An overview of the Human Mortality Database ongoing developments

Magali Barbieri

University of California, Berkeley and Institut national d'études démographiques, Paris
New HMD developments/projects

1. Adding Cause-of-death information to the HMD
2. Subnational Mortality Databases
3. MortX: Beyond the HMD
Project 1: Including cause-of-death information in the HMD

- Main idea: To enrich the HMD with cause-of-death data series for selected countries

- Other international cause-specific mortality database have important limitations
  - WHO: Not-user friendly (diversity of format, lack of documentation, changes in classifications/shortlists…)
  - EUROSTAT: Limited to 10/15 years and to European countries
Basic principles

• For all HMD countries with cause-of-death data coded to the ICD

• Back to 1950 or earliest year available

• Data series consistent with all-cause series:
  – Cause-specific death counts
  – Age-specific cause-specific death rates

• Shortlist of <100 exclusive cause-of-death categories
  (mostly compatible with EUROSTAT and NCHS)

• Emphasis on disruptions arising from revisions of the ICD
## COD series

<table>
<thead>
<tr>
<th>Ready to publish</th>
<th>In-progress</th>
</tr>
</thead>
<tbody>
<tr>
<td>England and Wales (1950-2013)</td>
<td>Italy (1955-2014)</td>
</tr>
<tr>
<td>Japan (1950-2013)</td>
<td></td>
</tr>
<tr>
<td>Norway (1951-2012)</td>
<td></td>
</tr>
<tr>
<td>Sweden (1952-2012)</td>
<td></td>
</tr>
<tr>
<td>The United States (1959-2016)</td>
<td></td>
</tr>
</tbody>
</table>
Project 3
Subnational Mortality Databases

• Motivations
  – To monitor geographic inequalities in mortality
  – To identify “laggards” and “pioneers” in longevity within a country (E./W. Germany)

• Previous independent work with HMD technical support:
  – Canada (provinces)
  – Japan (prefectures)

• Current HMD work:
  – Germany (various geographic units; since 1982 for the landers)
  – The United States (states/counties)

• HMD-like mortality series with same basic principles
  (comparability, accessibility, flexibility, quality control)
Status of the United States Mortality DataBase (USMDB)

United States Mortality Database
Nagach Barbieri, Director
University of California, Berkeley & INED, France

John Wilmoth, Founding Director
United Nations & formerly University of California, Berkeley

General Project Description: The United States Mortality Database (USMDB) brings you the first rigorously documented historical set of complete state-level life tables, updated to the latest year of available data, designed to be usable in any geographic context, currently for each of the 50 U.S. Census Divisions, 4 Census Regions, 39 States and the District of Columbia, for each year since 1830 with mortality rates up to age 110. The data are available for free to all interested researchers.

The USMDB is an outgrowth of the Human Mortality Database (HMD) project. It was developed to provide detailed mortality and population data to researchers, students, journalists, policy analysts, and others interested in state-level mortality trends and geographic variations in the length of life within the United States. The USMDB has been created by the HMD team at the University of California, Berkeley in collaboration with the Mortality Branch at the National Center for Health Statistics, Centers for Disease Control (CDC) and with support from the Center on the Economics and Demography of Aging (CEDA) and from the Torch Institute for Demographic Studies (TIDS). It has been funded, in part, by grants from the National Institutes of Health (ROI: AR042926) and from the Institute of Actuaries (UK) Post Fund.

For more information, please begin by reading an overview of the database. If you have comments or questions, or trouble gaining access to the data, please visit our FAQs [http://usa.mortality.org/](http://usa.mortality.org/).

Disclaimer: This is a preliminary version of the USMDB. We have made our best efforts to check the quality of the data and to verify that the regional life tables contained therein have been constructed on the basis of sound scientific judgment. However, we make no warranties with that effect, and we shall not be liable for any damages that may result from errors in the data. Furthermore, we will seek to continuously update the USMDB. This information form may not be current up to date as it processes.

