In search of a trade-off between health and longevity: the 5-Country Oldest Old Project (5-COOP)

Jean-Marie Robine, Sarah Cubaynes, Marie Herr, Sefan Fors, Marti Parker, Yusuhiko Saito, Bernard Jeune and François R Herrmann for the 5-COOP Consortium
Outline

1. Arguments for a possible trade-off between the level of mortality selection and the functional health status of the survivors
2. The selection of the 5 countries based on survival and mortality features
3. The main characteristics of the samples of centenarians used, similarities and differences
4. The age trajectory of a geriatric condition with the example of frailty
1. Arguments for a possible trade-off between the level of mortality selection and the functional health status of the survivors
1- The adult longevity revolution

French women, 1900 - 1980 - 2013
2- The variation in this revolution

GERMANY, Age 100

NETHERLANDS, Age 100

French women, 1900 - 1980 - 2013
3- contradictory results of existing centenarian studies

- In Denmark
- In Japan
Genetic and Environmental Determinants of Healthy Aging

Improving Activities of Daily Living in Danish Centenarians—But Only in Women: A Comparative Study of Two Birth Cohorts Born in 1895 and 1905

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Background. The number of centenarians has increased rapidly since the 1950s. In Denmark, 42% more of the 1905

Results. The 1905 cohort displayed better self-reported ADLs than the 1895 cohort did. Stratified by gender, this apparent cohort advantage was due to women in the 1905 cohort performing significantly better than their female counterparts in the 1895 cohort.

Activities of Daily Living (PADLs) were assessed in both cohorts.

Conclusion. The increasing number of female centenarians does not entail increasing proportions of disabled individuals. In contrast, there is a lack of improvement in ADLs among male centenarians even though the number of male centenarians is stagnating.

Key Words: Centenarians—Activities of Daily Living—Cohort comparisons.
## Prevalence of centenarians confined to the room

<table>
<thead>
<tr>
<th>Year</th>
<th>Population size</th>
<th>Sampling rate</th>
<th>% confined to the room</th>
<th>% bedridden</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Males</td>
<td>Females</td>
</tr>
<tr>
<td>1973 (1)</td>
<td>405</td>
<td>28.9</td>
<td>19.1</td>
<td>37.5</td>
</tr>
<tr>
<td>1975 (2)</td>
<td>548</td>
<td>39.1</td>
<td>38.5</td>
<td>46.8</td>
</tr>
<tr>
<td>1981 (3)</td>
<td>1072</td>
<td>94.2</td>
<td>33.1</td>
<td>50.7</td>
</tr>
<tr>
<td>1992 (4)</td>
<td>4152</td>
<td>13.2</td>
<td>36.5</td>
<td>59.8</td>
</tr>
<tr>
<td>1993 (5)</td>
<td>4802</td>
<td>59.9</td>
<td>39.3</td>
<td>61.1</td>
</tr>
<tr>
<td>2000 (6)</td>
<td>13036</td>
<td>14.6</td>
<td>57.0</td>
<td>78.0</td>
</tr>
</tbody>
</table>

### Research reports

- (1) Tokyo metropolitan institute of aging (1973)
- (2) Center for development of elderly welfare (1976)
- (3) Japan Health promotion and Fitness Foundation (1992)
- (4) Japan College of Social Work (1992)
- (5) Japan Health promotion and Fitness Foundation (1993)
- (6) Japan Health promotion and Fitness Foundation (2002)

Courtesy from Yasuyuki Gondo
Number of centenarians (100+): Japan vs. Denmark

This suggests a trade-off between the level of mortality selection and the functional health of the survivors to the highest ages.

Source 5-COOP, GSA 2014
2. The selection of the 5 countries based on survival and mortality features
Criteria of selection for the countries

1. Good data quality about age and survival
2. Existence of research teams studying oldest old people (demographers, epidemiologists and/or geriatricians)
3. Displaying different speeds of accumulation of nonagenarians and centenarians
The 5-COOP study

Denmark  France  Japan  Sweden  Switzerland
Number of centenarians in the 5-COOP countries

Number of centenarians in Japan

Number of centenarians in France

Number of centenarians in Switzerland

Number of centenarians in Sweden

Number of centenarians in Denmark
Probability of surviving to age 100

Male probability of surviving to age 100

Female probability of surviving to age 100
Levels of mortality selection

**Males**
- Up to 100 years
  - Japan
  - France and Switzerland
  - Denmark and Sweden
- At age 100 and after
  - Japan
  - France, Denmark and Switzerland
  - Sweden

**Females**
- Up to 100 years
  - Japan
  - France
  - Denmark, Sweden and Switzerland
- At age 100 and after
  - Japan
  - France and Denmark, Sweden and Switzerland
3. The main characteristics of the samples of centenarians used, similarities and differences
Design

1. Multinational cross-sectional study
2. Comparison of representative samples (at the national or regional level)
3. Subjects aged 100 years (N=5*250)
4. At the same point in time
## Sampling scheme

