U.S. Population Mortality Rates 2000-2023

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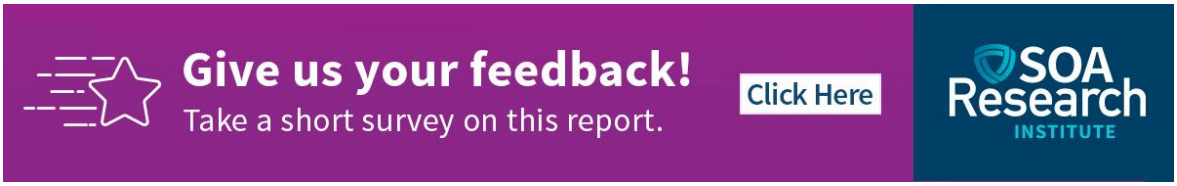
AUTHOR Patrick Nolan, FSA, MAAA
Director of Experience Studies
Society of Actuaries



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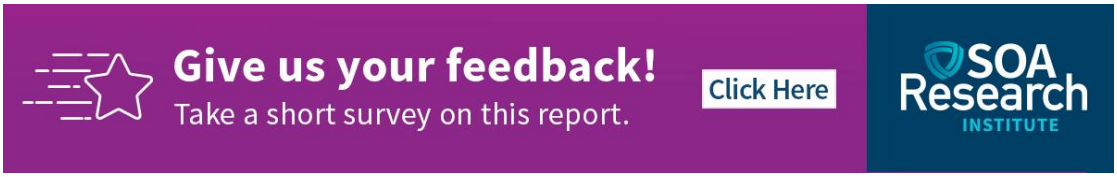
Section 1: Purpose of the Study

This publication contains historical U.S. population mortality rates by gender and single year of age for calendar years 2000-2023. These rates represent one-year probabilities of death. This is an update to a series of such publications; the prior iteration consisting of 2000-2022 mortality rates can be found here. The key updates from the previous publication are the addition of mortality rates for 2023 and true ups of historical data from 2000-2022.



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 20-64 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 ages 20-64 come from the Census Bureau, with source vintages as follows:

- The 2000-2009 population counts were taken from the Census Bureau's 2010 Vintage July 1 population estimates.
- The 2010-2019 population counts were taken from the Census Bureau's 2020 Vintage July 1 population estimates.
- The 2020- 2023 population counts were taken from the Census Bureau's 2024 Vintage July 1 population estimates.

Note that the previous year's publication utilized census counts for ages 20-64 from the Census Bureau's 2022 Vintage population estimates, which used an estimates base developed from a blend of several sources, as described in a documentation note on the Census Bureau web page. The Census Bureau's methodology for the 2023 and 2024 Vintage population estimates have been modified from the 2022 Vintage and is described in a methods statement released with the publication. This change has resulted in differences in the population counts under age 65 for the years 2020, 2021, and 2022. For females, this resulted in generally increased mortality rates for ages 20-24 and generally decreased mortality rates for ages 25-64. For males, this change generally increased mortality rates for ages 20-55 and generally decreased mortality rates for ages 56-64.

A second change made was a correction to the under-65 mortality rates for the year 2000. Previous iterations of this report relied directly upon the April 1, 2000 census counts. For consistency with the other years presented, the 2000 census counts for this publication were taken from the July 1, 2000 intercensal estimates.

For ages 65 and up, the SOA Research Institute requested counts of enrollments and deaths from the Centers for Medicare & Medicaid Services (CMS). The Institute chose to use this data set for the over-65 population because Medicare enrollment requires verification of date of birth, so age information and population counts can be more reliable in the CMS data than in other sources, particularly for the oldest subset of the population. CMS issues true-ups of their counts of deaths and lives enrolled for the most recent previous two years, so mortality rates presented for 2021 and 2022 for ages over 65 will have modest differences from last year's publication.

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 the SSA's Long-Range OASDI Projection Methodology documentation. 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 2020 and 2023 for males. Due to the COVID-19 pandemic, mortality improvement rates were significantly negative for younger ages from 2020 to 2021. However, the oldest ages in the population experienced a reduction in mortality in 2021 relative to the initial stages of the pandemic in 2020.

Both 2022 and 2023 represented significant decreases in mortality from pandemic highs for all broad age groups. The largest decreases were observed in the 45-64 age group in both 2022 and 2023. In 2023, there was improvement in every five-year age group, with improvement percentages ranging from 5.4% (ages 95-to-100) to 10.4% (ages 25-to-29).

