



Society of Actuaries Research Brief

Impact of COVID-19

May 15, 2020





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Introduction

In late December 2019, doctors in the city of Wuhan, China, began to piece together information from several medical cases showing similar symptoms. As 2019 ended, Chinese officials announced a pneumonia-like outbreak and began to identify a “novel coronavirus” linked to the cases. By January 23, over 600 cases had been confirmed,¹ and Wuhan and other areas in China instituted social distancing policies and travel restrictions.² On March 11, World Health Organization (WHO) publicly characterized COVID-19 as a pandemic,³ and on March 13, the United States declared the COVID-19 outbreak a national emergency.⁴



Even with “stay at home” orders issued in many countries,⁵ by April 2, the disease had spread to nearly all corners of the world. By May 13, 2020, 4.4 million confirmed cases involving the novel coronavirus now named “SARS-CoV-2”—which causes the respiratory disease now named “coronavirus disease 2019” (COVID-19)⁶—had been reported worldwide with general agreement that the number is higher due to delays in full testing and reporting in many countries. Approximately 170 countries have reported at least one case and about 297,000 deaths have resulted from COVID-19.⁷ It is important to recognize that the number of reported cases for any disease typically lags the number of actual cases. As a result, the number of reported cases typically continues to rise after the actual number of new cases declines. A key differentiation among some countries is the speed at which they have ramped up testing and identification processes across their populations.

The health, mortality and economic focus is of unprecedented international concern compared to recent times. Financial markets have been volatile as new economic information becomes available, monetary policies are implemented, and value and opportunity come in and out of favor with investors. Supply chains of international operations are greatly impacted as well, as many major worldwide manufacturers are evermore connected across continents. Unemployment rates have risen as the world adjusts to lower levels of economic activity.

A confluence of risks has come together. Operational and financial risks have emerged, compounding the current situation. Actuaries will be watching for any additional risk events that layer on to the current environment, especially ones that may cause additional property, mortality and health risks such as catastrophic weather events. This update to the Society of Actuaries (SOA) Research Brief on the Impact of COVID-19 has been constructed to highlight some of the key continuing and new features of the pandemic all around the world and contemplate the risks for the actuarial profession to consider in their work. Noteworthy changes since the May 1 edition of this report are marked by an icon:



Updated numbers



Revised material



New material

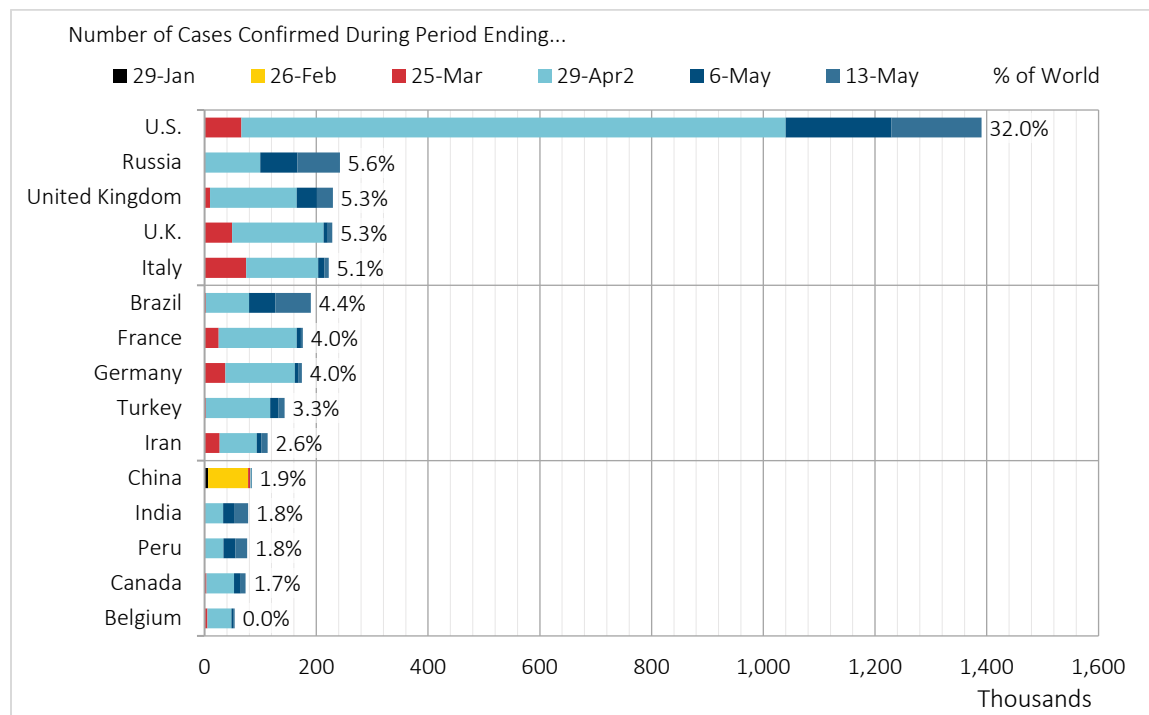
Key Statistics

REPORTED CASES

WORLDWIDE CASES

National health organizations around the world have been fast at work in connecting with health care providers to collect current case information. Confirmed cases are a function of the ability for any public health agency across countries to distribute, administer and collect results from their respective health systems. Through May 13, 2020, approximately 4.3 million cases have been reported worldwide. Eight countries comprise about two-thirds of the world's cases, with nearly half (48%) of the world's cases in four countries: U.S., Spain, Italy and U.K. Figure 1 shows the periodic progression of confirmed cases for the 15 countries that have reported the most cases.

Figure 1
NUMBER OF REPORTED COVID-19 CASES FOR 15 COUNTRIES WITH THE MOST CASES, MAY 13, 2020

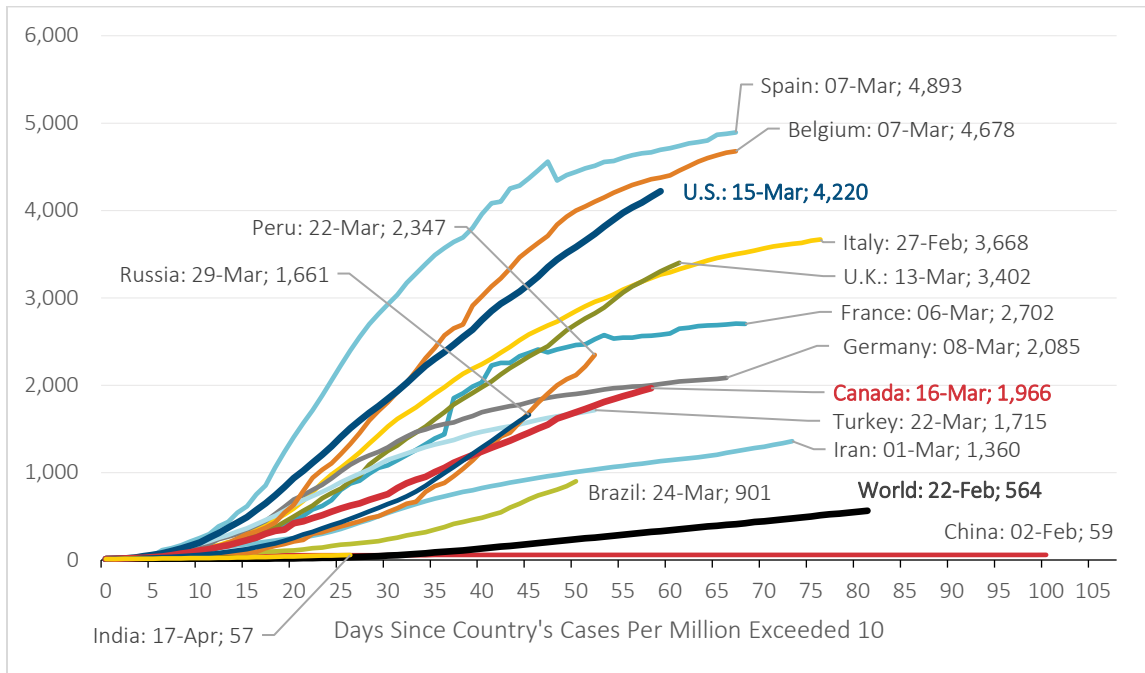


Data source: Johns Hopkins University

The number of confirmed cases in the U.S. is about 6 times the number of confirmed in Spain, the country with the second most confirmed cases in the world. However, the U.S. is far more populous than Spain. To put the number of reported cases in context of country size, Figure 2 shows the number of confirmed cases per million of population. For Figure 2, the day that a country's reported cumulative COVID-19 cases per million reached or exceeded 10.0 is considered day zero (day 0). The appendix includes a table showing data from Figure 2.



Figure 2
CONFIRMED COVID-19 CASES PER MILLION—15 COUNTRIES WITH THE MOST CASES, MAY 13, 2020



Data source: Johns Hopkins University and authors' calculations

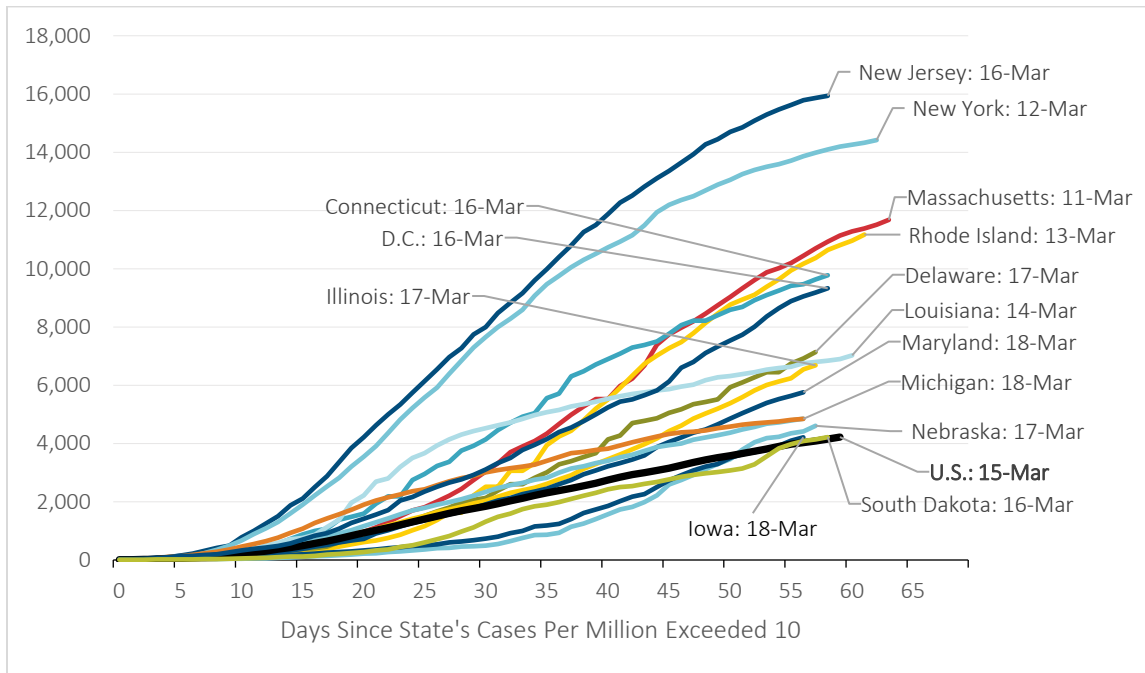
U.S. AND CANADIAN CASES

Figure 3 shows the 15 U.S. states with the greatest number of confirmed cases per million as of May 13, 2020; Figure 4 shows the equivalent for Canadian provinces. Refer to the appendix for data from the graphs.

It is important to recognize that these data show **reported** cases, not actual cases. Major differences exist between testing and reporting, and the differences vary by country. Countries with the highest reported case rates likely reflect serious infection rates, while countries with low reported case rates may reflect slower reporting or underreporting. For example, as of March 3, 2020, Indonesia, the world's fourth most populous country, had reported only two cases. Epidemiologists noted this was implausible and statistically impossible, especially given Indonesia's close ties to China and visits between the two countries.⁸



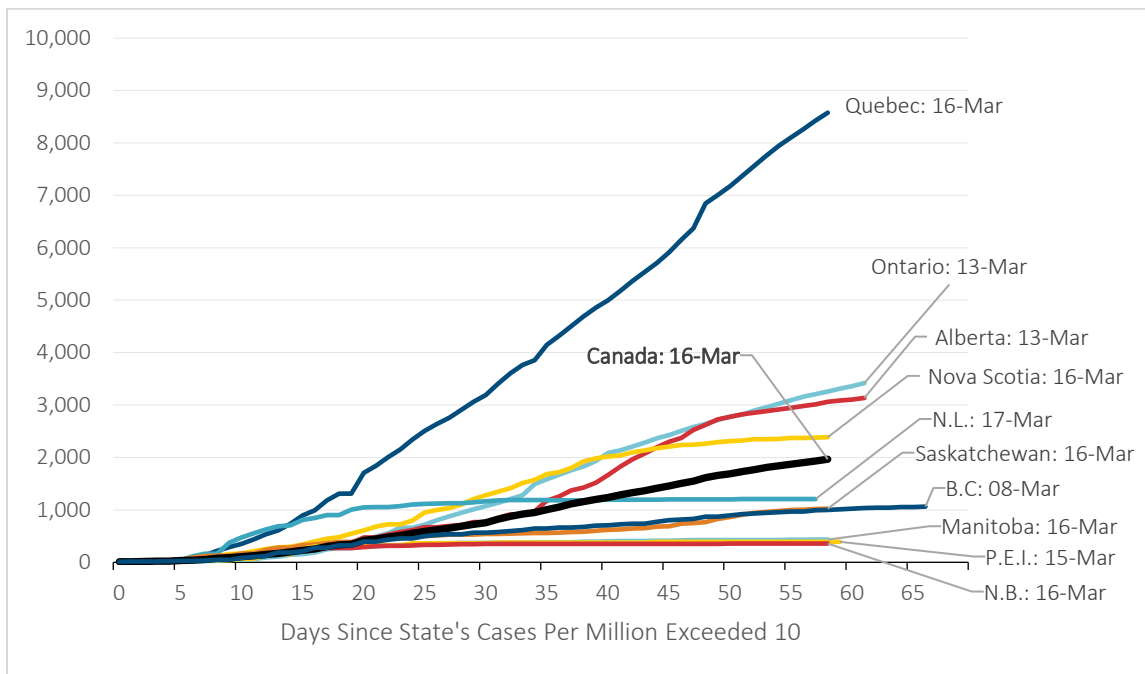
Figure 3
CONFIRMED CASES PER MILLION: 15 TOP U.S. STATES, MAY 13, 2020



Data source: Johns Hopkins University and authors' calculations



Figure 4
CONFIRMED CASES PER MILLION BY CANADIAN PROVINCE, MAY 13, 2020



Data source: Johns Hopkins University and authors' calculations

CASE FATALITY RATES

The ultimate rate of mortality from COVID-19 will evolve over time, after the actual number of cases, rather than the reported number of cases, is better understood.⁹ This may take years.

At the start of a pandemic, mortality rates are crudely estimated using a statistic known as the “case fatality rate” (CFR), which divides the known deaths by the identified number of cases.¹⁰ Using this methodology and the Johns Hopkins University database through April 14, 2020, the COVID-19 CFR across the worldwide set of case information is 6.4%. These raw estimates, however, often are adjusted to produce updated rates, due to the current likelihood of underreporting of actual cases. Some key health officials in the U.S. expect an ultimate case fatality rate from the disease, once all known cases are included in the calculation, to settle in the 0.1%–1.0% range.¹¹

Many potential cases may yet be identified in some countries due to limited supply of testing kits and a reduced ability to process tests in laboratory settings. In addition, individuals with asymptomatic and mild cases of the disease may not actively seek treatment in the local health care systems. Death rates are also substantially impacted by other factors such as age, smoking and social interactions in each country.

Initial CFRs in the U.S. ranged between 3.5% and 4.5%, slightly higher than the worldwide rate, primarily due to the disease initially being seen in higher age groups, per the Centers for Disease Control and Prevention (CDC). As more cases have been identified, the CDC’s estimate of the U.S. CFR has trended downward to the 1.8%–3.4% range.¹²



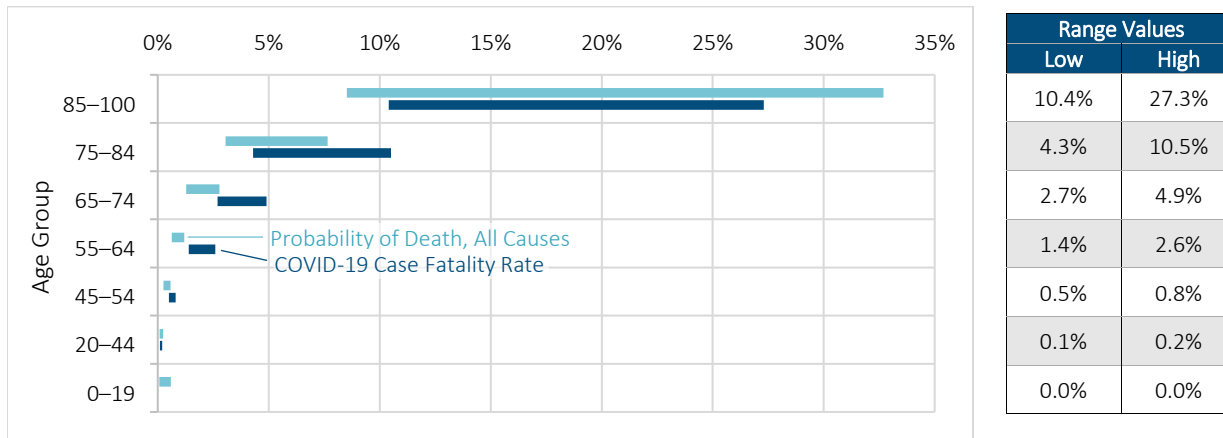
As of May 13, 2020, the U.S. CFR was 6.0%, based on Johns Hopkins University data. Because the pandemic is rapidly evolving, the U.S. CFR is likely overstated because the number of new cases each day has been increasing significantly. In Hubei province, China, where the pandemic began, the number of new cases daily had declined to a relatively small level by the beginning of March. The stability of the Hubei province data reduces the risk of CFR overestimation.¹³ As of May 13, the CFR for Hubei province, China, was 6.6%, and it had remained stable since April 17. China had adjusted the reported number of cases on April 17, causing the CFR to jump from 4.8% on April 16. Prior to April 13, the CFR had been flat at 4.7% since March 22.

While the CFR is a useful starting point for mortality analysis, it does not address the fact that some symptomatic individuals—particularly those with mild symptoms—may be excluded from the data. With enough time, researchers may be able to assemble the information required to estimate the size of this pool of individuals. The estimate can be used to calculate the symptomatic case fatality rate, which is equal to the number of deaths divided by the estimated number of individuals who developed symptoms associated with the virus. Joseph T. Wu and other researchers estimated the COVID-19 symptomatic case mortality rate for Wuhan—the capital city of Hubei province and the location of most of the COVID-19 deaths in the province—to be 1.4%, with a 95% confidence interval running from 0.9% to 2.1%.¹⁴

CFRS BY AGE GROUP

CFR and mortality rates by age have become available as the pandemic progresses. Figure 5 compares ranges of COVID-19 CFR by age group in the U.S. estimated by the CDC to the most recent mortality rates for the U.S. general population computed by the Social Security Administration. For someone between the ages of 45 and 84 who contracts COVID-19, the probability of dying from COVID-19 is generally higher than the probability of dying from all other causes combined. Although the CFR for children is relatively low, COVID-19 has been linked to cases of a potentially life-threatening illness similar to Kawasaki-like disease in children¹⁵.

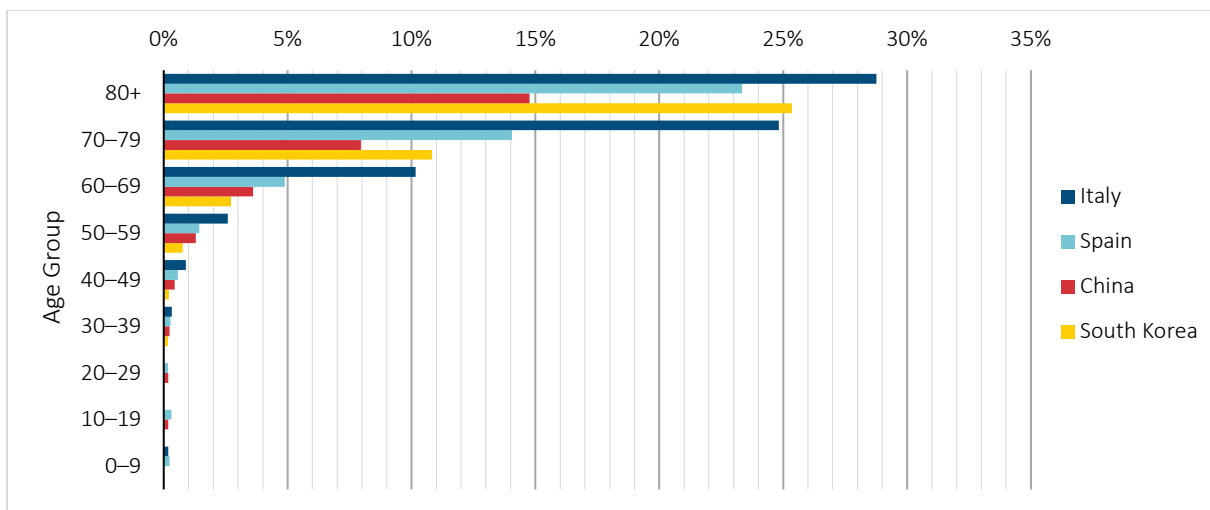
Figure 5
U.S. GENERAL POPULATION MORTALITY AND COVID-19 CASE FATALITY RATE RANGES BY AGE GROUP



Data sources: Centers for Disease Control and Prevention, *Morbidity and Mortality Weekly Report*, March 27, 2020 (published as early release March 18, 2020); Social Security Administration Period Tables for 2016, the most current tables available.

