Impact of COVID-19 on Future U.S. Mortality

Expert Opinion Survey 2

Mortality and Longevity

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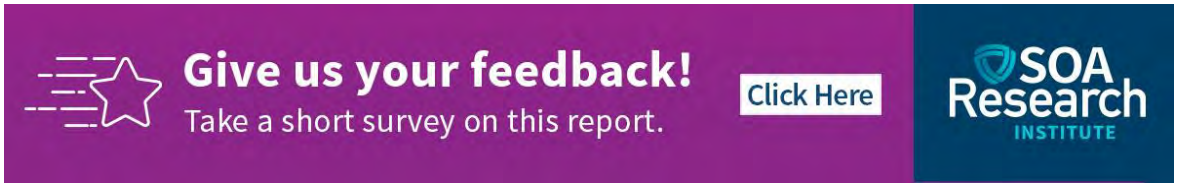

CONTENTS

Impact of COVID-19 on Future U.S. Mortality

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Executive Summary

As COVID-19 continues to evolve and its consequences emerge, the Society of Actuaries (SOA) Research Institute's Mortality and Longevity Strategic Research Program Steering Committee (MLPSC) decided to revisit its earlier COVID-19 survey[1] to see how views on the disease's impact on future U.S. mortality may have changed. Questions focused on excess mortality at various points in time along with a desire to investigate the drivers behind future mortality changes. As time goes by and more data are collected, researchers will learn more about topics including "long COVID," the impact of responses to COVID-19 on mortality and how future mortality rates have been impacted by previous excess deaths during the pandemic. Will mortality quickly return to pre-pandemic levels upon its conclusion, or will COVID-19 be a lingering factor in future U.S. mortality from the potential occurrence of new coronavirus variants, post-COVID-19 conditions (long COVID), deferral of needed health care treatment, a fatigued health care system and other elements? Only time will provide the answers to these questions, and the study is ongoing.

To gather insights into what the future may hold, a panel of experts of varying backgrounds participated in a survey examining how COVID-19 might affect future U.S. general population mortality. The panel also considered how future U.S. mortality for the life insured, annuitant and pension plan populations might differ from the general U.S. population. Four years were examined: 2022, 2023, 2025 and 2030.

Participants were asked to provide excess mortality estimates. They were instructed to assume 2019 levels for each age as the starting point for expected mortality calculations and adjust as necessary to trend forward to the appropriate projection period. Total excess mortality estimates were requested with and without COVID-19 as a cause of death for each age and time period combination. The participants also provided thoughts on factors influencing their excess mortality estimates and opinions on data resources.

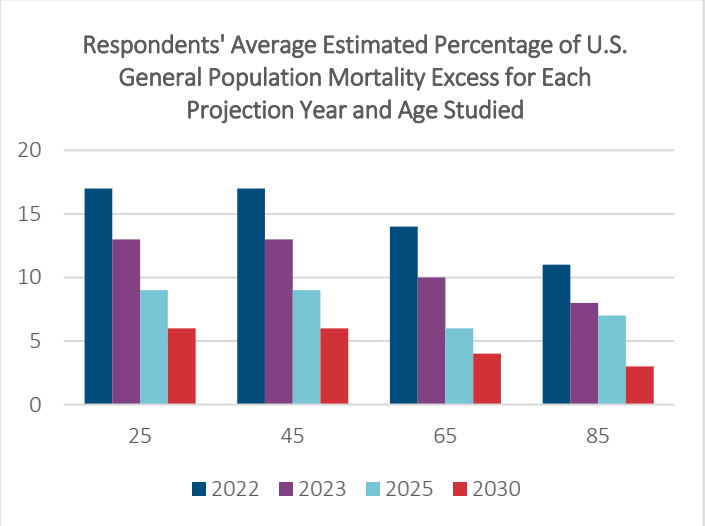
While the survey provides an update for many of the initial survey's findings, a section was added to collect information from the experts on the endemic nature of the pandemic, asking about the expected time period for mortality and morbidity from COVID-19 to become permanently stable in the population as well as how COVID-19 will interact with influenza in the future.

Thirty-nine individuals participated in the survey. Most of the responses focused on the U.S. general population. Results were aggregated and analyzed. Participants had diverse opinions on how COVID-19 will impact future mortality. Unless otherwise noted, the analysis and comments presented in the paper are based on the average excess mortality estimates of the respondents and the most predominant responses selected by the participants. Based on this approach, observations for U.S. general population future mortality are as follows:

[1] The MLPSC initial survey (*https://www.soa.org/resources/research-reports/2022/covid-19-short-term-impact-us-mort/*) was released in August 2022 and captured views from mortality experts during March 2022.

1. **Excess mortality is expected to occur for all years studied with amounts varying by year and age.**

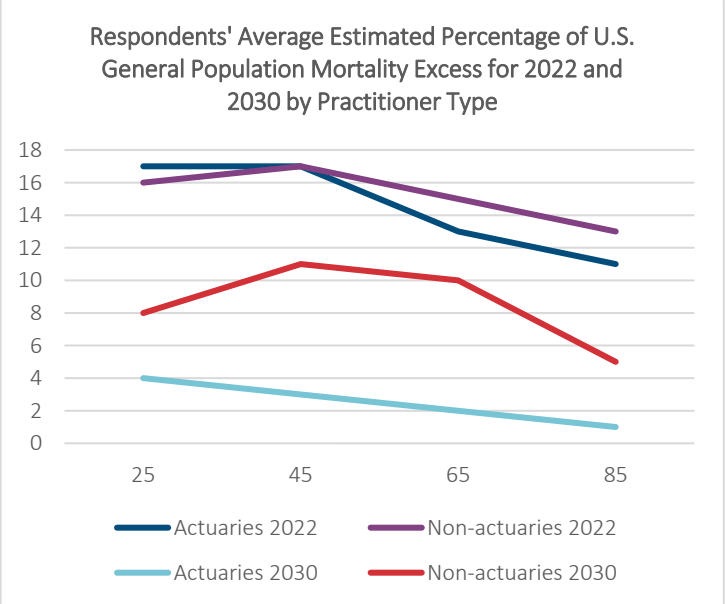
Although the largest mortality excess numbers for the U.S. general population are foreseen for 2022, excess mortality is expected to decline in years 2023 and 2025, and by 2030, excess mortality numbers are nearing expected levels. For 2030, mortality is projected to be 3–6% higher than would have previously been expected by respondents for all ages. Younger ages are at the high end of the range. In the prior survey the range was –1% to 2%.



Based on the average of the participants, generally, the mortality excess percentage is anticipated to be highest at younger ages. For example, for 2022, projected mortality is anticipated to be 17% (14% in the prior survey) higher compared to expected levels for age 25, 17% (13% previously) higher for age 45, 14% (10%) higher for age 65 and 11% (10%) higher for age 85.

2. **Actuaries and non-actuaries have differing views on excess mortality.**

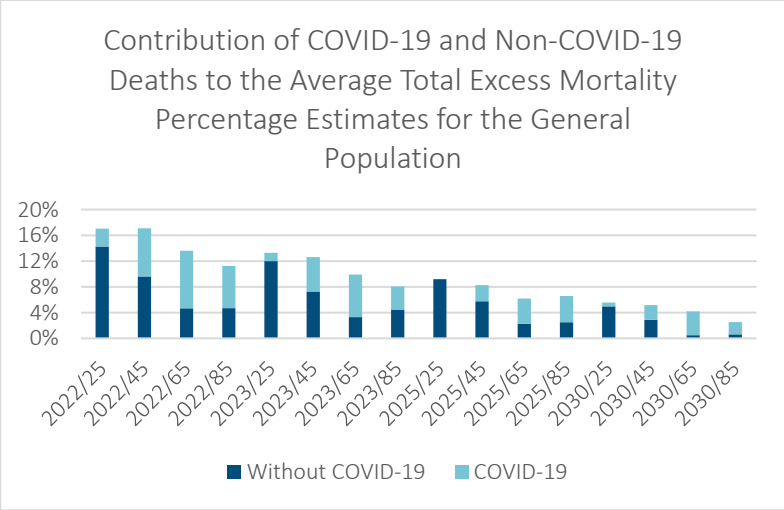
Approximately 70% of the respondents were actuaries and 30% were non-actuaries. In comparing the aggregate responses for actuaries to those of non-actuaries, the average of the excess mortality percentages estimated by actuaries are expected to be lower than the average of those estimated by non-actuaries. Generally, a widening of the gap between the two groups is also seen as the projection year increases. For 2022, average excess mortality estimates are foreseen to be similar. For example, the average actuarial projected excess mortality level for age 25 in 2022 is 17% compared to 16% by non-actuaries, but at older ages the actuaries' estimates are lower. By 2030, the higher excess mortality estimated by non-actuaries for all ages is 5–11%.



Differing views can partially be explained by looking at what is driving the estimates. For 2022, actuaries anticipate higher immunity due to vaccination, infection/reinfection, increased access to current or future new COVID-19 medical treatments and higher virulence of current or future COVID-19 strains. Non-actuaries also identified higher immunity due to vaccination, infection/reinfection and increased access to current or future new COVID-19 medical treatments, but they also expected a less healthy population than pre-pandemic due to long COVID and indirect COVID-19 impacts. For the 2030 actuarial estimates, the top two drivers are the same as those for 2022. Actuaries also think that by 2030 there will be a switch from higher to lower virulence of current or future COVID-19 strains. However, non-

actuaries maintain their top three drivers of increased access to COVID-19 medical treatments, worse mortality from long COVID and higher immunity.

3. **Non-COVID-19 causes of death contribute more to total excess mortality than COVID-19 for younger ages. For older ages, COVID-19 is driving excess mortality.**



Examining the differences in respondents' estimates of excess mortality with and without COVID-19 as a cause of death provides insights into how much of the total excess is directly attributable to COVID-19 as a cause of death. For age 25, non-COVID-19 causes are expected to contribute most of the excess deaths. However, COVID-19 has a larger impact on total projected excess deaths at 65 and 85 in most years. For example, in 2022, for age 25 the average total estimated percentage of excess mortality with COVID-19 is 17%, of which respondents estimate only 3% of the excess is due to COVID-19 deaths. At age 85, the average total excess mortality percentage is 11%, with the majority of this (6%) due to COVID-19 deaths. By 2030 most of the excess for age 25 is still coming from non-COVID-19 causes, but for the other ages studied, COVID-19 is driving the mortality excess.

4. **Respondents expect general population mortality deterioration in all years due to drug overdoses and cardiovascular disorders, offset somewhat by improvement in cancer mortality.**

   These three mortality change drivers are consistent for all years, but the order varies, with drug overdoses ranked first in 2022 and third by 2030. Cardiovascular disorders mortality deterioration is expected to outpace cancer mortality improvement in all years.

5. **Average excess mortality percentages for the U.S. general population are expected to be higher than for the insured, annuitant and pension plan populations.**

6. **Post-pandemic, mortality from influenza in a normal flu season is expected to be similar to that of a pre-pandemic flu season or slightly lower.**

   As of March 2023, most respondents believe the pandemic is either in the ending stage (50%) or is already endemic in the U.S. (47%). All respondents do expect COVID-19 to become endemic at some point.

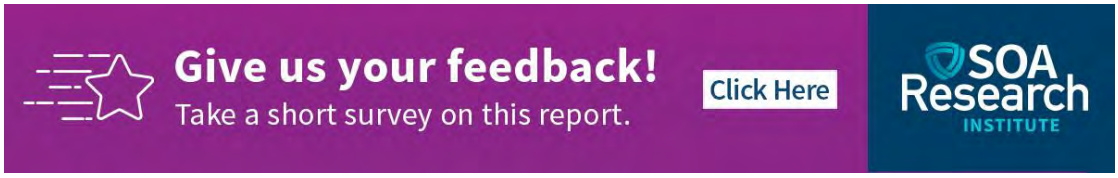
   Survey participants also provided thoughts on what mortality might look like post-pandemic. For COVID-19 mortality, 42% responded that they think it will be similar to pre-pandemic influenza mortality levels during a normal flu season. For influenza, 22% believe mortality levels will be at similar levels to a normal flu season pre-pandemic, but 39% think mortality from influenza will be 5–25% lower than normal pre-pandemic levels.

7. **The results from the current survey place greater emphasis on non-COVID-19 excess deaths rather than direct COVID-19 excess deaths.**

8. **Results are similar to those of the prior survey for repeat questions.** The first survey was collected from March 11 to March 31, 2022, and the current survey opened nearly a year later on January 24 and closed on March 24, 2023, to allow those with annual reporting responsibilities to participate. While the total number of respondents fell from 59 to 39, 92% participated in both surveys.

   Although the relationships and trends seen in the results of this survey are similar to the results from the 2022 survey, total excess mortality estimates are higher than in the prior survey, with a larger emphasis on non-COVID-19 impacts.

   Many of these are due to an expected increase in excess deaths due to drug overdoses, and this is reflected in the current survey's results. Respondents expect this result to fade over time and become less prominent after 2023.



Section 1: Introduction

To help actuaries and others model future mortality and mortality improvement, the Society of Actuaries Research Institute's Mortality and Longevity Strategic Research Program Steering Committee (MLPSC) assembled a panel of experts to document and gather opinions and insights into the possible future course of the pandemic, its impact on future mortality and how their views might change over time. Potential panelists were identified through recommendations from MLPSC members, actuarial volunteers overseeing this project (Project Oversight Group [POG]), SOA staff and an open call for panel members. After a vetting process, individuals were invited to participate. Approximately 40 prospects of varying backgrounds accepted the opportunity for the second project in this series, resulting in a panel that was almost 70% actuaries and 30% non-actuaries.

MLPSC defined the second activity of the expert panel, a follow-up survey that updates expectations for U.S. excess mortality of insured, annuitant, pension and general populations over the short term (less than 10 years) and delegated the execution of the study to the POG and SOA Research Institute staff.

The structure of this paper is the same as that used in the August 2022 Survey 1 report to allow for easier comparison between the two studies. When the same question appears in both surveys, the data from survey 1 are also included in this report. A refreshed questionnaire, found in Appendix A, was developed and included three sections:

1. Demographics captured the characteristics of the respondents, including practitioner and employer type, number of years of experience and area of expertise among the four U.S. mortality populations studied—U.S. general population, U.S. life insurance industry, U.S. annuity industry and U.S. private and public pension plans.

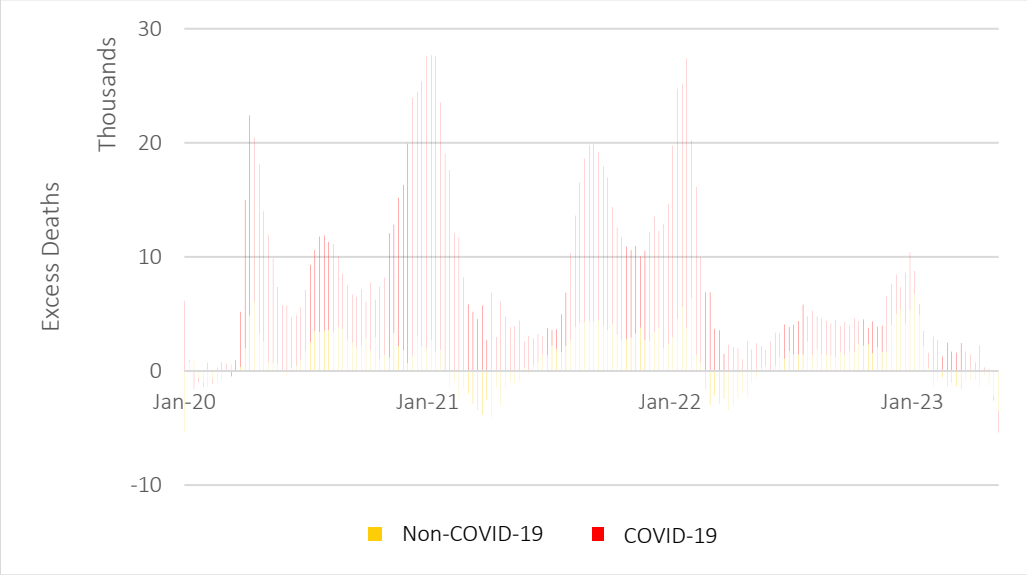
2. Future changes in U.S. all-cause mortality generated estimates for all-cause excess mortality with and without COVID-19 as a cause of death for each population for 2022, 2023, 2025 and 2030. Four ages were also studied for each year: 25, 45, 65 and 85. In addition to the estimates, respondents provided thoughts on factors and mortality changes that influenced their estimates from year to year.

   This section included views on changes in all-cause mortality and future mortality for seven (improvement and deterioration) individual causes of death; cardiovascular disorders, cancer, Alzheimer's and other dementias, flu/pneumonia, drug overdoses and accidents excluding drug overdoses.

3. The state of COVID-19 and whether it has/would become endemic, as well as possible futures relative to influenza results, comprised the final section.

The online survey was open to the panelists from January 24, 2023, to March 24, 2023, nearly a year after the first survey was completed. Deaths started to fall before the first survey closed, after peaking at more than 17,000 deaths in a single week (Figure 1).

Figure 1
WEEKLY TRENDS IN NUMBER OF EXCESS DEATHS IN THE U.S.



Source: CDC NCHS Excess Deaths Associated with COVID-19 as of June 1, 2023 (https://www.cdc.gov/nchs/nvss/vsrr/covid19/excess_deaths.htm#dashboard).

Some analysis has been done comparing this survey with one done previously. Most, but not all, of the respondents overlap between the surveys. This could bias the results as we are not getting a broader perspective beyond these individuals.

Section 2: Results

Access to the individual responses was limited to the research team that was responsible for aggregating and analyzing them, with the POG providing guidance and peer review. Participants had diverse opinions on how COVID-19 will impact future mortality. Unless otherwise noted, the analysis and comments presented in this paper are based on the average excess mortality estimates of the respondents and the most predominant responses selected by the participants. This section summarizes the expert panel views from the survey.

2.1 DEMOGRAPHICS OF EXPERT PANEL SURVEY PARTICIPANTS

Although the entire mortality expert panel was invited to participate, roughly 40% (39 individuals) submitted responses. Of those who responded, 69% were actuaries and 31% were other practitioner types, with academics/demographers being the most prevalent type represented in the latter category. The remaining five individuals were professionals in medicine, epidemiology, underwriting and data science.

Respondents were generally employed by consulting firms, insurers and reinsurers. However, 38% of the total worked for academic/research institutions, government agencies, banks/investment management/financial services companies, pension plans or international organizations, or they classified themselves as being self-employed or retired.

Given that respondents were experts in their respective fields, a high level of experience was expected. Here 100% of the respondents had 10 or more years of experience, with the majority (64%) specifying 25 or more years of experience.

Most of the survey focused on the impact of COVID-19 on future U.S. general population mortality. Yet participants were asked to provide estimates of COVID-19's impact on future excess mortality over the period 2022–2030 based on their indicated area of skills. Table 1 provides the respondents' expertise breakdown, with the majority reporting to have knowledge of U.S. mortality for the life insurance industry insured and/or general populations. Even though 54% of the respondents designated themselves as experts with the U.S. life insurance industry, not all provided estimates.

In developing the questions, the POG felt the majority of the expert panel members would have a good understanding of U.S. general population mortality. Therefore, all survey participants had the opportunity to weigh in and provide opinions about future U.S. general population mortality.

Table 1
SURVEY RESPONDENTS' AREA OF EXPERTISE (*N* = 39)

Area of Expertise	No. Responding*	Percentage of Respondents* (%)	Percentage of Respondents* (%) in Previous Survey	No. of Excess Mortality Estimates Submitted
U.S. general population mortality	32	82	66	39
U.S. life insurance industry insured population mortality	18	46	54	14
U.S. annuity industry annuitant population mortality	8	21	10	7
U.S. private and public pension plan population mortality	9	23	25	7
None of the above	0	0	2	0

*Respondents were asked to select all that apply. Therefore, some respondents provided more than one area of expertise.

2.2 CHANGES IN FUTURE EXCESS MORTALITY ESTIMATES

Once the skills of the participants were determined, they were asked to provide their opinions on future all-cause excess mortality with and without COVID-19 as a cause of death for each combination of ages 25, 45, 65 and 85 and years 2022, 2023, 2025 and 2030. The survey explained that excess mortality with COVID-19 was determined by examining projected mortality, including deaths that are directly or indirectly attributed to COVID-19 for a specific period, over pre-pandemic expectations for that period.

Non-COVID-19 excess mortality had the same definition as excess mortality with COVID-19 except that projected mortality did not include COVID-19 as a cause of death.

The participants were given historical mortality information for the U.S. general and life insurance insured populations along with simple examples for calculating excess mortality. This information is found in Appendix A.

2.2.1 EXCESS MORTALITY ESTIMATES WITH AND WITHOUT COVID-19

In examining the average of the excess all-cause mortality estimates submitted (Tables 2a and 2b), the average excess mortality estimated values were highest for the U.S. general population. They also vary by age for each population, with the highest average excess mortality value occurring at age 25. The average excess mortality value generally drops with each subsequent age following the same pattern as the historical excess mortality examples given in the survey.

In looking at the year-by-year estimates, the estimated values with COVID-19 relative to expected values declined each year so that by 2030 the projected mortality was nearing the expected mortality levels for all populations. This was especially true for the life, annuity and pension plan populations. For the annuity population, the average

excess mortality estimates without COVID-19 as a cause of death were higher than the pension plan population initially, but by 2023 the two lines were similar.

The excess mortality wearing-off pattern over time for the U.S. general population was different from the insured, annuitant and pension populations. The average of the excess mortality estimates still showed mortality deterioration in 2030.

Comparing the average excess mortality estimates with COVID-19 (Table 2a) to the non-COVID-19 average excess mortality estimates (Table 2b), the excess mortality percentages with COVID-19 are generally higher. By subtracting the two, participants' insights into how much of the total average excess mortality estimates is due to COVID-19 were obtained. Generally, at ages 25 and 45, non-COVID-19 causes contribute the most to total excess mortality estimates, but for ages 65 and 85, COVID-19 has a larger impact. The tables show results from the current and prior surveys, with the more recent results shown first.

Comparing the results of the two surveys, first for estimates of excess mortality with COVID-19 and the general population, at ages 25 and 45 the new survey is 3–4% higher in all years. For age 65 there is little change, and for age 85 the differences are generally smaller.

Comparing surveys for the general population without COVID-19 as a cause of death gives results that are very similar, although the differences grade off by 2030.

For life insurance insureds with COVID-19, the results are similar in 2022 but increase by several percentage points for survey 2 in later years. Annuities and pension plans are higher in all years, but more so in 2022 and 2023.

Results for the life insureds without COVID-19 as a cause of death are higher in the current survey in all years as well as for annuity and pension plans except for 2022.

Table 2a

AVERAGE ALL-CAUSE EXCESS MORTALITY ESTIMATES WITH COVID-19 BY POPULATION AND AGE (SURVEY 2/SURVEY 1)

U.S. Population (No. of Responses)	Current Age	2022 (%)	2023 (%)	2025 (%)	2030 (%)
Total Respondents					
General (*N* = 39/56)	25	17/14	13/9	9/6	6/2
	45	17/13	13/9	9/5	6/2
	65	14/10	10/7	6/5	4/2
	85	11/9	8/6	7/3	3/1
Life Insurance Industry Insured (*N* = 14/29)	25	10/10	7/5	5/2	3/–1
	45	11/10	8/5	6/2	4/–1
	65	10/9	7/5	5/1	3/–1
	85	7/7	5/3	3/1	2/–1
Annuity Industry Annuitant (*N* = 7/6)	25	13/5	8/3	6/0	3/–1
	45	10/5	7/2	4/0	2/–2
	65	9/5	6/1	4/–1	2/–3
	85	7/6	5/1	3/–1	1/–3
Private and Public Pension Plan (*N* =7/15)	25	12/8	11/5	6/2	1/–1
	45	12/7	11/5	6/2	2/–1
	65	11/6	8/4	4/1	1/–3
	85	6/6	5/4	3/0	1/–3

Table 2b

AVERAGE ALL-CAUSE EXCESS MORTALITY ESTIMATES WITHOUT COVID-19 AS A CAUSE OF DEATH BY POPULATION AND AGE (SURVEY 2/SURVEY 1)

U.S. Population (Number of Responses)	Current Age	2022 (%)	2023 (%)	2025 (%)	2030 (%)
Total Respondents					
General (*N* = 34/55)	25	14/10	12/8	9/5	5/3
	45	10/7	7/6	6/3	3/1
	65	5/4	3/3	2/1	1/–1
	85	5/2	4/1	3/0	1/–2
Life Insurance Industry Insured (*N* = 14/6)	25	8/8	6/5	4/2	3/0
	45	7/5	6/3	4/1	2/–1
	65	5/3	3/2	2/1	0/–1
	85	4/2	3/1	2/0	0/–1
Annuity Industry Annuitant (*N* = 7/14)	25	10/3	6/1	4/–1	3/–3
	45	7/3	4/1	2/–2	1/–4
	65	5/1	2/–1	0/–3	–1/–5
	85	4/1	2/–1	0/–3	–1/–6
Private and Public Pension Plan (*N* =7/14)	25	7/5	6/3	4/2	1/–1
	45	5/5	4/3	2/1	1/–2
	65	2/2	1/1	0/–1	–0/–4
	85	1/2	1/1	0/–2	–1/–4

2.2.2 DRIVERS AND FACTORS FOR THE EXCESS MORTALITY ESTIMATES

The survey participants were also asked about the top three drivers for their excess mortality estimates with COVID-19 from the lists shown in Tables 3a and 3b. A score was assigned to each response. A driver with a response of rank 1 received a score of 3; a driver with a response of rank 2 received a score of 2; and a driver with a response of rank 3 received a score of 1. Comparing the total scores for each driver, we were able to identify the top drivers among all the respondents for each area of expertise, which are the bold numbers in the tables. The number of responses is much lower for the annuity and pension plan parts of the survey and so are generally not split out. More details can be found in Appendix A.

Higher immunity due to vaccination, infection/reinfection, increased access to current or future new COVID-19 medical treatments, and a less healthy population than pre-pandemic due to long COVID and indirect COVID-19 impacts are among the top drivers for the general population estimates for 2022. For the life insurance industry insured population, the top drivers were generally the same as those for the general population but included lower virulence of current or future COVID-19 strains/variants instead of a less healthy population than pre-pandemic due to long COVID and indirect COVID-19 impacts. Annuity results were similar to those for the general population. Higher virulence of current or future COVID-19 strains/variants was a top driver for estimates for pension plans.

Comparing the two surveys for these drivers and the general population reflects knowledge gained since the first survey was completed. In 2022 the drivers focused on expected lower virulence, vaccinations and treatments. In 2023 lower virulence moved out to 2030 before joining the top three overall, replaced by higher immunity due to vaccination and infection/reinfection. The pension plan respondents were also concerned about higher virulence of future variants.

Table 3a

DRIVER SCORES FOR ALL-CAUSE EXCESS MORTALITY ESTIMATES WITH COVID-19 BY YEAR (SURVEY 2)

Driver	2022	2023	2025	2030
General Population				
Higher immunity due to vaccination, infection/reinfection	**53**	**61**	**49**	**49**
Increased access to current or future new COVID-19 medical treatments	**38**	**39**	**41**	**42**
Less healthy population than pre-pandemic due to long COVID and indirect COVID-19 impacts	19	**34**	**29**	24
Lower virulence of current or future COVID-19 strains/variants	17	24	27	**28**
Higher virulence of current or future COVID-19 strains/variants	**24**	17	16	16
Lower immunity due to vaccination, infection/reinfection	11	8	11	10
Healthier population than pre-pandemic as older, less healthy individuals die from COVID-19	11	4	9	15
Increased deferral of health care and treatment due to COVID-19	15	9	4	5
Decreased use of social distancing and isolation	6	5	5	5
Decreased deferral of health care and treatment due to COVID-19	3	4	5	7
Decreased use of masks	6	7	1	1
Increased use of masks	8	1	1	0
Increased use of social distancing and isolation	0	0	1	1
Decreased access to current or future new COVID-19 medical treatments	0	0	0	0
Life Insurance Industry Insured Population				
Higher immunity due to vaccination, infection/reinfection	**24**	**26**	**27**	**25**
Increased access to current or future new COVID-19 medical treatments	**11**	**13**	**14**	**18**
Less healthy population than pre-pandemic due to long COVID and indirect COVID-19 impacts	7	6	8	7
Lower virulence of current or future COVID-19 strains/variants	**10**	**11**	**12**	**13**
Higher virulence of current or future COVID-19 strains/variants	6	6	6	6
Lower immunity due to vaccination, infection/reinfection	5	3	3	3
Healthier population than pre-pandemic as older, less healthy individuals die from COVID-19	6	4	4	4
Increased deferral of health care and treatment due to COVID-19	8	6	0	0
Decreased use of social distancing and isolation	4	4	4	4
Decreased deferral of health care and treatment due to COVID-19	0	2	6	4
Decreased use of masks	0	0	0	0
Increased use of masks	0	0	0	0
Increased use of social distancing and isolation	0	0	0	0
Decreased access to current or future new COVID-19 medical treatments	0	0	0	0
Annuity Industry Annuitant Population				
Higher immunity due to vaccination, infection/reinfection	**14**	**15**	**15**	**14**

Increased access to current or future new COVID-19 medical treatments	7	8	8	8
Less healthy population than pre-pandemic due to long COVID and indirect COVID-19 impacts	5	6	6	5
Lower virulence of current or future COVID-19 strains/variants	1	2	2	4
Higher virulence of current or future COVID-19 strains/variants	5	5	5	5
Lower immunity due to vaccination, infection/reinfection	2	3	3	3
Healthier population than pre-pandemic as older, less healthy individuals die from COVID-19	1	1	1	1
Increased deferral of health care and treatment due to COVID-19	6	1	0	0
Decreased use of social distancing and isolation	4	4	4	4
Decreased deferral of health care and treatment due to COVID-19	0	0	1	1
Decreased use of masks	0	0	0	0
Increased use of masks	0	0	0	0
Increased use of social distancing and isolation	0	0	0	0
Decreased access to current or future new COVID-19 medical treatments	0	0	0	0
Private and Public Pension Plan Population				
Higher immunity due to vaccination, infection/reinfection	9	9	7	8
Increased access to current or future new COVID-19 medical treatments	9	8	7	7
Less healthy population than pre-pandemic due to long COVID and indirect COVID-19 impacts	2	3	3	3
Lower virulence of current or future COVID-19 strains/variants	1	0	6	6
Higher virulence of current or future COVID-19 strains/variants	9	9	9	9
Lower immunity due to vaccination, infection/reinfection	4	4	4	4
Healthier population than pre-pandemic as older, less healthy individuals die from COVID-19	1	2	2	2
Increased deferral of health care and treatment due to COVID-19	3	2	0	0
Decreased use of social distancing and isolation	0	0	0	0
Decreased deferral of health care and treatment due to COVID-19	0	0	0	0
Decreased use of masks	0	3	0	0
Increased use of masks	3	0	0	0
Increased use of social distancing and isolation	1	1	1	1
Decreased access to current or future new COVID-19 medical treatments	0	0	0	0

Table 3b

DRIVER SCORES FOR ALL-CAUSE EXCESS MORTALITY ESTIMATES WITH COVID-19 BY YEAR (SURVEY 1)

Driver	2022	2023	2025	2030
General Population				
Lower virulence of current or future COVID-19 strains	**56**	**61**	**60**	**78**
Change in vaccination/booster rate	**54**	**42**	32	28
New COVID-19 treatments	**54**	**66**	**84**	**81**
Higher virulence of current or future COVID-19 strains	52	38	22	16
Public deferral of health care treatment due to COVID-19	28	31	21	11
Worse mortality from long COVID	23	31	**37**	26
Better mortality as less healthy individuals die from COVID-19	21	20	23	**29**
Change in public behavior for masking	10	10	3	5
Life Insurance Industry Insured Population				
Lower virulence of current or future COVID-19 strains	**28**	**25**	**25**	**27**
Public deferral of health care treatment due to COVID-19	**28**	16	13	7
New COVID-19 treatments	**26**	**41**	**42**	**45**
Higher virulence of current or future COVID-19 strains	23	14	9	6
Change in vaccination/booster rate	21	18	14	14
Worse mortality from long COVID	18	**28**	**24**	12
Better mortality as less healthy individuals die from COVID-19	6	10	18	**19**
Change in public behavior for masking	4	3	2	7
Annuity Industry Annuitant Population				
Lower virulence of current or future COVID-19 strains	**11**	**5**	**7**	3
New COVID-19 treatments	**7**	**8**	**11**	**8**
Change in vaccination/booster rate	**7**	**6**	3	**7**
Public deferral of health care treatment due to COVID-19	4	**5**	2	0
Worse mortality from long COVID	3	4	5	2
Change in public behavior for masking	2	2	0	0
Better mortality as less healthy individuals die from COVID-19	1	2	**7**	**9**
Higher virulence of current or future COVID-19 strains	0	0	0	2
Private and Public Pension Plan Population				
Change in vaccination/booster rate	**20**	**19**	**13**	11
Lower virulence of current or future COVID-19 strains	**12**	**11**	**13**	**13**
Better mortality as less healthy individuals die from COVID-19	**12**	**13**	**13**	**16**
Higher virulence of current or future COVID-19 strains	9	10	5	6
Public deferral of health care treatment due to COVID-19	6	6	2	0
New COVID-19 treatments	5	5	**15**	***17***
Worse mortality from long COVID	5	5	1	2
Change in public behavior for masking	2	2	2	2

For the non-COVID-19 excess mortality estimates, participants were asked to provide their top three influential mortality changes impacting their estimates. The mortality changes shown were both improvement and deterioration for cardiovascular disorders, cancer, Alzheimer's and other dementias, accidents excluding drug overdoses, drug overdoses, and flu/pneumonia. They could also respond with other mortality changes. Similar to the driver scores in Tables 3a and 3b, a mortality change with a response of rank 1 received a score of 3; a mortality change with a response of rank 2 received a score of 2; and a mortality change with a response of rank 3 received a score of 1. Comparing the total scores for each mortality change, we were able to identify the top three mortality changes for each population and projection year, which are shown in Tables 4a and 4b. Although we asked about mortality changes for six different causes of death, the top three mortality changes for all populations are expected to be from cardiovascular disorders, cancer and drug overdoses.

For the U.S. general population, the top three changes that the experts indicated drove their responses for 2022 were a deterioration in drug overdoses, a deterioration in cardiovascular disorders and an improvement in cancer mortality. For later years cardiovascular deterioration maintained its edge over cancer improvements, while drug overdose deterioration fell from first to third.

