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Mortality and Longevity

U.S. Population Mortality Observations Preview of 2020 Experience

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U.S. Population Mortality Observations

Preview of 2020 Experience

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Executive Summary

The COVID-19 (COVID) pandemic has increased the demand for data and analysis on the impact of COVID on U.S. population mortality. In response, the Society of Actuaries (SOA) has reviewed the most recently released 2020 mortality data from the U.S. Centers for Disease Control and Prevention (CDC) and summarized observations obtained from this review into this report.

This report is based on 2020 provisional death data released by the CDC. Data for calendar year 2020 was available for the overall, sex, and age-group analyses. The COD provisional death data was available through the second or third quarters of 2020. The SOA plans to update this report after additional 2020 cause of death data in released by the CDC later in 2021.

It is important to understand the potential limitations around the provisional aspect of the data used in this report. Delays in death reporting may result in data that is more incomplete for the most recent months and the final cause of death may not be available at the time the provisional estimates are available.[1] Finally, the assignment of COD can be somewhat subjective with the potential for the misclassification of CODs[2].

Key observations from the review of the provisional mortality data include:

- The overall age-adjusted mortality rate for 2020 was 828.7 deaths per 100,000 of population. This rate was 15.9% greater than the 2019 overall age-adjusted mortality rate. This high level of mortality has not been experienced in the U.S. since 2003.
- If deaths coded as COVID (COVID deaths)[3] were excluded, the overall age-adjusted 2020 mortality rate would have been 737.2 per 100,000 or 3.1% higher than the 2019 rate. This increase excluding COVID deaths is also noteworthy because it reverses the two previous calendar years of decreasing mortality; however, some or all of this may be due to the misclassification of CODs as discussed in Section 6.
- 2020 mortality rates increased in both sexes, with the male rates increasing more than the female rates. The differences in the increases between males and females were about 3% when all causes of death (CODs) are included and about 1% when COVID deaths are excluded.
- The slope of the 2020 COVID mortality curve by age group is not as steep as the slope of the non-COVID deaths, indicating that COVID impacts younger ages more evenly across age groups that all other non-COVID CODs combined.
- In the review of the 2020 mortality rates by age group, it is interesting to see that the highest percentage increases were in the younger adult ages, not at the very old ages. When COVID deaths were removed, ages 15-44 saw the largest increases in mortality rates.

[1] https://www.cdc.gov/nchs/nvss/vsrr/mortality-technical-notes.htm
[2] https://www.cdc.gov/nchs/nvss/vsrr/covid19/tech_notes.htm
[3] The COD used in this report is determined from the single underlying cause of death as identified on the death certificate, as opposed to one of the multiple causes of death on a death certificate. See Section 6 for more information.

- Almost all the increases in 2020 mortality rates for ages 55+ were due to COVID deaths, while the increases in mortality rates for ages 15-44 were due to non-COVID CODs.
- Mortality rates for ages under 5 decreased in 2020, with COVID having little to no impact on the 2020 change in mortality for those ages.
- Deaths from heart disease increased in the second and third quarters of 2020 by 1.1% and 1.4%, respectively, which is notable given heart disease's long-term trends over the past 20 years of decreasing to level rates of mortality.
- Of the CODs analyzed in detail, cancer saw improvements in mortality rates in each of the first three quarters of 2020 across all age groups. Death rates from pulmonary disease and suicide were also lower in most age group/calendar quarters.
- Notable increases in accidents, diabetes and liver mortality rates were observed in many age group/calendar quarters. It is unclear what is driving the increase in accidents given that the data is still emerging, but deaths due to motor vehicle accidents and drug overdoses have impacted changes in accidental deaths in the past and may be factors in 2020.

Section 1: Introduction

The Society of Actuaries (SOA) has developed this report to provide early insights into the level of U.S. population mortality in 2020 This information can be viewed together with the SOA's 'U.S. Population Mortality Observations - Updated with 2019 Experience' report[4] released in January 2021 to obtain a comprehensive understanding of historical and current trends in U.S. population mortality[5].

This report uses estimates from the most recent National Center for Health Statistics (NCHS) National Vital Statistics System (NVSS) Rapid Release Quarterly Provisional Estimates[6] (CDC Rapid Release), historical experience from 1999 to 2019 from the Centers for Disease Control and Prevention's (CDC) Wide-ranging Online Data for Epidemiologic Research (CDC WONDER) database[7], and information from the CDC's Mortality and Morbidity Weekly Report on Provisional Mortality Data – United States, 2020[8] (MMWR). The provisional death count and mortality rate estimates from the Rapid Release and the MMWR may change as additional data becomes available. Final mortality counts and mortality rates for 2020 are expected to be released by the CDC by the end of 2021 or in early 2022.

The report begins with an analysis of overall population mortality, followed by analyses of mortality by age groups and COD. The report uses data from CDC WONDER for historical rates back to 1999, the MMWR for mortality rates over calendar year 2020 and the CDC Rapid Release estimates for any annual mortality rates ending in calendar quarters. The cause of death section includes analyses for 15 of the physiological CODs and three of the external CODs available in the CDC Rapid Release. The cause of death section also includes detail of the changes in annual mortality rates ending in the first two or three quarters of 2020 for 10 selected causes of death. The CDC Rapid Release provided data through second quarter 2020 for the external CODs included in this report and data through third quarter 2020 for the physiological CODs included in this report.

The overall population and age-group analyses show results with and without COVID deaths in 2020. It is important to understand that the death counts and rates provided by the CDC and used in this report are provisional estimates. Delays in death reporting may result in data that is more incomplete for the most recent months and the final cause of death may not be available at the time the provisional estimates are available.[9] Finally, the assignment of COD can be somewhat subjective, resulting in a potential for the misclassification of CODs[10].

Unless otherwise noted, all mortality rates shown are per 100,000 of population and annual rates over the 12-month period ending as of the date indicated. All mortality rates in this report, except for age-group mortality rates, are age-adjusted rates, as opposed to crude rates, and are based on the 2000 U.S. standard[11] population basis. Section 6 contains details on the methodologies and assumptions underlying the data used in this report.

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[4] https://www.soa.org/resources/research-reports/2021/us-population-mortality/

[5] Age adjusted mortality rates in the 'U.S. Population Mortality Observations - Updated with 2019 Experience' report may differ from age-adjusted rates in this report because the former uses the "Non-Standard" population of 2010 to determine age-adjusted rates and this report uses the default 2000 standard population

[6] https://www.cdc.gov/nchs/nvss/vsrr/mortality.htm

[7] https://wonder.cdc.gov/

[8] Ahmad FB, Cisewski JA, Miniño A, Anderson RN. Provisional Mortality Data — United States, 2020. MMWR Morb Mortal Wkly Rep 2021;70:519–522. DOI: https://www.cdc.gov/mmwr/volumes/70/wr/mm7014e1.htm?s_cid=mm7014e1_w

[9] https://www.cdc.gov/nchs/nvss/vsrr/mortality-technical-notes.htm

[10] https://www.cdc.gov/nchs/nvss/vsrr/covid19/tech_notes.htm

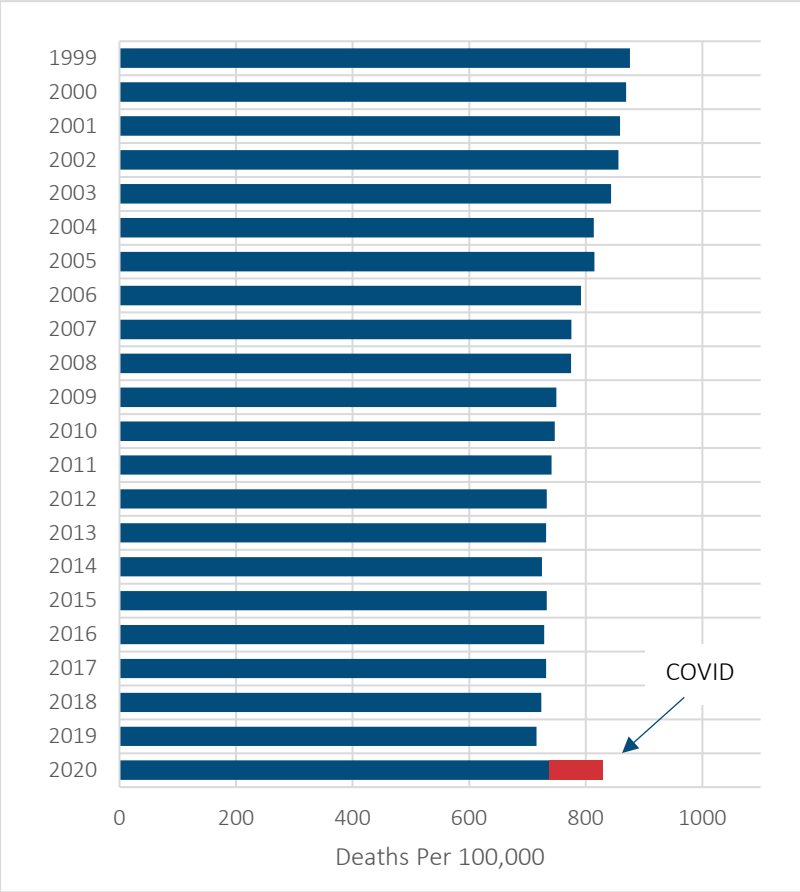
[11] In WONDER, the user may choose the population distribution used for calculating age-adjusted rates. Several "Standard" populations, including the default 2000 standard population, are available. As an alternative, the user can select a "Non-Standard" population, such as 2010, for the population distribution in the age adjustment.

Section 2: 2020 U.S. Population Mortality – Overall Population Analysis

Historical U.S. population mortality rates are shown in Figure 1. The mortality rate for 2020 was 15.9% higher than in 2019 and at a level not seen since 2003. COVID accounted for about 80% of this increase. Without COVID, the U.S. would have seen a 3.1% increase in mortality in 2020.[12] The 2020 increase, either with or without COVID, offset the emerging trend of improving mortality seen in 2018 and 2019.

Figure 1

1999 – 2020 U.S. POPULATION MORTALITY RATES – OVERALL POPULATION



CDC WONDER; CDC MMWR.

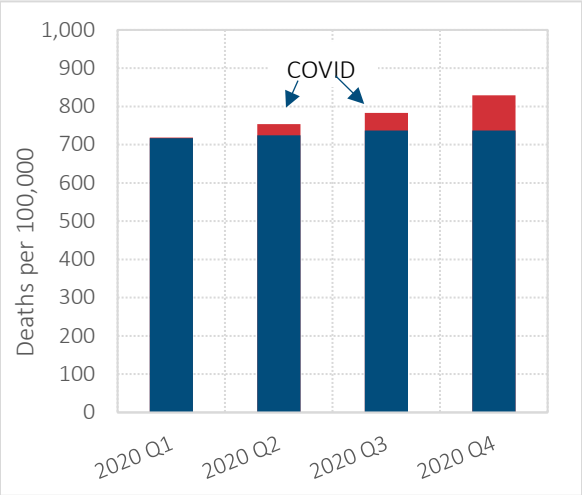
Year	Deaths per 100,000	Change from Prior Year
1999	875.6	n/a
2000	869.0	-0.8%
2001	858.8	-1.2%
2002	855.9	-0.3%
2003	843.5	-1.4%
2004	813.7	-3.5%
2005	815.0	0.2%
2006	791.8	-2.8%
2007	775.3	-2.1%
2008	774.9	-0.1%
2009	749.6	-3.3%
2010	747.0	-0.3%
2011	741.3	-0.8%
2012	732.8	-1.1%
2013	731.9	-0.1%
2014	724.6	-1.0%
2015	733.1	1.2%
2016	728.8	-0.6%
2017	731.9	0.4%
2018	723.6	-1.1%
2019	715.2	-1.2%
2020	**828.7**	**15.9%**
2020 w/o COVID	**737.2**	**3.1%**

[12] See Section 5 for caveats related to the classifications of COD in the provisional estimates used in this report.

Figure 2 shows the mortality rate for the 12-month period ending in each quarter in 2020. The overall mortality rate, including COVID deaths, increased each quarter with the highest increase of 5.8% in the fourth quarter. If COVID deaths were excluded, the second and third quarters saw increases of about 1-2%, while quarters one and four remained relatively level.

Figure 2

2020 U.S. POPULATION MORTALITY RATES AND CHANGE IN MORTALITY RATES – OVERALL POPULATION



Quarter Ending	Total		Without COVID	
	Deaths per 100,000	Change from Prior Quarter	Deaths per 100,000	Change from Prior Quarter
Q1	718.9	0.5%	717.2	0.3%
Q2	753.8	4.9%	724.8	1.1%
Q3	783.4	3.9%	737.2	1.7%
Q4	828.7	5.8%	737.2	0.0%

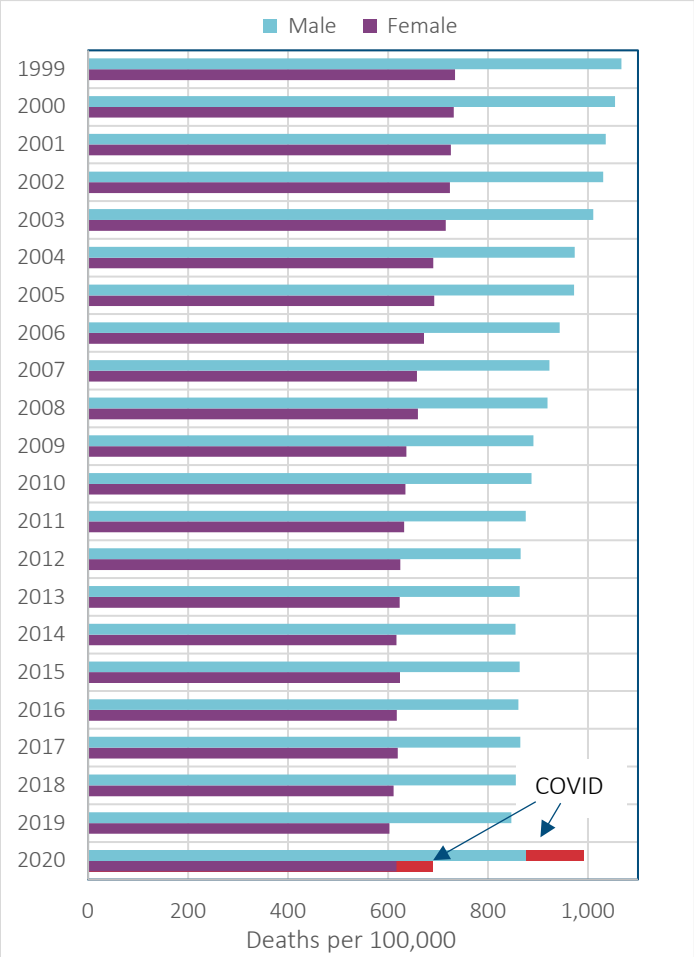
CDC Rapid Release; CDC MMWR.

