Mortality
and Longevity

2022 Cause of Death Report

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2022 Cause of Death Report

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Section 1: Introduction

LIMRA, Reinsurance Group of America (RGA), the Society of Actuaries (SOA) Research Institute, and TAI have collaborated on an ongoing effort to analyze the impact of COVID-19 on the individual life insurance industry's mortality experience and share the emerging results with the insurance industry and the public. The Individual Life COVID-19 Project Work Group (Work Group) was formed as a collaboration of LIMRA, RGA, the SOA, and TAI to design, implement, and create the study and to produce and distribute a variety of analyses.

This report is the fifth public release from this collaboration and contains the results of a cause of death (COD) analysis focused on how the rates of death for various causes were impacted throughout the pandemic period through the first quarter of 2021. Data from 31 companies representing approximately 72% of the industry face amount inforce have been included in the analyses in this report. A total of 2.8 million death claims from individual life policies from January 1, 2015, through March 31, 2021, make up the basis of the analyses.

The Work Group expects to receive ongoing data submissions from the 31 participating companies plus additional companies during the remainder of 2022. In an effort to continue to supply the industry and public with the latest mortality information on individual life insurance, the Work Group plans to issue future updates as more industry data becomes available.

Some notable observations from the report are summarized in section 2. Important assumptions and methodologies, including the development of the expectations used to analyze changes in rates of death, are covered in section 3. Sections 4 through 7 explore the individual life insured mortality experience results by various attributes, including underwriting class, smoker status, and underwriting method.

In this report, we explore how trends by cause of death changed during the pandemic for the insured population. We examine the relationship between COVID deaths and overall excess deaths over the period. We look at changes in rates of death by cause for three age-and-sex-standardized cohorts with distinct differences in cause profiles: age groups 5-39, 40-74 and 75-94. The youngest group has a larger share of non-medical deaths in their profile. The two older groups have larger shares of non-communicable deaths, but the proportions of underlying causes within that category differ. The 40-74 age group has more cancer followed by cardiovascular deaths. The 75-94 age group has more cardiovascular, then cancer, then a very large amount of nervous system (Alzheimer's and other dementia, for example) deaths.

Section 2: Executive Summary

We consolidated the causes of death from the 31 available companies in the study into three main categories plus unknown cause of death. Each of those three main categories were split into four or eight subcategories as shown in the following summary tables. Note that all analyses in this report are based on policy and death counts, not on amounts.

Table 1
SUMMARY OF CLAIMS BY YEAR, QUARTER, AND MAIN CAUSE GROUP, 2015 - 1Q 2021

Calendar Year	Quarter	Communicable	COVID-19	Non-Communicable	Non-Medical	Unknown	Quarter Totals
2015	1	13,023	0	59,018	3,723	45,271	121,035
	2	10,228	0	52,365	3,598	41,353	107,544
	3	8,713	0	50,913	3,730	39,178	102,534
	4	9,697	0	52,800	3,610	46,182	112,289
2016	1	11,301	0	55,732	3,624	44,586	115,243
	2	9,475	0	51,034	3,748	40,853	105,110
	3	8,764	0	49,916	3,880	40,322	102,882
	4	9,693	0	54,151	3,743	46,114	113,701
2017	1	11,878	0	56,685	3,738	45,412	117,713
	2	9,418	0	50,929	3,854	40,827	105,028
	3	8,710	0	49,083	3,930	40,039	101,762
	4	9,671	0	52,616	3,785	47,762	113,834
2018	1	12,511	0	55,172	3,555	48,001	119,239
	2	8,956	0	50,014	3,692	42,297	104,959
	3	8,074	0	49,109	3,723	41,132	102,038
	4	8,509	0	50,810	3,578	50,169	113,066
2019	1	9,648	0	50,776	3,493	51,261	115,178
	2	7,933	0	46,892	3,622	48,770	107,217
	3	6,717	0	45,219	3,717	47,873	103,526
	4	7,776	0	48,856	3,600	49,990	110,222
2020	1	10,231	763	52,978	3,414	48,406	115,792
	2	8,988	10,052	52,012	3,652	48,196	122,900
	3	8,046	5,707	52,164	3,945	45,632	115,494
	4	9,133	16,567	53,504	3,662	52,506	135,372
2021	1	8,928	15,242	51,741	3,494	51,791	131,196
Cause Totals		236,021	48,331	1,294,489	92,110	1,143,923	2,814,874

Table 2
SUMMARY OF CLAIMS BY CAUSE AND AGE GROUP, 2015 - 1Q 2021

Main Cause Category	Cause Subcategory	5-39	40-74	75-94	Cause Grand Total
Communicable	Influenza/Pneumonia	380	15,608	53,689	69,677
	Other Communicable	329	10,655	22,833	33,817
	Respiratory Diseases	634	39,564	92,329	132,527
	COVID-19	261	17,678	30,392	48,331
Non-Communicable	Cancer	4,070	187,994	185,608	377,672
	CVD other than hypertension	3,481	147,555	371,409	522,445
	Diabetes	285	7,622	9,878	17,785
	Digestive	775	18,359	17,136	36,270
	Hypertension	228	12,240	29,723	42,191
	Kidney Disease	178	8,294	18,676	27,148
	Nervous System	859	26,011	121,574	148,444
	Other Non-Communicable	2,247	30,821	89,466	122,534
Non-Medical	Auto Transport Accidents	3,056	7,171	2,547	12,774
	Other Accidents	7,392	17,341	22,142	46,875
	Other Non-Medical	3,054	5,235	5,125	13,414
	Suicide	4,152	12,368	2,527	19,047
Unknown	Unknown	10,855	430,545	702,523	1,143,923
Age Group Grand Total		42,236	995,061	1,777,577	2,814,874

As discussed in more detail in the methodology section, expected deaths were calculated by projecting the 2015 – 2019 experience into the 2020/2021 pandemic period. Results in this report compare the pandemic experience against these trended expected results. The following are some of the more notable observations from the analyses detailed in the report.

For all causes of death, there were significant variations in the COVID impact by age and by quarter, making generalizations regarding the overall comparisons to pre-COVID mortality experience difficult. We would note the following very broad observations:

- Cancer deaths were generally higher than expected, usually in the range of 102% to 105% of expected.
- Cardiovascular deaths were also approximately 4% higher than expected for ages 40 – 94.
- Other non-communicable deaths were generally around 10% lower than expected.
- Deaths from diabetes were much higher than expected and, for older age groups, averaged as high as 30% more than expected.
- Deaths ascribed to the nervous system were substantially higher than expected, sometimes as high as 30% greater than expected.
- Respiratory deaths were roughly in line with expected, except for the younger age groups where they were higher on average, but very variable (which could be a miscoding of COVID deaths).

COVID Relationship to Excess Deaths

- Evidence to date supports the following:
    - The relationship between COVID deaths and overall excess deaths is largely a function of age and magnitude of COVID deaths.
    - Younger lives' non-COVID excess deaths are **much higher** than their COVID deaths.
    - Older lives' non-COVID excess deaths are **lower** than their COVID deaths.

Insights by Cause

Non-Medical Deaths

- Deaths by suicide, which excludes drug overdoses, were noticeably lower during the pandemic compared with prior age group and period cohorts from 2015-2019.
- Deaths by motor vehicle accident were noticeably increased against the 2015-2019 trend for the youngest age group and noticeably decreased for the older age groups.
- The rate of death for the category "other non-medical" deaths, which includes drug overdoses, was up noticeably against the 2015-2019 trend for most cohorts in the study.

Non-Communicable Deaths

- The leading cause of death for the 40-74 age group was cancer, both before and during the pandemic. The rate of cancer deaths typically increased significantly against the 2015-2019 trend in each of the five pandemic quarters available for study.
- The leading cause of death for the 75-94 age group was cardiovascular disease. These rates increased significantly in three of the five pandemic quarters against the 2015-2019 trend.

Communicable Deaths

- COVID-19 dominated this category beginning in the second quarter of 2020.
- The first quarter is typically when influenza and pneumonia deaths have the most impact. In this study, those deaths were either in line with prior expectations or significantly lower than prior expectations against the 2015-2019 trend for each cohort in the first quarters of 2020 and 2021.
- Respiratory deaths, which included COPD in this study, were close to pre-pandemic expectations in the study – and significantly better for some cohorts against the 2015-2019 trend.

Underwriting Class

- For the older preferred lives, the pandemic increased the rate of death considerably. However, the increased rate for the oldest (ages 75-94) preferred lives was almost entirely due to COVID-19 in the study.
- Standard lives were likely to have rates of death increase significantly against the 2015-2019 trend for other causes.

Smoker Status

- Smokers did not have as many young cohorts, with a significant increase in non-medical deaths against the 2015-2019 trend, as did non-smokers. They also did not have the same significant decrease against the 2015-2019 trend in the middle age group as non-smokers.

Section 3: Methodology

Many of the analyses in this report focus on age-and-sex standardized rates of death per 1000, usually split into more specific causes of death. Raw totals of deaths and proportions of causes of death lack sufficient context to provide much useful information for several reasons:

- The cause mix changes by age, sex and over time;
- Exposures and, therefore, deaths have higher variance in a multi-company, multi-product line study such as this one; and
- Trends in cause of death counts can be masked or distorted by exposure inconsistencies.

We address these issues by developing age-and-sex-standardized mortality rates per 1000 (we will refer to these as "ASMR" throughout the report) for the various age groups. Many age groups are used in the first section detailing the relationship of COVID deaths to overall excess deaths. Later sections looking at certain causes or common experience study aggregators will focus on only three groups: 5-39, 40-74, and 75-94.
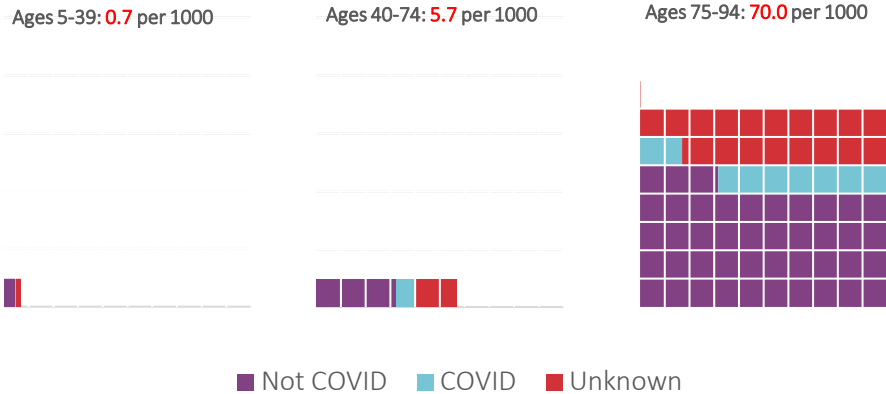
We looked at the results initially on both a count and amount basis. The results based on amount were substantially more volatile than those based on counts, making it difficult to draw inferences from the analysis by amount. Hence, all the results in this report have been calculated on a count basis.

Each subgroup discussed in the report, such as non-smoker or smoker, has a unique age/sex mix for standardization that is developed from the ages and time periods discussed. If looking at the fourth quarters for non-smokers aged 40-74, then exposures and deaths are taken from only non-smokers in the fourth quarters from 2015-2020, ages 40-74. Those distributions by age and sex become the standard for that subset. This is necessary to allow consistency across time periods for causes to develop a meaningful trend. For example, the age/sex mix of non-smokers is quite different than for smokers. We want to see how the rate of cancer deaths, for example, trended for non-smokers and how it trended for smokers so we may then determine the impact of COVID-19 in the pandemic period. The trends of rates of death by cause for non-smokers will be more meaningful if results by age and sex are adjusted specifically for non-smokers. This means that, while rates of death by cause shown *within* any subgroup are meaningful, they are not directly comparable in the report to rates within a different subgroup. This **contrasts** with the **prior report** that ended in the fourth quarter of 2020[1]; in that report, the rates of death shown were meant to be comparable across any subgroup. The unique nature of a cause of death study forces the change.

Creating a single age group would have limited much of the analyses. Younger ages have a very different mix of causes than older ages. The proportion of causes for the two older groups here is somewhat similar, but the rates per 1000 are vastly different. Figure 1 shows the difference in the rates of death for the three age groups in the first quarter of 2021. Three causes are shown: COVID, causes that are known but are not COVID (simplified to "Not COVID"), and unknown, which may include some COVID.

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[1] https://www.soa.org/resources/experience-studies/2021/covid-mortality-update-2020-4th-qtr/

Figure 1

AGE-AND-SEX-STANDARDIZED RATES OF DEATH PER 1000, 1Q 2021 BY PRIMARY COD

Ages 5-39: 0.7 per 1000   Ages 40-74: 5.7 per 1000   Ages 75-94: 70.0 per 1000

■ Not COVID   ■ COVID   ■ Unknown

Waffle charts, where one full square equals one age-and-sex-standardized rate of death per 1000 and each is color-coded by cause, are used in Figure 1 because a simple stacked bar chart left the 5-39 age group looking flat against the x-axis since their rate of deaths per 1000 is less than 1% of the 75-94 rate. The takeaway is that we will be showing many results in this report within an age group and showing relative levels of increase or decrease for that age group (see figures 6 and 9 as examples); that chart type will be scaled to the rate of death of the age group studied and will look similar in style for all three age groups.

In the section on COVID deaths versus overall excess, we proportionally assign the unknown deaths to either COVID or non-COVID because the total value of each ASMR is more important to the findings. In that same section, we also remove flu deaths from all periods to remove a major source of volatility from the non-COVID data sets. For later sections that look at more refined causes, the rates of unknown causes of death in the study were consistent enough over time to make us comfortable with the overall analysis and we do not believe that unknowns are having an appreciable impact on the results shown when simply looking at the increase or decrease of a cause versus trend. Figure 2 shows the levels of unknown deaths by quarter for each age band.