Data Description: The United States Mortality Database provides open access to complete and abridged life tables for each calendar year since 1830 for the 50 U.S. states and the District of Columbia, for the 4 Census Divisions, 4 Census Regions, and for the nation as a whole.

Life tables are provided in two different output formats and may be downloaded in text or comma-delimited text files. The entire set of life tables can be downloaded in this format [http://usa.mortality.org](http://usa.mortality.org) or the user can select life tables for a given state, division, region, or the nation from the tables below.

http://usa.mortality.org/
## Status of the United States Mortality DataBase (USMDB)

The United States Mortality DataBase (USMDB) is a comprehensive repository of mortality data for the United States. The data includes statistics on various aspects of mortality, such as age, gender, and cause of death. The USMDB is maintained by the Centers for Disease Control and Prevention (CDC) and is accessible through their website [USA.Mortality.org](http://usa.mortality.org/).

### Lifetables by Geographic Level

#### Geographic Level: National

<table>
<thead>
<tr>
<th>State</th>
<th>Lifetable</th>
</tr>
</thead>
<tbody>
<tr>
<td>USA</td>
<td>National</td>
</tr>
</tbody>
</table>

#### Geographic Level: Census Region (Reg)

<table>
<thead>
<tr>
<th>Region</th>
<th>Lifetable</th>
</tr>
</thead>
<tbody>
<tr>
<td>N. Northeast</td>
<td>Reg1: North East</td>
</tr>
<tr>
<td>S. Northeast</td>
<td>Reg1: South East</td>
</tr>
<tr>
<td>M. Midwest</td>
<td>Reg2: Midwest</td>
</tr>
<tr>
<td>S. West</td>
<td>Reg2: South West</td>
</tr>
</tbody>
</table>

#### Geographic Level: Census Division (Div)

<table>
<thead>
<tr>
<th>Division</th>
<th>Lifetable</th>
</tr>
</thead>
<tbody>
<tr>
<td>N. New England</td>
<td>Div1: New England</td>
</tr>
<tr>
<td>M. Middle Atlantic</td>
<td>Div1: Middle Atlantic</td>
</tr>
<tr>
<td>S. East South Central</td>
<td>Div1: East South Central</td>
</tr>
<tr>
<td>S. West South Central</td>
<td>Div1: West South Central</td>
</tr>
</tbody>
</table>