For the life insurance industry insured population, cardiovascular disorders mortality deterioration is expected to be the top mortality change influencing 2022 estimates, followed by Alzheimer's and other dementias deterioration, drug overdoses deterioration and cancer deterioration. For 2025 and 2030 cancer improvement replaces drug overdoses deterioration, but otherwise the top three are similar. The annuity industry annuitant population had similar results to the life insurance industry.

Table 4a

RESPONDENTS' TOP THREE MORTALITY CHANGES DRIVING ALL-CAUSE EXCESS MORTALITY ESTIMATES WITHOUT COVID-19 AS A CAUSE OF DEATH BY YEAR (SURVEY 2)

Change in Mortality	2022 Top 3	2023 Top 3	2025 Top 3	2030 Top 3
General Population				
Cardiovascular Disorders Mortality Deterioration	2	1	1	1
Cancer Mortality Improvement	**3**	3	3	2
Drug Overdoses Mortality Deterioration	1	2	2	3
Life Insurance Industry Insured Population				
Cardiovascular Disorders Mortality Deterioration	1	1	1	2
Cancer Mortality Improvement			2	1
Cancer Mortality Deterioration	3		**3**	
Alzheimer's and Other Dementias Mortality Deterioration	2	3		**3**
Drug Overdoses Mortality Deterioration	3	2		
Annuity Industry Annuitant Population				
Cardiovascular Disorders Mortality Deterioration	1	1	**1**	**1**
Cancer Mortality Improvement	2	2	**2**	**1**
Drug Overdoses Mortality Deterioration	3	3	**3**	**3**
Private and Public Pension Plan Population				
Cardiovascular Disorders Mortality Deterioration	1	1	1	1
Accidents Excluding Drug Overdoses Mortality Deterioration	3	3	3	3
Drug Overdoses Mortality Deterioration	2	2	2	2

Table 4b

RESPONDENTS' TOP THREE MORTALITY CHANGES DRIVING ALL-CAUSE EXCESS MORTALITY ESTIMATES WITHOUT COVID-19 AS A CAUSE OF DEATH BY YEAR (SURVEY 1)

Change in Mortality	2022 Top 3	2023 Top 3	2025 Top 3	2030 Top 3
General Population				
Cardiovascular Disorders Mortality Improvement			3	2
Cardiovascular Disorders Mortality Deterioration	2	2		
Cancer Mortality Improvement		3	1	1
Cancer Mortality Deterioration	3			
Drug Overdoses Mortality Deterioration	1	1	2	3
Life Insurance Industry Insured Population				
Cardiovascular Disorders Mortality Improvement	3	3	2	2
Cardiovascular Disorders Mortality Deterioration	1	2	3	3
Cancer Mortality Improvement		3	1	1
Cancer Mortality Deterioration	2	1		
Annuity Industry Annuitant Population				
Cardiovascular Disorders Mortality Improvement	3	1	2	2
Cardiovascular Disorders Mortality Deterioration	2			
Cancer Mortality Improvement		1	1	1
Cancer Mortality Deterioration	1	1	3	
Alzheimer's and Other Dementias Mortality Deterioration			3	3
Drug Overdoses Mortality Deterioration	3			
Private and Public Pension Plan Population				
Cardiovascular Disorders Mortality Improvement	3	2	2	
Cardiovascular Disorders Mortality Deterioration				3
Cancer Mortality Improvement	2	1	1	
Drug Overdoses Mortality Improvement		3	3	1
Drug Overdoses Mortality Deterioration	1			
Flu/Pneumonia Mortality Improvement				2

2.2.3 ACTUARIAL EXCESS MORTALITY ESTIMATES COMPARED TO NONACTUARIES' ESTIMATES

Only one non-actuary provided future excess mortality estimates for the annuity industry, and none responded for private and public pension plan populations. However, both actuaries and other practitioner types provided future excess mortality estimates for the general population and life insurance industry insured populations. Table 5 shows, for the current and prior surveys, the average future excess mortality estimates with COVID-19 by practitioner type. Other practitioner types' excess mortality estimates are higher than those of actuaries, especially for years 2023, 2025 and 2030. The participating non-actuaries believed there would be excess mortality in 2022, ranging from 13% to 17% (12–15% previously), higher than the previous survey. For 2025 and 2030 the ranges were 10–13% (7–13% previously) and 5–11% (6–11% previously), respectively. On the other hand, the participating actuaries' average excess mortality estimates are expected to range from 11% to 17% (9–13% previously) for 2022, from 4% to 8% (2–5% previously) for 2025, and from 1% to 4% (–1% to 1% previously) for 2030. The results for both actuaries and non-actuaries are higher in the current survey than previously.

For the life insurance industry insured population, the actuarial average excess mortality estimates are generally lower than those for other practitioner types, especially in 2030. For 2022, the average excess mortality estimates

are very similar between the two practitioner groups. Relative to non-actuaries, actuaries responded with lower excess mortality estimates for the reasons shared in Tables 6a and 6b.

Table 5

AVERAGE ALL-CAUSE EXCESS MORTALITY ESTIMATES WITH COVID-19 SPLIT BY PRACTITIONER TYPE FOR GENERAL AND LIFE INSURANCE INDUSTRY INSURED POPULATIONS (SURVEY 2/SURVEY 1)

U.S. Population (No. of Responses)	Current Age	2022 (%)	2023 (%)	2025 (%)	2030 (%)
Total Respondents					
General (*N* = 39/56)	25	17/14	13/9	9/6	6/2
	45	17/13	13/9	9/5	6/2
	65	14/10	10/7	6/5	4/2
	85	11/10	8/4	7/2	3/0
Life Insurance Industry Insured (*N* = 14/29)	25	10/10	7/5	5/2	3/–1
	45	11/10	8/5	6/2	4/–1
	65	10/9	7/5	5/1	3/–1
	85	7/7	5/3	3/1	2/–1
Actuaries Only					
General (*N* = 27/45)	25	17/13	13/9	8/5	4/1
	45	17/13	12/8	6/4	3/1
	65	13/10	9/5	4/3	2/0
	85	11/9	7/5	4/2	1/–1
Life Insurance Industry Insured (*N* = 9/24)	25	10/11	7/5	4/2	2/–1
	45	11/10	7/5	4/2	2/–1
	65	10/9	6/4	4/1	2/–2
	85	7/7	5/2	3/0	1/–2
Other Practitioner Types Only					
General (*N* = 12/11)	25	16/15	15/13	11/9	8/6
	45	17/15	15/14	12/9	11/7
	65	15/12	13/15	10/13	10/11
	85	13/12	11/10	13/7	5/6
Life Insurance Industry Insured (*N* = 5/5)	25	10/8	8/5	7/4	5/3
	45	12/8	11/6	9/5	6/3
	65	9/7	9/5	7/2	5/3
	85	7/7	7/4	5/2	4/3

Annuitant and pension plan populations are excluded because only actuaries responded to these questions in the first survey, and only one non-actuary responded in the second survey.

The differences in perspectives between these two groups are highlighted when looking at the top three drivers for the excess mortality estimates (Tables 6a and 6b). For the general population, the top two drivers for the actuarial estimates for all years are higher immunity due to vaccination, infection/reinfection and increased access to current or future new COVID-19 medical treatments. In the first two years, third place is held by higher virulence of current or future COVID-19 strains, and this is replaced in 2025 and 2030 by its opposite, lower virulence of current or future COVID-19 strains.

However, for the other practitioner types and general population estimates of excess deaths, we see slightly different risks than those for the actuarial estimates. Higher immunity and access to new medical treatments remain the top two, but less healthy population than pre-pandemic due to long COVID and indirect COVID-19 impacts replaces the virulence choices.

Table 6a

DRIVER SCORES FOR ALL-CAUSE EXCESS MORTALITY ESTIMATES WITH COVID-19 BY YEAR (SURVEY 2)

Driver	2022	2023	2025	2030
Actuaries				
General Population				
Higher immunity due to vaccination, infection/reinfection	**37**	**42**	**33**	**34**
Increased access to current or future new COVID-19 medical treatments	**28**	**27**	**32**	**30**
Higher virulence of current or future COVID-19 strains	**23**	17	16	16
Lower virulence of current or future COVID-19 strains	11	**18**	**20**	**21**
Less healthy population than pre-pandemic due to long COVID and indirect COVID-19 impacts	6	15	15	12
Increased deferral of health care and treatment due to COVID-19	11	6	4	5
Healthier population than pre-pandemic as older, less healthy individuals die from COVID-19	11	4	4	7
Lower immunity due to vaccination, infection/reinfection	7	5	7	7
Decreased use of social distancing	5	4	4	4
Decreased deferral of health care and treatment due to COVID-19	3	4	3	3
Decreased use of masks	3	4	1	1
Increased use of masks	5	1	1	0
Increased use of social distancing	0	0	1	1
Decreased access to current or future new COVID-19 medical treatments	0	0	0	0
Life Insurance Industry Insured Population				
Higher immunity due to vaccination, infection/reinfection	**18**	**19**	**19**	**17**
Increased access to current or future new COVID-19 medical treatments	**8**	**8**	**12**	**13**
Higher virulence of current or future COVID-19 strains	6	6	5	5
Lower virulence of current or future COVID-19 strains	**8**	**9**	**10**	**11**
Less healthy population than pre-pandemic due to long COVID and indirect COVID-19 impacts	2	2	2	2
Increased deferral of health care and treatment due to COVID-19	3	4	0	0
Healthier population than pre-pandemic as older, less healthy individuals die from COVID-19	5	2	0	0
Lower immunity due to vaccination, infection/reinfection	1	1	1	1
Decreased use of social distancing	3	3	3	3
Decreased deferral of health care and treatment due to COVID-19	0	0	2	2
Decreased use of masks	0	0	0	0
Increased use of masks	0	0	0	0
Increased use of social distancing	0	0	0	0
Decreased access to current or future new COVID-19 medical treatments	0	0	0	0
Other Practitioner Types				
General Population				
Higher immunity due to vaccination, infection/reinfection	**16**	**19**	**16**	**15**

Increased access to current or future new COVID-19 medical treatments	10	12	9	12
Higher virulence of current or future COVID-19 strains	1	0	0	0
Lower virulence of current or future COVID-19 strains	6	6	7	7
Less healthy population than pre-pandemic due to long COVID and indirect COVID-19 impacts	13	19	14	12
Increased deferral of health care and treatment due to COVID-19	0	0	2	4
Healthier population than pre-pandemic as older, less healthy individuals die from COVID-19	0	0	5	8
Lower immunity due to vaccination, infection/reinfection	4	3	4	3
Decreased use of social distancing	1	1	1	1
Decreased deferral of health care and treatment due to COVID-19				
Decreased use of masks	3	3	0	0
Increased use of masks	3	0	0	0
Increased use of social distancing	0	0	0	0
Decreased access to current or future new COVID-19 medical treatments	0	0	0	0
Life Insurance Industry Insured Population				
Higher immunity due to vaccination, infection/reinfection	6	7	8	8
Increased access to current or future new COVID-19 medical treatments	3	5	2	5
Higher virulence of current or future COVID-19 strains	0	0	1	1
Lower virulence of current or future COVID-19 strains	2	2	2	2
Less healthy population than pre-pandemic due to long COVID and indirect COVID-19 impacts	5	4	6	5
Increased deferral of health care and treatment due to COVID-19	5	2	0	0
Healthier population than pre-pandemic as older, less healthy individuals die from COVID-19	1	2	4	4
Lower immunity due to vaccination, infection/reinfection	4	2	2	2
Decreased use of social distancing	1	1	1	1
Decreased deferral of health care and treatment due to COVID-19	0	2	4	2
Decreased use of masks	0	0	0	0
Increased use of masks	0	0	0	0
Increased use of social distancing	0	0	0	0
Decreased access to current or future new COVID-19 medical treatments	0	0	0	0

Annuitant and pension plan populations are excluded because only one non-actuary responded.

Table 6b

DRIVER SCORES FOR ALL-CAUSE EXCESS MORTALITY ESTIMATES WITH COVID-19 BY YEAR (SURVEY 1)

Driver	2022	2023	2025	2030
Actuaries				
General Population				
Lower virulence of current or future COVID-19 strains	**50**	**58**	**57**	**72**
New COVID-19 treatments	**50**	**56**	**73**	**70**
Change in vaccination/booster rate	**43**	**33**	**29**	25
Higher virulence of current or future COVID-19 strains	**43**	28	18	15
Public deferral of health care treatment due to COVID-19	21	24	15	5
Better mortality as less healthy die from COVID-19	15	16	23	**29**
Worse mortality from long COVID	14	21	22	18
Change in public behavior for masking	8	7	1	1
Life Insurance Industry Insured Population				
Lower virulence of current or future COVID-19 strains	**28**	**25**	**25**	**27**
New COVID-19 treatments	**25**	**36**	**40**	**41**
Change in vaccination/booster rate	**21**	**18**	14	14
Higher virulence of current or future COVID-19 strains	19	13	8	5
Public deferral of health care treatment due to COVID-19	15	13	8	3
Worse mortality from long COVID	11	**18**	15	7
Better mortality as less healthy die from COVID-19	6	8	**18**	**19**
Change in public behavior for masking	3	2	2	5
Other Practitioner Types				
General Population				
Change in vaccination/booster rate	**11**	9	3	3
Higher virulence of current or future COVID -19 strains	**9**	**10**	4	1
Worse mortality from long COVID	**9**	**10**	**15**	**8**
Lower virulence of current or future COVID-19 strains	6	3	3	**6**
New COVID-19 treatments	4	**10**	**11**	**11**
Change in public behavior for masking	2	3	2	4
Better mortality as less healthy die from COVID-19	6	4	0	0
Public deferral of health care treatment due to COVID	7	7	**6**	**6**
Life Insurance Industry Insured Population				
Worse mortality from long COVID	**7**	**8**	**8**	**5**
Higher virulence of current or future COVID-19 strains	**4**	1	1	1
Public deferral of health care treatment due to COVID-19	**3**	**3**	**5**	**4**
New COVID-19 treatments	1	**5**	**2**	**4**
Change in public behavior for masking	1	1	0	2
Lower virulence of current or future COVID-19 strains	0	0	0	0
Change in vaccination/booster rate	0	0	0	0
Better mortality as less healthy die from COVID-19	0	2	0	0

Annuitant and pension populations are excluded because only actuaries responded to these questions in survey 1, and one non-actuary responded in survey 2.

Non-COVID-19 excess mortality estimates are also examined by practitioner expertise (Table 7) and exhibit the same patterns as those of COVID-19 estimates for the general population. In this case, the other practitioner types' excess estimates are higher than the actuarial excess mortality estimates. This is the case too for the life insurance industry, although not by as much. While there is a tendency for non-actuaries to have higher non-COVID-19 excess mortality estimates for life insureds, the differences are less than for the general population.

Table 7

AVERAGE ALL-CAUSE EXCESS MORTALITY ESTIMATES WITHOUT COVID-19 AS A CAUSE OF DEATH SPLIT BY PRACTITIONER TYPE FOR GENERAL AND LIFE INSURANCE INDUSTRY INSURED POPULATIONS (SURVEY 2/SURVEY 1)

U.S. Population (No. of Responses)	Current Age	2022 (%)	2023 (%)	2025 (%)	2030 (%)
Total Respondents					
General (*N* = 34)	25	14/10	12/8	9/5	5/3
	45	10/7	7/6	6/3	3/1
	65	5/4	3/3	2/1	1/–1
	85	5/2	4/1	3/0	1/–2
Life Insurance Industry Insured (*N* = 14)	25	8/8	6/5	4/2	3/0
	45	7/5	6/3	4/1	2/–1
	65	5/3	3/2	2/1	0/–1
	85	4/2	3/1	2/0	0/–1
Actuaries Only					
General (*N* = 24)	25	13/9	11/7	8/4	5/1
	45	10/7	7/5	5/2	2/–1
	65	4/3	3/1	1/0	0/–3
	85	4/2	3/0	2/–1	0/–3
Life Insurance Industry Insured (*N* = 9)	25	8/7	5/4	4/2	3/–1
	45	7/5	4/3	3/0	2/–2
	65	5/2	3/1	2/0	0/–2
	85	4/1	2/0	1/1	–1/–3
Other Practitioner Types Only					
General (*N* = 10)	25	17/15	15/13	11/12	5/9
	45	9/11	8/10	7/10	5/7
	65	6/11	5/10	4/10	2/9
	85	7/6	8/4	4/3	2/3
Life Insurance Industry Insured (*N* = 5)	25	8/8	7/8	5/6	3/5
	45	8/7	8/7	6/6	3/5
	65	5/8	4/8	3/6	1/6
	85	5/7	5/7	4/6	2/6

Annuitant and pension populations are excluded because only one non-actuary responded.

In looking at the changes in mortality driving the non-COVID-19 estimates (Tables 8a and 8b) for the general population in 2022, actuaries expected the top three to be mortality deterioration from cardiovascular disorders, drug overdoses and accidents excluding drug overdoses, offset by cancer improvements. For 2023 and later years, cardiovascular mortality deterioration moved to the top and accidents excluding drug overdoses dropped out.

The other practitioner types group mostly agreed with the participating actuaries, with top mortality changes impacting the 2022 non-COVID-19 excess mortality estimates being mortality deterioration from cardiovascular disorders, Alzheimer's and other dementias, and drug overdoses. In 2025 and 2030 cancer improvement replaced drug overdoses deterioration.

For the life insurance industry insured population, participating actuaries chose four changes that lead to deterioration: cardiovascular disorders, cancer, accidents excluding drug overdoses and drug overdoses. By 2030

cancer improvement replaced deterioration from drug overdoses and accidents excluding drug overdoses. In 2030 actuaries ranked both mortality improvement and deterioration from cardiovascular disorders in the top three.

Contrary to the participating actuaries, the other practitioner types' top three mortality changes for the non-COVID-19 excess mortality estimates for the life insurance industry insured population are similar to those for the general population estimates. Mortality deterioration from cardiovascular disorders, drug overdoses (2022 and 2023 only) and Alzheimer's and other dementias are expected to be in the top three throughout the study period, with improvement from cancer mortality arriving in 2025 and 2030.

Table 8a

RESPONDENTS' TOP THREE MORTALITY CHANGES FOR ALL-CAUSE EXCESS MORTALITY ESTIMATES WITHOUT COVID-19 AS A CAUSE OF DEATH BY PRACTITIONER TYPE AND YEAR (SURVEY 2)

Change in Mortality	2022 Top 3	2023 Top 3	2025 Top 3	2030 Top 3
Actuaries				
General Population				
Cardiovascular Disorders Mortality Deterioration	2	1	1	1
Cancer Mortality Improvement	3	3	3	3
Accidents Excluding Drug Overdoses Mortality Deterioration	3			
Drug Overdoses Mortality Deterioration	1	2	2	2
Life Insurance Industry Insured Population				
Cardiovascular Disorders Mortality Improvement				3
Cardiovascular Disorders Mortality Deterioration	1	1	1	2
Cancer Mortality Improvement			3	1
Cancer Mortality Deterioration	2	2	2	
Accidents Excluding Drug Overdoses Mortality Deterioration	3	3		
Drug Overdoses Mortality Deterioration	3	3		
Other Practitioner Types				
General Population				
Cardiovascular Disorders Mortality Deterioration	1	1	1	2
Cancer Mortality Improvement			2	1
Alzheimer's and Other Dementias Mortality Deterioration	3	3		
Drug Overdoses Mortality Deterioration	3	2	3	3
Drug Overdoses Mortality Improvement				3
Life Insurance Industry Insured Population				
Cardiovascular Disorders Mortality Deterioration	1	1	1	2
Cancer Mortality Improvement			2	1
Alzheimer's and Other Dementias Mortality Deterioration	2	3	3	3
Drug Overdoses Mortality Deterioration	3	2		

Annuitant and pension populations are excluded because only actuaries responded to these questions.

Table 8b

RESPONDENTS' TOP THREE MORTALITY CHANGES FOR ALL-CAUSE EXCESS MORTALITY ESTIMATES WITHOUT COVID-19 AS A CAUSE OF DEATH BY PRACTITIONER TYPE AND YEAR (SURVEY 1)

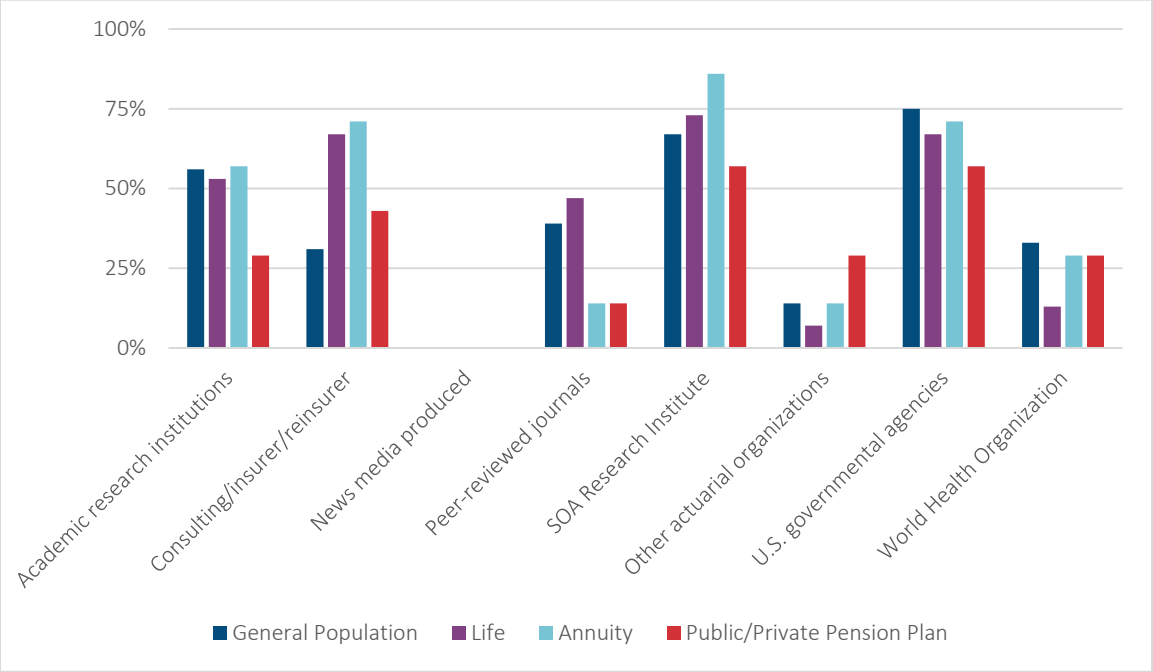
Change in Mortality	2022 Top 3	2023 Top 3	2025 Top 3	2030 Top 3
Actuaries				
General Population				
Cardiovascular Disorders Mortality Deterioration	2	1	1	1
Cancer Mortality Improvement	3	3	3	3
Accidents Excluding Drug Overdoses Mortality Deterioration	3			
Drug Overdoses Mortality Deterioration	1	2	2	2
Life Insurance Industry Insured Population				
Cardiovascular Disorders Mortality Improvement				3
Cardiovascular Disorders Mortality Deterioration	1	1	1	2
Cancer Mortality Improvement			3	1
Cancer Mortality Deterioration	2	2	2	
Accidents Excluding Drug Overdoses Mortality Deterioration	3	3		
Drug Overdoses Mortality Deterioration	3	3		
Other Practitioner Types				
General Population				
Cardiovascular Disorders Mortality Deterioration	1	1	1	2
Cancer Mortality Improvement			2	1
Alzheimer's and Other Dementias Mortality Deterioration	2	3	3	3
Drug Overdoses Mortality Deterioration	3	2		
Life Insurance Industry Insured Population				
Cardiovascular Disorders Mortality Deterioration	1	1	1	2
Cancer Mortality Improvement			2	1
Alzheimer's and Other Dementias Mortality Deterioration	2	3	3	3
Drug Overdoses Mortality Deterioration	3	2		

Annuitant and pension populations are excluded because only actuaries responded to these questions.

2.3 BEST RESOURCES FOR MONITORING COVID-19'S IMPACT ON MORTALITY

Sources of mortality data are very important for the mortality experts. Each of the four specialties has its own favorites, but the Society of Actuaries Research Institute and U.S. governmental agencies rank in the top three for all four. Academic research institutions are favored for the general population and life, with consulting/insurer/ reinsurer preferred for annuity and pension plans. Respondents were not limited to a certain number of choices.

Figure 2
BEST RESOURCES FOR MONITORING COVID-19'S IMPACT ON MORTALITY



Section 3: The State of COVID-19

Government responses are often driven, at least in part, by declarations from the World Health Organization (WHO). COVID-19 was declared a pandemic on March 11, 2020, and this survey was completed in early 2023. As of May 5, 2023, COVID-19 is no longer considered a public health emergency by the WHO. A disease becomes endemic when morbidity and mortality impacts are permanent and generally stable and does not consider indirect impacts (e.g., economic, supply chain, geopolitical).

The vast majority (97%) of respondents selected that the pandemic was currently either close to or already endemic in the U.S., as shown in Table 9.

Table 9
CURRENT STATE OF THE U.S. COVID-19 PANDEMIC

Current State of the U.S. COVID-19 Pandemic	General Population
Ending stage of the pandemic but not yet endemic	50%
COVID-19 has become endemic in the U.S.	47%
Middle stage of the pandemic	3%

The drivers for these conclusions noted high immunity levels, available treatments and lower virulence of recent variants, as illustrated in Table 10.

Table 10
DRIVERS OF THE CURRENT STATE OF THE U.S. COVID-19 PANDEMIC

Drivers for the Current State of the U.S. COVID-19 Pandemic	
High immunity level	61%
Available antivirals and other medical treatments	56%
Lower virulence of recent variants compared to past variants	53%
COVID-19 is becoming predictable	33%
Potential for more virulent strains	22%
COVID-19 remains unpredictable	19%
Low level of immunity in the U.S.	8%
Federal and state COVID-19 response	6%
COVID-19 is becoming more unpredictable	0%
An endemic state is not achievable with COVID-19	0%

Additional responses considered levels of public support, less extreme waves of cases, missing data and high exposure rate. A full set of responses can be found in Appendix A.

Nearly half (44%) of respondents thought COVID-19 is already endemic in the U.S. Everyone felt it would eventually become endemic, as shown in Table 11.

Table 11
WHEN WILL PANDEMIC BE ENDEMIC?

When Will COVID-19 Be Endemic in the U.S.?	
COVID-19 is already endemic in the U.S.	44%
2023	11%
2024	28%
2025 or later	17%
It will never be endemic in the U.S.	0%
I don't know.	0%

The mortality experts were asked to opine about what COVID-19 might look like in a year in which it is endemic.[2] With multiple responses allowed, the results were compared to flu (Table 12).

Table 12
WHAT WILL ENDEMIC COVID-19 LOOK LIKE?

Characteristics of Future COVID-19	
Initial COVID-19 mortality will be similar to flu mortality during a normal pre-pandemic flu season, but long COVID has increased longer term mortality.	42%
It will be prevalent throughout the year.	36%
COVID-19 mortality will be higher than flu mortality during a normal pre-pandemic flu season.	36%
It will behave like the flu and predominantly occur in the fall/winter.	28%
COVID-19 mortality will be lower than flu mortality during a normal pre-pandemic flu season.	11%
I don't know.	6%

[2] During a "normal pre-pandemic flu season," there will be 35,000 deaths on average. (Source: CDC, Past Seasons Estimated Influenza Disease Burden, https://www.cdc.gov/flu/about/burden/past-seasons.html).

The mortality experts were also asked to weigh in on what U.S. general population flu mortality levels might look like in a "normal" flu season post-pandemic. The leading responses were that flu would be at or below normal levels (Table 13).

Table 13
WHAT WILL FUTURE FLU SEASONS LOOK LIKE?

Characteristics of Future Flu Seasons	
Flu mortality will be at least 100% higher than flu mortality during a normal pre-pandemic flu season.	6%
Flu mortality will be 75–99% higher than flu mortality during a normal pre-pandemic flu season.	8%
Flu mortality will be 50–74% higher than flu mortality during a normal pre-pandemic flu season.	3%
Flu mortality will be 25–49% higher than flu mortality during a normal pre-pandemic flu season.	6%
Flu mortality will be similar to a normal pre-pandemic flu season.	22%
Flu mortality will be 5–24% lower than flu mortality during a normal pre-pandemic flu season.	39%
Flu mortality will be 25–49% lower than flu mortality during a normal pre-pandemic flu season.	3%
Flu mortality will be 50–74% lower than flu mortality during a normal pre-pandemic flu season.	0%
Flu mortality will be 75–99% lower than flu mortality during a normal pre-pandemic flu season.	0%
There will be no flu mortality.	0%
I don't know.	8%

Two additional comments were received about future mortality when COVID-19 is endemic, and they are shared here in their entirety:

- *The wild card here is that we are working from the proposition that COVID-19 is the last major virus to come. That is unlikely, but it is hard to project what is coming next and when.*

- *Earlier coronaviruses ended up as common colds—the question is how long does it take to become "common."*

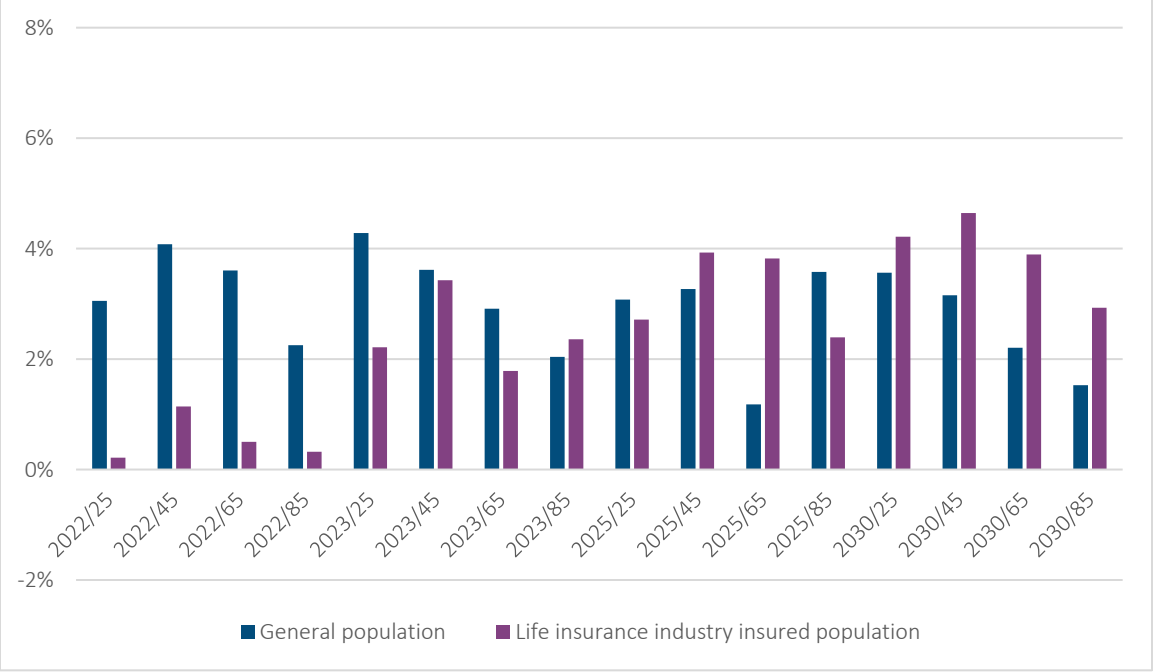
Section 4: Comparison of Survey 1 and Survey 2

This research report was designed to update the results from an earlier survey, incorporating any lessons brought out in the meantime. While COVID-19 deaths continue to fall (but not to zero), a major development as the pandemic has progressed is its impact on mental and physical health in general. Concerns have been shared about the long-term effects from COVID-19 and the consequences from the COVID-19 lockdown on mortality. Comparing the results of this survey to those of survey 1 provides insights into the emerging thinking on this topic. Figures 3 through 8 show the difference in excess death expectations including COVID-19, without COVID-19, and exclusively from COVID-19 for all age groups and years.

Figure 3 shows the difference between survey 1 and survey 2 for general population and life insurance excess deaths by year and age. Combining excess deaths from COVID-19 and indirect causes leads to mixed results, with general population excess deaths higher than previously expected in early years and life insured excess deaths higher than expected in later years.

Figure 3

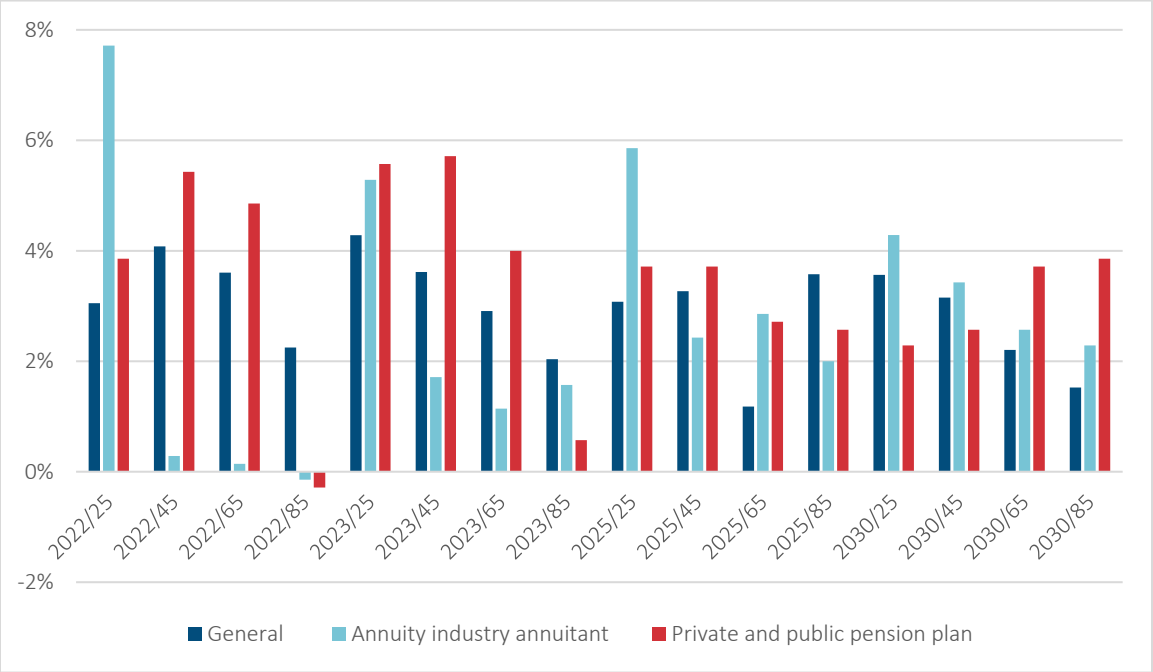
SURVEY 2 – SURVEY 1 (ESTIMATED EXCESS MORTALITY WITH COVID-19 – GENERAL AND LIFE INSURANCE INDUSTRY INSURED POPULATIONS)



With fewer data points, the results for the annuity industry annuitant and private and public pension plan populations were more variable between years and ages (Figure 4).