Section 3: 2020 U.S. Population Mortality – Analysis by Sex

Historical U.S. population mortality rates by sex are shown in Figure 3. Female mortality rates have been about 70% of male rates between 1999 and 2020. The increase in mortality in 2020 was 17.0% for males and 14.4% for females. COVID accounted for about 80-85% of this increase[13]. Excluding COVID deaths, the 2020 mortality rate increases were noteworthy at 3.4% for males and 2.3% for females. The 2020 male mortality rate excluding COVID would have been at a level not seen for about nine years. The 2020 female mortality rate level without COVID would not have seen as much of a setback, with a level higher than in only the prior two years.

Figure 3

1999 - 2020 U.S. POPULATION MORTALITY RATES BY SEX



CDC WONDER. CDC MMWR.

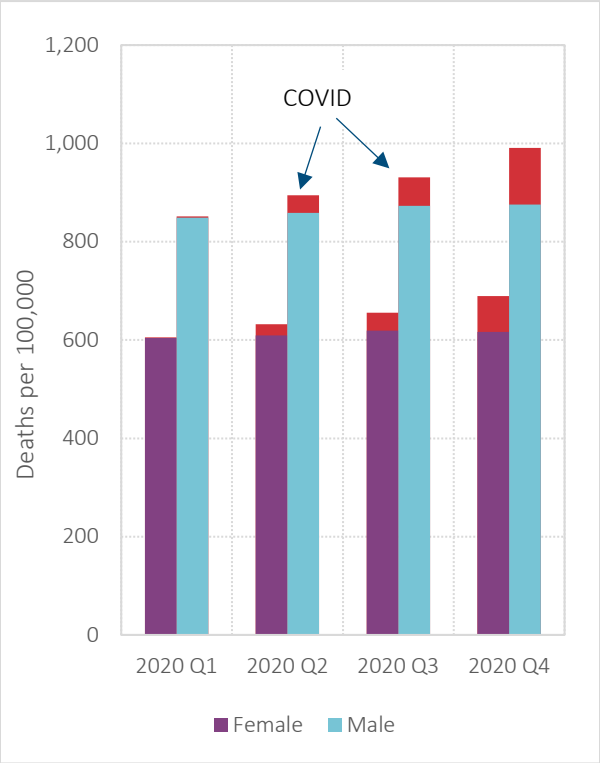
Year	Female		Male	
	Deaths per 100,000	Change from Prior Year	Deaths per 100,000	Change from Prior Year
1999	734.0	n/a	1,067.0	n/a
2000	731.4	-0.4%	1,053.8	-1.2%
2001	725.6	-0.8%	1,035.4	-1.7%
2002	723.6	-0.3%	1,030.6	-0.5%
2003	715.2	-1.2%	1,010.3	-2.0%
2004	690.5	-3.5%	973.3	-3.7%
2005	692.3	0.3%	971.9	-0.1%
2006	672.2	-2.9%	943.5	-2.9%
2007	658.1	-2.1%	922.9	-2.2%
2008	659.9	0.3%	918.8	-0.4%
2009	636.8	-3.5%	890.9	-3.0%
2010	634.9	-0.3%	887.1	-0.4%
2011	632.4	-0.4%	875.3	-1.3%
2012	624.7	-1.2%	865.1	-1.2%
2013	623.5	-0.2%	863.6	-0.2%
2014	616.7	-1.1%	855.1	-1.0%
2015	624.2	1.2%	863.2	0.9%
2016	617.5	-1.1%	861.0	-0.3%
2017	619.7	0.4%	864.5	0.4%
2018	611.3	-1.4%	855.5	-1.0%
2019	602.7	-1.4%	846.7	-1.0%
2020	**689.2**	**14.4%**	**990.5**	**17.0%**
2020 w/o COVID	**616.7**	**2.3%**	**875.5**	**3.4%**

[13] See Section 5 for caveats related to the classifications of COD in the provisional estimates used in this report.

Figure 4 shows the mortality rates for the 12-month period ending in each quarter in 2020. The 2020 mortality rate increased each quarter for both males and females, with each male increase being higher than its corresponding female increase. The fourth quarter had the greatest increases of 5.2% for females and 6.4% for males. If COVID deaths were excluded, similar to the overall results in Section 2, the second and third quarters saw increases of about 1-2%. However, females would have seen a slight improvement in the fourth quarter if COVID deaths were removed.

Figure 4

2020 U.S. POPULATION MORTALITY RATES AND CHANGE IN MORTALITY BY SEX



Sex	Quarter Ending	All CODs		Without COVID	
		Deaths per 100,000	Change from Prior Quarter	Deaths per 100,000	Change from Prior Quarter
Female	Q1	605.3	0.4%	604.2	0.2%
	Q2	632.3	4.5%	609.3	0.8%
	Q3	655.4	3.7%	618.9	1.6%
	Q4	689.2	5.2%	616.7	-0.4%
Male	Q1	851.3	0.5%	849.0	0.3%
	Q2	894.6	5.1%	858.5	1.1%
	Q3	931.1	4.1%	873.1	1.7%
	Q4	990.5	6.4%	875.5	0.3%

CDC Rapid Release. CDC MMWR.

Section 4: 2020 U.S. Population Mortality – Age Group Analysis

Total non-COVID and COVID death counts by age group in 2020 are shown in Table 1. Each cell, as a percent of the total 3.3 million 'all ages' deaths, is also shown. Going down the percentage columns, the 'Total Deaths' and the 'Non-COVID Deaths' show a similar steep, increasing pattern by age group. However, the 'COVID Deaths' percentages do not increase as dramatically by age group, indicating that COVID's mortality curve is not as steep as non-COVID deaths. Another way to see this is to look at the COVID deaths as a percent of total deaths within each age group, as shown in last column. Here, the percentages are relatively flat for ages above 45 and close to the overall percentage of 11.3%.

Table 1

2020 U.S. POPULATION DEATHS BY AGE GROUP

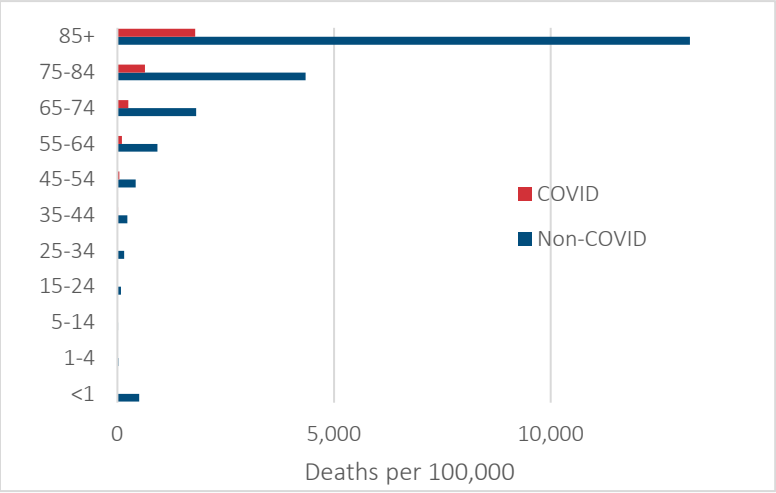
Age Group	Total Deaths	% of 'All Ages Total' Deaths	Non-COVID Deaths	% of 'All Ages Total' Deaths	COVID Deaths	% of 'All Ages Total' Deaths	COVID Deaths/ Total Deaths
< 1	19,146	0.6%	19,103	0.6%	43	0.0%	0.2%
1-4	3,469	0.1%	3,445	0.1%	24	0.0%	0.7%
5-14	5,556	0.2%	5,489	0.2%	67	0.0%	1.2%
15-24	35,470	1.1%	34,883	1.0%	587	0.0%	1.7%
25-34	72,678	2.2%	70,151	2.1%	2,527	0.1%	3.5%
35-44	103,389	3.1%	96,772	2.9%	6,617	0.2%	6.4%
45-54	189,397	5.6%	171,492	5.1%	17,905	0.5%	9.5%
55-64	436,886	13.0%	392,255	11.7%	44,631	1.3%	10.2%
65-74	669,316	19.9%	588,699	17.5%	80,617	2.4%	12.0%
75-84	816,307	24.3%	712,095	21.2%	104,212	3.1%	12.8%
85+	1,007,114	30.0%	886,466	26.4%	120,648	3.6%	12.0%
Not Stated	86	0.0%	81	0.0%	5	0.0%	5.8%
All Ages	**3,358,814**	**100.0%**	**2,980,931**	**88.7%**	**377,883**	**11.3%**	**11.3%**

CDC MMWR.

The relative difference in the steepness of the 2020 mortality curves for COVID and non-COVID deaths can also be seen in a graph of mortality rates as shown in Figure 5.

Figure 5

2020 U.S. POPULATION MORTALITY RATES BY AGE GROUP



CDC Rapid Release; CDC MMWR.

The increase of the 2020 mortality rate over 2019 by age group is shown in Table 2. It is interesting to note how the younger adult age groups had the highest increases. Including all CODs, ages 25-44 had the highest increases at around 23%. Excluding COVID deaths, the highest increases ranged between 15% and 18% at ages 15-44. Non-COVID CODs were the main drivers of mortality increases in ages under 34. COVID was the main influence of increased mortality for ages above 55. Children under age 14 saw little to no increase in mortality in 2020 and the mortality for ages under five surprisingly saw large improvements of about 5% or greater.

The overall 15.9% increase in mortality in 2020 and the 3.1% increase excluding COVID deaths can be broken down and attributed by age group. The two right columns in Table 2 show how the change in mortality rates for each age contributed to the overall 15.9% and 3.1% increases in mortality. It is interesting to note that, excluding COVID, the attribution by age is flatter than the attribution including COVID. This supports the relatively large influence of non-COVID CODs on younger ages in 2020.

Table 2

2020 U.S. POPULATION MORTALITY RATES AND CHANGE IN MORTALITY RATES BY AGE GROUP

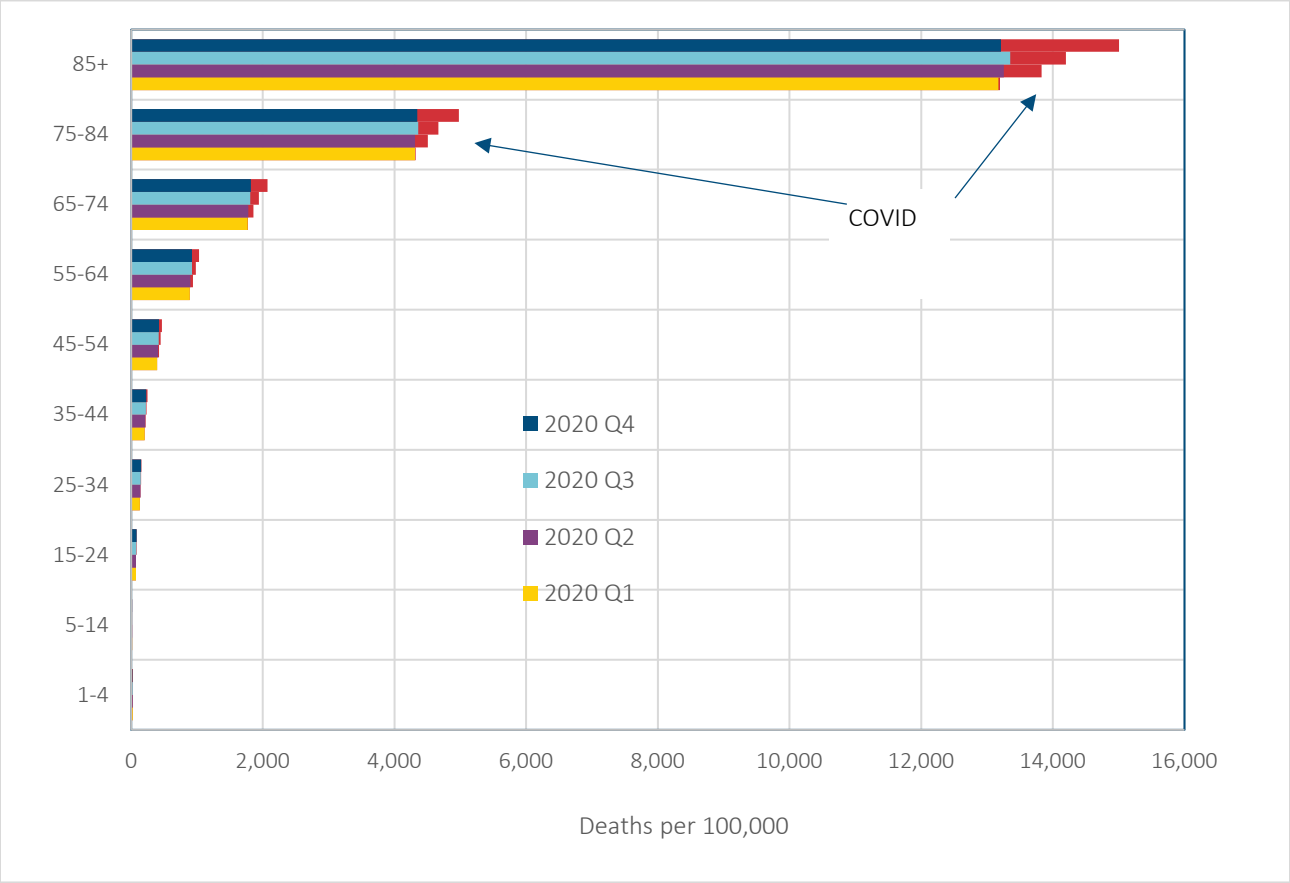
Age Group	Deaths per 100,000		Change from Prior Year		Attribution of Change by Age Group	
	All CODs	Excl COVID	All CODs	Excl COVID	All CODs	Excl COVID
<1	506.0	504.9	-8.5%	-8.7%	-0.1%	-0.1%
1-4	22.2	22.0	-4.7%	-5.6%	0.0%	0.0%
5-14	13.6	13.4	1.5%	0.0%	0.0%	0.0%
15-24	83.2	81.8	19.4%	17.4%	0.3%	0.2%
25-34	157.9	152.4	22.6%	18.3%	0.6%	0.4%
35-44	246.2	230.4	23.6%	15.7%	1.1%	0.7%
45-54	467.8	423.6	19.2%	8.0%	1.4%	0.6%
55-64	1,028.5	923.4	16.4%	4.5%	1.8%	0.5%
65-74	2,068.8	1,819.6	17.2%	3.1%	2.8%	0.5%
74-84	4,980.2	4,344.4	15.6%	0.8%	4.2%	0.2%
85+	15,007.4	13,209.6	13.4%	-0.1%	3.9%	0.0%
Total	**828.7**	**737.2**	**15.9%**	**3.1%**	**15.9%**	**3.1%**

CDC WONDER; CDC MMWR.