Figure 2

UNKNOWN COD AS A PERCENT OF FULLY UNDERWRITTEN DEATHS, BY CALENDAR YEAR AND QUARTER
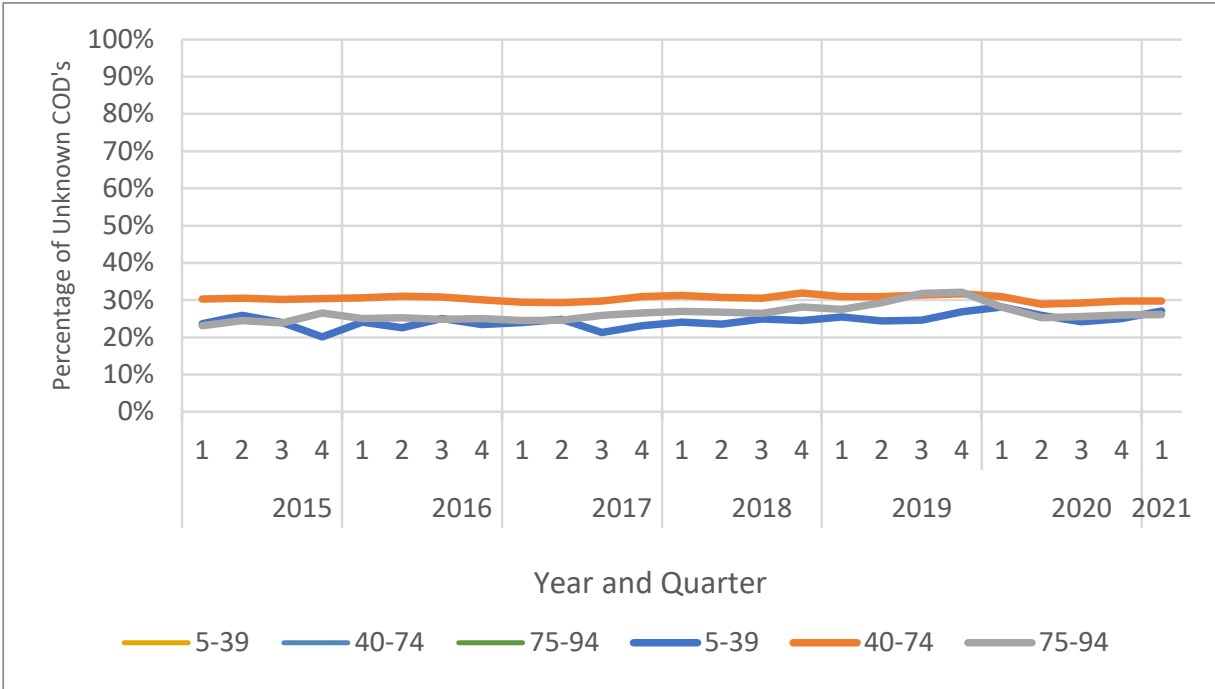
We were most concerned with unknown causes of death in the most recent quarters. The greatest period of instability occurred in quarters 2, 3 and 4 of 2019 for the 75-94 age group. More unknown causes may artificially lower the rates of death of other causes in those three quarters, which would lower the trend. However, the increase in unknown causes of death in those quarters is still only 2-3% above what was typical. The pandemic period (first quarter 2020 through first quarter 2021 in the study) shows a relatively typical proportion of unknown causes of death in each cohort relative to the baseline coming into that period.

To understand how COVID deaths are impacting other causes, we need to have some understanding of how other causes might have developed had COVID not arrived. To address this, we modeled linear trends using the 2015-2019 quarterly death rate data and projected results into the pandemic period. If the underlying volatility between the actual data and the trend is small, we can reason that increases and decreases to the actual (ASMR) against the expectation indicate a legitimate change.

The next several figures develop an example starting with all causes and moving down to one cause of death in the specific cohort of age 40-74 for males and females in the fourth quarters over the study period.

Figure 3 begins with a look at all-cause age-and-sex adjusted rates of death.

Figure 3
ALL-CAUSE ASMR PER 1000, AGES 40-74, 3Q 2015-2020, FULLY UNDERWRITTEN
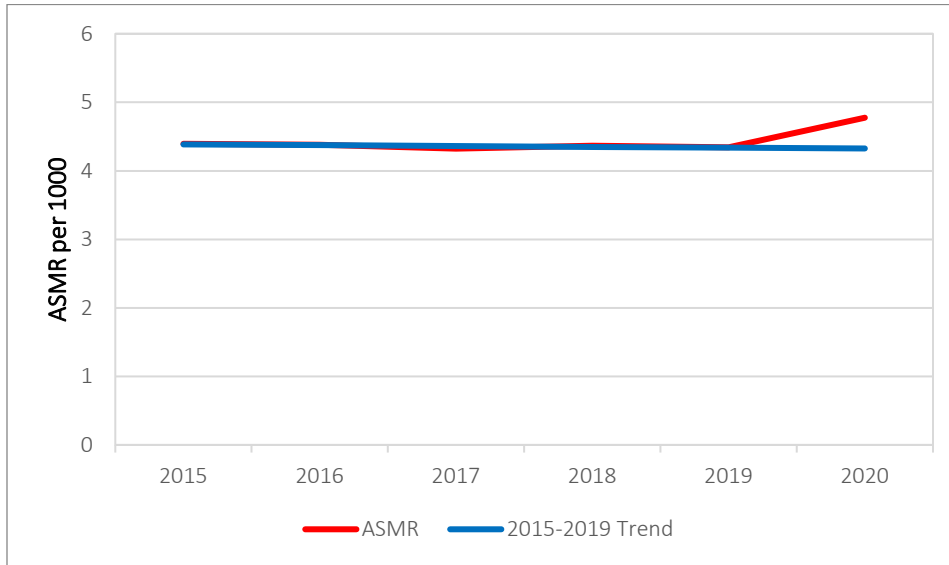
The ASMRs are fairly steady for this cohort across the third quarters until the significant increase in 2020. Next, figure 4 carves out the non-communicable deaths (cancer, heart disease, etc.) from this cohort.
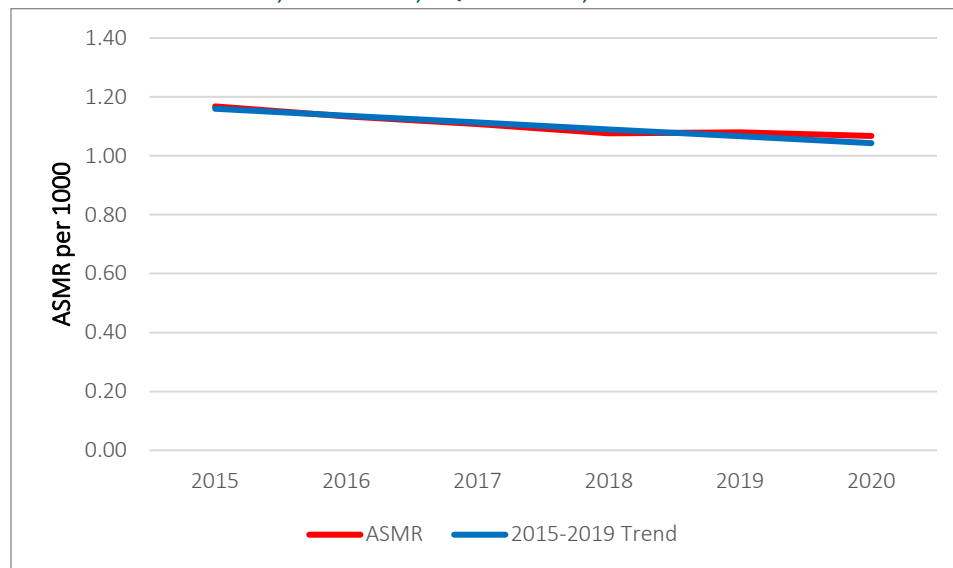
Figure 4
NON-COMMUNICABLE ASMR PER 1000, AGES 40-74, 3Q 2015-2020, FULLY UNDERWRITTEN
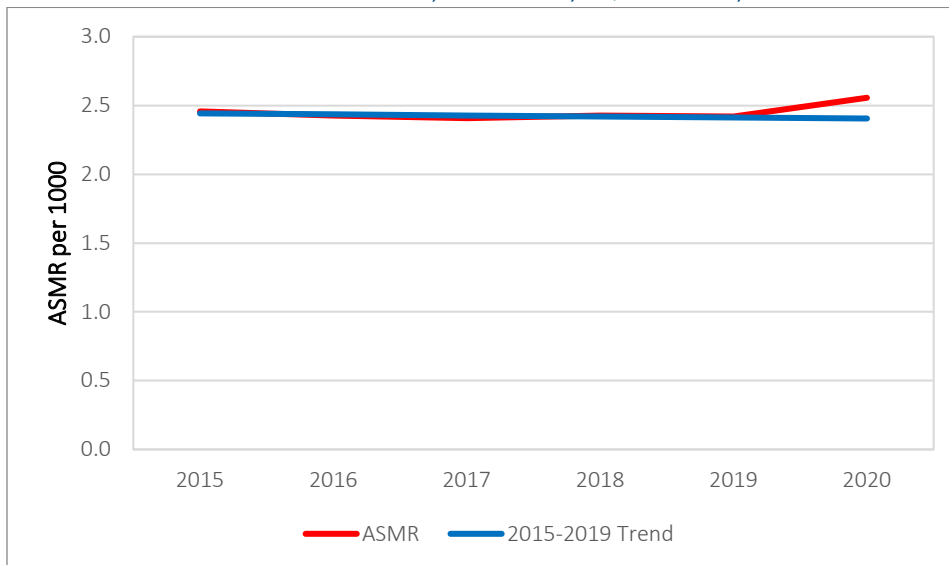
Non-communicable deaths are fairly steady with a clear increase in 2020. Figure 5 looks at the same cohort, but is confined to subsetting only known cancer deaths out of the non-communicable deaths.

Figure 5
CANCER ASMR PER 1000, AGES 40-74, 3Q 2015-2020, FULLY UNDERWRITTEN

The rate of cancer deaths in this cohort had been decreasing, but nudged up in 2019 and remained elevated in the third quarter of 2020.

Looking back at figures 4 and 5 provides some insight into how we define significant results in this report. Figure 4 showed the actual non-communicable rates of death for a cohort and the corresponding trend. We applied 95% confidence bands (using a traditional normal approximation and standard deviation to estimate the size of the bands) to all trend lines to give some mathematical guidance around whether a result is an outlier or not. In the case of overall non-communicable deaths in figure 4, the 2020 result shown is significantly higher than the upper end of the 95% confidence interval. For cancer specifically, the 2020 result from figure 5 is also significantly above the expectation set by the 2015-2019 trend.

For the discussion, we will often simplify results in the style shown in figure 6, where the actual rates of death by a cause group for one age mix in a quarter are shown in the upper chart columns, and the increase or decrease versus expected is presented in the bars directly beneath. This provides a fast visual representation of how the causes shown were impacted in that quarter, both in magnitude and direction.

Figure 6
ACTUAL ASMR, ACTUAL ASMR MINUS EXPECTED ASMR, AGES 40-74, 3Q 2020, FULLY UNDERWRITTEN
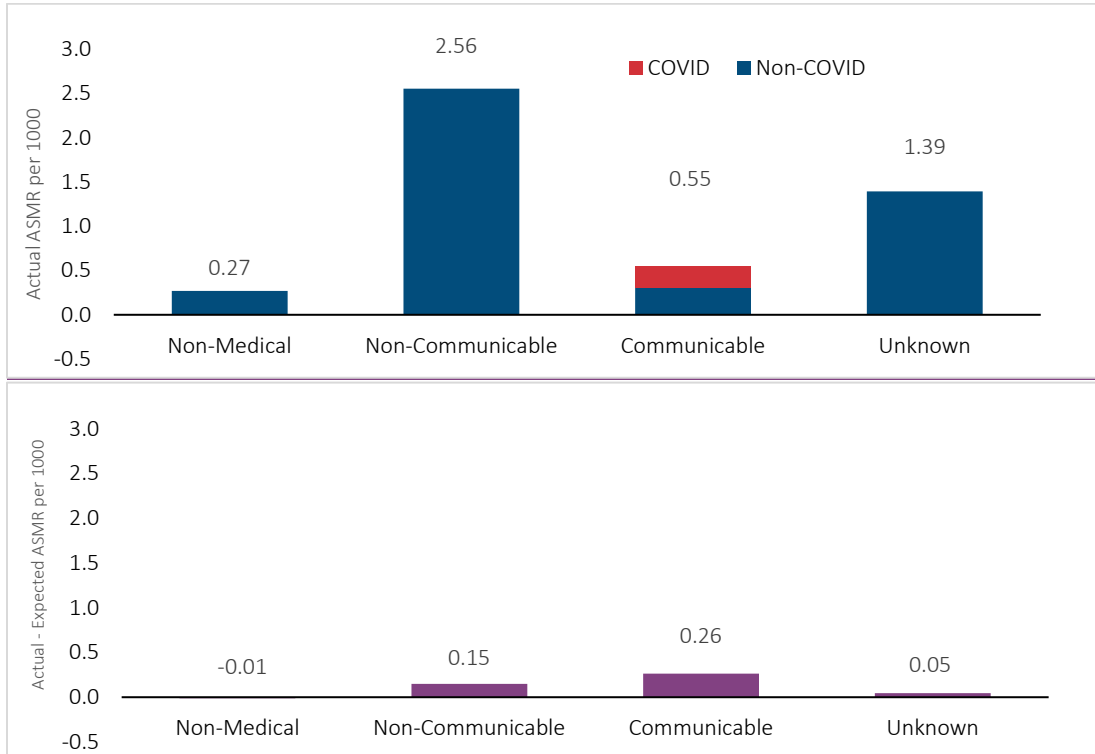
It should be clear from the lower portion of figure 6 that fully underwritten lives in this study at ages 40-74 in the third quarter of 2020 experienced a very large increase in deaths per 1000 lives over expected (sum the values in the lower chart to arrive at approximately 0.45 added deaths per 1000), where most of that increase was from communicable diseases. Non-communicable causes of death also increased well over expectation for this cohort. The upper chart also indicates that most of the increase in communicable causes was due to COVID-19 (red portion of the Communicable bar relative to the excess Communicable bar in purple). Non-medical rates of death were very much in line with the expectations of a non-pandemic impacted third quarter.

Care was taken to make these two charts, such as in figure 6, work together in terms of scale. That is, the height of 0.26 in the lower chart will be roughly the same height in the corresponding upper chart. The goal is not to be exact, but to be extremely close and allow the reader to make an immediate assessment of the impact to a cause of death in the cohort shown.

Section 4: COVID vs Other Excess Deaths

Early in the pandemic, it became clear that the excess deaths, or deaths occurring in excess of what would have been expected without the pandemic, were not simply a match of COVID deaths. An accurate model of excess deaths requires an additional adjustment if only COVID deaths are projected.

Figure 7 shows the weekly excess deaths published by the CDC over nearly a two-year span. The light blue bars are the COVID deaths, and the dark blue represents the difference between COVID deaths and the estimated excess deaths in any given week. Note that, in several weeks, the non-COVID excess is a negative value. In these weeks, the COVID deaths were greater than the overall excess.

