Mortality and Longevity

U.S. Population Mortality Rates 2000-2020

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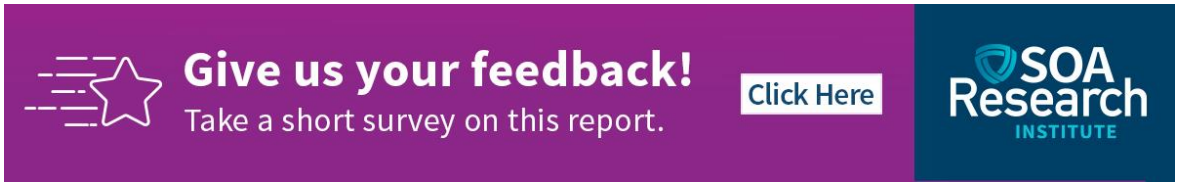
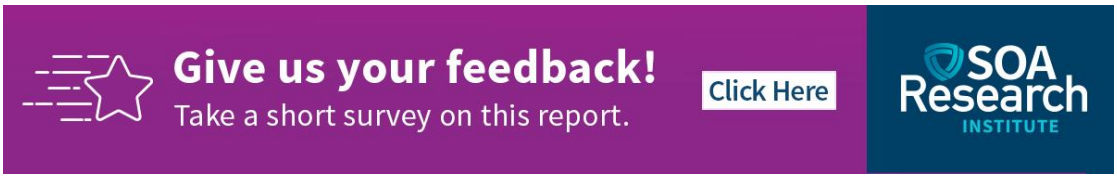


CONTENTS

U.S. Population Mortality Rates 2000-2020

Section 1: Purpose of the Study

This publication contains historical U.S. population mortality rates by gender and single year of age for calendar years 2000-2020. These rates represent one-year probabilities of death. This is an update to a series of such publications; the prior iteration consisting of 2000-2019 mortality rates can be found here. The key updates from the previous publication are the addition of mortality rates for 2020 and true-ups of historical data from 2010-2019.



Section 2: Data Sources

The mortality rates found in this publication are based on the same data sets underlying the historical probabilities of death published by the Social Security Administration (SSA). The death counts for ages 0-64 were taken from the National Center for Health Statistics via the "Multiple Cause of Death" data published in the CDC WONDER database. The corresponding population counts for years 2000-2009 are taken from the same source. The 2010-2020 population counts were taken from the Census Bureau's 2020 Vintage July 1 population estimates.

For ages 65 and up, the SOA requested counts of enrollments and deaths from the Centers for Medicare & Medicaid Services (CMS). The SOA chose to use this data set for the over-65 population because Medicare enrollment requires verification of date of birth, so age information can be more reliable in the CMS data than in other sources, particularly for the oldest subset of the population.

CMS provided revised estimates for 2018 and 2019 deaths and enrollments to reflect retroactive data updates. These changes resulted in some mortality rates in this publication differing from the corresponding rates in last year's 2000-2019 historical mortality rates publication. All of the changes were increases. For ages above 65, the percentage increase in the rates by age due to these CMS data updates ranged between 0.00% and approximately 0.49%

These historical mortality rates are unsmoothed rates. The SSA uses the same data sources and similar adjustments to compute their historical probabilities of death, but the SSA rates are graduated within a given calendar year per the process outlined in Actuarial Study No. 120. No such smoothing was done for this publication.

Section 3: Analysis

Mortality improvement rates can be used to analyze how mortality changes from year-to-year. Positive mortality improvement indicates a drop in mortality rates, while negative mortality improvement indicates a year-to-year increase in mortality. Below are some observations on recent mortality improvement trends.

3.1 KEY OBSERVATIONS - MALES

The three tables below show annual mortality improvement rates between 2017 and 2020 for males. Due to the COVID-19 pandemic, mortality improvement rates were significantly negative from 2019 to 2020, with varying changes by age group. While improvement rates were negative for all age groups shown, the rates generally become less negative with increasing age. For the over-65 population, age-adjusted mortality improvement was approximately -15%, while improvement for the under-65 population was approximately -21%. Improvement rates by five-year age group ranged between -11% and -27%.

Table 3.1

2017-2020 MORTALITY IMPROVEMENT IN FIVE-YEAR AGE GROUPS, MALES

Age Band	2017 -> 2018	2018 -> 2019	2019 -> 2020
20-to-24	5.5%	0.5%	-22.5%
25-to-29	4.7%	1.2%	-22.4%
30-to-34	3.2%	-1.3%	-26.9%
35-to-39	-0.1%	-1.7%	-26.7%
40-to-44	-0.1%	-3.6%	-26.8%
45-to-49	-0.1%	0.2%	-25.2%
50-to-54	1.9%	0.6%	-21.4%
55-to-59	0.1%	1.1%	-18.4%
60-to-64	-0.3%	0.8%	-18.7%
65-to-69	-0.3%	1.0%	-16.7%
70-to-74	0.7%	2.1%	-16.6%
75-to-79	1.1%	1.9%	-16.6%
80-to-84	1.7%	1.6%	-15.4%
85-to-89	1.2%	1.4%	-13.7%
90-to-94	0.7%	1.5%	-12.9%
95-to-100	0.7%	1.5%	-11.8%
All Ages	**0.9%**	**1.1%**	**-17.4%**