Researchers have calculated CFRs by age group for China, Italy, Spain and South Korea, as shown in Figure 6. Italy has the highest rate in most age groups, while South Korea has the lowest CFR in most age groups. The range of CFR across these countries is greatest at the older age groups. CFR for the 70–79 age group ranges between 8.0% in China and 24.8% in Italy. And for those above age 80, CFR ranges between 14.8% in China and 28.8% in Italy.¹⁶

Figure 6
SELECTED COUNTRIES COVID-19 CASE FATALITY RATES BY AGE GROUP



Data source: Sánchez, R.; Ordaz, A., Mendoza, S. P., *eldiarios.es*, March 22, 2020, reflecting updated data as accessed May 8, 2020

Gender differences in CFRs have also been emerging in the available data, and men have fared worse than women. In Spain, as of May 11, 10.5% of the male cases have died, while only 6% of the female cases have died.¹⁷ Other risk factors are also prevalent in those who have died. Of the 18,352 people who died in Spain as of May 11, 81.1% had one or more risk factors such as heart disease, respiratory disease or diabetes.¹⁸ In the U.S., 78% of the intensive care unit (ICU) patients and 71% of the non-ICU hospitalizations have had multiple risk factors.¹⁹

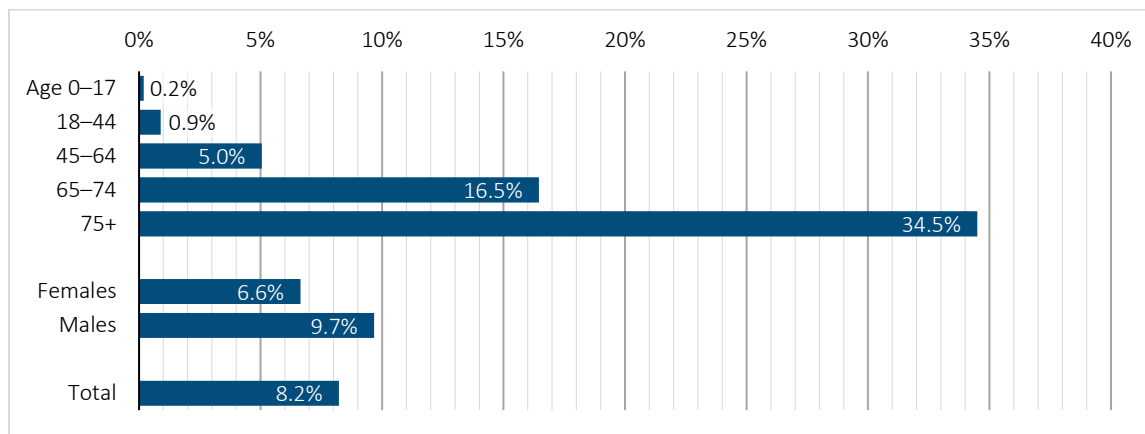
U.S. SUBPOPULATIONS



New York City also has statistics on the number of cases and deaths by gender and age group (Figure 7). As of May 12, 2020, the New York City CFR for males is 9.7% and for females is 6.6%. Because the city’s age groupings do not align with those shown for Italy, China, Spain and South Korea, it is difficult to compare results. However, New York City’s CFRs appear to be higher than the ranges that CDC had estimated in March (Figure 5).



Figure 7
NEW YORK CITY CASE FATALITY RATES, MAY 12, 2020



Data source: New York City Department of Health and authors’ calculations

Several states and large cities have released preliminary data that COVID-19 is infecting and causing fatalities for African Americans at significantly higher rates. For instance, statistics released for Chicago show that African Americans make up more than half of those who have tested positive and 72 percent of virus-related fatalities in Chicago, even though they are slightly less than one-third of the population. Michigan and Louisiana have also reported disproportionate rates.²⁰

Some health researchers and officials have attributed these rates to several factors including higher rates of underlying health conditions; less access to care; more individuals working essential jobs, which reduces social distancing; less available information about COVID-19; housing disparities; and living in more densely packed areas—factors that are generally accepted as driving higher death rates for communicable diseases. At present, however, experts say the data is too limited to make broad conclusions about COVID-19. Federal authorities are currently working to provide further statistics on what might be explanations for these preliminary data.²¹

Further, to the above reference about densely packed areas, an article prepared by the CDC COVID-19 response team noted that population density could be a significant factor in the transmission of COVID-19. Since COVID-19 is transmitted mainly by respiratory droplets, increased density could lead to acceleration in the transmission. Urban areas such as New York City and the District of Columbia are exceeding national averages. Louisiana has shown greater incidence and increase in incidence than other states in the South. This could be connected to the level of population density that occurred during Mardi Gras celebrations, before many major events were cancelled.²²



In a rare mission within the U.S., Doctors Without Borders sent a team to the Navajo Nation in a remote area of the southwest U.S. in April. The Navajo Nation, with a population of roughly 170,000, has more coronavirus cases per capita than any U.S. state. Doctors Without Borders also sent a smaller team to help the Pueblos in northern New Mexico.²³

CFR LIMITATIONS

It should continue to be reinforced that emerging statistics on the pandemic contraction and case fatality rates lag real-time information. In the early onset of the disease, cases might often be realized in datasets between one to two weeks after the first identification of the case occurred. The amount of time between contraction of the disease, onset of symptoms, and its ultimate treatment and identification in public health statistics could be much longer in counties without complete implementation of test processing. Deaths also occur on a lagged basis. Deaths and death rates will greatly increase in many countries and communities over the next month.

As with other viruses such as influenza, climate conditions may have an impact on the ability of the virus to survive. Viruses often survive better in cold weather because of the coatings that allow them to survive in the air and be passed on from person to person. These features degrade in warm temperatures. However, it is questionable whether COVID-19 is similar to other viruses in this regard. In the Southern hemisphere, South America and Australia saw significant outbreaks even in their warmer seasons.

The number of reported cases and deaths will continue to grow over the coming weeks. However, the pace will be very different in each community and country. It is important to understand the different timing of different numbers. Deaths are a lagging indicator. In general, deaths will continue to increase for a time after the number of new reported cases slows.

One technique to limit wild fluctuation in and gross under- or overstatement of CFRs that often occur during early reporting is to “lag” the number cases in the denominator by seven or 14 days. The lag better aligns the deaths with an appropriate exposure for calculating a CFR. However, CFRs calculated with a “lagged” case number could potentially be significantly higher than a CFR using a non-lagged case number, especially during the early days of an epidemic.

Another approach for avoiding misrepresentation of mortality rates because of early reporting issues is to analyze data for a location only after a certain number of deaths have been recorded there.

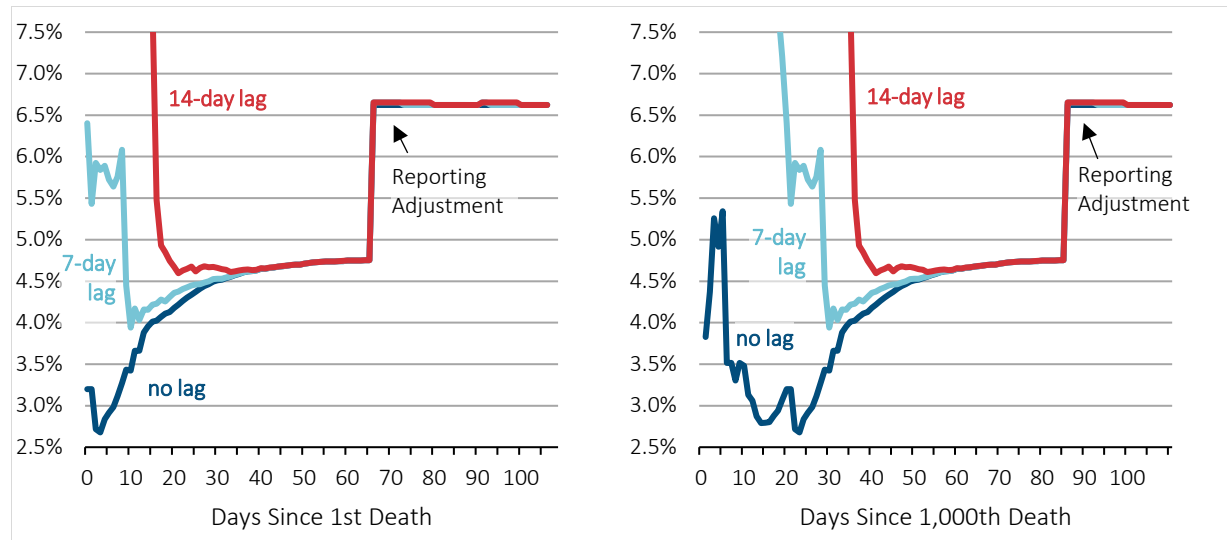
A word of caution: Many of the CFRs shown in and quoted in this brief have been pulled from sources that did not clearly document whether a lag is included. The reader should be aware of these potential shortcomings when reviewing these statistics and other reported CFRs.



Figure 8 highlights the effect of using lagged CFRs for Hubei province, China, as well as the impact of analyzing data only after 1,000 deaths were recorded in Hubei province. It appears the lagged and unlagged CFRs for Hubei province have converged and stabilized at about 6.6%. In Figure 9, the reader can see that the lagged and unlagged CFRs for the U.S. have not yet converged.



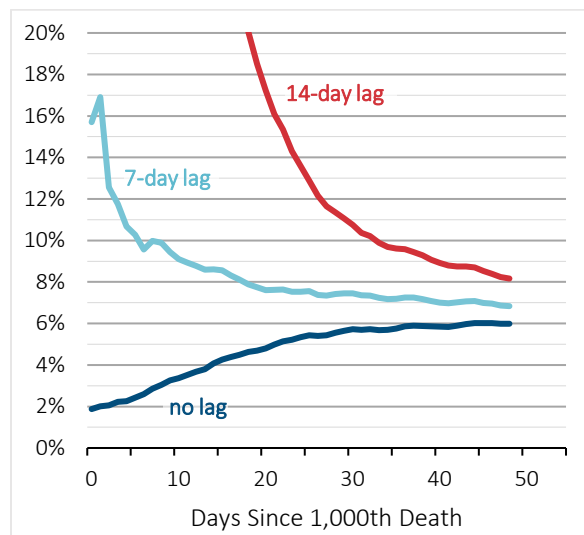
Figure 8
HUBEI PROVINCE, CHINA COVID-19 CFRS THROUGH MAY 11, 2020



Data source: Johns Hopkins University and authors' calculations. The Johns Hopkins University database shows a 40% increase on April 17, 2020, in the number of cumulative deaths in Hubei province—from 3,222 to 4,512—while the number of cumulative cases in Hubei province increased by 0.48%—from 67,803 to 68,128.



Figure 9
U.S. COVID-19 CFRS THROUGH MAY 11, 2020

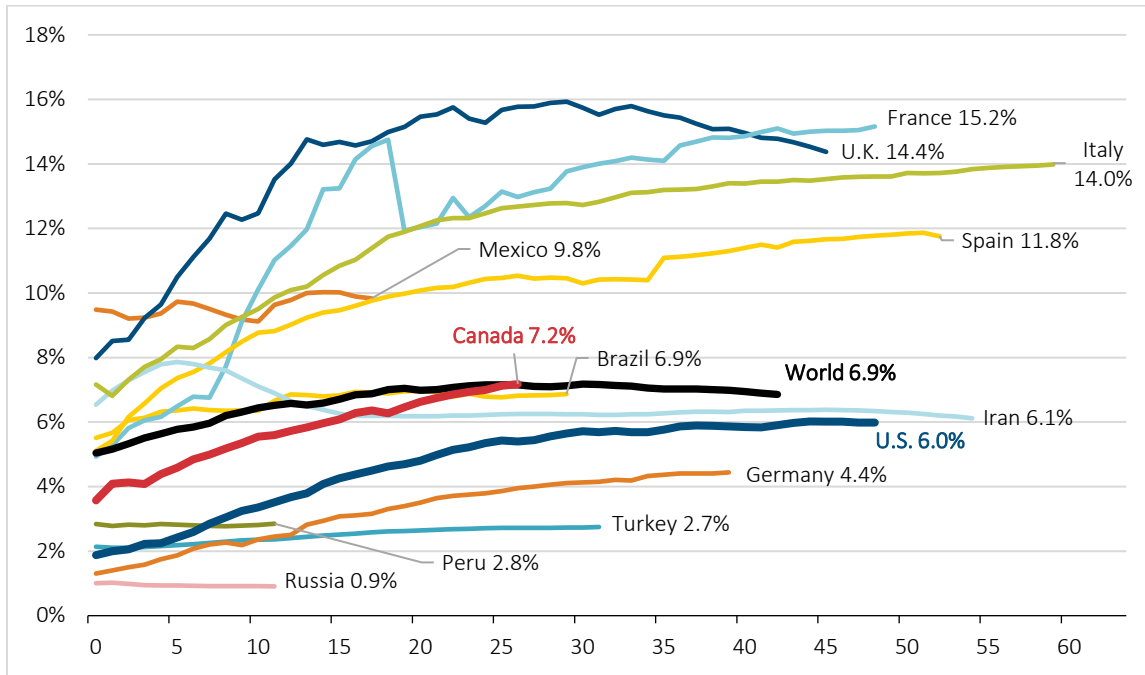


Data source: Johns Hopkins University and authors' calculations

Figure 10 shows unlagged CFRs for countries with at least 100 COVID-19 confirmed cases per million of population and at least 1,000 COVID-19 deaths. The effects of early reporting are clear. Although it is too early to draw conclusions about the likely long-term CFRs among countries, the differences are striking. Using Johns Hopkins University data as of May 13, 2020, France's CFR is 15.4%, followed by the U.K. at 14.4% and Italy at 14.0%. CFRs in Canada and the U.S. are 7.4% and 6.0%, respectively.



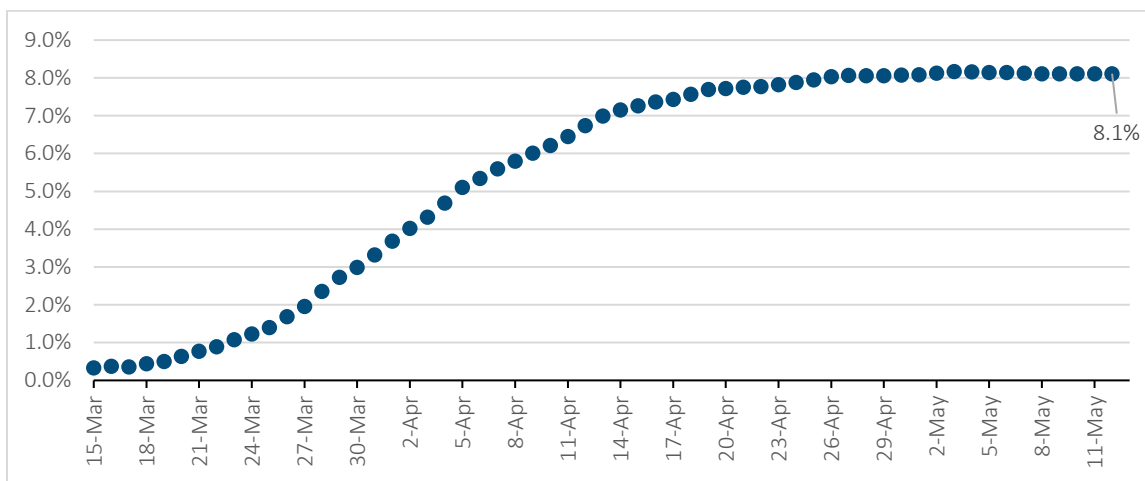
Figure 10
CFRS WITHOUT LAG FOR COUNTRIES WITH AT LEAST 100 COVID-19 CASES PER MILLION AND AT LEAST 1,000 COVID-19 DEATHS, THROUGH MAY 13, 2020



Data source: Johns Hopkins University and authors' calculations

Similarly, New York City's CFR shows the effects of early reporting (Figure 11) but also appears to be stabilizing around 8.1%.

Figure 11
NEW YORK CITY TOTAL CFR WITHOUT LAG, MARCH 15, 2020–MAY 12, 2020



Data source: New York City Department of Health and authors' calculations

REPORTED CASES VS. ACTUAL CASES

As previously stated, at this early stage in the pandemic, the CFR focuses on mortality rates relative to only confirmed and reported cases. Due to resource constraints, most countries have focused COVID-19 testing almost exclusively on individuals who exhibit severe symptoms.²⁴ Consequently, a key question remains unanswered: What percentage of the population has already been exposed to the virus?

A high exposure percentage would be good news, indicating that a significant portion of the population has already contracted the virus, experiencing either mild or no symptoms. The greater the number of infected individuals who have experienced little or no discomfort because of the virus—relative to the number who have experienced severe complications or death—the less danger the virus poses to the population that has not yet been infected.

In the absence of random testing of the general population, some researchers have used indirect approaches to estimate the portion of the population that has already been infected by SARS-CoV-2, the coronavirus that causes the illness known as COVID-19. For example, researchers from Penn State University and Montana State University examined publicly available U.S. influenza-like illness (ILI) data for this past March and identified a surge in non-influenza ILI. The surge defied patterns seen in prior years. Across U.S. states, the researchers found that the surge correlates with COVID-19 case counts. The authors conclude that the “symptomatic case detection rate of SARS-CoV-2 in the U.S. to be 1/100 to 1/1000.”²⁵ This conclusion, in turn, suggests that tens of millions of Americans have already been infected by the SARS-CoV-2 and, correspondingly, implies that the mortality rate among infected persons may be far lower than previously believed.

Additional emerging evidence supports the idea that COVID-19 is much more prevalent than indicated by the number of identified cases in most populations. Thus, the CFR may not be as deadly as originally thought. Data from Iceland, where testing has been more broadly implemented than in other countries, indicates that the prevalence may be around 1%. Using the deaths that have occurred in Iceland and its population age mix, this would extrapolate to a global CFR of about 0.6%.²⁶ The USS Theodore Roosevelt is another population where there has been widespread testing. As of April 16, 585 of the 4,860 crew had tested positive, resulting in an infection rate of 12%. There has only been one death associated with this Navy ship, although it may be early in the cycle of disease progression.²⁷



A recent study uses a modeling approach to estimate²⁸ an Infection Fatality Rate (IFR) at 1.3%. The IFR attempts to overcome the shortcomings of a CFR by correcting for the underreporting of the true number of COVID-19 deaths and cases. The model uses trends in reported COVID-19 deaths and cases and is unable to account for the fraction of the population who remain asymptomatic with infections.

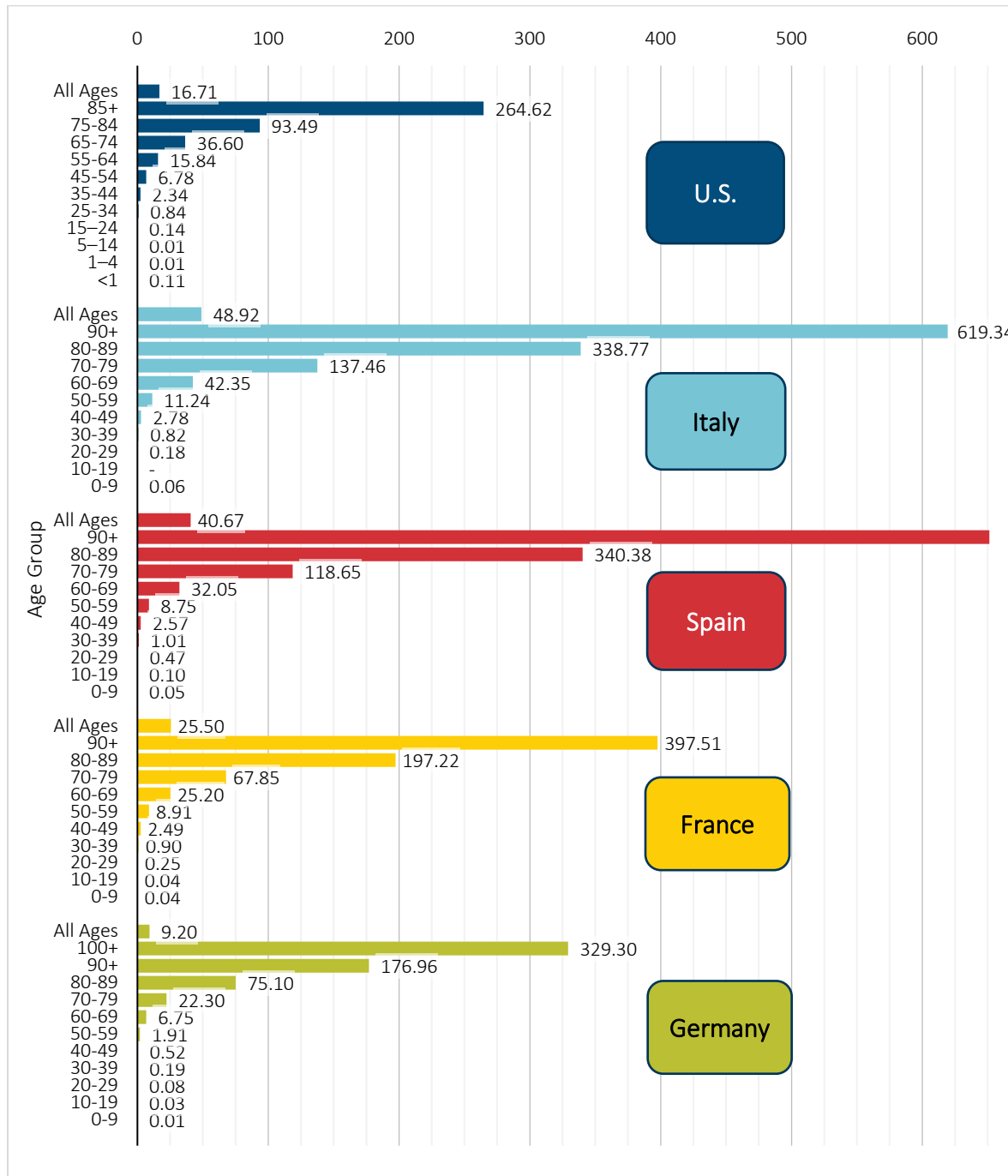


COVID-19 MORTALITY RATE CURVES

COVID-19 mortality rate data by age group in the U.S. and other countries is becoming more available. Mortality rates for the U.S. can be determined by using death counts from the CDC²⁹ and populations from the U.S. Census Bureau³⁰. The French Institute for Demographic Studies (INED)³¹ compiles data for France, Italy, Germany, Spain, Denmark, Netherlands, and other countries. Below are the mortality rates by age group for Italy, Spain, France, Germany, along with the U.S. The U.S. rates appear favorable, but it could be do the fact that other countries may be ahead of the U.S. in terms of weeks into the pandemic. See Figure 9. However, the U.S. mortality is lower than Germany even though it is ahead of Germany in the timeline. Spain’s mortality is higher than Italy and is behind Italy in terms of the pandemic timeline.