Figure 7
U.S. POPULATION EXCESS DEATHS, MAR 2020 - DEC 2021
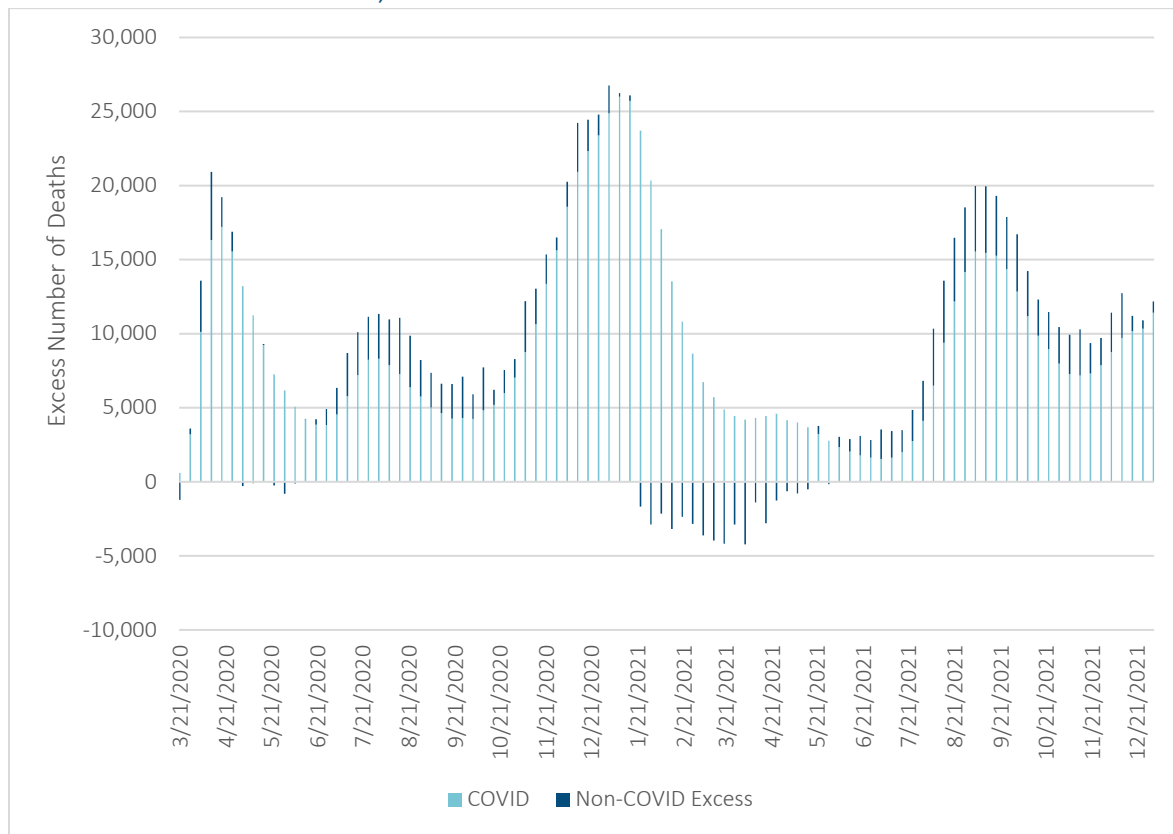
The implications are that COVID is not the only influence on excess deaths, and it appears that a large surge in COVID deaths can be followed by drops in non-COVID excess below expected.

In this section, we try to determine how large the impact is and what factors are most relevant.

Evidence in this insured data study strongly supports that the relationship between COVID deaths and the ultimate deaths above expected is largely a function of age and the magnitude of COVID. Specifically

- Younger lives' excess is much higher than just their COVID deaths.
- Older lives' excess is less than their COVID deaths.
- Higher COVID deaths (from a very high-peak shorter wave, or from a high prolonged wave) appear to be followed by a period where excess non-COVID deaths are negative. This could indicate that COVID is

displacing deaths. To give an indication of how the relationships play out between age and magnitude of COVID, figures 8a through 8c show COVID and non-COVID excess ASMRs for ages 80-84, 85-89 and 90-94. The critical piece here is the high COVID peak in November 2020 through January 2021, followed by a large decrease in non-COVID excess in the aftermath.

Figure 8a

COVID ASMR AND NON-COVID, NON-FLU EXCESS, JAN 2020 – MAR 2021, AGES 80-84
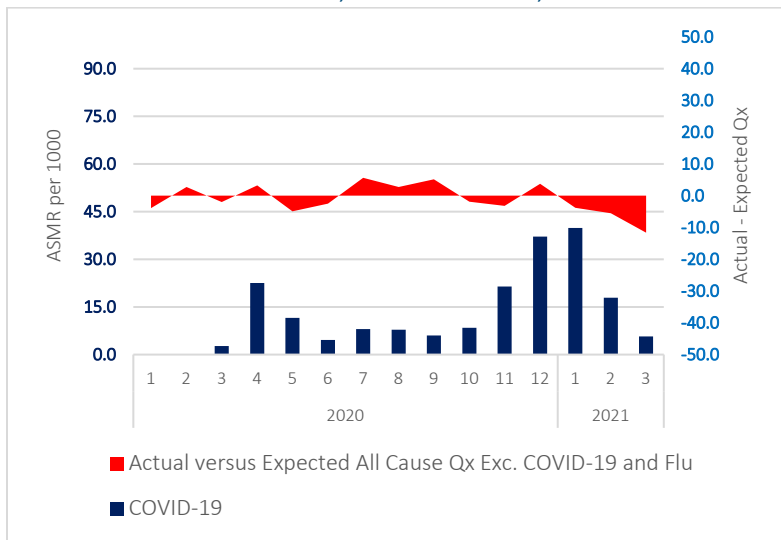
Figure 8b

COVID ASMR AND NON-COVID, NON-FLU EXCESS, JAN 2020 – MAR 2021, AGES 85-89
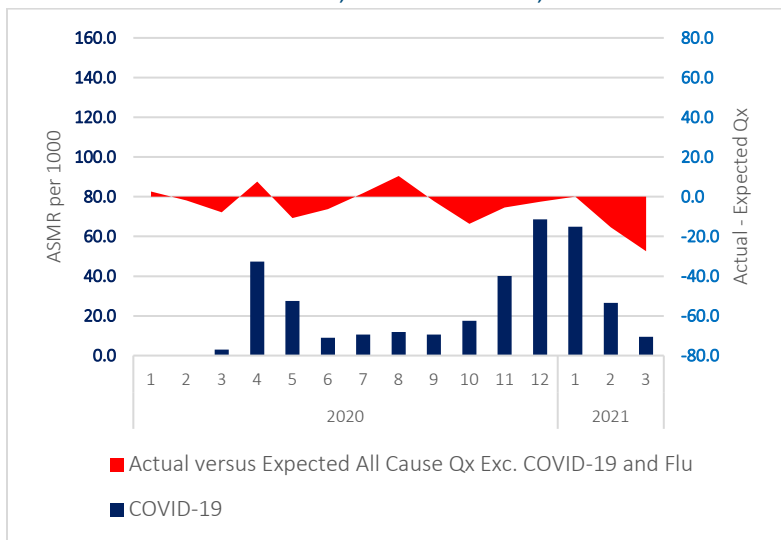
Figure 8c
COVID ASMR AND NON-COVID, NON-FLU EXCESS, JAN 2020 – MAR 2021, AGES 90-94
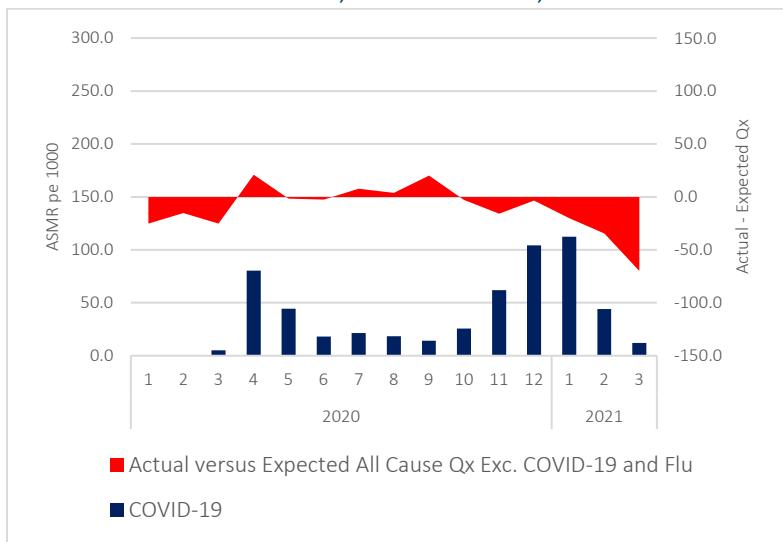
Notice the impact increases with age. The non-COVID excess becomes a larger negative as age advances. Also note that the relationship is much more pronounced following a large surge in COVID deaths.

Figure 9 shows broad categories of deaths for ages 75-94 in the first quarter of 2021.

Figure 9
ACTUAL ASMR, ACTUAL ASMR MINUS EXPECTED ASMR, AGES 75-94, 1Q 2021, FULLY UNDERWRITTEN
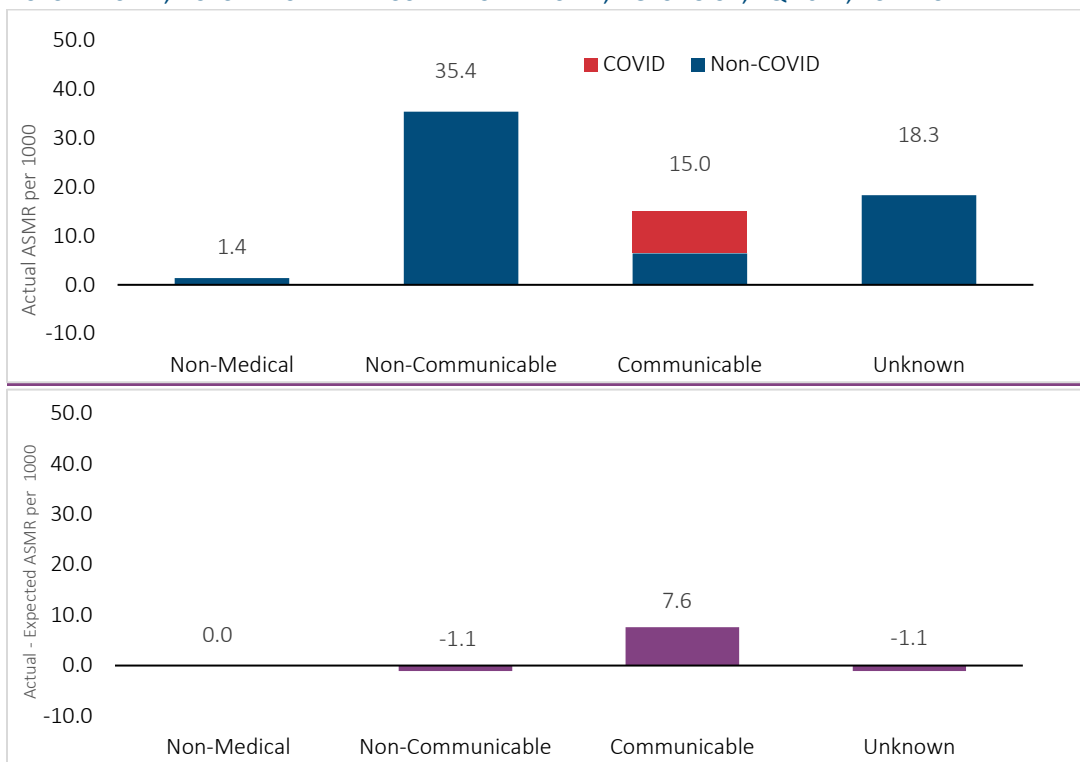
In the first quarter of 2021 for ages 75-94, the COVID ASMR was 8.55 per 1000. The combined excess ASMR of non-medical, non-communicable and other, non-COVID, and communicable deaths was -2.12. Unknown deaths were below trend. As COVID can only be a positive contributor to the unknown category, the full -1.1 excess-to-trend of unknown may be added to bring the total to -3.22. The key takeaway is that, in the oldest cohort, COVID deaths are well **over** the sum of all excess deaths.

Figure 10 shows broad categories of deaths for ages 5-39 in the third quarter of 2020.

Figure 10
ACTUAL ASMR, ACTUAL ASMR MINUS EXPECTED ASMR, AGES 5-39, Q3 2020, FULLY UNDERWRITTEN

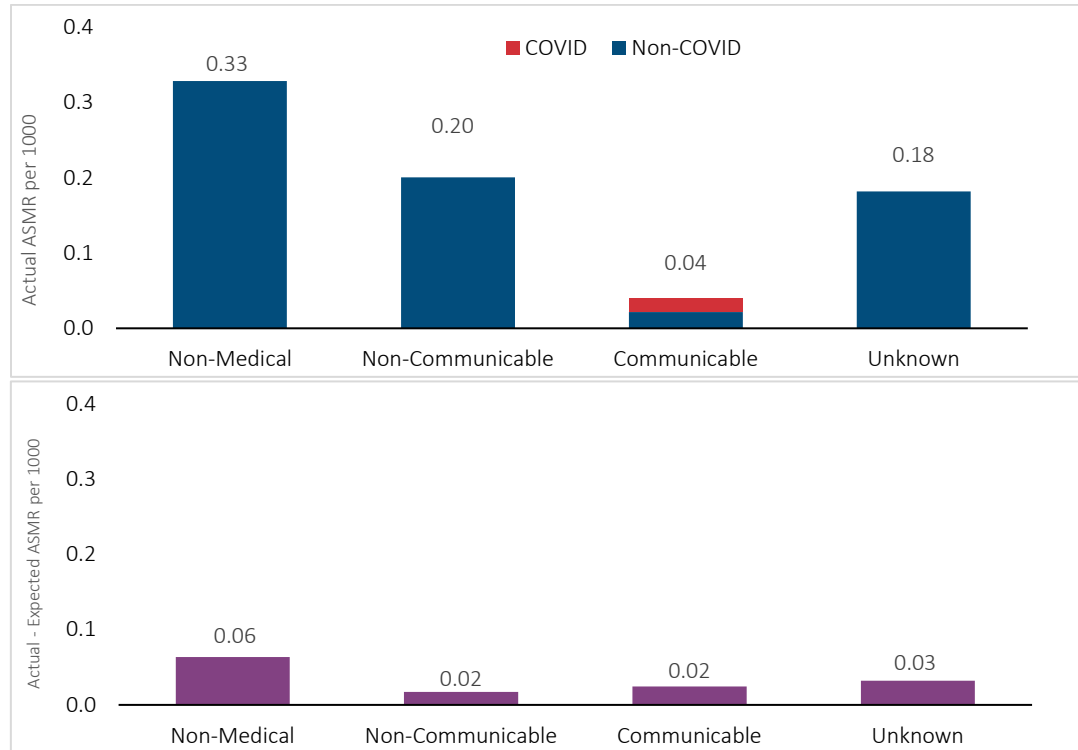In the third quarter of 2020 for ages 5 to 39, COVID accounted for 0.02 ASMR per 1000, which was slightly less than the ASMR excess of all communicable causes. Non-medical and non-communicable ASMRs were noticeably increased. Even baselessly assigning all unknown excess to COVID would still leave twice as many non-COVID excess deaths in other cause categories. The key takeaway is that, in the youngest cohort, COVID deaths are well **under** the sum of all excess deaths.