Figure 4

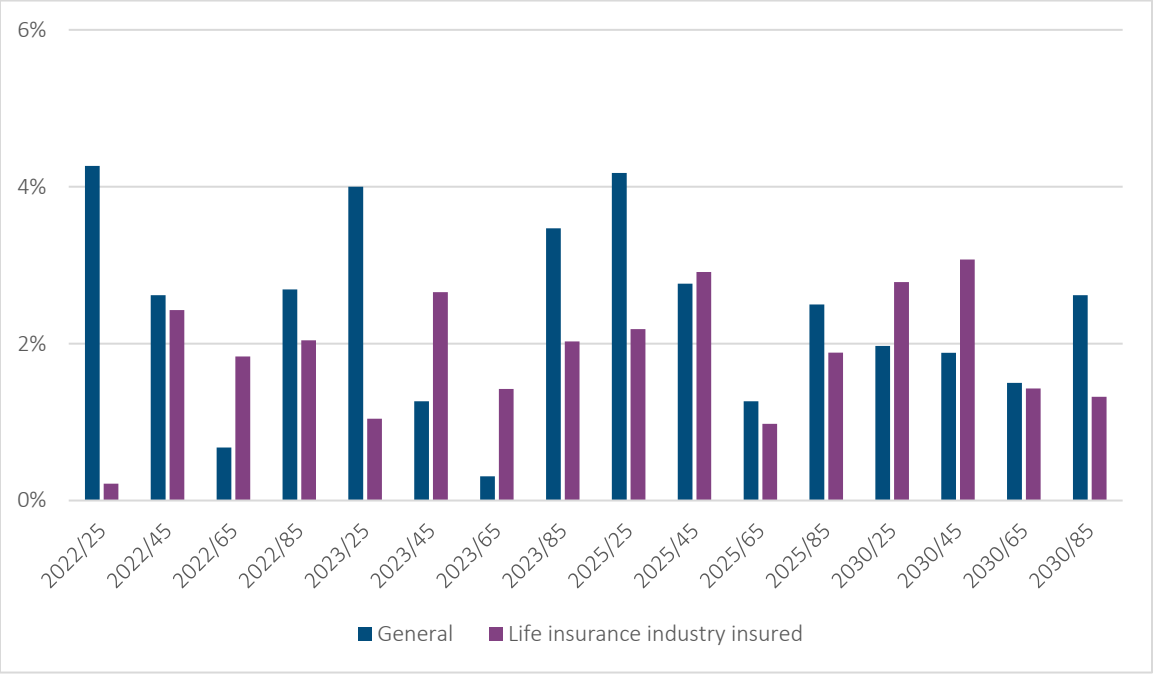
SURVEY 2 – SURVEY 1 (ESTIMATED EXCESS MORTALITY WITH COVID-19 – GENERAL, ANNUITY INDUSTRY ANNUITANT AND PRIVATE AND PUBLIC PENSION PLAN POPULATIONS)



Looking at expected excess mortality without COVID-19 allows analysis of the indirect deaths. For general population and life, the results are similar to those for mortality with COVID-19, with general population results higher in the early years and ages, and life higher in the later years at the younger ages (Figure 5).

Figure 5

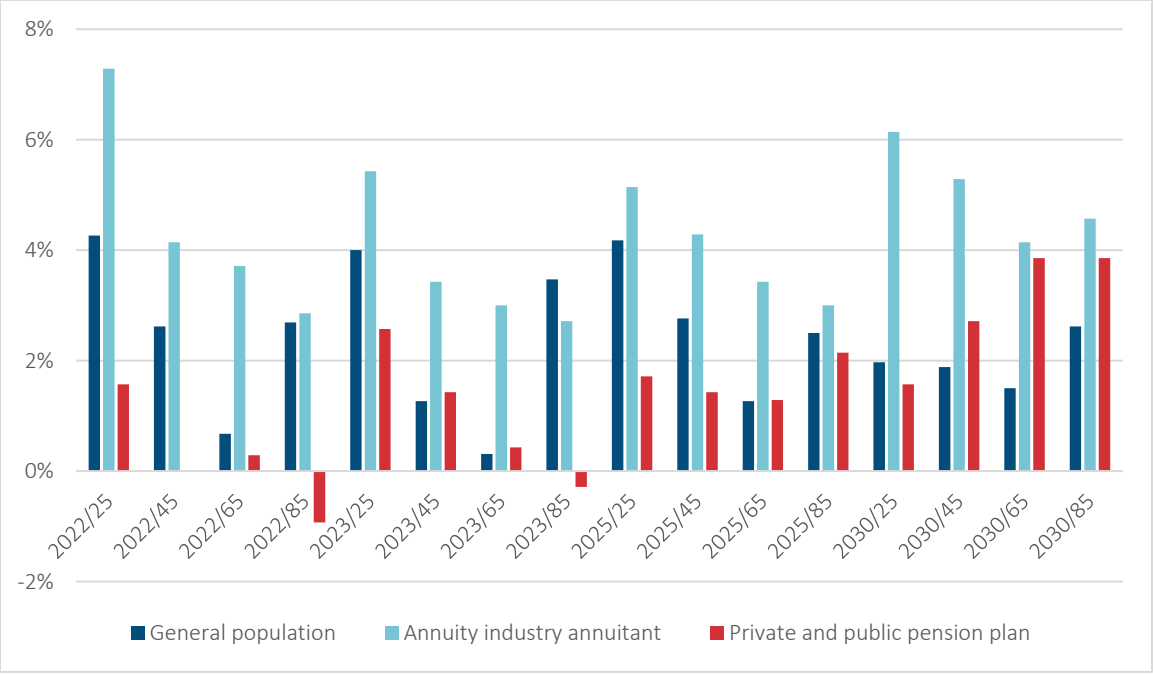
SURVEY 2 – SURVEY 1 (ESTIMATED EXCESS MORTALITY WITHOUT COVID-19 – GENERAL AND LIFE INSURANCE INDUSTRY INSURED POPULATIONS)



When reviewing results without COVID-19, annuitant population excess mortality is larger than the pension plan population at all ages. Results increase for the pension plan population in the later years of the survey (Figure 6).

Figure 6

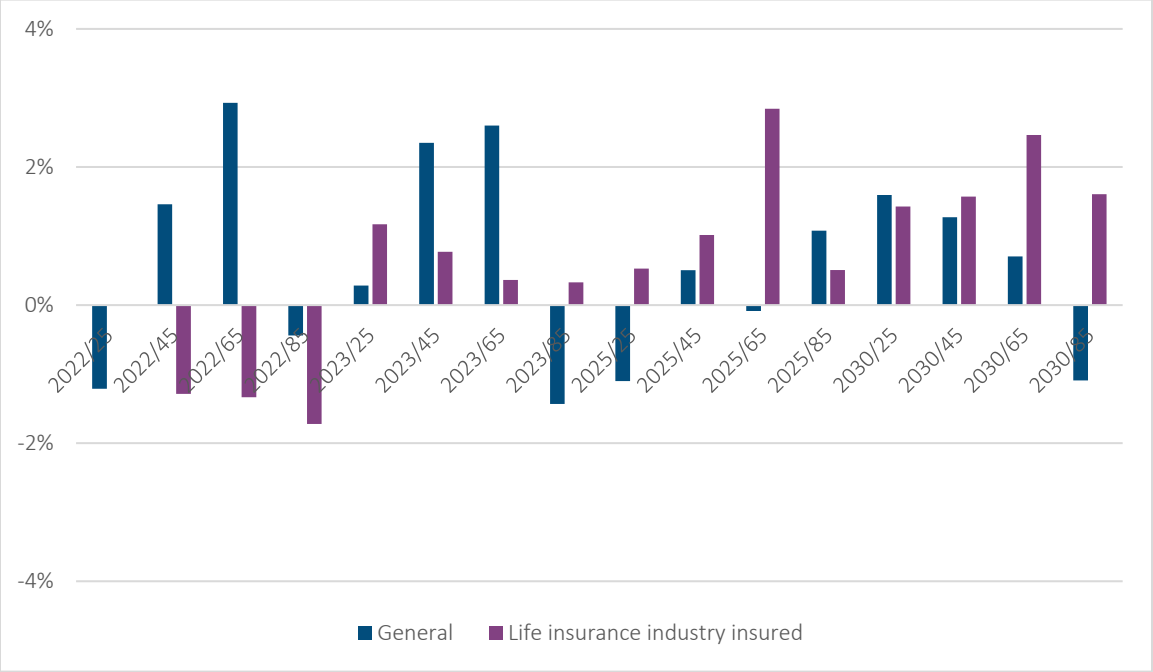
SURVEY 2 – SURVEY 1 (ESTIMATED EXCESS MORTALITY WITHOUT COVID-19 – GENERAL POPULATION, ANNUITY INDUSTRY ANNUITANT AND PRIVATE AND PUBLIC PENSION PLAN POPULATIONS)



When COVID-19 deaths are separated out from the results by subtracting excess mortality without COVID-19 from the excess mortality with COVID-19, the general population excess deaths compared to the expected decrease in later years, and life excess deaths increase (Figure 7).

Figure 7

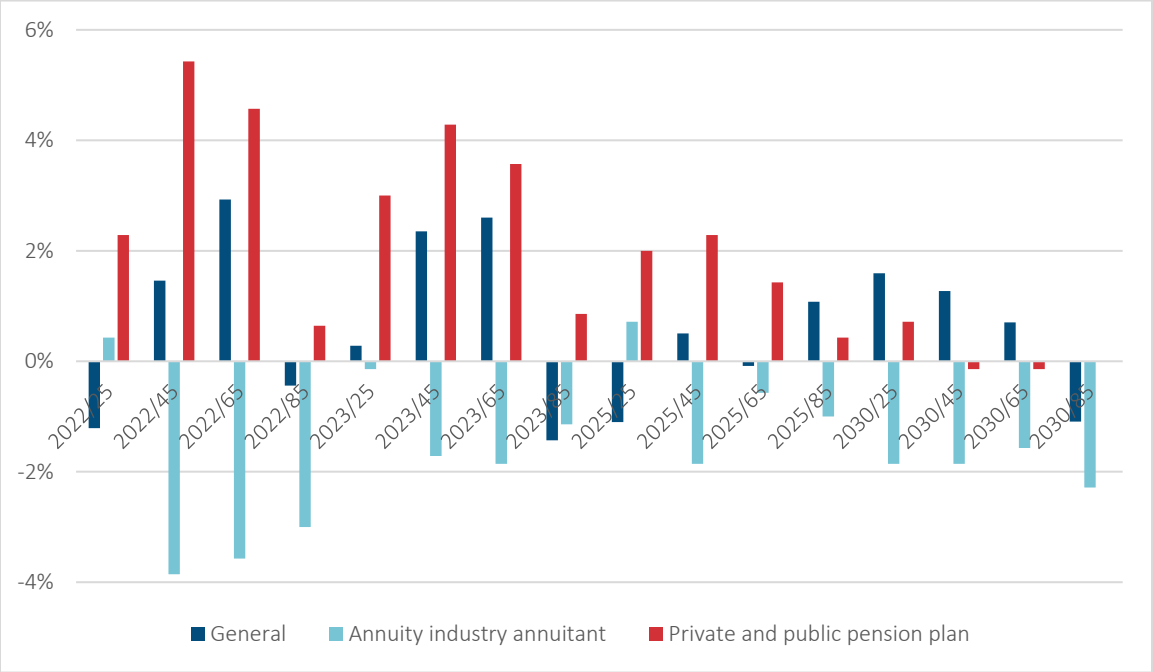
SURVEY 2 – SURVEY 1 (ESTIMATED EXCESS MORTALITY FROM COVID-19 DEATHS – GENERAL AND LIFE INSURANCE INDUSTRY INSURED POPULATIONS)



Although the number of data points is small, some of the more interesting comparisons appear in Figure 8, where COVID-19 excess deaths against the expected are projected for the annuitant and pension plan populations. Annuities expect negative excess deaths due to COVID-19, and pension plans expect positive excess deaths, with each effect muted in later years.

Figure 8

SURVEY 2 – SURVEY 1 (ESTIMATED EXCESS MORTALITY FROM COVID-19 DEATHS – GENERAL, ANNUITY INDUSTRY ANNUITANT, AND PRIVATE AND PUBLIC PENSION PLAN POPULATIONS)



Section 5: Observations and Conclusion

Overall, the takeaway from this study is that respondents expect the indirect impact from COVID-19 to remain strong for the rest of the decade. Actuaries should assess how this impacts their company including examining whether changes to mortality assumptions are needed.

New COVID-19 variants continue to evolve with new symptoms. Because of this, uncertainty remains about the future course of COVID-19 and the consequences to mortality. Since the close of the survey, COVID-19 cases, hospitalizations and deaths have declined prompting the World Health Organization and the U.S. federal government to end the COVID-19 public health emergency. As a result, the authors held two webcasts (June 23 and June 27) to present the preliminary survey results to study participants and gather their thoughts in light of recent COVID-19 developments. Approximately 20 individuals attended and were asked what their general population total excess mortality estimates would be for periods 2023 and 2030 given what has transpired since they provided their survey 2 responses during the first quarter of this year. For 2023, the predominant answer was that excess mortality estimates would be the same or a little better than that provided earlier in the year. For 2030 excess mortality estimates, the individuals also indicated very little change to the initial survey 2 excess mortality estimates.

Additional insights from the discussions are provided below and may be helpful in considering the analysis in this report.

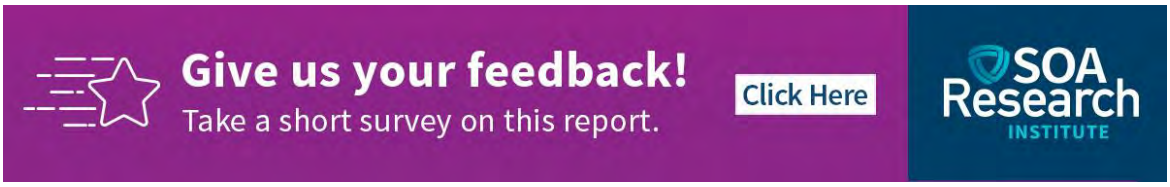
- Some participants shared that they only examine total excess mortality given COVID-19 death reporting in the U.S. This made it difficult for them to answer the excess mortality estimates without COVID-19 survey questions.

- There were comments about the difficulty in distinguishing short term vs. long term mortality trends.

- It was mentioned there is existing research that also supports COVID-19 mortality converging to flu mortality levels.
- A few participants expressed that mortality from drug overdoses will likely continue to worsen as the U.S. has not done enough to change behavior driving the use of these drugs.
- An individual mentioned that in addition to direct and indirect COVID-19, the consolidation of healthcare delivery such as physician practices and hospitals might also be a factor in future excess mortality. Less competition might result in higher prices and impact access and cause deferral of treatment.
- An individual commented on the difficulty to an insurer in identifying individuals in the early stages of Alzheimer's and other dementias as these individuals can usually pass underwriting.

Although COVID-19 is no longer a public health emergency, the environment remains very fluid. Currently new variants such as EG.5 and BA.2.86 are circulating in the U.S. as the fall season approaches. The questions about whether COVID-19 has become endemic and what that means for future mortality remain.

Planning is already underway for a refresh of this study in 2024 and additional projects to investigate the evolution of the coronavirus and its implications to mortality over the next few years. If there are COVID-19 topics that you think are important to cover in a future expert opinion survey, please send an email to Research-ML@soa.org.



Section 6: List of Survey Participants

Robert Anderson*

Tom Ashley*

Marcy Baker

Magali Barbieri*

Mary Pat Campbell

Marjorie Carlson

Carolyn Covington

Natalia Gavrilova*

Bobby Gentry

Karen Glenn

Nik Godon

Steve Goss

Dale Hall

Brad Heltemes*

Martin Hill

Brian Ivanovic*

Joel Jones*

Derek Kueker

Daniel Kunetz

Grant Martin

Jessica Mosher

Murali Niverthi

Hengchang Pan

Stefanie Porta

John R. Popiolek

William Rooney*

Daniel J. Rueschhoff

Erika Shadduck

Joel Sklar

Mark Spong

Justin Struby

David A. Swanson*

William M. Tilford*

Elizabeth Wiley

Kerry Worgan

Daniel Zamarripa*

There were three additional participants from the expert panel, one non-actuary and two actuaries, who wished to remain anonymous.

*Participant is not an actuary.

Section 7: Acknowledgments

The author's deepest gratitude goes to those without whose efforts this project could not have come to fruition: the volunteers who generously shared their wisdom, insights, advice, guidance and arm's-length review of this study prior to publication. Any opinions expressed may not reflect their opinions nor those of their employers. Any errors belong to the author alone.

The 39 mortality expert panel members who participated in the survey.

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Appendix A: Survey and Responses

Impact of COVID-19 on Future U.S. Mortality

Please Respond: Impact of COVID-19 on Future Mortality Survey 2

Due February 21, 2023

Dear SOA Research Institute Mortality Expert Panel Member,

Thank you for your interest in participating in the Society of Actuaries Research Institute Mortality Expert Panel. We have assembled a multidisciplinary team to seek your opinions throughout the year on emerging mortality topics and the impact on short and long term mortality trends. Since the first COVID-19 survey was fielded in March, several variants have developed and generated waves of cases in the U.S., and abroad. Because of this, we again are asking for your thoughts on future excess mortality. New to this survey are questions on the state of the pandemic including if and when COVID-19 becomes endemic.

We value your insights and invite you to participate in the survey. We encourage you to share your thoughts and experiences in the comment boxes, which will be used to help shape future surveys to this group. Participants will receive a draft copy of the report prior to publication and be invited to a virtual meeting where results will be presented.

Please complete this survey by February 21, 2023. Please direct questions about the survey to Ronora Stryker at rstryker@soa.org. Thank you for your consideration.

The initial survey deadline was February 21, 2023, but the deadline to complete the survey was extended to March 24, 2023.

Impact of COVID-19 on Future U.S. Mortality Survey 2

Introduction

Since the start of the pandemic, great strides have been made in understanding how COVID-19 has impacted mortality with more and more data becoming available for assessing recent mortality outcomes. Yet, uncertainty remains about future mortality given the nature of the virus to mutate, public response to COVID-19 mitigation methods, the potential for medical advances to prevent or treat COVID-19 and other factors. This Society of Actuaries Research Institute study seeks your opinions and insights on the impact of COVID-19 on the future mortality for four populations:

1. U.S. General Population
2. U.S. Life Insurance Industry Insured Population
3. U.S. Annuity Industry Annuitant Population
4. U.S. Private and Public Pension Plan Population.

The survey is composed of three sections in which several future time periods are explored. You will respond to questions for those populations you choose based on your areas of mortality knowledge.

As you complete the three sections of the survey (Demographics, Future Changes in U.S. All-Cause Mortality, The State of COVID-19), keep in mind that you cannot use the "back" button in your browser to review prior answers. Use the "GO BACK" button at the bottom of each page to navigate back to already answered questions. Upon completion of the survey, you will be provided a printable report of your survey responses. If you are having challenges entering information in the survey, please clear the browsing history as it may resolve the issue. **Please respond no later than February 17, 2023.**

A copy of the survey questions can be found here. It may be helpful to print the questions and use as a reference as you go through the online survey especially for Section 2.

Responses will be kept anonymous, and results will be summarized in a report to be published on the SOA website at www.soa.org.

Your name and email address are requested below to contact you should we have questions about your submission and to send you a copy of the report prior to publication.

Name:

Email Address:

May we list your name as a participant in the summary report to be published on the SOA Research Institute website? Responses will not be identifiable by individual participant name or company in the report. _____YES _____NO

Section 1: Demographics

39 total responses

1: Practitioner type (Please select all that apply.):

- Academic (3)
- Actuary (27)
- Data scientist (2)
- Demographer (3)
- Epidemiologist (2)
- Medical professional (6)
- Regulator (0)
- Researcher (8)
- Retirement professional (0)
- Risk manager (2)
- Underwriter (4)
- Other (2)—Policy advisor, statistician

2: Number of years of experience (Please select one.):

- 1–4 (0)
- 5–9 (0)
- 10–14 (4)
- 15–19 (5)
- 20–24 (5)
- 25+ (25)

3. Employer type (Please select the primary one.):

- Academic/research institution (5)
- Bank/investment management/financial services company (1)
- Consulting (11)
- Insurer (7)
- Government agency (3)
- Pension plan (1)
- Rating agency (0)
- Reinsurer (8)
- Self-employed (2)
- Retired (2)
- Other (1)—International organization

4. Did you participate in the March 2022 survey? 36 Yes 3 No

5. Area of mortality knowledge (Please select all that apply. Questions received are based on your selection.)

- U.S. General Population Mortality **(If selected, respond to Section 2, question 1; Section 3 all questions.)**
- U.S. Life Insurance Industry Insured Population Mortality **(If selected, respond to Section 2, questions 1 and 2; Section 3 all questions.)**
- U.S. Annuity Industry Annuitant Population Mortality **(If selected, respond to Section 2, questions 1 and 3; Section 3 all questions.)**
- U.S. Private and Public Pension Plan Population Mortality **(If selected, respond to Section 2, questions 1 and 4; Section 3 all questions.)**
- None of the above **(If selected, thank you for participating. Please submit your response)**

SURVEY RESPONDENTS' AREA OF EXPERTISE (*N* = 39)

Area of Expertise	No. Responding	Percentage of Respondents (%)	Percentage of Respondents (%) in Previous Survey	No. of Excess Mortality Estimates Submitted
U.S. Life Insurance Industry Insured Population Mortality	18	46	54	14
U.S. Annuity Industry Annuitant Population Mortality	8	21	10	7
U.S. Private and Public Pension Plan Population Mortality	9	23	25	7
U.S. General Population Mortality	32	82	66	39
None of the above	0	0	2	0

Section 2 Future Changes in U.S. All-Cause Mortality

In this section we are interested in understanding your thoughts on future changes in all-cause mortality for each of four populations: U.S. General Population, U.S. Life Insurance Industry Insured Population, U.S. Annuity Industry Annuitant Population, and U.S. Private and Public Pension Plan Population.

Excess mortality, including deaths that are directly or indirectly attributed to COVID-19 for a specific period, over pre-pandemic expectations will be explored for four future time periods.

Using historical information and your knowledge of COVID-19 and its impact on mortality, please provide your thoughts on how much total excess mortality there will be in future years. Total excess mortality estimates With and Without COVID-19 as a cause of death for four time periods, 2022, 2023, 2025, and 2030 and four ages: 25, 45, 65, and 85 are requested.

In responding to the questions in this section, please assume 2019 mortality levels for each age as the starting point for your expected mortality calculation and adjust as necessary to trend forward to the appropriate projection period. Do not consider direct or indirect COVID-19 in the calculation. For example, if examining historical information to establish trend assumptions such as mortality improvement,

demographic changes in the population or other factors to apply to the 2019 mortality levels to produce expected levels, use 2019 or earlier data. Projected mortality with and without COVID-19 will be compared to the same estimated expected level to determine mortality excess.

In addition to the excess mortality estimates, you will be asked for your thoughts on what is driving your responses as well as what you consider to be the best resources for monitoring COVID-19's impact on mortality.

Your responses will help us understand your thoughts on the future course of the pandemic and its impact on future mortality.

All participants will receive U.S. General Population Mortality questions.

Historical Information and a Sample Excess mortality calculation is provided here. It will be helpful to print the data and excess mortality calculation to use as a reference as you go through Section 2.

Examples of excess mortality calculations using historical U.S. general population all-cause mortality for 2019-2021 from the Centers for Disease Control and Prevention (CDC) were provided.

HISTORICAL U.S. GENERAL POPULATION ALL-CAUSE AND COVID-19 CRUDE DEATH RATES BY YEAR AND AGE

Current Age	A 2019 All Cause Deaths per 100,000	B 2020 All Cause Deaths per 100,000	C 2020 COVID-19 Deaths per 100,000+	D = B – C 2020 Deaths per 100,000* without COVID-19 Deaths**	E 2021 All-Cause Deaths per 100,000	F 2021 COVID-19 Deaths per 100,000+	G = E – F 2021 Deaths per 100,000* without COVID-19 Deaths**
25–34	128.8	159.5	4.9	154.6	180.8	13.5	167.3
45–54	392.4	473.5	42.0	431.6	531.0	90.6	440.4
65–74	1,764.6	2,072.3	234.3	1,838.0	2,151.3	305.1	1,846.2
85+	13,228.6	15,210.9	1,645.0	13,565.9	15,743.3	1,354.4	14,388.9

**Deaths from COVID-19 were identified using underlying cause-of-death codes U07.1 in the *International Classification of Diseases, Tenth Revision*.

Source: Centers for Disease Control and Prevention. About Underlying Cause of Death, 2018–2021, Single Race (https://wonder.cdc.gov/ucd-icd10-expanded.html).

Many methodologies exist for performing excess mortality analysis. A very simple example follows.

The first step of the process is to determine excess mortality. It is a **simplified example** for estimating U.S. General Population expected mortality for 2020 and 2021 in which only mortality improvement is applied to trend the 2019 levels forward. Columns A and B are user input items with 2019 all cause deaths coming from the previous table and the mortality improvement assumption (deterioration if negative) in Column B from the SOA Research Institute's mortality improvement model, MIM-2021-v3.

U.S. GENERAL POPULATION EXPECTED MORTALITY EXAMPLE

Current Age	A 2019 All-Cause Deaths per 100,000*	B Annual Mortality Improvement Assumption**	C = 1 – B Annual Mortality Improvement Factor	D = A x C Estimated 2020 Expected Mortality	E = D x C Estimated 2021 Expected Mortality
25-34	128.8	-1%	1.01	130.1	131.4
45-54	392.4	.75%	.9925	389.5	386.6
65-74	1,764.6	1.5%	.985	1,738.1	1,712.0
85+	13,228.6	1.5%	.985	13,030.2	12,834.7

*Column A is from the first table.

**Source: MIM Advisory Group, MIM-2021-v3 Data Analysis Tool (https://www.soa.org/resources/research-reports/2022/mortality-improvement-model/).

Continuing the simple example, using the expected mortality estimates for 2020 and 2021 and the actual crude death rates, excess mortality for 2020 and 2021 can be determined. The calculations are shown below. The excess mortality estimates are shown in Columns C and F.

U.S. GENERAL POPULATION TOTAL EXCESS MORTALITY EXAMPLE FOR 2020 AND 2021 WITH COVID-19 AS A CAUSE OF DEATH

Current Age	A Estimated 2020 Expected Mortality	B 2020 All-Cause Deaths per 100,000	C = B/A – 1 Estimated 2020 Total Excess Mortality	D Estimated 2021 Expected Mortality	E 2021 All-Cause Deaths per 100,000	F = E/D – 1 Estimated 2021 Total Excess Mortality
25–34	130.1	159.5	**23%**	131.4	180.8	**38%**
45–54	389.5	473.5	**22%**	386.6	530.9	**37%**
65–74	1,738.1	2,072.3	**19%**	1,712.0	2,151.0	**26%**
85+	13,030.2	15,210.9	**17%**	12,834.7	15,743.3	**23%**

U.S. GENERAL POPULATION EXCESS MORTALITY EXAMPLE FOR 2020 AND 2021 WITHOUT COVID-19 AS A CAUSE OF DEATH

Current Age	A Estimated 2020 Expected Mortality	B 2020 Deaths per 100,000 without COVID-19 Deaths*	C = B/A – 1 Estimated 2020 Excess Mortality without COVID-19 Deaths*	D Estimated 2021 Expected Mortality	E 2021 Deaths per 100,000 without COVID-19 Deaths*	F = E/D – 1 Estimated 2021 Excess Mortality without COVID-19 Deaths*
25–34	130.1	154.6	**19%**	131.4	167.3	**27%**
45–54	389.5	431.6	**11%**	386.6	440.4	**14%**
65–74	1,738.1	1,838.0	**6%**	1,712.0	1,846.2	**8%**
85+	13,030.2	13,565.9	**4%**	12,834.7	14,388.9	**12%**

*Deaths from COVID-19 were identified using underlying cause-of-death codes U07.1 in the *International Classification of Diseases, Tenth Revision*.

Other methodologies for analysis of U.S. population excess mortality:

Society of Actuaries Research Institute: 2020-2021 Excess Deaths in the U.S. General Population by Age and Sex Updated August 2022 by Rick Leavitt

CDC: Excess Deaths Associated with COVID-19

Another excess mortality example is provided in the following table utilizing the same methodology as discussed for the U.S. General Population. Columns A, E and F are historical individual life insurance mortality data contributed by companies participating in the SOA Research Institute's COVID-19 industry studies. Columns C and D are the estimated 2020 and 2021 expected number of deaths determined by trending the 2019 data forward. Columns G and H show the total excess mortality estimates for these years. In comparing the total excess mortality estimates in the two examples, the 2020 and 2021 excess mortality estimates are lower for the U.S. individual life insurance industry insured population than the total excess mortality estimates for the U.S. General Population (shown in the first table on page 40). Also the U.S. Individual Life Insurance Industry's estimates do not have as much variability by age as the U.S. General Population example.

U.S. INDIVIDUAL LIFE INSURANCE INDUSTRY INSURED POPULATION
ALL-CAUSE MORTALITY

Current Age	A 2019 Number of Deaths per 100,000	B Annual Mortality Improvement Factor	C = (A x B) Estimated 2020 Expected Number of Deaths per 100,000	D = (C x B) Estimated 2021 Expected Number of Deaths per 100,000	E 2020 Actual All-Cause Deaths per 100,000	F 2021* Actual All-Cause Deaths per 100,000	G = E/C – 1 Estimated 2020 Total Excess Mortality	H = F/D – 1 Estimated 2021* Total Excess Mortality
25–34	74.3	1.01	75.1	75.8	83.5	88.3	**11%**	**16%**
45–64	374.4	.9925	371.6	368.8	416.0	448.0	**12%**	**21%**
65–84	2,304.2	.985	2,269.6	2,235.6	2,606.2	2,641.2	**15%**	**18%**
85+	12,838.4	.985	12,645.8	12,456.1	14,296.1	13,855.1	**13%**	**11%**

*Based on 12 months ending third quarter 2021.
Source: Contributing company data for SOA Research Institute, LIMRA, RGA, TAI COVID-19 individual life studies.

1. U.S. GENERAL POPULATION MORTALITY

The following questions relate to **U.S. General Population** mortality. Historical information

1.a.1. Assuming 2019 mortality levels trended forward with mortality improvement or deterioration for future expected mortality, as described above. Please indicate the total level of excess mortality you expect from all causes **including COVID-19 deaths** for each of the years and ages listed below. Please express all numbers in decimal form. Here are three examples on how to respond:

From the **U.S. General Population excess mortality example provided (link to the historical information example document),** for age 25-44, the level of excess in 2020 in relation to 2020 expected mortality levels, is 23%.

- If you believe the level of excess mortality for age 25 will remain at the same level for 2022 as the U.S. General Population 25-44 historical information for 2020, code the 23% level as ".23".
- If you believe the excess mortality for age 25 will be reduced, e.g., to a level of 15% excess mortality, code ".15".
- If you believe that excess mortality for age 25 will go away and there will be additional mortality improvement of, for example 5%, express the 5% mortality improvement as a negative number, "-.05".

Please use the "Tab" button on your keyboard to advance from cell to cell.

AVERAGE ALL-CAUSE EXCESS MORTALITY ESTIMATES WITH COVID-19 BY POPULATION AND AGE

U.S. Population (No. of Responses)	Current Age	2022 (%)	2023 (%)	2025 (%)	2030 (%)
Total Respondents					
General (*N* = 39)	25	17	13	9	6
	45	17	13	9	6
	65	14	10	6	4
	85	11	8	7	3
Actuaries Only					
General (*N* = 27)	25	17	13	8	4
	45	17	12	6	3
	65	13	9	4	2
	85	11	7	4	1
Other Practitioner Types Only					
General (*N* = 12)	25	16	15	11	8
	45	17	15	12	11
	65	15	13	10	10
	85	13	11	13	5

AGGREGATION OF RESPONSES FOR TOTAL EXCESS MORTALITY WITH COVID-19 U.S. GENERAL POPULATION[3]

Current Age		Total Excess Mortality with COVID-19			
		2022	2023	2025	2030
25	Min	0%	-5%	−7%	−10%
	Max	42%	42%	35%	50%
	Average	17%	13%	9%	6%
	Median	15%	10%	8%	2%
	25th percentile	10%	4%	2%	0%
	75th percentile	24%	20%	15%	8%
	No. of responses	38	39	39	39
45	Min	2%	−4%	−8%	−8%
	Max	40%	40%	37%	50%
	Average	17%	13%	8%	7%
	Median	16%	10%	5%	2%
	25th percentile	10%	5%	2%	0%
	75th percentile	23%	18%	15%	5%
	No. of responses	38	39	39	39
65	Min	–3%	−5%	−7%	−7%
	Max	30%	39%	30%	50%
	Average	14%	10%	6%	4%
	Median	12%	8%	4%	2%

[3] Although both median and mean are calculated, in surveys the median is typically used for analytics to lower the weight of any outliers.

	25th percentile	10%	5%	1%	0%
	75th percentile	17%	13%	10%	3%
	No. of responses	38	39	39	39
85	Min	-2%	−5%	−7%	−10%
	Max	25%	28%	50%	23%
	Average	11%	8%	7%	3%
	Median	10%	5%	3%	1%
	25th percentile	5%	2%	0%	0%
	75th percentile	16%	12%	10%	3%
	No. of responses	38	39	39	39

1.a.2 What are the top 3 COVID-19 drivers, for each year listed, influencing your future total excess mortality **Including COVID-19 Deaths** estimates? "1" is the most influential COVID-19 driver.

A score was assigned to each response. A driver with a response of rank 1 received a score of 3; a driver with a response of rank 2 received a score of 2; and a driver with a response of rank 3 received a score of 1. These were summed to produce a total score for each driver option.

