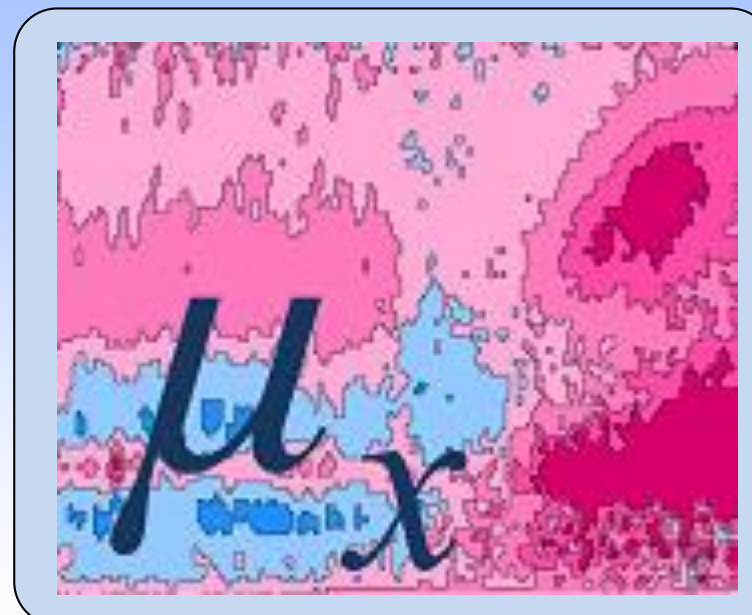


Mortality Trends at a Glance: MortalityTrends.org



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Summary A web application has been developed for dissemination, visualization, and comparison of national mortality data: www.mortalitytrends.org. The website provides access to complete annual life tables for about 200 individual countries or areas together with the frequently requested aggregate mortality indicators such as life expectancy at birth, life expectancy at age 65, adult mortality, infant mortality among others. Life tables have been computed from available empirical data by the standard demographic methods. Exploring of mortality trends is facilitated by online plots. Currently, it is the only website providing access to the complete annual life tables for all national populations.

Methods

Mortality estimates for the countries with well-functioning vital registration systems have been produced (in general) following the protocol for Human Mortality Database (HMD) (www.mortality.org). In several cases, however, additional adjustments were required, especially at infant and older ages, as the HMD protocol has no provision for adjusting data affected by problems of misclassification of live births, misreporting of age, or adjusting data for incomplete vital registration.

For the rest of countries, complete period life tables for single calendar years are derived by spline interpolation of abridged quinquennial life tables from bi-annual revisions of the World Population Prospects (unpopulation.org). The final estimates are presented in the same format, but the underlying data and methods used are completely different.

Illustration of the process of constructing mortality estimates on example of Japan

Figure 1 shows available input data on population and deaths for Japan. For 1947-1949, deaths are available in 5-year age groups (Lexis rectangles with 1-year width and 5-year heights in Fig. 1), and up to the age 80+. For 1959-2014, deaths are available by single calendar year, single year of age, and by cohort (or by Lexis triangles), for all ages up to the highest age attained. For the period 1947-1995, population estimates are available from quinquennial censuses (vertical yellow lines) which are published by single year of age and up to age 100+, for 1995-2010 both from censuses and intercensal estimates (magenta lines), and for years 2010 and later from the postcensal estimates.

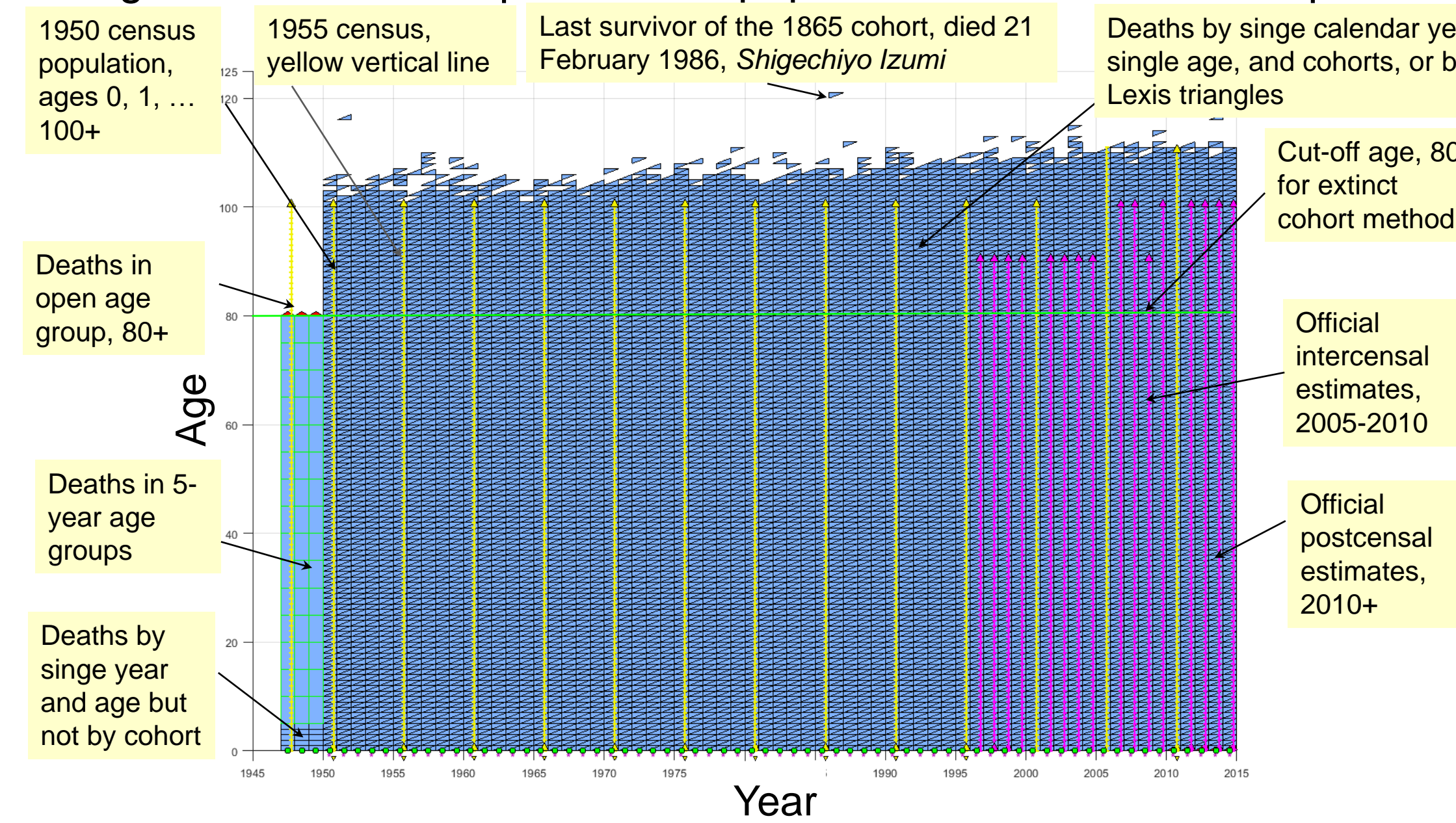
Steps to compute death rates include:

- distribution of deaths in 5-year age groups and in open age groups by Lexis triangles, years 1947-1949;
- computation of intercensal population estimates, years 1947-1995 based on assumption census population below age 80 is correct and that residual migration is distributed evenly along the cohorts;
- computation of population estimates for ages 80+ for extinct and almost extinct cohorts by (almost) extinct cohort method (Fig. 2).

d) **computation of death rates** by Lexis rectangles, corresponding **life tables** etc. (Fig. 3). Below age 80, death rates are based on deaths and official population estimates (Area 1, Fig. 3). Above age 80, for extinct cohorts (earlier years), death rates are based on deaths only (Area 2, Fig. 3), and for non-extinct cohorts death rates are based both on deaths and on survivor estimates of the cohorts (recent years, Area 3, Fig.3).

Before the mortality estimates are made online, an internal **data quality report** is produced to assess the reliability of the estimates. The report includes plots of age distribution of population and deaths with age heaping and age misreporting indices, age-specific schedules and time trends in death rates, Lexis maps of death rates, mortality improvement rates, sex ratios of death rates, maps of residual net migration among others. In addition, external mortality estimates are collected from different sources and compared with the mortality estimates for the current country. As a final step, the current estimates are compared with the previous version of the estimates. The final estimates are made available at a country page (e.g. for Japan at <http://www.mortalitytrends.org/data/jpn/>).

Figure 1. Available input data on population and deaths for Japan



List of data sources is available at <http://www.mortalitytrends.org/data/jpn/sources.htm>