We explored relationships of excess deaths to COVID deaths using this approach across hundreds of combinations of study elements, leading to these critical findings:

- Two characteristics are fundamental in explaining excess mortality experience:
  o Age: Younger ages have far more non-COVID excess deaths than just COVID and older ages have fewer non-COVID excess deaths than their COVID deaths.
  o Magnitude of COVID: The greater the number of COVID deaths, the larger the impact on displaced deaths at older ages. Put another way, periods of very high COVID deaths lower the overall excess relative to just COVID.

- Traditional experience study aggregators do **not** have a major impact:
  - The ASMRs are obviously different – preferred rates of death are always lower than standard and so forth – but the patterns by age are roughly the same any time the counts were high enough to reasonably develop trends; that is:
    - Smokers and non-smokers, high or low face amounts; all experienced much higher excess deaths than just COVID at the younger ages and fewer total excess than COVID at the older ages.

Section 5: Fully Underwritten Business

As stated in the methodology, we compared results for a cohort in the pandemic period against an expectation developed by the 2015-2019 results within that cohort. We also created standard 95% confidence bands around the trend. We show tables throughout this report with rates of death by cause or cause group for the cohorts studied. In the remaining tables in this paper, if a result in the tables is statistically significantly lower than the expected, it is coded in blue. If a rate of death falls above the upper expectation, it is coded red (as are all COVID-19 numbers). Results falling within the confidence intervals are black. Many values in the tables will fall outside the calculated 95% confidence intervals due to the tables exclusively showing values from the pandemic period. For context, the 2015-2019 results only had three out of 189 data points fall outside the confidence intervals. That makes sense as those data were used to build the trends. The pandemic had a major impact on how the overall causes developed in the insured population from 2020 through the end of our study period and, thus, there are a great many values in these tables showing as red or blue.

Table 3
ASMR PER 1000 BY AGE GROUP, QUARTERLY RESULTS, ALL QUARTERS, FULLY UNDERWRITTEN

Cause	Year	Quarter	5-39	40-74	75-94
Communicable (Excluding COVID)	2020	Q1	0.03	0.4	7.6
	2020	Q2	0.02	0.4	6.5
	2020	Q3	0.02	0.3	5.6
	2020	Q4	0.02	0.4	6.1
	2021	Q1	0.01	0.4	6.4
COVID-19	2020	Q1	0.002	0.1	0.3
	2020	Q2	0.02	0.4	6.1
	2020	Q3	0.02	0.2	2.9
	2020	Q4	0.02	0.6	9.8
	2021	Q1	0.03	0.7	8.5
Non-Communicable	2020	Q1	0.19	2.6	36.6
	2020	Q2	0.19	2.5	35.0
	2020	Q3	0.20	2.6	33.9
	2020	Q4	0.20	2.5	34.4
	2021	Q1	0.18	2.6	35.4
Non-Medical	2020	Q1	0.24	0.2	1.4
	2020	Q2	0.28	0.3	1.3
	2020	Q3	0.33	0.3	1.4
	2020	Q4	0.27	0.2	1.3
	2021	Q1	0.27	0.2	1.4

There are five quarters in the pandemic period available in this study, from the start of the first quarter of 2020 through end of the first quarter of 2021. The next figures show the **worst quarter** in terms of total excess rates of death for each age group. As described in the methodology section, "unknown" deaths generally scaled with prior expectations as a percentage of total deaths, and are included here for completeness.

Figure 11

ACTUAL ASMR, ACTUAL ASMR MINUS EXPECTED ASMR, AGES 5-39, Q3 2020, FULLY UNDERWRITTEN
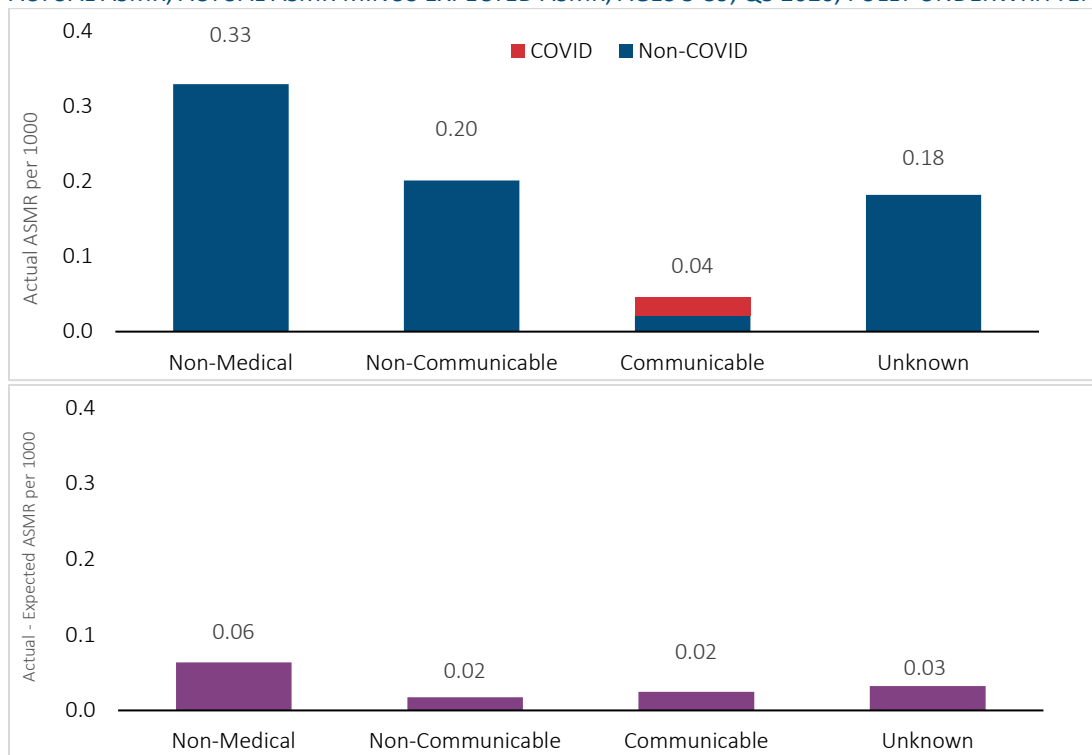
For the youngest ages, the rate of death increased the most in the third quarter of 2020 and impacted all three major categories. Most of the impact to communicable causes came from COVID-19, but non-medical causes had the largest impact to the overall excess. This is explored more in the section on non-medical deaths.

Figure 12
ACTUAL ASMR, ACTUAL ASMR MINUS EXPECTED ASMR, AGES 40-74, Q1 2021, FULLY UNDERWRITTEN
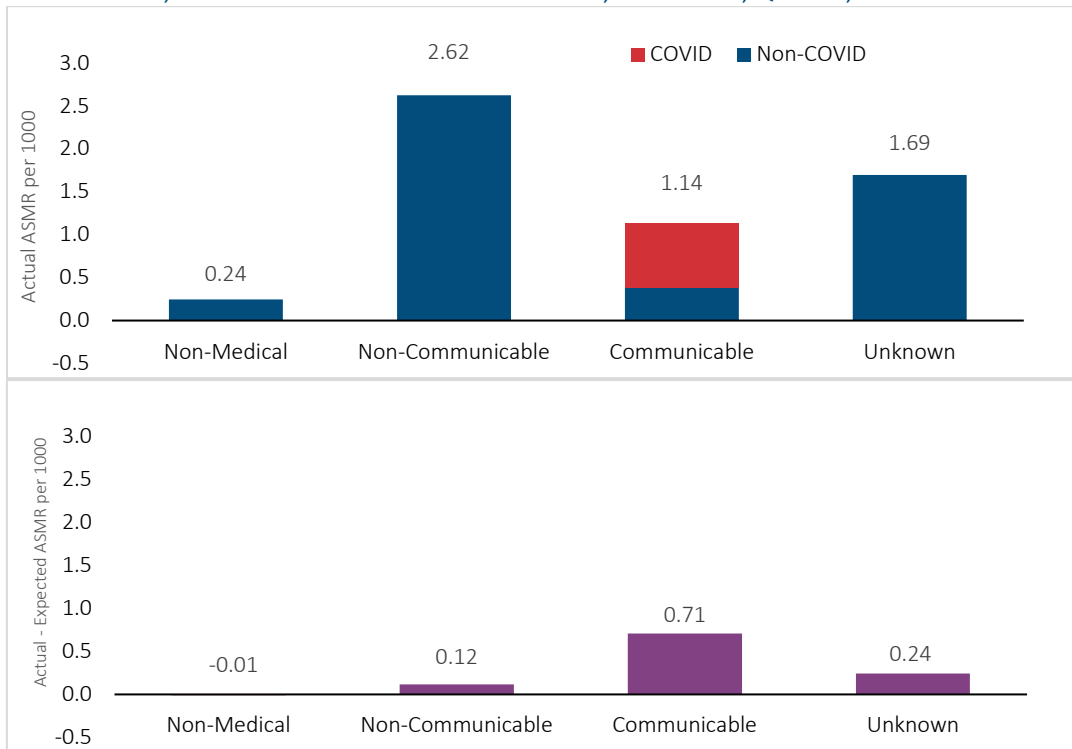
For this cohort the excess is dominated by COVID-19, but the non-communicable death rate increase is also significant.

Figure 13
ACTUAL ASMR, ACTUAL ASMR MINUS EXPECTED ASMR, AGES 75-94, Q4 2020, FULLY UNDERWRITTEN
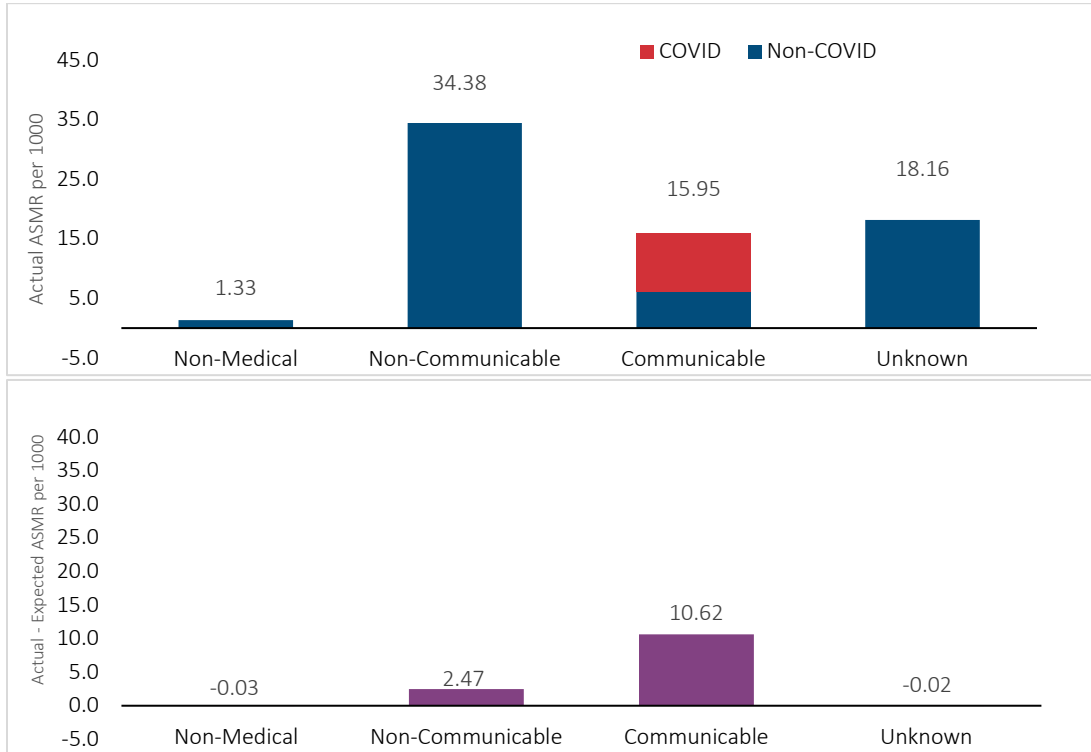
Like the 40-74 age group, the excess is dominated by communicable deaths where most of the excess is COVID-19. However, non-communicable rates of death in this cohort were also up significantly (above the 95% confidence interval).

Non-Medical Causes of Death

The directional impact on non-medical causes of death varied by age group in the insured data, as table 4 shows.

Table 4
FULLY UNDERWRITTEN NON-MEDICAL ASMR PER 1000

Cause	Year	Quarter	5-39	40-74	75-94
Non-Medical	2020	Q1	0.24	0.2	1.4
	2020	Q2	0.28	0.3	1.3
	2020	Q3	0.33	0.3	1.4
	2020	Q4	0.27	0.2	1.3
	2021	Q1	0.27	0.2	1.4

We dig deeper into categories that stand out against expectation in table 5.

Table 5
FULLY UNDERWRITTEN NON-MEDICAL ASMR PER 1000 BY SPECIFIC CAUSE

Cause	Year	Quarter	5-39	40-74	75-94
Auto Transport Accident	2020	Q1	0.03	0.03	0.11
	2020	Q2	0.04	0.04	0.07
	2020	Q3	0.07	0.05	0.12
	2020	Q4	0.04	0.05	0.07
	2021	Q1	0.06	0.04	0.08
Other Accident	2020	Q1	0.10	0.10	1.0
	2020	Q2	0.04	0.10	0.9
	2020	Q3	0.13	0.11	1.0
	2020	Q4	0.12	0.11	0.9
	2021	Q1	0.10	0.10	0.9
Other Non-Medical	2020	Q1	0.05	0.03	0.16
	2020	Q2	0.06	0.03	0.22
	2020	Q3	0.06	0.03	0.19
	2020	Q4	0.06	0.03	0.22
	2021	Q1	0.06	0.05	0.22
Suicide	2020	Q1	0.06	0.07	0.12
	2020	Q2	0.05	0.08	0.10
	2020	Q3	0.07	0.08	0.11
	2020	Q4	0.05	0.06	0.11
	2021	Q1	0.04	0.07	0.11

Non-medical deaths are the most common cause of death for the youngest age group in the study. In the third and fourth quarters of 2020, this age group experienced high excess mortality in non-medical deaths (figures 14a-b).