DRIVER SCORES FOR ALL-CAUSE EXCESS MORTALITY ESTIMATES WITH COVID-19 BY YEAR – ALL RESPONDENTS

Drivers	Total Excess Mortality (Including COVID-19 Deaths) Estimates			
	2022	2023	2025	2030
Masks – Increased use of	"1"–2 "2"–1 "3"–0 TS = 8	"1"–0 "2"–0 "3"–1 TS = 1	"1"–0 "2"–0 "3"–1 TS = 1	"1"–0 "2"–0 "3"–0 TS = 0
Masks – Decreased use of	"1"–1 "2"–0 "3"–3 TS = 6	"1"–2 "2"–0 "3"–1 TS = 7	"1"–0 "2"–0 "3"–1 TS = 1	"1"–0 "2"–0 "3"–1 TS = 1
Treatment Access – Increased access to current or future new COVID-19 medical treatments	"1"–5 "2"–8 "3"–7 TS = 38	"1"–6 "2"–6 "3"–9 TS = 39	"1"–7 "2"–8 "3"–4 TS = 41	"1"–7 "2"–9 "3"–3 TS = 42
Treatment Access – Decreased access to current or future new COVID-19 medical treatments	"1"–0 "2"–0 "3"–0 TS = 0	"1"–0 "2"–0 "3"–0 TS = 0	"1"–0 "2"–0 "3"–0 TS = 0	"1"–0 "2"–0 "3"–0 TS = 0

Population Health Status - Healthier population than pre-pandemic as older, less healthy individuals die from COVID-19	"1"–1 "2"–3 "3"–2 TS = 11	"1"–0 "2"–1 "3"–2 TS = 4	"1"–1 "2"–2 "3"–2 TS = 9	"1"–3 "2"–2 "3"–2 TS = 15
Population Health Status - Less healthy population than pre-pandemic due to long COVID and indirect COVID-19 impacts.	"1"–2 "2"–3 "3"–7 TS = 19	"1"–4 "2"–7 "3"–8 TS = 34	"1"–5 "2"–5 "3"–4 TS = 29	"1"–5 "2"–3 "3"–3 TS = 24
Treatment Deferral – Increased deferral of health care and treatment due to COVID-19	"1"–3 "2"–2 "3"–2 TS = 15	"1"–2 "2"–1 "3"–1 TS = 9	"1"–1 "2"–0 "3"–1 TS = 4	"1"–1 "2"–0 "3"–2 TS = 5
Treatment Deferral – Decreased deferral of health care and treatment due to COVID-19	"1"–0 "2"–1 "3"–1 TS = 3	"1"–0 "2"–2 "3"–0 TS = 4	"1"–0 "2"–1 "3"–3 TS = 5	"1"–0 "2"–2 "3"–3 TS = 7
Social distancing and isolation – Increased use of	"1"–0 "2"–0 "3"–0 TS = 0	"1"–0 "2"–0 "3"–0 TS = 0	"1"–0 "2"–0 "3"–1 TS = 1	"1"–0 "2"–0 "3"–1 TS = 1
Social distancing and isolation – Decreased use of	"1"–1 "2"–0 "3"–3 TS = 6	"1"–1 "2"–0 "3"–2 TS = 5	"1"–1 "2"–0 "3"–2 TS = 5	"1"–1 "2"–0 "3"–2 TS = 5
Immunity – Higher immunity due to vaccination, infection/reinfection	"1"–13 "2"–5 "3"–4 TS = 53	"1"–15 "2"–6 "3"–4 TS = 61	"1"–10 "2"–6 "3"–7 TS = 49	"1"–9 "2"–8 "3"–6 TS = 49
Immunity – Lower immunity due to vaccination, infection/reinfection	"1"–0 "2"–5 "3"–1 TS = 11	"1"–0 "2"–3 "3"–2 TS = 8	"1"–0 "2"–5 "3"–1 TS = 11	"1"–0 "2"–4 "3"–2 TS = 10
Virulence – Higher virulence of current or future COVID-19 strains/variants	"1"–7 "2"–1 "3"–1 TS = 24	"1"–5 "2"–1 "3"–0 TS = 17	"1"–5 "2"–0 "3"–1 TS = 16	"1"–5 "2"–0 "3"–1 TS = 16
Virulence – Lower virulence of current or	"1"–2 "2"–5 "3"–1	"1"–3 "2"–7 "3"–1	"1"–5 "2"–5 "3"–2	"1"–5 "2"–5 "3"–3

future COVID-19 strains/variants	TS = 17	TS = 24	TS = 27	TS = 28
Other – Drug overdoses & reactions	"1"–1 "2"–0 "3"–0 TS = 3	"1"–1 "2"–0 "3"–0 TS = 3	"1"–1 "2"–0 "3"–0 TS = 3	"1"–1 "2"–0 "3"–0 TS = 3
Other – Depression/mental health	"1"–0 "2"–1 "3"–0 TS = 2	"1"–0 "2"–1 "3"–0 TS = 2	"1"–0 "2"–1 "3"–0 TS = 2	"1"–0 "2"–1 "3"–0 TS = 2
Other – Psychological/accident/ abuse	"1"–0 "2"–0 "3"–1 TS = 1	"1"–0 "2"–0 "3"–1 TS = 1	"1"–0 "2"–0 "3"–1 TS = 1	"1"–0 "2"–0 "3"–1 TS = 1
Other – Vaccine/COVID-19 misinformation	"1"–0 "2"–0 "3"–1 TS = 1	"1"–0 "2"–0 "3"–1 TS = 1	"1"–0 "2"–0 "3"–1 TS = 1	"1"–0 "2"–0 "3"–1 TS = 1
Other – Deferral of care – all causes	"1"–0 "2"–0 "3"–1 TS = 1	"1"–0 "2"–0 "3"–1 TS = 1	"1"–0 "2"–0 "3"–0 TS = 0	"1"–0 "2"–0 "3"–0 TS = 0

DRIVER SCORES FOR ALL-CAUSE EXCESS MORTALITY ESTIMATES WITH COVID-19 BY YEAR – ACTUARIES

Drivers	Total Excess Mortality (Including COVID-19 Deaths) Estimates			
	2022	2023	2025	2030
Masks – Increased use of	"1"–1 "2"–1 "3"–0 TS = 5	"1"–0 "2"–0 "3"–1 TS = 1	"1"–0 "2"–0 "3"–1 TS = 1	"1"–0 "2"–0 "3"–0 TS = 0
Masks – Decreased use of	"1"–0 "2"–0 "3"–3 TS = 3	"1"–1 "2"–0 "3"–1 TS = 4	"1"–0 "2"–0 "3"–1 TS = 1	"1"–0 "2"–0 "3"–1 TS = 1
Treatment Access – Increased access to current or future new COVID-19 medical treatments	"1"–4 "2"–6 "3"–4 TS = 28	"1"–4 "2"–5 "3"–5 TS = 27	"1"–6 "2"–6 "3"–2 TS = 32	"1"–5 "2"–7 "3"–1 TS = 30
Treatment Access – Decreased access to current or future new	"1"–0 "2"–0 "3"–0 TS = 0	"1"–0 "2"–0 "3"–0 TS = 0	"1"–0 "2"–0 "3"–0 TS = 0	"1"–0 "2"–0 "3"–0 TS = 0

COVID-19 medical treatments				
Population Health Status - Healthier population than pre-pandemic as older, less healthy individuals die from COVID-19	"1"–1 "2"–3 "3"–2 TS = 11	"1"–0 "2"–1 "3"–2 TS = 4	"1"–0 "2"–1 "3"–2 TS = 4	"1"–1 "2"–1 "3"–2 TS = 7
Population Health Status - Less healthy population than pre-pandemic due to long COVID and indirect COVID-19 impacts.	"1"–0 "2"–1 "3"–4 TS = 6	"1"–1 "2"–3 "3"–6 TS = 15	"1"–2 "2"–3 "3"–3 TS = 15	"1"–2 "2"–2 "3"–2 TS = 12
Treatment Deferral – Increased deferral of health care and treatment due to COVID-19	"1"–2 "2"–2 "3"–1 TS = 11	"1"–1 "2"–1 "3"–1 TS = 6	"1"–1 "2"–0 "3"–1 TS = 4	"1"–1 "2"–0 "3"–2 TS = 5
Treatment Deferral – Decreased deferral of health care and treatment due to COVID-19	"1"–0 "2"–1 "3"–1 TS = 3	"1"–0 "2"–2 "3"–0 TS = 4	"1"–0 "2"–1 "3"–1 TS = 3	"1"–0 "2"–1 "3"–1 TS = 3
Social distancing and isolation – Increased use of	"1"–0 "2"–0 "3"–0 TS = 0	"1"–0 "2"–0 "3"–0 TS = 0	"1"–0 "2"–0 "3"–1 TS = 1	"1"–0 "2"–0 "3"–1 TS = 1
Social distancing and isolation – Decreased use of	"1"–1 "2"–0 "3"–2 TS = 5	"1"–1 "2"–0 "3"–1 TS = 4	"1"–1 "2"–0 "3"–1 TS = 4	"1"–1 "2"–0 "3"–1 TS = 4
Immunity – Higher immunity due to vaccination, infection/reinfection	"1"–9 "2"–3 "3"–4 TS = 37	"1"–11 "2"–3 "3"–3 TS = 42	"1"–7 "2"–3 "3"–6 TS = 33	"1"–7 "2"–4 "3"–5 TS = 34
Immunity – Lower immunity due to vaccination, infection/reinfection	"1"–0 "2"–3 "3"–1 TS = 7	"1"–0 "2"–2 "3"–1 TS = 5	"1"–0 "2"–3 "3"–1 TS = 7	"1"–0 "2"–3 "3"–1 TS = 7
Virulence – Higher virulence of current or future COVID-19 strains/variants	"1"–7 "2"–1 "3"–0 TS = 23	"1"–5 "2"–1 "3"–0 TS = 17	"1"–5 "2"–0 "3"–1 TS = 16	"1"–5 "2"–0 "3"–1 TS = 16

Virulence – Lower virulence of current or future COVID-19 strains/variants	"1"–2 "2"–2 "3"–1 TS = 11	"1"–3 "2"–4 "3"–1 TS = 18	"1"–4 "2"–4 "3"–0 TS = 20	"1"–4 "2"–4 "3"–1 TS = 21

DRIVER SCORES FOR ALL-CAUSE EXCESS MORTALITY ESTIMATES WITH COVID-19 BY YEAR – OTHER PRACTITIONER TYPES

Drivers	Total Excess Mortality (Including COVID-19 Deaths) Estimates			
	2022	2023	2025	2030
Masks – Increased use of	"1"–1 "2"–0 "3"–0 TS = 3	"1"–0 "2"–0 "3"–0 TS = 0	"1"–0 "2"–0 "3"–0 TS = 0	"1"–0 "2"–0 "3"–0 TS = 0
Masks – Decreased use of	"1"–1 "2"–0 "3"–0 TS = 3	"1"–1 "2"–0 "3"–0 TS = 3	"1"–0 "2"–0 "3"–0 TS = 0	"1"–0 "2"–0 "3"–0 TS = 0
Treatment Access – Increased access to current or future new COVID-19 medical treatments	"1"–1 "2"–2 "3"–3 TS = 10	"1"–2 "2"–1 "3"–4 TS = 12	"1"–1 "2"–2 "3"–2 TS = 9	"1"–2 "2"–2 "3"–2 TS = 12
Treatment Access – Decreased access to current or future new COVID-19 medical treatments	"1"–0 "2"–0 "3"–0 TS = 0	"1"–0 "2"–0 "3"–0 TS = 0	"1"–0 "2"–0 "3"–0 TS = 0	"1"–0 "2"–0 "3"–0 TS = 0
Population Health Status - Healthier population than pre-pandemic as older, less healthy individuals die from COVID-19	"1"–0 "2"–0 "3"–0 TS = 0	"1"–0 "2"–0 "3"–0 TS = 0	"1"–1 "2"–1 "3"–0 TS = 5	"1"–2 "2"–1 "3"–0 TS = 8
Population Health Status - Less healthy population than pre-pandemic due to long COVID and indirect COVID-19 impacts.	"1"–2 "2"–2 "3"–3 TS = 13	"1"–3 "2"–4 "3"–2 TS = 19	"1"–3 "2"–2 "3"–1 TS = 14	"1"–3 "2"–1 "3"–1 TS = 12
Treatment Deferral – Increased deferral of health care and	"1"–1 "2"–0 "3"–1 TS = 4	"1"–1 "2"–0 "3"–0 TS = 3	"1"–0 "2"–0 "3"–0 TS = 0	"1"–0 "2"–0 "3"–0 TS = 0

treatment due to COVID-19				
Treatment Deferral – Decreased deferral of health care and treatment due to COVID-19	"1"–0 "2"–0 "3"–0 TS = 0	"1"–0 "2"–0 "3"–0 TS = 0	"1"–0 "2"–0 "3"–2 TS = 2	"1"–0 "2"–1 "3"–2 TS = 4
Social distancing and isolation – Increased use of	"1"–0 "2"–0 "3"–0 TS = 0	"1"–0 "2"–0 "3"–0 TS = 0	"1"–0 "2"–0 "3"–0 TS = 0	"1"–0 "2"–0 "3"–0 TS = 0
Social distancing and isolation – Decreased use of	"1"–0 "2"–0 "3"–1 TS = 1	"1"–0 "2"–0 "3"–1 TS = 1	"1"–0 "2"–0 "3"–1 TS = 1	"1"–0 "2"–0 "3"–1 TS = 1
Immunity – Higher immunity due to vaccination, infection/reinfection	"1"–4 "2"–2 "3"–0 TS = 16	"1"–4 "2"–3 "3"–1 TS = 19	"1"–3 "2"–3 "3"–1 TS = 16	"1"–2 "2"–4 "3"–1 TS = 15
Immunity – Lower immunity due to vaccination, infection/reinfection	"1"–0 "2"–2 "3"–0 TS = 4	"1"–0 "2"–1 "3"–1 TS = 3	"1"–0 "2"–2 "3"–0 TS = 4	"1"–0 "2"–1 "3"–1 TS = 3
Virulence – Higher virulence of current or future COVID-19 strains/variants	"1"–0 "2"–0 "3"–1 TS = 1	"1"–0 "2"–0 "3"–0 TS = 0	"1"–0 "2"–0 "3"–0 TS = 0	"1"–0 "2"–0 "3"–0 TS = 0
Virulence – Lower virulence of current or future COVID-19 strains/variants	"1"–0 "2"–3 "3"–0 TS = 6	"1"–0 "2"–3 "3"–0 TS = 6	"1"–1 "2"–1 "3"–2 TS = 7	"1"–1 "2"–1 "3"–1 TS = 7

1.b.1 Assuming 2019 mortality levels trended forward with mortality improvement or deterioration for future expected mortality, as described above. Please indicate the level of excess mortality from all causes **except those deaths directly attributed to COVID-19** that you expect for each of the years and ages listed below. Please express all numbers in decimal form. Here are three examples on how to respond:

From the **U.S. General Population excess mortality example provided** for ages 25-44, the level of excess for non-COVID-19 causes of deaths in 2020 in relation to 2020 expected mortality levels, is 19%.

- If you believe the level of excess mortality for age 25 will remain at the same level for 2022, as the U.S. General Population 25-44 historical information for 2020, code the 19% level as ".19".
- If you believe the excess mortality will be reduced, e.g., to a level of 15% excess mortality, code ".15".

- If you believe that excess mortality will go away and there will be additional mortality improvement of, for example 5%, express the 5% mortality improvement as a negative number, "-.05".

U.S. General Population

AVERAGE ALL-CAUSE EXCESS MORTALITY ESTIMATES WITHOUT COVID-19 AS A CAUSE OF DEATH BY POPULATION AND AGE

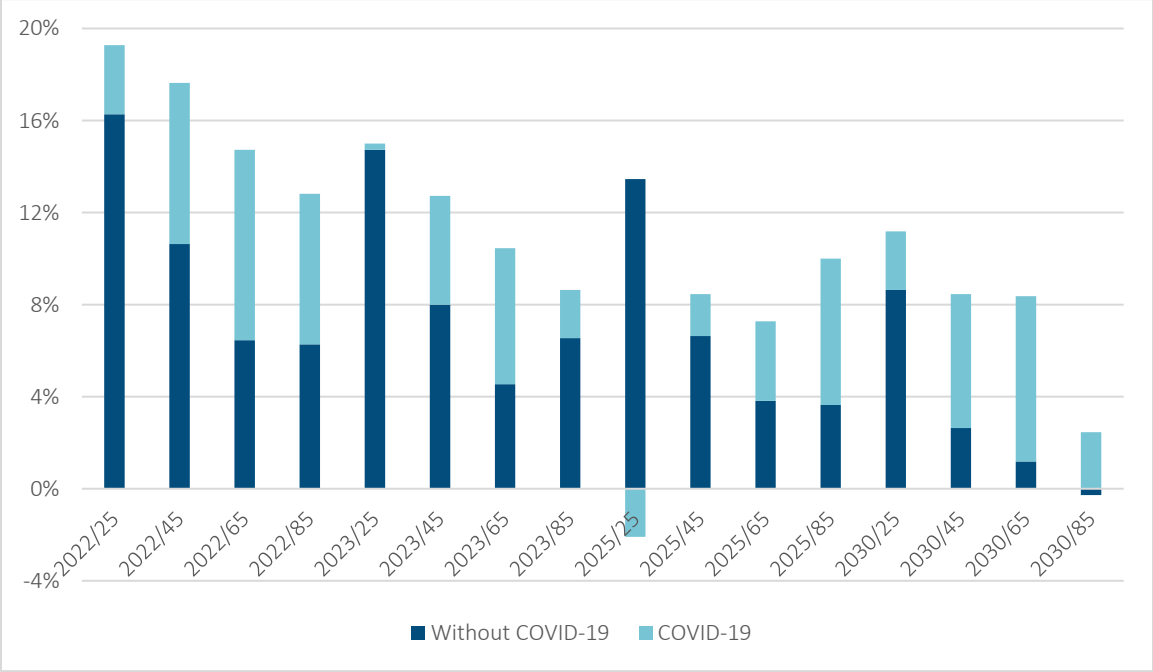
U.S. Population (No. of Responses)	Current Age	2022 (%)	2023 (%)	2025 (%)	2030 (%)
Total Respondents					
General (*N* = 34)	25	14	12	9	5
	45	10	7	6	3
	65	5	3	2	1
	85	5	4	3	1
Actuaries Only					
General (*N* = 24)	25	13	11	8	5
	45	10	7	5	2
	65	4	3	1	0
	85	4	3	2	0
Other Practitioner Types Only					
General (*N* = 10)	25	17	15	11	5
	45	9	8	7	5
	65	6	5	4	2
	85	7	8	4	2

AGGREGATION OF RESPONSES FOR TOTAL EXCESS MORTALITY WITHOUT COVID-19 AS A CAUSE OF DEATH U.S. GENERAL POPULATION

Total Excess Mortality without COVID-19 as a Cause of Death					
Current Age		2022	2023	2025	2030
25	Min	−1%	−1%	−1%	−10%
	Max	35%	35%	35%	35%
	Average	14%	12%	9%	5%
	Median	14%	10%	6%	2%
	25th percentile	7%	4%	1%	0%
	75th percentile	21%	20%	15%	6%
	No. of responses	34	34	34	34
45	Min	−1%	−1%	−1%	−8%
	Max	20%	20%	25%	20%
	Average	10%	7%	6%	3%
	Median	10%	5%	5%	1%
	25th percentile	5%	3%	0%	0%
	75th percentile	14%	12%	10%	5%
	No. of responses	34	34	34	34
65	Min	−2%	−2%	−2%	−6%
	Max	14%	12%	15%	10%

	Average	5%	3%	2%	1%
	Median	5%	3%	1%	0%
	25th percentile	2%	1%	0%	−1%
	75th percentile	7%	5%	4%	2%
	No. of responses	34	34	34	34
85	Min	−5%	−3%	−5%	−10%
	Max	20%	20%	20%	12%
	Average	5%	4%	3%	1%
	Median	3%	2%	0%	0%
	25th percentile	1%	0%	−0%	−2%
	75th percentile	9%	9%	4%	2%
	No. of responses	34	34	34	34

General population breakdown between expected excess deaths by year and age for COVID-19 and indirect causes (not specific to COVID-19).



1.b.2 What are the top 3 changes in future causes of death mortality, for each year listed, largely influencing your future total excess mortality **Without Deaths Directly Attributed To COVID-19** responses? "1" is the most influential change. In the table below, IMP stands for mortality improvement, and DET stands for mortality deterioration.

Change in Mortality from	2022		2023		2025		2030	
	IMP	DET	IMP	DET	IMP	DET	IMP	DET
Cardiovascular Disorders								
Cancer								
Alzheimer's and Other Dementias								
Accidents Excluding Drug Overdoses								
Drug Overdoses								
Flu/Pneumonia								
Other 1_____								
Other 2_____								
Other 3_____								

NUMBER OF RESPONSES PER MORTALITY CHANGE RANK OPTION AND TOTAL SCORES (TS) WITHOUT COVID-19 AS A CAUSE OF DEATH BY YEAR – ALL RESPONSES

Change in Mortality from	2022	2023	2025	2030
Cardiovascular Disorders Mortality Improvement	"1"–3 "2"–1 "3"–2 TS = 13	"1"–3 "2"–1 "3"–2 TS = 13	"1"–5 "2"–2 "3"–2 TS = 21	"1"–5 "2"–2 "3"–2 TS = 21
Cardiovascular Disorders Mortality Deterioration	"1"–12 "2"–5 "3"–4 TS = 50	"1"–15 "2"–4 "3"–4 TS = 57	"1"–13 "2"–4 "3"–4 TS = 51	"1"–11 "2"–6 "3"–2 TS = 47
Cancer Mortality Improvement	"1"–3 "2"–4 "3"–3 TS = 20	"1"–3 "2"–4 "3"–4 TS = 21	"1"–6 "2"–6 "3"–3 TS = 33	"1"–7 "2"–6 "3"–3 TS = 36
Cancer Mortality Deterioration	"1"–1 "2"–4 "3"–2 TS = 13	"1"–0 "2"–6 "3"–2 TS = 14	"1"–1 "2"–3 "3"–2 TS = 11	"1"–2 "2"–3 "3"–1 TS = 13
Alzheimer's and Other Dementias Mortality Improvement	"1"–0 "2"–1 "3"–1 TS = 3	"1"–0 "2"–1 "3"–1 TS = 3	"1"–0 "2"–2 "3"–2 TS = 6	"1"–0 "2"–2 "3"–3 TS = 7

Alzheimer's and Other Dementias Mortality Deterioration	"1"–0 "2"–6 "3"–4 TS = 16	"1"–1 "2"–4 "3"–4 TS = 15	"1"–1 "2"–5 "3"–3 TS = 16	"1"–1 "2"–5 "3"–3 TS = 16
Accidents Excluding Drug Overdoses Mortality Improvement	"1"–0 "2"–0 "3"–0 TS = 0	"1"–0 "2"–0 "3"–0 TS = 0	"1"–0 "2"–1 "3"–0 TS = 2	"1"–0 "2"–1 "3"–0 TS = 2
Accidents Excluding Drug Overdoses Mortality Deterioration	"1"–2 "2"–5 "3"–2 TS = 18	"1"–1 "2"–5 "3"–3 TS = 16	"1"–0 "2"–3 "3"–2 TS = 8	"1"–0 "2"–2 "3"–3 TS = 7
Drug Overdoses Mortality Improvement	"1"–0 "2"–0 "3"–3 TS = 3	"1"–0 "2"–0 "3"–4 TS = 4	"1"–1 "2"–2 "3"–3 TS = 10	"1"–1 "2"–2 "3"–5 TS = 12
Drug Overdoses Mortality Deterioration	"1"–13 "2"–3 "3"–6 TS = 51	"1"–10 "2"–5 "3"–6 TS = 46	"1"–7 "2"–2 "3"–9 TS = 34	"1"–7 "2"–2 "3"–8 TS = 33
Flu/Pneumonia Mortality Improvement	"1"–0 "2"–2 "3"–1 TS = 5	"1"–1 "2"–1 "3"–1 TS = 6	"1"–1 "2"–1 "3"–1 TS = 6	"1"–1 "2"–2 "3"–1 TS = 8
Flu/Pneumonia Mortality Deterioration	"1"–1 "2"–1 "3"–2 TS = 7	"1"–2 "2"–1 "3"–1 TS = 9	"1"–1 "2"–2 "3"–1 TS = 8	"1"–1 "2"–0 "3"–1 TS = 4

NUMBER OF RESPONSES PER MORTALITY CHANGE RANK OPTION AND TOTAL SCORES (TS) WITHOUT COVID-19 AS A CAUSE OF DEATH BY YEAR – ACTUARIES

Change in Mortality from	2022	2023	2025	2030
Cardiovascular Disorders Mortality Improvement	"1"–2 "2"–1 "3"–1 TS = 9	"1"–2 "2"–1 "3"–1 TS = 9	"1"–4 "2"–1 "3"–1 TS = 15	"1"–4 "2"–1 "3"–1 TS = 15
Cardiovascular Disorders Mortality Deterioration	"1"–8 "2"–3 "3"–4 TS = 34	"1"–10 "2"–2 "3"–4 TS = 38	"1"–9 "2"–2 "3"–3 TS = 34	"1"–8 "2"–3 "3"–2 TS = 32
Cancer Mortality Improvement	"1"–2 "2"–4 "3"–1 TS = 15	"1"–2 "2"–4 "3"–2 TS = 16	"1"–3 "2"–5 "3"–1 TS = 20	"1"–3 "2"–5 "3"–1 TS = 20
Cancer Mortality Deterioration	"1"–1 "2"–3 "3"–1 TS = 10	"1"–0 "2"–4 "3"–1 TS = 9	"1"–1 "2"–2 "3"–1 TS = 8	"1"–2 "2"–2 "3"–0 TS = 10
Alzheimer's and Other Dementias Mortality Improvement	"1"–0 "2"–1 "3"–1 TS = 3	"1"–0 "2"–1 "3"–1 TS = 3	"1"–0 "2"–2 "3"–1 TS = 5	"1"–0 "2"–2 "3"–1 TS = 5
Alzheimer's and Other Dementias Mortality Deterioration	"1"–0 "2"–3 "3"–3	"1"–1 "2"–2 "3"–2	"1"–1 "2"–4 "3"–1	"1"–1 "2"–4 "3"–2

	TS = 9	TS = 9	TS = 12	TS = 13
Accidents Excluding Drug Overdoses Mortality Improvement	"1"–0 "2"–0 "3"–0 TS = 0	"1"–0 "2"–0 "3"–0 TS = 0	"1"–0 "2"–0 "3"–0 TS = 0	"1"–0 "2"–0 "3"–0 TS = 0
Accidents Excluding Drug Overdoses Mortality Deterioration	"1"–2 "2"–4 "3"–1 TS = 15	"1"–1 "2"–4 "3"–2 TS = 13	"1"–0 "2"–3 "3"–1 TS = 7	"1"–0 "2"–2 "3"–2 TS = 6
Drug Overdoses Mortality Improvement	"1"–0 "2"–0 "3"–2 TS = 2	"1"–0 "2"–0 "3"–2 TS = 2	"1"–0 "2"–0 "3"–2 TS = 2	"1"–0 "2"–0 "3"–4 TS = 4
Drug Overdoses Mortality Deterioration	"1"–10 "2"–2 "3"–5 TS = 39	"1"–7 "2"–4 "3"–5 TS = 34	"1"–5 "2"–1 "3"–8 TS = 25	"1"–5 "2"–2 "3"–6 TS = 25
Flu/Pneumonia Mortality Improvement	"1"–0 "2"–2 "3"–1 TS = 5	"1"–1 "2"–1 "3"–1 TS = 6	"1"–1 "2"–1 "3"–1 TS = 6	"1"–1 "2"–1 "3"–1 TS = 6
Flu/Pneumonia Mortality Deterioration	"1"–1 "2"–0 "3"–1 TS = 4	"1"–2 "2"–0 "3"–1 TS = 7	"1"–1 "2"–1 "3"–1 TS = 6	"1"–1 "2"–0 "3"–1 TS = 4

NUMBER OF RESPONSES PER MORTALITY CHANGE RANK OPTION AND TOTAL SCORES (TS) WITHOUT COVID-19 AS A CAUSE OF DEATH BY YEAR – OTHER PRACTITIONER TYPES

Change in Mortality from	2022	2023	2025	2030
Cardiovascular Disorders Mortality Improvement	"1"–0 "2"–0 "3"–1 TS = 1	"1"–0 "2"–0 "3"–1 TS = 1	"1"–0 "2"–0 "3"–2 TS =2	"1"–0 "2"–0 "3"–2 TS =2
Cardiovascular Disorders Mortality Deterioration	"1"–2 "2"–1 "3"–1 TS = 9	"1"–2 "2"–1 "3"–2 TS = 10	"1"–2 "2"–1 "3"–1 TS = 9	"1"–1 "2"–1 "3"–1 TS = 6
Cancer Mortality Improvement	"1"–1 "2"–0 "3"–0 TS = 3	"1"–1 "2"–1 "3"–0 TS = 5	"1"–1 "2"–1 "3"–1 TS = 6	"1"–2 "2"–1 "3"–0 TS = 8
Cancer Mortality Deterioration	"1"–0 "2"–1 "3"–0 TS = 2	"1"–0 "2"–1 "3"–0 TS = 2	"1"–0 "2"–1 "3"–0 TS = 2	"1"–0 "2"–1 "3"–0 TS = 2
Alzheimer's and Other Dementias Mortality Improvement	"1"–0 "2"–0 "3"–0 TS = 0	"1"–0 "2"–0 "3"–0 TS = 0	"1"–1 "2"–0 "3"–0 TS = 3	"1"–1 "2"–0 "3"–1 TS = 4
Alzheimer's and Other Dementias Mortality Deterioration	"1"–0 "2"–3 "3"–0 TS = 6	"1"–0 "2"–3 "3"–0 TS = 6	"1"–1 "2"–1 "3"–0 TS = 5	"1"–1 "2"–1 "3"–0 TS = 5

Accidents Excluding Drug Overdoses Mortality Improvement	"1"–0 "2"–0 "3"–1 TS = 1	"1"–0 "2"–0 "3"–2 TS = 2	"1"–1 "2"–0 "3"–1 TS = 4	"1"–1 "2"–0 "3"–1 TS = 4
Accidents Excluding Drug Overdoses Mortality Deterioration	"1"–1 "2"–0 "3"–0 TS = 3	"1"–1 "2"–0 "3"–0 TS = 3	"1"–0 "2"–0 "3"–0 TS = 0	"1"–0 "2"–0 "3"–0 TS = 0
Drug Overdoses Mortality Improvement	"1"–0 "2"–0 "3"–0 TS = 0	"1"–0 "2"–0 "3"–0 TS = 0	"1"–0 "2"–1 "3"–0 TS = 2	"1"–0 "2"–1 "3"–0 TS = 2
Drug Overdoses Mortality Deterioration	"1"–1 "2"–0 "3"–1 TS = 4	"1"–2 "2"–0 "3"–1 TS = 7	"1"–1 "2"–0 "3"–1 TS = 4	"1"–1 "2"–0 "3"–1 TS = 4
Flu/Pneumonia Mortality Improvement	"1"–0 "2"–0 "3"–0 TS = 0	"1"–0 "2"–0 "3"–0 TS = 0	"1"–0 "2"–0 "3"–0 TS = 0	"1"–0 "2"–0 "3"–0 TS = 0
Flu/Pneumonia Mortality Deterioration	"1"–0 "2"–0 "3"–0 TS = 0	"1"–0 "2"–0 "3"–0 TS = 0	"1"–0 "2"–0 "3"–0 TS = 0	"1"–0 "2"–0 "3"–0 TS = 0

Additional option listed was GI/Liver disease.

1.c In your opinion, what are the best resources for monitoring COVID-19's impact on Mortality? (Please select all that apply.)

- Academic research institutions
- Consulting/insurer/reinsurer
- News media produced
- Peer-reviewed journals
- SOA Research Institute
- Other actuarial organizations
- U.S. governmental agencies
- World Health Organization
- Other _____

36 responses

Best Resources for Monitoring COVID-19's Impact on Mortality	Number	Percentage
Academic research institutions	20	56%
Consulting/insurer/reinsurer	11	31%
News media produced	0	0%
Peer-reviewed journals	14	39%
SOA Research Institute	24	67%
Other actuarial organizations	5	14%
U.S. governmental agencies	27	75%
World Health Organization	12	33%

Other resources:

- Human Mortality Database STMF toolkit
- European government studies

1.d Additional comments about future excess mortality: _____

- *Not all deferral of care is COVID-19-related, excessive consolidation of some health care delivery systems has aggravated provider shortages. That cycle is likely to continue in the short run, but hopefully the pendulum will swing the other way within five years. In the meantime, patients are at greater risk of cancer deaths due to later diagnoses.*
- *It will be a few years before its effects are reflected statistically, but the increasing availability of narcan and its cousins will eventually begin to mitigate the death rate from drug overdoses somewhat.*
- *COVID-19 deaths should decline substantially in the next few years if the newest variants are any clue.*
- *In most European countries mortality now is below 2019 level and continues to improve. In the U.S. overdose epidemic and other mostly social causes do not allow mortality to follow the European example.*
- *I think the pandemic has further widened the mortality improvement gap between the highest and lowest socioeconomic groups. I think mortality improvement for the general population will struggle to recover to pre-pandemic levels as a whole, but when divided by socioeconomic levels, the highest levels will eventually recover and see mortality improvement again while the lowest levels may never recover.*
- *The UK actuarial organizations do a pretty good job with the CMI (continuous mortality investigation), which is done in conjunction w/ the UK government.*
- *I expect long COVID to have higher mortality that slowly grades off. I'm also worried about lockdown impact—deaths of despair (not just drugs)—socioeconomic status may matter as much as age—homicides/suicides*

2. U.S. LIFE INSURANCE INDUSTRY INSURED POPULATION MORTALITY

The following questions relate to **U.S. Life Insurance Industry Insured Population** mortality.

2.a.1 Assuming 2019 mortality levels trended forward such as with mortality improvement or deterioration for future expected mortality, please indicate the total level of excess mortality you expect from all causes **including COVID-19 deaths** for each of the years and ages listed below. Please express all numbers in decimal form. Here are three examples on how to respond (consistent with General Population instructions):

No historical U.S. life insurance industry insured population mortality information is provided. In this example U.S. individual life insurance industry historical mortality with COVID-19 information is used. From the **U.S. individual life insurance industry historical information provided**, (**Link to historical information and excess mortality examples)** for ages 25-44, the level of excess in 2020 in relation to 2020 expected mortality levels, is 11%.