Figure 2. Almost extinct cohort method

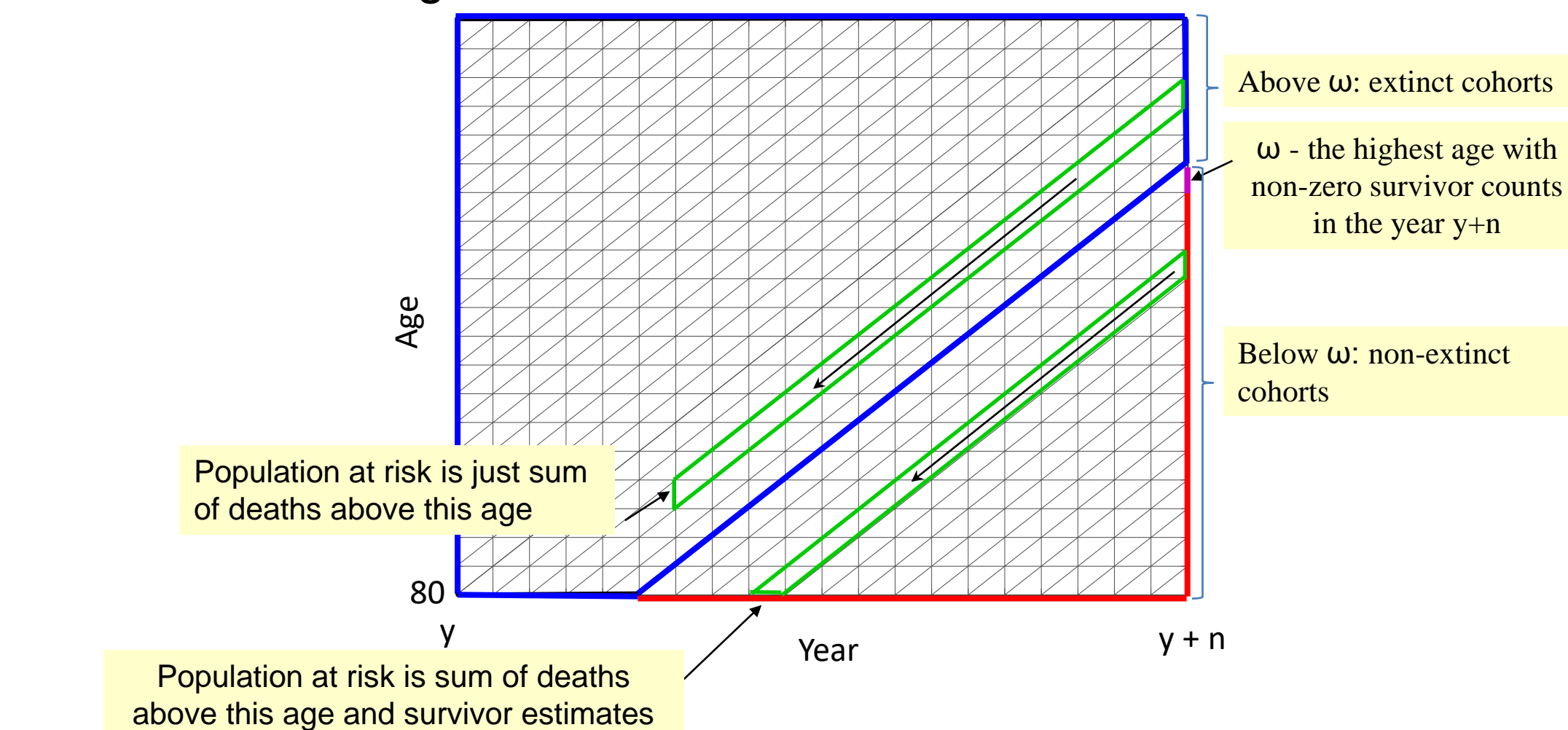
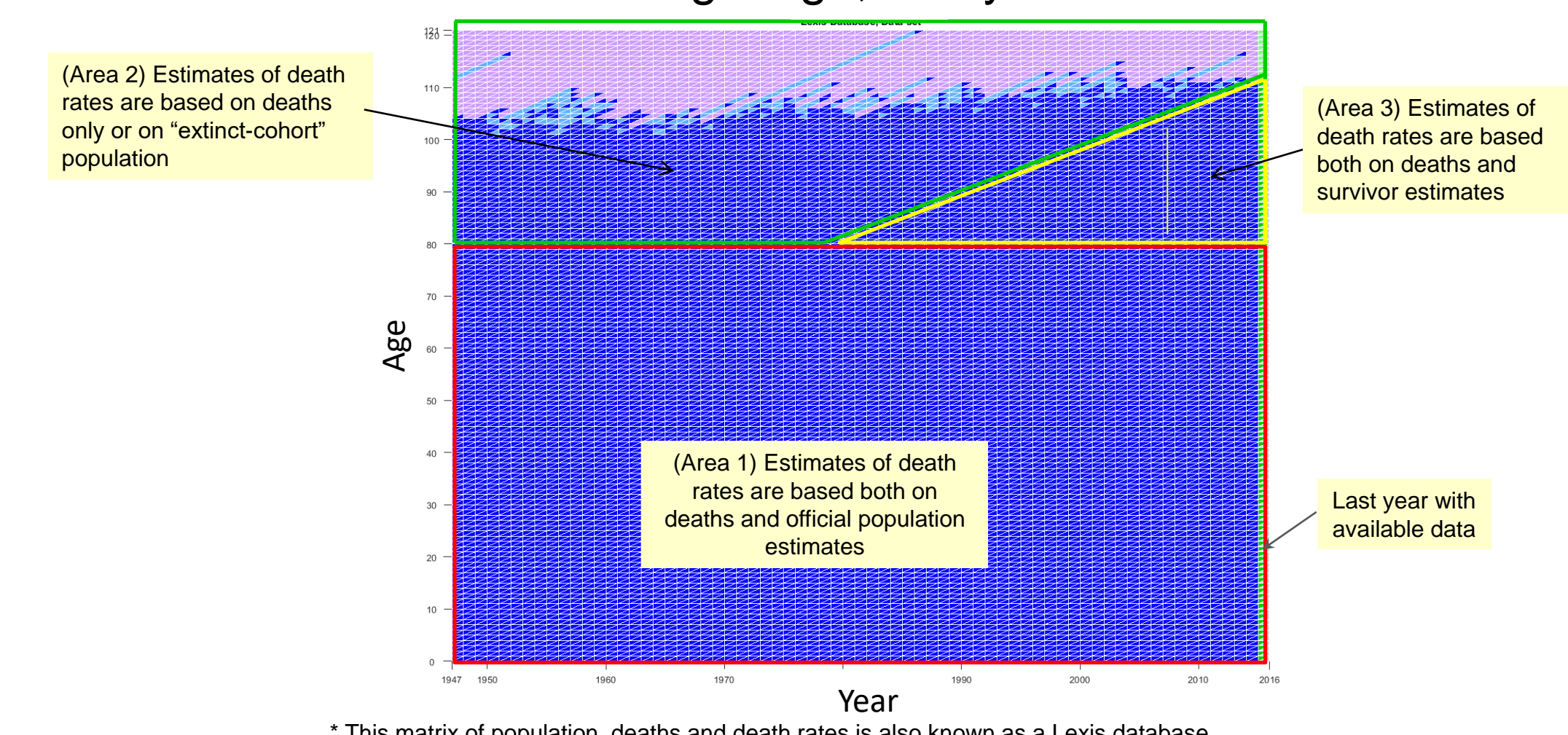