Figure 14a

ACTUAL ASMR, ACTUAL ASMR MINUS EXPECTED ASMR, AGES 5-39, Q3 2020, FULLY UNDERWRITTEN, NON-MEDICAL COD
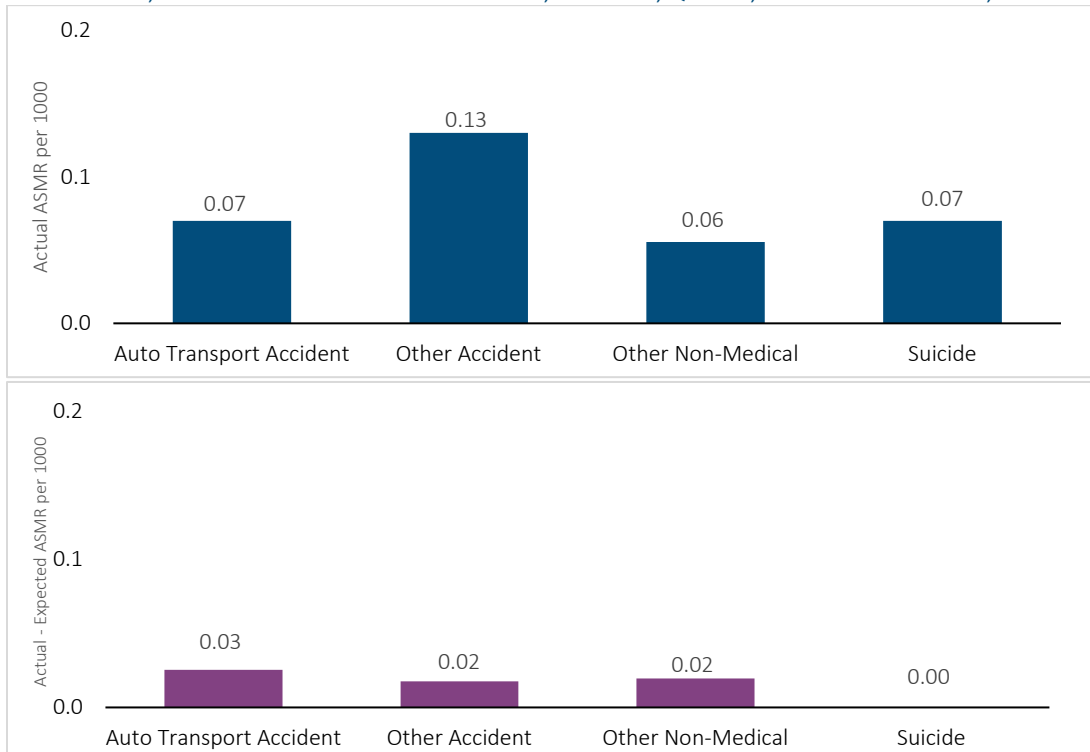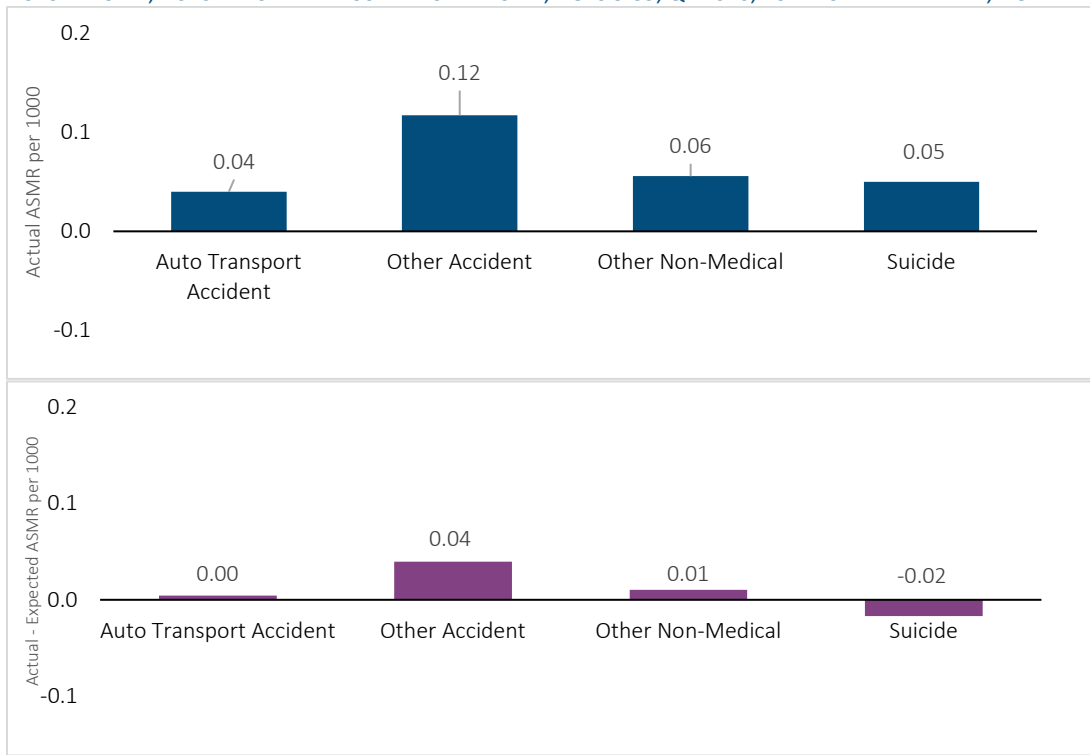
Figure 14b
ACTUAL ASMR, ACTUAL ASMR MINUS EXPECTED ASMR, AGES 5-39, Q4 2020, FULLY UNDERWRITTEN, NON-MEDICAL COD

The specific causes influencing the excess non-medical rate of death vary a bit between the third and fourth quarters of 2020. The third quarter increase shows a mix of motor vehicle fatalities, other accidents (falls, drowning, etc.), and other non-medical. Other non-medical here will largely be drug overdoses, but will include homicide and other causes as well. Suicide deaths were lower than expected in each quarter, and this was typical for suicide in each cohort.

The 40-74 age group experienced lower than expected non-medical deaths throughout 2020 (table 4). This happened despite higher than expected rates of "other non-medical" deaths in every quarter. The other causes in this category were so much lower than normal that the consistent increase to that one cause did not counter the positive gains in the other three.

The 75-94 age group experienced typical rates of death by non-medical causes throughout the study period. There was a balance of very good experience with motor vehicle accidents and only a small amount of poor experience with "other non-medical" deaths.

Communicable Causes of Death

It is helpful to exclude COVID-19 from the set of communicable diseases; otherwise, every rate in the next table would be red, indicating experience higher than the 95% confidence interval.

Table 6
COMMUNICABLE CAUSES ASMR PER 1000 (EXCLUDING COVID-19), FULLY UNDERWRITTEN

Cause	Year	Quarter	5-39	40-74	75-94
Communicable (Excluding COVID)	2020	Q1	0.03	0.4	7.6
	2020	Q2	0.02	0.4	6.5
	2020	Q3	0.02	0.3	5.6
	2020	Q4	0.02	0.4	6.1
	2021	Q1	0.01	0.4	6.4

The next table splits out three communicable causes. The worst quarter for flu and pneumonia deaths in the United States is typically the first quarter. Here we see that those deaths were lower than typical, both in the first quarter of 2020 and the first quarter of 2021. Spring, summer, and fall showed some significant excess in influenza and pneumonia among the cohorts. "Other communicable" was higher than normal for many cohorts (9 of the 15). We lack the necessary detail in the study to understand what specific causes were driving those results, but it is within the realm of possibility that some of the significantly higher flu and pneumonia deaths were miscoded as COVID deaths.

Table 7
COMMUNICABLE CAUSES ASMR PER 1000, FULLY UNDERWRITTEN

Cause	Year	Quarter	5-39	40-74	75-94
Influenza & Pneumonia	2020	Q1	0.009	0.11	2.3
	2020	Q2	0.019	0.09	2.0
	2020	Q3	0.005	0.07	1.4
	2020	Q4	0.006	0.08	1.7
	2021	Q1	0.003	0.08	1.8
Other Communicable	2020	Q1	0.004	0.06	0.9
	2020	Q2	0.004	0.06	0.9
	2020	Q3	0.008	0.06	0.8
	2020	Q4	0.004	0.08	1.2
	2021	Q1	0.003	0.08	1.0
Respiratory	2020	Q1	0.014	0.24	4.3
	2020	Q2	0.010	0.21	3.6
	2020	Q3	0.009	0.21	3.3
	2020	Q4	0.012	0.21	3.2
	2021	Q1	0.009	0.23	3.6

The 40-74 age group had poor experience relative to expectation in all communicable causes in the second quarter of 2020. Though statistically significant, the combined increases to the three non-COVID categories are dramatically overshadowed by the COVID-19 deaths in that cohort.

Figure 15

ACTUAL ASMR, ACTUAL ASMR MINUS EXPECTED ASMR, AGES 40-74, Q2 2020, FULLY UNDERWRITTEN, COMMUNICABLE COD
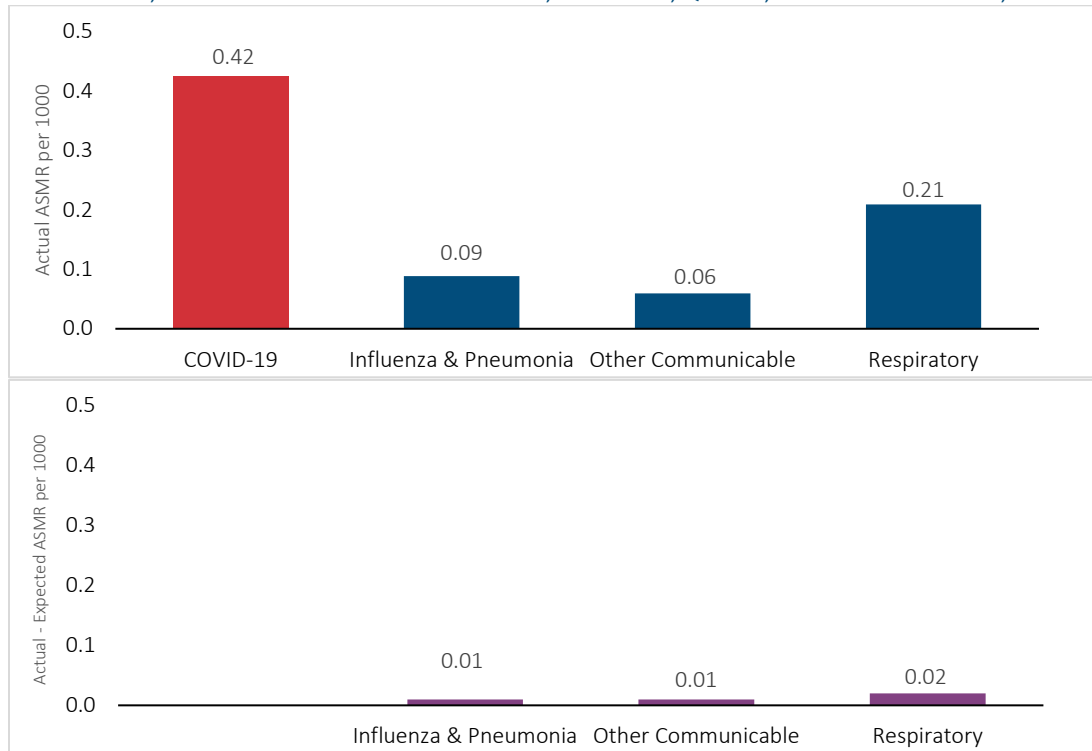
Respiratory deaths were much closer to normal through the pandemic, although a significant decrease in the age 75-94 first quarter 2021 cohort may have offset some COVID-19 deaths.

Figure 16

ACTUAL ASMR, ACTUAL ASMR MINUS EXPECTED ASMR, AGES 75-94, Q1 2021, FULLY UNDERWRITTEN, COMMUNICABLE COD
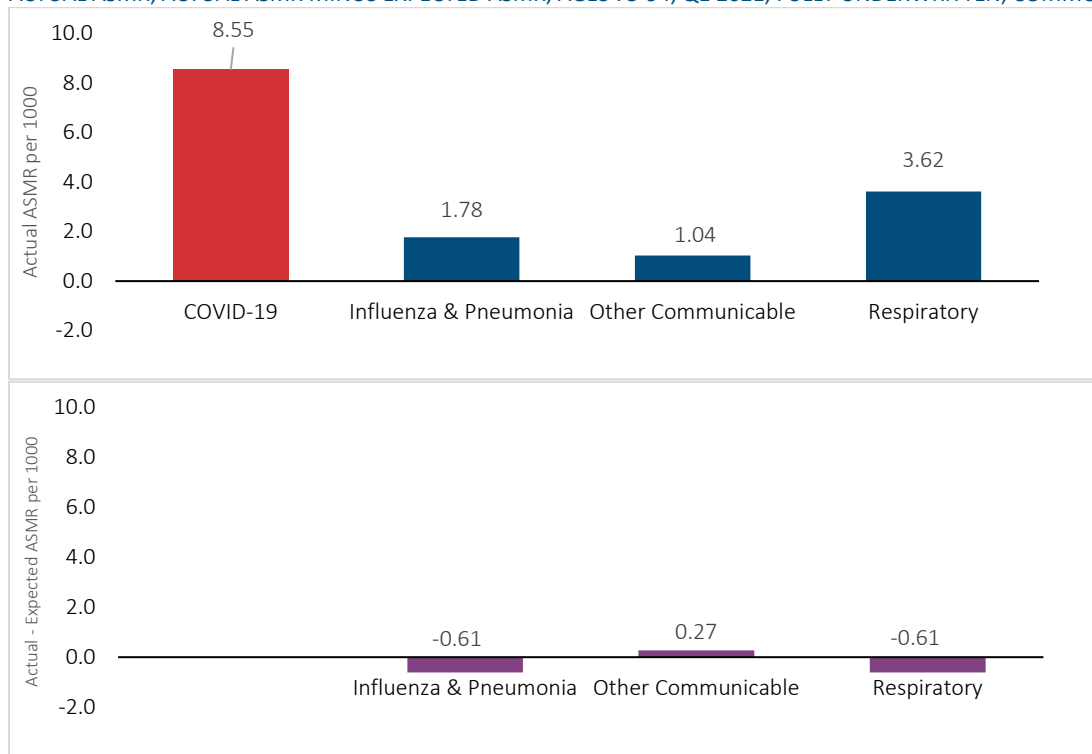
Notice that, while the rate of flu deaths per 1000 in this cohort was below trend just as much as respiratory deaths, the decrease for flu is not outside the bound of the 95% confidence interval. This is because the variance in first quarter experience for the flu is larger than the variance for respiratory causes.