Figure 6 shows the relative magnitude of the mortality rates with and without COVID by age group. This graph also shows how the absolute level rates increased each quarter in 2020.

Figure 6

2020 U.S. POPULATION MORTALITY RATES BY AGE GROUP



CDC Rapid Release; CDC MMWR.

Table 3 shows the mortality rates from Figure 6 and the percentage change in those mortality rates from quarter to quarter. Mortality rates and their changes for all CODs and for all CODs excluding COVID are provided.

For all CODs, mortality rates increased in 2020 for almost all age groups in all quarters. Ages 1-4 were the only age group with improving mortality in most quarters. For ages 5-14, only quarter three saw a small increase and about half of it was due to non-COVID CODs. The second and third quarters were the worst quarters for younger adult ages, while the fourth quarter was the worst for the older ages. The second and third quarters saw the largest increases around 6-7% in the middle age groups between ages 25-44 for all CODS, and ages 15-44 had the largest increases of about 5-6% for all CODs excluding COVID. The fourth quarter saw the largest increases, above 5%, in ages 65+ for all CODs. Ages 75+ had small increases in fourth quarter mortality if COVID deaths were excluded.

Table 3

2020 U.S. POPULATION MORTALITY RATES AND CHANGE IN MORTALITY RATES BY AGE GROUP

Ages	Quarter Ending	Total		Without COVID		Ages	Quarter Ending	Total		Without COVID	
		Deaths per 100,000	Change from Prior Quarter	Deaths per 100,000	Change from Prior Quarter			Deaths per 100,000	Change from Prior Quarter	Deaths per 100,000	Change from Prior Quarter
1-4	Q1	23.8	2.1%	23.8	2.1%	45-54	Q1	396.4	1.0%	395.2	0.7%
	Q2	23.0	-3.4%	22.9	-3.8%		Q2	422.0	6.5%	406.8	2.9%
	Q3	22.8	-0.9%	22.7	-0.9%		Q3	446.0	5.7%	420.2	3.3%
	Q4	22.2	-2.6%	22.0	-3.1%		Q4	467.8	4.9%	423.6	0.8%
5-14	Q1	13.4	0.0%	13.4	0.0%	55-64	Q1	891.3	0.9%	889.0	0.6%
	Q2	13.4	0.0%	13.4	0.0%		Q2	936.2	5.0%	901.6	1.4%
	Q3	13.6	1.5%	13.5	0.7%		Q3	980.4	4.7%	921.9	2.3%
	Q4	13.6	0.0%	13.4	-0.7%		Q4	1,028.5	4.9%	923.4	0.2%
15-24	Q1	71.6	2.7%	71.6	2.7%	65-74	Q1	1,776.2	0.7%	1,771.4	0.4%
	Q2	75.4	5.3%	75.0	4.7%		Q2	1,858.7	4.6%	1,780.1	0.5%
	Q3	80.6	6.9%	79.8	6.4%		Q3	1,938.8	4.3%	1,809.0	1.6%
	Q4	83.2	3.2%	81.8	2.5%		Q4	2,068.8	6.7%	1,819.6	0.6%
25-34	Q1	132.7	3.0%	132.5	2.9%	75-84	Q1	4,321.9	0.3%	4,310.9	0.1%
	Q2	142.4	7.3%	140.5	6.0%		Q2	4,506.9	4.3%	4,313.9	0.1%
	Q3	151.4	6.3%	148.1	5.4%		Q3	4,667.2	3.6%	4,359.0	1.0%
	Q4	157.9	4.3%	152.4	2.9%		Q4	4,980.2	6.7%	4,344.4	-0.3%
35-44	Q1	204.0	2.4%	203.5	2.2%	85+	Q1	13,196.7	-0.2%	13,172.6	-0.4%
	Q2	218.7	7.2%	213.4	4.9%		Q2	13,827.2	4.8%	13,254.7	0.6%
	Q3	233.6	6.8%	224.3	5.1%		Q3	14,199.9	2.7%	13,350.8	0.7%
	Q4	246.2	5.4%	230.4	2.7%		Q4	15,007.4	5.7%	13,209.6	-1.1%

CDC Rapid Release; CDC MMWR.

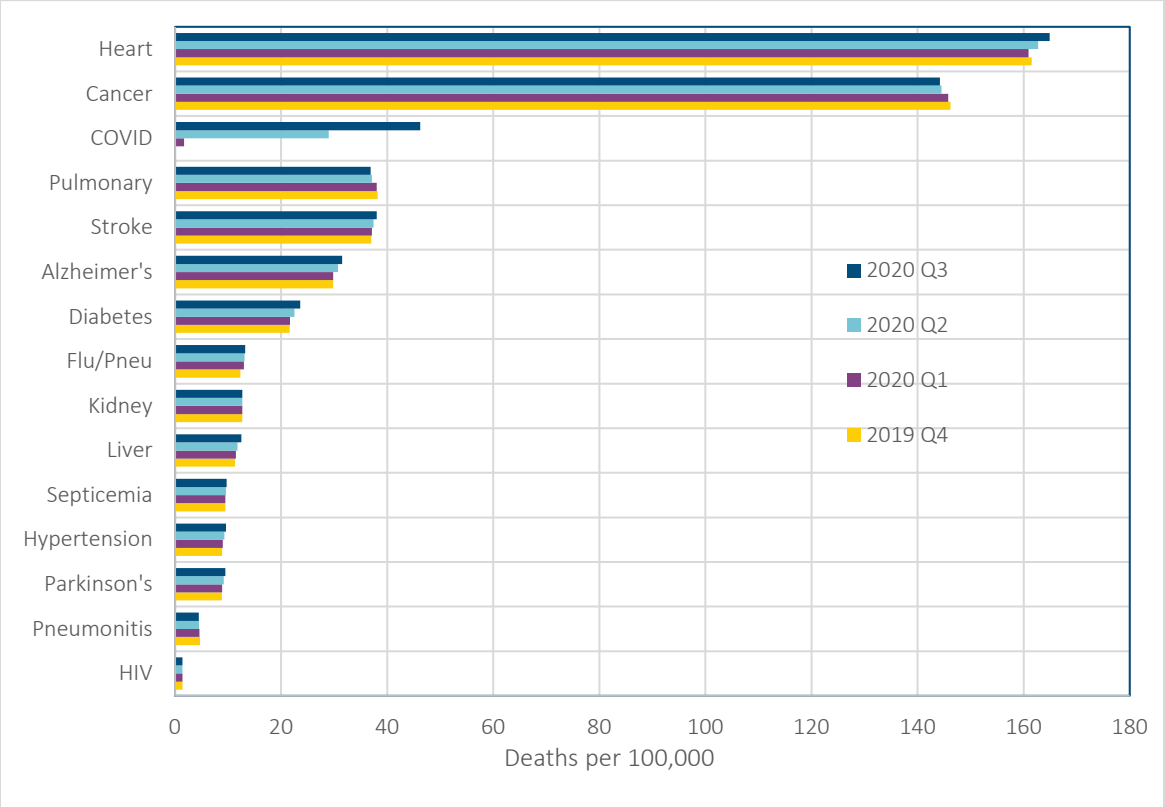
Section 5: 2020 U.S. Population Mortality – Cause of Death Analysis

5.1 2020 U.S. POPULATION MORTALITY RATES – PHYSIOLOGICAL CAUSES OF DEATH

Mortality rates for 15 physiological CODs are shown by quarter in Figure 7 and provide context around the relative size of these 15 physiological CODs. The values in Figure 7 and the percentage change in mortality from quarter to quarter are shown in Table 4.

Figure 7

2020 U.S. POPULATION MORTALITY RATES BY CAUSE OF DEATH – PHYSIOLOGICAL



CDC Rapid Release.

Physiological or natural CODs include the largest CODs for older ages. Across all age groups, heart disease and cancer continued to dominate the first three quarters of 2020, about 3-4 times the rate of the next largest COD. COVID took over the as the number three killer in the third quarter of 2020, but at only about one-quarter the size of heart disease. Pulmonary, stroke, Alzheimer's and diabetes continued to be the next largest CODs in 2020. Additional analysis of the changes in the top eight physiological CODs are included in sections 5.3-5.9 and 5.12.

These 15 CODs represent about 70.5% of all deaths in the U.S. in 2019 and increased about 4-6% in the second and third quarters in 2020 as shown in Table 4. Excluding COVID, their increases were 0.5% and 1.1% in the second and third quarters of 2020, respectively.

Table 4

2020 U.S. POPULATION MORTALITY RATES AND CHANGE IN MORTALITY RATES BY CAUSE OF DEATH - PHYSIOLOGICAL

Cause of Death	Quarter Ending	Deaths per 100,000	Change from Prior Quarter	Cause of Death	Quarter Ending	Deaths per 100,000	Change from Prior Quarter
Heart	Q1	160.9	-0.4%	Kidney	Q1	12.7	0.0%
	Q2	162.7	1.1%		Q2	12.7	0.0%
	Q3	164.9	1.4%		Q3	12.7	0.0%
Cancer	Q1	145.8	-0.3%	Liver	Q1	11.5	1.8%
	Q2	144.5	-0.9%		Q2	11.8	2.6%
	Q3	144.2	-0.2%		Q3	12.5	5.9%
COVID	Q1	1.7	n/a	Septicemia	Q1	9.5	0.0%
	Q2	29.0	1605.9%		Q2	9.6	1.1%
	Q3	46.2	59.3%		Q3	9.7	1.0%
Pulmonary	Q1	38.0	-0.5%	Hypertension	Q1	9.0	1.1%
	Q2	37.1	-2.4%		Q2	9.3	3.3%
	Q3	36.9	-0.5%		Q3	9.6	3.2%
Stroke	Q1	37.1	0.3%	Parkinson's	Q1	8.9	1.1%
	Q2	37.4	0.8%		Q2	9.2	3.4%
	Q3	38.0	1.6%		Q3	9.5	3.3%
Alzheimer's	Q1	29.8	0.0%	Pneumonitis	Q1	4.6	-2.1%
	Q2	30.7	3.0%		Q2	4.5	-2.2%
	Q3	31.5	2.6%		Q3	4.5	0.0%
Diabetes	Q1	21.7	0.5%	HIV	Q1	1.4	0.0%
	Q2	22.5	3.7%		Q2	1.4	0.0%
	Q3	23.6	4.9%		Q3	1.4	0.0%
Flu/Pneu	Q1	13.0	5.7%	Sum	Q1	505.6	0.3%
	Q2	13.1	0.8%		Q2	535.5	5.9%
	Q3	13.2	0.8%		Q3	558.4	4.3%

CDC Rapid Release.

5.2 2020 U.S. POPULATION MORTALITY RATES – EXTERNAL CAUSES OF DEATH

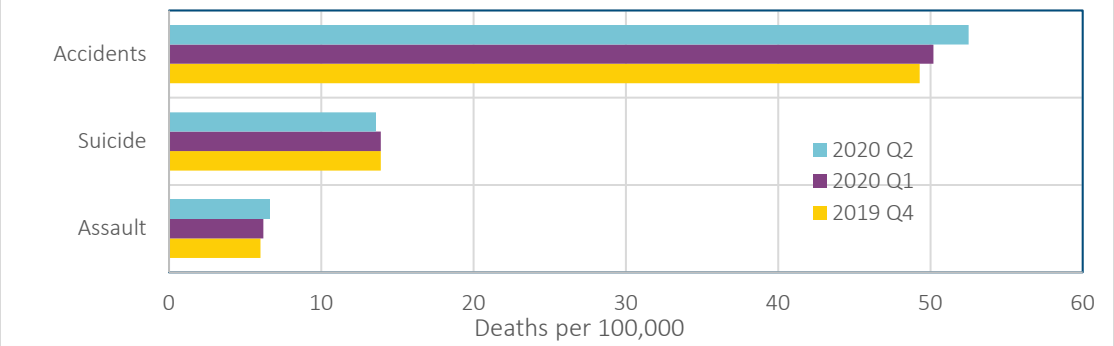
Mortality rates for the three external CODs (accidents, suicides and assault) were available from the CDC and are shown by quarter in Figure 8. External CODs, especially accidental deaths, tend to be the largest CODs for younger ages. The values in Figure 8 and the percentage change in mortality from quarter to quarter are shown in Table 5. Data for only the first two quarters of 2020 were available for these CODs at the time of publication of this report.

Accidental deaths is a broad category that includes motor vehicle accidents (MVA). Accidental deaths also intersect partially with drug overdose deaths. MVA detail is not included in this report because data on MVAs is not yet available from the CDC.[14] Drug overdose deaths have not been included in this report because only first quarter drug overdose data was available from the CDC; however, the 12-month annualized mortality rate ending in the first quarter of 2020 was up 4.6% over the 12-month annualized mortality ending in the fourth quarter of 2019. An assessment of the detailed changes in accidental deaths will be possible when final 2020 COD data becomes available in late 2021 or early 2022.

Accidents, suicides and assault deaths represented about 9.7% of all deaths in the U.S. in 2019 and, in total, increased 1.6% and 3.4% in the first and second quarters of 2020, respectively. These increases compared to increases of 0.5% and 1.1% in the second and third quarters, respectively, with the 15 physiological CODs excluding COVID as discussed in Section 5.1.