Figure 3. Population and deaths by single calendar year, single age, and year of birth



* This matrix of population, deaths and death rates is also known as a Lexis database

Mortality Statistics

Country pages provide access to mortality statistics

United States

Documentation Sources

Mortality Statistics Years = 1933-2018

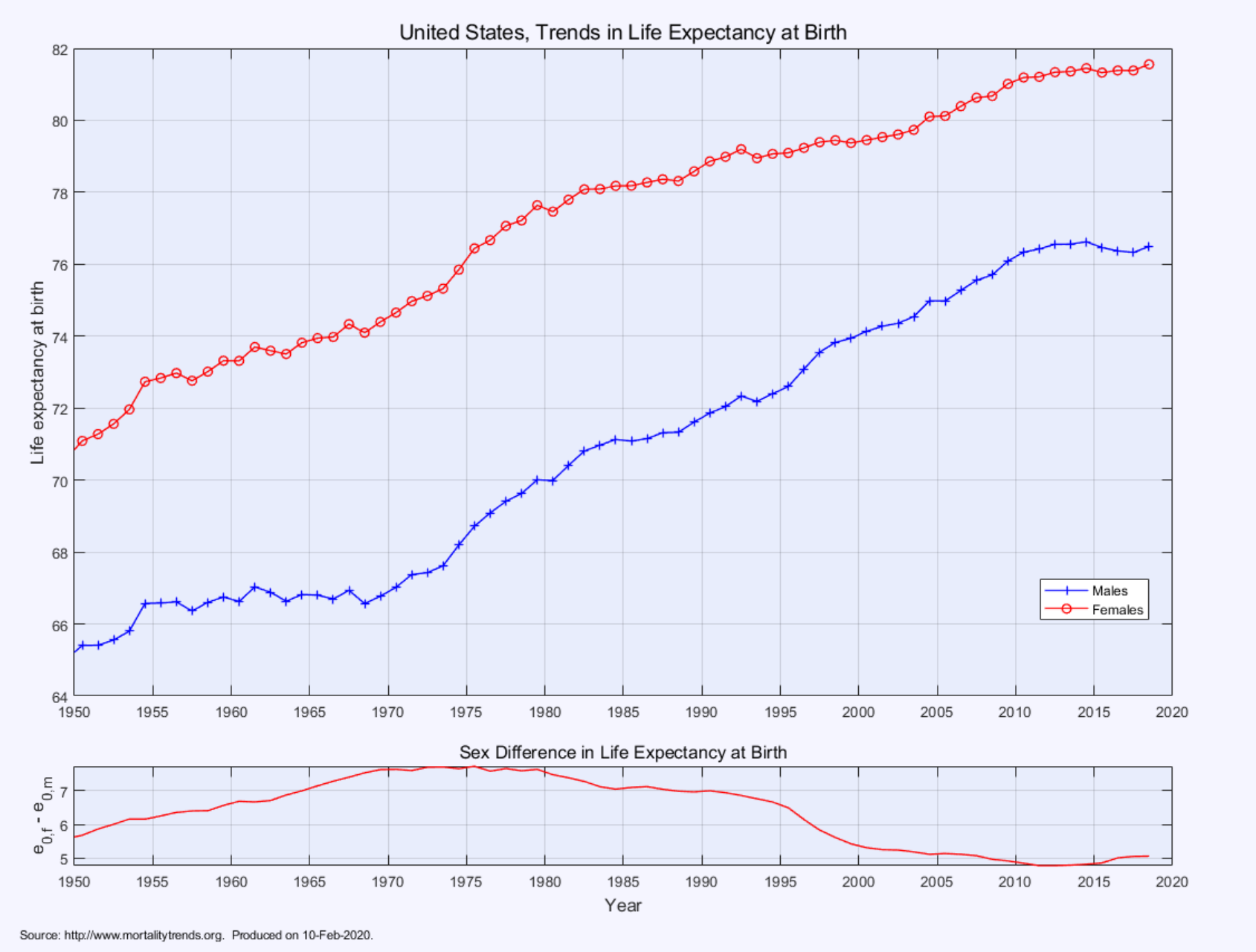
Period Indicators			
Life expectancy at birth	Males	Females	Total
Life expectancy at selected ages, Total	10-65	80	
Life expectancy at selected ages, Males	10-65	80	
Life expectancy at selected ages, Females	10-65	80	
Sex difference in life expectancy	0-10	65-80	
Infant mortality rate			
Child mortality between ages 1-5	Males	Females	Total
Under-five mortality			
Adult mortality	Males	Females	Total
Life Tables			
Complete life tables for single calendar years	Males	Females	Total
Abridged life tables for 5-year periods	Males	Females	Total
Plots			
Life expectancy at birth	Plot		
Time trends in death rates	Plot		
Age-specific schedules of death rates	Plot		
Lexis maps of death rates	Males	Females	
Lexis map of sex ratio of death rates	Plot		