Table 3.1

2020-2023 MORTALITY IMPROVEMENT IN FIVE-YEAR AGE GROUPS, MALES

Age Band	2020 -> 2021	2021 -> 2022	2022 -> 2023
20-to-24	-3.6%	10.6%	7.8%
25-to-29	-9.8%	10.8%	10.4%
30-to-34	-13.9%	9.0%	9.1%
35-to-39	-16.5%	10.2%	7.0%
40-to-44	-18.5%	12.1%	6.1%
45-to-49	-16.0%	14.2%	8.2%
50-to-54	-13.2%	15.7%	9.2%
55-to-59	-9.7%	13.4%	9.6%
60-to-64	-7.2%	11.8%	8.6%
65-to-69	-5.0%	9.6%	7.6%
70-to-74	-1.9%	7.9%	8.2%
75-to-79	0.3%	8.1%	8.6%
80-to-84	2.6%	4.9%	8.1%
85-to-89	4.1%	3.2%	7.2%
90-to-94	5.5%	1.2%	6.2%
95-to-100	5.5%	-0.4%	5.4%
All Ages	**-3.4%**	**8.5%**	**8.0%**

Table 3.2

2020-2023 MORTALITY IMPROVEMENT IN BROAD AGE GROUPS, MALES

Age Band	2020 -> 2021	2021 -> 2022	2022 -> 2023
20-to-44	-13.6%	10.7%	7.8%
45-to-64	-10.4%	13.5%	8.9%
65-to-84	-0.7%	7.5%	8.1%
85-to-100	4.7%	2.2%	6.7%
All Ages	**-3.4%**	**8.5%**	**8.0%**

Table 3.3
2020-2023 MORTALITY IMPROVEMENT UNDER/OVER AGE 65, MALES

Age Band	2020 -> 2021	2021 -> 2022	2022 -> 2023
Under 65	-11.3%	12.7%	8.6%
65 and over	1.0%	5.9%	7.7%
All Ages	**-3.4%**	**8.5%**	**8.0%**

3.2 KEY OBSERVATIONS - FEMALES

The three tables below show annual mortality improvement rates between 2020 and 2023 for females. Similar to males, the COVID-19 pandemic resulted in significantly negative mortality improvement rates from 2020 to 2021 for most younger ages, with only the 85-to-100 broad age group experiencing improvement relative to the initial stage of the pandemic in 2020. Also similar to males, considerable improvement was seen in 2022 and 2023 for all broad age groups, with the largest percentage decreases in the pre-retirement age bands. Aggregate improvement was lower in both 2022 and 2023 for females than for males.

Table 3.4
2020-2023 MORTALITY IMPROVEMENT IN FIVE-YEAR AGE GROUPS, FEMALES

Age Band	2020 -> 2021	2021 -> 2022	2022 -> 2023
20-to-24	-11.6%	10.7%	9.5%
25-to-29	-9.1%	9.3%	14.2%
30-to-34	-15.3%	12.2%	9.1%
35-to-39	-17.6%	12.7%	9.6%
40-to-44	-19.6%	13.5%	7.5%
45-to-49	-16.0%	14.7%	10.4%
50-to-54	-11.9%	14.4%	9.5%
55-to-59	-10.4%	12.0%	10.5%
60-to-64	-9.0%	10.6%	8.6%
65-to-69	-6.6%	9.3%	7.1%
70-to-74	-2.5%	7.1%	8.3%
75-to-79	-0.8%	6.4%	7.6%
80-to-84	3.5%	3.6%	6.5%
85-to-89	6.2%	1.5%	6.5%
90-to-94	7.3%	0.1%	4.6%
95-to-100	7.9%	-1.7%	4.9%
All Ages	**-0.3%**	**5.6%**	**7.1%**

Table 3.5
2020-2023 MORTALITY IMPROVEMENT IN BROAD AGE GROUPS, FEMALES

Age Band	2020 -> 2021	2021 -> 2022	2022 -> 2023
20-to-44	-16.0%	12.2%	9.4%
45-to-64	-10.9%	12.4%	9.5%
65-to-84	-0.6%	6.1%	7.2%
85-to-100	6.9%	0.5%	5.5%
All Ages	**-0.3%**	**5.6%**	**7.1%**

Table 3.6
2020-2023 MORTALITY IMPROVEMENT UNDER/OVER AGE 65, FEMALES

Age Band	2020 -> 2021	2021 -> 2022	2022 -> 2023
Under 65	-12.0%	12.3%	9.5%
65 and over	3.1%	3.4%	6.4%
All Ages	**-0.3%**	**5.6%**	**7.1%**

Section 4: Mortality Improvement Calculation Methodology

The Institute 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 Institute 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 Institute 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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Society of Actuaries Research Institute
8770 W Bryn Mawr Ave, Suite 1000
Chicago, IL 60631
www.SOA.org