Figure 12
COVID-19 MORTALITY RATES PER 100,000 OF POPULATION BY AGE GROUP AS OF MAY 13, 2020



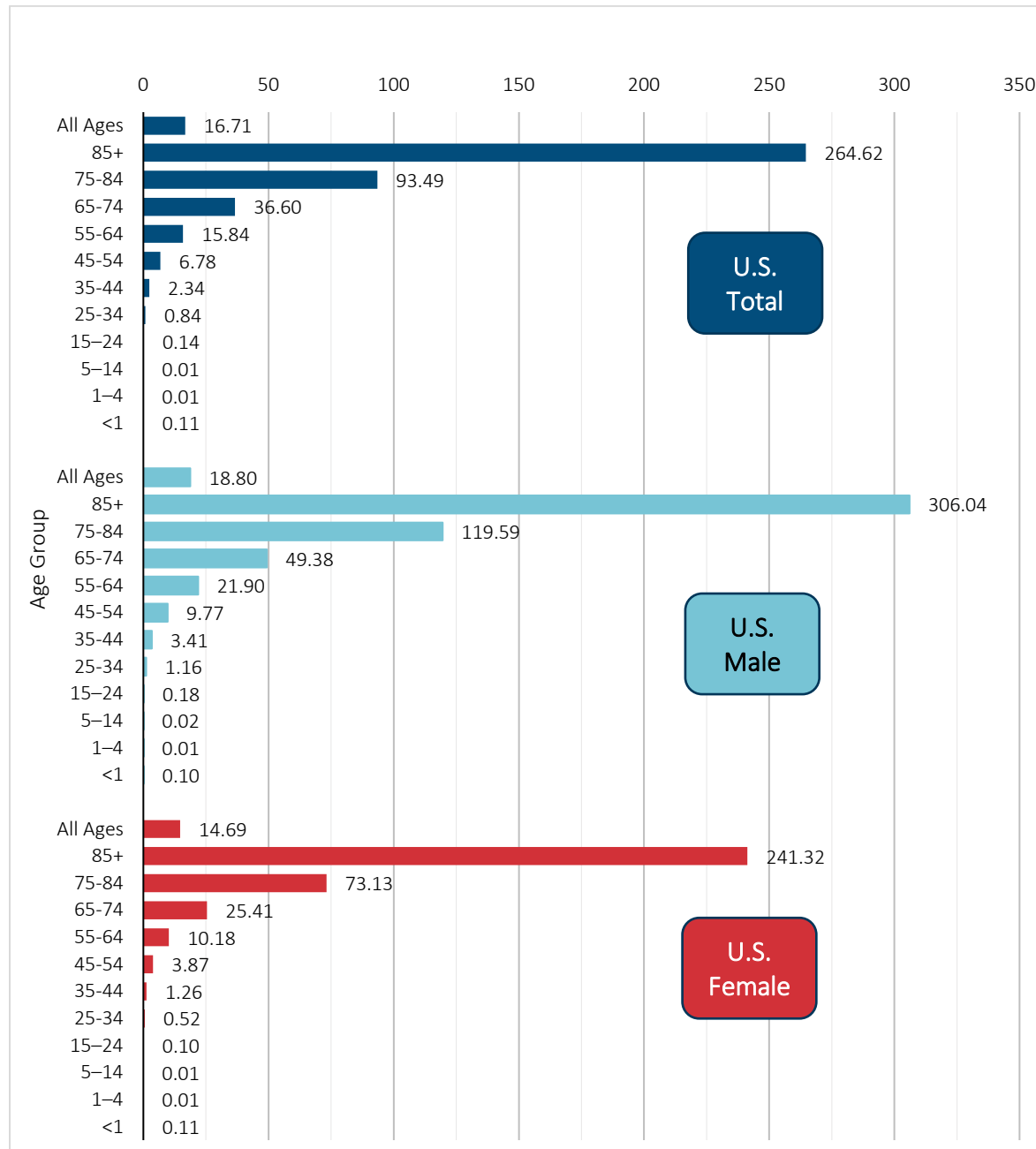
Data source: INED

COVID-19 mortality rates per 100,000 of population by gender in the U.S. are shown in Figure 13. Female rates are running about 78% of male rates for ages 85+ and for all ages. For ages 65–75, the female rate is about half the male rate and for ages 35–54, the female rate is about 40% of the male rate.



Figure 13

U.S. MORTALITY RATES PER 100,000 OF POPULATION BY AGE GROUP AND GENDER AS OF MAY 13, 2020



Data source: CDC



COVID-19 MORTALITY RELATIVE TO ALL CAUSES OF DEATH

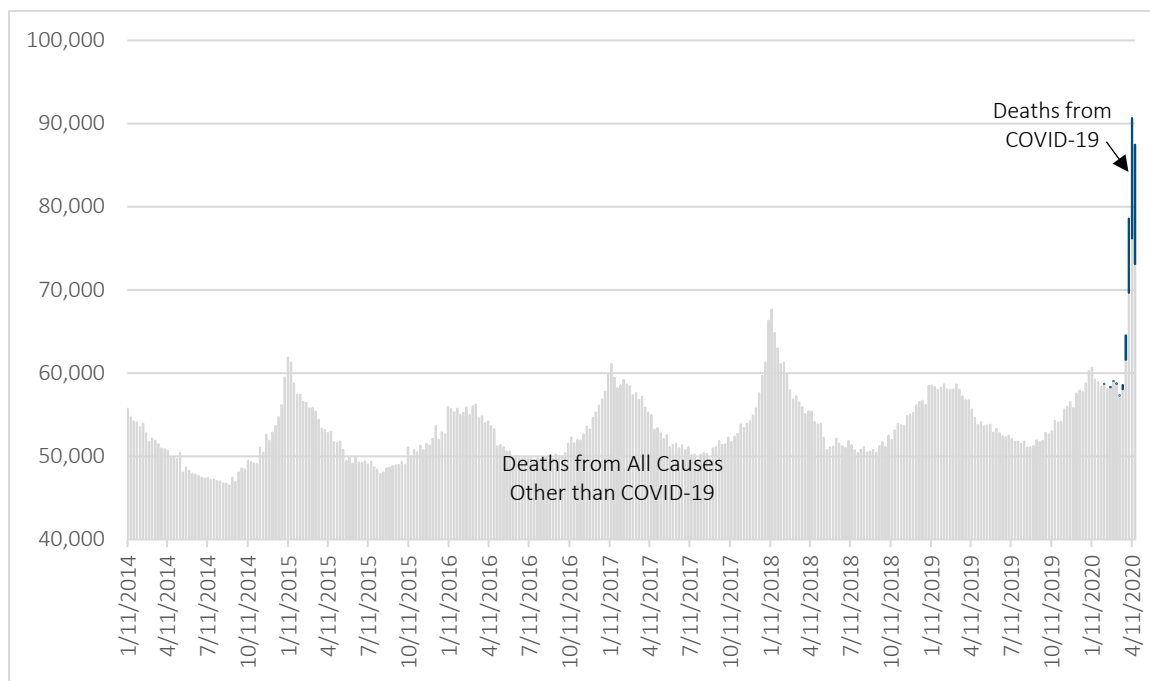
The tracking of cause of death (COD) is not a precise science because of the inconsistencies in the way COD is assigned to deaths on death certificates. Many deaths due to COVID-19 may be assigned to other causes of deaths. Some entries of COVID-19 as a COD may occur in cases only when COVID-19 is confirmed through testing. Other deaths may be coded as COVID-19 in cases where COVID-19 is suspected even if not confirmed through testing. One method that helps to understand the impact of a particular COD is to look at deaths from all causes and compare those “total” deaths to “total” deaths from other periods of time.



Figure 14 shows U.S. population deaths by week since the start of the 2013–2014 flu season as reported by the CDC analyzing death certificates. Deaths with COVID-19 indicated as a COD on a death certificate have also been added to this graph. Because of the 1- to 2-week lag in death certificate data, only data through April 18 is shown. As of April 18, the number of weekly deaths were 8% higher than the peak of the 2017–2018 flu season on January 13, 2018.



Figure 14
WEEKLY DEATHS IN THE U.S., JANUARY 11, 2014–APRIL 18, 2020



Data source: CDC



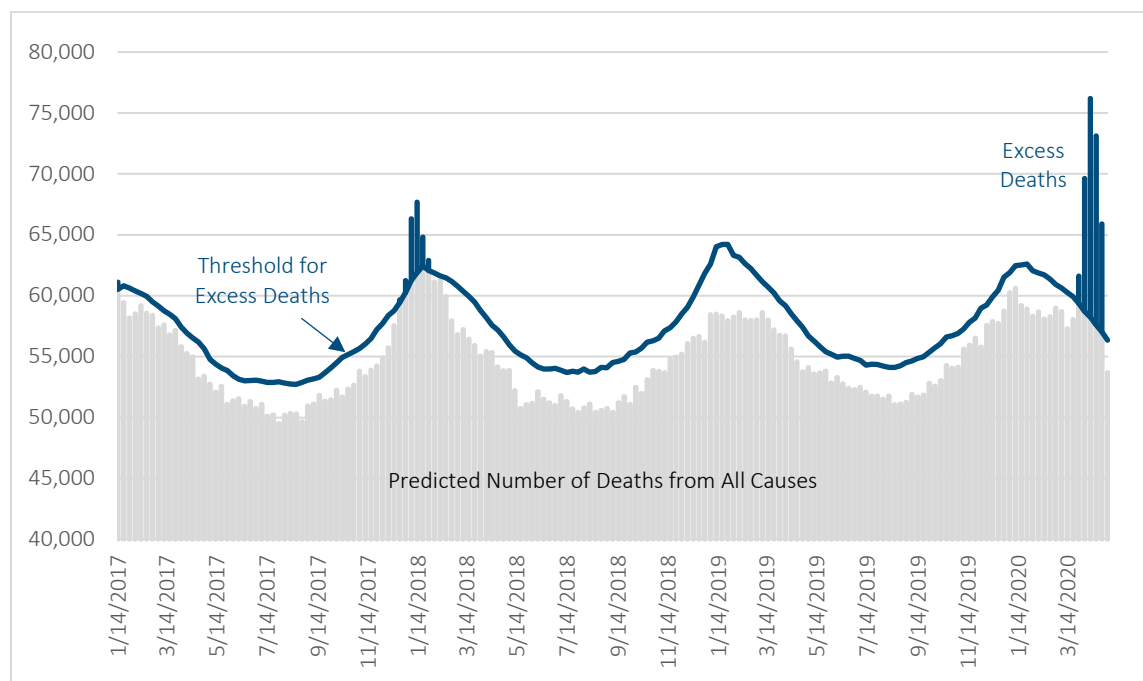
EXCESS MORTALITY

An analysis of excess mortality is useful to understand the mortality impact of the current pandemic and can help to overcome potentially misleading results due to inconsistencies in the reporting of COD. In an excess mortality analysis, total deaths are compared to an “expected” level of deaths. The CDC has begun analyzing excess deaths to help understand the impact of COVID-19. They have determined a set of expected deaths counts and the upper bound of the 95% confidence interval (CI) of these expected counts. This upper bound is used as a threshold to estimate excess mortality. Figure 15 shows the CDC’s predicted deaths from all causes compared to this CDC

threshold from January 14, 2017 through April 18, 2020. * Excess deaths did appear during the 2017–2018 flu season. The highest percentage of excess deaths to threshold prior to 2020 was 9.4% during the week of January 13, 2018. In 2020, excess deaths began appearing during the week of March 28, 2020. Through April 18, the highest excess deaths as a percent of threshold occurred during the week of April 11, 2020 and was 30.8%. Cumulative 2020 excess deaths as of April 18, 2020 totaled 46,666 or 0.014% of the U.S. July 1, 2019 population. As a comparison point, excess mortality during the 1918 pandemic was about 0.5%.



Figure 15
CDC EXCESS DEATH ANALYSIS THROUGH APRIL 18, 2020



Data source: CDC

COMPARISON TO PAST PANDEMICS AND INFLUENZA

COVID-19 AND PAST EPIDEMICS AND PANDEMICS

By comparison, the spread of COVID-19 has been much greater than similar epidemics witnessed in the 21st century but also with much lower mortality rates. SARS-CoV-2 is one of seven distinct coronaviruses that can infect humans and get their name from the crown-like spikes on their surfaces. Four common coronaviruses (known as 229E, NL63, OC43 and HKU1) rarely cause serious complications or mortality events. Two other coronaviruses were more prominent in their impact on human illness and mortality. The SARS-CoV virus caused the severe acute respiratory syndrome (SARS) outbreak of 2003³² and the MERS-CoV virus created the Middle East Respiratory Syndrome (MERS)

* See the Technical Notes section on https://www.cdc.gov/nchs/nvss/vsrr/covid19/excess_deaths.htm for detailed information on how the predicted deaths and the threshold were determined.

in 2012.³³ Table 1 shows comparative statistics of COVID-19 compared to the severe acute respiratory syndrome (SARS) outbreak of 2003 and the Middle East Respiratory Syndrome (MERS) in 2012.³⁴

The U.S. was a very small part of these previous outbreaks in comparison to the level of activity seen with COVID-19. Eight U.S. patients had evidence of the SARS infection, and no deaths occurred in the U.S. due to SARS. The U.S. saw only two cases and no deaths due to MERS in 2014, both associated with individuals who had lived or worked on the Arabian Peninsula. As of May 13, 2020, the U.S. had reported about 1.4 million confirmed cases of COVID-19, roughly 32% of the world’s confirmed cases.



Table 1
COMPARISON OF SELECTED CORONAVIRUS EPIDEMICS

Coronavirus Epidemic	Number of Countries Reporting Cases	Estimated Deaths	Estimated Contracted Cases	Estimated Case Fatality Rate
SARS (2002–2003)	29	774	8,098	9.6%
MERS (2012–2014)	27	858	2,494	34.4%
COVID-19 (2019–5/13/2020)				
No lag	170	297,197	4,347,018	6.8%
Lag-7	--	--	--	7.9%
Lag-14	--	--	--	9.4%

Note: Significant differences between the estimated COVID-19 case fatality rates (CFRs) with and without lags indicate that CFRs are likely distorted by reporting issues that often exist in the early stages of epidemics. COVID-19 CFRs are expected to change as the epidemic matures.

COVID-19 AND INFLUENZA

In addition, it can be beneficial to compare the extent of the impact of a sample influenza year to understand the magnitude and strain on health care systems and population mortality. The most recent full year of mortality in the U.S. is from 2018, which was also a fairly harsh year for the age-adjusted influenza mortality rate. The U.S. influenza season across 2017–2018 saw over 48 million people become ill, with over 950,000 people hospitalized and over 79,000 deaths.³⁵ The annual case fatality rate for influenza in the U.S. typically is observed between 0.1% and 0.2%, with population mortality generally in the range of 12 to 20 deaths per 100,000 of population (0.012% to 0.020%) depending on the severity of the season.³⁶



During the 1918 influenza H1N1 pandemic as World War I was ending, mortality was high in people younger than 5 years old, people aged 20 through 40, and in people age 65 years and older.³⁷ The high mortality in healthy people, including those in the 20–40-year age group, was a unique feature of this pandemic. Health officials estimate mortality was approximately 50 million deaths worldwide. An estimated 500,000 people or 0.5% of the population died in the U.S in the 1918 pandemic. As of April 18, 2020, excess deaths, presumably due to COVID-19 in the U.S., were up to 0.014%.

Since 1918, the world has experienced three additional pandemics, in 1957, 1968 and most recently in 2009.³⁸ These subsequent pandemics were less severe and caused considerably lower mortality rates than the 1918 pandemic. The 1957 H2N2 pandemic and the 1968 H3N2 pandemic each resulted in an estimated 1 million global deaths, while the 2009 H1N1 pandemic resulted in fewer than 300,000 deaths in its first year.³⁹

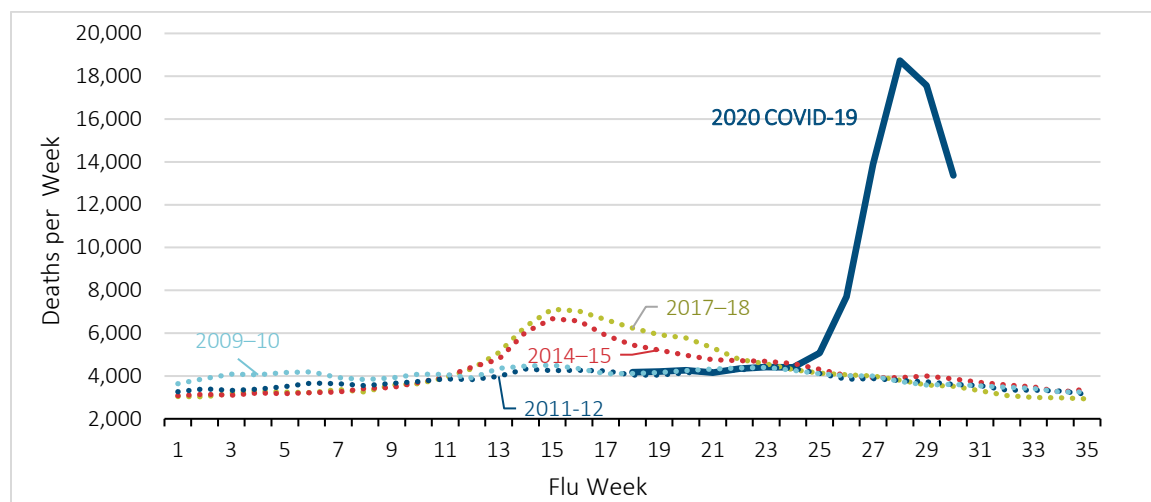
When looking at deaths, each flu season can vary by timing within the flu season and by severity. Figure 11 shows the weekly flu and pneumonia deaths for the total U.S. population for four highlighted flu seasons using data from

the CDC’s Flu Activity and Surveillance webpage⁴⁰ and flu, pneumonia and COVID-19 deaths from the CDC’s Weekly Surveillance Summary of U.S. COVID-19 activity.⁴¹ A flu season in the U.S. is measured by week and typically begins in week 40 of a calendar year through week 39 in the following calendar year. Week 40 in a calendar year will be the first flu week. Deaths in the 2014–2015 and 2017–2018 flu seasons peaked in week 14, increasing by about 25% over the prior week. The week-over-week increases in the 2009–2010 and 2011–2012 seasons were much lower, with the largest increase of 8.8% occurring in week 14 of the 2011–2012 season.



Figure 16

WEEKLY FLU, PNEUMONIA AND COVID-19 DEATHS BY FLU SEASON—TOTAL POPULATION



Data source: CDC



Results for the COVID-19 deaths and 2020 flu and pneumonia deaths captured on May 14, through flu week 30 or April 25, are included in Figure 11. Flu and pneumonia deaths are included to provide context for understanding the completeness of COVID-19 mortality data and related trends. Deaths due to COVID-19 may be misclassified as flu or pneumonia deaths and the increase in flu and pneumonia deaths may be an indicator of excess COVID-19 related mortality. Weekly death data for COVID-19 increased greatly in weeks 26 through 28. As of flu week 30, the total flu, pneumonia and COVID-19 deaths equaled 106,303, greatly surpassing the 2017–2018 flu season weekly high. Note, the death counts are lagged by 1–2 weeks. The National Vital Statistics System (NVSS) updates death counts as the CDC’s National Center for Health Statistics (NCHS) receives more death certificate information.

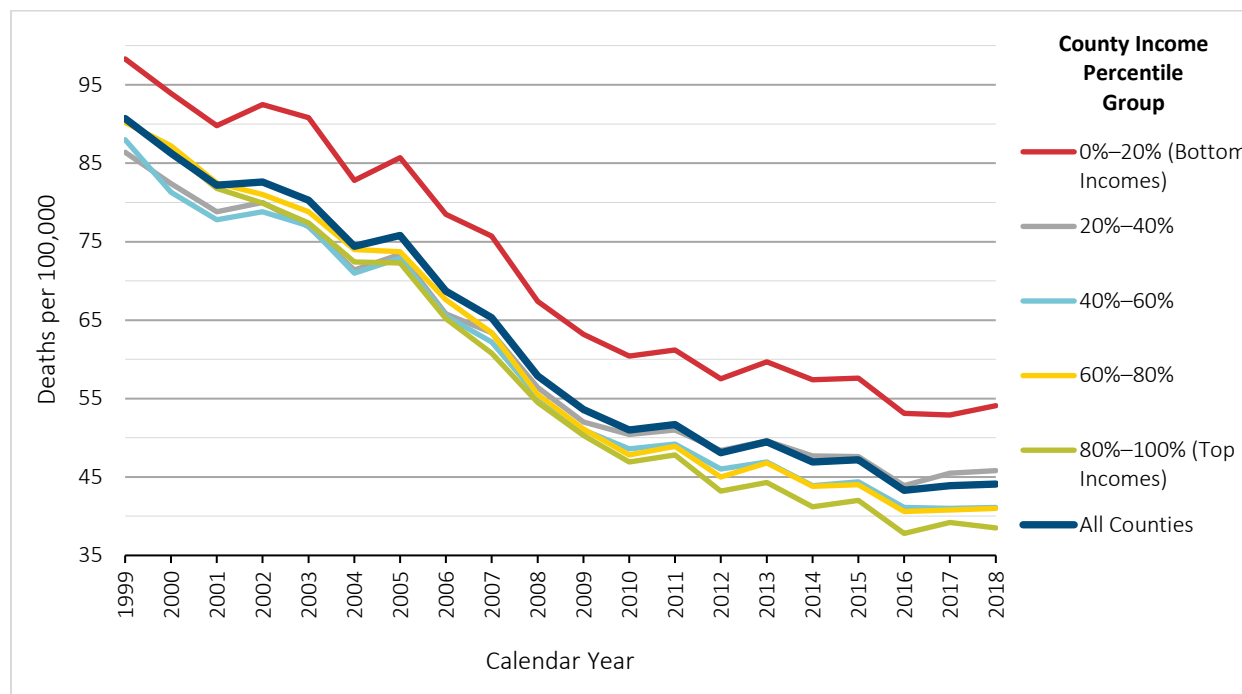
Life insurance companies will focus on how general population mortality rates translate into the ultimate mortality of their own insured populations. Socioeconomic factors may be a key driver of how mortality plays out, because an individual’s access to health care services and current health condition are often factors that drive survival rates in a confirmed case.