including complete life tables

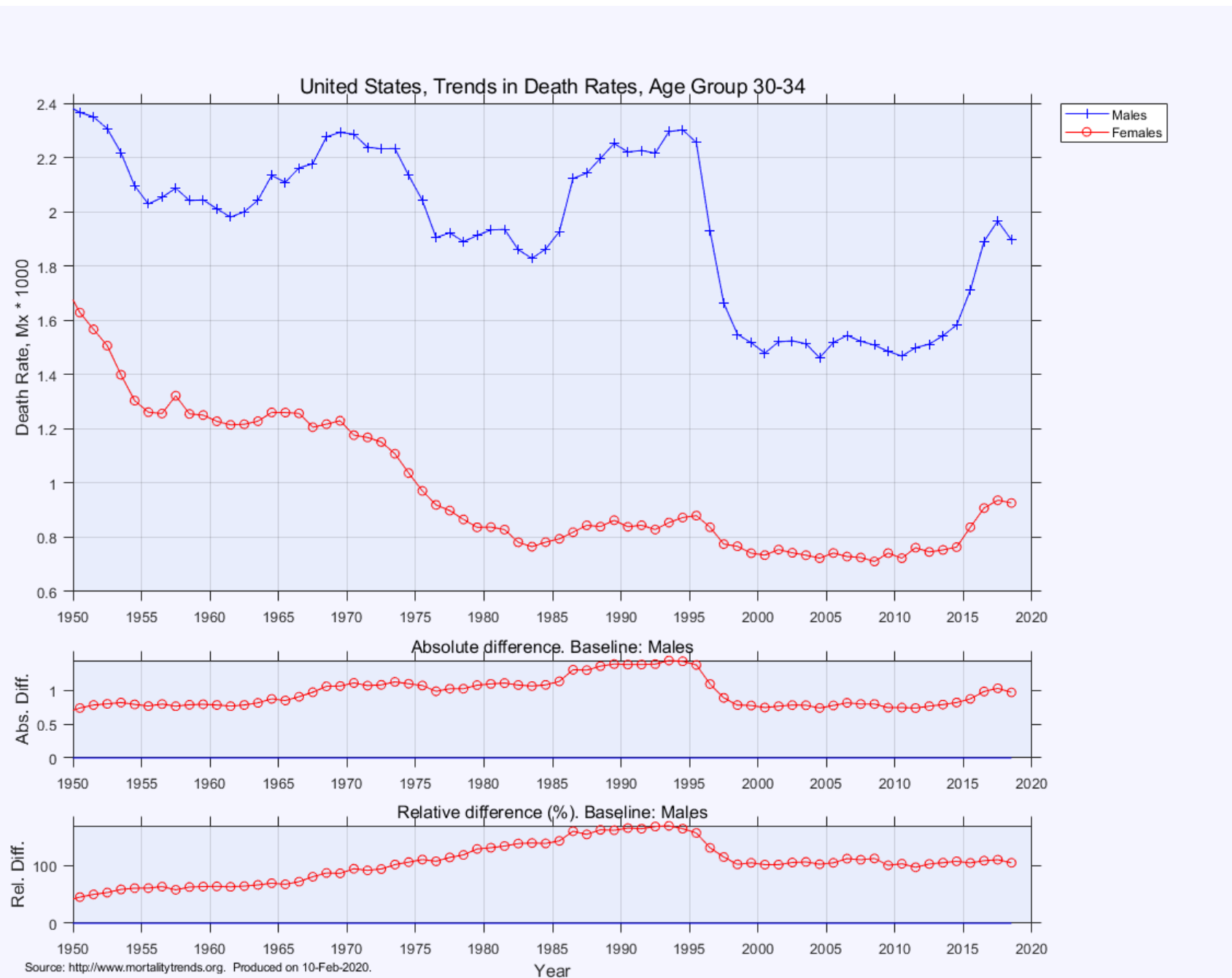
United States, Complete life tables, Males

year	age	m_x	a_x	q_x	l_x	d_x	L_x	T_x	e_x
1933	0	0.068550	0.228988	0.065109	100000.00	6510.89	94980.03	5916215.99	59.1622
1933	1	0.009911	0.500000	0.009962	93489.11	921.98	93208.12	5823235.96	62.2879
1933	2	0.004653	0.500000	0.004643	92567.13	429.75	92352.25	5730207.84	61.9033
1933	3	0.003331	0.500000	0.003326	91317.38	306.43	91984.16	5637955.58	61.1897
1933	4	0.002514	0.500000	0.002511	91039.09	230.56	91716.97	5546971.42	60.3922
1933	5	0.002025	0.500000	0.002021	91003.29	191.53	91564.63	5444155.76	59.5429
1933	6	0.001899	0.500000	0.001897	91469.87	173.42	91322.16	5362651.13	58.6656
1933	7	0.001745	0.500000	0.001743	91235.45	159.05	91155.93	5271328.97	57.7772
1933	8	0.001614	0.500000	0.001613	91075.40	146.87	91003.97	5180173.04	56.8772
1933	9	0.001511	0.500000	0.001509	90929.53	137.25	90860.91	5089170.07	55.9683
1933	10	0.001455	0.500000	0.001454	90792.28	130.20	90727.18	4998309.17	55.0521
1933	11	0.001409	0.500000	0.001408	90662.08	127.67	90596.25	4907581.99	54.1305
1933	12	0.001459	0.500000	0.001458	90534.41	131.96	90468.43	4816983.74	53.2061