Table 3.2

2017-2020 MORTALITY IMPROVEMENT IN BROAD AGE GROUPS, MALES

Age Band	2017 -> 2018	2018 -> 2019	2019 -> 2020
20-to-44	2.2%	-1.3%	-25.5%
45-to-64	0.3%	0.8%	-20.1%
65-to-84	0.9%	1.7%	-16.3%
85-to-100	0.9%	1.5%	-13.2%
All Ages	**0.9%**	**1.1%**	**-17.4%**

Table 3.3

2017-2020 MORTALITY IMPROVEMENT UNDER/OVER AGE 65, MALES

Age Band	2017 -> 2018	2018 -> 2019	2019 -> 2020
Under 65	0.8%	0.2%	-21.4%
65 and over	0.9%	1.6%	-15.3%
All Ages	**0.9%**	**1.1%**	**-17.4%**

3.2 KEY OBSERVATIONS - FEMALES

The three tables below show annual mortality improvement rates between 2017 and 2020 for females. Similar to males, the COVID-19 pandemic resulted in significantly negative mortality improvement rates from 2019 to 2020, with varying changes by age group. Similar to males, there was a general trend of a declining mortality shock with increasing age, though these age effects were less pronounced than those for males. For the over-65 population, age-adjusted mortality improvement was approximately -14%, while improvement for the under-65 population was approximately -17%. Improvement rates by five-year age group ranged between -13% and -23%. In aggregate, mortality improvement in 2020 was less negative for females (-15%) than males (-17%).

Table 3.4

2017-2020 MORTALITY IMPROVEMENT IN FIVE-YEAR AGE GROUPS, FEMALES

Age Band	2017 -> 2018	2018 -> 2019	2019 -> 2020
20-to-24	5.5%	0.0%	-18.3%
25-to-29	1.7%	3.5%	-22.9%
30-to-34	0.8%	-0.2%	-19.4%
35-to-39	-1.0%	-1.0%	-19.2%
40-to-44	2.2%	-0.4%	-21.9%
45-to-49	1.9%	0.9%	-18.7%
50-to-54	2.5%	2.4%	-16.8%
55-to-59	1.5%	1.9%	-14.6%
60-to-64	0.7%	-0.8%	-15.4%
65-to-69	2.0%	1.9%	-15.8%
70-to-74	1.5%	2.2%	-13.4%
75-to-79	1.3%	2.1%	-14.1%
80-to-84	1.5%	2.0%	-13.9%
85-to-89	0.1%	1.6%	-14.4%
90-to-94	0.8%	1.4%	-13.6%
95-to-100	0.1%	2.5%	-13.1%
All Ages	**1.1%**	**1.6%**	**-14.7%**

Table 3.5

2017-2020 MORTALITY IMPROVEMENT IN BROAD AGE GROUPS, FEMALES

Age Band	2017 -> 2018	2018 -> 2019	2019 -> 2020
20-to-44	1.5%	0.1%	-20.5%
45-to-64	1.5%	0.9%	-15.9%
65-to-84	1.5%	2.1%	-14.2%
85-to-100	0.4%	1.7%	-13.9%
All Ages	**1.1%**	**1.6%**	**-14.7%**

Table 3.6

2017-2020 MORTALITY IMPROVEMENT UNDER/OVER AGE 65, FEMALES

Age Band	2017 -> 2018	2018 -> 2019	2019 -> 2020
Under 65	1.5%	0.7%	-16.8%
65 and over	1.0%	1.9%	-14.0%
All Ages	**1.1%**	**1.6%**	**-14.7%**

Section 4: Mortality Improvement Calculation Methodology

The SOA computed the above mortality improvement rates by calculating the age-adjusted death rates (ADRs) for each age group within each year. This methodology is described in the following paper published by the Centers for Disease Control and Prevention and written by Lester R. Curtin, Ph.D. and Richard J. Klein, M.P.H.: https://www.cdc.gov/nchs/data/statnt/statnt06rv.pdf

The SOA applied the direct standardization method described on pages 2-3 of the paper using 2012 population counts (as described above under "Data Sources") as the reference population. 2012 was selected to ensure consistency with previous iterations of this study. The unrounded mortality rates for each age band were weighted by 2012 population counts. For each age band 'x' and calendar year 'y', the mortality improvement rate $f_{(x,y)}$ was calculated from the weighted mortality rates $q_{(x,y)}$:

$$f_{(x,y)} = 1 - \frac{q_{(x,y)}}{q_{(x,y-1)}}$$

Section 5: Reliance and Limitations

In producing this report, the SOA relied upon data furnished by CMS, the CDC, and the U.S. Census Bureau. These data may be trued up in future years.

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