### Geographic Level: State

<table>
<thead>
<tr>
<th>State</th>
<th>Lifetable</th>
</tr>
</thead>
<tbody>
<tr>
<td>AL</td>
<td>Alabama</td>
</tr>
<tr>
<td>AK</td>
<td>Alaska</td>
</tr>
<tr>
<td>AZ</td>
<td>Arizona</td>
</tr>
<tr>
<td>AR</td>
<td>Arkansas</td>
</tr>
<tr>
<td>CA</td>
<td>California</td>
</tr>
<tr>
<td>CO</td>
<td>Colorado</td>
</tr>
<tr>
<td>CT</td>
<td>Connecticut</td>
</tr>
<tr>
<td>DE</td>
<td>Delaware</td>
</tr>
<tr>
<td>FL</td>
<td>Florida</td>
</tr>
<tr>
<td>GA</td>
<td>Georgia</td>
</tr>
<tr>
<td>HI</td>
<td>Hawaii</td>
</tr>
<tr>
<td>ID</td>
<td>Idaho</td>
</tr>
<tr>
<td>IN</td>
<td>Indiana</td>
</tr>
<tr>
<td>IA</td>
<td>Iowa</td>
</tr>
<tr>
<td>KS</td>
<td>Kansas</td>
</tr>
<tr>
<td>KY</td>
<td>Kentucky</td>
</tr>
<tr>
<td>LA</td>
<td>Louisiana</td>
</tr>
<tr>
<td>ME</td>
<td>Maine</td>
</tr>
<tr>
<td>MD</td>
<td>Maryland</td>
</tr>
<tr>
<td>MA</td>
<td>Massachusetts</td>
</tr>
<tr>
<td>MI</td>
<td>Michigan</td>
</tr>
<tr>
<td>MN</td>
<td>Minnesota</td>
</tr>
<tr>
<td>MS</td>
<td>Mississippi</td>
</tr>
<tr>
<td>MO</td>
<td>Missouri</td>
</tr>
<tr>
<td>MT</td>
<td>Montana</td>
</tr>
<tr>
<td>NE</td>
<td>Nebraska</td>
</tr>
<tr>
<td>NV</td>
<td>Nevada</td>
</tr>
<tr>
<td>NH</td>
<td>New Hampshire</td>
</tr>
<tr>
<td>NJ</td>
<td>New Jersey</td>
</tr>
<tr>
<td>NM</td>
<td>New Mexico</td>
</tr>
<tr>
<td>NY</td>
<td>New York</td>
</tr>
<tr>
<td>NC</td>
<td>North Carolina</td>
</tr>
<tr>
<td>ND</td>
<td>North Dakota</td>
</tr>
<tr>
<td>OH</td>
<td>Ohio</td>
</tr>
<tr>
<td>OK</td>
<td>Oklahoma</td>
</tr>
<tr>
<td>OR</td>
<td>Oregon</td>
</tr>
<tr>
<td>PA</td>
<td>Pennsylvania</td>
</tr>
<tr>
<td>RI</td>
<td>Rhode Island</td>
</tr>
<tr>
<td>SC</td>
<td>South Carolina</td>
</tr>
<tr>
<td>SD</td>
<td>South Dakota</td>
</tr>
<tr>
<td>TN</td>
<td>Tennessee</td>
</tr>
<tr>
<td>TX</td>
<td>Texas</td>
</tr>
<tr>
<td>UT</td>
<td>Utah</td>
</tr>
<tr>
<td>VT</td>
<td>Vermont</td>
</tr>
<tr>
<td>VA</td>
<td>Virginia</td>
</tr>
<tr>
<td>WI</td>
<td>Wisconsin</td>
</tr>
<tr>
<td>WV</td>
<td>West Virginia</td>
</tr>
<tr>
<td>WY</td>
<td>Wyoming</td>
</tr>
</tbody>
</table>

---

For more detailed information and access to the data, visit [USA.Mortality.org](http://usa.mortality.org/).
Output

• 1959-2015 Period life tables by sex, single year of age

• For the United States
  – Census Regions (4)
  – Census Divisions (9)
  – States (50)
  – And the District of Columbia

• Additional formats to be made available
  – Abridged life tables (5-year age groups)
  – 5- and 10-year periods
Project 3
MortX: Expanding to other parts of the world

- HMD limited to countries with data of the highest quality
- Interest of scientists to monitor mortality trends in Latin America, Asia, Africa
- International effort to improve data collection (vital statistics) systems (Millenium/Sustainable Development Goals)
- Using the HMD approach to expand to other regions of the world
Main challenges

- Availability of data of “reasonable” quality (Census data and vital statistics)
- Develop the HMD tools to evaluate input data quality
- Non-HMD methods require to adjust unreliable/incomplete input data (beyond the HMD => indirect estimation)
- Impact of data quality issues on the measurement of biometric risks and mortality improvement models
- Human resources => Need for additional funds
- Exploratory work with selected case studies (Chile, Costa-Rica, Hong Kong and Mexico) partly funded by a grant from the AXA Research Fund
The contribution of drug-related deaths to the US disadvantage in mortality

Magali Barbieri

University of California, Berkeley and Institut national d'études démographiques, Paris
Motivation

US mortality trends since 1980:

1. Exponential increase in drug-related deaths
2. Growing gap in life expectancy at birth between the US and other high-income democracies

⇒ How much does the drug epidemic contribute to the US disadvantage in mortality?
Drug-related deaths in the US

A rapid increase in the number of deaths due to drug poisoning (mostly opioids) in 1980-2016 (Case and Deaton, 2015, 2017)

Source: reconstruction of the number of drug-related deaths (prescription and illicit drugs) for years 1979-2016 adjusted for ICD change (using the 1996 bridge coding study).
The US drug epidemic

- 600,000 deaths due to drug poisoning (overdoses) since 2000 (x 10 in 35 years => from 6,500 in 1980 to 65,000 in 2016)
- 75-85% of all drug overdoses = 20-50 years old
- Same trend for both sexes but women less affected than men.