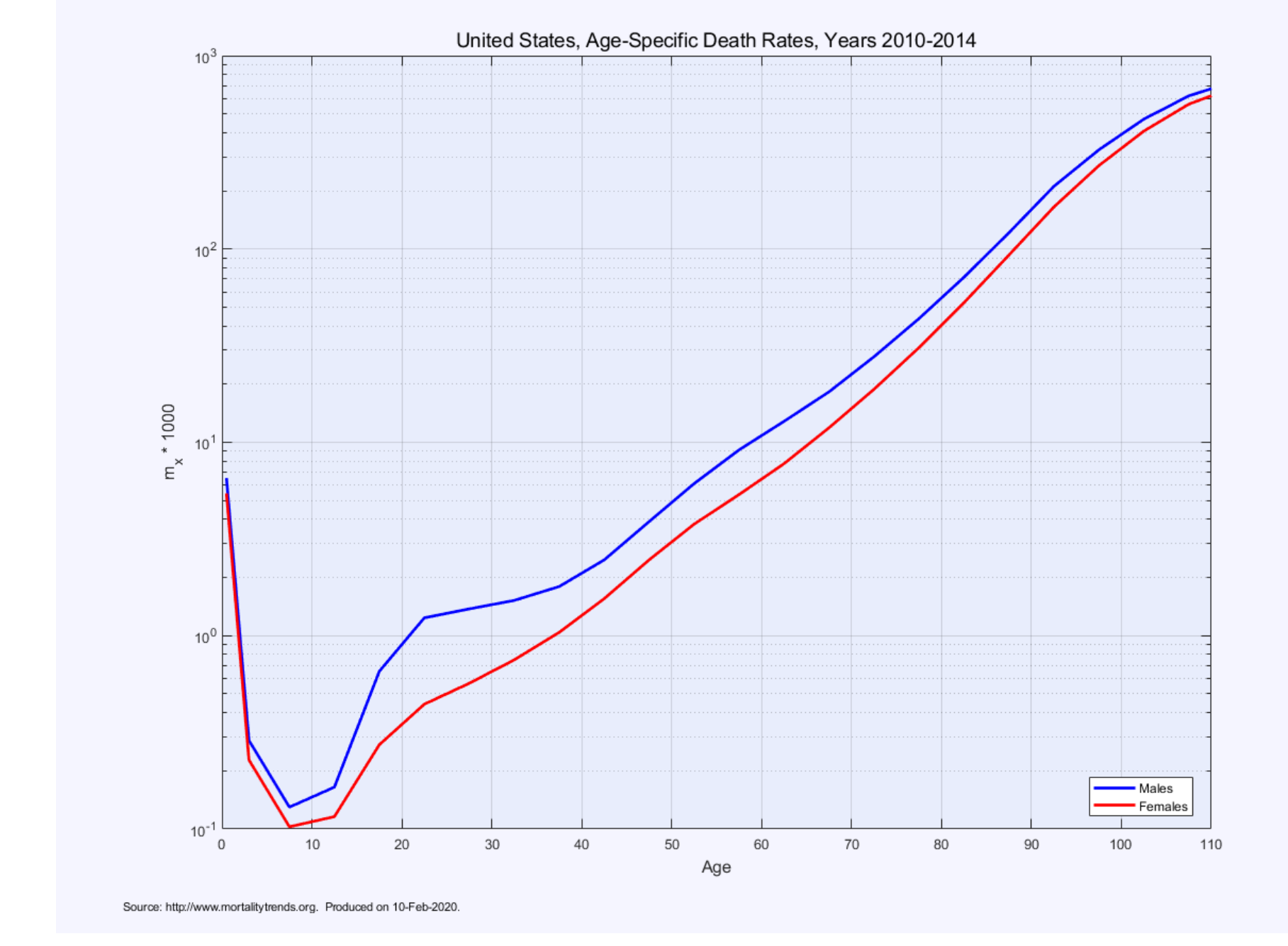
Plots of mortality indicators include plots of trends in life expectancy at birth



