the odds of reaching age 75 for people aged ≥40 years.

Effects are less important at very old age

- When looking at the odds of achieving age 90, the influence of early-life conditions vanishes in the centenarian sample; while it remains present, although less important, in the control group.

Effects are less important for women

- For women, having a father who was illiterate, an urban worker or an urban white collar reduces the chance to achieve age 75 in the general population. These variables are no longer influential beyond that age nor for sisters of centenarians.

Conclusions and Outlook

- Socioeconomic conditions in childhood are associated with mortality in later life.
- However, the effect of these factors on longevity is not equal for all individuals. The association of early life conditions and longevity is greater for men compared to women, for individual of the general population (controls) compared to siblings of centenarians and for people reaching the average age at death (40 to 75) compared to those achieving the oldest age (75 to 70).
- Siblings of centenarians may be less vulnerable to adverse conditions because of favorable genetic background, biological robustness or a more homogenous sample.

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