![Graph showing the number of deaths from drug overdoses by year and gender.]
Growing US mortality disadvantage

• The divergence with other high-income market economies started around 1980 (« Shorter lives, poorer health », National Research Council 2013)

• The US disadvantaged affects a large range of health and mortality indicators

• American men and women are similarly disadvantaged

• 2/3 of the gap in life expectancy at birth attributable to ages below 50 years (Ho, 2013)
Study goals

1. Update analysis of US lag in life expectancy at birth with other high-income countries
2. Compare trends in drug-related mortality in the US with other countries
3. Measure the contribution of drug poisoning to the increasing gap in life expectancy
Research design

Data:

1. Human Mortality Database
   (1980-2014 life tables by sex for the US + 18 countries)
2. World Health Organization mortality database
   (2000-2014 deaths by cause in 12 countries + the US)

Methods:

• Age-standardized mortality rates for 7 broad cause-of-death categories (drug poisoning, alcohol and chronic liver diseases, suicide, cancer, cardiovascular diseases, other diseases, other external causes) for each country in 2014

• Decomposition method to quantify the contribution of drug poisoning to the difference in life expectancy at birth
Drug-related mortality

Restrictive definition:

• Underlying cause of death only

• ICD-10 codes (10th Revision of the International Classification of Diseases) = CDC definition:
  - X40-X44 (accidental poisoning – prescription + illicit drugs)
  - X85 (homicide by drug poisoning)
  - Y10-Y14 (drug poisoning with undetermined intent)
  - Y45, Y47, Y49 (consequences of therapeutic use of pharmaceutical or biological substances)

⇒ Excludes
  - suicides (X60-X64)
  - Mental and behavioural disorders due to psychoactive substance use (F10-F19)
Drug-related mortality

Restrictive definition:

• Underlying cause of death only

• ICD-10 codes (10\textsuperscript{th} Revision of the International Classification of Diseases) = CDC definition:
  
  – X40-X44 (accidental poisoning – prescription + illicit drugs)
  – X85 (homicide by drug poisoning)
  – Y10-Y14 (drug poisoning with undetermined intent)
  – Y45, Y47, Y49 (consequences of therapeutic use of pharmaceutical or biological substances)

⇒ Excludes
  
  - suicides (X60-X64)
  - Mental and behavioural disorders due to psychoactive substance use (F10-F19)
Trends in life expectancy at birth in the US and 18 other high-income countries, 1980-2014

Life expectancy at birth

Source: HMD data for Australia, Austria, Belgium, Denmark, Finland, France, Iceland, Ireland, Japan, Luxembourg, New-Zealand, Norway, Portugal, Spain, Sweden, Switzerland, the United Kingdom and Germany.
Ratio of the age-specific death rates (all causes) in the US to the average in 18 other high-income countries, 1960, 1980, 2000 and 2014

Source: HMD data for Australia, Austria, Belgium, Denmark, Finland, France, Iceland, Ireland, Japan, Luxembourg, New-Zealand, Norway, Portugal, Spain, Sweden, Switzerland, the United Kingdom and Germany.
Drug-related age-standardized mortality rate in the US and 12 other high-income countries, 2000-2014

Source: HMD and WHO data for Austria, Belgium, Denmark, Finland, France, Germany, Ireland, Japan, Norway, Spain, Sweden and the United Kingdom.
Drug-related age-standardized mortality rate in the US and 12 other high-income countries, 2000-2014

Source: HMD and WHO data for Austria, Belgium, Denmark, Finland, France, Germany, Ireland, Japan, Norway, Spain, Sweden and the United Kingdom.
Drug-related age-standardized mortality rate in the US and 12 other high-income countries, 2000-2014