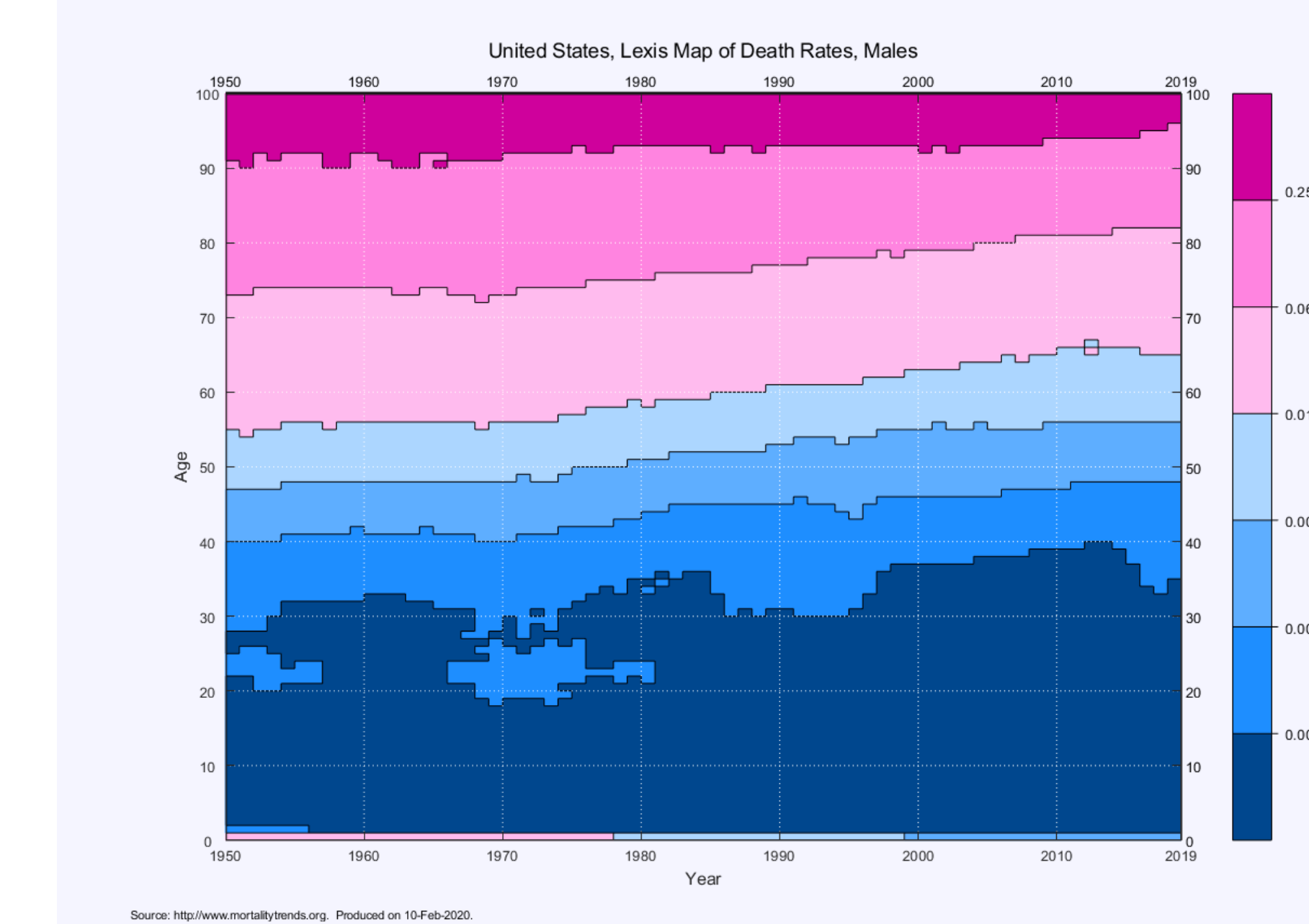
trends in age-specific death rates



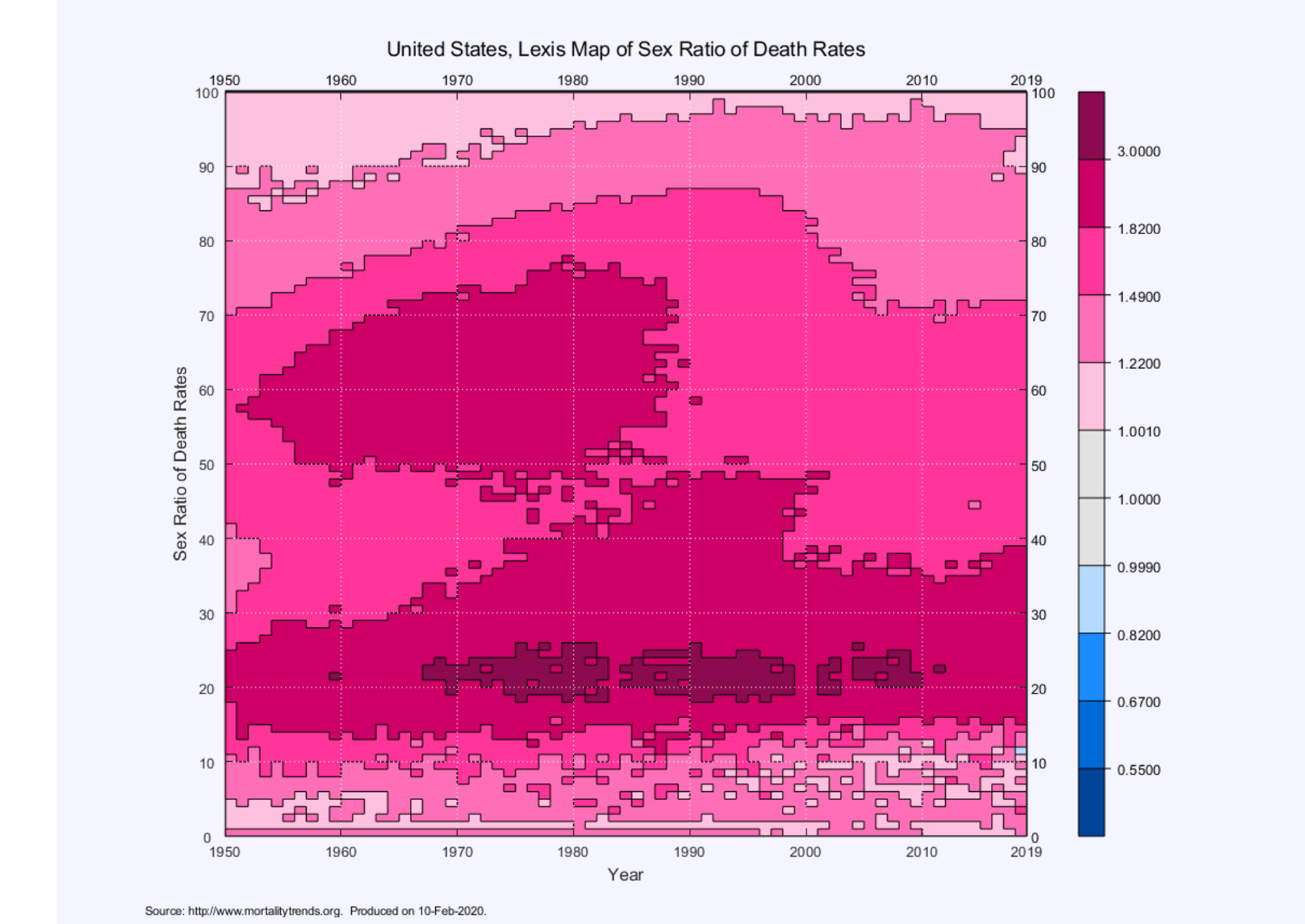
plots of age-specific schedules of death rates