- If you believe the U.S. life insurance industry insured population level of excess mortality, for age 25, will remain at the same level for 2022 as the U.S. individual life insurance industry 25-44 historical information for 2020, code the 11% level as ".11".
- If you believe the excess mortality will be reduced, e.g., to a level of 10% excess mortality, code ".10".
- If you believe that excess mortality will go away and there will be additional mortality improvement of, for example 5%, express the 5% mortality improvement as a negative number, "-.05".

U.S. LIFE INSURANCE INDUSTRY INSURED POPULATION MORTALITY

AVERAGE ALL-CAUSE EXCESS MORTALITY ESTIMATES WITH COVID-19 BY POPULATION AND AGE

U.S. Population (No. of Responses)	Current Age	2022 (%)	2023 (%)	2025 (%)	2030 (%)
Total Respondents					
Life Insurance Industry Insured (*N* = 14)	25	10	7	5	3
	45	11	8	6	4
	65	10	7	5	3
	85	7	5	3	2
Actuaries Only					
Life Insurance Industry Insured (*N* = 9)	25	10	7	4	2
	45	11	7	4	2
	65	10	6	4	2
	85	7	5	3	1
Other Practitioner Types Only					
Life Insurance Industry Insured (*N* = 5)	25	10	8	7	5
	45	12	11	9	6
	65	9	9	7	5
	85	7	7	5	4

AGGREGATION OF RESPONSES FOR TOTAL EXCESS MORTALITY WITH COVID-19 U.S. LIFE INSURANCE INDUSTRY INSURED POPULATION

Current Age		Total Excess Mortality with COVID-19			
		2022	2023	2025	2030
25	Min	1%	−1%	−1%	−1%
	Max	20%	18%	15%	12%
	Average	10%	7%	5%	3%
	Median	10%	5%	3%	1%
	25th percentile	6%	3%	0%	0%
	75th percentile	15%	12%	11%	10%
	No. of responses	14	14	14	14
45	Min	1%	−2%	−2%	−3%
	Max	23%	23%	20%	18%
	Average	11%	8%	6%	4%
	Median	10%	6%	4%	1%
	25th percentile	7%	3%	0%	0%
	75th percentile	15%	15%	13%	9%
	No. of responses	14	14	14	14
65	Min	2%	−2%	−3%	−6%
	Max	18%	18%	15%	15%
	Average	10%	7%	5%	3%
	Median	10%	5%	2%	1%
	25th percentile	5%	2%	0%	−1%
	75th percentile	15%	14%	13%	9%
	No. of responses	14	14	14	14
85	Min	0%	−2%	−3%	−6%
	Max	14%	15%	14%	14%
	Average	7%	5%	3%	2%
	Median	8%	5%	2%	1%
	25th percentile	3%	2%	0%	−1%
	75th percentile	11%	11%	6%	4%
	No. of responses	14	14	14	14

2.a.2 What are the top 3 COVID-19 drivers, for each year listed, influencing your future total excess mortality **Including COVID-19 Deaths estimates**? "1" is the most influential driver.

DRIVER SCORES FOR ALL-CAUSE EXCESS MORTALITY ESTIMATES WITH COVID-19 BY YEAR – ALL RESPONSES

Drivers	Total Excess Mortality (Including COVID-19 Deaths) Estimates			
	2022	2023	2025	2030
Masks – Increased use of	"1"–0 "2"–0 "3"–0 TS = 0	"1"–0 "2"–0 "3"–0 TS = 0	"1"–0 "2"–0 "3"–0 TS = 0	"1"–0 "2"–0 "3"–0 TS = 0
Masks – Decreased use of	"1"–0 "2"–0 "3"–0 TS = 0	"1"–0 "2"–0 "3"–0 TS = 0	"1"–0 "2"–0 "3"–0 TS = 0	"1"–0 "2"–0 "3"–0 TS = 0
Treatment Access – Increased access to current or future new COVID-19 medical treatments	"1"–1 "2"–2 "3"–4 TS = 11	"1"–2 "2"–1 "3"–5 TS = 13	"1"–2 "2"–2 "3"–4 TS = 14	"1"–3 "2"–3 "3"–3 TS = 18
Treatment Access – Decreased access to current or future new COVID-19 medical treatments	"1"–0 "2"–0 "3"–0 TS = 0	"1"–0 "2"–0 "3"–0 TS = 0	"1"–0 "2"–0 "3"–0 TS = 0	"1"–0 "2"–0 "3"–0 TS = 0
Population Health Status - Healthier population than pre-pandemic as older, less healthy individuals die from COVID-19	"1"–1 "2"–1 "3"–1 TS = 6	"1"–0 "2"–2 "3"–0 TS = 4	"1"–1 "2"–0 "3"–1 TS = 4	"1"–1 "2"–0 "3"–1 TS = 4
Population Health Status - Less healthy population than pre-pandemic due to long COVID and indirect COVID-19 impacts.	"1"–1 "2"–1 "3"–2 TS =7	"1"–1 "2"–1 "3"–1 TS = 6	"1"–2 "2"–1 "3"–0 TS = 8	"1"–1 "2"–2 "3"–0 TS = 7
Treatment Deferral – Increased deferral of health care and treatment due to COVID-19	"1"–1 "2"–2 "3"–1 TS = 8	"1"–1 "2"–1 "3"–1 TS = 6	"1"–0 "2"–0 "3"–0 TS = 0	"1"–0 "2"–0 "3"–0 TS = 0

Treatment Deferral – Decreased deferral of health care and treatment due to COVID-19	"1"–0 "2"–0 "3"–0 TS = 0	"1"–0 "2"–1 "3"–0 TS = 2	"1"–0 "2"–2 "3"–2 TS = 6	"1"–0 "2"–1 "3"–2 TS = 4
Social distancing and isolation – Increased use of	"1"–0 "2"–0 "3"–0 TS = 0	"1"–0 "2"–0 "3"–0 TS = 0	"1"–0 "2"–0 "3"–0 TS = 0	"1"–0 "2"–0 "3"–0 TS = 0
Social distancing and isolation – Decreased use of	"1"–1 "2"–0 "3"–1 TS = 4	"1"–1 "2"–0 "3"–1 TS = 4	"1"–1 "2"–0 "3"–1 TS = 4	"1"–1 "2"–0 "3"–1 TS = 4
Immunity – Higher immunity due to vaccination, infection/reinfection	"1"–6 "2"–2 "3"–2 TS = 24	"1"–6 "2"–3 "3"–2 TS = 26	"1"–6 "2"–4 "3"–1 TS = 27	"1"–5 "2"–4 "3"–2 TS = 25
Immunity – Lower immunity due to vaccination, infection/reinfection	"1"–0 "2"–2 "3"–1 TS = 5	"1"–0 "2"–1 "3"–1 TS = 3	"1"–0 "2"–1 "3"–1 TS = 3	"1"–0 "2"–1 "3"–1 TS = 3
Virulence – Higher virulence of current or future COVID-19 strains/variants	"1"–1 "2"–1 "3"–1 TS = 6	"1"–1 "2"–1 "3"–1 TS = 6	"1"–1 "2"–0 "3"–3 TS = 6	"1"–1 "2"–0 "3"–3 TS = 6
Virulence – Lower virulence of current or future COVID-19 strains/variants	"1"–2 "2"–2 "3"–0 TS = 10	"1"–2 "2"–2 "3"–1 TS = 11	"1"–2 "2"–3 "3"–0 TS = 12	"1"–3 "2"–2 "3"–0 TS = 13

DRIVER SCORES FOR ALL-CAUSE EXCESS MORTALITY ESTIMATES WITH COVID-19 BY YEAR – ACTUARIES ONLY

Drivers	Total Excess Mortality (Including COVID-19 Deaths) Estimates			
	2022	2023	2025	2030
Masks – Increased use of	"1"–0 "2"–0 "3"–0 TS = 0	"1"–0 "2"–0 "3"–0 TS = 0	"1"–0 "2"–0 "3"–0 TS = 0	"1"–0 "2"–0 "3"–0 TS = 0
Masks – Decreased use of	"1"–0 "2"–0 "3"–0	"1"–0 "2"–0 "3"–0	"1"–0 "2"–0 "3"–0	"1"–0 "2"–0 "3"–0

	TS = 0	TS = 0	TS = 0	TS = 0
Treatment Access – Increased access to current or future new COVID-19 medical treatments	"1"–1 "2"–1 "3"–3 TS = 8	"1"–1 "2"–1 "3"–3 TS = 8	"1"–2 "2"–2 "3"–2 TS = 12	"1"–2 "2"–3 "3"–1 TS = 13
Treatment Access – Decreased access to current or future new COVID-19 medical treatments	"1"–0 "2"–0 "3"–0 TS = 0	"1"–0 "2"–0 "3"–0 TS = 0	"1"–0 "2"–0 "3"–0 TS = 0	"1"–0 "2"–0 "3"–0 TS = 0
Population Health Status - Healthier population than pre-pandemic as older, less healthy individuals die from COVID-19	"1"–1 "2"–1 "3"–0 TS = 5	"1"–0 "2"–1 "3"–0 TS = 2	"1"–0 "2"–0 "3"–0 TS = 0	"1"–0 "2"–0 "3"–0 TS = 0
Population Health Status - Less healthy population than pre-pandemic due to long COVID and indirect COVID-19 impacts.	"1"–0 "2"–1 "3"–0 TS =2	"1"–0 "2"–1 "3"–0 TS =2	"1"–0 "2"–1 "3"–0 TS =2	"1"–0 "2"–1 "3"–0 TS =2
Treatment Deferral – Increased deferral of health care and treatment due to COVID-19	"1"–0 "2"–1 "3"–1 TS = 3	"1"–1 "2"–0 "3"–1 TS = 4	"1"–0 "2"–0 "3"–0 TS = 0	"1"–0 "2"–0 "3"–0 TS = 0
Treatment Deferral – Decreased deferral of health care and treatment due to COVID-19	"1"–0 "2"–0 "3"–0 TS = 0	"1"–0 "2"–0 "3"–0 TS = 0	"1"–0 "2"–0 "3"–2 TS = 2	"1"–0 "2"–0 "3"–2 TS = 2
Social distancing and isolation – Increased use of	"1"–0 "2"–0 "3"–0 TS = 0	"1"–0 "2"–0 "3"–0 TS = 0	"1"–0 "2"–0 "3"–0 TS = 0	"1"–0 "2"–0 "3"–0 TS = 0
Social distancing and isolation – Decreased use of	"1"–1 "2"–0 "3"–0 TS = 3	"1"–1 "2"–0 "3"–0 TS = 3	"1"–1 "2"–0 "3"–0 TS = 3	"1"–1 "2"–0 "3"–0 TS = 3
Immunity – Higher immunity due to	"1"–4 "2"–2 "3"–2	"1"–4 "2"–3 "3"–1	"1"–4 "2"–3 "3"–1	"1"–3 "2"–3 "3"–2

vaccination, infection/reinfection	TS = 18	TS = 19	TS = 19	TS = 17
Immunity – Lower immunity due to vaccination, infection/reinfection	"1"–0 "2"–0 "3"–1 TS = 1	"1"–0 "2"–0 "3"–1 TS = 1	"1"–0 "2"–0 "3"–1 TS = 1	"1"–0 "2"–0 "3"–1 TS = 1
Virulence – Higher virulence of current or future COVID-19 strains/variants	"1"–1 "2"–1 "3"–1 TS = 6	"1"–1 "2"–1 "3"–1 TS = 6	"1"–1 "2"–0 "3"–2 TS = 5	"1"–1 "2"–0 "3"–2 TS = 5
Virulence – Lower virulence of current or future COVID-19 strains/variants	"1"–2 "2"–1 "3"–0 TS = 8	"1"–2 "2"–1 "3"–1 TS = 9	"1"–2 "2"–2 "3"–0 TS = 10	"1"–3 "2"–1 "3"–0 TS = 11

DRIVER SCORES FOR ALL-CAUSE EXCESS MORTALITY ESTIMATES WITH COVID-19 BY YEAR – OTHER TYPES OF PRACTITIONERS

Drivers	Total Excess Mortality (Including COVID-19 Deaths) Estimates			
	2022	2023	2025	2030
Masks – Increased use of	"1"–0 "2"–0 "3"–0 TS = 0	"1"–0 "2"–0 "3"–0 TS = 0	"1"–0 "2"–0 "3"–0 TS = 0	"1"–0 "2"–0 "3"–0 TS = 0
Masks – Decreased use of	"1"–0 "2"–0 "3"–0 TS = 0	"1"–0 "2"–0 "3"–0 TS = 0	"1"–0 "2"–0 "3"–0 TS = 0	"1"–0 "2"–0 "3"–0 TS = 0
Treatment Access – Increased access to current or future new COVID-19 medical treatments	"1"–0 "2"–1 "3"–1 TS = 3	"1"–1 "2"–0 "3"–2 TS = 5	"1"–0 "2"–0 "3"–2 TS = 2	"1"–1 "2"–0 "3"–2 TS = 5
Treatment Access – Decreased access to current or future new COVID-19 medical treatments	"1"–0 "2"–0 "3"–0 TS = 0	"1"–0 "2"–0 "3"–0 TS = 0	"1"–0 "2"–0 "3"–0 TS = 0	"1"–0 "2"–0 "3"–0 TS = 0
Population Health Status - Healthier population than pre-pandemic as older, less healthy	"1"–0 "2"–0 "3"–1 TS = 1	"1"–0 "2"–1 "3"–0 TS = 2	"1"–1 "2"–0 "3"–1 TS = 4	"1"–1 "2"–0 "3"–1 TS = 4

individuals die from COVID-19				
Population Health Status - Less healthy population than pre-pandemic due to long COVID and indirect COVID-19 impacts.	"1"–1 "2"–0 "3"–2 TS =5	"1"–1 "2"–0 "3"–1 TS = 4	"1"–2 "2"–0 "3"–0 TS = 6	"1"–1 "2"–1 "3"–0 TS = 5
Treatment Deferral – Increased deferral of health care and treatment due to COVID-19	"1"–1 "2"–1 "3"–0 TS = 5	"1"–0 "2"–1 "3"–0 TS = 2	"1"–0 "2"–0 "3"–0 TS = 0	"1"–0 "2"–0 "3"–0 TS = 0
Treatment Deferral – Decreased deferral of health care and treatment due to COVID-19	"1"–0 "2"–0 "3"–0 TS = 0	"1"–0 "2"–1 "3"–0 TS = 2	"1"–0 "2"–2 "3"–0 TS = 4	"1"–0 "2"–1 "3"–0 TS = 2
Social distancing and isolation – Increased use of	"1"–0 "2"–0 "3"–0 TS = 0	"1"–0 "2"–0 "3"–0 TS = 0	"1"–0 "2"–0 "3"–0 TS = 0	"1"–0 "2"–0 "3"–0 TS = 0
Social distancing and isolation – Decreased use of	"1"–0 "2"–0 "3"–1 TS = 1	"1"–0 "2"–0 "3"–1 TS = 1	"1"–0 "2"–0 "3"–1 TS = 1	"1"–0 "2"–0 "3"–1 TS = 1
Immunity – Higher immunity due to vaccination, infection/reinfection	"1"–2 "2"–0 "3"–0 TS = 6	"1"–2 "2"–0 "3"–1 TS = 7	"1"–2 "2"–1 "3"–0 TS = 8	"1"–2 "2"–1 "3"–0 TS = 8
Immunity – Lower immunity due to vaccination, infection/reinfection	"1"–0 "2"–2 "3"–0 TS = 4	"1"–0 "2"–1 "3"–0 TS = 2	"1"–0 "2"–1 "3"–0 TS = 2	"1"–0 "2"–1 "3"–0 TS = 2
Virulence – Higher virulence of current or future COVID-19 strains/variants	"1"–0 "2"–0 "3"–0 TS = 0	"1"–0 "2"–0 "3"–0 TS = 0	"1"–0 "2"–0 "3"–1 TS = 1	"1"–0 "2"–0 "3"–1 TS = 1
Virulence – Lower virulence of current or future COVID-19 strains/variants	"1"–0 "2"–1 "3"–0 TS = 2	"1"–0 "2"–1 "3"–0 TS = 2	"1"–0 "2"–1 "3"–0 TS = 2	"1"–0 "2"–1 "3"–0 TS = 2

2.b.1 Assuming 2019 mortality levels trended forward such as with mortality improvement or deterioration for future expected mortality, please indicate the level of excess mortality from all causes except those deaths directly attributed to COVID-19 that you expect for each of the years and ages listed below. Please express all numbers in decimal form. Here are three examples on how to respond (consistent with General Population instructions):

No historical U.S. life insurance industry insured population mortality information is provided. In this example, the U.S. General Population excess mortality example provided, for age 25-44, the level of excess mortality for non-COVID-19 causes of death in 2020 in relation to 2020 expected mortality levels, is 19%.

- If you believe the U.S. life insurance industry insured population level of excess mortality, for age 25, will remain at the same level for 2022 as the U.S. individual life insurance industry 25-44 historical information for 2020, code the 19% level as ".19".
- If you believe the excess mortality will be reduced, e.g., to a level of 15% excess mortality, code ".15".
- If you believe that excess mortality will go away and there will be additional mortality improvement of, for example 5%, express the 5% mortality improvement as a negative number, "-.05".

U.S. LIFE INSURANCE INDUSTRY INSURED POPULATION MORTALITY

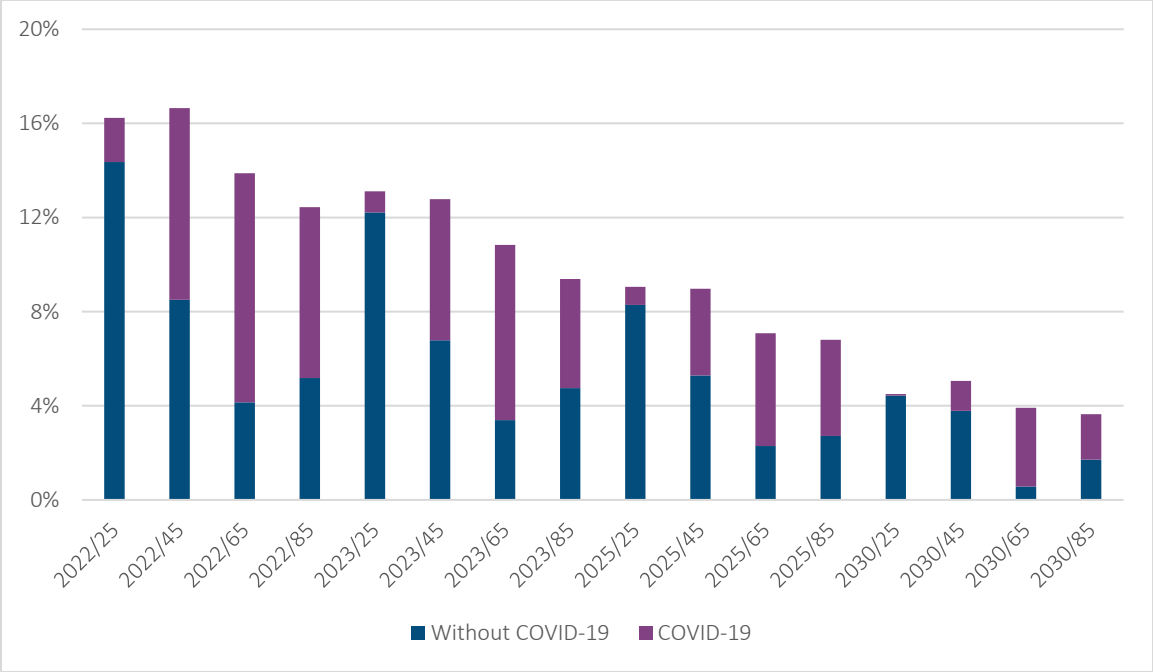
AVERAGE ALL-CAUSE EXCESS MORTALITY ESTIMATES WITHOUT COVID-19 AS A CAUSE OF DEATH BY POPULATION AND AGE

U.S. Population (No. of Responses)	Current Age	2022 (%)	2023 (%)	2025 (%)	2030 (%)
Total Respondents					
Life Insurance Industry Insured (*N* = 14)	25	8	6	4	3
	45	7	6	4	2
	65	5	3	2	0
	85	4	3	2	0
Actuaries Only					
Life Insurance Industry Insured (*N* = 9)	25	8	5	4	3
	45	7	4	3	2
	65	5	3	2	0
	85	4	2	1	–1
Other Practitioner Types Only					
Life Insurance Industry Insured (*N* = 5)	25	8	7	5	3
	45	8	8	6	3
	65	5	4	3	1
	85	5	5	4	2

AGGREGATION OF RESPONSES FOR TOTAL EXCESS MORTALITY WITHOUT COVID-19 AS A CAUSE OF DEATH U.S. LIFE INSURANCE INDUSTRY INSURED POPULATION

Total Excess Mortality without COVID-19 as a Cause of Death					
Current Age		**2022**	**2023**	**2025**	**2030**
25	Min	1%	−2%	−1%	−1%
	Max	20%	19%	18%	18%
	Average	8%	6%	4%	3%
	Median	6%	4%	2%	1%
	25th percentile	3%	2%	0%	−1%
	75th percentile	13%	10%	7%	4%
	No. of responses	14	14	14	14
45	Min	1%	−3%	−2%	−3%
	Max	15%	17%	15%	11%
	Average	7%	6%	4%	2%
	Median	6%	5%	1%	1%
	25th percentile	3%	2%	1%	−1%
	75th percentile	11%	11%	10%	4%
	No. of responses	14	14	14	14
65	Min	0%	−3%	−3%	−6%
	Max	16%	14%	12%	9%
	Average	5%	3%	2%	0%
	Median	4%	2%	1%	−1%
	25th percentile	2%	1%	−0%	−2%
	75th percentile	6%	5%	3%	3%
	No. of responses	14	14	14	14
85	Min	−1%	−3%	−3%	−6%
	Max	14%	15%	14%	14%
	Average	4%	3%	2%	0%
	Median	3%	2%	1%	0%
	25th percentile	1%	0%	−1%	−4%
	75th percentile	6%	5%	2%	2%
	No. of responses	14	14	14	14

Life product breakdown between expected excess deaths by year and age for COVID-19 and indirect causes (not specific to COVID-19).



2.b.2 What are the top 3 changes in future causes of death mortality, for each year listed, largely influencing your future total excess mortality **Without Deaths Directly Attributed to COVID-19** responses? "1" is the most influential change. In the table below, IMP stands for mortality improvement, and DET stands for mortality deterioration.

Change in Mortality from	2022		2023		2025		2030	
	IMP	DET	IMP	DET	IMP	DET	IMP	DET
Cardiovascular Disorders								
Cancer								
Alzheimer's and Other Dementias								
Accidents Excluding Drug Overdoses								
Drug Overdoses								
Flu/Pneumonia								
Other 1_____								
Other 2_____								

Other 3_____								

NUMBER OF RESPONSES PER MORTALITY CHANGE RANK OPTION AND TOTAL SCORES (TS) – ALL RESPONDENTS

Change in Mortality from	2022	2023	2025	2030
Cardiovascular Disorders Mortality Improvement	"1"–1 "2"–0 "3"–1 TS = 4	"1"–1 "2"–0 "3"–1 TS = 4	"1"–1 "2"–0 "3"–2 TS = 5	"1"–1 "2"–2 "3"–2 TS = 9
Cardiovascular Disorders Mortality Deterioration	"1"–7 "2"–2 "3"–3 TS = 28	"1"–7 "2"–2 "3"–4 TS = 29	"1"–6 "2"–3 "3"–2 TS = 26	"1"–4 "2"–2 "3"–2 TS = 18
Cancer Mortality Improvement	"1"–2 "2"–0 "3"–2 TS = 8	"1"–2 "2"–1 "3"–2 TS = 10	"1"–3 "2"–1 "3"–3 TS = 14	"1"–6 "2"–1 "3"–2 TS = 22
Cancer Mortality Deterioration	"1"–1 "2"–4 "3"–0 TS = 11	"1"–1 "2"–4 "3"–0 TS = 11	"1"–2 "2"–3 "3"–0 TS = 12	"1"–1 "2"–2 "3"–0 TS = 7
Alzheimer's and Other Dementias Mortality Improvement	"1"–0 "2"–0 "3"–0 TS = 0	"1"–0 "2"–0 "3"–0 TS = 0	"1"–1 "2"–1 "3"–0 TS = 5	"1"–1 "2"–1 "3"–3 TS = 8
Alzheimer's and Other Dementias Mortality Deterioration	"1"–0 "2"–5 "3"–2 TS = 12	"1"–0 "2"–5 "3"–2 TS = 12	"1"–1 "2"–3 "3"–2 TS = 11	"1"–1 "2"–3 "3"–1 TS = 10
Accidents Excluding Drug Overdoses Mortality Improvement	"1"–0 "2"–0 "3"–1 TS = 1	"1"–0 "2"–0 "3"–2 TS = 2	"1"–1 "2"–0 "3"–1 TS = 4	"1"–1 "2"–0 "3"–1 TS = 4
Accidents Excluding Drug Overdoses Mortality Deterioration	"1"–3 "2"–0 "3"–1 TS = 10	"1"–3 "2"–0 "3"–1 TS = 10	"1"–0 "2"–1 "3"–1 TS =3	"1"–0 "2"–1 "3"–0 TS =2
Drug Overdoses Mortality Improvement	"1"–0 "2"–0 "3"–0 TS = 0	"1"–0 "2"–0 "3"–0 TS = 0	"1"–0 "2"–1 "3"–0 TS = 2	"1"–0 "2"–1 "3"–0 TS = 2
Drug Overdoses Mortality Deterioration	"1"–2 "2"–2 "3"–1 TS = 11	"1"–3 "2"–2 "3"–1 TS = 14	"1"–2 "2"–0 "3"–2 TS = 8	"1"–2 "2"–0 "3"–2 TS = 8
Flu/Pneumonia Mortality Improvement	"1"–0 "2"–0 "3"–0	"1"–0 "2"–0 "3"–0	"1"–1 "2"–0 "3"–0	"1"–1 "2"–0 "3"–0

	TS = 0	TS = 0	TS = 3	TS = 3
Flu/Pneumonia Mortality Deterioration	"1"–0 "2"–0 "3"–0 TS = 0	"1"–0 "2"–0 "3"–0 TS = 0	"1"–0 "2"–0 "3"–0 TS = 0	"1"–0 "2"–0 "3"–0 TS = 0

NUMBER OF RESPONSES PER MORTALITY CHANGE RANK OPTION AND TOTAL SCORES (TS) – ACTUARIES ONLY

Change in Mortality from	2022	2023	2025	2030
Cardiovascular Disorders Mortality Improvement	"1"–1 "2"–0 "3"–0 TS = 3	"1"–1 "2"–0 "3"–0 TS = 3	"1"–1 "2"–0 "3"–0 TS = 3	"1"–1 "2"–2 "3"–0 TS = 7
Cardiovascular Disorders Mortality Deterioration	"1"–5 "2"–1 "3"–2 TS = 19	"1"–5 "2"–1 "3"–2 TS = 19	"1"–4 "2"–2 "3"–1 TS = 17	"1"–3 "2"–1 "3"–1 TS = 12
Cancer Mortality Improvement	"1"–1 "2"–0 "3"–2 TS = 5	"1"–1 "2"–0 "3"–2 TS = 5	"1"–2 "2"–0 "3"–2 TS = 8	"1"–4 "2"–0 "3"–2 TS = 14
Cancer Mortality Deterioration	"1"–1 "2"–3 "3"–0 TS = 9	"1"–1 "2"–3 "3"–0 TS = 9	"1"–2 "2"–2 "3"–0 TS = 10	"1"–1 "2"–1 "3"–0 TS = 5
Alzheimer's and Other Dementias Mortality Improvement	"1"–0 "2"–0 "3"–0 TS = 0	"1"–0 "2"–0 "3"–0 TS = 0	"1"–0 "2"–1 "3"–0 TS = 2	"1"–0 "2"–1 "3"–2 TS = 4
Alzheimer's and Other Dementias Mortality Deterioration	"1"–0 "2"–2 "3"–2 TS = 6	"1"–0 "2"–2 "3"–2 TS = 6	"1"–0 "2"–2 "3"–2 TS = 6	"1"–0 "2"–2 "3"–1 TS = 5
Accidents Excluding Drug Overdoses Mortality Improvement	"1"–0 "2"–0 "3"–0 TS = 0	"1"–0 "2"–0 "3"–0 TS = 0	"1"–0 "2"–0 "3"–0 TS = 0	"1"–0 "2"–0 "3"–0 TS = 0
Accidents Excluding Drug Overdoses Mortality Deterioration	"1"–2 "2"–0 "3"–1 TS = 7	"1"–2 "2"–0 "3"–1 TS = 7	"1"–0 "2"–1 "3"–1 TS =3	"1"–0 "2"–1 "3"–0 TS =2
Drug Overdoses Mortality Improvement	"1"–0 "2"–0 "3"–0 TS = 0	"1"–0 "2"–0 "3"–0 TS = 0	"1"–0 "2"–0 "3"–0 TS = 0	"1"–0 "2"–0 "3"–0 TS = 0
Drug Overdoses Mortality Deterioration	"1"–1 "2"–2 "3"–0 TS = 7	"1"–1 "2"–2 "3"–0 TS = 7	"1"–1 "2"–0 "3"–1 TS = 4	"1"–1 "2"–0 "3"–1 TS = 4

Flu/Pneumonia Mortality Improvement	"1"–0 "2"–0 "3"–0 TS = 0	"1"–0 "2"–0 "3"–0 TS = 0	"1"–1 "2"–0 "3"–0 TS = 3	"1"–1 "2"–0 "3"–0 TS = 3
Flu/Pneumonia Mortality Deterioration	"1"–0 "2"–0 "3"–0 TS = 0	"1"–0 "2"–0 "3"–0 TS = 0	"1"–0 "2"–0 "3"–0 TS = 0	"1"–0 "2"–0 "3"–0 TS = 0

NUMBER OF RESPONSES PER MORTALITY CHANGE RANK OPTION AND TOTAL SCORES (TS) – OTHER PRACTITIONERS ONLY

Change in Mortality from	2022	2023	2025	2030
Cardiovascular Disorders Mortality Improvement	"1"–0 "2"–0 "3"–1 TS = 1	"1"–0 "2"–0 "3"–1 TS = 1	"1"–0 "2"–0 "3"–2 TS = 2	"1"–0 "2"–0 "3"–2 TS = 2
Cardiovascular Disorders Mortality Deterioration	"1"–2 "2"–1 "3"–1 TS = 9	"1"–2 "2"–1 "3"–2 TS = 10	"1"–2 "2"–1 "3"–1 TS = 9	"1"–1 "2"–1 "3"–1 TS = 6
Cancer Mortality Improvement	"1"–1 "2"–0 "3"–0 TS = 3	"1"–1 "2"–1 "3"–0 TS = 5	"1"–1 "2"–1 "3"–1 TS = 6	"1"–2 "2"–1 "3"–0 TS = 8
Cancer Mortality Deterioration	"1"–0 "2"–1 "3"–0 TS = 2	"1"–0 "2"–1 "3"–0 TS = 2	"1"–0 "2"–1 "3"–0 TS = 2	"1"–0 "2"–1 "3"–0 TS = 2
Alzheimer's and Other Dementias Mortality Improvement	"1"–0 "2"–0 "3"–0 TS = 0	"1"–0 "2"–0 "3"–0 TS = 0	"1"–1 "2"–0 "3"–0 TS = 3	"1"–1 "2"–0 "3"–1 TS = 4
Alzheimer's and Other Dementias Mortality Deterioration	"1"–0 "2"–3 "3"–0 TS = 6	"1"–0 "2"–3 "3"–0 TS = 6	"1"–1 "2"–1 "3"–0 TS = 5	"1"–1 "2"–1 "3"–0 TS = 5
Accidents Excluding Drug Overdoses Mortality Improvement	"1"–0 "2"–0 "3"–1 TS = 1	"1"–0 "2"–0 "3"–2 TS = 2	"1"–1 "2"–0 "3"–1 TS = 4	"1"–1 "2"–0 "3"–1 TS = 4
Accidents Excluding Drug Overdoses Mortality Deterioration	"1"–1 "2"–0 "3"–0 TS = 3	"1"–1 "2"–0 "3"–0 TS = 3	"1"–0 "2"–0 "3"–0 TS =0	"1"–0 "2"–0 "3"–0 TS =0
Drug Overdoses Mortality Improvement	"1"–0 "2"–0 "3"–0 TS = 0	"1"–0 "2"–0 "3"–0 TS = 0	"1"–0 "2"–1 "3"–0 TS = 2	"1"–0 "2"–1 "3"–0 TS = 2

Drug Overdoses Mortality Deterioration	"1"–1 "2"–0 "3"–1 TS = 4	"1"–2 "2"–0 "3"–1 TS = 7	"1"–1 "2"–0 "3"–1 TS = 4	"1"–1 "2"–0 "3"–1 TS = 4
Flu/Pneumonia Mortality Improvement	"1"–0 "2"–0 "3"–0 TS = 0	"1"–0 "2"–0 "3"–0 TS = 0	"1"–0 "2"–0 "3"–0 TS = 0	"1"–0 "2"–0 "3"–0 TS = 0
Flu/Pneumonia Mortality Deterioration	"1"–0 "2"–0 "3"–0 TS = 0	"1"–0 "2"–0 "3"–0 TS = 0	"1"–0 "2"–0 "3"–0 TS = 0	"1"–0 "2"–0 "3"–0 TS = 0

2.c In your opinion, what are the best resources for monitoring COVID-19's impact on Mortality? (Please select all that apply.)

- Academic research institutions
- Consulting/insurer/reinsurer
- News media produced
- Peer-reviewed journals
- SOA Research Institute
- Other actuarial organizations
- U.S. governmental agencies
- World Health Organization
- Other_____

15 responses

Best Resources for Monitoring COVID-19's Impact on Mortality	Number	Percentage
Academic research institutions	8	53%
Consulting/insurer/reinsurer	10	67%
News media produced	0	0%
Peer-reviewed journals	7	47%
SOA Research Institute	11	73%
Other actuarial organizations	1	7%
U.S. governmental agencies	10	67%
World Health Organization	2	13%

Other resources mentioned:

- European government studies

2.d Additional comments about future excess mortality: _____

- *We appear to be on the cusp of dementia interventions that will mitigate what might otherwise be a mortality spike from that cause.*
- *Measures such as narcan will eventually mitigate drug overdoses, but it will take a few years yet.*
- *COVID-19 mortality per se will decline.*

3. U.S. ANNUITY INDUSTRY ANNUITANT POPULATION MORTALITY

The following questions relate to **U.S. Annuity Industry Annuitant Population** mortality.