Figure 8

2020 U.S. POPULATION MORTALITY RATES BY CAUSE OF DEATH – EXTERNAL



CDC Rapid Release.

Table 5

2020 U.S. POPULATION MORTALITY RATES AND CHANGE IN MORTALITY RATES BY CAUSE OF DEATH – EXTERNAL

Cause of Death	Quarter Ending	Deaths per 100,000	Change from Prior Quarter	Cause of Death	Quarter Ending	Deaths per 100,000	Change from Prior Quarter
Accidents	Q1	50.2	1.8%	Assault	Q1	6.2	3.3%
	Q2	52.5	4.6%		Q2	6.6	6.5%
Suicide	Q1	13.9	0.0%	Sum	Q1	70.3	1.6%
	Q2	13.6	-2.2%		Q2	72.7	3.4%

CDC Rapid Release.

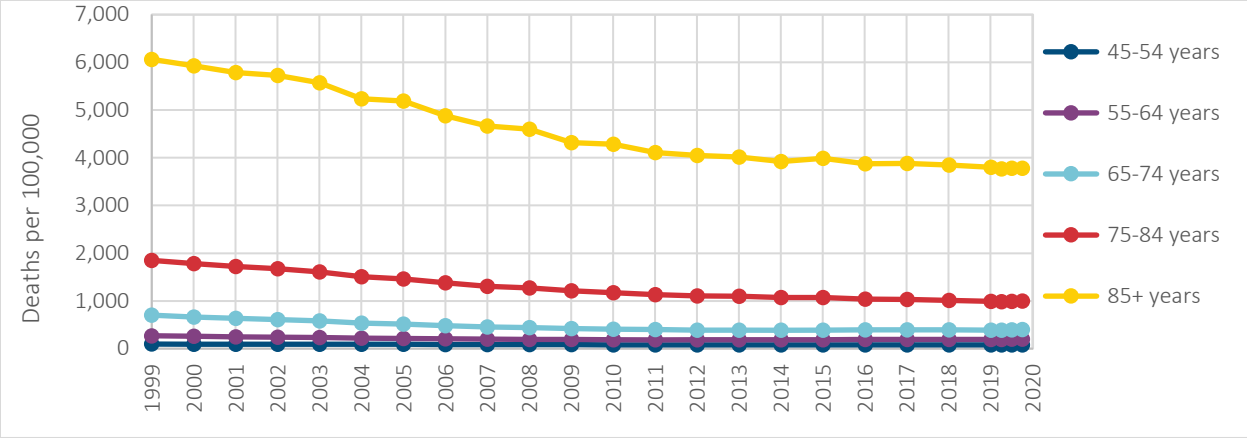
[14] The National Safety Council is estimating an 8% increase in motor vehicle deaths in 2020. https://injuryfacts.nsc.org/motor-vehicle/overview/preliminary-estimates/

5.3 MORTALITY RATES AND CHANGE IN MORTALITY RATES BY AGE GROUP - HEART

Deaths from heart disease in the first three quarters of 2020 continued to level off after a period of decline during the first 10-12 years of the 21st century as shown in Figure 9.

Figure 9

1999-2020 U.S. POPULATION MORTALITY RATES - HEART DISEASE

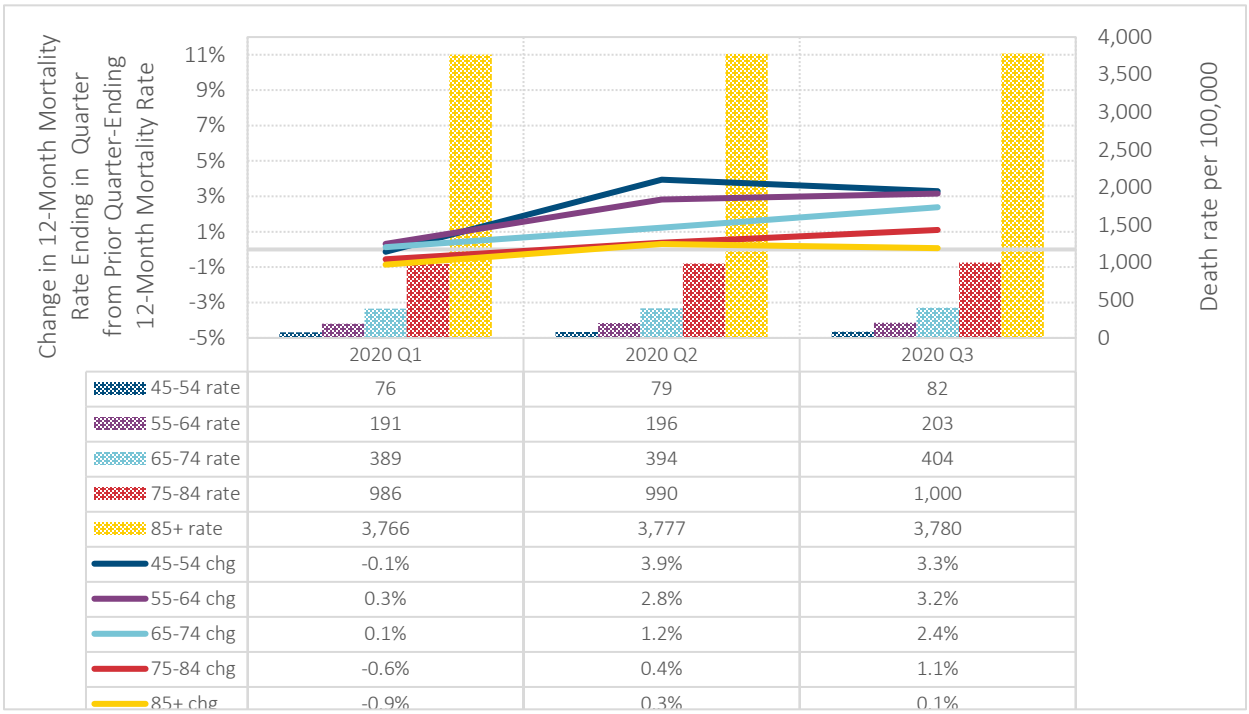


CDC WONDER; CDC Rapid Release.

Details of the annual mortality rates ending in the first three quarters of 2020 by age group are shown in Figure 10. Death rates for ages 45+ increased in the second and third quarter, with the largest increase of 3.9% for ages 45-54. These 2020 increases raised the annualized mortality rates for these age groups to levels not seen since 2010 or prior. The oldest age group, 85+, was the only one to see a net improvement in rate levels over the first three quarters of 2020.

Figure 10

2020 U.S. POPULATION CHANGE IN MORTALITY AND MORTALITY RATES BY AGE - HEART DISEASE



	2020 Q1	2020 Q2	2020 Q3
45-54 rate	76	79	82
55-64 rate	191	196	203
65-74 rate	389	394	404
75-84 rate	986	990	1,000
85+ rate	3,766	3,777	3,780
45-54 chg	-0.1%	3.9%	3.3%
55-64 chg	0.3%	2.8%	3.2%
65-74 chg	0.1%	1.2%	2.4%
75-84 chg	-0.6%	0.4%	1.1%
85+ chg	-0.9%	0.3%	0.1%

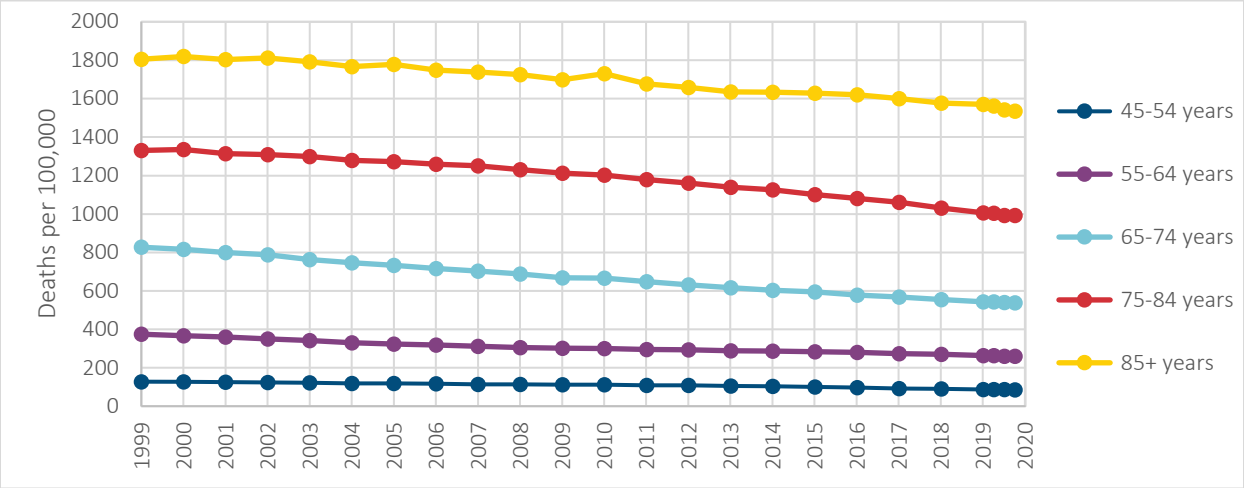
CDC Rapid Release.

5.4 MORTALITY RATES AND CHANGE IN MORTALITY RATES BY AGE GROUP – CANCER

Figure 11 shows that deaths from cancer in the first three quarters of 2020 decreased for ages 85+, leveled off somewhat for ages 75-84, and remained in a relatively flat pattern for ages 45-74.

Figure 11

1999-2020 U.S. POPULATION MORTALITY RATES – CANCER

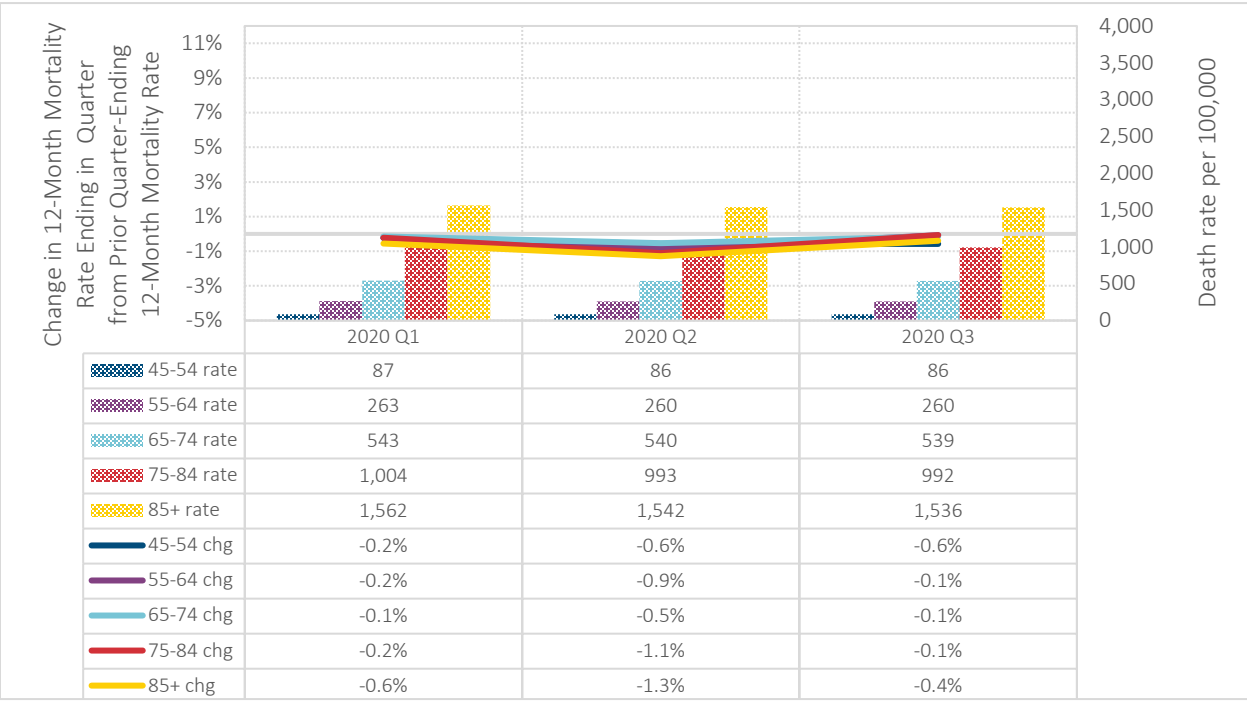


CDC WONDER; CDC Rapid Release.

Details of the annual mortality rates ending in the first three quarters of 2020 by age group are shown in Figure 12. All ages above 45 saw improvement in all three quarters of 2020, with the second quarter having the largest improvements of 0.5% or greater. Mortality rates were modestly improved in the first and third quarters for ages 55-84. Ages 85+ had the greatest improvement in each of the three quarters.

Figure 12

2020 U.S. POPULATION CHANGE IN MORTALITY AND MORTALITY RATES BY AGE – CANCER



	2020 Q1	2020 Q2	2020 Q3
45-54 rate	87	86	86
55-64 rate	263	260	260
65-74 rate	543	540	539
75-84 rate	1,004	993	992
85+ rate	1,562	1,542	1,536
45-54 chg	-0.2%	-0.6%	-0.6%
55-64 chg	-0.2%	-0.9%	-0.1%
65-74 chg	-0.1%	-0.5%	-0.1%
75-84 chg	-0.2%	-1.1%	-0.1%
85+ chg	-0.6%	-1.3%	-0.4%

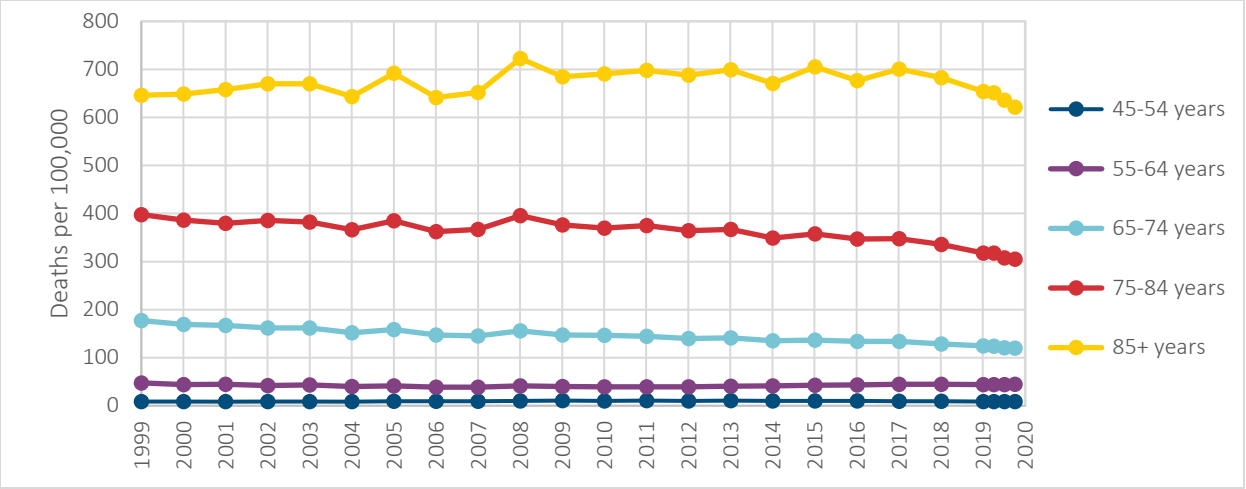
CDC Rapid Release.