Insurers who can segment their policyholders into various income level groupings may be able to make use of U.S. population mortality data, shown in Figure 12, to benchmark their own flu and pneumonia death rates. This along with an understanding of the relationship between past flu events and the emerging COVID-19 experience can be useful in estimating the potential impact of COVID-19 on an insured block of business.

Figure 17 demonstrates how flu and pneumonia death rates in the U.S. have varied historically by various county level income percentile groups. U.S. counties were ranked based on median household income and split into five county level groups. The 80–100% group represents the quintile of counties with the highest income, and the 0–20% group is the quintile of counties with the lowest income. The bottom income quintile (0%–20%) has had

significantly higher mortality, ranging from 8.4% to 22.7% higher, than the total population. The other quintile groups have clustered together, and their rank order has shifted over time. However, the top income quintile (80%–100%) has had the lowest mortality rates since 2005 and has ranged from 0.2% higher to 12.7% lower than the total population.⁴²

Figure 17
U.S. POPULATION DEATHS FROM FLU AND PNEUMONIA BY COUNTY INCOME PERCENTILE



Data source: CDC WONDER Online Database

In a recent survey completed by the SOA, the Life Insurance Marketing and Research Association (LIMRA), Oliver Wyman and the American Council of Life Insurers (ACLI), life insurance companies were asked which median household income quintile their policyholders fell into on average.⁴³ The results were across the board. Thirty-two of 53 responded with the following percentile groups: 7 in the top 20th; 4 in the 21st–40th; 9 in the 41st–60th; 9 in the 61st–80th; and 3 in the 81st–100th. The remaining 21 could not provide an answer. The results show a lack of homogeneity in the insurance industry and indicate that each insurer needs to consider its own block of business if using population mortality as a benchmark to its own flu, pneumonia and COVID-19 claims.

HEALTH CARE COST AND UTILIZATION

Data on the cost and utilization of treatment for individuals who are diagnosed with COVID-19 is still emerging. The financial impact of COVID-19 is seen through increases in underlying expenses and is driven by costs for testing, special equipment, protective systems for health care workers and additional staffing needs. In some locations, additional hospital and ICU beds are often needed, and they are being built or converted from other sources.⁴⁴

These increased costs may be passed onto payers immediately through fee-for-service claims or later in other payment arrangements. In the U.S., many insurers are waiving patient out-of-pocket costs for health care treatment related to COVID-19.⁴⁵ As an example, a broad list of health care insurance activities being used to provide access to care and support in the current environment can be found on the website of America's Health Insurance Plans (AHIP), a U.S. national association whose members provide health insurance coverage and health-related services.⁴⁶

The largest increases in costs are directly connected to the critical care needed for the sickest patients who have contracted the virus. Intensive care units for these patients are very expensive and the costs are further compounded by the need for isolating them. The impact also varies by the outbreak situation in local areas depending on demographics and efforts such as social distancing to slow the spread. Additional details on the range of estimates for COVID-19 health care claims can be seen in the Society of Actuaries report *COVID-19 Costs to Commercial Health Insurers*.⁴⁷



SUPPLY OF MEDICAL RESOURCES

An issue in some countries, including the U.S., was that the supply of many testing and critical care resources was lower than the demand during the earlier weeks of this pandemic.⁴⁸ Demonstrating critical care equipment supply issues, Mayor de Blasio stated that New York City had 2,000 ventilators as of March 23 but was expecting to need 15,000 by the end of May.⁴⁹

Testing for the virus involves collecting respiratory specimens from a patient and running it through test kits at laboratories that perform real-time RT-polymerase chain reaction (rRT-PCR) detection of the SARS-CoV-2 virus. Inside the labs, reagents are required to test the specimen provided. Supply of test kits has been growing, despite production challenges, but one constraint may also be the amount of lab capacity that is or can be revised to be made available.

Some countries have dramatically increased capacity for testing, leveraging off past investments in health care infrastructure. As an example, South Korea established drive-through test centers to expedite the process and extend testing ability. These methods also help limit health care workers from having extended direct exposure to the virus.⁵⁰

On April 21, 2020, the U.S. Food and Drug Administration (FDA) authorized the first diagnostic test with a home collection option for COVID-19.⁵¹ On April 27, 2020, several U.S. retail pharmacy chains announced expansion of free coronavirus testing to be conducted in their parking lots or drive-thru windows.⁵² From insurer and consumer cost perspectives, federal law now requires most private health plans to cover testing for the coronavirus with no cost-sharing during the current emergency period.⁵³



On May 9, the FDA approved an antigen test for COVID-19. Antigen tests diagnose active infections by detecting the earliest toxic traces of the virus rather than genetic code of the virus itself. The test provides results in approximately 15 minutes. The antigen test is the third type of test to be authorized by the FDA and it expects to authorize more antigen tests in the future.⁵⁴

Testing is important during a pandemic to help detect infections and contain the spread of the virus. Once containment is no longer possible, the strategy shifts from containment to protection of the most vulnerable through social distancing and self-isolation.

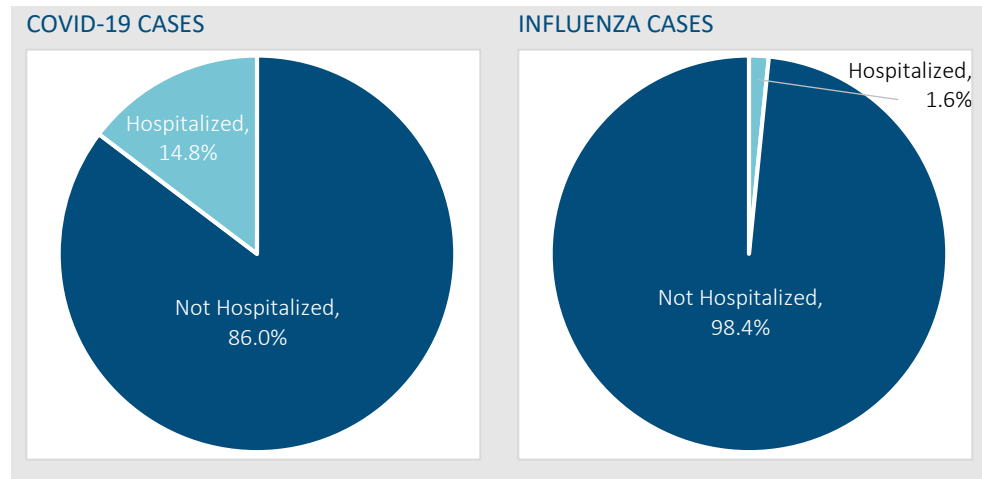
HOSPITALIZATION RATES



Hospitalization rates for COVID-19 patients appear to be high. Obtaining adequate U.S.-wide data to compute COVID-19 hospitalization rates is challenging. However, data for a very rough estimate is available from various sources. Using the CDC's hospitalization rate of 40.4 per 100,000 population⁵⁵ and the CDC's 895,766 number of cases⁵⁶ as of April 25 along with a U.S. population of 330.7 million,⁵⁷ the hospitalization rate per COVID-19 cases in the U.S. is 14.8% and much higher than the hospitalization rate of 1%–2% for influenza patients (Figure 18). Note the 14.8% rate was compiled based on data from different sources and, therefore, the exact timing of the data from these different sources may not line up precisely.



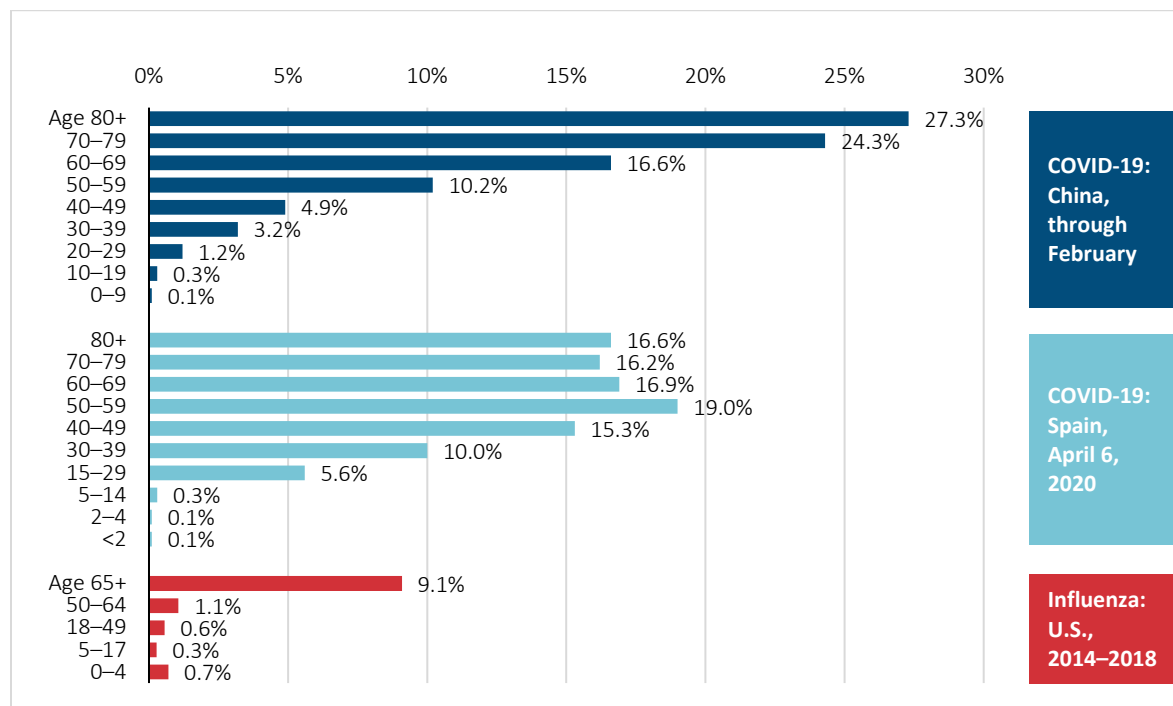
Figure 18
PERCENTAGE OF U.S. COVID-19 AND INFLUENZA CASES THAT REQUIRED HOSPITALIZATION



Data source: Centers for Disease Control and Prevention

Figure 19 digs into hospitalization rates a little deeper and compares COVID-19 hospitalization rates by age groups for COVID-19 and influenza. Based on COVID-19 data from China and Spain and influenza data from the U.S., COVID-19 hospitalization rates significantly exceed influenza hospitalization rates for ages 18 and up.⁵⁸

Figure 19
PERCENTAGE OF CASES REQUIRING HOSPITALIZATION BY AGE GROUP



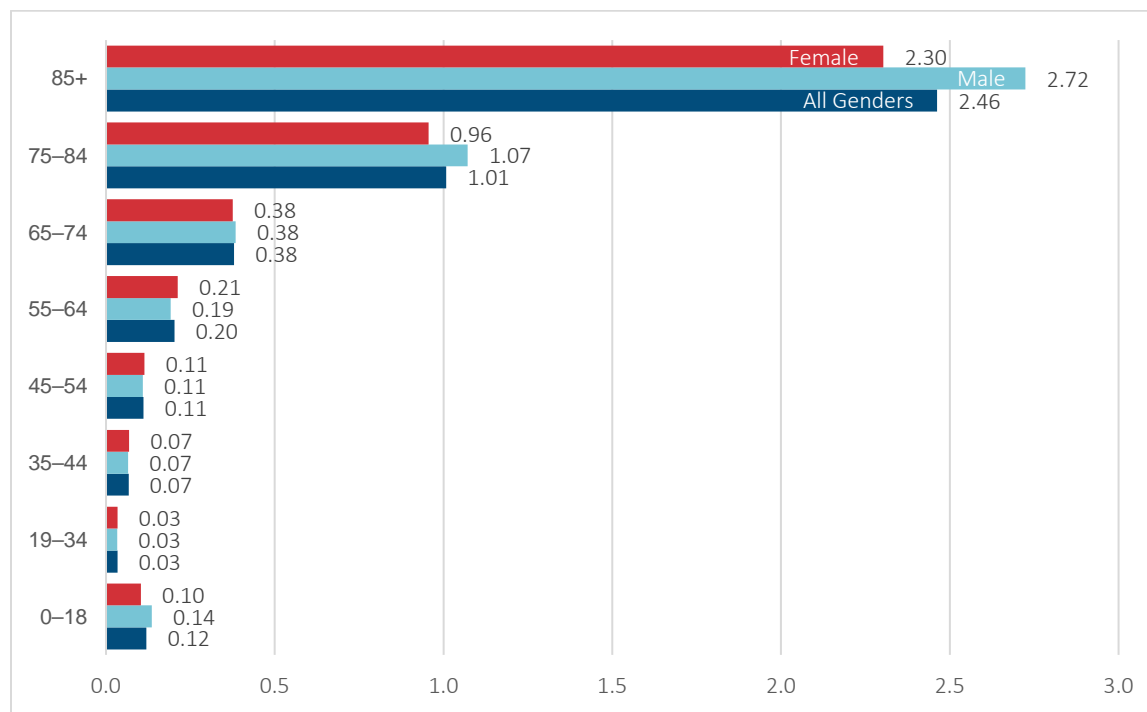
Data sources: Imperial College of London for COVID-19 (China); Red Nacional de Vigilancia Epidemiológica for COVID-19 (Spain); Centers for Disease Control and Prevention for U.S. influenza.

However, there are other comparisons of COVID-19 to influenza that may be used to get a better understanding of COVID-19 populations as they relate to comorbidities. According to the CDC, comorbidities played a key role in helping to determine the severity of COVID-19 patients. In fact, according to one of their recent studies, individuals with underlying conditions had a 40.5% chance of hospitalization versus 9% of those with no underlying conditions. Similarly, hospitalized patients had underlying health conditions 71% of the time for non-ICU admissions and 78% of ICU patients. This helps to validate the frequently repeated trope that comorbidities and underlying medical conditions can lead to more severe cases of COVID-19.⁵⁹

The critical focus shifted from testing kits toward having adequate numbers of hospital beds and ventilators for COVID-19 patients and sufficient personal protective equipment for frontline health care professionals and other critical service employees like police. The number of hospital beds per 1,000 people in the U.S. is 2.8 and lags Italy (3.2 per 1,000), China (4.3 per 1,000) and South Korea (12.3 per 1,000).⁶⁰ Models and projections of hospital bed usage in the U.S. produced by ProPublica demonstrate why public health officials are so intent on “flattening the curve.”⁶¹

Figure 19 emphasized the distribution of hospitalization related to influenza claims. Figure 20 shows the incidence rates of influenza hospitalizations by age group for each flu season. These results are similar in that there are significant increases in flu hospitalizations as members age, with incidence rates more than doubling as members shift into different 10-year age bands. In addition, males tend to have slightly higher hospitalization rates with those discrepancies increasing at higher ages.

Figure 20
HOSPITAL ADMISSION RATE PER THOUSAND MEMBERS DUE TO INFLUENZA BY GENDER, 2013–2017



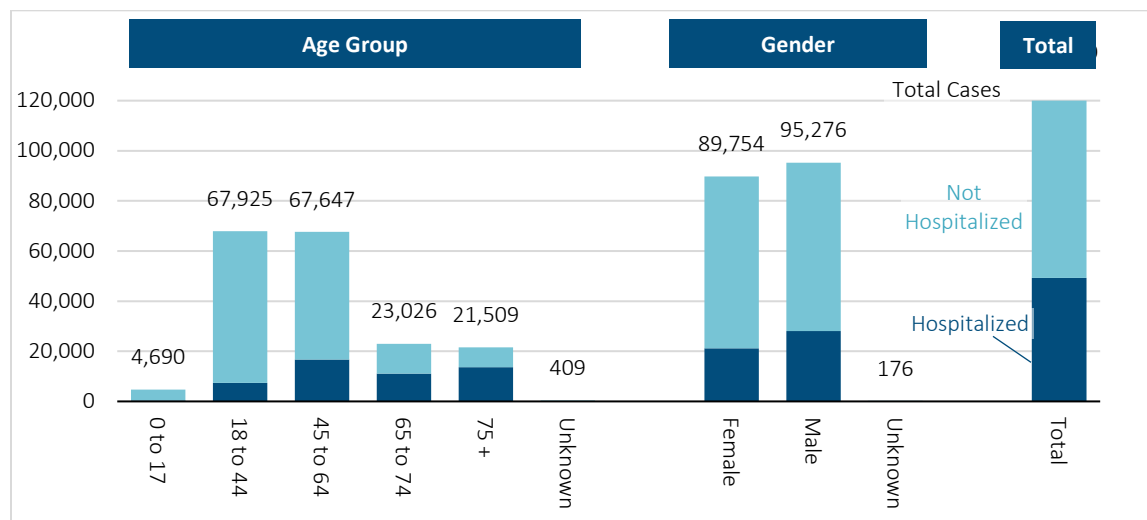
Source: Health Care Cost Institute Enrollment and Inpatient Claims Data from 2013–2017.

New York City released data of the cumulative number of reported COVID-19 cases and hospitalizations in the city, as shown in Figures 21 and 22. The data show that most COVID-19 cases appear in persons age 18 to 44. However, compared to all older age groups, a much smaller percentage of persons age 18 to 44 who contracted COVID-19

have been hospitalized.⁶² Note that data from a very specific locale such as New York City may not be representative of situations in other locales.



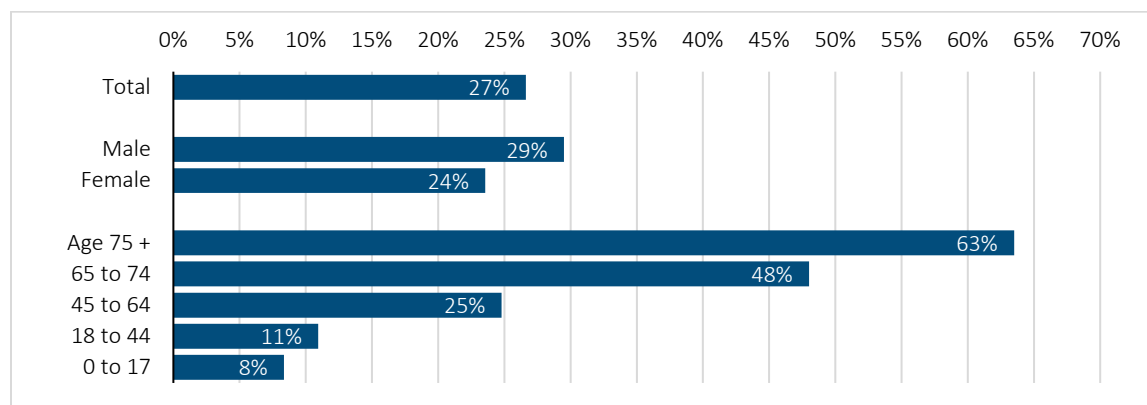
Figure 21
CUMULATIVE NUMBER OF NEW YORK CITY REPORTED COVID-19 CASES AND HOSPITALIZATIONS, MAY 12, 2020



Data source: New York City Department of Health



Figure 22
PERCENTAGE OF NEW YORK CITY REPORTED COVID-19 CASES THAT HAVE BEEN HOSPITALIZED, MAY 12, 2020



Data source: New York City Department of Health



New York City’s data shows that through May 12, 2020, 27% of COVID-19 patients have been hospitalized. It also shows that males are more likely than females to contract COVID-19, and they are more likely to get sicker from COVID-19 than are females. Approximately 48% of New York City’s population is male,⁶³ yet males have contracted 51% of the confirmed cases, and 57% of the hospitalized cases have been males.

Each influenza outbreak can differ by the time of year it will peak. Figure 18 shows the weekly hospitalization rate for the total U.S. population for four highlighted flu seasons using data from the CDC’s Weekly Surveillance Summary of U.S. COVID-19 activity⁶⁴ and the CDC’s Flu Activity and Surveillance webpage.⁶⁵ A flu season in the U.S. is measured by week and typically begins in week 40 of a calendar year through week 39 of the following calendar year. Week 40 in a calendar year will be the first flu week. The 2009–2010 season was unusual in that it peaked

early in flu week three, whereas the 2011–2012 flu season peaked in flu week 24. The 2014–2015 season’s peak was quite severe at a rate of 14.6 per 100,000 hospitalizations in week 14 but dropped off quickly the following week. The 2017–2018 season also peaked in week 14 at a rate of 10.2 and dropped off slowly over the next eight weeks.

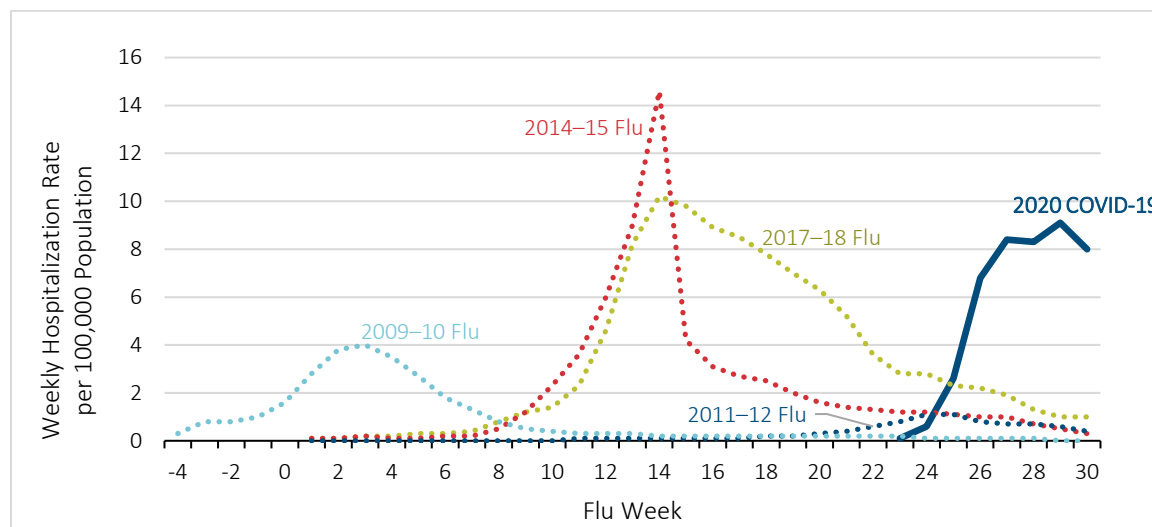


Results for the COVID-19 season are also shown in Figure 23 through April 25 or flu week 30. These results begin to appear in flu week 23, but because of the lag in reported data, this data may be updated in future weeks. The trend in COVID-19 hospitalizations is quite steep through week 27 and has neared the peak hospitalization rate of the 2017-18 flu season. In week 29, the weekly hospitalization rate across all ages was 9.1 hospitalizations per 100,000 or 62% of peak weekly rate in the 2014–2015 season.