Non-Communicable Causes of Death

Non-communicable deaths include the most common causes of death for ages over 40 in the study. The leading cause in the 40-74 age group was cancer, and the leading cause in the 75-94 group was cardiovascular disease. We split out eight total non-communicable causes with rates of death for our cohorts shown in the next two tables.

Table 8a
FULLY UNDERWRITTEN ASMR PER 1000 DUE TO NON-COMMUNICABLE CAUSES (PT. 1)

Cause	Year	Quarter	5-39	40-74	75-94
Cancer	2020	Q1	0.06	1.09	7.6
	2020	Q2	0.05	1.08	7.4
	2020	Q3	0.07	1.07	7.6
	2020	Q4	0.06	1.04	7.0
	2021	Q1	0.06	1.04	7.2
CVD (Excluding Hypertension)	2020	Q1	0.06	0.88	15.8
	2020	Q2	0.06	0.83	14.8
	2020	Q3	0.06	0.84	13.9
	2020	Q4	0.06	0.85	14.7
	2021	Q1	0.05	0.94	15.6
Diabetes	2020	Q1	0.00	0.05	0.5
	2020	Q2	0.01	0.05	0.5
	2020	Q3	0.01	0.05	0.5
	2020	Q4	0.00	0.05	0.5
	2021	Q1	0.01	0.05	0.5
Digestive	2020	Q1	0.01	0.11	0.7
	2020	Q2	0.01	0.10	0.6
	2020	Q3	0.02	0.11	0.7
	2020	Q4	0.01	0.11	0.7
	2021	Q1	0.01	0.11	0.6

During the pandemic, cancer, the leading cause of death for fully underwritten lives in the 40-74 age group in our study, increased past the 95% threshold in four of the five quarters available for analysis. The leading cause for fully underwritten lives ages 75-94, cardiovascular disease, increased above the 95% expectation in three of the five quarters.

Regarding the 5-39 age group, these causes are less impactful than the non-medical causes. It is still, perhaps, noteworthy that their rate of death due to cardiovascular disease was higher than the 95% confidence band in three of the five quarters.

Table 8b
FULLY UNDERWRITTEN ASMR PER 1000 DUE TO NON-COMMUNICABLE CAUSES (PT. 2)

Cause	Year	Quarter	5-39	40-74	75-94
Hypertension	2020	Q1	0.003	0.07	1.2
	2020	Q2	0.003	0.07	1.2
	2020	Q3	0.003	0.07	1.0
	2020	Q4	0.006	0.06	0.8
	2021	Q1	0.001	0.06	0.9
Kidney Disease	2020	Q1	0.003	0.06	1.0
	2020	Q2	0.003	0.05	0.9
	2020	Q3	0.007	0.05	0.9
	2020	Q4	0.004	0.05	0.9
	2021	Q1	0.001	0.06	1.1
Nervous System	2020	Q1	0.024	0.17	5.9
	2020	Q2	0.015	0.17	5.9
	2020	Q3	0.012	0.18	5.6
	2020	Q4	0.014	0.18	6.4
	2021	Q1	0.010	0.19	6.1
Other Non-Communicable	2020	Q1	0.035	0.20	3.9
	2020	Q2	0.038	0.19	3.7
	2020	Q3	0.033	0.19	3.6
	2020	Q4	0.034	0.18	3.4
	2021	Q1	0.040	0.18	3.4

Part two of the fully underwritten non-communicable death table shows many values beyond the upper threshold for both older age groups. Many of those are attributable to kidney disease, though comparatively this is not as impactful to total death counts as some more prevalent causes. The category "Nervous System" in the table would include causes such as Parkinson's Disease and Alzheimer's Disease; both older age groups experienced significant increases within this cause group in four of the five quarters of this study. Better results occurred in the catch-all, but important category "Other Non-Communicable." The two older groups were either in range or below the lower 95% confidence band.

The next set of charts display the **worst quarter** for non-communicable causes **for each age group** in the study.
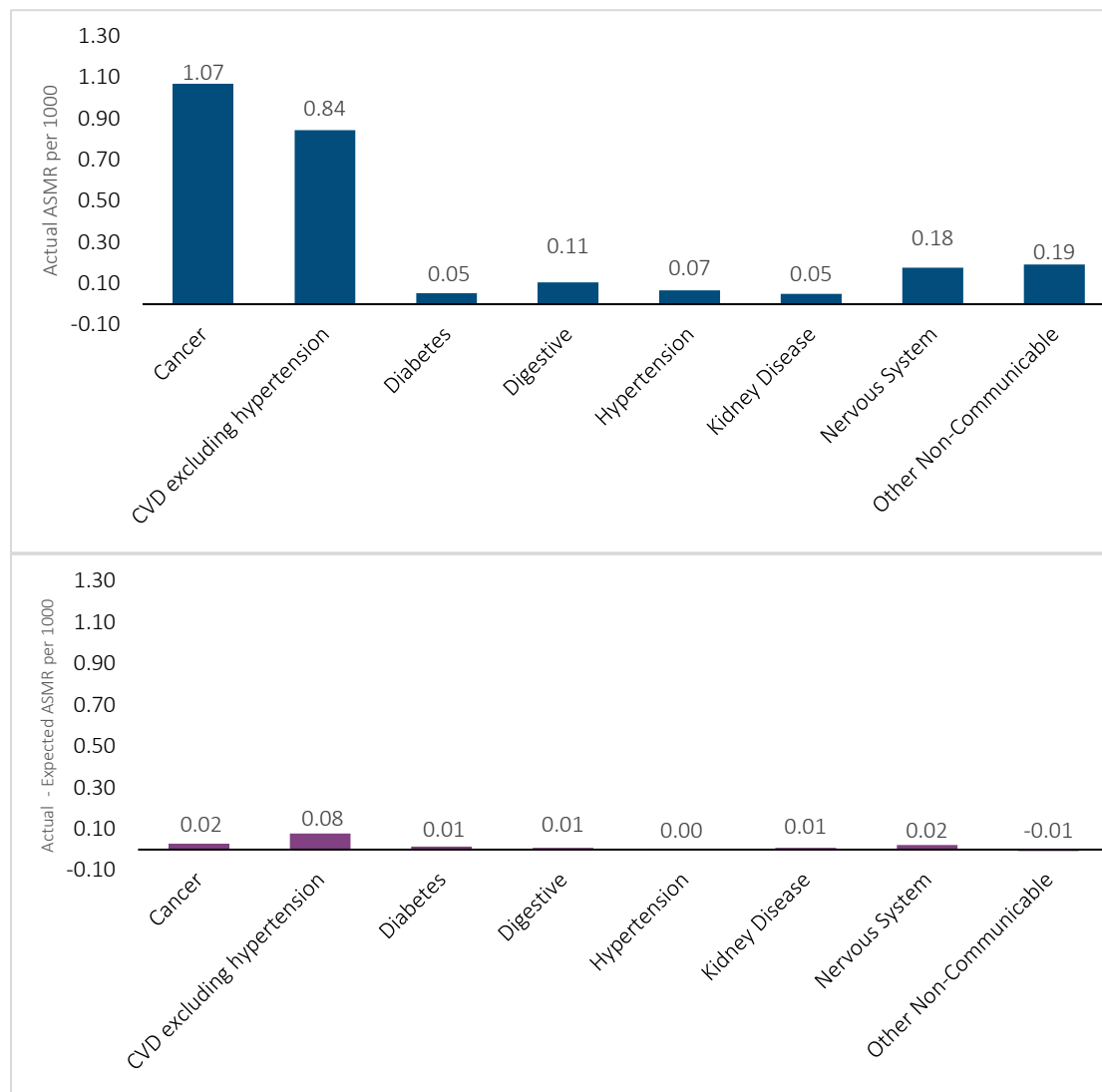
Figure 17

ACTUAL ASMR, ACTUAL ASMR MINUS EXPECTED ASMR, AGES 5-39, Q4 2020, FULLY UNDERWRITTEN, NON-COMMUNICABLE COD
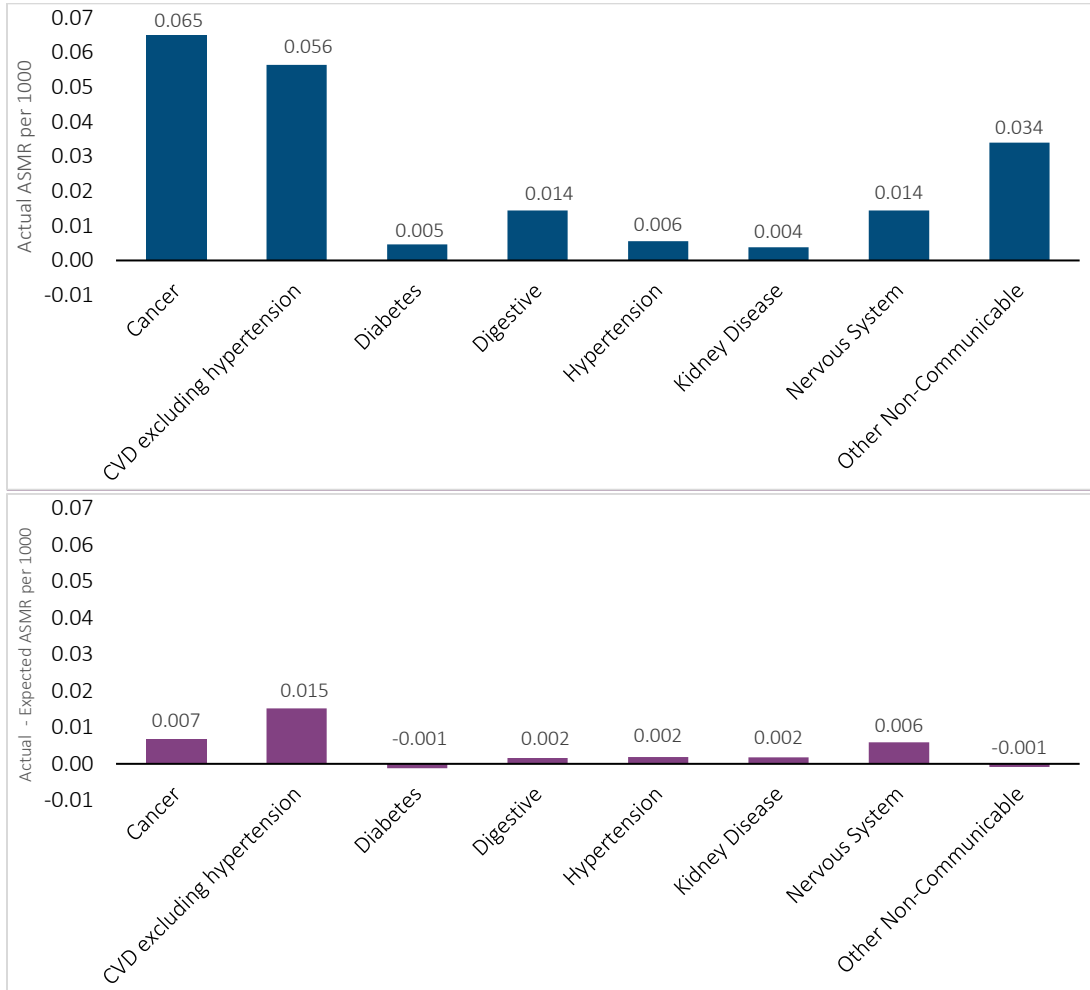
The fourth quarter of 2020 had the largest increase in non-communicable rates of death for the 5 to 39 age cohort. While six causes showed some increase, four increases were considered significant based on past trends: cardiovascular disease, hypertension, kidney disease, and nervous system.

Figure 18

ACTUAL ASMR, ACTUAL ASMR MINUS EXPECTED ASMR, AGES 40-74, Q3 2020, FULLY UNDERWRITTEN, NON-COMMUNICABLE COD

The third quarter of 2020 had the largest additional rate of non-communicable deaths for the 40-74 age cohort. The decreases to both hypertension and other non-communicable were not mathematically significant; increases in all six other categories were statistically significant and made it the worst quarter for non-communicable deaths for this cohort.
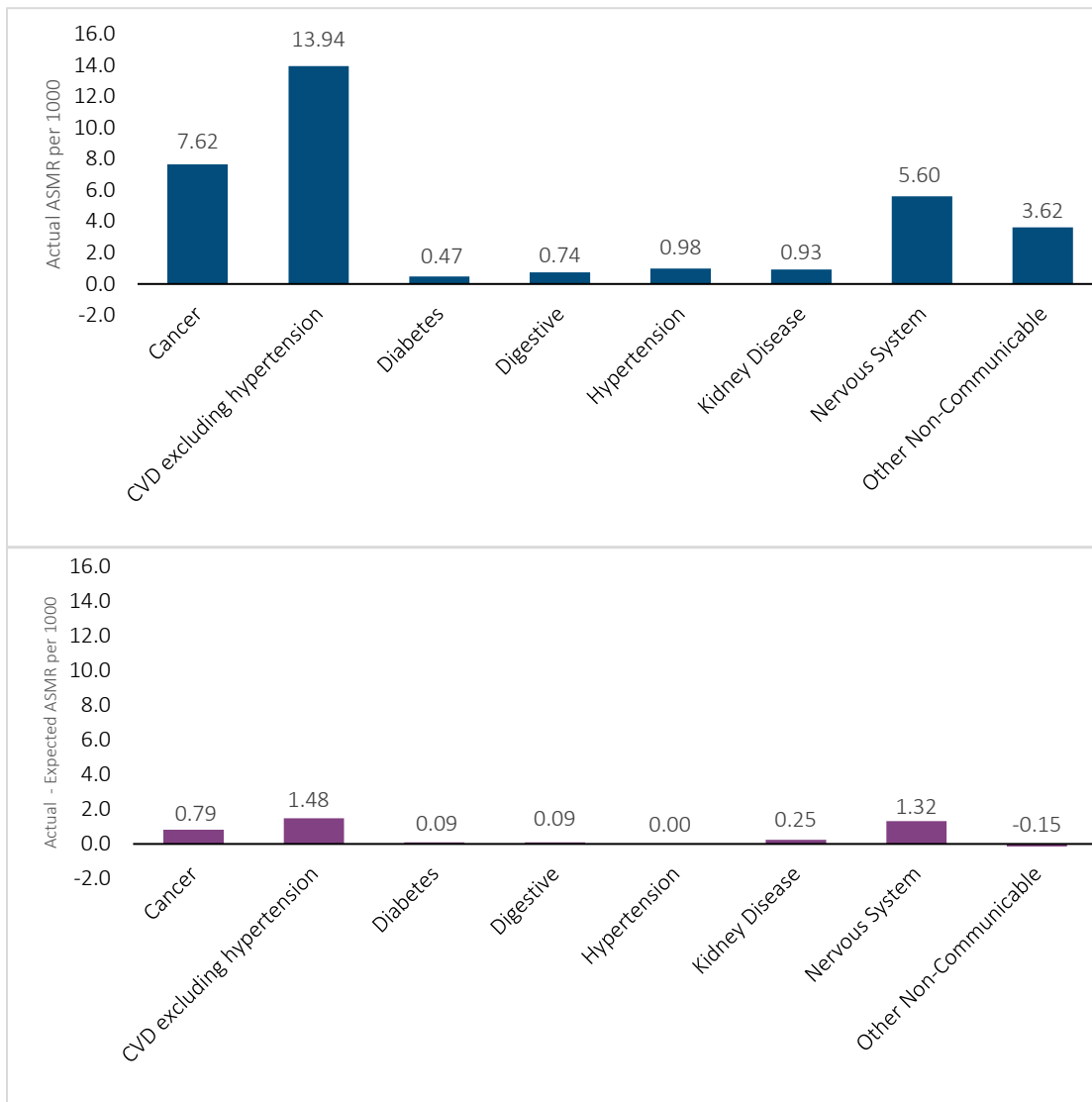
Figure 19

ACTUAL ASMR, ACTUAL ASMR MINUS EXPECTED ASMR, AGES 75-94, Q3 2020, FULLY UNDERWRITTEN, NON-COMMUNICABLE COD

The third quarter of 2020 had the largest additional rate of death in non-communicable causes for the 75-94 age group, just as it did for the 40-74 age group. The only increases shown that were not significant were for digestive and hypertension. The decrease in "other non-communicable" was not significant.