5.5 MORTALITY RATES AND CHANGE IN MORTALITY RATES BY AGE GROUP – PULMONARY

Ages 65+ saw a net improvement in mortality rates across the first three quarters of 2020. These improvements appear to be continuing a downward trend, which began around 2016-2017, as shown in Figure 13.

Figure 13

1999-2020 U.S. POPULATION MORTALITY RATES – PULMONARY

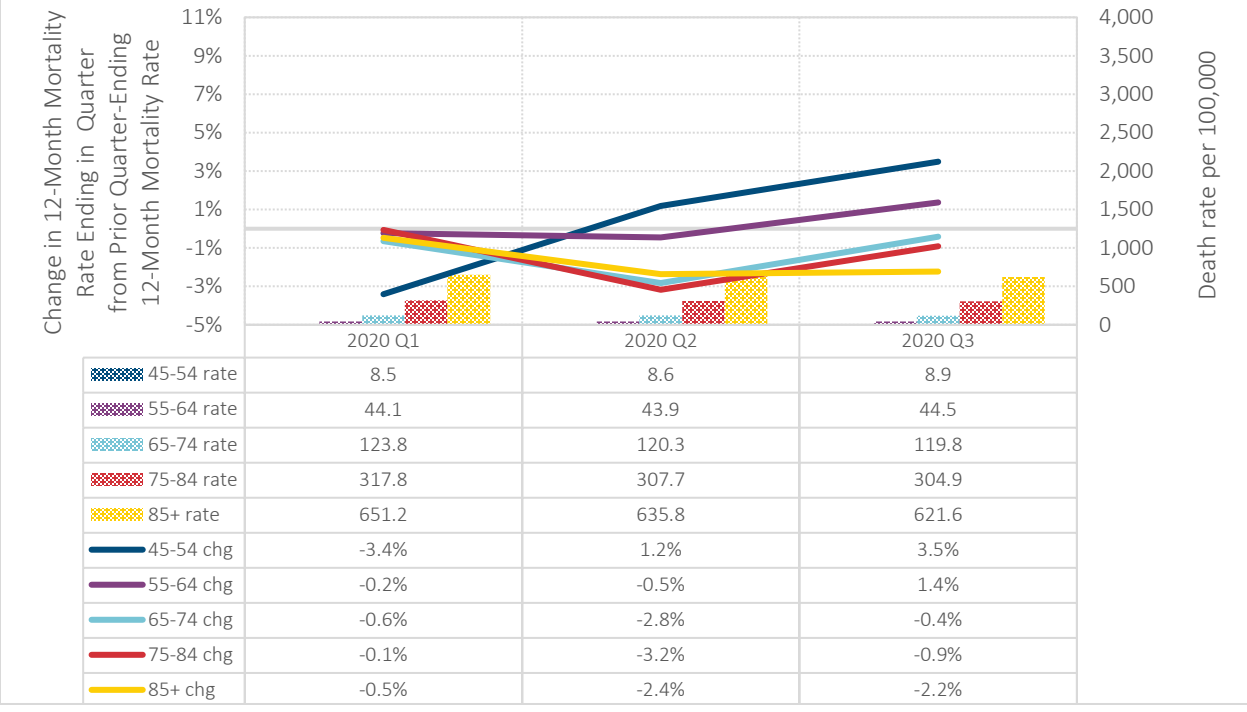


CDC WONDER; CDC Rapid Release.

Details of the annual mortality rates ending in the first three quarters of 2020 by age group are shown in Figure 14. Pulmonary deaths had the greatest improvement in the second quarter of 2020 for ages 55+. Ages 65+ saw improvement in all three quarters of 2020. Ages 45-64 had increases in mortality in the third quarter.

Figure 14

2020 U.S. POPULATION CHANGE IN MORTALITY AND MORTALITY RATES BY AGE – PULMONARY



	2020 Q1	2020 Q2	2020 Q3
45-54 rate	8.5	8.6	8.9
55-64 rate	44.1	43.9	44.5
65-74 rate	123.8	120.3	119.8
75-84 rate	317.8	307.7	304.9
85+ rate	651.2	635.8	621.6
45-54 chg	-3.4%	1.2%	3.5%
55-64 chg	-0.2%	-0.5%	1.4%
65-74 chg	-0.6%	-2.8%	-0.4%
75-84 chg	-0.1%	-3.2%	-0.9%
85+ chg	-0.5%	-2.4%	-2.2%

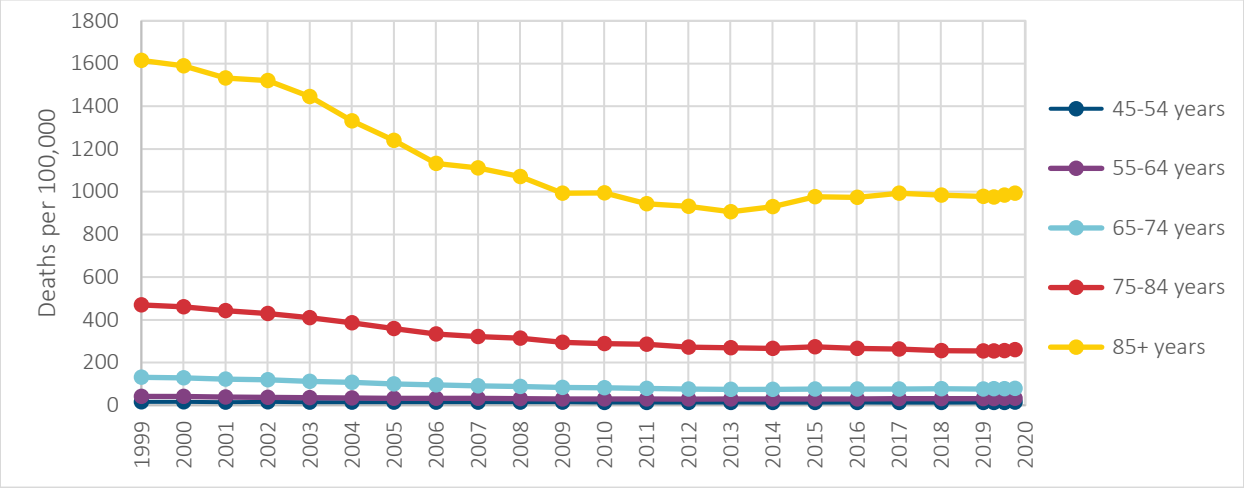
CDC Rapid Release.

5.6 MORTALITY RATES AND CHANGE IN MORTALITY RATES BY AGE GROUP – STROKE

Figure 15 shows how mortality from stroke remained relatively level in the recent years and in 2020 for ages 75 and below. It also shows an increasing pattern in 2020 for ages above 85.

Figure 15

1999-2020 U.S. POPULATION MORTALITY RATES – STROKE

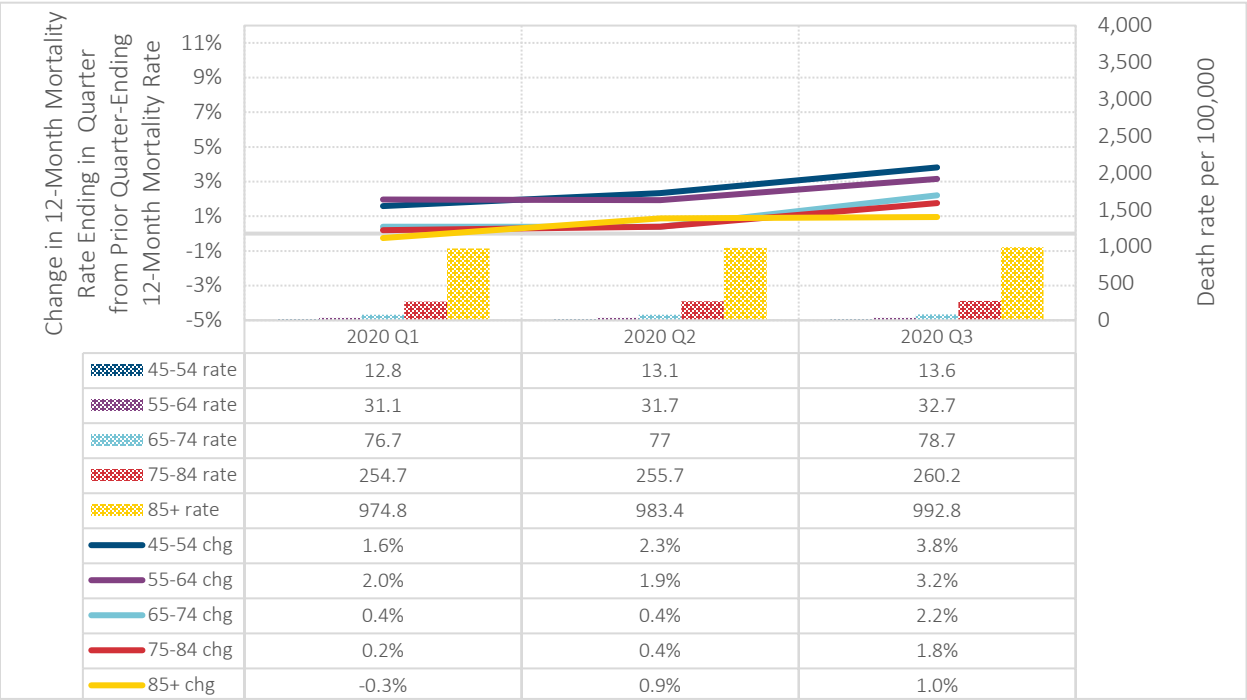


CDC WONDER; CDC Rapid Release.

Details of the annual mortality rates ending in the first three quarters of 2020 by age group are shown in Figure 16. Aside from a small decrease in the first quarter of 2020 for ages 85+, all other age group/quarter rates increased in the first three quarters. The level of increase was inversely related to age with the levels at or below 1% at age 85+.

Figure 16

2020 U.S. POPULATION CHANGE IN MORTALITY AND MORTALITY RATES BY AGE – STROKE



	2020 Q1	2020 Q2	2020 Q3
45-54 rate	12.8	13.1	13.6
55-64 rate	31.1	31.7	32.7
65-74 rate	76.7	77	78.7
75-84 rate	254.7	255.7	260.2
85+ rate	974.8	983.4	992.8
45-54 chg	1.6%	2.3%	3.8%
55-64 chg	2.0%	1.9%	3.2%
65-74 chg	0.4%	0.4%	2.2%
75-84 chg	0.2%	0.4%	1.8%
85+ chg	-0.3%	0.9%	1.0%

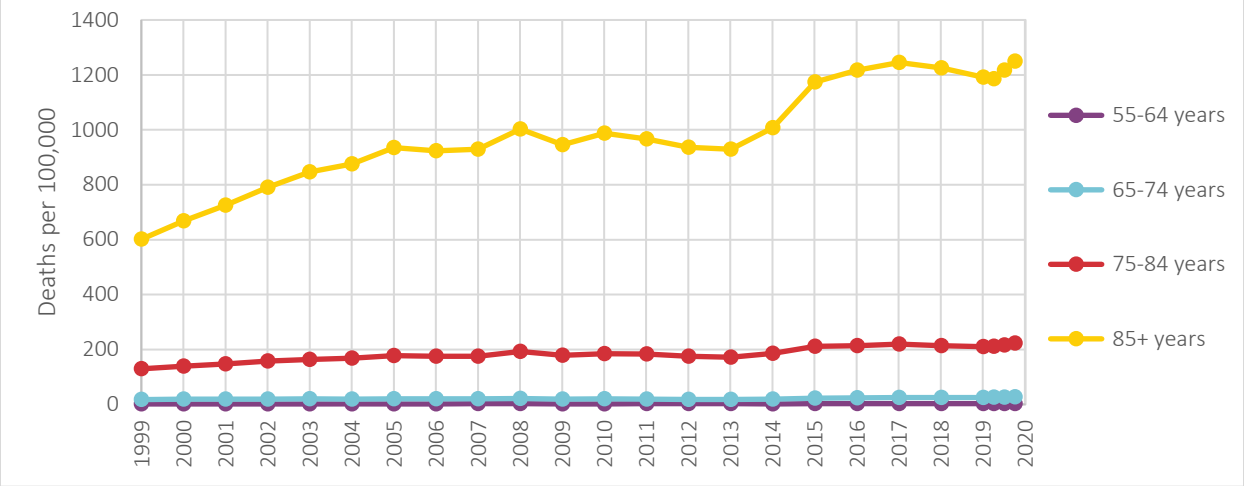
CDC Rapid Release.

5.7 MORTALITY RATES AND CHANGE IN MORTALITY RATES BY AGE GROUP – ALZHEIMER'S

Figure 17 shows the relative magnitude of historical mortality from Alzheimer's by age group and how the ages 85+ rate has more than doubled since 1999. Some of the early increase here may have been due to the increased attribution of deaths to Alzheimer's away from other CODs.

