Mortality

- Key terms
  - Lifespan
  - Life expectancy
- Calculation of death rates (crude, by age)
- Immediate/proximate/distal causes of death
- Debate over importance of distal factors
- Role of inequality

Lifespan

- How long you could possibly live
  - Record is 122.

Life expectancy

- Statistically, the average length of life
  \[ e_0 = \text{average life expectancy at birth} \]
What does life expectancy mean?

<table>
<thead>
<tr>
<th>Period</th>
<th>Life expectancy (women)</th>
<th>1</th>
<th>5</th>
<th>25</th>
<th>65</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre-modern</td>
<td>20</td>
<td>63</td>
<td>47</td>
<td>34</td>
<td>8</td>
</tr>
<tr>
<td>Lowest today</td>
<td>40</td>
<td>82</td>
<td>73</td>
<td>63</td>
<td>29</td>
</tr>
<tr>
<td>Mexico</td>
<td>76</td>
<td>98</td>
<td>98</td>
<td>98</td>
<td>83</td>
</tr>
<tr>
<td>U.S.</td>
<td>80</td>
<td>99</td>
<td>99</td>
<td>98</td>
<td>86</td>
</tr>
<tr>
<td>Japan</td>
<td>83</td>
<td>99</td>
<td>99</td>
<td>98</td>
<td>89</td>
</tr>
</tbody>
</table>

Rectangularization of mortality (U.S.)
High life expectancies

Figure 16: Geography of centenarian distribution, born in Sardinia from 1880 to 1900 (AKEA longevity), and of total mortality for men and women aged 80 plus in 1990-1994

Crude death rate

\[ \text{Crude death rate} = \frac{\text{Total deaths in a year}}{\text{Average total population (midyear)}} \times 1000 \]

Needs only three pieces of information:
- Total deaths in the year
- Population at beginning of year
- Population at end of year
The paradox of the CDR

- Mexico (2000)
  - Life expectancy = 72 yrs.
  - CDR = 4
  - % population age 65+ = 5

- Lithuania (2000)
  - Life expectancy = 72 yrs.
  - CDR = 11
  - % population age 65+ = 13

Age/sex-specific death rate

\[
\text{Age/sex-specific death rate} = \frac{\text{# deaths in year of people aged } x \text{ to } x + n}{\text{Midyear population aged } x \text{ to } x + n} \times 100,000
\]

Age-specific death rates are often calculated in 5-year spans.

females aged 65-69 = 1,530
Age-specific death rates form J-curve

Immediate/Proximate/Distal Causes of Death

Immediate cause
(e.g. heart disease)

Proximate causes
(e.g. smoking, obesity, seat-belt usage, sleep, cholesterol level, stress)

Distal causes
(e.g. socioeconomic status, social relations, geographic factors, war)
Proximate and immediate causes of death in U.S., 2000

- Tobacco use
  - (1) Heart disease (29.6 %)
  - (2) Cancer (23.0 %)
  - (3) Stroke (7.0 %)
- Diet / activity
  - (4) Lung disease (5.1%)
- Alcohol misuse
  - (5) Accidents (4.1%)
  - (6) Diabetes (2.9 %)
- Exposure to toxins
  - (11) Suicide (1.2 %)
  - (12) Liver disease (1.1 %)
- Firearms
  - (14) Homicide (0.7 %)
- Sexual behavior
- Drug use
- ... HIV / AIDS

Distal Causes

- Theory is still evolving
- Traces to Demographic Transition
  - Industrialization → rising GDP
  - Rising GDP increases investment in health
  - Rising investment in education, esp. girls’
- Competing theories on the mechanism:
  - Nutrition (based loosely on grain markets)
  - Public health/sanitation
  - Modern medicine
Caldwell’s interpretation of the health transition in the developing world

- Socioeconomic differentials in mortality have always existed, even before modern medicine.
- Social differentials X medicine explains much of contemporary mortality.
- Social mechanisms underlying mortality decline are part of same phenomenon: modernization/individualization (rise of choice).
  - Social counterpart to rise of market economy
  - Rise of (female) education and autonomy
  - Paradigm shift in beliefs (away from divine will)

Updating Caldwell

- Modern context: Reversals (sometimes temporary) in trend toward lower mortality
  - Conflict in Africa
  - HIV/AIDS
  - Breakup of Soviet Union
  - Low-SES whites in the United States
- Appearance of income/mortality lag in oil states (high mortality had been attributed to religion’s effect on women’s status)
- Movement among high relative achievers on mortality
Preston: Relations between $e_0$ and national income, 1900s, 1930s, and 1960s
Inequality matters for health and mortality

For individuals: Americans in the bottom 5% of income in 1980 had 25% percent lower life expectancy than Americans in top 5%.

Overall inequality also matters for the social structure. More unequal places have worse outcomes for all.

Source: NYT, 2005.
“Life at the Top in America Isn't Just Better, It's Longer”

Caldwell: Connecting distal factors

• Historically: SES mattered for mortality.
• Developing world: SES x medicine
• Modernization and rise of individualism
  – Female education (knowledge, attitudes)
  – Female autonomy
  – Secularization of health behaviors
  – Movement to market from family economy
  – Relative importance of these varies by context
New Distal Factor: “Nutrition Transition”

- Shift to processed food, more animal fat, and sugar.
- 1 in 6 people worldwide now obese or overweight.
- Projected growth in overweight/obesity of 50 percent over next 10 years.
- Developing world ill-equipped to handle many cases of heart disease and diabetes.

Distal factors in the US: SES

Mortality Rates for People Ages 25 to 64, by Sex and Years of Education, 1999

Deaths (per 100,000 people)

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