Section 6: Underwriting Class

Here we examine trends for preferred lives versus standard lives.

Preferred lives have passed through more rigorous underwriting and should be less likely to suffer from underlying conditions compared to standard. Their mortality expectation is better overall than standard. But, do preferred lives appear to have more resiliency than standard during the pandemic?

Table 9
ASMR PER 1000 BY CAUSE GROUP, FULLY UNDERWRITTEN, PREFERRED LIVES

Cause	Year	Quarter	5-39	40-74	75-94
Communicable (Excluding COVID)	2020	Q1	0.011	0.11	4.7
	2020	Q2	0.001	0.11	4.0
	2020	Q3	0.00	0.1	3.1
	2020	Q4	0.01	0.1	3.5
	2021	Q1	0.00	0.1	3.5
COVID-19	2020	Q1	0.002	0.03	0.2
	2020	Q2	0.010	0.19	4.5
	2020	Q3	0.012	0.11	1.6
	2020	Q4	0.01	0.2	5.3
	2021	Q1	0.01	0.3	5.2
Non-Communicable	2020	Q1	0.122	1.07	20.7
	2020	Q2	0.099	1.05	19.2
	2020	Q3	0.12	1.0	18.9
	2020	Q4	0.12	1.0	19.7
	2021	Q1	0.12	1.1	19.8
Non-Medical	2020	Q1	0.104	0.16	0.8
	2020	Q2	0.114	0.15	0.9
	2020	Q3	0.184	0.17	1.0
	2020	Q4	0.14	0.2	1.0
	2021	Q1	0.11	0.1	0.8

The study included about 155,000 preferred claims. Sixty percent of those are in the 40-74 age group. There are considerably more blue and black values in this table than the corresponding table that looked at all fully underwritten lives at the start of section 5. In fact, for the oldest age group, there is no cause apart from COVID-19 that is higher than the trend would have predicted had there been no pandemic. Furthermore, a handful of quarter/cause of death combinations are even significantly better than trend for the 75-94 group.

Standard lives tell a different story, and it corresponds closely to table 3, which showed all fully underwritten lives.

Table 10
ASMR PER 1000 BY CAUSE GROUP, FULLY UNDERWRITTEN, STANDARD LIVES

Cause	Year	Quarter	5-39	40-74	75-94
Communicable (Excluding COVID)	2020	Q1	0.04	0.5	7.8
	2020	Q2	0.03	0.5	6.8
	2020	Q3	0.03	0.4	5.8
	2020	Q4	0.03	0.5	6.5
	2021	Q1	0.02	0.5	6.8
COVID-19	2020	Q1	0.00	0.1	0.4
	2020	Q2	0.03	0.6	6.6
	2020	Q3	0.02	0.3	2.9
	2020	Q4	0.02	0.8	9.8
	2021	Q1	0.04	1.0	8.7
Non-Communicable	2020	Q1	0.25	3.4	36.2
	2020	Q2	0.25	3.2	35.2
	2020	Q3	0.26	3.3	33.8
	2020	Q4	0.26	3.2	33.9
	2021	Q1	0.22	3.4	35.4
Non-Medical	2020	Q1	0.31	0.3	1.4
	2020	Q2	0.36	0.3	1.4
	2020	Q3	0.42	0.3	1.4
	2020	Q4	0.33	0.3	1.3
	2021	Q1	0.36	0.3	1.4

Values here are significantly higher than in the overall fully underwritten cohorts, and a few rates are significantly better. Standard results are similar to the overall fully underwritten table: a large majority of claims are standard in the study.

It is remarkable that, while preferred lives did suffer very poor experience during the period studied in this report, an outsized proportion was due to only the COVID-19 deaths that came through, especially in the middle and older age cohorts.

Section 7: Smoker Status

Smokers have such a different cause of death profile than non-smokers that it might be of use to see if they also were impacted in different ways by the pandemic.

Non-smokers should have a lower share of non-medical deaths and a lower share of cancer deaths, but we are investigating changes to patterns by cause for a subpopulation rather than just a contrast in proportion of death types.

Tables 11a and b show the ASMR for fully underwritten business split by non-smoker and smoker.

Table 11a
ASMR PER 1000, FULLY UNDERWRITTEN, NON-SMOKER

Cause	Year	Quarter	5-39	40-74	75-94
Communicable (Excluding COVID)	2020	Q1	0.02	0.3	7.3
	2020	Q2	0.02	0.3	6.2
	2020	Q3	0.02	0.2	5.3
	2020	Q4	0.02	0.3	5.7
	2021	Q1	0.01	0.3	6.0
COVID-19	2020	Q1	0.00	0.0	0.3
	2020	Q2	0.02	0.4	6.3
	2020	Q3	0.02	0.2	2.7
	2020	Q4	0.02	0.6	9.4
	2021	Q1	0.03	0.7	8.3
Non-Communicable	2020	Q1	0.17	2.2	33.9
	2020	Q2	0.17	2.1	32.4
	2020	Q3	0.18	2.1	30.9
	2020	Q4	0.18	2.1	31.1
	2021	Q1	0.17	2.2	32.3
Non-Medical	2020	Q1	0.18	0.2	1.3
	2020	Q2	0.20	0.2	1.3
	2020	Q3	0.26	0.2	1.3
	2020	Q4	0.20	0.2	1.3
	2021	Q1	0.20	0.2	1.3

Table 11b
ASMR PER 1000, FULLY UNDERWRITTEN, SMOKER

Cause	Year	Quarter	5-39	40-74	75-94
Communicable (Excluding COVID)	2020	Q1	0.04	1.2	8.2
	2020	Q2	0.02	1.0	7.8
	2020	Q3	0.04	0.9	6.6
	2020	Q4	0.04	1.0	8.3
	2021	Q1	0.04	1.1	8.6
COVID-19	2020	Q1	0.00	0.1	0.5
	2020	Q2	0.01	0.5	6.2
	2020	Q3	0.02	0.3	2.9
	2020	Q4	0.01	0.9	9.0
	2021	Q1	0.04	1.0	8.2
Non-Communicable	2020	Q1	0.29	5.6	37.7
	2020	Q2	0.27	5.5	38.2
	2020	Q3	0.29	5.5	38.3
	2020	Q4	0.28	5.4	37.7
	2021	Q1	0.24	5.9	39.9
Non-Medical	2020	Q1	0.39	0.4	1.5
	2020	Q2	0.48	0.5	1.4
	2020	Q3	0.53	0.5	1.5
	2020	Q4	0.44	0.4	1.2
	2021	Q1	0.48	0.4	1.5

There are some key differences between smokers and non-smokers. Notably, the smokers did not have as many significantly increased quarters in the rate of non-medical deaths as non-smokers. Also, smokers in the 40-74 age group did not see much significant impact in communicable deaths compared to past quarters. Non-smokers were significantly over trend in three of the five quarters studied. Typically, the smokers' excess deaths were marginally higher than non-smokers excess deaths, but because the expectations for smokers are worse, they did not exceed the 95% significance threshold in as many cohort/cause combinations as non-smokers. Further, as mentioned in the methodology, each subset has its own standard and, therefore, direct comparisons of subsets are not terribly meaningful.

Section 8: Limited Underwriting

Simplified Issue

Cause of death is a bit harder to study for limited underwriting products because they have far more claims coming in without a cause of death attached. Simplified issue claims in our study have a known cause of death less than half the time. The unknown deaths are also not as consistent from period to period in the data as they are in the fully underwritten claims. As such, the rate values in table 12 may be less than half of what the actual experience was.

Table 12
ASMR PER 1000 BY QUARTER AND AGE GROUP, SIMPLIFIED ISSUE

Cause	Year	Quarter	5-39	40-74	75-94
Communicable (Excluding COVID)	2020	Q1	0.06	0.8	3.6
	2020	Q2	0.03	0.8	2.7
	2020	Q3	0.04	0.7	2.3
	2020	Q4	0.04	0.7	2.9
	2021	Q1	0.02	0.8	2.5
COVID-19	2020	Q1	0.01	0.1	0.4
	2020	Q2	0.02	1.5	5.9
	2020	Q3	0.02	1.2	4.0
	2020	Q4	0.07	2.1	10.5
	2021	Q1	0.07	2.7	9.1
Non-Communicable	2020	Q1	0.21	4.0	17.1
	2020	Q2	0.07	4.0	16.2
	2020	Q3	0.18	3.9	14.1
	2020	Q4	0.19	4.1	15.7
	2021	Q1	0.15	3.9	13.6
Non-Medical	2020	Q1	0.29	0.2	0.3
	2020	Q2	0.37	0.3	0.5
	2020	Q3	0.32	0.3	0.4
	2020	Q4	0.34	0.2	0.4
	2021	Q1	0.30	0.3	0.3

Due to limitations in the data, we did not dig any further. If accurate – again, within the limitations, the results do show more cohort results coming in higher than trend across the main groups than there were for fully underwritten lives.

Guaranteed Issue

Guaranteed issue claims have even more unknown causes than simplified issue; it is difficult to have as much confidence in the results given the limitation that now three out of four claims have no cause of death data. Also, there are only 92 total guaranteed issue claims in the study in the youngest age group. Table 13 excludes those young age/quarter cohorts for that reason.

Table 13
ASMR PER 1000 BY CAUSE GROUP, GUARANTEED ISSUE

Cause	Year	Quarter	40-74	75-94
Communicable (Excluding COVID)	2020	Q1	1.0	3.8
	2020	Q2	1.1	3.3
	2020	Q3	1.2	2.9
	2020	Q4	1.4	3.3
	2021	Q1	1.2	3.2
COVID-19	2020	Q1	0.1	0.2
	2020	Q2	1.4	4.9
	2020	Q3	0.9	2.1
	2020	Q4	2.1	6.6
	2021	Q1	2.5	5.5
Non-Communicable	2020	Q1	4.6	14.6
	2020	Q2	5.2	15.1
	2020	Q3	5.9	14.5
	2020	Q4	6.0	15.1
	2021	Q1	6.3	15.6
Non-Medical	2020	Q1	0.1	0.3
	2020	Q2	0.2	0.4
	2020	Q3	0.2	0.3
	2020	Q4	0.2	0.4
	2021	Q1	0.2	0.3

The 75-94 cohorts were significantly over prior trend in almost every quarter. The 40-74 cohorts at least had relatively normal experience in non-medical causes of death throughout the study period.

Section 9: Acknowledgments

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Maureen Shaughnessy, FSA, MAAA (LIMRA)

Mike Skelley (TAI)

Appendix A: 2020 Annual Charts

We derive and show the results in this report on a quarterly basis as part of an effort to control for seasonality, which can have a great impact on cause of death results. Here we present the full year 2020 results for the three main categories, side-by-side with the first quarter 2021 results. Bear in mind, the deaths from COVID-19 did not begin to have a major impact on the U.S. population until mid-March of 2020. Therefore, the full year results are not a great comparison to the first quarter of 2021 and are included for completeness.