Figure 17

1999-2020 U.S. POPULATION MORTALITY RATES – ALZHEIMER'S

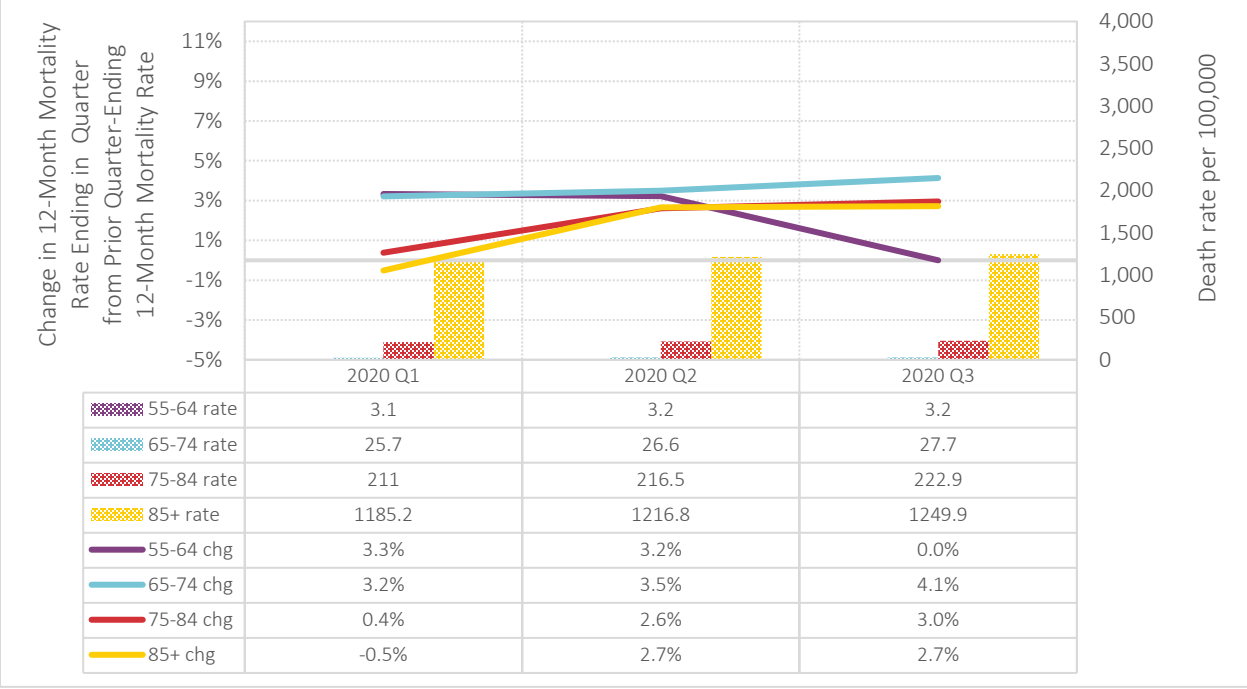


CDC WONDER; CDC Rapid Release.

Details of the annual mortality rates ending in the first three quarters of 2020 by age group are shown in Figure 18. Aside from a small decrease in the first quarter of 2020 for ages 85+, all other age group/quarter rates increased in the first three quarters, with most changes in the 3-4% range.

Figure 18

2020 U.S. POPULATION CHANGE IN MORTALITY AND MORTALITY RATES BY AGE – ALZHEIMER'S



	2020 Q1	2020 Q2	2020 Q3
55-64 rate	3.1	3.2	3.2
65-74 rate	25.7	26.6	27.7
75-84 rate	211	216.5	222.9
85+ rate	1185.2	1216.8	1249.9
55-64 chg	3.3%	3.2%	0.0%
65-74 chg	3.2%	3.5%	4.1%
75-84 chg	0.4%	2.6%	3.0%
85+ chg	-0.5%	2.7%	2.7%

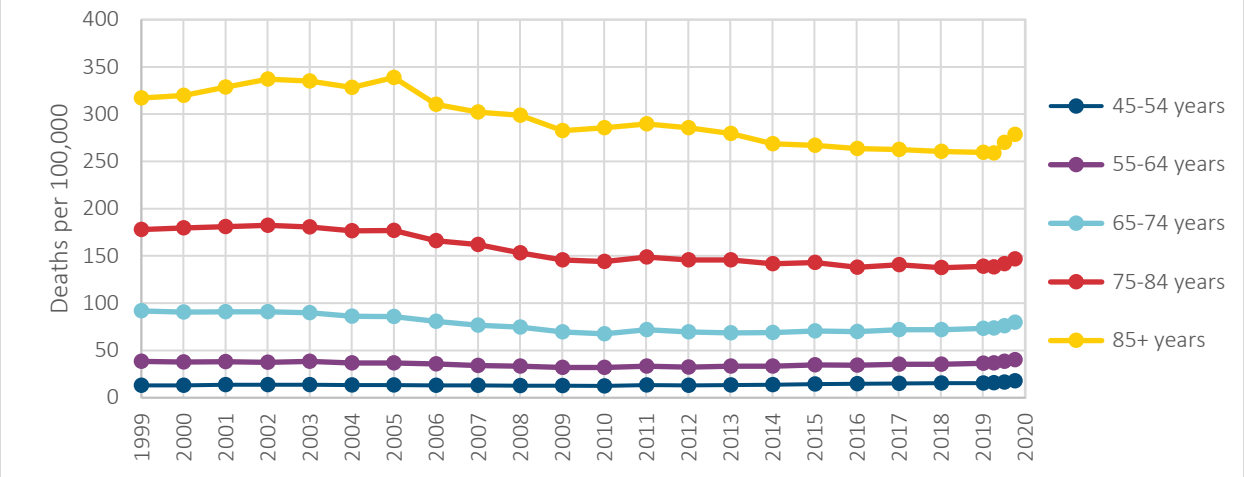
CDC Rapid Release.

5.8 MORTALITY RATES AND CHANGE IN MORTALITY RATES BY AGE GROUP – DIABETES

The diabetes mortality rates in Figure 19 show a downward trend in ages 75+ and a level trend for ages 45-74 in recent years before 2020. There was an increased mortality rate from diabetes in 2020 for all of the age groups shown.

Figure 19

1999-2020 U.S. POPULATION MORTALITY RATES – DIABETES

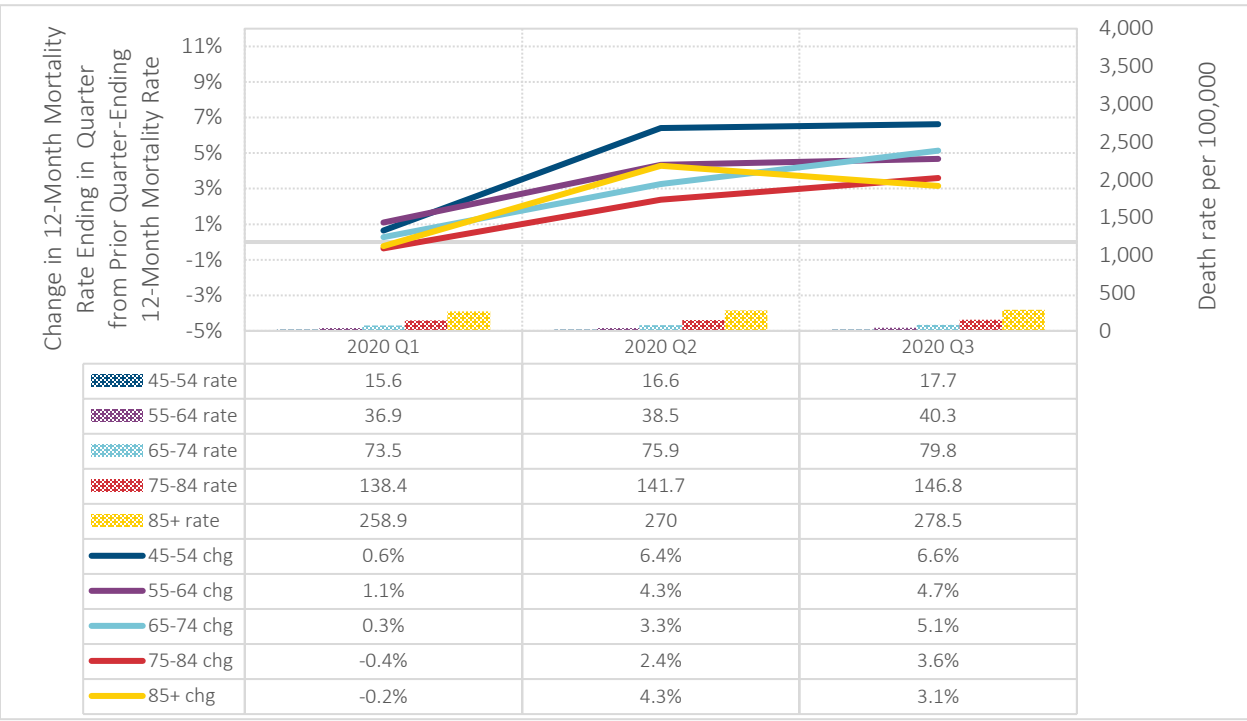


CDC WONDER; CDC Rapid Release.

Details of the annual mortality rates ending in the first three quarters of 2020 by age group are shown in Figure 20. Mortality from diabetes increased noticeably in the second and third quarters of 2020 for all ages above 45, with the size of the increase being inversely related to age.

Figure 20

2020 U.S. POPULATION CHANGE IN MORTALITY AND MORTALITY RATES BY AGE – DIABETES



	2020 Q1	2020 Q2	2020 Q3
45-54 rate	15.6	16.6	17.7
55-64 rate	36.9	38.5	40.3
65-74 rate	73.5	75.9	79.8
75-84 rate	138.4	141.7	146.8
85+ rate	258.9	270	278.5
45-54 chg	0.6%	6.4%	6.6%
55-64 chg	1.1%	4.3%	4.7%
65-74 chg	0.3%	3.3%	5.1%
75-84 chg	-0.4%	2.4%	3.6%
85+ chg	-0.2%	4.3%	3.1%

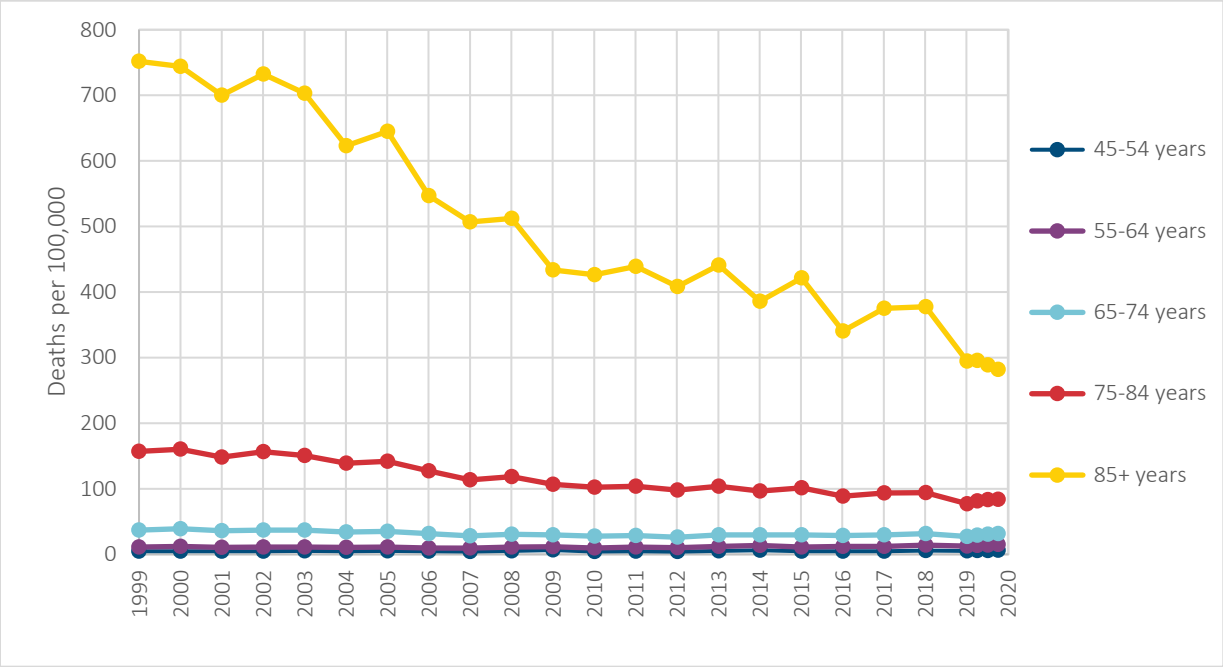
CDC Rapid Release.

5.9 MORTALITY RATES AND CHANGE IN MORTALITY RATES BY AGE GROUP – INFLUENZA/PNEUMONIA

Flu and pneumonia deaths can fluctuate widely from year to year and are dependent on the emergence of new flu strains and the efficacy of flu vaccines. Figure 21 shows some of this volatility and how older ages are at greater risk.

Figure 21

1999-2020 U.S. POPULATION MORTALITY RATES – INFLUENZA/PNEUMONIA

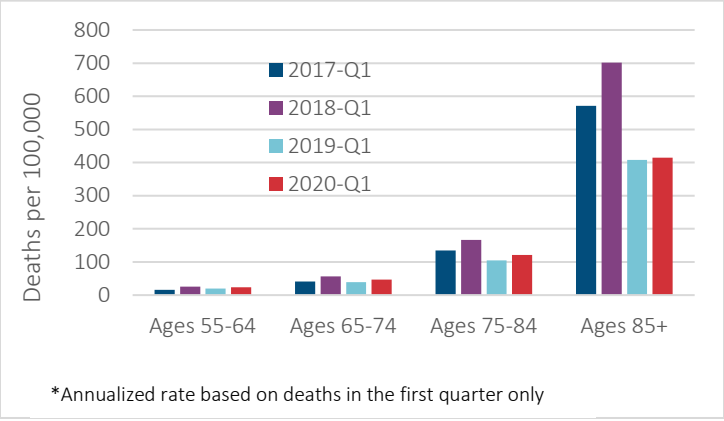


CDC WONDER; CDC Rapid Release.

The first quarter of a calendar year is often the quarter with the highest mortality rate in flu and pneumonia season. Figure 22 shows the annualized mortality rates based on deaths in the first quarter (three months of deaths only) of the last four years by age group. The 2020 first quarter mortality rate was comparable to 2019's and lower than 2017's and 2018's. First quarter 2018 was part of a relatively bad flu season occurring in late 2017 and early 2018. 2020 mortality levels were about 60% of 2018 levels for ages 85+, the age group most at risk for flu and pneumonia.