Figure 23

WEEKLY HOSPITALIZATION RATE BY FLU SEASON—TOTAL U.S. POPULATION



Data source: CDC

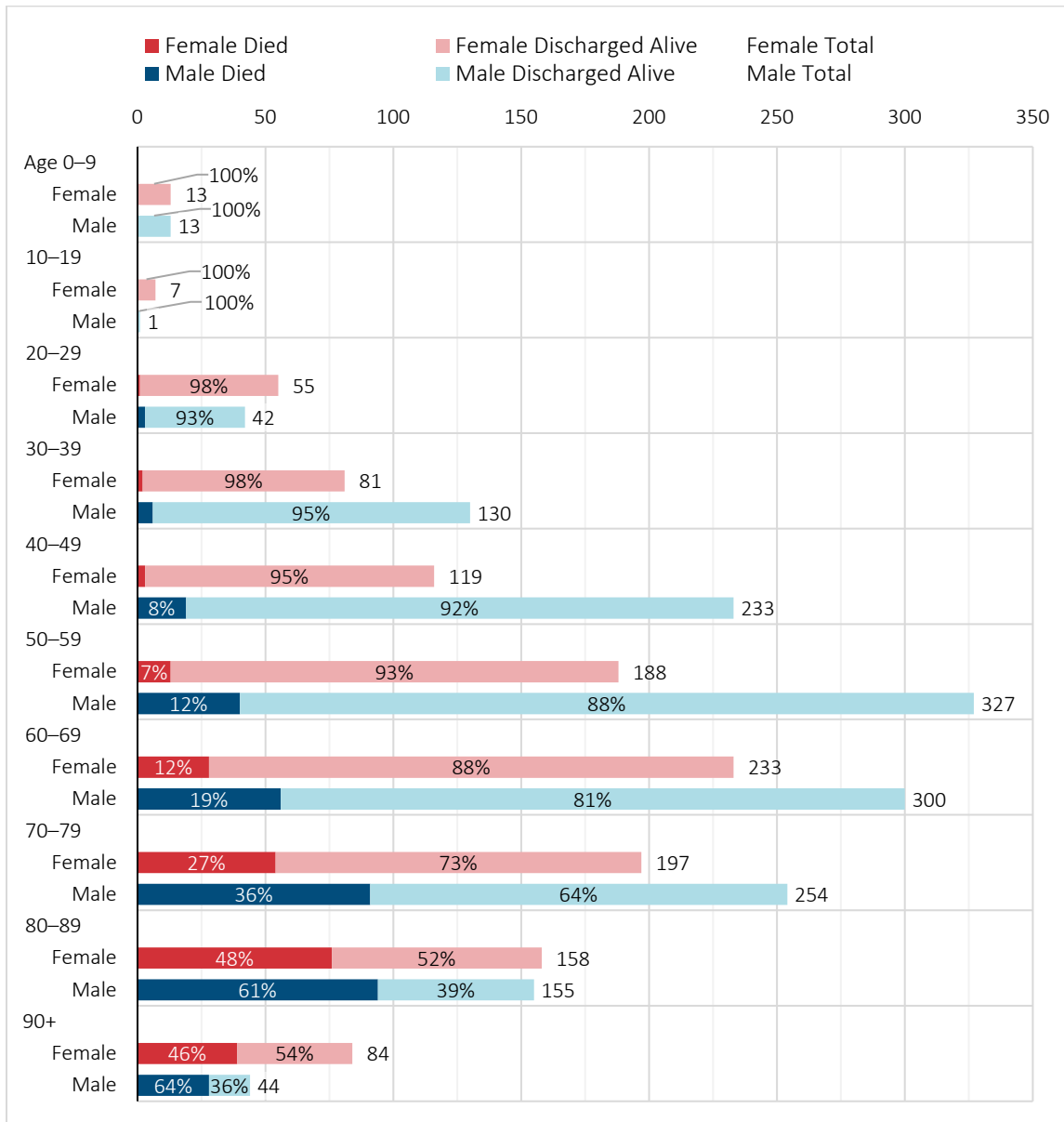
This report previously mentioned that during the 2017–2018 influenza season, about 8% of hospitalized influenza patients died.

On a cautionary note, data from China and New York City are instrumental to understanding the COVID-19 situation in those specific locales; however, experience in other locations may differ, depending on many factors including, population density, availability of medical resources, the degree to which movement was allowed and the degree to which social distancing was observed, among other things.

Extreme weather is another factor that may impact resource demand. Regions prone to extreme weather or other disaster events should plan for additional health care resource strain and the need for more beds in case such an extreme event occurs concurrently with the pandemic. The level of additional strain will vary based on how well these regions have planned previously for future extreme events and the need for increased capacity.

The outcomes of hospitalized COVID-19 patients are also of interest. A study recently published by the American Medical Association examined 5,700 medical records of COVID-19 patients hospitalized during March 1, 2020, through April 4, 2020, in Northwell Health hospitals in the New York City area.⁶⁶ Figure 24 shows the outcomes by gender for the 2,634 patients who had died or were discharged alive during the period studied. The 3,066 patients who were in the hospital at the end of the study are excluded from the figure.

Figure 24
DISCHARGE DISPOSITION OF SAMPLE COVID-19 HOSPITALIZED PATIENTS IN THE NEW YORK CITY AREA

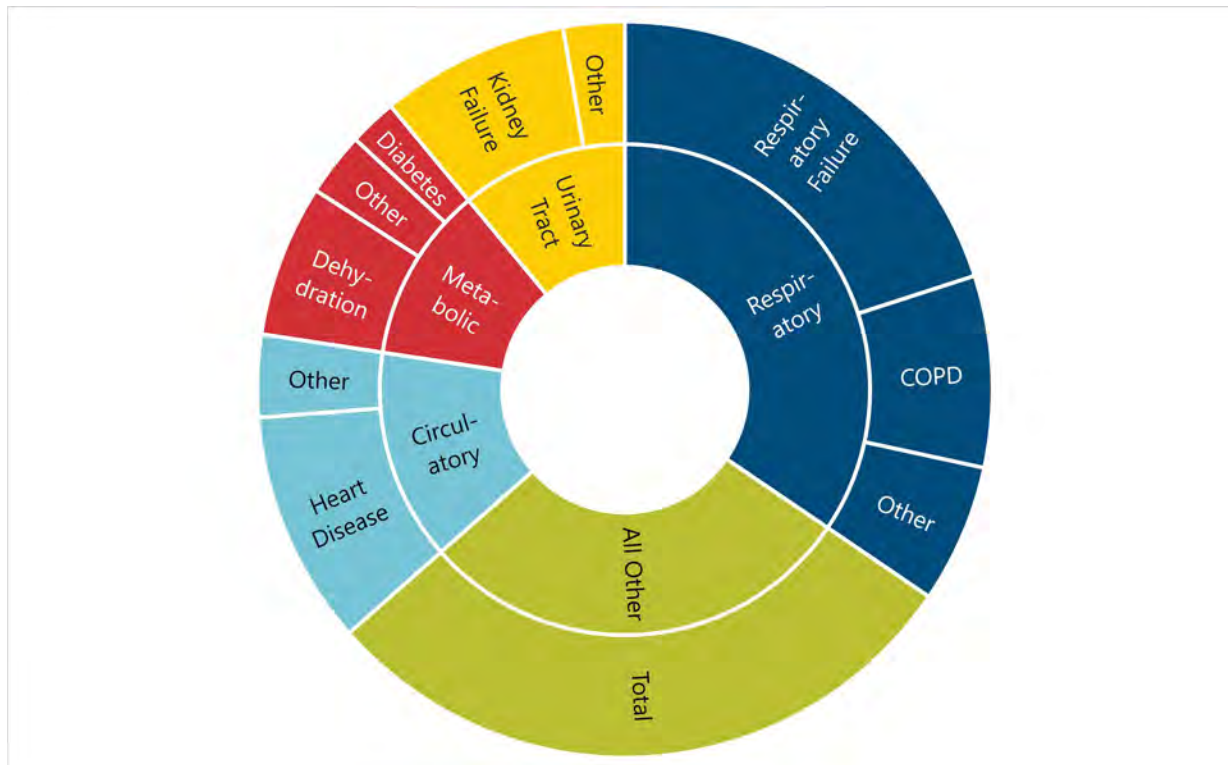


Data source: Richardson, Safiya et al. (2020, April 22). "Presenting Characteristics, Comorbidities and Outcomes Among 5,700 Patients Hospitalized With COVID-19 in the New York City Area." <https://jamanetwork.com/journals/jama/fullarticle/2765184>.

COMORBIDITIES

It is worth noting, though, that comorbidities play a key role in influenza hospitalizations. As previous shown, the rate of hospitalization for influenza cases is very low. However, when looking at Health Care Cost Institute (HCCI) data from 2013–2017, there is a high rate of comorbidities for hospitalized influenza patients. Figure 25 shows rates of the main comorbidity for hospitalized influenza patients. The most common ones fall into main categories of conditions: respiratory, circulatory, metabolic and urinary tract. Many of these individuals also have comorbidities as many of these conditions and others are present in patients hospitalized due to influenza.

Figure 25
MAIN COMORBIDITIES FOR HISTORICAL INFLUENZA CLAIMS



Source: Health Care Cost Institute Enrollment and Inpatient Claims Data from 2013–2017

One of the complicating factors of COVID-19 is the prevalence of underlying conditions, or comorbidities, among hospitalized persons. Table 2 shows the relative prevalence of several different comorbidities for those hospitalized with influenza or COVID-19. The influenza data is based on Commercial and Medicare Advantage insured populations from HCCI for the years 2015–2017.⁶⁷ The COVID-19 data is based on New York City experience data.⁶⁸ The disease categories and conditions from the two data sources have been lined up where possible. Both influenza and COVID-19 hospitalizations have similar prevalence of hypertension and diabetes. Obesity is more prevalent in COVID-19 hospitalizations. Heart disease, COPD, kidney disease and cancer are more prevalent in influenza hospitalizations.

Table 2
COMMON COMORBID CONDITIONS FOR HOSPITALIZED INFLUENZA AND COVID-19 PATIENTS

Disease Category	Condition	Influenza Patients		COVID-19 Patients
		Ages 65+	Ages <65	
Cardiovascular	Hypertension	69.20%	36.90%	56.6%
	Heart Disease	56.60%	22.10%	11.1% Coronary Artery Disease 6.9% Congestive Heart Failure
Metabolic	Diabetes	30.30%	19.90%	33.8%
	Obesity	12.10%	18.20%	41.7% BMI ≥30 19.0% BMI ≥35
Respiratory	COPD	29.90%	16.50%	5.4%
	Asthma	8.60%	19.90%	9.0%
Genitourinary	Kidney Disease	33.00%	18.3	5.0% Chronic 3.5% End-Stage
	Urinary Disorders	9.40%	4.50%	n/a
Cancer	Cancer	29.50%	30.80%	6.0%
Immunosuppression	HIV	n/a	n/a	0.8%
	History of Solid Organ Transplant	n/a	n/a	1.0%
Liver	Cirrhosis	n/a	n/a	0.4%
	Chronic–Hepatitis B	n/a	n/a	0.1%
	Chronic–Hepatitis C	n/a	n/a	0.1%
Other	Anemia	14.40%	12.00%	n/a
	Brain Disorders	7.60%	2.90%	n/a
	Muscle Disorders	6.50%	2.70%	n/a

Data source: Richardson, Safiya et al. (2020, April 22). "Presenting Characteristics, Comorbidities and Outcomes Among 5,700 Patients Hospitalized With COVID-19 in the New York City Area." <https://jamanetwork.com/journals/jama/fullarticle/2765184>.

COVID-19 TREATMENT

Several companies have been developing and testing treatments for symptoms of COVID-19, though results are still preliminary.⁶⁹ In addition to these antiviral and anti-infective treatments, preventive medicines and therapeutic antibodies are being reviewed. The newness of the virus complicates research efforts, even with increasing information coming from early cases in China to help guide what might be potential treatments or solutions. On March 30, the FDA issued an emergency-use authorization for two anti-malarial drugs for use in treating patients infected with COVID-19.⁷⁰ The drugs, chloroquine phosphate and hydroxychloroquine sulfate, have been previously used off-label anecdotally.

The World Health Organization (WHO) and its partners launched the Solidarity international clinical trial in March to help find an effective treatment for COVID-19. The Solidarity trial compares four treatment options to assess their relative effectiveness against COVID-19: remdesivir (previously tested for Ebola treatment); lopinavir/ritonavir (used for HIV treatment); lopinavir/ritonavir with interferon beta-1a (used for multiple sclerosis treatment); and chloroquine or hydroxychloroquine (used for malaria treatment—see above). The goal is to assess as quickly as possible the effectiveness of the treatment options by enrolling patients in multiple countries; at least 90 countries are participating.⁷¹

The Bill & Melinda Gates Foundation, the Wellcome Trust and Mastercard announced in mid-March the launch of the COVID-19 Therapeutics Accelerator, a \$125 million fund for coronavirus pandemic initiatives. The Accelerator’s initial efforts are focused on exploring how existing drugs can help treat COVID-19. It has two current trials: one for the drug chloroquine and the other for hydroxychloroquine. The goal of these trials is to see how the two drugs can stop people who are exposed to the virus from getting sick. This differs from the WHO’s Solidarity trial, which is investigating chloroquine treatment for its use to shorten COVID-19 patient symptoms.⁷² In addition, efforts to

develop vaccines are well underway. More than 30 companies and academic institutions are racing to create such a vaccine, several of which already have candidates they have been testing in animals. It is expected that human trials will begin soon. Some estimates indicate that it may take up to 12–18 months to know the effectiveness and safety of any proposed vaccines. On May 12, 2020, Dr. Anthony S. Fauci, director of the National Institute of Allergy and Infectious Diseases, told U.S. senators that a vaccine would not be ready in time for the school year beginning in the fall of 2020.⁷³

Reports on COVID-19 treatment developments have been mixed. Initial media reports about a remdesivir trial for use with severe condition COVID-19 patients at the University of Chicago Hospital noted encouraging partial data results. Subsequent reports cautioned against drawing any conclusions emphasizing the incompleteness of the data at present.⁷⁴ However, on April 29, 2020, Dr. Fauci said that a federal trial has shown that treatment with remdesivir can speed recovery in patients infected with the coronavirus.⁷⁵ As a result, the FDA issued an emergency use authorization for the remdesivir on May 1.⁷⁶

A panel convened by the National Institute of Allergy and Infectious Diseases recommends against doctors using a combination of hydroxychloroquine and azithromycin for the treatment of COVID-19 patients because of potential toxicities. The panel further noted that there was "insufficient clinical data to recommend either for or against" the use of hydroxychloroquine or chloroquine alone. It reached the same conclusion about remdesivir.⁷⁷

On other treatment fronts, news came from a panel convened by the National Institute of Allergy and Infectious Diseases. The panel recommends against doctors using a combination of hydroxychloroquine and azithromycin for the treatment of COVID-19 patients because of potential toxicities. The panel further noted that there was "insufficient clinical data to recommend either for or against" the use of hydroxychloroquine or chloroquine alone.⁷⁸

Scientists around the world are continuing to work as fast as possible on developing a potential vaccine with more than 100 efforts currently underway. It was reported on April 23, that for the first time, one of the vaccines in development by a Chinese Biotech firm has protected an animal from COVID-19 infection. The vaccine also produced no side effects in the monkeys who were given it. Researchers cautioned that the number of animals given the vaccine was too small to yield statistically significant results. Human trials for this vaccine began on April 16. The WHO reported that six other vaccines had entered human trials as of April 23. The vast majority of vaccines currently being developed use genetic engineering in their creation.⁷⁹

There has been discussion among experts about a scenario where a vaccine for COVID-19 is never found. This topic is relevant to the current extensive efforts to find a vaccine because there have been well-known viruses that still do not have vaccines. For example, after forty years, there has still not yet been found a vaccine for HIV, or for other coronaviruses such as SARS and MERS. Dr. David Nabarro of Imperial College London notes that it should not be assumed absolutely that a COVID-19 vaccine will appear or meet other requirements for distribution. In such a scenario, there could be a mindset that COVID-19 remains a threat with social life and economic activity needing to adjust accordingly. Measures including physical distancing and restricted onsite work could become frequently imposed. Meanwhile, if a vaccine continues to prove elusive, efforts towards treatment with antivirals would become even more important to help bring some normalcy to those who have contracted the virus.⁸⁰

Much has been reported about antibody testing for COVID-19 and its implications for reopening the economy. Many individuals are hoping to take antibody tests to see if they might avoid social distancing restrictions and other similar measures if they are immune to the virus. Antibody testing is different than diagnostic testing which looks to see whether an active virus is present. In antibody testing, blood samples are used to see if there is evidence of the body's immune response to the virus. At present, there is limited data related to antibodies against COVID-19. Some reports suggest most healthy people start making antibodies 11 to 14 days after symptoms first appear. An outstanding question is what a positive COVID-19 antibody test result means—Is there full immunity or partial

immunity or no immunity to the disease? And, if immunity occurs, how long will it persist? More research is needed to answer these questions and will probably take at least a year of data collection.⁸¹

Another concern is the accuracy of antibody tests currently on the market. In a study reported by the New York Times, only 3 out of 14 antibody tests evaluated by researchers produced accurate results.⁸² Finally, the WHO warned in a scientific brief published on April 25, that there is no evidence yet that people who have had COVID-19 will not get a second infection. The Infectious Diseases Society of America similarly warned that people with antibodies not to change their behavior in any way and to continue social distancing.⁸³

NON-COVID-19 HEALTH CARE

Overall health care cost and utilization in many countries will also be impacted by the decisions that individuals make surrounding other typical illnesses that may arise and elective procedures. Some patients need procedures that may not be able to be deferred indefinitely due to the nature of the illness, such as scheduled chemotherapy treatments. In these cases, hospitals are looking to make sure high-risk patients with compromised immune systems are not exposed to the virus.

Some individuals may be nervous about personal contact in a medical office or a hospital setting where the virus may be present. Consequently, individuals may defer some services, and health care providers may see non-urgent ailments less frequently. In addition, health officials have been strongly encouraging patients to carefully consider use of emergency room services and not to use them for minor health issues.

Telemedicine providers have seen a rise in utilization.⁸⁴ Low utilization of telehealth services in the U.S. prior to COVID-19 have been typically attributed to lower consumer awareness and higher comfort with traditional methods. But since the advent of COVID-19, the use of telemedicine has risen dramatically.⁸⁵ Related to this, insurers should be prepared to see an increase in short-term disability claims as patients recover from the disease and other complications.

MENTAL HEALTH

Mental health concerns and treatments may see an increased demand in the coming weeks as populations deal increasingly more with self-isolation and reduced social interaction.⁸⁶ Mental side effects of the COVID-19 crisis are increasingly looking to be addressed by health professionals and heightened as health resources are diverted to the most immediate concerns. In past national disasters, such as terrorism attacks or large-scale weather catastrophes, the primal human social instinct has been to seek comfort in a larger group—whether it be family, friends, neighbors or co-workers.⁸⁷

However, in the COVID-19 pandemic, isolation is recommended to reduce the spread of the virus. While social media outlets have certainly increased since past national disasters in the U.S., such as 9/11 and Hurricane Katrina, it may not be a full replacement for social interaction or as available and used by older or more remote segments of the population. To give perspective on the stress of isolation and to offer advice on ways to contend with living in confined spaces for long periods of time, the U.S. National Aeronautics and Space Administration (NASA) identified key skills the public can consider. Using insights from NASA astronauts, the agency promoted personal skills

including maintaining a plan and schedule; taking time for creative and fun activities; and finding time, if possible, to get in a daily walk and fresh air.⁸⁸ The SOA has released a report: *Mental Health Trends and COVID-19*.[†]

INFECTION SPREAD RATE

Transmission rates for diseases, and the intensity of an outbreak, are highly dependent on how the pathogen travels between people. Coronaviruses generally can travel up to six feet from an infected person, as they move through respiratory droplets produced through sneezes, coughs or conversations. Some estimates suggest that each person with the new coronavirus could infect between two and four people over the course of the illness without effective containment measures.

The incubation period for COVID-19 is also relatively long compared to other diseases, with estimates running from 2–14 days from the time of exposure to when the individual shows symptoms. With concerns about the spread of the disease and the length of the incubation period, many countries have implemented social distancing policies. The policies vary broadly, including limitations on entering the country and restrictions on movement within a region or country. A report was released on March 16 indicating the potential for infection spread on the virus from a team at Imperial College in London, led by Neil Ferguson. It warned that spread of the disease could cause over 500,000 deaths in the United Kingdom if a more forward government response on reducing population mobility was not taken. The report also noted that up to 2.2 million deaths in the U.S. could occur if there were no risk-mitigating response to the virus.⁸⁹

In early March, the Italian government declared the entire country a “red zone,” meaning people should stay home except for work and emergencies.⁹⁰ By the end of March, more than 100 countries had issued full or partial stay-at-home orders.⁹¹ Action is also specific to regions and communities. As of April 20, all but five U.S. states had issued “stay at home” or “shelter-in-place” orders, although businesses, such as grocery stores, that provide essential services can remain open.⁹² More than one-third of the world’s population had been asked or ordered to stay home to try to dampen the spread of the coronavirus.⁹³ Businesses have taken action for their employees, such as offering or mandating remote work.

The concepts of social distancing and physical distancing have become common vocabulary. It includes personal action as people are encouraged to maintain distance between themselves and others to reduce the spread of the disease, and broader actions such as business closures. Actuarial model simulations can illustrate the impact of social distancing. The SOA has made available a simple example of a social distancing model.[‡] This model simulates the proportion of a population in various states of health across time: healthy, mild illness, severe illness and death, using probabilities from a hypothetical virus. Because this is a simplified model for illustration purposes only, these health states are conceptual and are not explicitly defined.