3.a.1 Assuming 2019 mortality levels trended forward such as with mortality improvement or deterioration for future expected mortality, please indicate the total level of excess mortality you expect from all causes **including COVID-19 deaths** for each of the years and ages listed below. Please express all numbers in decimal form. Here are three examples on how to respond (consistent with General Population instructions):

No historical U.S. annuity industry annuitant population mortality information is provided. In this example, the U.S. General Population simplified example provided at the beginning of Section 2 is used. From the U.S. General Population excess mortality example provided (link to the historical information example document) , for age 25-44, the level of excess in 2020 in relation to 2020 expected mortality levels is 23%.

- If you believe the U.S. annuity industry annuitant population level of excess mortality with COVID-19, for age 25 will remain at the same level for 2022 as the U.S. population 25-44 historical information in 2020, code the 21% level as ".23".
- If you believe the excess mortality will be reduced, e.g., to a level of 15% excess mortality, code ".15".
- If you believe that excess mortality will go away and there will be additional mortality improvement of, for example 5%, express the 5% mortality improvement as a negative number, "-.05".

U.S. Annuity Industry Annuitant Population (7 responses)

AVERAGE ALL-CAUSE EXCESS MORTALITY ESTIMATES WITH COVID-19 BY POPULATION AND AGE

U.S. Population (No. of Responses)	Current Age	2022 (%)	2023 (%)	2025 (%)	2030 (%)
Total Respondents					
Annuity Industry Annuitant (*N* = 7)	25	13	8	6	3
	45	10	7	4	2
	65	9	6	4	2
	85	7	5	3	1

AGGREGATION OF RESPONSES FOR TOTAL EXCESS MORTALITY WITH COVID-19 U.S. ANNUITY INDUSTRY ANNUITANT POPULATION

Current Age		Total Excess Mortality with COVID-19			
		2022	2023	2025	2030
25	Min	5%	2%	0%	−1%
	Max	30%	22%	22%	22%
	Average	13%	8%	6%	3%
	Median	10%	4%	2%	0%
	25th percentile	5%	2%	0%	0%
	75th percentile	22%	20%	15%	1%
	No. of responses	7	7	7	7
45	Min	3%	1%	0%	−5%
	Max	20%	20%	20%	20%
	Average	10%	7%	4%	2%
	Median	10%	5%	2%	0%
	25th percentile	5%	2%	0%	−1%
	75th percentile	15%	10%	5%	2%
	No. of responses	7	7	7	7
65	Min	1%	1%	0%	−5%
	Max	18%	18%	18%	18%
	Average	9%	6%	4%	2%
	Median	10%	5%	1%	1%
	25th percentile	7%	2%	0%	−5%
	75th percentile	10%	7%	4%	2%
	No. of responses	7	7	7	7
85	Min	0%	0%	−3%	−6%
	Max	17%	17%	17%	17%
	Average	7%	5%	3%	1%
	Median	6%	4%	1%	1%
	25th percentile	0%	0%	0%	−5%
	75th percentile	10%	5%	3%	2%
	No. of responses	7	7	7	7

3.a.2 What are the top 3 COVID-19 drivers, for each year listed, influencing your future total excess mortality **Including COVID-19 Deaths** estimates? "1" is the most influential driver.

Drivers	Total Excess Mortality (Including COVID-19 Deaths) Estimates			
	2022	2023	2025	2030
Masks – Increased use of	"1"–0 "2"–0 "3"–0 TS = 0	"1"–0 "2"–0 "3"–0 TS = 0	"1"–0 "2"–0 "3"–0 TS = 0	"1"–0 "2"–0 "3"–0 TS = 0
Masks – Decreased use of	"1"–0 "2"–0 "3"–0 TS = 0	"1"–0 "2"–0 "3"–0 TS = 0	"1"–0 "2"–0 "3"–0 TS = 0	"1"–0 "2"–0 "3"–0 TS = 0
Treatment Access – Increased access to current or future new COVID-19 medical treatments	"1"–1 "2"–2 "3"–0 TS = 7	"1"–1 "2"–2 "3"–1 TS = 8	"1"–1 "2"–2 "3"–1 TS = 8	"1"–1 "2"–2 "3"–1 TS = 8
Treatment Access – Decreased access to current or future new COVID-19 medical treatments	"1"–0 "2"–0 "3"–0 TS = 0	"1"–0 "2"–0 "3"–0 TS = 0	"1"–0 "2"–0 "3"–0 TS = 0	"1"–0 "2"–0 "3"–0 TS = 0
Population Health Status - Healthier population than pre-pandemic as older, less healthy individuals die from COVID-19	"1"–0 "2"–0 "3"–1 TS = 1	"1"–0 "2"–0 "3"–1 TS = 1	"1"–0 "2"–0 "3"–1 TS = 1	"1"–0 "2"–0 "3"–1 TS = 1
Population Health Status - Less healthy population than pre-pandemic due to long COVID and indirect COVID-19 impacts.	"1"–1 "2"–0 "3"–2 TS = 5	"1"–1 "2"–1 "3"–1 TS = 6	"1"–1 "2"–1 "3"–1 TS = 6	"1"–1 "2"–1 "3"–0 TS = 5
Treatment Deferral – Increased deferral of health care and treatment due to COVID-19	"1"–1 "2"–1 "3"–1 TS = 6	"1"–0 "2"–0 "3"–1 TS = 1	"1"–0 "2"–0 "3"–0 TS = 0	"1"–0 "2"–0 "3"–0 TS = 0
Treatment Deferral – Decreased deferral of health	"1"–0 "2"–0 "3"–0	"1"–0 "2"–0 "3"–0	"1"–0 "2"–0 "3"–1	"1"–0 "2"–0 "3"–1

care and treatment due to COVID-19	TS = 0	TS = 0	TS = 1	TS = 1
Social distancing and isolation – Increased use of	"1"–0 "2"–0 "3"–0 TS = 0	"1"–0 "2"–0 "3"–0 TS = 0	"1"–0 "2"–0 "3"–0 TS = 0	"1"–0 "2"–0 "3"–0 TS = 0
Social distancing and isolation – Decreased use of	"1"–1 "2"–0 "3"–1 TS = 4	"1"–1 "2"–0 "3"–1 TS = 4	"1"–1 "2"–0 "3"–1 TS = 4	"1"–1 "2"–0 "3"–1 TS = 4
Immunity – Higher immunity due to vaccination, infection/reinfection	"1"–4 "2"–1 "3"–0 TS = 14	"1"–5 "2"–0 "3"–0 TS = 15	"1"–5 "2"–0 "3"–0 TS = 15	"1"–4 "2"–1 "3"–0 TS = 14
Immunity – Lower immunity due to vaccination, infection/reinfection	"1"–0 "2"–1 "3"–0 TS = 2	"1"–0 "2"–1 "3"–1 TS = 3	"1"–0 "2"–1 "3"–1 TS = 3	"1"–0 "2"–1 "3"–1 TS = 3
Virulence – Higher virulence of current or future COVID-19 strains/variants	"1"–1 "2"–1 "3"–0 TS = 5	"1"–1 "2"–1 "3"–0 TS = 5	"1"–1 "2"–1 "3"–0 TS = 5	"1"–1 "2"–1 "3"–0 TS = 5
Virulence – Lower virulence of current or future COVID-19 strains/variants	"1"–0 "2"–0 "3"–1 TS = 1	"1"–0 "2"–1 "3"–0 TS = 2	"1"–0 "2"–1 "3"–0 TS = 2	"1"–1 "2"–0 "3"–1 TS = 4

3.b. Assuming 2019 mortality levels trended forward such as with mortality improvement or deterioration for future expected mortality, please indicate the level of excess mortality from all causes **except those deaths directly attributed to COVID-19** that you expect for each of the years and ages listed below. Please express all numbers in decimal form. Here are three examples on how to respond (consistent with General Population instructions):

No historical U.S. annuity industry annuitant population mortality information is provided. In this example, the U.S. General Population simplified example provided at the beginning of Section 2 is used. From the U.S. General Population excess mortality example provided (link to the historical information example document), for age 25-44, the level of excess mortality for non-COVID-19 causes of death in 2020 in relation to 2020 expected mortality levels, is 19%.

- If you believe the U.S annuity industry annuitant population level of excess mortality, for age 25, will remain at the same level for 2022 as the U.S. General Population 25-44 historical information for 2020, code the 19% level as ".19".
- If you believe the excess mortality will be reduced, e.g., to a level of 15% excess mortality, code ".15".

- If you believe that excess mortality will go away and there will be additional mortality improvement of, for example 5%, express the 5% mortality improvement as a negative number, "-.05".

U.S. Annuity Industry Annuitant Population (7 responses)

	Excess Mortality (Without Deaths Directly Attributed To COVID-19) Estimates			
Current Age	2022	2023	2025	2030
25	.10	.06	.04	.03
45	.07	.04	.02	.01
65	.05	.02	.00	–.01
85	.04	.02	.00	–.01

AVERAGE ALL-CAUSE EXCESS MORTALITY ESTIMATES WITHOUT COVID-19 AS A CAUSE OF DEATH BY POPULATION AND AGE

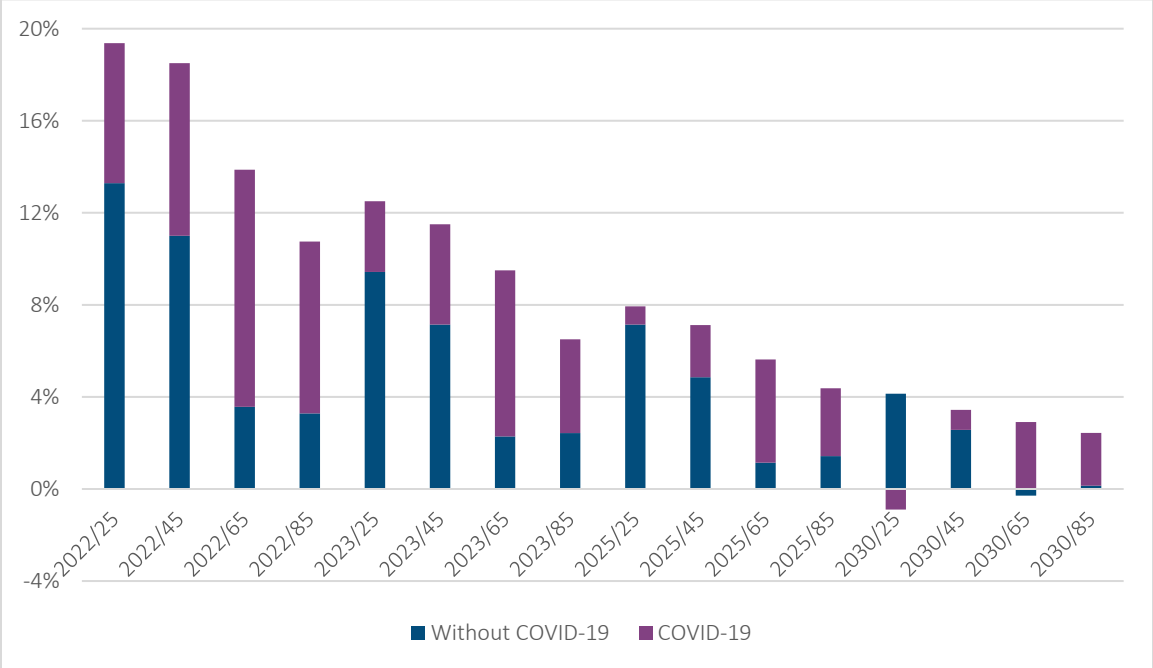
U.S. Population (No. of Responses)	Current Age	2022 (%)	2023 (%)	2025 (%)	2030 (%)
Total Respondents					
Annuity Industry Annuitant (*N* = 7)	25	10	6	4	3
	45	7	4	2	1
	65	5	2	0	−1
	85	4	2	0	−1

AGGREGATION OF RESPONSES FOR TOTAL EXCESS MORTALITY WITHOUT COVID-19 AS A CAUSE OF DEATH U.S. ANNUITY INDUSTRY ANNUITANT POPULATION

Total Excess Mortality without COVID-19 as a Cause of Death					
Current Age		2022	2023	2025	2030
25	Min	3%	0%	0%	−1%
	Max	20%	18%	18%	18%
	Average	10%	6%	4%	3%
	Median	10%	3%	0%	0%
	25th percentile	5%	2%	0%	0%
	75th percentile	18%	15%	10%	5%
	No. of responses	7	7	7	7
45	Min	2%	0%	0%	−1%
	Max	10%	10%	10%	10%
	Average	7%	4%	2%	1%
	Median	10%	3%	0%	0%
	25th percentile	3%	1%	0%	0%

	75th percentile	10%	10%	5%	0%
	No. of responses	7	7	7	7
65	Min	0%	0%	−2%	−5%
	Max	10%	5%	5%	5%
	Average	5%	2%	0%	−1%
	Median	4%	2%	0%	−1%
	25th percentile	2%	0%	−1%	−4%
	75th percentile	10%	5%	1%	0%
	No. of responses	7	7	7	7
85	Min	−1%	−1%	−3%	−6%
	Max	10%	5%	3%	3%
	Average	4%	2%	0%	−1%
	Median	3%	2%	0%	−1%
	25th percentile	0%	0%	−1%	−5%
	75th percentile	10%	3%	1%	0%
	No. of responses	7	7	7	7

Annuity product breakdown between expected excess deaths by year and age for COVID-19 and indirect causes (not specific to COVID-19).



3.b.2 What are the top 3 changes in future causes of death mortality, for each year listed, largely influencing your future total excess mortality **Without Deaths Directly Attributed To COVID-19** responses? "1" is the most influential change. In the table below, IMP stands for mortality improvement, and DET stands for mortality deterioration.

Change in Mortality from	2022		2023		2025		2030	
	IMP	DET	IMP	DET	IMP	DET	IMP	DET
Cardiovascular Disorders								
Cancer								
Alzheimer's and Other Dementias								
Accidents Excluding Drug Overdoses								
Drug Overdoses								
Flu/Pneumonia								
Other 1_____								
Other 2_____								
Other 3_____								

NUMBER OF RESPONSES PER MORTALITY CHANGE RANK OPTION AND TOTAL SCORES (TS)

Change in Mortality from	2022	2023	2025	2030
Cardiovascular Disorders Mortality Improvement	"1"–0 "2"–0 "3"–1 TS = 1	"1"–0 "2"–0 "3"–1 TS = 1	"1"–1 "2"–0 "3"–0 TS = 3	"1"–1 "2"–1 "3"–0 TS = 5
Cardiovascular Disorders Mortality Deterioration	"1"–4 "2"–1 "3"–1 TS = 15	"1"–4 "2"–1 "3"–0 TS = 14	"1"–4 "2"–1 "3"–0 TS = 14	"1"–4 "2"–0 "3"–0 TS = 12
Cancer Mortality Improvement	"1"–1 "2"–3 "3"–0 TS = 9	"1"–1 "2"–3 "3"–0 TS = 9	"1"–1 "2"–3 "3"–0 TS = 9	"1"–2 "2"–3 "3"–0 TS = 12
Cancer Mortality Deterioration	"1"–1 "2"–0 "3"–0 TS = 3	"1"–1 "2"–0 "3"–0 TS = 3	"1"–1 "2"–0 "3"–0 TS = 3	"1"–0 "2"–0 "3"–0 TS = 0

Alzheimer's and Other Dementias Mortality Improvement	"1"–0 "2"–0 "3"–1 TS = 1	"1"–0 "2"–0 "3"–1 TS = 1	"1"–0 "2"–0 "3"–1 TS = 1	"1"–0 "2"–0 "3"–2 TS = 2
Alzheimer's and Other Dementias Mortality Deterioration	"1"–0 "2"–1 "3"–2 TS = 4	"1"–0 "2"–1 "3"–2 TS = 4	"1"–0 "2"–1 "3"–2 TS = 4	"1"–0 "2"–1 "3"–1 TS = 3
Accidents Excluding Drug Overdoses Mortality Improvement	"1"–0 "2"–0 "3"–0 TS = 0	"1"–0 "2"–0 "3"–0 TS = 0	"1"–0 "2"–0 "3"–0 TS = 0	"1"–0 "2"–0 "3"–0 TS = 0
Accidents Excluding Drug Overdoses Mortality Deterioration	"1"–1 "2"–1 "3"–0 TS = 5	"1"–1 "2"–1 "3"–0 TS = 5	"1"–0 "2"–1 "3"–1 TS = 3	"1"–0 "2"–1 "3"–1 TS = 3
Drug Overdoses Mortality Improvement	"1"–0 "2"–0 "3"–0 TS = 0	"1"–0 "2"–0 "3"–0 TS = 0	"1"–0 "2"–0 "3"–0 TS = 0	"1"–0 "2"–0 "3"–0 TS = 0
Drug Overdoses Mortality Deterioration	"1"–2 "2"–1 "3"–0 TS = 8	"1"–2 "2"–0 "3"–1 TS = 7	"1"–1 "2"–1 "3"–1 TS = 6	"1"–1 "2"–1 "3"–1 TS = 6
Flu/Pneumonia Mortality Improvement	"1"–0 "2"–0 "3"–0 TS = 0	"1"–0 "2"–1 "3"–0 TS = 2	"1"–1 "2"–0 "3"–0 TS = 3	"1"–1 "2"–0 "3"–0 TS = 3
Flu/Pneumonia Mortality Deterioration	"1"–0 "2"–0 "3"–0 TS = 0	"1"–0 "2"–0 "3"–0 TS = 0	"1"–0 "2"–0 "3"–0 TS = 0	"1"–0 "2"–0 "3"–0 TS = 0

3.c In your opinion, what are the best resources for monitoring COVID-19's impact on mortality? (Please select all that apply.)

- Academic research institutions
- Consulting/insurer/reinsurer
- News media produced
- Peer-reviewed journals
- SOA Research Institute
- Other actuarial organizations
- U.S. governmental agencies

- World Health Organization
- Other_____

7 responses

Best Resources for Monitoring COVID-19's Impact on Mortality	Number	Percentage
Academic research institutions	4	57%
Consulting/insurer/reinsurer	5	71%
News media produced	0	0%
Peer-reviewed journals	1	14%
SOA Research Institute	6	86%
Other actuarial organizations	1	14%
U.S. governmental agencies	5	71%
World Health Organization	2	29%

3.d Additional comments about future excess mortality: _____

- *Questions like 3.b.2 are tough to answer because there are different drivers of mortality changes for the various age groups, e.g., drug overdose deaths are important CODs at certain ages but become less significant at older ages.*

4. U.S. PUBLIC AND PRIVATE PENSION PLAN POPULATION MORTALITY

The following questions relate to **U.S. Public and Private Pension Plan Population** mortality.

4.a.1 Assuming 2019 mortality levels trended forward such as with mortality improvement or deterioration for future expected mortality, please indicate the total level of excess mortality you expect from all causes **including COVID-19 deaths** for each of the years and ages listed below. Please express all numbers in decimal form. Here are three examples on how to respond (consistent with General Population instructions):

No historical U.S. public and private pension plan population mortality information is provided. In this example, U.S. General Population simplified example provided at the beginning of Section 2 is used. From the **U.S. General Population excess mortality example provided (link to the historical information example document),** for age 25-44 the level of excess in 2020 in relation to 2020 expected mortality levels, is 23%.

- If you believe the U.S. public and private pension plan population level of excess mortality with COVID-19 will remain at the same level for 2022, as the U.S. population 25-44 historical information in 2020, code the 23% level as ".23".
- If you believe the excess mortality will be reduced, e.g., to a level of 15% excess mortality, code ".15".

- If you believe that excess mortality will go away and there will be additional mortality improvement of, for example 5%, express the 5% mortality improvement as a negative number, "-.05".

U.S. Public and Private Pension Plan Population (7 responses)

AVERAGE ALL-CAUSE EXCESS MORTALITY ESTIMATES WITH COVID-19 BY POPULATION AND AGE

U.S. Population (No. of Responses)	Current Age	2022 (%)	2023 (%)	2025 (%)	2030 (%)
Total Respondents					
Private and Public Pension Plan (*N* =7)	25	12	11	6	1
	45	12	11	6	2
	65	11	8	4	1
	85	6	5	3	1

AGGREGATION OF RESPONSES FOR TOTAL EXCESS MORTALITY WITH COVID-19 U.S. PUBLIC AND PRIVATE PENSION PLAN POPULATION

Current Age		Total Excess Mortality with COVID-19			
		2022	2023	2025	2030
25	Min	1%	0%	0%	0%
	Max	30%	30%	15%	5%
	Average	12%	11%	6%	1%
	Median	10%	9%	3%	1%
	25th percentile	2%	1%	0%	0%
	75th percentile	25%	20%	15%	2%
	No. of responses	7	7	7	7
45	Min	2%	0%	0%	0%
	Max	30%	30%	15%	5%
	Average	12%	11%	6%	2%
	Median	10%	9%	3%	1%
	25th percentile	4%	2%	0%	0%
	75th percentile	25%	20%	15%	3%
	No. of responses	7	7	7	7
65	Min	4%	2%	1%	0%
	Max	20%	20%	10%	2%
	Average	11%	8%	4%	1%
	Median	10%	8%	4%	0%
	25th percentile	5%	3%	1%	0%
	75th percentile	15%	10%	5%	2%
	No. of responses	7	7	7	7
85	Min	1%	0%	1%	0%
	Max	12%	10%	5%	2%
	Average	6%	5%	3%	1%

	Median	5%	5%	2%	1%
	25th percentile	1%	1%	1%	0%
	75th percentile	10%	8%	4%	2%
	No. responses	7	7	7	7

4.a.2 What are the top 3 COVID-19 drivers, for each year listed, influencing your future total excess mortality **Including COVID-19 Deaths** estimates? "1" is the most influential driver.

Drivers	Total Excess Mortality (Including COVID-19 Deaths) Estimates			
	2022	2023	2025	2030
Masks – Increased use of	"1"–1 "2"–0 "3"–0 TS = 3	"1"–0 "2"–0 "3"–0 TS = 0	"1"–0 "2"–0 "3"–0 TS = 0	"1"–0 "2"–0 "3"–0 TS = 0
Masks – Decreased use of	"1"–0 "2"–0 "3"–0 TS = 0	"1"–1 "2"–0 "3"–0 TS = 3	"1"–0 "2"–0 "3"–0 TS = 0	"1"–0 "2"–0 "3"–0 TS = 0
Treatment Access – Increased access to current or future new COVID-19 medical treatments	"1"–1 "2"–3 "3"–0 TS = 9	"1"–1 "2"–2 "3"–1 TS = 8	"1"–1 "2"–2 "3"–0 TS = 7	"1"–1 "2"–2 "3"–0 TS = 7
Treatment Access – Decreased access to current or future new COVID-19 medical treatments	"1"–0 "2"–0 "3"–0 TS = 0	"1"–0 "2"–0 "3"–0 TS = 0	"1"–0 "2"–0 "3"–0 TS = 0	"1"–0 "2"–0 "3"–0 TS = 0
Population Health Status - Healthier population than pre-pandemic as older, less healthy individuals die from COVID-19	"1"–0 "2"–0 "3"–1 TS = 1	"1"–0 "2"–0 "3"–2 TS = 2	"1"–0 "2"–0 "3"–2 TS = 2	"1"–0 "2"–0 "3"–2 TS = 2
Population Health Status - Less healthy population than pre-pandemic due to long COVID and indirect COVID-19 impacts.	"1"–0 "2"–0 "3"–2 TS = 2	"1"–0 "2"–1 "3"–1 TS = 3	"1"–0 "2"–1 "3"–1 TS = 3	"1"–0 "2"–1 "3"–1 TS = 3
Treatment Deferral – Increased deferral of health care and	"1"–0 "2"–1 "3"–1	"1"–0 "2"–1 "3"–0	"1"–0 "2"–0 "3"–0	"1"–0 "2"–0 "3"–0

treatment due to COVID-19	TS = 3	TS = 2	TS = 0	TS = 0
Treatment Deferral – Decreased deferral of health care and treatment due to COVID-19	"1"–0 "2"–0 "3"–0 TS = 0	"1"–0 "2"–0 "3"–0 TS = 0	"1"–0 "2"–0 "3"–0 TS = 0	"1"–0 "2"–0 "3"–0 TS = 0
Social distancing and isolation – Increased use of	"1"–0 "2"–0 "3"–1 TS = 1	"1"–0 "2"–0 "3"–1 TS = 1	"1"–0 "2"–0 "3"–1 TS = 1	"1"–0 "2"–0 "3"–1 TS = 1
Social distancing and isolation – Decreased use of	"1"–0 "2"–0 "3"–0 TS = 0	"1"–0 "2"–0 "3"–0 TS = 0	"1"–0 "2"–0 "3"–0 TS = 0	"1"–0 "2"–0 "3"–0 TS = 0
Immunity – Higher immunity due to vaccination, infection/reinfection	"1"–2 "2"–1 "3"–1 TS = 9	"1"–2 "2"–1 "3"–1 TS = 9	"1"–1 "2"–1 "3"–2 TS = 7	"1"–1 "2"–2 "3"–1 TS = 8
Immunity – Lower immunity due to vaccination, infection/reinfection	"1"–0 "2"–2 "3"–0 TS = 4	"1"–0 "2"–2 "3"–0 TS = 4	"1"–0 "2"–2 "3"–0 TS = 4	"1"–0 "2"–2 "3"–0 TS = 4
Virulence – Higher virulence of current or future COVID-19 strains/variants	"1"–3 "2"–0 "3"–0 TS = 9	"1"–3 "2"–0 "3"–0 TS = 9	"1"–3 "2"–0 "3"–0 TS = 9	"1"–3 "2"–0 "3"–0 TS = 9
Virulence – Lower virulence of current or future COVID-19 strains/variants	"1"–0 "2"–0 "3"–1 TS = 1	"1"–0 "2"–0 "3"–0 TS = 0	"1"–2 "2"–0 "3"–0 TS = 6	"1"–2 "2"–0 "3"–0 TS = 6

Other – Vaccine/COVID-19 misinformation

4.b.1 Assuming 2019 mortality levels trended forward such as with mortality improvement or deterioration for future expected mortality, please indicate the level of excess mortality from all causes **except those deaths directly attributed to COVID-19** that you expect for each of the years and ages listed below. Please express all numbers in decimal form. Here are three examples on how to respond (consistent with General Population instructions):

No historical U.S. public and private pension plan population mortality information is provided. In this example, U.S. General Population simplified example provided at the beginning of Section 2 is used. From the U.S. General Population excess mortality example provided (link to the historical information example document), the level of excess mortality for non-COVID-19 causes of death in 2020 in relation to 2020 expected mortality levels is 19%.

- If you believe the U.S. public and private pension plan population level of excess mortality will remain at the same level for 2022 as the U.S. population 25-44 historical information in 2020, code the 19% level as ".19".
- If you believe the excess mortality will be reduced, e.g., to a level of 15% excess mortality, code ".15".
- If you believe that excess mortality will go away and there will be additional mortality improvement of, for example 5%, express the 5% mortality improvement as a negative number, "-.05".

U.S. Public and Private Pension Plan Population

	Excess Mortality (without Deaths Directly Attributed to COVID-19) Estimates			
Current Age	2022	2023	2025	2030
25	.07	.06	.04	.01
45	.05	.04	.02	.01
65	.02	.01	.00	.00
85	.01	.01	.00	.00

AVERAGE ALL-CAUSE EXCESS MORTALITY ESTIMATES WITHOUT COVID-19 AS A CAUSE OF DEATH BY POPULATION AND AGE

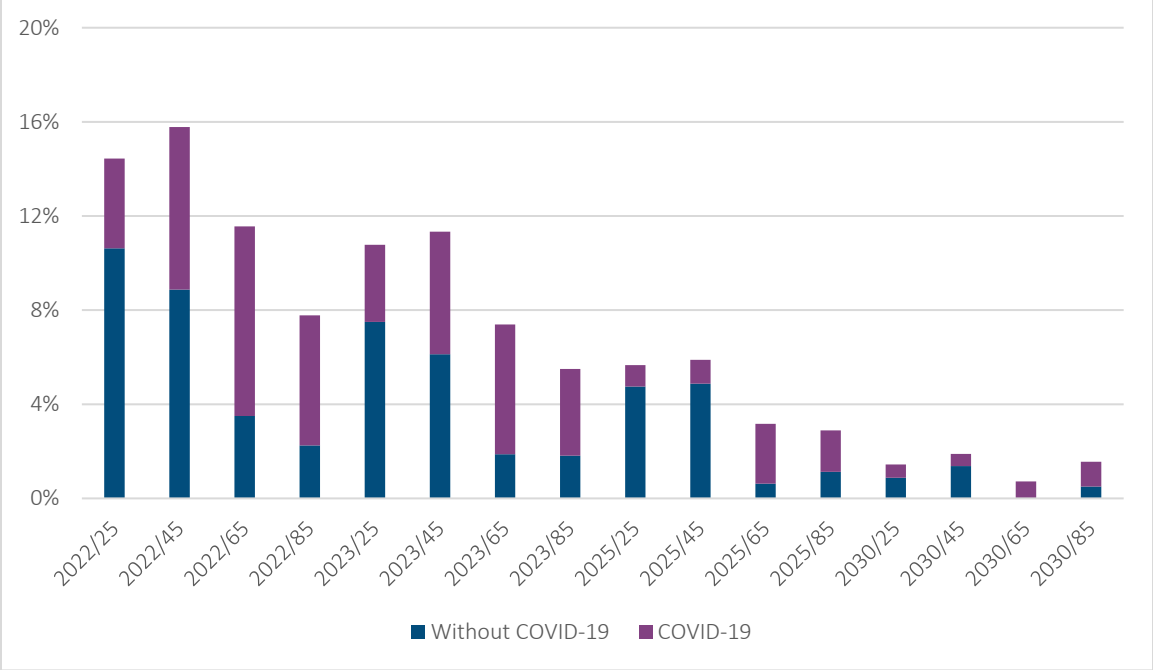
U.S. Population (No. of Responses)	Current Age	2022 (%)	2023 (%)	2025 (%)	2030 (%)
Total Respondents					
Private and Public Pension Plan (*N* =7)	25	7	6	4	1
	45	5	4	2	1
	65	2	1	0	0
	85	1	1	0	−1

AGGREGATION OF RESPONSES FOR TOTAL EXCESS MORTALITY WITHOUT COVID-19 AS A CAUSE OF DEATH U.S. PUBLIC PENSION PLAN POPULATION

Total Excess Mortality without COVID-19 as a Cause of Death					
Current Age		**2022**	**2023**	**2025**	**2030**
25	Min	0%	0%	0%	0%
	Max	20%	20%	15%	2%
	Average	7%	6%	4%	1%
	Median	4%	4%	3%	0%
	25th percentile	1%	0%	0%	0%
	75th percentile	10%	9%	5%	1%
	No. of responses	7	7	7	7
45	Min	0%	0%	0%	0%
	Max	15%	15%	7%	3%

	Average	5%	4%	2%	1%
	Median	4%	3%	2%	0%
	25th percentile	1%	0%	0%	0%
	75th percentile	9%	9%	5%	1%
	No. of responses	7	7	7	7
65	Min	1%	0%	0%	–1%
	Max	5%	2%	1%	0%
	Average	2%	1%	0%	-0%
	Median	2%	2%	0%	0%
	25th percentile	1%	1%	0%	0%
	75th percentile	3%	2%	1%	0%
	No. of responses	7	7	7	7
85	Min	–3%	–2%	–1%	–1%
	Max	3%	2%	1%	0%
	Average	1%	1%	0%	0%
	Median	2%	1%	0%	0%
	25th percentile	1%	0%	0%	0%
	75th percentile	2%	2%	1%	0%
	No. of responses	7	7	7	7

Pension plan breakdown between expected excess deaths by year and age for COVID-19 and indirect causes (not specific to COVID-19).



4.b.2 What are the top 3 changes in future causes of death mortality, for each year listed, largely influencing your future total excess mortality **Without Deaths Directly Attributed To COVID-19** responses? "1" is the most influential change. In the table below, IMP stands for mortality improvement, and DET stands for mortality deterioration.

Change in Mortality from	2022		2023		2025		2030	
	IMP	DET	IMP	DET	IMP	DET	IMP	DET
Cardiovascular Disorders								
Cancer								
Alzheimer's and Other Dementias								
Accidents Excluding Drug Overdoses								
Drug Overdoses								
Flu/Pneumonia								
Other 1_____								
Other 2_____								
Other 3_____								

NUMBER OF RESPONSES PER MORTALITY CHANGE RANK OPTION AND TOTAL SCORES (TS)

Change in Mortality from	2022	2023	2025	2030
Cardiovascular Disorders Mortality Improvement	"1"–1 "2"–0 "3"–0 TS = 3	"1"–1 "2"–0 "3"–0 TS = 3	"1"–1 "2"–0 "3"–0 TS = 3	"1"–1 "2"–0 "3"–0 TS = 3
Cardiovascular Disorders Mortality Deterioration	"1"–3 "2"–0 "3"–1 TS = 10	"1"–3 "2"–0 "3"–1 TS = 10	"1"–2 "2"–1 "3"–1 TS = 9	"1"–2 "2"–1 "3"–1 TS = 9
Cancer Mortality Improvement	"1"–0 "2"–1 "3"–0 TS = 2	"1"–0 "2"–1 "3"–0 TS = 2	"1"–0 "2"–1 "3"–0 TS = 2	"1"–0 "2"–1 "3"–0 TS = 2
Cancer Mortality Deterioration	"1"–0 "2"–1 "3"–0 TS = 2	"1"–0 "2"–1 "3"–0 TS = 2	"1"–1 "2"–0 "3"–0 TS = 3	"1"–1 "2"–0 "3"–0 TS = 3
Alzheimer's and Other Dementias Mortality Improvement	"1"–0 "2"–1 "3"–0 TS = 2	"1"–0 "2"–1 "3"–0 TS = 2	"1"–0 "2"–1 "3"–1 TS = 3	"1"–0 "2"–1 "3"–1 TS = 3

Alzheimer's and Other Dementias Mortality Deterioration	"1"–0 "2"–1 "3"–1 TS = 3	"1"–0 "2"–1 "3"–1 TS = 3	"1"–0 "2"–1 "3"–0 TS = 2	"1"–0 "2"–1 "3"–0 TS = 2
Accidents Excluding Drug Overdoses Mortality Improvement	"1"–0 "2"–0 "3"–0 TS = 0	"1"–0 "2"–0 "3"–0 TS = 0	"1"–0 "2"–0 "3"–0 TS = 0	"1"–0 "2"–0 "3"–0 TS = 0
Accidents Excluding Drug Overdoses Mortality Deterioration	"1"–0 "2"–2 "3"–0 TS = 4	"1"–0 "2"–3 "3"–0 TS = 6	"1"–0 "2"–3 "3"–0 TS = 6	"1"–0 "2"–3 "3"–0 TS = 6
Drug Overdoses Mortality Improvement	"1"–0 "2"–0 "3"–1 TS = 1	"1"–0 "2"–0 "3"–1 TS = 1	"1"–0 "2"–0 "3"–1 TS = 1	"1"–0 "2"–0 "3"–1 TS = 1
Drug Overdoses Mortality Deterioration	"1"–2 "2"–0 "3"–2 TS = 8	"1"–2 "2"–0 "3"–2 TS = 8	"1"–2 "2"–0 "3"–2 TS = 8	"1"–2 "2"–0 "3"–2 TS = 8
Flu/Pneumonia Mortality Improvement	"1"–0 "2"–0 "3"–1 TS = 1	"1"–0 "2"–0 "3"–1 TS = 1	"1"–0 "2"–0 "3"–1 TS = 1	"1"–0 "2"–0 "3"–1 TS = 1
Flu/Pneumonia Mortality Deterioration	"1"–0 "2"–1 "3"–1 TS = 3	"1"–1 "2"–0 "3"–1 TS = 4	"1"–1 "2"–0 "3"–1 TS = 4	"1"–1 "2"–0 "3"–1 TS = 4

Deferred care was listed for both improvement and deterioration.