Figure 22

U.S. POPULATION ANNUALIZED MORTALITY RATES OF FIRST QUARTER DEATHS* BY AGE – INFLUENZA/PNEUMONIA



Ages	2017-Q1 ÷ 2018-Q1	2019-Q1 ÷ 2018-Q1	2020-Q1 ÷ 2018-Q1
55-64	61.7%	75.4%	92.6%
65-74	72.9%	69.0%	83.2%
75-84	80.6%	62.9%	72.9%
85+	81.4%	58.1%	59.1%

CDC Rapid Release.

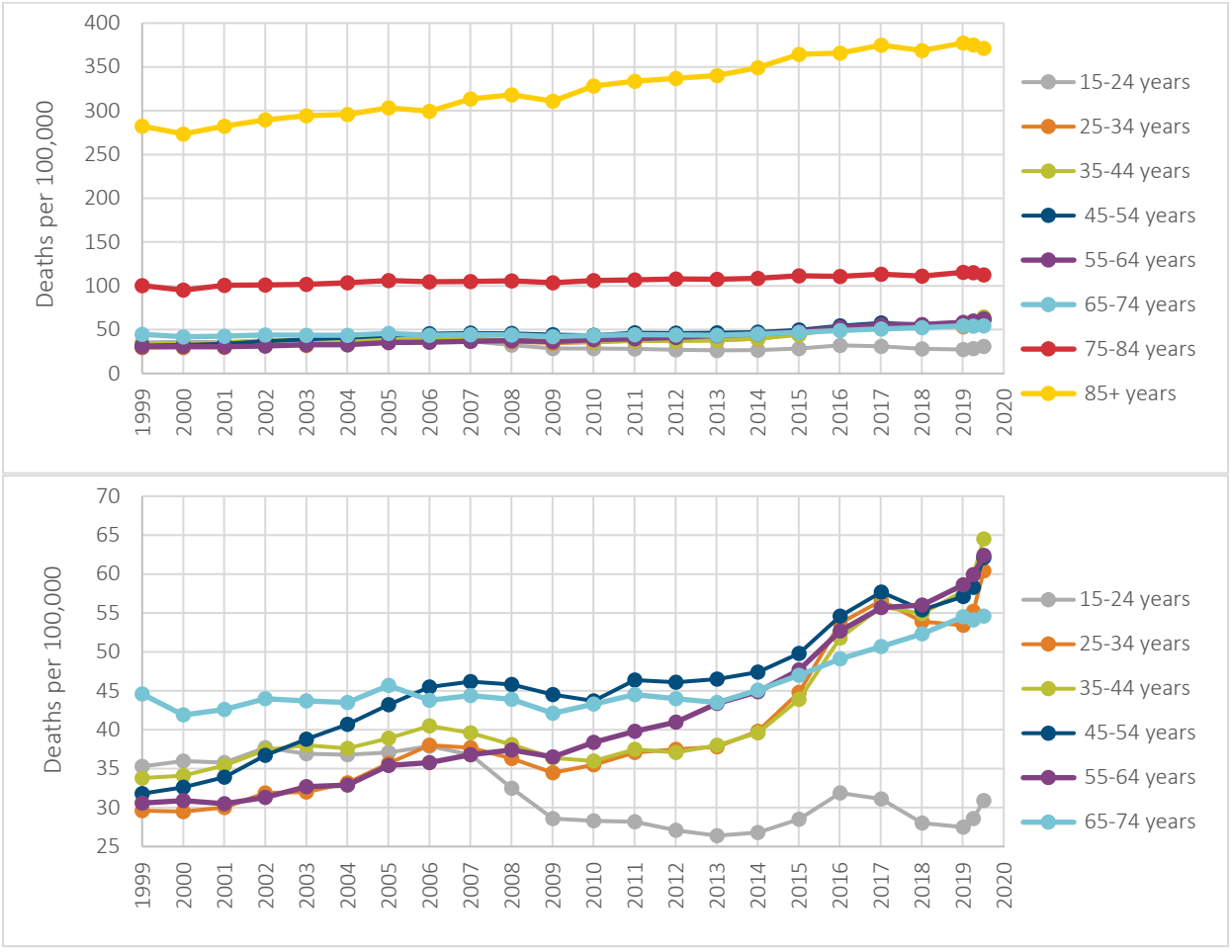
5.10 MORTALITY RATES AND CHANGE IN MORTALITY RATES BY AGE GROUP – ACCIDENTS

Accidental deaths are typically the third largest COD in the U.S. but were pushed to fourth place in 2020 due to COVID. They typically are the top COD for younger age groups.

As seen in Figure 23, accidental deaths were up in the first two quarters of 2020 for ages below 65 and down for ages above 75. The bottom half of Figure 23 zooms in on ages below 75 and shows the large increases that have occurred since around 2010 for ages 25-74.

Figure 23

1999-2020 U.S. POPULATION MORTALITY RATES – ACCIDENTS



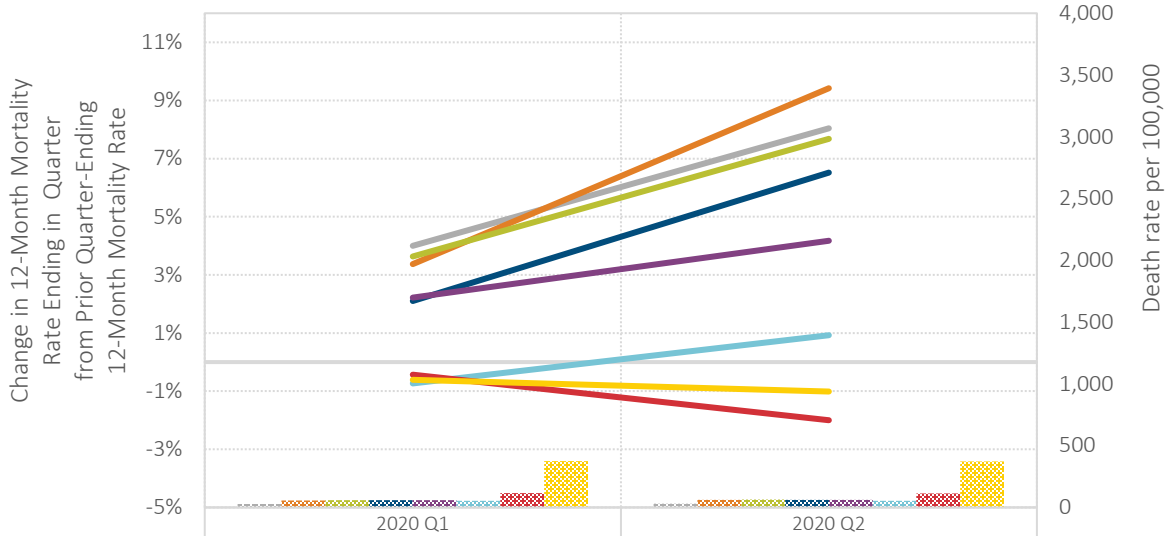
CDC WONDER; CDC Rapid Release.

As explained in Section 5.2, accidental deaths is a broad category that includes motor vehicle accidents. Accidental deaths also partially intersect drug overdose deaths. Motor vehicle accident detail is not included in this report because it is not yet available from the CDC. Drug overdose deaths have not been included in this report because only first quarter drug overdose data was available. An assessment of the detailed changes in accidental deaths will be possible when final 2020 COD data becomes available in late 2021 or early 2022.

Details of the annual mortality rates ending in the first two quarters of 2020 by age group are shown in Figure 24. Ages below 55 saw increases in both the first and second quarters of 2020, with the increases in quarter two about twice as large as in quarter one. The increases also were inversely related to age and peaked at 9.4% for ages 25-34 in the second quarter. Ages 75+ had decreasing mortality from accidents in both quarters.

Figure 24

2020 U.S. POPULATION CHANGE IN MORTALITY AND MORTALITY RATES BY AGE – ACCIDENTS



	2020 Q1	2020 Q2
15-24 rate	28.6	30.9
25-34 rate	55.2	60.4
35-44 rate	59.9	64.5
45-54 rate	58.3	62.1
55-64 rate	59.9	62.4
65-74 rate	54.1	54.6
75-84 rate	115	112.7
85+ rate	375.1	371.3
15-24 chg	4.0%	8.0%
25-34 chg	3.4%	9.4%
35-44 chg	3.6%	7.7%
45-54 chg	2.1%	6.5%
55-64 chg	2.2%	4.2%
65-74 chg	-0.7%	0.9%
75-84 chg	-0.4%	-2.0%
85+ chg	-0.6%	-1.0%

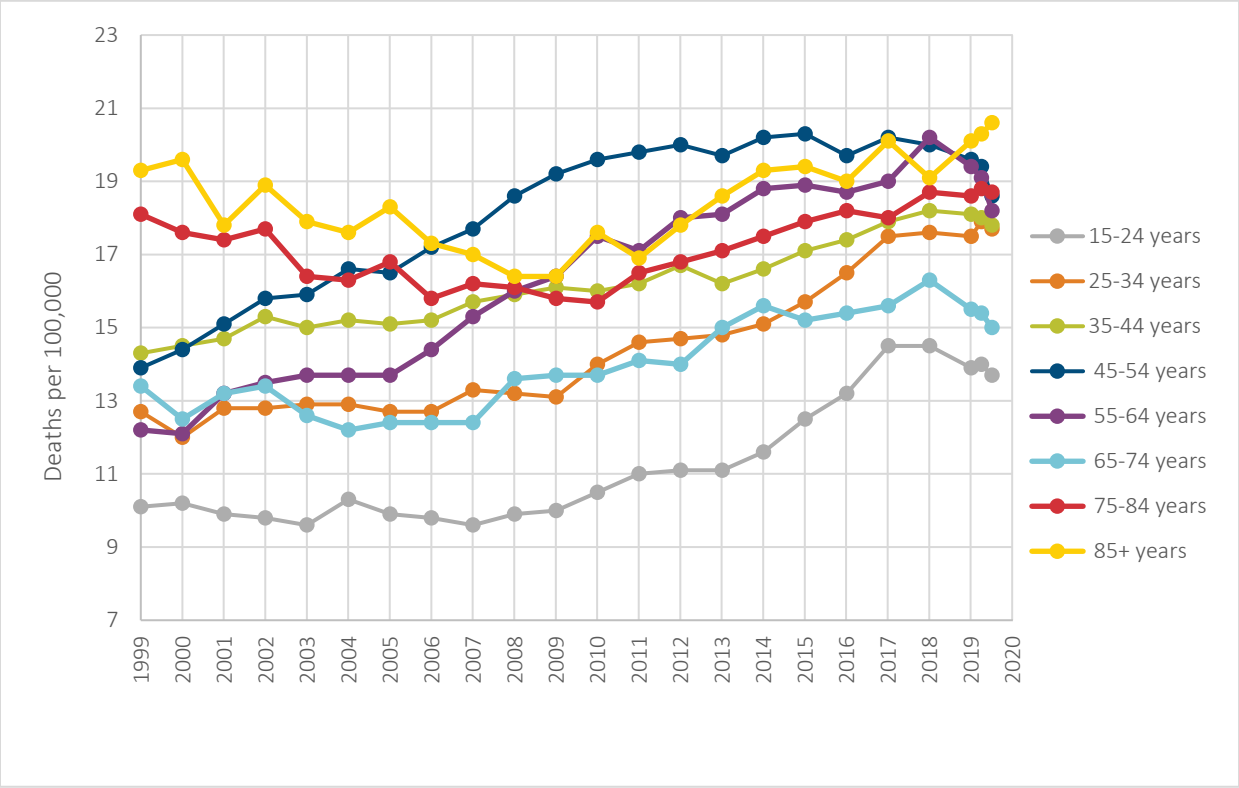
CDC Rapid Release.

5.11 MORTALITY RATES AND CHANGE IN MORTALITY RATES BY AGE GROUP – SUICIDE

Deaths from suicides were analyzed because it has been considered one of the deaths of despair CODs and, even though absolute levels of suicide rates are low, there was a desire to see if COVID has had any impact on 'deaths of despair.' Figure 25 shows the level of suicide rates by age group since 1999. Although some increasing trends can be seen in most age groups over the past 15 years, the first half of 2020 is showing improvement in ages 15-74.