By comparison to COVID-19, other pathogens more easily travel through the air for longer distances, such as up to 30 meters for tuberculosis, chickenpox and measles. With the SARS coronavirus in 2003, world health authorities were able to eventually track and isolate cases. The result was to bring the average number each sick person infected down to 0.4, suppressing the outbreak.⁹⁴


[†] Hall, R. Dale. (2020, April). *Mental Health Trends and COVID-19*. Society of Actuaries. <https://www.soa.org/resources/research-reports/2020/covid-19-mental-health/>.


[‡] Society of Actuaries. (2020, April 30). *Model of the Impact of Social Distancing on the Transmission Rate of a Communicable Virus*. <https://www.soa.org/resources/research-reports/2020/impact-coronavirus/>.

Among the concerns to life and health insurers is the potential for the virus to spread quickly among older individuals who are highest at risk and living in close proximity to others, such as in senior care facilities and nursing homes. In U.S. senior care facilities alone, the disease has reportedly caused over 2,000 deaths, with some level of illness in over 14,000 individuals at over 2,000 distinct centers.⁹⁵ The CDC has provided guidance to nursing home facilities on practices that are designed to stem the transmission of the virus within care centers and to staff and visitors. The guidance includes restricting all visitation except for certain compassionate care situations, such as end-of-life situations; restricting all volunteers and nonessential health care personnel; stopping all group activities and communal dining; and screening of residents and health care providers for fever and respiratory symptoms.⁹⁶

Secondary health impacts of having coronavirus infection and recovery are beginning to be seen. Early reports on the impact of the disease beyond respiratory illness are being noted, especially in relation to neurological conditions with symptoms such as brain inflammation, hallucinations, seizures, cognitive deficits and loss of smell and taste. Recent studies on recovered Chinese patients have indicated that more than one-third had some form of neurologic symptoms.⁹⁷

 While numbers of cases, deaths, and recoveries have been among the metrics most frequently appearing in news and research about the virus, another metric named R_0 (pronounced “R-naught” and sometimes written as R_0) will likely start to garner more attention. R_0 represents the number of new infections estimated to stem from a single case. For example, if R_0 is 4, then an individual is expected to infect 4 others, on average. When R_0 is above 1, it indicates that the number of cases is growing. On the other hand, values of R_0 less than 1 are associated with a shrinking number of cases.

 R_0 can be difficult to calculate because it may vary significantly by region and can change daily. Yet, although it is an estimate, it may be used during a pandemic as a numerical guide to the type of measures put in place to stem the spread of the outbreak. For perspective on its relative value, initial studies in China during the beginning of the outbreak had estimated R_0 as 5.7 for COVID-19. Studies now estimate it to be somewhere in the range of 2 to 2.5. Countries have been closely watching the progression of their R_0 metrics to gauge whether social distancing practices have been reducing their estimated value, which would be a sign that the outbreak is diminishing. This monitoring will surely continue as decisions are made on phases of opening the economy and allowing increasing opportunities for social gatherings and public events.⁹⁸

 Another aspect of infection spread rate is what is known as “herd immunity.” Herd immunity refers to when a critical mass of infection has occurred in lower-risk populations, which, in turn, ultimately thwarts further transmission. Sweden has adopted a strategy for combatting the virus outbreak that relies in part on the approach of herd immunity and less so, on stringent measures of shutting down businesses and social distancing, like in other countries. Mixed results have been reported using this strategy and it is continuing to be watched closely for lessons that other countries may learn from Sweden’s experience.⁹⁹

The SOA recently published a report providing an overview of population models of epidemics, including the release of an Excel model for exploring the impact of social distancing for downloading.⁵

⁵ Wiese, Patrick. (2020, April). *An Overview of Population Models of Epidemics and A Model of the Impact of Social Distancing on the Spread of a Communicable Virus*. Society of Actuaries. <https://www.soa.org/resources/research-reports/2020/2020-overview-population-models/>.

Economic and Asset Impact

MACROECONOMIC VARIABLES



With COVID-19 impacting business around the world, financial markets and governments have reacted to reflect lower levels of economic activity. Countries have imposed restrictions on travel and trade to slow the spread of the virus as well as retain critical supplies.

MONETARY AND FISCAL POLICY



While China implemented measures starting in February 2020, March 3 marked the initial U.S. Federal Reserve actions that led quickly to a rate to nearly 0%.¹⁰⁰ Soon after the Bank of England, Bank of Japan and European Central Bank loosened monetary policies.¹⁰¹ This supported liquidity and stabilized the banking system.

Central banks around the world have continued to use monetary policy levers to help stimulate economic activity. The Federal Reserve rolled out an array of programs to make loans available to companies and governments, so they can cover current expenses and potentially avoid laying off employees. It committed to buy as much government debt and mortgage-backed securities as deemed necessary to ensure functioning liquidity in these markets and ensure cash is available to the financial system.¹⁰² Many of these programs bring back those used during the Great Financial Crisis, but some go further. The Treasury now manages entities called Special Purpose Vehicles (SPV) that are allowed to own assets the Federal Reserve can't such as corporate bonds, both investment grade and some noninvestment grade, asset backed securities and municipal bonds. This provides liquidity for many asset classes utilized by insurers and pension funds.

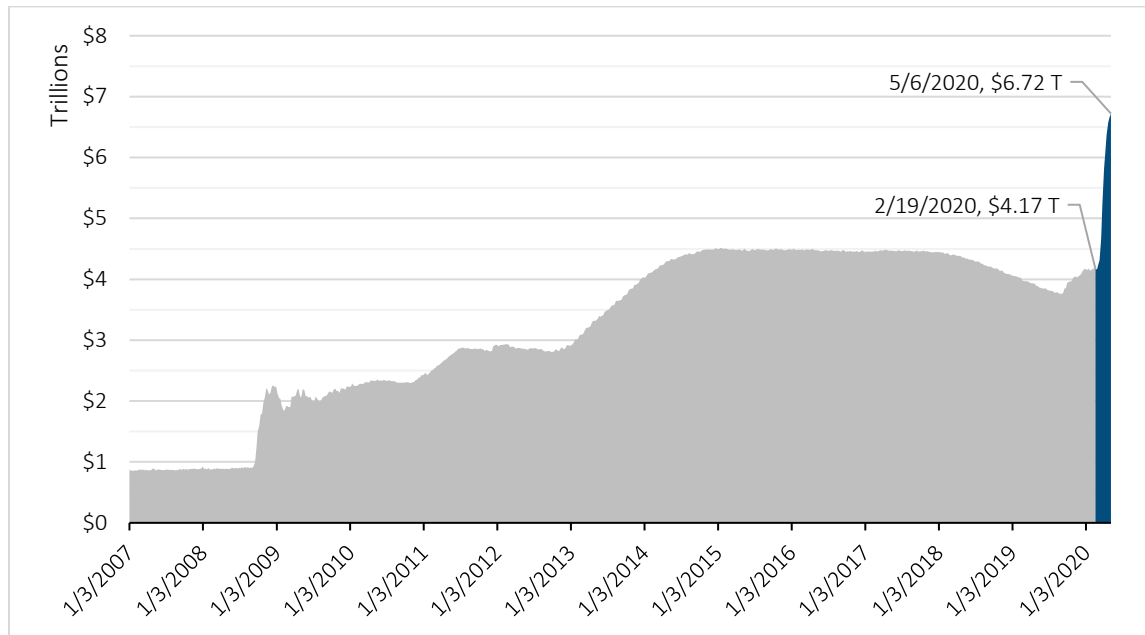
The Federal Reserve is buying corporate bonds, including fallen angels that started off as investment grade but later downgraded to junk, for the first time in its history.¹⁰³ On May 12, 2020, the Federal Reserve Bank of New York implemented the first stage of its corporate bond buying program when it bought exchange traded funds (ETFs).¹⁰⁴ Similar programs have been implemented by central banks in other countries.



While these monetary policy changes help to offset the impact of low economic activity resulting from COVID-19, they come at a cost. Figure 26 looks at the U.S. Federal Reserve Bank total assets less eliminations from consolidation: Wednesday level (WALCL) from 2007 to present. By May 6, 2020, the Fed's balance sheet had increased to \$6.72 trillion. Also notable to compare is how the history of Fed assets has changed over time relative to previous eras, such as the Financial Crisis of 2007–2008, which saw high default rates in the U.S. subprime home mortgage sector.



Figure 26
FEDERAL RESERVE BANK TOTAL ASSETS AND LIABILITIES (USD)

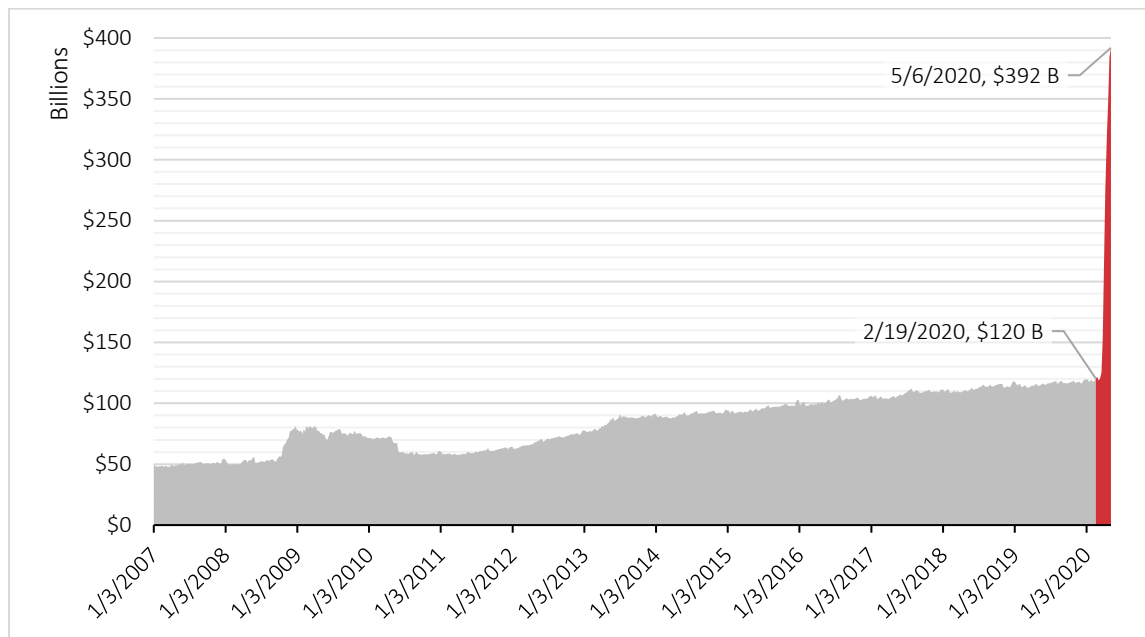


Data source: FRED Economic Data, Federal Reserve of St. Louis

The Bank of Canada balance sheet (Figure 27) also spiked from \$120 billion CAD on February 19, 2020, to \$392 billion CAD on May 6, 2020.¹⁰⁵



Figure 27
BANK OF CANADA ASSETS AND LIABILITIES (CAD)



Data source: Bank of Canada

Legislative branches of many countries are developing ways to use fiscal policy to maintain economic activity amid the COVID-19 pandemic. On March 27, the U.S. adopted and signed into law the Coronavirus Aid, Relief, and Economic Security (CARES) Act, the third coronavirus stimulus package in the U.S. since March 3, and the largest stimulus package in U.S. history.¹⁰⁶

The CARES Act aims to inject \$2 trillion into the economy, which equates to approximately 10% of gross domestic product (GDP), with benefits and programs from the wide-reaching provisions available to individuals, small businesses, large corporations, hospitals and public health organizations, state and local governments, and education institutions, including:

- Direct payments to households, depending on income and family size, with payments being shaped as an advance on a tax credit that is available for the entire year of 2020.
- Expanded unemployment benefits with primary focus on those who are unable to work from home.
- Paycheck Protection Program, which provides small businesses and nonprofit organizations an option to receive federal government loans with the opportunity to have the portions of the loans used to cover payroll costs, interest on mortgage obligations, rent and utilities to be forgiven.¹⁰⁷
- Temporarily easing access to and removing required minimum distributions from retirement plan accounts like a 401(k) or IRA.¹⁰⁸



On April 24, the U.S. enacted a \$484 billion stimulus package that provides aid to small business and the health care system, including a second round of the Paycheck Protection Program.¹⁰⁹ As of May 14, 2020, another potential and significant stimulus package is being hotly debated in Washington, D.C.¹¹⁰

Mortgage lenders are also keeping an eye on the stimulus package and other economic programs to track any potential increase in mortgage defaults. Commercial defaults on retail, lodging and office properties may be under higher levels of concern due to slowdown in economic activity. Both residential and commercial mortgages are often combined into mortgage-backed investment securities that the actuarial profession models, and assumptions for defaults can be reviewed and updated as information develops.

EMPLOYMENT

COVID-19 has heavily influenced employment in key economic markets around the world. With travel restrictions anticipated to be in place for extended periods of time and less of an ability to convert work or services to a remote work basis, the transportation, travel planning, and leisure and hospitality labor sectors are expected to be among the industries highest at risk for reduced work or unemployment. Conversely, industries allowed to stay open and operate, even in shelter-in-place scenarios, such as pharmacies and grocery markets, are hiring at a rapid pace to meet the demand created.

In the U.S., persons who lose their jobs may also lose their health insurance simultaneously, although some employers have furloughed their employees to allow continued coverage. Some firms have announced halts to their stock buy-back programs and are contemplating cuts to 401(k) matching contributions and dividend payments.

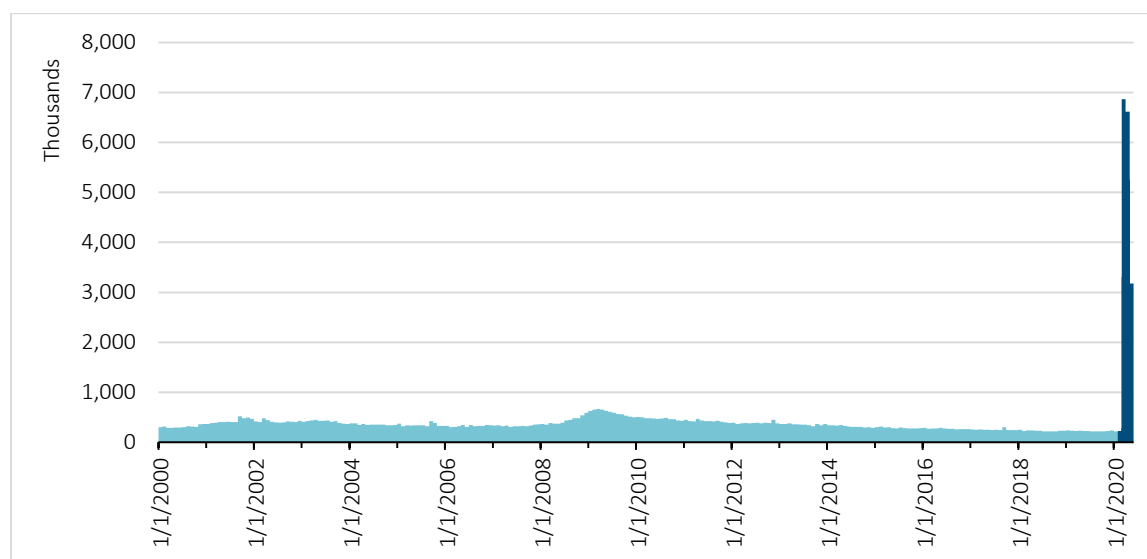
Among the most dramatic and indicative economic reports received in many years were the recent series of U.S. Department of Labor's (DOL) Unemployment Insurance Weekly Claims reports (Figure 28). The report released on March 26, 2020, announced a record-setting 3.3 million initial claims for unemployment during the week ending March 21. In contrast, in early March, before closures of businesses swept across vast swaths of the U.S., the number stood at 211,000 initial claims, close to a half-century low.

Weekly claims reports from March 26 through May 14 each reported millions of initial claims, for a total of about 36.5 million initial claims from March 14, 2020, through May 2.¹¹¹ In contrast, in early March, before closures of businesses swept across vast swaths of the U.S., the number stood at 211,000 initial claims, close to a half-century low.

On May 8, the DOL reported the U.S. unemployment rate had more than tripled from 4.4% for March to 14.7% for April, with all major industry sectors affected, especially the leisure and hospitality industry.¹¹² Some economists believe that a 14.7% unemployment rate is too low because of an incorrect classification in April of some individuals by the Bureau of Labor and Statistics, and correcting for the error would result in an unemployment rate near 20%.¹¹³ On May 13, Federal Reserve Chairman Jerome Powell noted that early data reveal that unemployment and the economic downturn have hurt the households least likely to bear it. He referred to a Fed survey showing that nearly 40% of the households that in February were making less than \$40,000 per year had lost a job in March.¹¹⁴

Figure 28

WEEKLY INITIAL UNEMPLOYMENT CLAIMS, SEASONALLY ADJUSTED, THROUGH MAY 2, 2020



Data source: U.S. Department of Labor

The employment situation in Canada is similar. It has been reported that from March 16–March 30, a total of 2.13 million Canadians applied for Employment Insurance claims, about 11% of Canada’s labor force.¹¹⁵ Statistics Canada reports a national unemployment rate of 13.0% for April 2020, compared to 7.8% for March 2020 and 5.7% for April 2019.¹¹⁶

Some publicly-traded companies have laid off or furloughed workers while distributing cash dividends to shareholders.¹¹⁷ Many other companies have cut pay or suspended 401(k) matching contributions to keep their companies afloat. Pay cuts have often included or even started with executives.¹¹⁸ For example, in early April, Rockwell Automation, Inc. announced suspension of 401(k) matching contributions and a 25% salary cut for their CEO, 15% salary cuts for senior vice presidents, 7.5% pay cuts for non-manufacturing employees and 50% reduction in cash fees for the board of directors.¹¹⁹ Aon announced on April 27, 2020, that worldwide, their executives would take a 50% salary reduction while 70% of their employees would take a 20% salary cut. In addition, the company would suspend its stock repurchase program.¹²⁰ According to a Willis Towers Watson pulse survey during the week of April 20, 12% of surveyed companies had suspended matching contributions and another 23% were planning or considering doing so.¹²¹

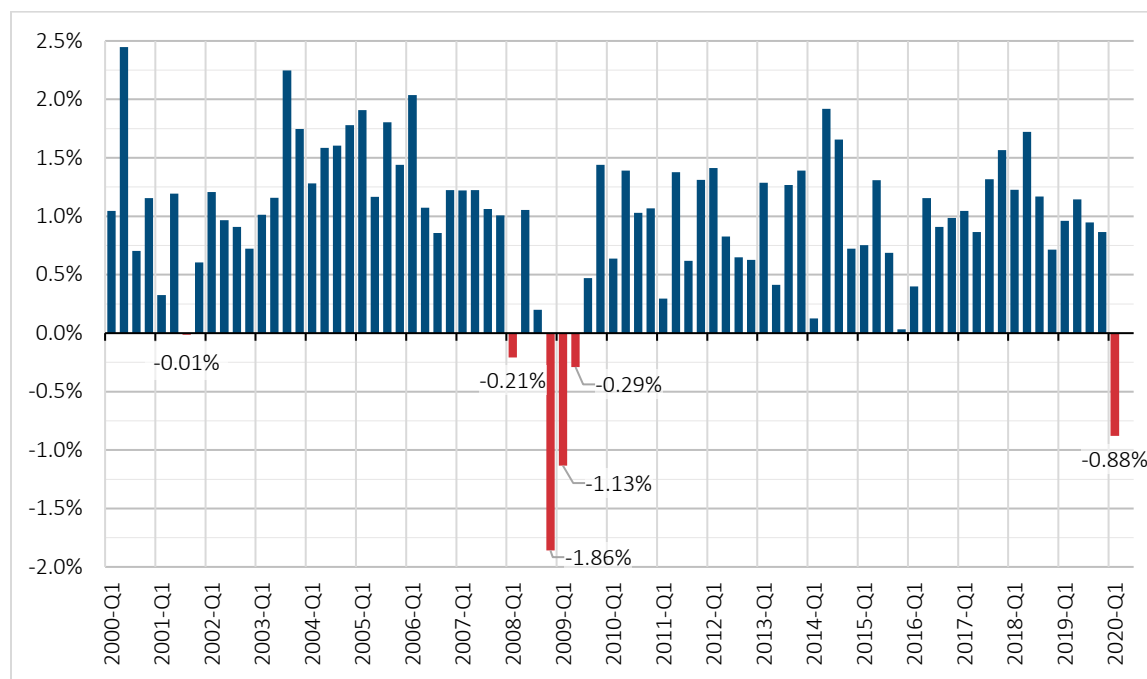
GROSS DOMESTIC PRODUCT

Reductions in growth estimates of GDP for high-GDP countries have been made over the past weeks from many sources with nearly daily changes in the expectation and timing. Updated estimates depend heavily on monetary policy moves and legislative approvals. Most consistently, economists generally expected large downturns in second quarter 2020 GDP, with early impacted markets like China having growth rebound in the near term.¹²² Early indicators such as traffic patterns and shipping data within some early onset COVID-19 Asia-Pacific markets show signs of potential. The shape of a recovery will determine the tools used to effectively counter it, whether it be a fast-rebound V, slower rebound U or worst-case depression L.¹²³

On March 23, International Monetary Fund (IMF) Managing Director Kristalina Georgieva made the following statement, “... the outlook for global growth for 2020 is negative—a recession at least as bad as during the Global Financial Crisis or worse. But we expect recovery in 2021.”¹²⁴ On April 14, the IMF followed up its signature World Economic Outlook report with new updated estimates of world growth and began to use the phrase “Great Lockdown” to denote the current environment as compared to past economic events such as the “Great Depression.” Updated estimates projected global GDP growth to fall to -3% in 2020, rebounding to 5.8% growth in 2021. The 2021 projection presumes the current pandemic recedes through 2020 and that government actions worldwide can prevent widespread corporate bankruptcies, extended unemployment, and economic strain.¹²⁵

In the U.S., the Bureau of Economic Analysis reported on April 29, 2020, that first quarter 2020 GDP decreased by 0.88% from the previous quarter—an annual rate of -4.8%.¹²⁶ The National Bureau of Economic Research released a working paper in April 2020 that projects real GDP to fall by nearly 11% during 2020 (Figure 29).¹²⁷

Figure 29
QUARTERLY CHANGES IN U.S. GDP, 2000–PRESENT



Data source: Bureau of Economic Analysis

During the first quarter of 2020, finance and business news was the fastest-growing area of online news and information during the coronavirus era, according to data from SimilarWeb. Compared to the first quarter of 2019,

finance and business news grew 42%, outpacing politics, which had grown 24%. Sports, on the other hand, lost significant traffic.¹²⁸

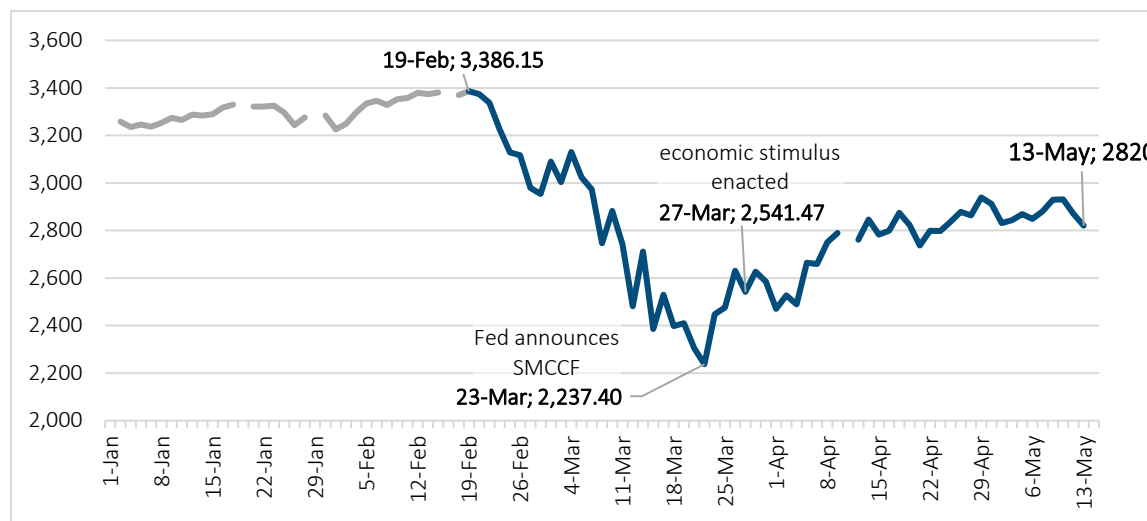
ASSET VALUES AND VOLATILITY

International financial markets have reacted to COVID-19 as some investors sought increasing shelter in government bonds amid uncertain future economic activity arising from the impact of COVID-19.