Source: HMD and WHO data for Austria, Belgium, Denmark, Finland, France, Germany, Ireland, Japan, Norway, Spain, Sweden and the United Kingdom.
Decomposition by cause of the difference in years lived at ages 20 to 50 between the US and Japan in 2014

Total difference in years lived at ages 20-50 (Japan – US): 2.06 years
Decomposition of the difference in years lived at ages 20-50 between the US and 13 high-income countries in 2014

Men
Decomposition of the difference in years lived at ages 20-50 between the US and 13 high-income countries in 2014

Men
Decomposition of the difference in years lived at ages 20-50 between the US and 13 high-income countries in 2014.

Women

Contributions in years:
- Drugs
- Alcohol
- Suicide
- Cancer
- Cardiovascular disease
- Other diseases
- Other external causes

The UK, Belgium, France, Denmark, Ireland, Germany, Finland, Austria, Norway, Sweden, Japan, Spain.
Decomposition of the difference in years lived at ages 20-50 between the US and 13 high-income countries in 2014

Women

The UK  Belgium  France  Denmark  Ireland  Germany  Finland  Austria  Norway  Sweden  Japan  Spain

-0.2  0.0  0.2  0.4  0.6  0.8  1.0  1.2

Drugs  Alcohol  Suicide  Cancer  Cardiovascular dis.  Other diseases  Other external causes

Contribution in years
Decomposition of the difference in life expectancy at birth between the US and 13 high-income countries in 2014

Men

- Drugs
- Alcohol
- Suicide
- Cancer
- Cardiovascular dis.
- Other diseases
- Other external causes

Contribution in years:

- Finland
- Germany
- Belgium
- Denmark
- Austria
- Ireland
- The UK
- France
- Norway
- Spain
- Sweden
- Japan

Institute and Faculty of Actuaries
Decomposition of the difference in life expectancy at birth between the US and 13 high-income countries in 2014

Men

- Contribution in years
- Countries: Finland, Germany, Belgium, Denmark, Austria, Ireland, The UK, France, Norway, Spain, Sweden, Japan
- Causes: Drugs, Alcohol, Suicide, Cancer, Cardiovascular dis., Other diseases, Other external causes

Institute and Faculty of Actuaries
Decomposition of the difference in life expectancy at birth between the US and 13 high-income countries in 2014

Women

Contribution in years

Drugs
Alcohol
Suicide
Cancer
Cardiovascular dis.
Other diseases
Other external causes

Denmark
The UK
Ireland
Germany
Belgium
Austria
Finland
Sweden
Norway
France
Spain
Japan
Decomposition of the difference in life expectancy at birth between the US and 13 high-income countries in 2014

Women

Contribution in years

- Drugs
- Alcohol
- Suicide
- Cancer
- Cardiovascular dis.
- Other diseases
- Other external causes
Trends in life expectancy at birth in the US and 12 other high-income countries in 1980-2014
Before and after eliminating drug-related deaths

Life expectancy at birth

Men

Women

USA - after
USA - before
Trends in life expectancy at birth in the US and 12 other high-income countries in 1980-2014

After eliminating drug-related deaths

Life expectancy at birth

[Graph showing trends in life expectancy for men and women in the US, with data points and box plots for each year from 2000 to 2012.]
Conclusion

• The mortality crisis associated with the drug epidemics is very specific to the United States (at least for now)

• Drug overdoses « explain » 30 to 40% of excess US mortality for working-age adults (20-50 years old) compared to other countries

• Concentrating on the factors particular to the US could help identify the main drivers of the mortality crisis

• Controlling drug-related mortality would hardly close the survival gap between the US and other countries
Questions?
Comments?
Suggestions?
Acknowledgments

Support provided by the U.S. National Institute on Aging (grants R01-AG011552 and R01-AG040245), the U.K. Institute and Faculty of Actuaries, the Canadian Institute of Actuaries, Hannover-Re, SCOR, RGA, AXA and the Society of Actuaries (REX-Pool Fund).