Figure 25

1999-2020 U.S. POPULATION MORTALITY RATES – SUICIDE

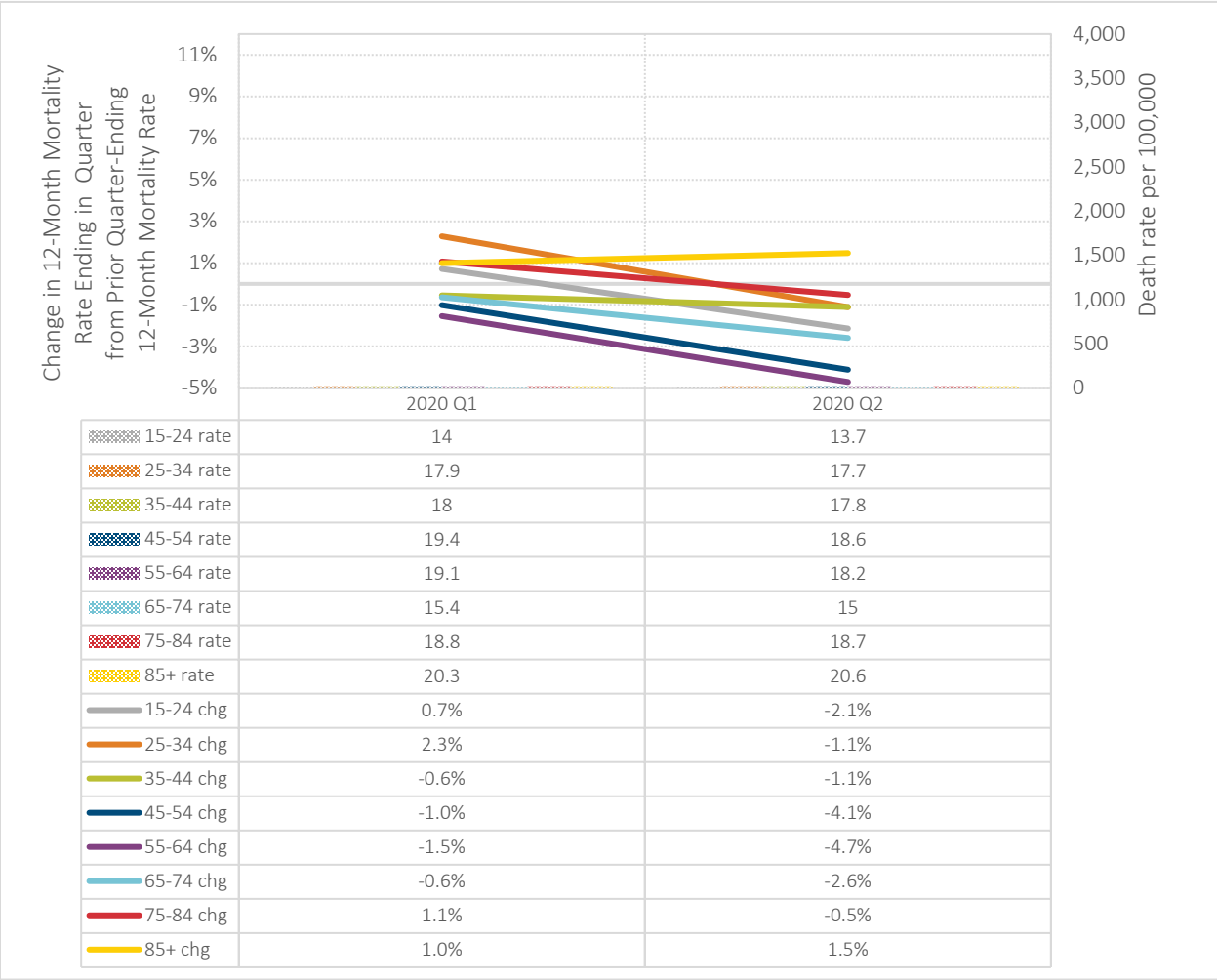


CDC WONDER; CDC Rapid Release.

Details of the annual mortality rates ending in the first two quarters of 2020 by age group are shown in Figure 26. Suicide rates improved for all age groups between 35-74 in both the first and second quarters of 2020. Age 85+ was the only age group to increase in both quarters.

Figure 26

2020 U.S. POPULATION CHANGE IN MORTALITY AND MORTALITY RATES BY AGE – SUICIDE



	2020 Q1	2020 Q2
15-24 rate	14	13.7
25-34 rate	17.9	17.7
35-44 rate	18	17.8
45-54 rate	19.4	18.6
55-64 rate	19.1	18.2
65-74 rate	15.4	15
75-84 rate	18.8	18.7
85+ rate	20.3	20.6
15-24 chg	0.7%	-2.1%
25-34 chg	2.3%	-1.1%
35-44 chg	-0.6%	-1.1%
45-54 chg	-1.0%	-4.1%
55-64 chg	-1.5%	-4.7%
65-74 chg	-0.6%	-2.6%
75-84 chg	1.1%	-0.5%
85+ chg	1.0%	1.5%

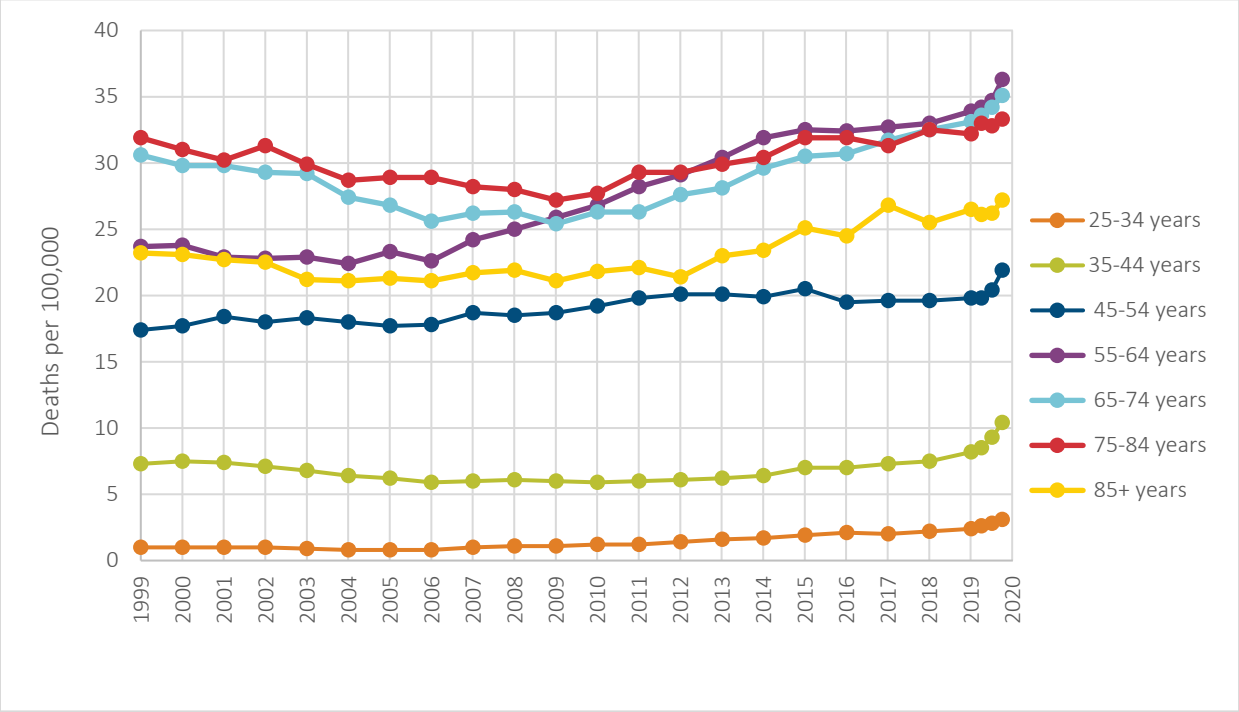
CDC Rapid Release.

5.12 MORTALITY RATES AND CHANGE IN MORTALITY RATES BY AGE GROUP – LIVER

Deaths from liver disease and cirrhosis were analyzed because it has been considered one of the deaths of despair CODs sometimes caused by excess use of alcohol. Even though absolute liver death rates are low, there was a desire to see if COVID has had any impact on 'deaths of despair.' Figure 27 shows the level of liver death rates by age group since 1999. Although the absolute levels are relatively small, increasing trends can be seen in most age groups over the past 15 years, with further increasing trends in 2020.

Figure 27

1999-2020 U.S. POPULATION MORTALITY RATES – LIVER

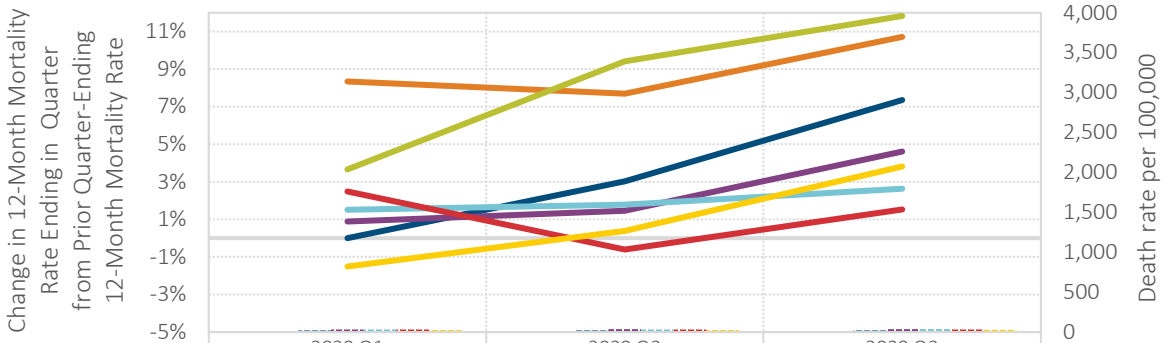


CDC WONDER; CDC Rapid Release.

Details of the annual rates ending in the first three quarters of 2020 by age group are shown in Figure 28. Rates increased in virtually all age group and quarter combinations. Third quarter 2020 saw the highest increases in all ages, with ages 25-44 increasing at rates over 10%.

Figure 28

2020 U.S. POPULATION CHANGE IN MORTALITY AND MORTALITY RATES BY AGE – LIVER



	2020 Q1	2020 Q2	2020 Q3
25-34 rate	2.6	2.8	3.1
35-44 rate	8.5	9.3	10.4
45-54 rate	19.8	20.4	21.9
55-64 rate	34.2	34.7	36.3
65-74 rate	33.6	34.2	35.1
75-84 rate	33	32.8	33.3
85+ rate	26.1	26.2	27.2
25-34 chg	8.3%	7.7%	10.7%
35-44 chg	3.7%	9.4%	11.8%
45-54 chg	0.0%	3.0%	7.4%
55-64 chg	0.9%	1.5%	4.6%
65-74 chg	1.5%	1.8%	2.6%
75-84 chg	2.5%	-0.6%	1.5%
85+ chg	-1.5%	0.4%	3.8%

CDC Rapid Release.

Section 6: Methodology and Reliances

This report uses estimates from the most recent National Center for Health Statistics (NCHS) National Vital Statistics System (NVSS) Rapid Release Quarterly Provisional Estimates[15], historical experience from 1999 to 2019 from the Centers for Disease Control and Prevention's (CDC) Wide-ranging Online Data for Epidemiologic Research (WONDER) database[16], and information from the CDC's Mortality and Morbidity Weekly Report (MMWR) on Provisional Mortality Data – United States, 2020[17]. The Quarterly Provisional Estimates and the MMWR Provisional Mortality Data include mortality rate estimates that may change as additional data becomes available.

Unless otherwise noted, all mortality rates shown are per 100,000 of population and annual rates over the 12-month period ending as of the date indicated. For example, the Q2-2020 rate covers deaths from Q3-2019 through Q2-2020. For tables and charts with only a calendar year indicated, the mortality rate covers deaths during that calendar year. All mortality rates in this report, except for age-group rates, are age-adjusted rates, as opposed to crude rates, and are based on the 2000 U.S. standard[18] population basis. These age-adjusted rates will differ from the age-adjusted rates shown in 'U.S. Population Mortality Observations - Updated with 2019 Experience' report[19], which were based on the CDC's non-standard population option of 2010, but the change in mortality rates is similar under the two population bases.

The CODs used in this report are determined from the single underlying cause of death[20] as identified on the death certificate, as opposed to one of the multiple causes of death[21] listed on a death certificate. It is important to understand that the death counts and rates provided by the CDC and used in this report are provisional estimates. Delays in death reporting may result in data that is more incomplete for the most recent months and the final cause may not be available at the time the provisional estimates are available.[22] Finally, the assignment of COD is somewhat subjective and there is potential for the misclassification of COD[23].

[15] https://www.cdc.gov/nchs/nvss/vsrr/mortality.htm
[16] https://wonder.cdc.gov/
[17] Ahmad FB, Cisewski JA, Miniño A, Anderson RN. Provisional Mortality Data — United States, 2020. MMWR Morb Mortal Wkly Rep 2021;70:519–522. DOI: http://dx.doi.org/10.15585/mmwr.mm7014eexternal icon
[18] In WONDER, the user may choose the population distribution used for calculating age-adjusted rates. Several "Standard" populations, including the default 2000 standard population, are available. As an alternative, the user can select a "Non-Standard" population, such as 2010, for the population distribution in the age adjustment.
[19] https://www.soa.org/research-reports/2017/population-mortality-observations/
[20] https://wonder.cdc.gov/wonder/help/ucd.html#
[21] https://wonder.cdc.gov/wonder/help/mcd.html
[22] https://www.cdc.gov/nchs/nvss/vsrr/mortality-technical-notes.htm
[23] https://www.cdc.gov/nchs/nvss/vsrr/covid19/tech_notes.htm

The NVSS Rapid Release Quarterly Provisional Estimates provide mortality estimates for the CODs shown in Table 6. Estimates for the third quarter of 2020 were available for all the CODs, except accident, suicide and assault. Estimates for the accident, suicide and assault CODs were available through the second quarter of 2020. Care should be taken when comparing rates across these CODs or when determining the mortality rate for all other CODs not shown here. The Drug Overdose, Falls Ages 65+ and Firearm CODs intersect with other CODs in Table 6 and are not included in any analysis in this report. The rates for Falls 65+ use the population for age 65+ only in the denominator of the mortality rate calculation, whereas the total population for all ages is used in the denominator in the rate for all other CODs.

Table 6

PRIMARY CAUSE OF DEATH IN RAPID RELEASE QUARTERLY PROVISIONAL ESTIMATES

Primary Cause of Death	ICD-10 Codes
COVID-19	Coronavirus disease (U07.1)
Heart	Diseases of heart (I00-I09, I11, I13, I20-I51)
Cancer	Malignant neoplasms (C00-C97)
Accidents	Unintentional Injuries (V01-X59, Y85-Y86)
Pulmonary	Chronic lower respiratory diseases (J40-J47)
Stroke	Cerebrovascular diseases (I60-I69)
Alzheimer's	Alzheimer's disease (G30)
Diabetes	Diabetes mellitus (E10-E14)
Flu/pneumonia	Influenza and pneumonia (J09-J18)
Kidney	Nephritis, nephrotic syndrome and nephrosis (N00-N07, N17-N19, N25-N27)
Suicide	Intentional self-harm (*U03, X60-X84, Y87.0)
Blood poisoning	Septicemia (A40-A41)
Liver	Chronic liver disease and cirrhosis (K70, K73-K74)
Hypertension	Essential hypertension and hypertensive renal disease (I10, I12, I15)
Parkinson’s	Parkinson's disease (G20-G21)
Pneumonitis	Pneumonitis due to solids and liquids (J69)
Assault	Assault (homicide) (*U01-*U02, X85-Y09, Y87.1)
HIV	Human immunodeficiency virus (HIV) disease (B20-B24)
Drug Overdose	Drug Overdose (X40-X44, X60-X64, X85, Y10-Y14)
Falls, 65+	Falls, ages 65 and over (W00-W19)
Firearms	Firearm-related injury (U01.4, W32-W34, X72-X74, X93-X95, Y22-Y24, Y35.0)

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