U.S. markets have been volatile since February 19, 2020, the date generally recognized as the start of COVID-19 impact on U.S. financial markets. Figure 30 tracks the S&P 500 since February 3, 2020.¹²⁹ By March 13, when the U.S. declared the COVID-19 outbreak a national emergency, the S&P 500 was down 20% from February 19. On March 23, the Fed announced the establishment of the Secondary Market Corporate Credit Facility (SMCCF), which would purchase corporate bonds of U.S. companies that were investment grade as of March 22.¹³⁰ The S&P 500 cratered on March 23, 34% below its February 19 level, and began to rise on March 24. By May 13, the S&P 500 had regained some of what it had lost, ending 16.7% below its February 19 level.



Figure 30
S&P 500 DURING 2020



Data source: Federal Reserve Bank of St. Louis

An additional item of note is the length and magnitude of past economic financial market downturns. Using the U.S. S&P 500 as a barometer, some notable downturns in equity markets have occurred over time. Table 3 notes occurrences in the past 100 years where a decrease in the index has eventually reached over 40%, the amount of time it has taken from its starting high point to final low point and how the index performed for the 12 months after completion of the downturn. Historically, many of the most severe financial downturns have been more prolonged events, with large declines occurring over at least a one- to two-year period, though notably having some strong declines over a one-month period.



Table 3
HISTORICAL 40% DROPS IN S&P 500 INDEX

Start	Finish	Duration (months)	Decrease in S&P 500 Index over 1 month	Decrease in S&P 500 Index over Full Duration	1-Year Index Return after Finish
Sep 3, 1929	Jul 8, 1932	34	-20%	-86%	124%
Mar 10, 1937	Apr 28, 1942	61	-9%	-60%	59%
Oct 9, 2007	Mar 9, 2009	17	-2%	-59%	68%
Mar 24, 2000	Oct 9, 2002	31	-3%	-49%	34%
Jan 11, 1973	Oct 3, 1974	21	-41%	-48%	38%
Feb 19, 2020	May 13, 2020	3	-34%	-16.7%	TBD

One of the most unique asset value occasions triggered by COVID-19 economic activity is that of crude oil futures. Prior to the pandemic, oil supply was accelerating while OPEC members negotiated limits.¹³¹ Once the pandemic started to impact economic activity, the timing of this surge in production proved unfortunate. The pandemic strongly reduced oil demand around the world, with estimates up to a 30% reduction, with supply from oil producers maintained at high levels. Spot oil prices for West Texas Intermediate (WTI) oil dropped. WTI is the main benchmark for US crude oil and its price is heavily followed in the U.S. Internationally, Brent crude oil is a common standard that is followed. Hardest hit among these oil types and financial contracts was WTI purchased on the futures markets. The futures contracts for WTI the month of May expired on Tuesday April 21, and physical settlement of the contract requires taking delivery of the oil at storage facilities in Cushing, OK. Cushing is a landlocked city in central Oklahoma, and the facility is composed of 15 storage terminals, several with major pipeline manifolds. Often, traders will counter and offset a futures trade in the open market, and avoid the requirement for physical settlement, but with the prices and risks coming into play, some futures traders were not finding other investors with storage capacity to take the other side of their purchase. On Monday, April 20, traders who were not equipped to take physical deliveries began rushing to sell their futures contracts to buyers who have booked storage in Cushing. People who owned the contracts for WTI were paying buyers to take their oil, sending the price into negative territory leading up to the expiry of the futures contracts.¹³²

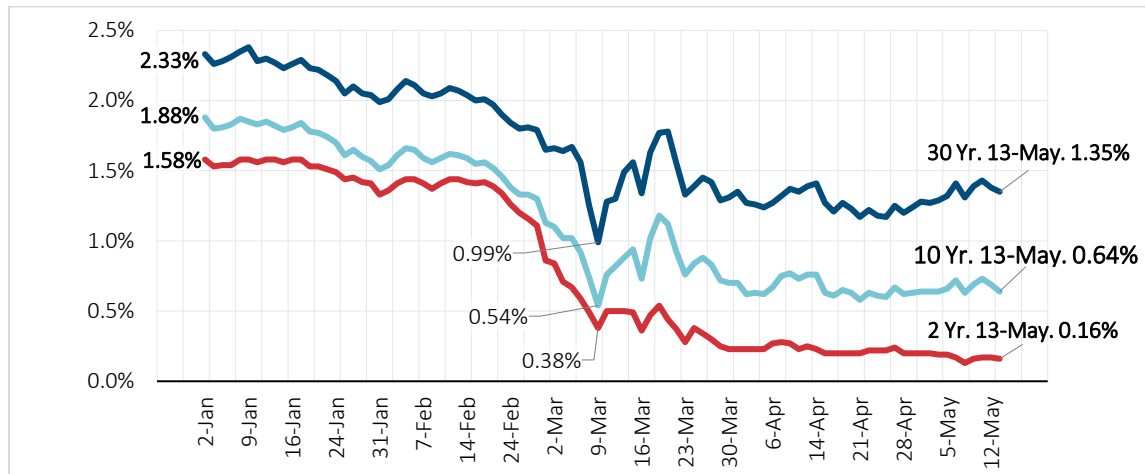
LOW INTEREST RATE ENVIRONMENT

Low interest rates for investment in major international financial markets have been more the norm over recent years, and the impact of COVID-19 has further driven down interest rate levels. In early March, benchmark Treasury yields in the U.S. fell nearly 100 basis points from February 19 levels (Figure 31).¹³³ The benchmark 10-year Treasury yield temporarily reached a record low of under 0.40% and the 30-year Treasury moved below 1.00% for the first time ever.¹³⁴ Some reversion has occurred from the lowest interest rate levels. As of May 13, 2020, Treasury rates at the long end of the curve were down approximately 70–90 basis points (bps) from their February 19, 2020 levels.





Figure 31
SELECTED U.S. DAILY TREASURY CURVE RATES DURING 2020



Data source: U.S. Department of the Treasury

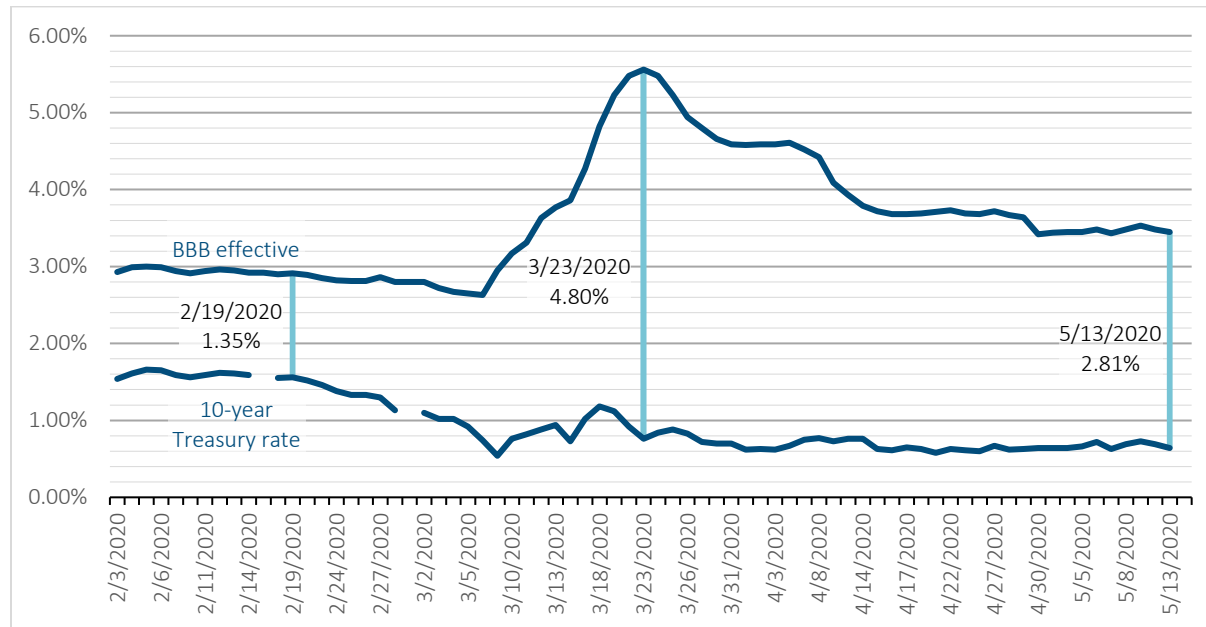
REINVESTMENT AND DEFAULT RISK

Corporate spreads, while initially stable through early March 2020, have widened substantially during March (Figure 32) At their highest point in March, credit spreads were still below those seen in the financial crisis of 2008–2009, but higher than those seen in other economic environments such as the tech bubble and Enron/MCI WorldCom accounting crises of 2002.¹³⁵ Credit spreads widen due to anticipated higher risk of defaults and an increasing probability of some bonds being downgraded to be below investment grade. The ratio of upgrades to downgrades had started to fall prior to COVID-19, and COVID-19 has accelerated the downfall.

While credit spreads have narrowed some during April and May, they continue to be significantly greater than they were on February 19, 2020.



Figure 32
U.S. CORPORATE BBB EFFECTIVE YIELD COMPARED TO 10-YEAR TREASURY RATES



Data source: Federal Reserve Bank of St. Louis and U.S. Department of the Treasury



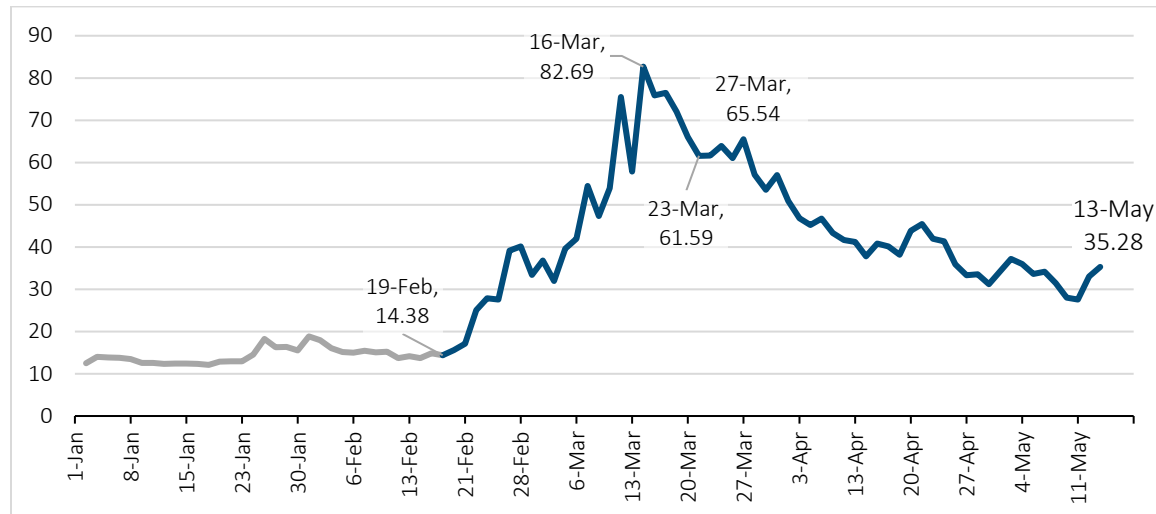
As economic pressures have increased, quality levels and the risks of default will continue to be monitored in both publicly traded and private placement investments. Higher debt levels from consumers, changes in consumer confidence and reduced levels of disposable income have been benchmarks historically indicative of companies having cash flow issues and potentially defaulting on debt payments. Retailers appear to be among the first wave of companies reporting issues, with J. Crew declaring bankruptcy and other companies noting stress due to financial debt loads. Travel and entertainment related industries are noted to be under similar financial pressures, with Avianca, one of Latin America's largest airlines, filing for bankruptcy on May 11.



The Chicago Board Options Exchange created the Cboe Volatility Index, or VIX, to measure the level of the expected volatility in the market for the next 30 days (Figure 33). Greater VIX values indicate expectations of greater volatility.¹³⁶ The VIX reached its highest point during 2020 on March 16. Effective on March 16 at 5 p.m. local time, 7 counties in California began stay-at-home orders.¹³⁷ On March 19, California became the first state to issue statewide stay-at-home orders, followed by Illinois and New York state on March 20.¹³⁸ As of closing on May 13, the VIX was still significantly higher than it was prior to February 19, 2020.



Figure 33
CBOE VOLATILITY INDEX (VIX) DURING 2020



Data source: Cboe

The current interest rate environment enhances the strong need for life insurers to be aware of these evolving risks, including the interactions between interest rates, credit spreads and defaults to construct products that emphasize risk management practices through financial modeling of the company's assets and liabilities. Life and health insurers typically use cash flow testing methods to perform regulatory asset adequacy analysis, as well as for internal risk management practices. Strong scenario testing within insurance companies includes the ability for actuaries to identify key assumptions for asset modeling, as well as to be able to model assets and liabilities with contingent cash flows and risks. Strategies to mitigate these risks may also involve the use of interest rate forwards, futures and swaps.

In a recent survey on cash flow testing completed by the SOA, the Life Insurance Marketing and Research Association (LIMRA), Oliver Wyman and the American Council of Life Insurers (ACLI), life insurance companies were asked if they have updated various stochastic modeling assumptions.¹³⁹ More than half of respondents have updated or are considering updating their mean reversion target and credit spreads.

When asked whether they are modeling negative interest rates, almost all said "no." In addition, most respondents replied that they assume a mean reversion point between 3% and 4% in their stochastic models. When asked about the widened credit spreads in the current market, most replied that they will assume spreads will narrow over time. Also, two-thirds of respondents consider the current environmental implied level scenario worse than moderately adverse. These responses are intriguing since the regulatory scenarios don't require negative rates, so companies may be creating their own scenario sets to manage their interest-sensitive business.

Impact on Insurance Industry

IMPACT ON LIFE INSURANCE COMPANIES

The individual life application process has seen some changes due to COVID-19. In a recent survey conducted by LIMRA (LIMRA Survey), about one-third of life insurance companies are seeing a decrease in the number of applications, and 24% have seen an increase in online/mobile applications.¹⁴⁰

The manual underwriting process for life insurers has also been disrupted because of the difficulty to obtain paramedical exams and lab reports in the current environment. Many companies are accepting previous insurance lab exams done in the past 24 months. In a joint survey completed by the SOA, the Life Insurance Marketing and Research Association (LIMRA), Oliver Wyman and the American Council of Life Insurers (ACLI) on new business and product processes,**¹⁴¹ (Joint NB Survey), two-thirds of respondents have changed their underwriting process to address the lack of access to underwriting results. Of those who have changed, about two-thirds are using attending physician statements in place of fluid requirements, two-thirds are increasing automated/accelerated underwriting limits, and about one-half are using phone screenings or FaceTime screenings.

Several carriers have added screenings for COVID-19 on their applications, adding questions on travel history and close contact with known COVID-19 persons.¹⁴² Over half of respondents have restricted life and health products for recent travel to specific countries and about half have restricted life and health products for high risk age groups. The restrictions may include limiting high issue ages, limiting the use of rated tables and either not accepting or postponing decisions on older issue ages. Companies are also requiring a signed Statement of Health upon policy delivery.



Insurers are making changes to their pricing assumptions. Per the Joint NB Survey, most respondents have increased focus towards tail scenarios or sensitivities in their pricing. About one-third have updated their long-term rate assumptions and two-thirds of those have reduced their ultimate rate. There has been little to no change of hedging new business economics. About one-third have adjusted their options budget. About two-thirds are partially or fully passing widening credit spreads through to pricing. Almost all respondents use a long-term credit default assumption versus a current credit default assumption. Of those who use a long-term assumption, 30% are considering updates to it and 17% have already updated it. About half of respondents have adjusted non-guaranteed elements and about 30% have adjusted guarantees.

Insurers are also making changes to their operational leniency. Some state regulators have requested insurers extend the grace period on premium payments, a common practice used for disaster reliefs after hurricanes.¹⁴³ For example, California has requested that all insurance companies provide a minimum 60-day grace period for a policyholder to pay premiums before the policy is cancelled for the nonpayment of premium.¹⁴⁴ New York now requires a 90 day grace period for the payment of premiums and fees.¹⁴⁵ Per the LIMRA Survey, 77% of companies are extending grace periods.



As interest rates have dropped because of COVID-19, some life insurers have temporarily stopped selling life insurance policies to people who are age 70 and older and who are in poor health. Some insurers have also temporarily suspended sales of 30-year term life policies.¹⁴⁶



Given the impact of COVID-19 on the economy and asset markets, life insurers are reviewing their asset/liability management (ALM) practices. A joint survey completed by the SOA, the Life Insurance Marketing and Research Association (LIMRA), Oliver Wyman and the American Council of Life Insurers (ACLI) on ALM^{††,147} (Joint ALM Survey) shows that life insurers are most concerned about low interest rate on ALM and how they will impact business margins, Statutory earnings, and new business sales. More than half of the respondents have changed or are

** Campion, Scott, et al. (2020, April 29). *COVID-19 New Business and Product Survey Summary of Results*. Society of Actuaries. <https://www.soa.org/resources/research-reports/2020/covid-19-pulse-surveys/>

†† Campion, Scott, et al. (2020, May 8). *COVID-19 Asset/Liability Management Survey Summary of Results*. Society of Actuaries. <https://www.soa.org/resources/research-reports/2020/covid-19-pulse-surveys/>

planning to change their investment strategy. Also, about one-third of companies are modeling a negative 10-year treasury rate in their ALM scenarios.

Life insurance actuaries will want to revisit the mortality patterns that could unfortunately evolve through increased depression and anxiety, accompanied by an increasing potential for new suicide claims. The SOA has produced an overview of mental health insurance trends in a separate brief: *Mental Health Trends and COVID-19*.^{††}

It is yet to be seen how much insured death claims will increase due to COVID-19. However, actuaries involved in cash flow testing need to address these assumptions in their models. In a recent survey on cash flow testing^{§§,148} completed by the SOA, the Life Insurance Marketing and Research Association (LIMRA), Oliver Wyman and the American Council of Life Insurers (ACLI), life insurance companies were asked if they have updated various assumptions used in their modeling. About half of respondents indicated they already have or are considering updating their mortality assumptions. Also, two-thirds of respondents consider the current environmental implied level scenario worse than moderately adverse. In addition, given the impact the pandemic has had on the economy, unemployment, and the limited availability of health care for non-COVID-19 related illnesses, the potential for changes in non-COVID-19 causes of death will be an area to monitor.

IMPACT ON HEALTH INSURANCE COMPANIES

Individual and group health coverages in the United States typically follow a calendar year cycle, with new and renewed coverages becoming effective on January 1. Rates are generally filed with state insurance departments for consideration in the months of May and June, with discussions and adjustments on the rate filings through July and August. Most states use a “prior approval” approach to health insurance rate filings, where carriers cannot use a rate until it is approved by the state’s health insurance regulator or, if the state takes no action for a certain period of time the rate is “deemed approved.” Deemer timelines usually run at either 30 or 60 days in most states.

The upcoming rating cycle for calendar year 2021 will be unique in that projected total claims costs for 2021 will be more challenging to predict given the various versions of “shelter in place” scenarios in most states that will continue to change in the coming months, as well as the impact of testing and treatment for COVID-19. The months of March and April 2020 saw dramatic changes in the level of health care services in the United States. Testing and treatment for the disease have taken a main priority for many local health care systems. With most states having issued shelter-in-place or stay-at-home orders to their local populations, the result has been a greatly reduced number of normally occurring health care visits to physician’s offices, outpatient procedures and visits, as well as limiting or even restricting inpatient medical and surgical services. In addition, new services have evolved to have higher utilization such as those for mental health and physician services offered through telemedicine. When and how local authorities loosen restrictions will define how health care services change over the remaining months of 2020 and into 2021, how the potential pent up demand for deferred services works its way through health care systems and the types of new services that might be demanded in 2021.