4c. In your opinion, what are the best resources for monitoring COVID-19's impact on Mortality? (Please select all that apply.)

- Academic research institutions
- Consulting/insurer/reinsurer
- News media produced
- Peer-reviewed journals
- SOA Research Institute
- Other actuarial organizations
- U.S. governmental agencies
- World Health Organization
- Other_____

7 responses

Best Resources for Monitoring COVID-19's Impact on Mortality	Number	Percentage
Academic research institutions	2	29%
Consulting/insurer/reinsurer	3	43%
News media produced	0	0%
Peer-reviewed journals	1	14%
SOA Research Institute	4	57%
Other actuarial organizations	2	29%
U.S. governmental agencies	4	57%
World Health Organization	2	29%

4.d Additional comments about future excess mortality: _____

- *The ONS in the UK has had excellent and timely coverage of excess death rates.*

Section 3 The State of COVID-19

In the following questions, endemic means morbidity and mortality impacts of COVID-19 are permanent within the U.S. and generally stable. This does not ask about indirect impacts of COVID-19 driving changes to economic, supply chain or geopolitical implications. The world is quickly evolving due to many complex interactions.

1. The World Health Organization declared COVID-19 a pandemic on March 11, 2020. In your opinion, what stage do you believe COVID-19 is currently in the U.S. (36 responses)

- Still in the beginning stages of the pandemic (0)
- Middle stage of the pandemic (1)
- Ending stage of the pandemic but not yet endemic (18)
- COVID-19 has become endemic in the U.S. (17)
- I don't know (0)

2. What is driving your response in 1. Check all that apply. (36 responses)

- Lower virulence of recent variants compared to past variants (19)
- Potential for more virulent strains. (8)
- COVID-19 is becoming predictable. (12)
- COVID-19 remains unpredictable. (7)
- COVID-19 is becoming more unpredictable. (0)
- Low level of immunity in the U.S. (3)
- High immunity level in the U.S. (22)
- Available antivirals and other medical treatments (20)

- Federal and state COVID-19 response (2)
- An endemic state is not achievable with COVID-19 (If respond go to end of survey) (0)
- Other (5)
    - *Lack of public support for actions that would reduce transmission.*
    - *Less extreme waves of COVID-19 cases and death and more of a steady state for 6+ months*
    - *As new strains become milder, fewer cases will be tracked and diagnosed—in other words, we already have more COVID-19 than we think we do.*
    - *Looks like it's part of regular mix of colds/flu as many have been exposed.*

3. When do you think the pandemic will be endemic in the U.S.? (36 responses)

- COVID-19 is already endemic in the U.S. (16)
- 2023 (4)
- 2024 (10)
- 2025 or later (6)
- It will never be endemic in the U.S. (If respond go to end of survey) (0)
- I don't know (0)

4. What might COVID-19 look like in a year in which it is endemic? Please select all that apply. During a "normal pre-pandemic flu season", there will be 35,000 deaths on average. (Source: CDC, Estimated Flu Disease Burden by Season, https://www.cdc.gov/flu/about/burden/past-seasons.html). (36 responses)

- It will behave like the flu and predominantly occur in the fall/winter. (10)
- It will be prevalent throughout the year. (13)
- COVID-19 mortality will be higher than flu mortality during a normal pre-pandemic flu season. (13)
- COVID-19 mortality will be lower than flu mortality during a normal pre-pandemic flu season. (4)
- Initial COVID-19 mortality will be similar to flu mortality during a normal pre-pandemic flu season, but long COVID has increased longer term mortality. (15)
- I don't know. (2)

5. What might U.S. General Population flu mortality levels be in a "normal" flu season post pandemic when COVID-19 is endemic in the U.S.? A "normal pre-pandemic flu season" means on average 35,000 deaths occur. (Source: CDC, Estimated Flu Disease Burden by Season, https://www.cdc.gov/flu/about/burden/past-seasons.html). (36 responses)

- Flu mortality will be at least 100% higher than flu mortality during a normal pre-pandemic flu season. (2)
- Flu mortality will be 75-99% higher than flu mortality during a normal pre-pandemic flu season. (3)
- Flu mortality will be 50-74% higher than flu mortality during a normal pre-pandemic flu season. (1)
- Flu mortality will be 25-49% higher than flu mortality during a normal pre-pandemic flu season. (2)
- Flu mortality will be 5-24% higher than flu mortality during a normal pre-pandemic flu season. (2)
- Flu mortality will be similar to a normal pre-pandemic flu season. (8)

- Flu mortality will be 5–24% lower than flu mortality during a normal pre-pandemic flu season. (14)
- Flu mortality will be 25–49% lower than flu mortality during a normal pre-pandemic flu season. (1)
- Flu mortality will be 50–74% lower than flu mortality during a normal pre-pandemic flu season. (0)
- Flu mortality will be 75–99% lower than flu mortality during a normal pre-pandemic flu season. (0)
- There will be no flu mortality. (0)
- I don't know. (3)

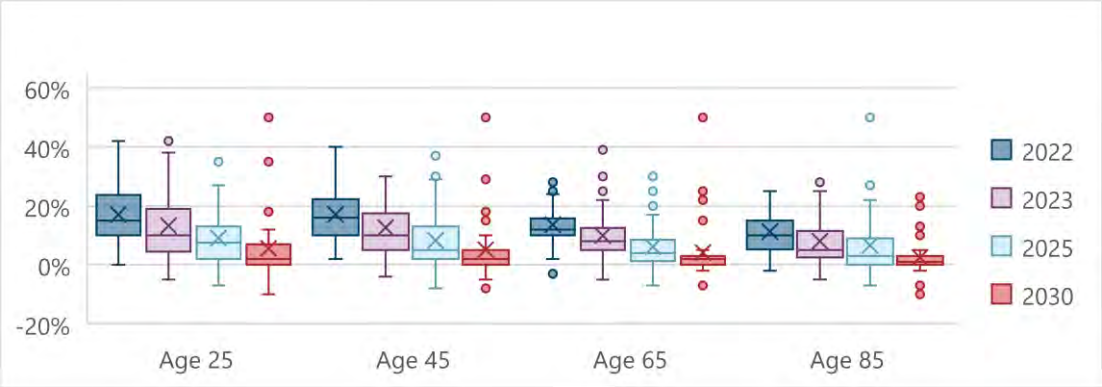
6. Additional comments on future mortality when COVID-19 is endemic:

- *The wild card here is that we are working from the proposition that COVID-19 is the last major virus to come. That is unlikely, but it is hard to project what is coming next and when.*
- *Earlier coronaviruses ended up as common colds—the question is how long does it take to become "common"?*

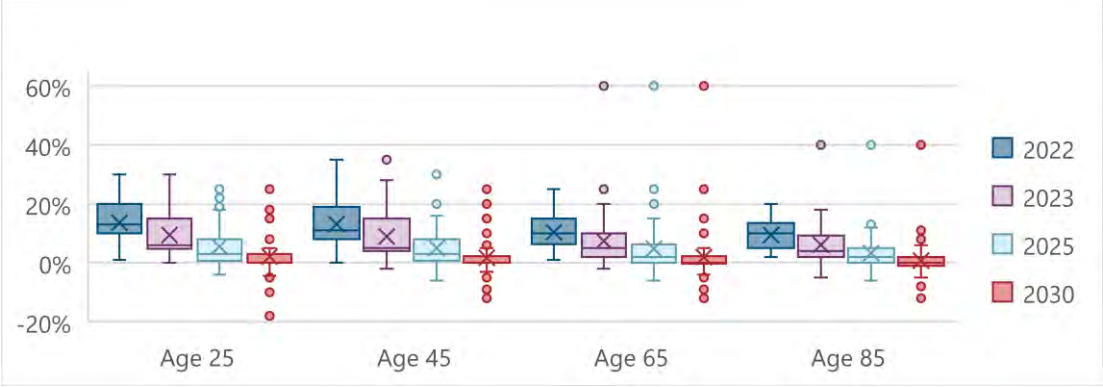
Appendix B: Distribution of Excess Mortality Estimates

For each of the populations, opinions varied among the participating experts. These figures are box and whisker plots showing the distribution of the submitted excess mortality estimates with and without COVID-19 as a cause of death. The bottom, middle and top lines of the boxes represent the 25th percentile, median and 75th percentile, respectively. The X's are the averages, and "outlier" data points are also shown.

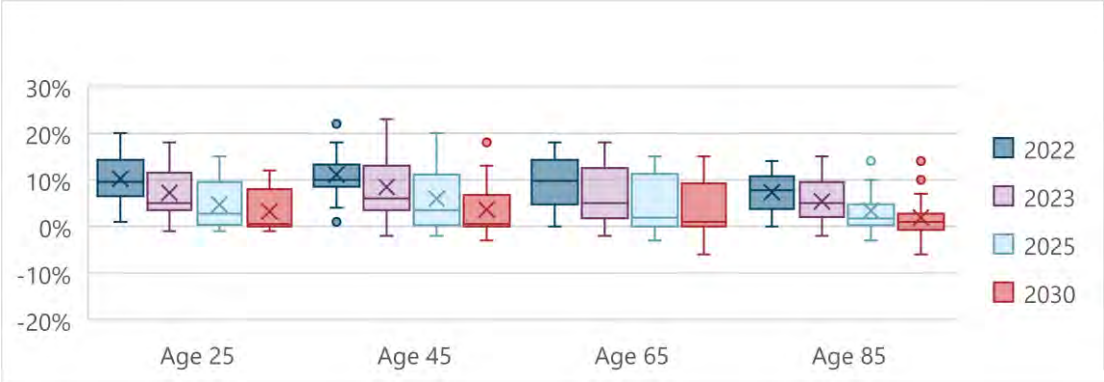
U.S. GENERAL POPULATION FUTURE EXCESS MORTALITY ESTIMATES WITH COVID-19 BY AGE – SURVEY 2 (*N* = 39)



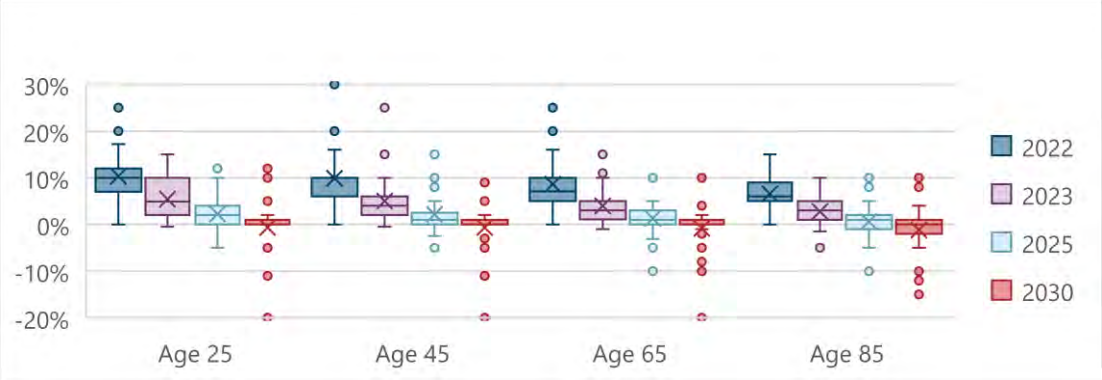
U.S. GENERAL POPULATION FUTURE EXCESS MORTALITY ESTIMATES WITH COVID-19 BY AGE – SURVEY 1 (*N* = 59)



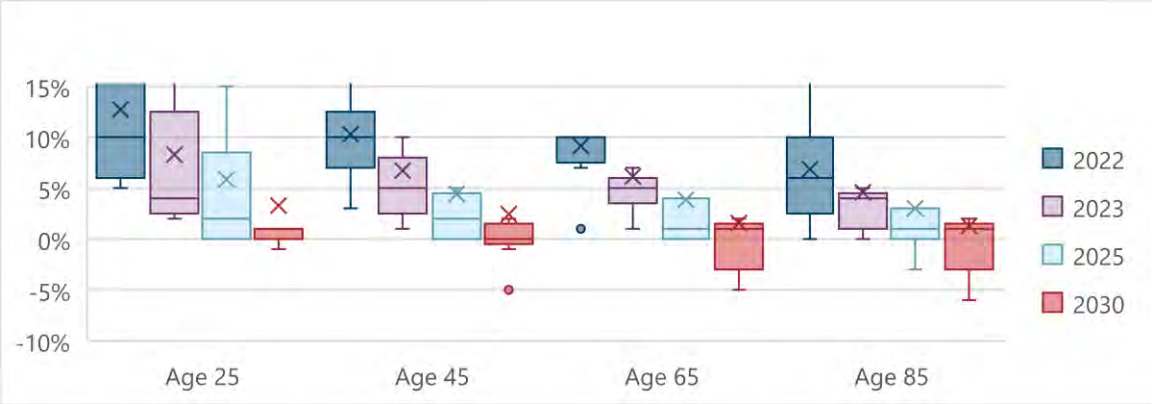
U.S. LIFE INSURANCE INDUSTRY INSURED POPULATION FUTURE EXCESS MORTALITY ESTIMATES WITH COVID-19 BY AGE – SURVEY 2 (*N* = 14)



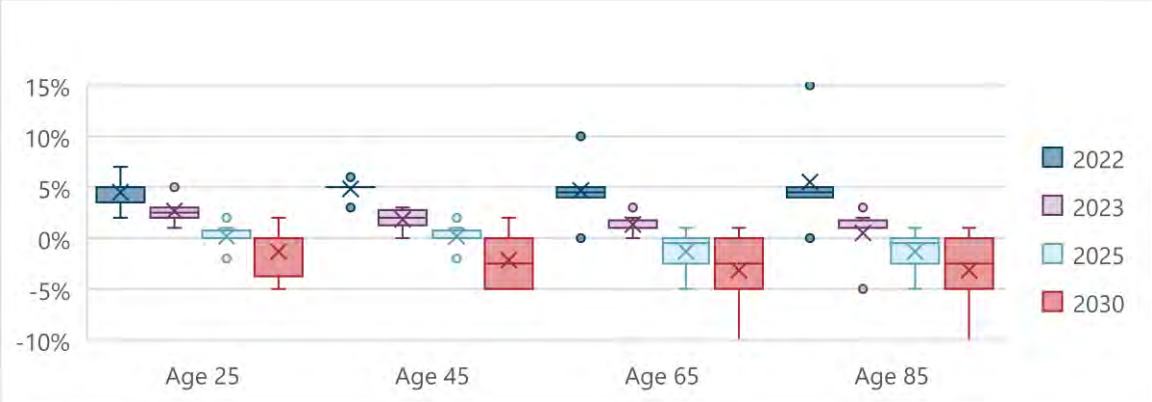
U.S. LIFE INSURANCE INDUSTRY INSURED POPULATION FUTURE EXCESS MORTALITY ESTIMATES WITH COVID-19 BY AGE – SURVEY 1 (*N* = 29)



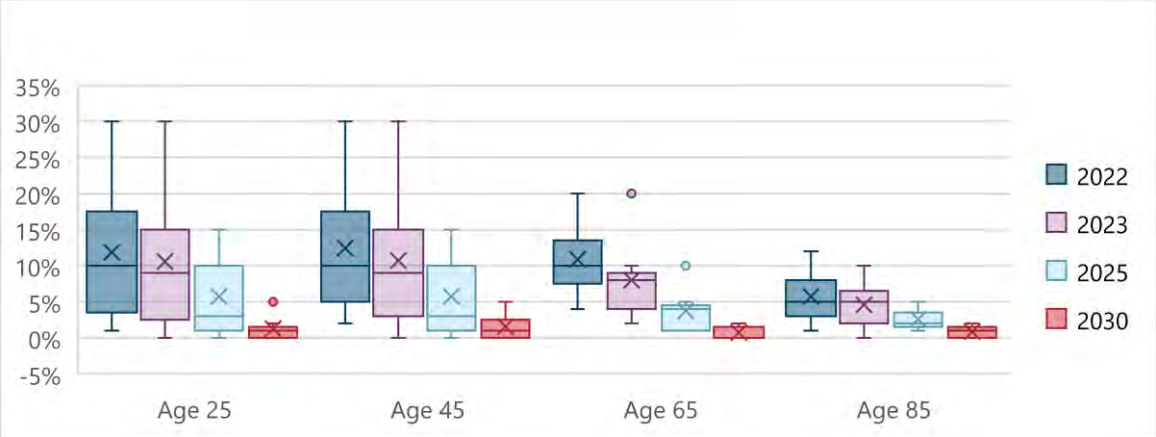
U.S. ANNUITY INDUSTRY ANNUITANT POPULATION FUTURE EXCESS MORTALITY ESTIMATES WITH COVID-19 BY AGE – SURVEY 2 (*N* = 7)



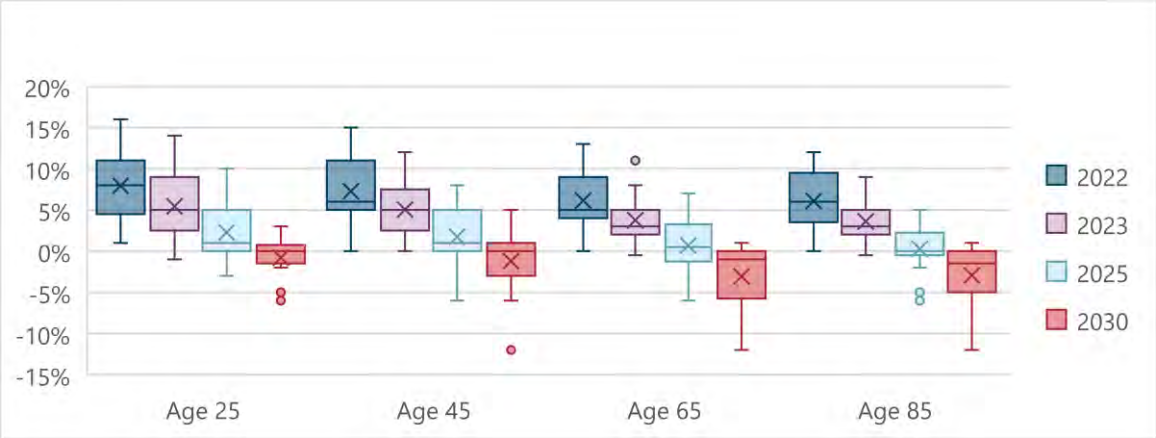
U.S. ANNUITY INDUSTRY ANNUITANT POPULATION FUTURE EXCESS MORTALITY ESTIMATES WITH COVID-19 BY AGE – SURVEY 1 (*N* = 6)



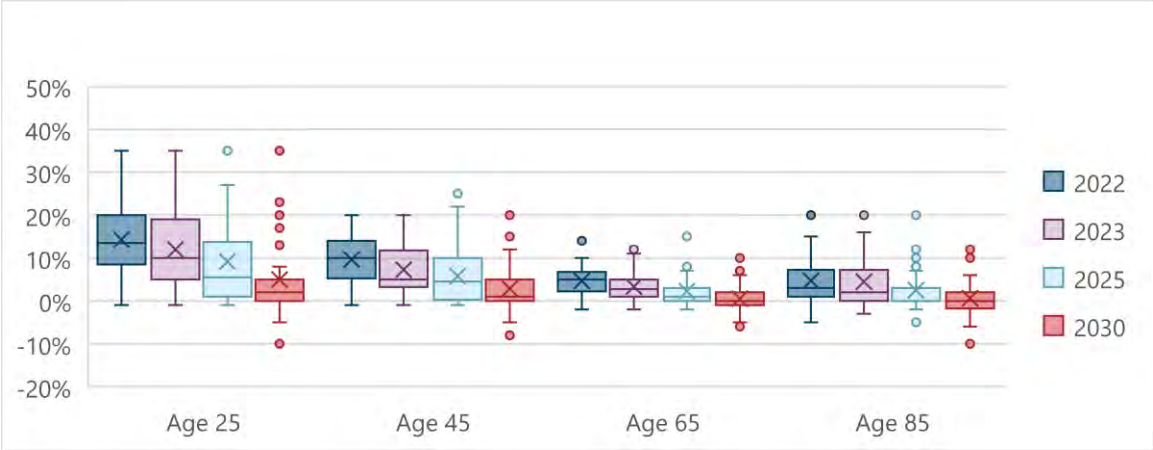
U.S. PRIVATE AND PUBLIC PENSION PLAN POPULATION FUTURE EXCESS MORTALITY ESTIMATES WITH COVID-19 BY AGE – SURVEY 2 (*N* = 7)



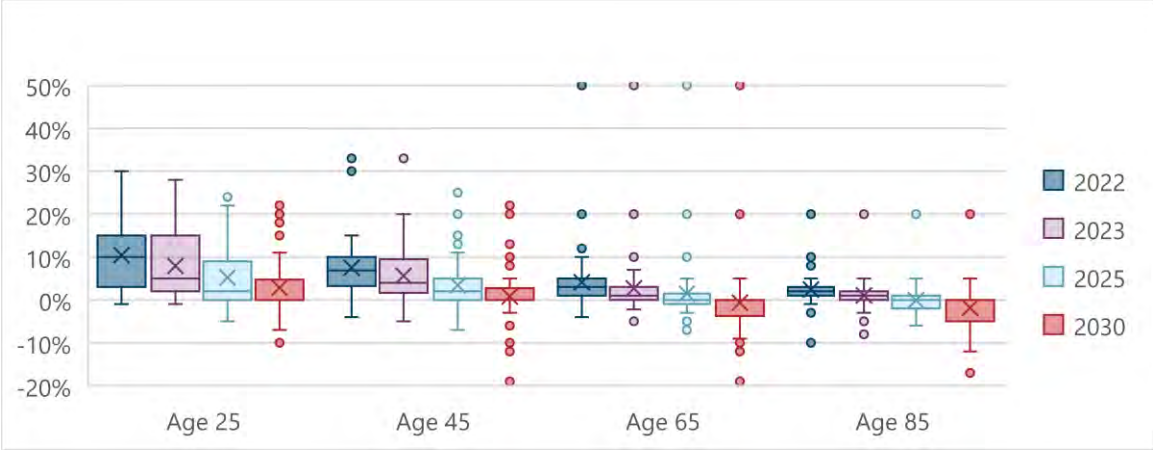
U.S. PRIVATE AND PUBLIC PENSION PLAN POPULATION FUTURE EXCESS MORTALITY ESTIMATES WITH COVID-19 BY AGE – SURVEY 1 (*N* = 15)



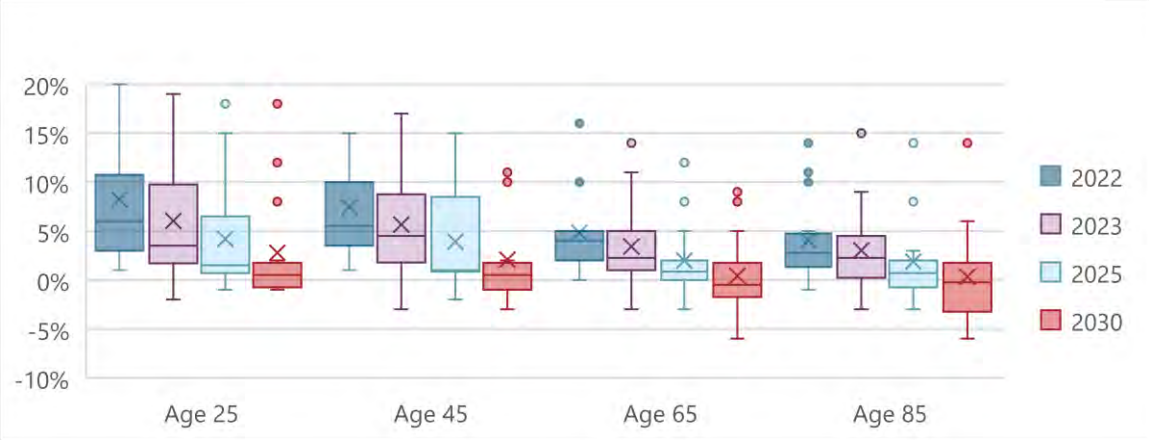
U.S. GENERAL POPULATION FUTURE EXCESS MORTALITY ESTIMATES WITHOUT COVID-19 AS A CAUSE OF DEATH BY AGE – SURVEY 2 (*N* = 34)



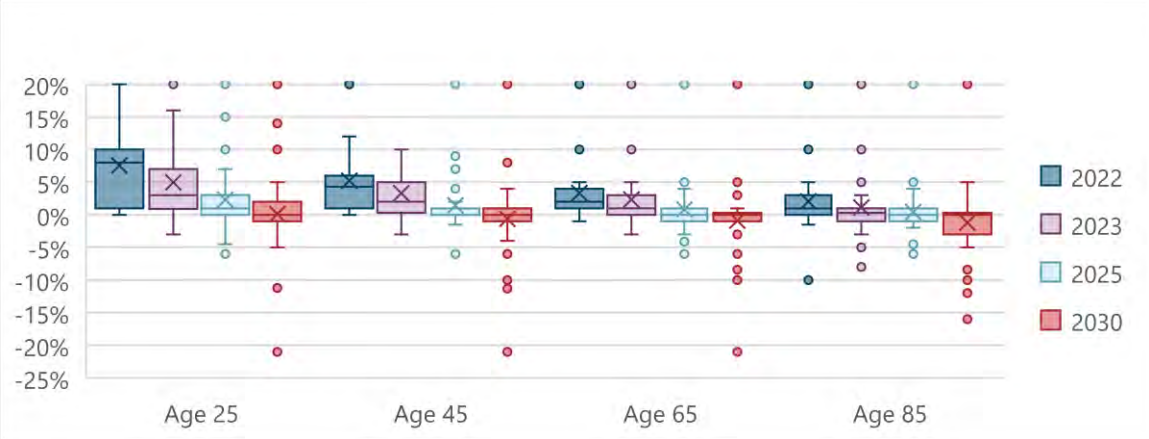
U.S. GENERAL POPULATION FUTURE EXCESS MORTALITY ESTIMATES WITHOUT COVID-19 AS A CAUSE OF DEATH BY AGE – SURVEY 1 (*N* = 55)



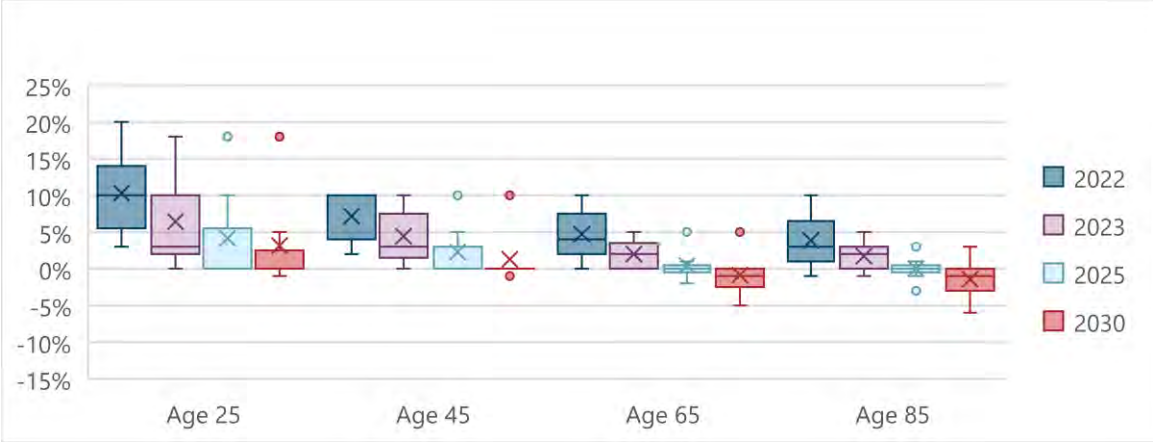
U.S. LIFE INSURANCE INDUSTRY INSURED POPULATION FUTURE EXCESS MORTALITY ESTIMATES WITHOUT COVID-19 AS A CAUSE OF DEATH BY AGE – SURVEY 2 (*N* = 14)



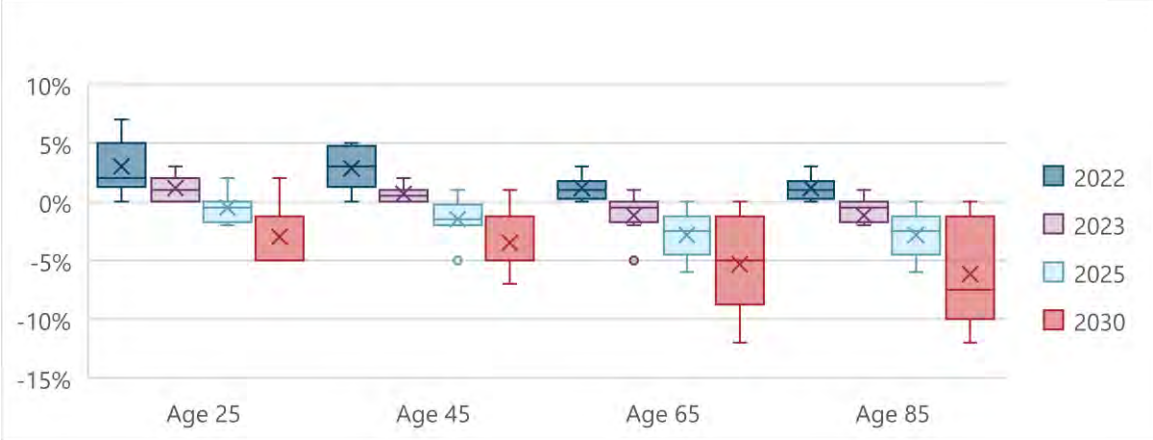
U.S. LIFE INSURANCE INDUSTRY INSURED POPULATION FUTURE EXCESS MORTALITY ESTIMATES WITHOUT COVID-19 AS A CAUSE OF DEATH BY AGE – SURVEY 1 (*N* = 29)



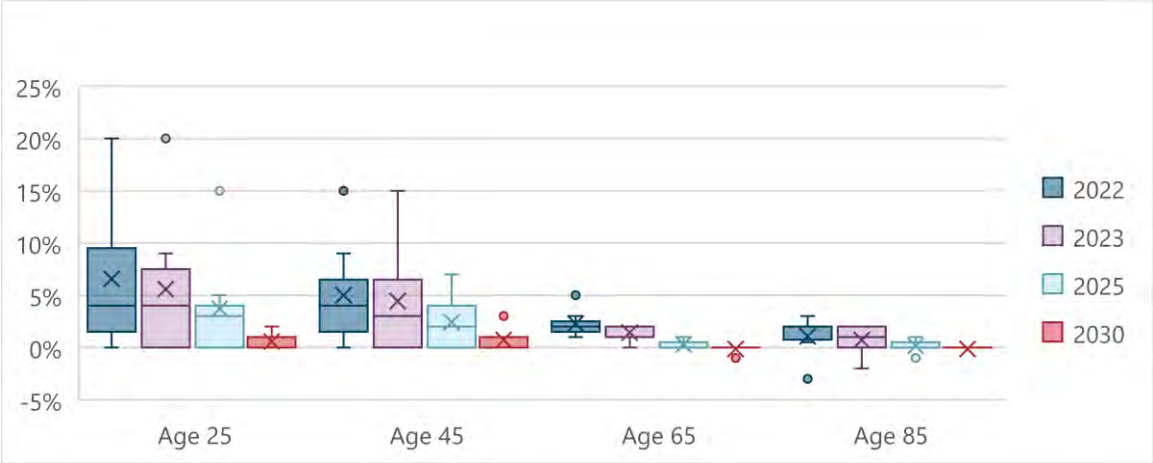
U.S. ANNUITY INDUSTRY ANNUITANT POPULATION FUTURE EXCESS MORTALITY ESTIMATES WITHOUT COVID-19 AS A CAUSE OF DEATH BY AGE – SURVEY 2 (*N* = 7)



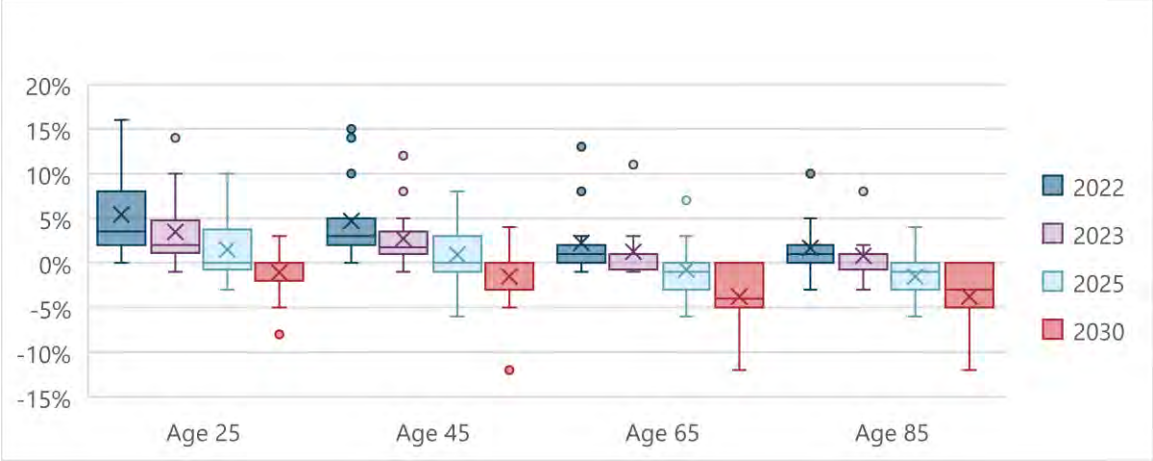
U.S. ANNUITY INDUSTRY ANNUITANT POPULATION FUTURE EXCESS MORTALITY ESTIMATES WITHOUT COVID-19 AS A CAUSE OF DEATH BY AGE – SURVEY 1 (*N* = 6)