<table>
<thead>
<tr>
<th>Ethical committee</th>
<th>DK</th>
<th>S</th>
<th>F</th>
<th>CH</th>
<th>J</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sample</td>
<td>National</td>
<td>National</td>
<td>Regional</td>
<td>Regional</td>
<td>5 cities</td>
</tr>
<tr>
<td>Residents lists</td>
<td>1</td>
<td>1</td>
<td>every 3 months</td>
<td>At different time for each administrative unit</td>
<td>Managed by cities</td>
</tr>
</tbody>
</table>

[Image of maps of France and Japan showing different regions covered in the sampling scheme.]
Data collection

• Standardization of the data collection across the 5 participating countries started before the field study (2008-2009-2010)
• Original questionnaire designed in English
• Includes standardized instruments
• Then translated in each local languages.
### Response rates

<table>
<thead>
<tr>
<th>%</th>
<th>DK</th>
<th>S</th>
<th>F</th>
<th>CH</th>
<th>J</th>
<th>All</th>
</tr>
</thead>
<tbody>
<tr>
<td>Response rate (b/(a-c)*100)</td>
<td>49.8</td>
<td>85.6</td>
<td>30.6</td>
<td>41.3</td>
<td></td>
<td>54.5</td>
</tr>
<tr>
<td>Sample size (a)</td>
<td>360</td>
<td>756</td>
<td>427</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Interviews (b)</td>
<td>251</td>
<td>274</td>
<td>212</td>
<td>170</td>
<td>346</td>
<td>1253</td>
</tr>
<tr>
<td>Deceased before interviewed (c)</td>
<td>40</td>
<td>63</td>
<td>15</td>
<td></td>
<td></td>
<td>118</td>
</tr>
</tbody>
</table>
Heterogeneity despite standardization

- Time synchronization
- Country wide vs regional sampling
- Response rates, modes and type of interviews, background of the interviewers vary among the 5 countries
4. The age trajectory of a geriatric condition with the example of frailty
The importance of frailty in geriatrics

- More than 600 variables in our survey
- Frailty as an example
- Predictor of poor health outcomes and predictor of use health care resources
- A window for action to prevent worsening of health and disability

Possibly the most important concept in modern geriatrics
Frailty in the oldest old

• Few data:

- Half of the individuals aged 90 years and over (54%) included in the SIPAF study, France (n=512)

- 60% of the 50 centenarians included in the Oporto Study (Portugal)

Figure 1. Prevalence of frailty and 95% confidence intervals.

Collard et al, JAGS 2012

Herr et al, Archives Gerontol Geriatr 2016

Duarte et al, Eur Geriatric Med 2014
Demography of centenarians

- According to the Population Division of the United Nations (UNDP), their number will reach 25 millions in 2100 (x15 their number in 2015)

Robine & Cubaynes, 2017
Objective

• The 5-COOP frailty study aims to describe the prevalence of frailty and associated factors in the centenarians participating in the Five Country Oldest Old Project (5-COOP).
### Frailty definition

**according to Fried et al, J Gerontol 2001**

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Weight loss</strong></td>
<td>Self-reported weight loss of 5 kg during the past year&lt;br&gt;And/or self-reported weight loss of 3 kg during the past 3 months&lt;br&gt;And/or Body Mass Index $\leq 18.5$ kg/m²</td>
</tr>
</tbody>
</table>
| **Fatigue**                      | Self-reported fatigue (when moving, resting or all the time)  
*Except Sweden*                                                             |
| **Weakness**                     | Grip strength lower than the 20th percentile<br>And/or self-reported difficulty carrying a bag weighting 5kg |
| **Slow walking speed**           | Self-reported slow walking speed<br>And/or difficulty walking up a flight of stairs             |
| **Low level of physical activity** | No regular exercise or outdoor activity (self-reported)                                       |
Prevalence of frailty
(according to the criteria of Fried et al, 2001)

<table>
<thead>
<tr>
<th>Frailty phenotype</th>
<th>Total N (%)</th>
<th>Men N (%)</th>
<th>Women N (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Robust</td>
<td>69 (5.6)</td>
<td>30 (12.2)</td>
<td>39 (4.0)</td>
</tr>
<tr>
<td>Pre-frail</td>
<td>378 (30.7)</td>
<td>92 (27.4)</td>
<td>286 (29.1)</td>
</tr>
<tr>
<td>Frail</td>
<td>783 (63.7)</td>
<td>124 (50.4)</td>
<td>659 (67.0)</td>
</tr>
</tbody>
</table>
Prevalence of frailty by country

Range: 48.9% - 78.8%
Slow walking speed
(logistic regression, OR)
Discussion
Almost 95% of the centenarians had at least one criteria for frailty; 63.7% had 3 criteria or more.

Frailty in the oldest old is mainly driven by:
- Lack of muscle strength
- Limited mobility
- Low level of physical activity

The risk of frailty was higher in France, Switzerland, and Denmark compared to Japan, but this pattern may differ according to the criteria of frailty considered.
Thank you
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