Lexis maps of death rates



Lexis maps of sex ratio of death rates



Data sources and methods

Each country page provides access to sources and methods used to derive mortality estimates e.g.:

Mortality estimates for this country have been produced by MortalityTrends.org. The estimates are based on available deaths from vital registration and population estimates. In general, the methods used are described in the following publication:

Wilmoth et al. (2007). Methods Protocol for the Human Mortality Database. University of California, Berkeley, and Max Planck Institute for Demographic Research, Rostock. <http://www.mortalitytrends.org/data/jpn/sources.htm>

N.B. The results produced by this method protocol depend heavily on the input data on population and deaths used e.g. whether intercensal or postcensal population estimates are used; by degree of aggregation in the data on death etc.

The following data sources have been used for producing mortality estimates:

1. U.S. Department of Commerce, Bureau of Census, POPULATION - U.S. POPULATION ESTIMATES BY AGE, SEX, AND RACE: 1900-1979 (PE-11), DSKPOP00/79-PE11.
2. U.S. Department of Commerce, Bureau of the Census, Current Population Reports, Population Estimates, Series P-25, No. 310, Estimates of the population of the United States, by Age, Sex, and Race: April 1, 1960 to July 1, 1973, 1974 Apr. Population published in [1] has been adjusted by excluding Armed Forces Overseas based on data published in [2]. Population estimates have been computed by Kirill Andreev (<http://kirillandreev.com/>).

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Future Plans

- Improving documentation of methods and underlying data used to derive mortality estimates
- Publication of estimated Lexis databases (see above) of population and death counts
- Developing procedures for producing additional mortality indicators: cohort life tables, mortality improvement rates, indicators of decomposition of life expectancy, compression and rectangularization indicators of human life span etc
- Database of external mortality indicators and comparisons of our data with external estimates
- Developing web interface for multi-country comparison reports and improving visualization experience

Contributors

MA is responsible for data collection, producing estimates, and running the website. KA serves entirely in advisory assistance. TA is a chief emotional support officer of the project.

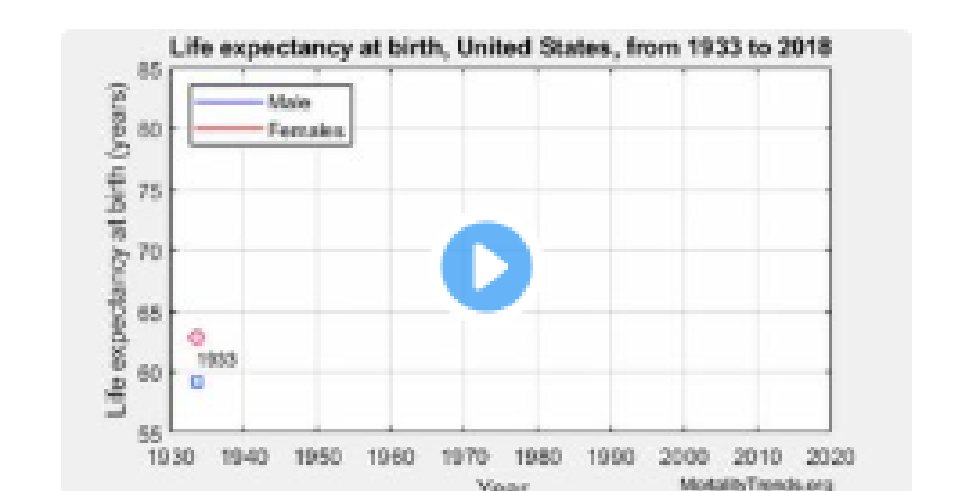
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We updated United States thru 2018. The life expectancy at birth increased by 0.15 years both for males and females. This is first improvement for males after three years of continuing decline. The male life expectancy at birth in 2018 is still below its peak in 2014.



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We updated United States thru 2017. Male life expectancy slightly declined in 2017, and female remained unchanged. This development is driven by increases in adult mortality, ages 15-45, for both sexes.

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We updated Canada thru 2017. Life expectancy has virtually stagnated over last years, and slightly declined for females in 2017.

Oct 14, 2019