U.S. PRIVATE AND PUBLIC PENSION PLAN POPULATION FUTURE EXCESS MORTALITY ESTIMATES WITHOUT COVID-19 AS A CAUSE OF DEATH BY AGE – SURVEY 2 (*N* = 7)

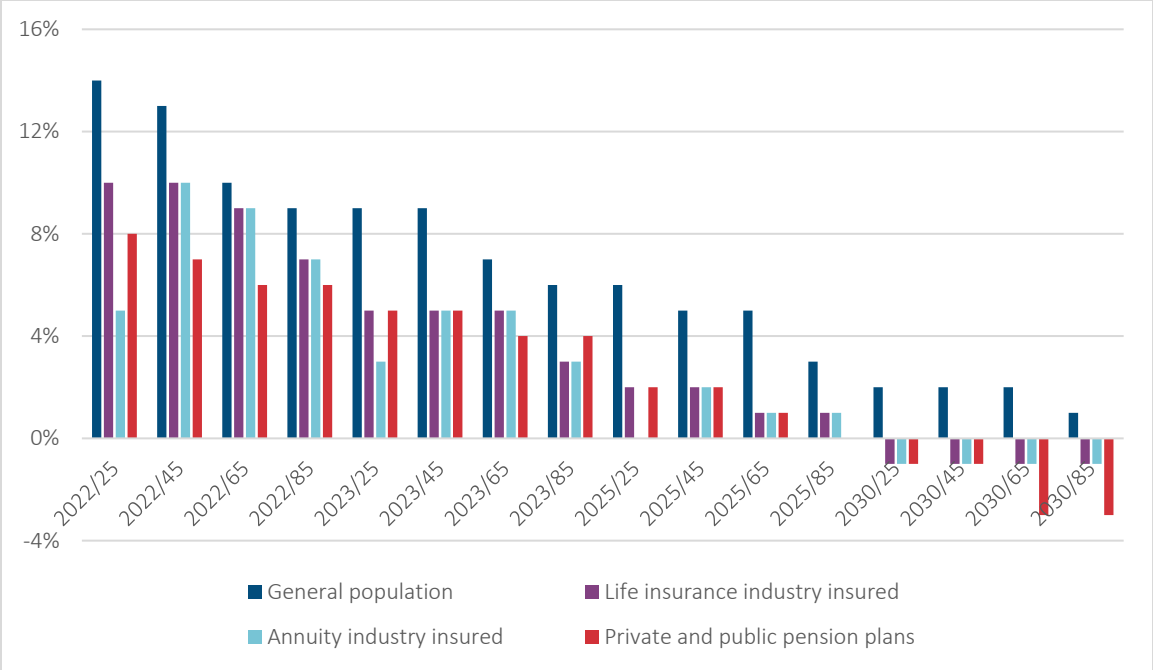


U.S. PRIVATE AND PUBLIC PENSION PLAN POPULATION FUTURE EXCESS MORTALITY ESTIMATES WITHOUT COVID-19 AS A CAUSE OF DEATH BY AGE – SURVEY 1 (*N* = 14)

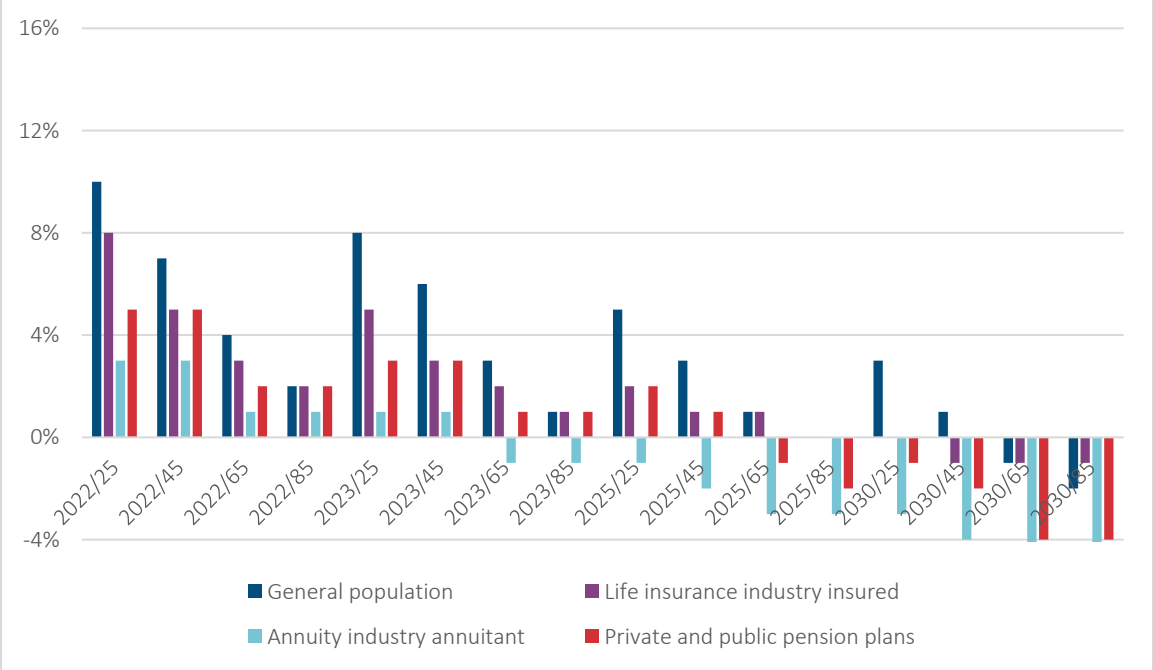


Appendix C: Comparison of Survey 1 and Survey 2

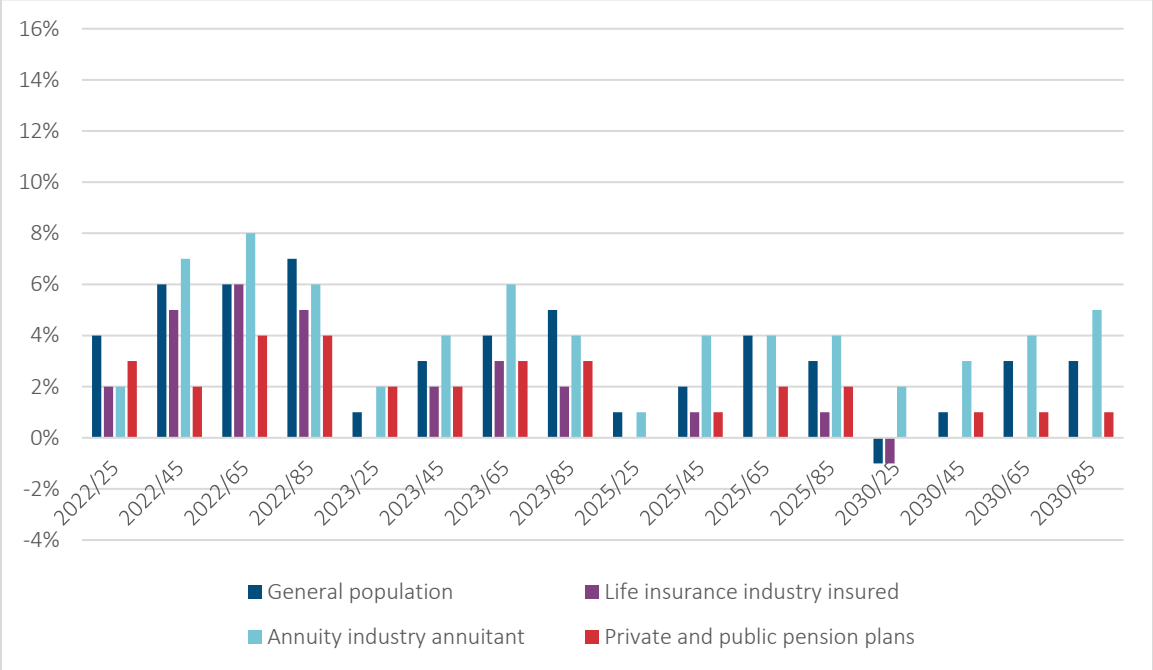
SURVEY 1 (WITH COVID-19)



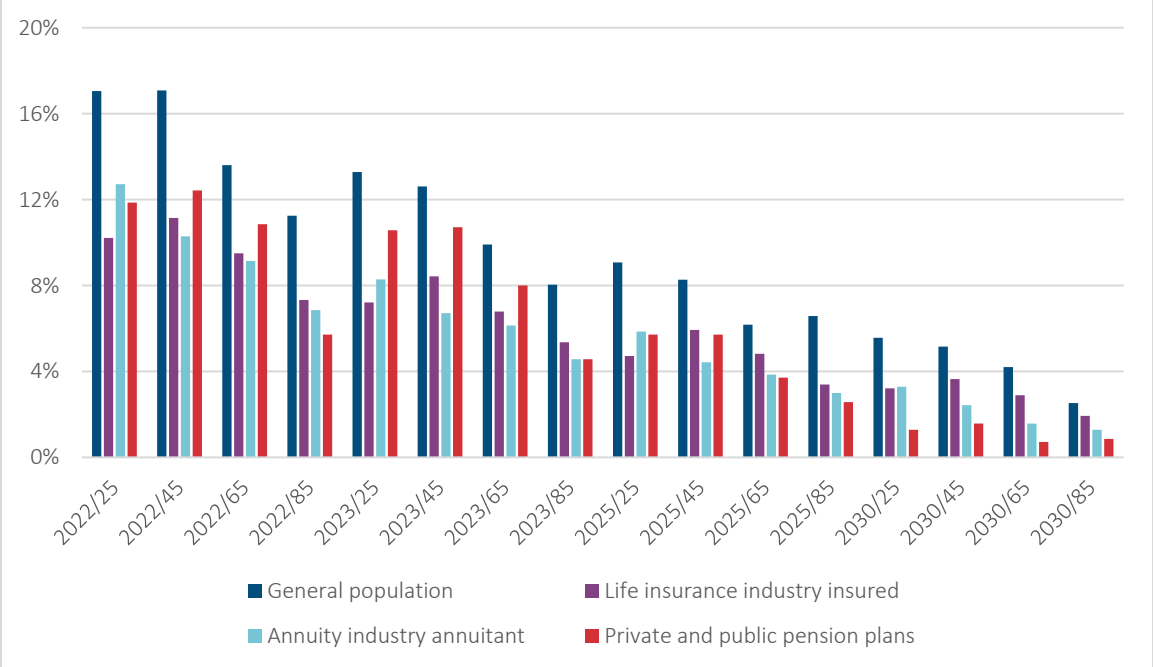
SURVEY 1 (WITHOUT COVID-19)



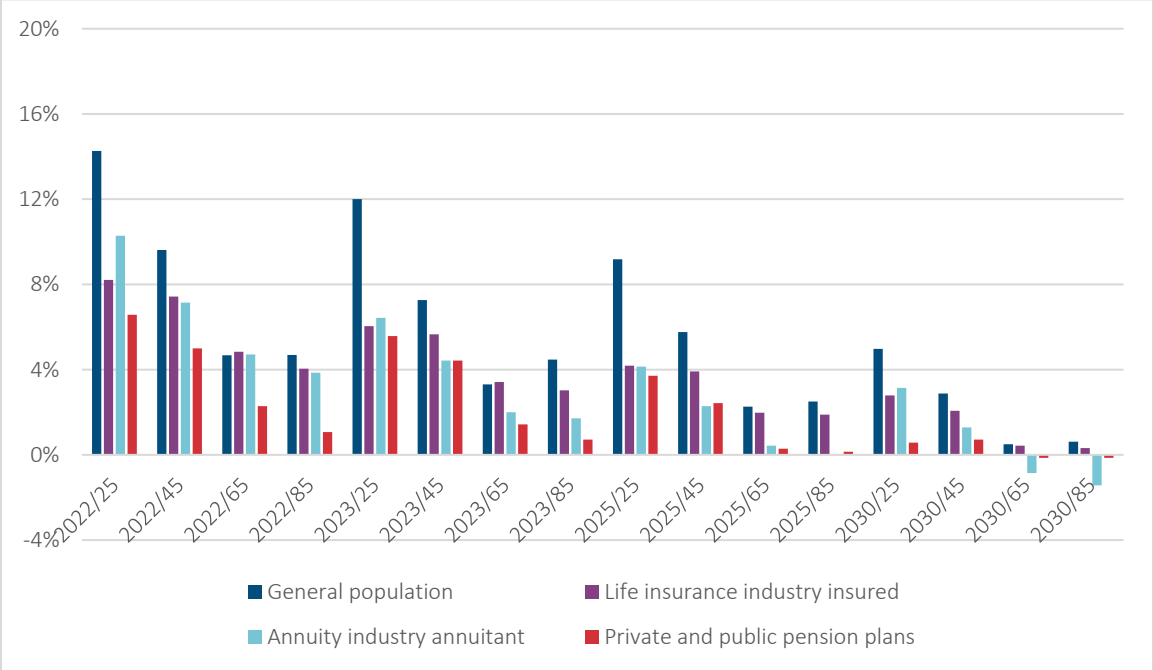
SURVEY 1 (COVID-19 EXCESS DEATHS)



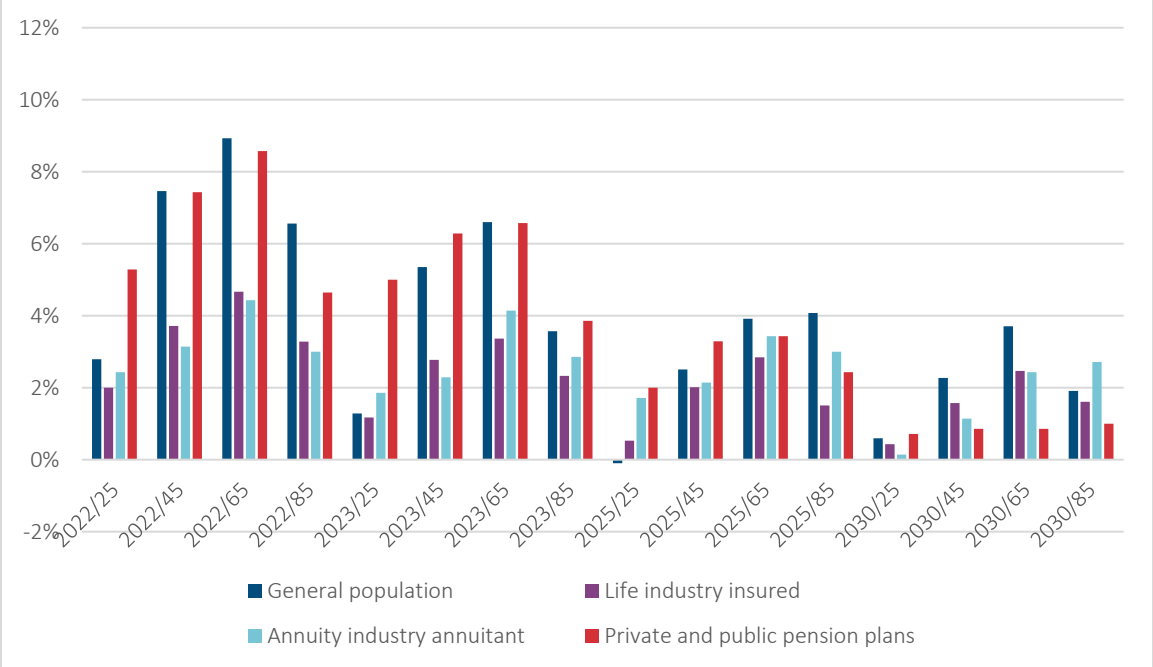
SURVEY 2 (WITH COVID-19)



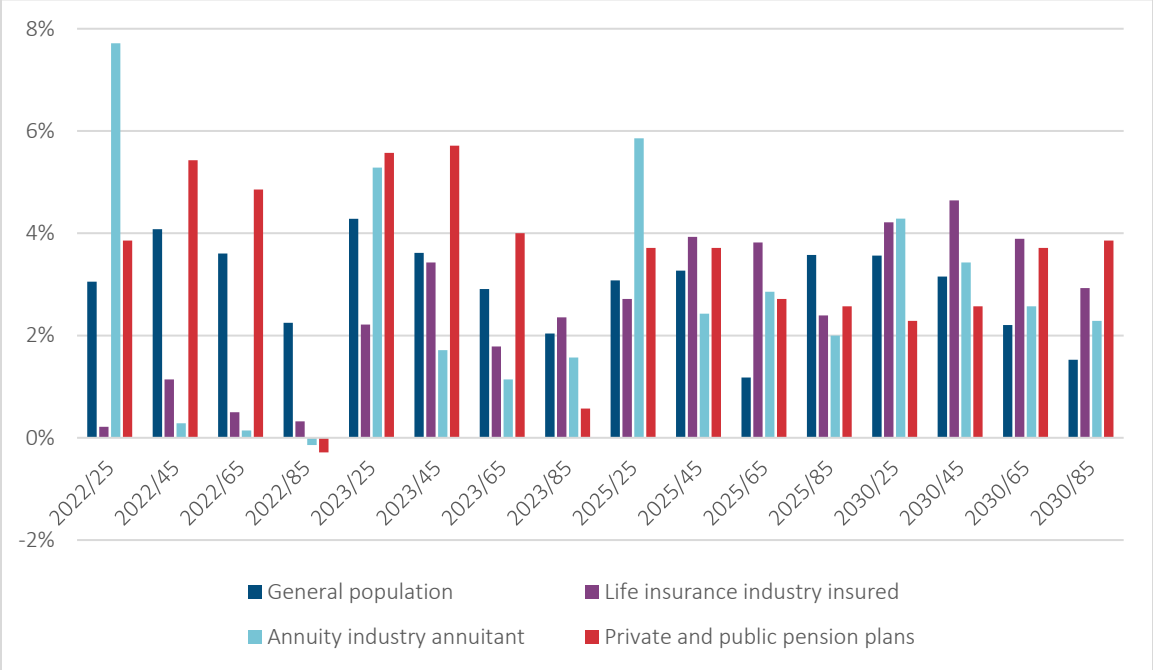
SURVEY 2 (WITHOUT COVID-19)



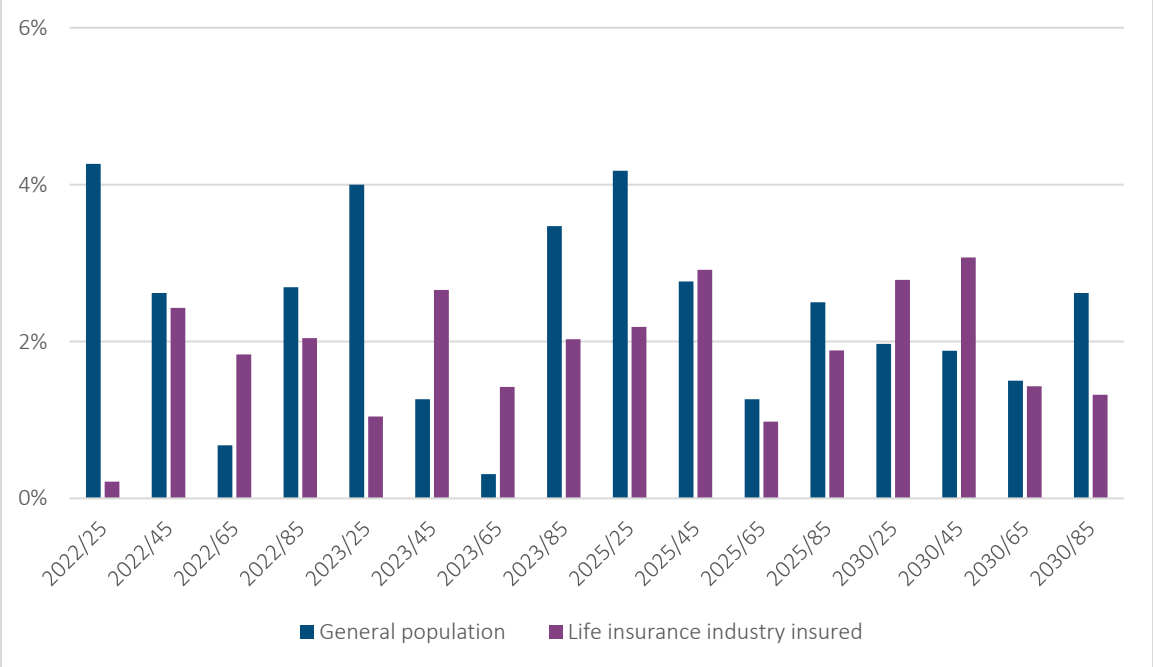
SURVEY 2 (COVID-19 EXCESS DEATHS)



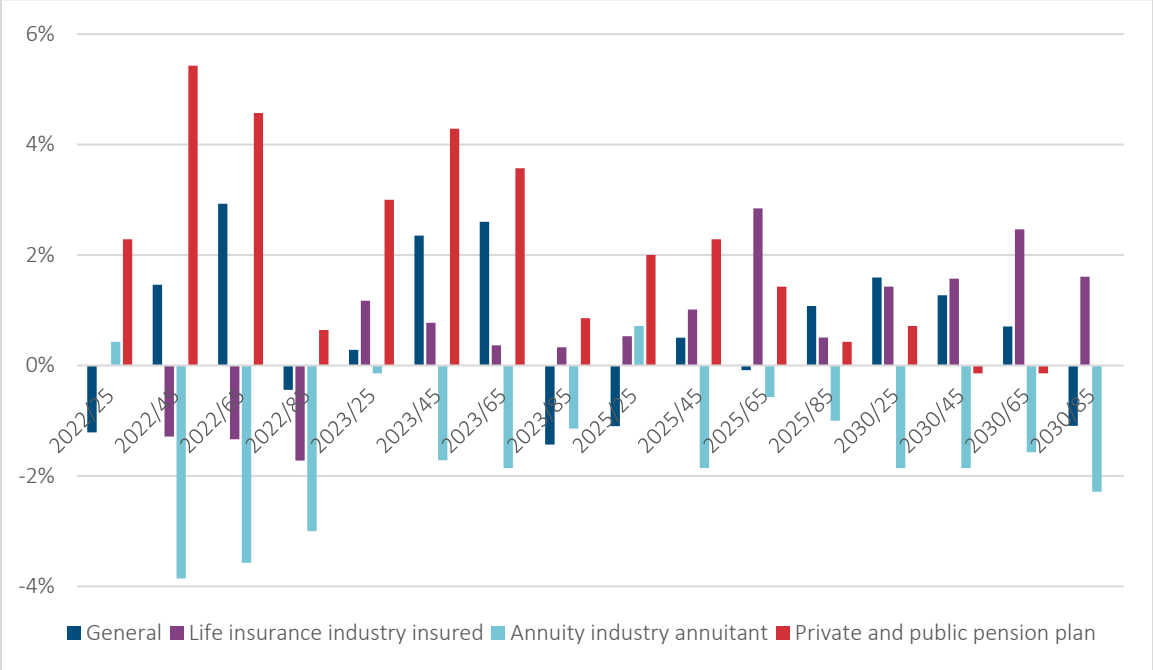
SURVEY 2 – SURVEY 1 (WITH COVID-19)



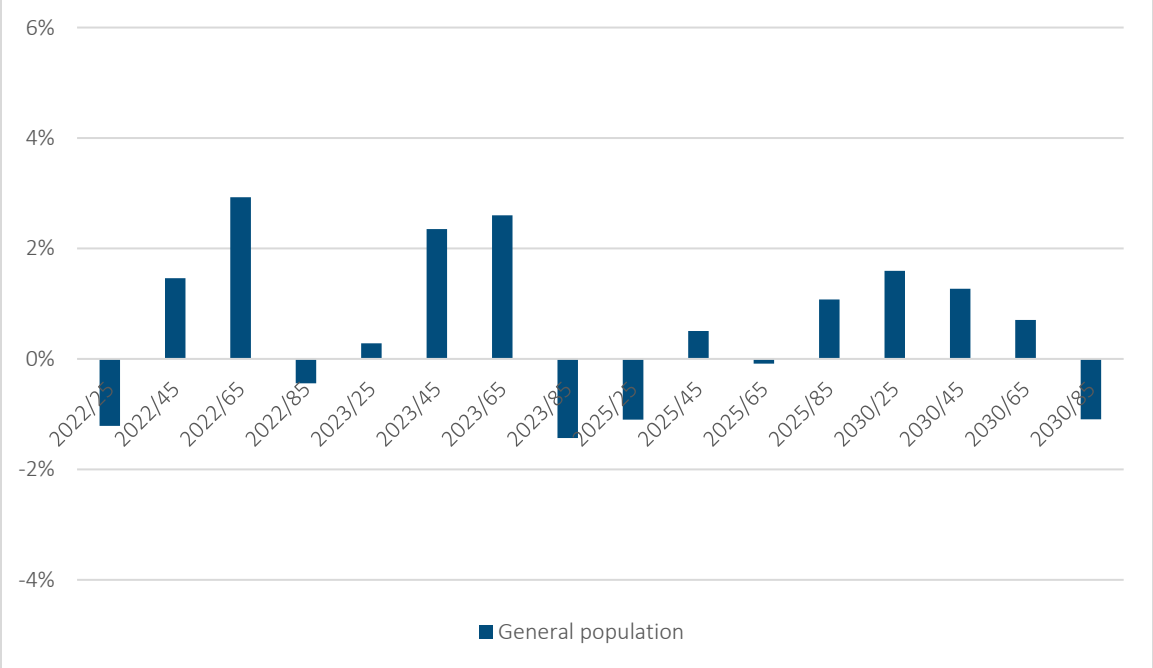
SURVEY 2 – SURVEY 1 (WITHOUT COVID-19)



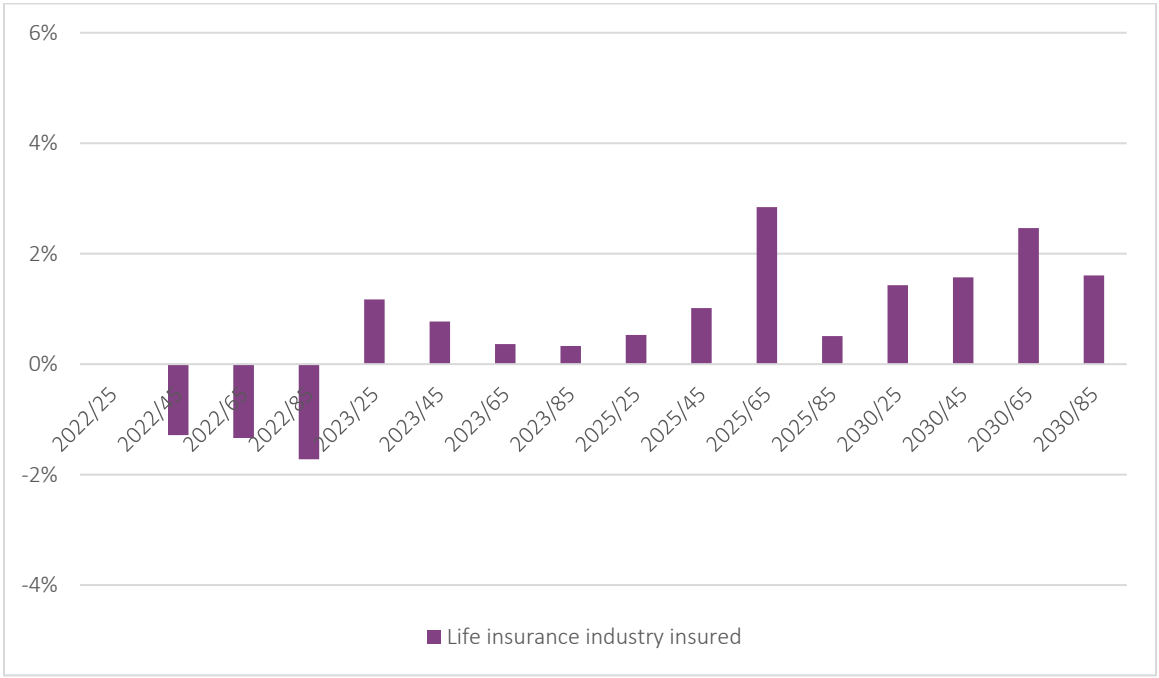
SURVEY 2 – SURVEY 1 (COVID-19 EXCESS DEATHS) BY POPULATION



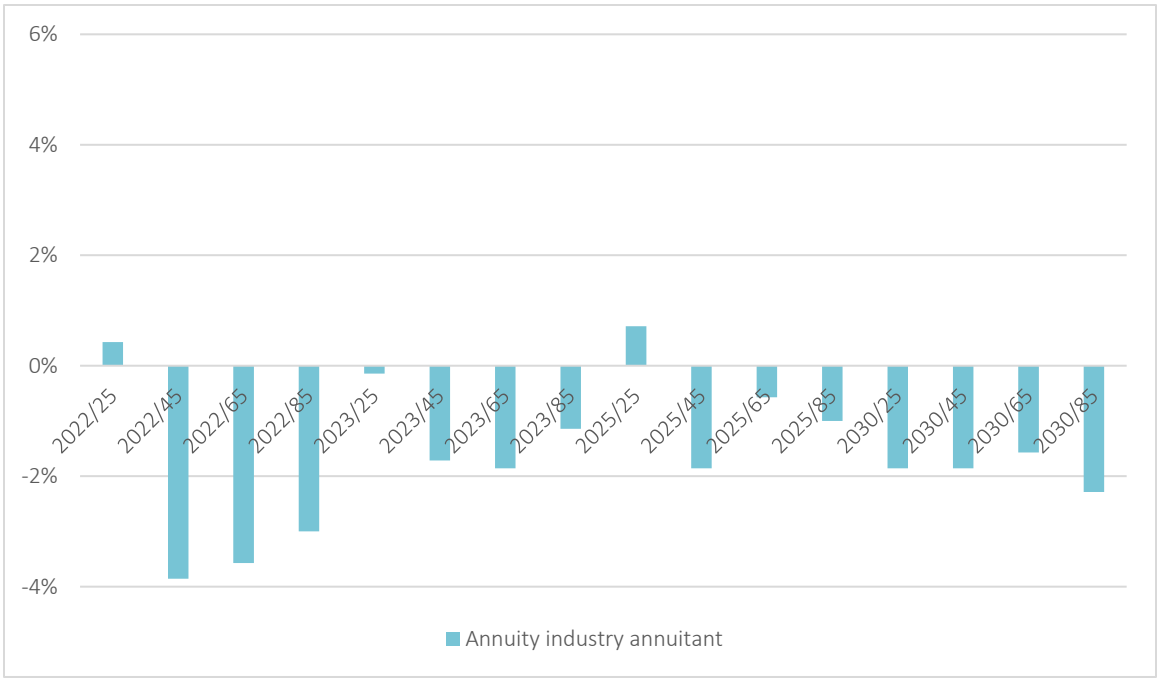
SURVEY 2 – SURVEY 1 (COVID-19 EXCESS DEATHS) GENERAL POPULATION



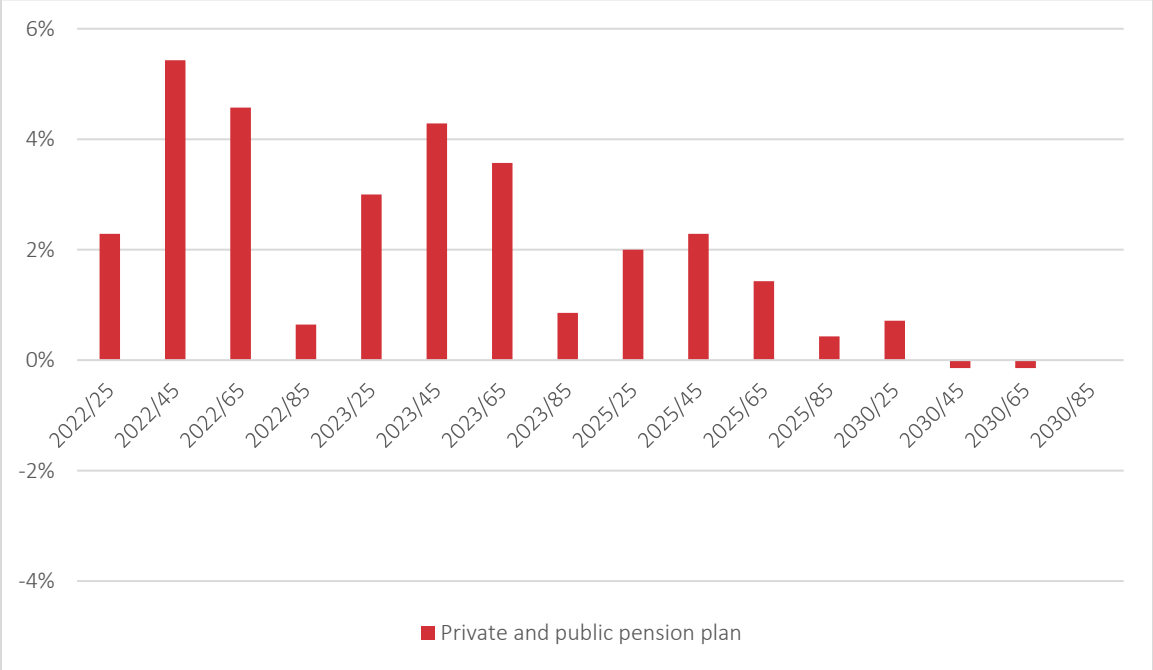
SURVEY 2 – SURVEY 1 (COVID-19 EXCESS DEATHS) LIFE INSURANCE INDUSTRY INSURED POPULATION



SURVEY 2 – SURVEY 1 (COVID-19 EXCESS DEATHS) ANNUITY INDUSTRY ANNUITANT POPULATION



SURVEY 2 – SURVEY 1 (COVID-19 EXCESS DEATHS) PRIVATE AND PUBLIC PENSION PLAN POPULATION



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