Figure 20a
ACTUAL ASMR, ACTUAL ASMR MINUS EXPECTED ASMR, AGES 5-39, CALENDAR YEAR 2020, FULLY UNDERWRITTEN
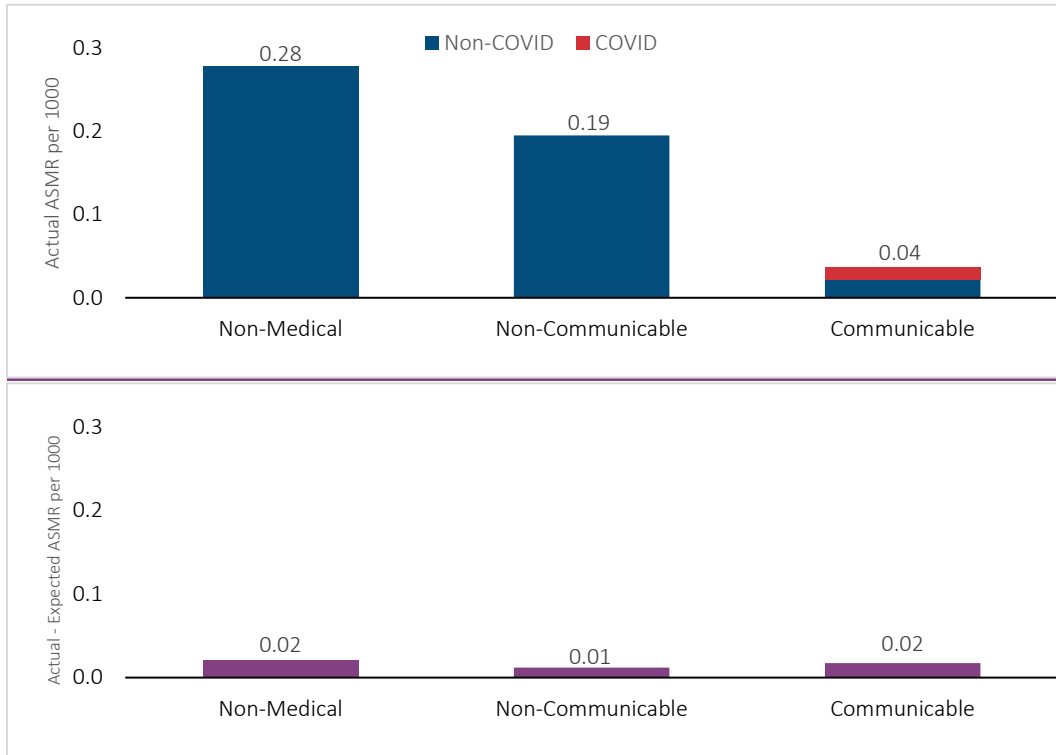
Figure 20b

ACTUAL ASMR, ACTUAL ASMR MINUS EXPECTED ASMR, AGES 5-39, Q1 2021, FULLY UNDERWRITTEN
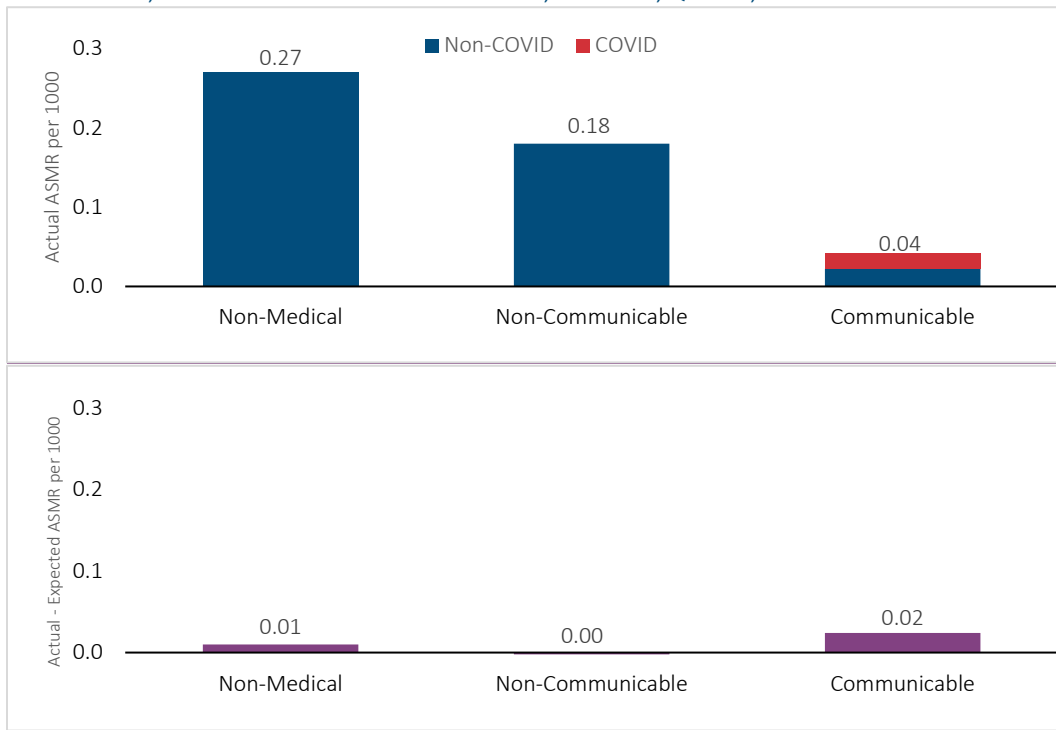
Figure 21a

ACTUAL ASMR, ACTUAL ASMR MINUS EXPECTED ASMR, AGES 40-74, CALENDAR YEAR 2020, FULLY UNDERWRITTEN
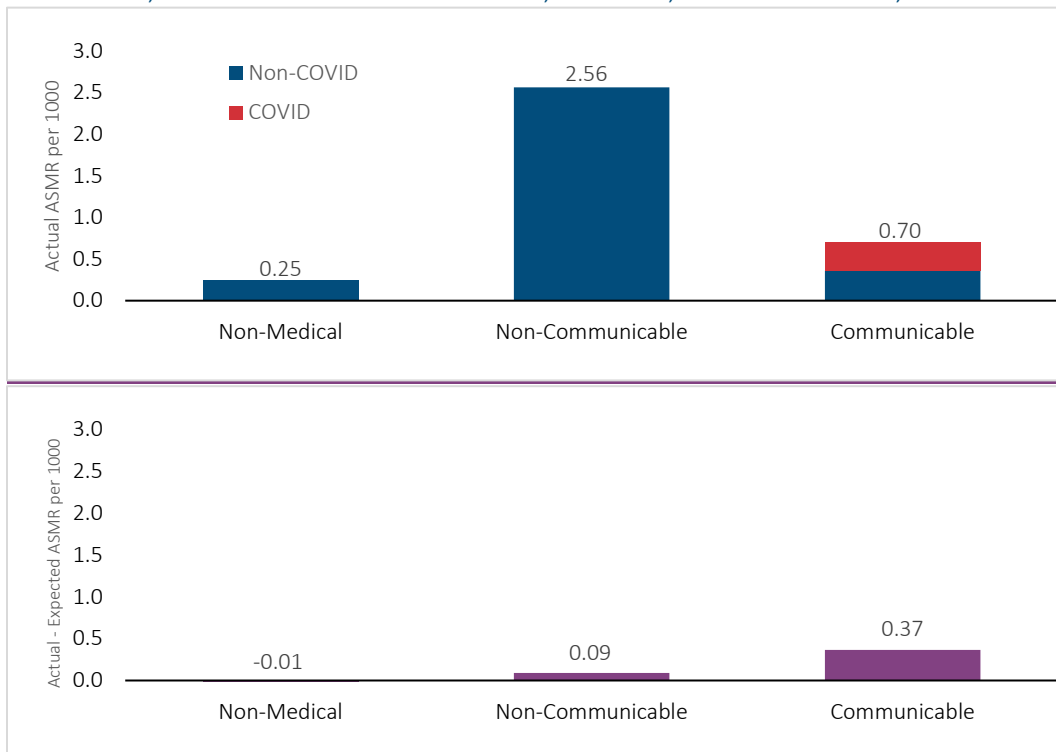
Figure 21b
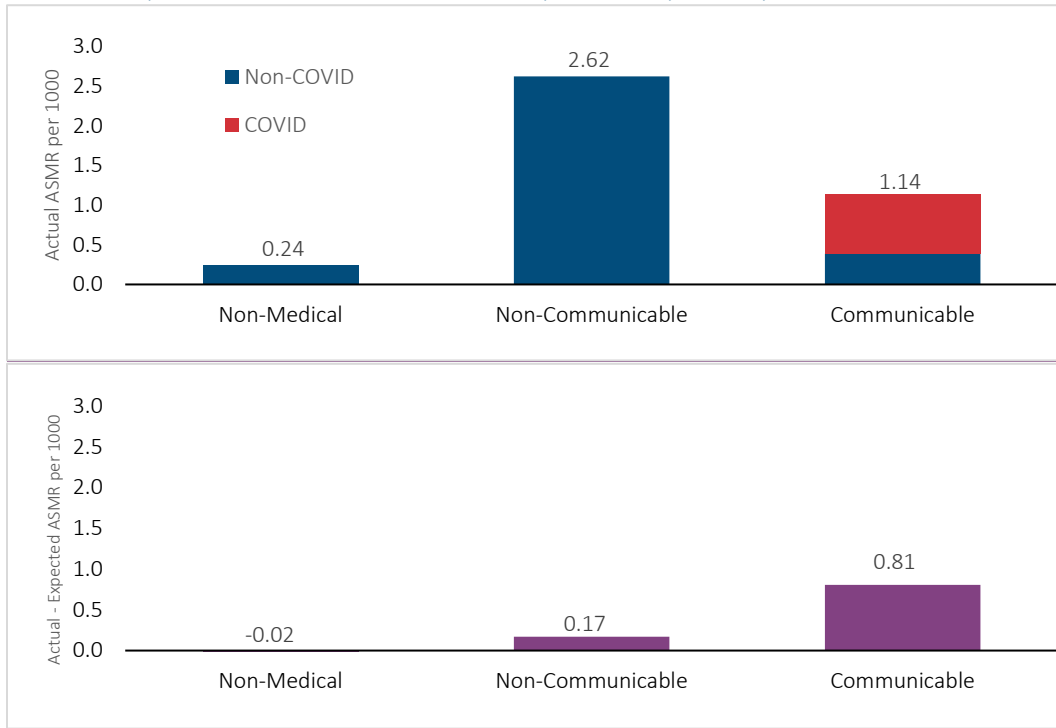ACTUAL ASMR, ACTUAL ASMR MINUS EXPECTED ASMR, AGES 40-74, Q1 2021, FULLY UNDERWRITTEN

Figure 22a
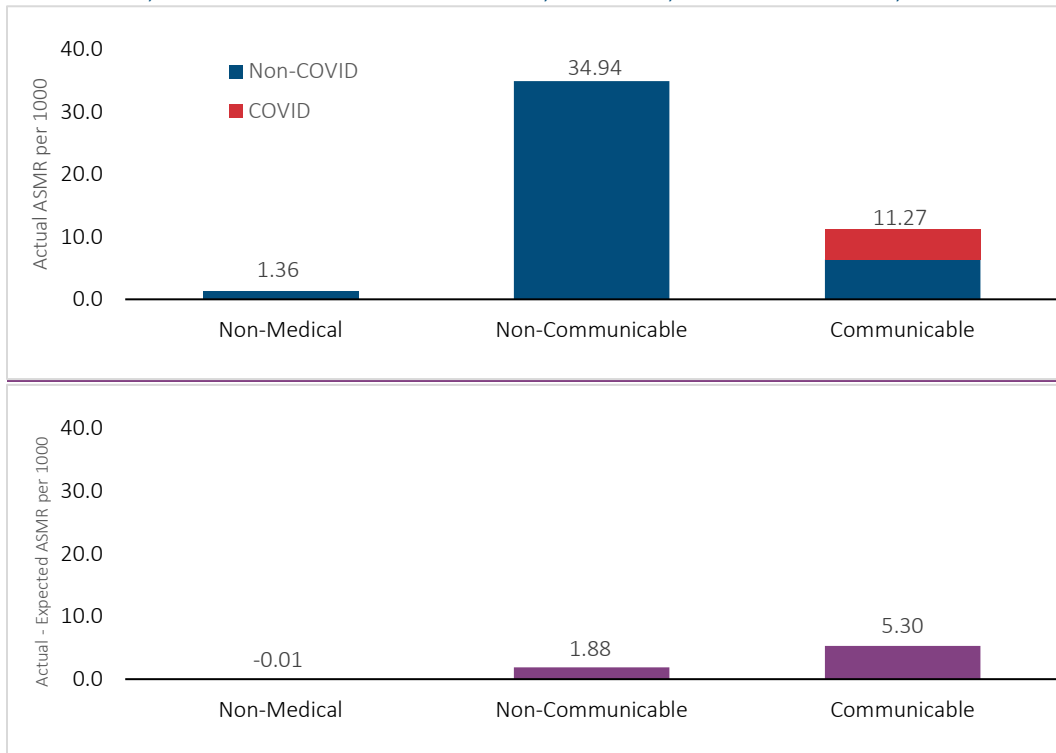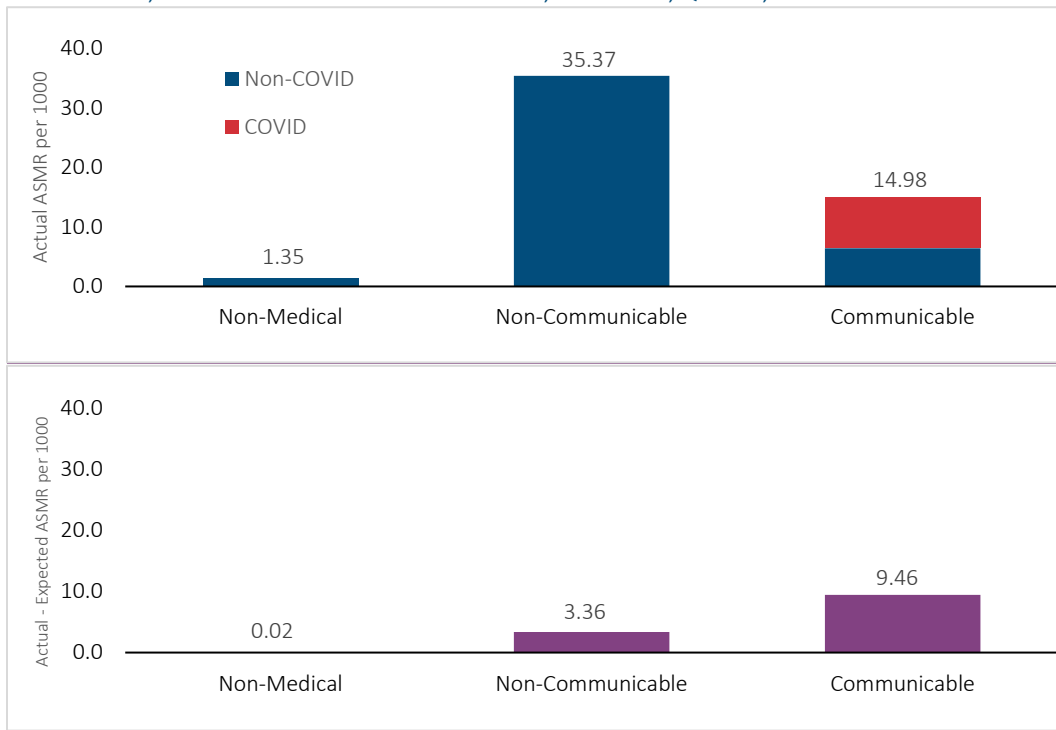ACTUAL ASMR, ACTUAL ASMR MINUS EXPECTED ASMR, AGES 75-94, CALENDAR YEAR 2020, FULLY UNDERWRITTEN

Figure 22b

ACTUAL ASMR, ACTUAL ASMR MINUS EXPECTED ASMR, AGES 75-94, Q1 2021, FULLY UNDERWRITTEN

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