The combination of these events compounds the issues of how health care insurers will file rates for approval with state departments of insurance beginning in late spring and early summer of 2020. Actuaries at insurers will aim to project forward estimates of health care costs with some uncertainty about the level of impact COVID-19 might be having on a specific state and try to assess the range of scenarios that might evolve over time. Each scenario may

^{††} Hall, R. Dale. (2020, April). *Mental Health Trends and COVID-19*. Society of Actuaries. <https://www.soa.org/resources/research-reports/2020/covid-19-mental-health/>.

^{§§} Campion, Scott, et al. (2020, April 23). *COVID-19 Low Interest Rate Environment Cash Flow Testing Survey Summary of Results*. Society of Actuaries <https://www.soa.org/resources/research-reports/2020/covid-19-pulse-surveys/>

have a different impact of the way health care cost estimates will evolve. In addition, new services may come into play in 2021, such as vaccinations for COVID-19 and potential increased wellness offerings for employers who have employees returning to an office or production environment. These health care cost ranges will form the backbone for state rate filings. State regulators also will be looking to do a similar analysis and review the rating work of the insurer's actuaries to ensure that rates to be approved are reasonable.

On March 24, Covered California, an independent part of the California state government whose job is to make the health insurance marketplace work for California's consumers, released a national projection of health care costs due to COVID-19.¹⁴⁹ Estimated one-year projected costs related to treatment and care of COVID-19 in the U.S. commercial health insurance market, which covers a population of approximately 170 million people, ranges from a low of \$34 billion to \$251 billion or more. As a percent of commercial health premium, these costs could range from about 2% to over 21% of premiums. Covered California also estimated that 2021 premium increases could range from 4% to 40% if carriers look to recoup 2020 costs, price for the same level of costs for the 2021 calendar year and look to protect their solvency.

Insurance premiums filed and approved for calendar year 2021 will depend on actuarial analysis and their insurance companies' forecasts for claim activity in 2021, as well as the level of certainty in the forecast. Current year results for 2020 could show that margins for unexpected fluctuation were too small if COVID-19 causes excessive claim costs and are not mitigated fully by reductions in other health care services. In the U.S., state insurance departments generally do not allow companies to build prior-year losses into future premium rates. Premium rates may be higher in 2021 due to higher uncertainty as to whether there will be a rebound of COVID-19 claims costs as predicted by some epidemiologists. Additionally, some insurers could project higher overall claim costs in 2021 due to pent-up demand for services in 2020 that had to be postponed.

At the April 23, 2020, meeting of the Health Actuarial Task Force of the National Association of Insurance Commissioners, in which the SOA participated, several presentations were given by actuarial organizations, health insurance trade industry groups and consumer advocate organizations. Among the topics mentioned as additional risks to health insurance rating in the U.S. as companies transition from 2020 into 2021 were the following items:

- 2020 health insurance claims, across a variety of health insurance lines of business, were noticeably lower than for similar timeframes in recent years due to the large amount of deferred services being seen. Ranges noted were up to 30% lower through April, across a wide variety of health care services, and there was some consistency across a variety of states and geographies.
- Emergency room claim costs were similarly down 30%, with insurers and health care systems contemplating what the future utilization of these services may be. Some groups postulate that there may be some "stickiness" to this trend with many individuals knowing that they may be able to contend with new illnesses or health situations without using emergency room services.
- The pool of insured lives for 2021 may be noticeably different among the typical places where health care insurance is provided. With the economic situation of COVID-19 still evolving and increasing unemployment, individuals may be quickly moving from insured plans to individual coverages or Medicaid coverage, or potentially moving more to be uninsured in 2021. Employers, especially those with small group coverages, may be more selective about when and where they terminate health care coverage, knowing that some employees or their families may have a condition that is dependent upon insurance plans assisting to cover treatments or services. This may lead to anti-selection of these coverages rolling into the 2021 plan year. Key assumptions for 2021 ratemaking will be how membership population in insurance programs will change, and the resulting change in morbidity levels that result.

- Insureds may have varying incentives to utilize services as calendar year 2020 flips to 2021. The use of deductibles during the early parts of 2020 may create a range of incentives. Some may desire the utilization of deferred health care services in 2020 before the deductible resets on January 1, 2021, while others may look to push utilization of healthcare into a fresh start of a health care plan in the next calendar year.

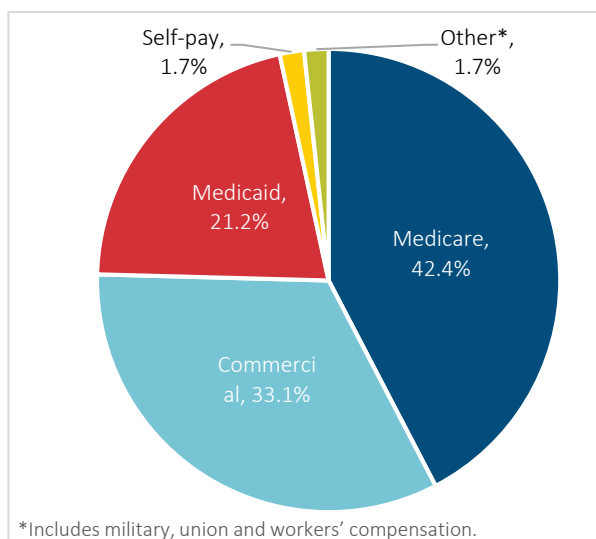


An additional consideration for how health care insurers will be impacted (both currently and in 2021) is the blurring of how workers' compensation claims will integrate with employer sponsored health care insurance plans, and which insurance coverage will bear the responsibility for a COVID-19 claim. With businesses reopening despite the ongoing pandemic, some workers comp insurers and state-run insurance systems fear large increases in claims. With the identification of where a COVID-19 illness was contracted being difficult to determine, and the potential for a large run on many cases becoming a risk, health insurers may need to plan for a variety of claim scenarios as 2020 runs its course and as they think about rating systems for 2021.

Health insurers are preparing for the potential to see an increase in the use of mental health benefits in health care insurance systems. With governments around the world issuing "stay at home" orders and workers transitioning to a work-from-home environment, individuals may quickly begin to feel a higher degree of social isolation. In addition, as many businesses have closed or slowed production, unemployment rates have skyrocketed. As a result, many households may perceive less income security and a more uncertain financial future. These items combine to raise a new awareness of mental health within the work of the actuarial profession and in a much different world situation than has been previously considered. Health actuaries will be increasingly interested in the utilization of mental health benefits in their insured population through the coming months.

Health insurers will also be interested in the type of health insurance, if any, covering COVID-19 patients. Figure 34 shows the types of coverage for recently hospitalized COVID-19 patients in the New York City area. The highest proportion of patients, about 42%, were covered by Medicare, which is expected given the high proportion of older COVID-19 patients who are hospitalized. Roughly one-third of the patients were covered by commercial insurance and approximately 21% of patients were covered by Medicaid.¹⁵⁰

Figure 34
HEALTH INSURANCE TYPE OF RECENTLY HOSPITALIZED COVID-19 PATIENTS IN THE NEW YORK CITY AREA



Data source: Safiya Richardson et al.

IMPACT ON PROPERTY/CASUALTY COVERAGES

In addition to the impact on life and health insurance coverages, the coronavirus and COVID-19 impact business interruption, workers' compensation, and personal and commercial auto insurance coverages.

BUSINESS INTERRUPTION INSURANCE

With the large amount of reduced or stopped economic activity occurring in most major international markets, business interruption insurance coverages are getting prominent attention among insurers and their customers, Congress, the insurance regulatory community and insurance trade organizations. Business interruption insurance generally compensates the insured for the financial loss of a business being unable to operate, as well as physical loss to property. Contingent business interruption insurance policies additionally protect the insured against supply chain disruptions but often may require that property damage has occurred.

In many cases, business interruption insurance is provided as part of a property insurance policy. Since the SARS outbreak of 2002-2003, insurers have generally added specific exclusions for bacterial or viral outbreaks to business interruption coverages, while maintaining the focus on events that may not prompt large amounts of coincident claims from a diversified book of business. These events mainly involve property damage from events such as fire, terrorism and natural catastrophes. In these cases, the policyholder typically must incur a physical loss on a covered property to trigger the business insurance coverage. Contingent business interruption insurance policies protect against losses from supply chain disruptions but may require the occurrence of the typical property damage to trigger coverage. On March 16, a lawsuit in the district court of New Orleans was filed to seek a declaratory judgment for a restaurant policyholder about whether the business income coverage in a Lloyd's of London property policy would cover a government-mandated shutdown.¹⁵¹

CANCELLATION INSURANCE

Cancellation insurance provides coverage for expenses arising from delays, rescheduling or cancellations due to unforeseen covered events. Current circumstances, however, are likely unprecedented. Policies may contain civil authority provisions, which may provide coverage for losses suffered in connection with a governmental order prohibiting access to a covered location. Issues of what constitutes physical damage or loss will likely arise. Driven by legislators, some states are looking to draft bills that will cause insurers to provide coverage for these types of losses. Typically, these updated rules or proclamations specifically cite property damage from COVID-19 as part of the basis for prompting the shutdown of local business.

WORKERS' COMPENSATION

Workers' compensation in all states covers medical expenses, lost income and survivor benefits for disease that is the result of occupation. Usually viruses are not considered an occupational disease. While it ultimately will be subject to determination by the Workers' compensation Boards of each state, it appears that COVID-19 will generally be deemed an occupational disease for workers who are likely to have caught the disease as the result of their work, such as grocery and health care workers. Additional uncertainty will be how the medical coverage for diagnosis, treatment and replacement of lost income will integrate with employer-sponsored health insurance programs. Health insurers may need to investigate how each individual caught the disease in order to pass cost of the occupational disease component on to workers' compensation insurers. Depending on the ultimate number of fatalities of infected workers, survivor benefits could be a significant impact to the workers' compensation industry. Workers' compensation systems that receive and process claims often don't have the resources to handle large surges of claims that health insurers or employers may end up contesting, and that could become more the case with potentially large counts of COVID-19 claims.

In addition to the impact on losses, there is also an impact on premiums due to the economic shutdown. Workers' compensation insurance premiums are generally based on estimated payroll of the employer at the start of the policy. After the policy expires, the actual audited payroll from the insurance period determines the premium. Due to the high levels of unemployment projected, many employers will have less actual payroll than the amount that was estimated at the start of their current workers' compensation policy and used to determine premium. As a



result, insurers will have to decrease premium for employers with reduced payroll, either during the policy term or after expiry by issuing a premium refund due to a payroll audit.

Some U.S. states are contemplating creating new laws, or amending their current statutes, to expand the coverages. As an example, legislation introduced in several states, including Ohio, New Jersey, Alaska and Washington, would specifically designate COVID-19 as an occupational disease for frontline health care and protection workers such as police, firefighters and emergency medical workers. Complicating the impact of workers' compensation insurance is the new interaction of federal and state programs that allow or encourage employers to continue with payroll payments to workers, even if they are furloughed. Insurers and businesses will need to sort out how wages and salaries paid to employees while they aren't working due to the stoppage of business operations will be included in exposure amounts that lead to premium determinations.¹⁵²

PERSONAL AUTOMOBILE INSURANCE

The amount of vehicle miles traveled and the degree of road congestion will be important variables to watch over the coming months because they are a key indicator for personal and commercial auto claim frequencies. Federal authorities in many countries will specifically track mileage and mobility statistics using a wide array of data sources. In the U.S., the Department of Transportation actively gathers information so that vehicle activity can be monitored and analyzed.¹⁵³ In addition, local authorities responsible for toll roads and maintenance of highways and bridges will continuously review vehicle statistics. Already, data are showing the impact of increased social distancing and remote work leading to less auto coverage exposures. In early March, as the San Francisco Bay area began to implement more shelter-in-place initiatives, bridge officials at the Golden Gate Bridge noted a 70% reduction in traffic during peak rush hour times.¹⁵⁴

The use of telematics to determine vehicle miles traveled, speed and acceleration trends and to use as a basis for "Pay as You Drive" auto insurance programs has grown in recent years. Advocates of these pricing mechanisms from consumer and auto insurance industry groups note the ability to provide more accurate pricing, because it depends on individuals' own behavior and is directly based on exposure to risk. In addition, subsidies across rating category groups have the potential to be decreased, and some studies have noted the ability to reduce the proportion of uninsured driving.

With reduced vehicle miles traveled leading to anticipated fewer personal and commercial auto insurance claims over the short-term environment, some consumer advocates have started to publicly call for the auto insurance industry to lower or refund premiums due to the extensive and growing shelter-in-place rules in many markets. Many industry auto insurers are announcing some form of premium refund of credit given observed and expected experience in their loss ratios on auto lines of business. As one of many examples, State Farm announced a program to give policyholders an approximate 25% credit on premiums paid between March 20 and May 31. The magnitude of the credit is estimated to return \$2 billion to policyholders from coverage on over 40 million vehicles.¹⁵⁵ California Insurance Commissioner Ricardo Lara ordered insurers to provide a premium credit, reduction, return of premium or other appropriate adjustments as soon as possible for auto premiums paid for the months of March and April. If shelter-in-place orders continue, the program will be extended to May.¹⁵⁶

With more vehicles sitting idle in parking garages and driveways, increases in car theft are being reported in some locations. Seattle and New York City, two cities where the disease has been notably prominent, have seen a 24% and 53% increase in car thefts during the month of April compared to the previous timeframe in 2019, respectively.¹⁵⁷

MEDICAL MALPRACTICE INSURANCE

For physicians and medical professionals working directly with COVID-19, it remains to be seen how the actual malpractice exposure differs from expected. Many other physicians have seen a great drop in activity because most of the procedures performed are elective and have been subject to the economic shutdown. For these physicians, the medical malpractice insurance premium they have paid will likely be greater than needed by insurers for the actual losses and expenses. Like automobile insurance, some insurers have voluntarily refunded some premium for affected physicians.

The California initiative also extends to medical malpractice insurance where exposures for some practices may be low or nonexistent due to current “stay-at-home” orders in the state and the reduction or full removal of some elective health procedures and treatment. Medical malpractice insurance also is impacted by the “return to work” of many retired medical professionals, who were asked or volunteered to return to medical facilities to assist with the growing number of COVID-19 and related cases. Insurers have developed programs that aim to extend medical professional liability coverage to retired members coming back to volunteer to provide care during the COVID-19 pandemic. In addition, the transition of many working medical professionals to use online or virtual session techniques have prompted liability insurance carriers to respond by extending coverage to telemedicine.¹⁵⁸

FINANCIAL GUARANTY/MORTGAGE GUARANTY

Financial guaranty insurance and mortgage guaranty insurance are subject to high levels of loss during an economic downturn. For now, the economic shutdown has not caused many bankruptcies or defaults partially due to the government bailout. Depending on the duration of the economic downturn and the level of future bailouts, it remains to be seen how significant the impact will be on these insurers.¹⁵⁹



IMPACT ON CAPTIVE INSURANCE COMPANIES

Additional focus has also been directed towards the impact on captive reinsurance companies, given that these companies may be involved in absorbing excess risk management losses such as for medical losses. These companies, which are insurers wholly owned by one or more non-insurance companies to insure the risks of its owner, cover a wide range of risks to drive corporate risk management. Once established and domiciled in a U.S. state, the captive operates like any commercial insurance company and are subject to state regulatory requirements including reporting, capital and reserve requirements. Large companies may self-insure on risks, but pass excess and stop-loss life, health and property risks to be insured by the captive. Going forward, businesses might find new uses for their captive insurance companies because of their experience with the impact of the COVID-19 pandemic.¹⁶⁰

CHANGES IN INSURANCE REGULATION AND CONTRACTUAL REQUIREMENTS

In times of crisis or catastrophe, insurance regulators and supervisors often move to ensure consumers have flexibility to meet their payment obligations and claim filing opportunities. In such times, consumers may be displaced from their residences, be contending with higher priority activities involved with recovering from catastrophe or have less of an ability to communicate with their insurance carrier. These crisis situations tend to occur due to natural extreme weather or terrorism events. With the development of COVID-19 internationally, many insurance regulatory authorities have begun to work with their local insurance markets to set new temporary rules for insurance contracts. In similar situations in the past, insurance regulators have taken steps to ensure that policies across all lines of business are not inadvertently cancelled due to an inability of policyholders to make timely payments.

One example is with the supervision of the insurance industry in Hong Kong, where the local regulator and the Hong Kong Federation of Insurers (KFI) have seen the market adapt to the new environment. In late February 2020, HKFI

announced the creation of an “Insurance Dashboard on COVID-19” at <https://www.hkfi.org.hk/covid19>, noting actions the local industry had taken to respond to shelter-in-place requirements. Among the alleviation measures taken by insurers were to waive waiting periods on medical insurance and critical illness policies, extend premium grace periods for several lines of business, and adopt simplified or express claim filing procedures.¹⁶¹

Similarly, in the U.S., the National Association of Insurance Commissioners (NAIC) and industry trade associations have been monitoring policy contract requirements, such as the lengthening of grace periods and extending coverage requirements. As an example of many quickly evolving requirements put in place is the emergency proclamation by the New York State Department of Financial Services regarding the requirement for coverage of telehealth services.¹⁶² On Friday, March 20, NAIC held a full-day special virtual session to discuss state response, coordination and potential guidance for the U.S. insurance industry around COVID-19. Presentation topics included pandemic modeling, information around policy coverage, financial impact to the insurance industry and insurer readiness.¹⁶³ The remainder of the NAIC Spring National Meeting was suspended to allow participants to focus on the health emergency. A SOA *Research Insights Podcast* interview with NAIC CEO Mike Consedine highlights the U.S. insurance regulatory perspective on COVID-19 implications.^{***}

CYBER RISK

Cyber criminals may take the opportunity, with both less physical presence at offices and more remote nodes connecting to an organization’s network, to increase cyberattacks. Distributed denial of service (DDoS) attacks may increase where attackers flood the bandwidth or resources of a targeted system, usually one or more web servers. These types of attacks can severely slow or cut off system access at critical times for organizations. As example, on Monday, March 16, the U.S. National Security Council acknowledged a cyber incident aimed on the U.S. Health and Human Services network.¹⁶⁴

Organizations will look to refresh or implement additional cyber protections, such as ensuring devices use full disk encryption. If a physical computer asset is lost or stolen, organizations will look to further ensure that data on the device would not be accessible. Usage of virtual private network (VPN) connections have increased to enable remote access to corporate networks. Increased remote access creates higher risk of unauthorized access and data leakage. The use of personal internet service providers (ISPs) and growth in the use of community-offered public Wi-Fi services also create opportunities that enhance cyber risk. In an era of growing data privacy concerns, the risk of costs associated with reconciling the loss of customer data become more prominent.

Impact on Retirement Plans

Retirement plans fall into two general categories: defined benefit and defined contribution. In addition, some plan designs include both defined benefit and defined contribution features. In this report, the authors explore some of the significant concerns facing retirement plans that the COVID-19 pandemic has created or greatly exacerbated.

In addition to the topics covered in this report, readers may be interested in the recently-released SOA research report *Impact of COVID-19 on Retirement Risks*, which identifies various risks associated with retirement: For defined benefit plans in general, recent market downturns may reduce funded status because of the plans’

^{***} Society of Actuaries. *Research Insights—Impact of COVID-19*. (2020, May 1). <https://www.soa.org/resources/research-reports/2020/impact-coronavirus/>.

allocation to equity and other return-seeking assets.^{†††} Reduced funded status will likely require increased contributions if assets have not recovered prior to the next actuarial valuation date. Although, many of the rules permit a degree of smoothing which could work to dampen and defer the full impact.

Plans may experience a greater mismatch between their assets and liabilities going forward. Most retirement plans rebalance their asset allocations to fall within banded allocation targets. The sharp decline in return-seeking assets accompanied by a rise in fixed-income prices could necessitate the sale of fixed-income securities, which better match the interest rate profile of the liabilities. This rebalancing would thus cause an increased duration mismatch and consequently increase the risk profile.

Defined benefit plans with positive net cash flow (i.e., contributions exceeding benefits and administrative expenses) may be able to avoid selling assets at their current low prices to pay benefits or expenses.



On May 12, 2020, the House of Representatives published H.R. 6800, an economic stimulus bill known as the HEROES Act.¹⁶⁵ The HEROES Act includes several retirement provisions that would provide funding relief for both corporate and multiemployer defined benefit plans, as well as extend increased participant access to retirement account balances.¹⁶⁶ As of May 13, 2020, concept of another significant economic stimulus bill is meeting resistance in Washington.¹⁶⁷

CORPORATE DEFINED BENEFIT RETIREMENT PLANS

For single employer, private-sector plans—often known as corporate plans—in the U.S., reduced funded status may trigger certain benefit restrictions (e.g., limitations on a plan’s ability to pay lump sums) when a plan’s adjusted funding target attainment percentage (AFTAP) as defined by federal law falls below 80%.¹⁶⁸ Recent market downturns may cause some plans’ AFTAP to fall below 80%. For 2020, however, the CARES Act allows plan sponsors to use for 2020 the AFTAP for the most recent plan year ending before 2020,¹⁶⁹ which may avoid triggering benefit restrictions.

Another consequence of reduced funded status may be increased premiums to the Pension Benefit Guaranty Corporation (PBGC), because part of the formula for computing PBGC premiums, the variable-rate premium, is related to the plan’s unfunded liability.¹⁷⁰

For immediate cash flow relief, the CARES Act allows single employer plan sponsors to choose to delay with accrued interest until January 1, 2021, any required cash contributions that are due during calendar year 2020.¹⁷¹

However, the optional delay does not extend to contributions that were previously required during 2021, so delaying 2020 contributions may put an employer at risk of a cash crunch in 2021 as up to three plan years’ contributions (2019 through 2021) fall partially or fully due within a single calendar year. To add potential insult to injury, the private-sector funding framework was already pre-programmed to increase contributions beginning with plan year 2021 as the interest rate smoothing corridor expands. This statutory change coupled with the gradual recognition of the likely asset losses incurred during 2020, will probably cause contributions to continue to rise after 2021 as well.

^{†††} Rappaport, Anna and Steven Siegel. (2020, April). *Impact of COVID-19 on Retirement Risks*. Society of Actuaries. <https://www.soa.org/resources/research-reports/2020/impact-coronavirus/>.

In Canada, the federal government has announced that it will provide funding relief to federally regulated DB pension plans in the form of a moratorium, through the remainder of 2020, on solvency payment requirements. The government will also be looking at 2021 funding relief options for federally regulated DB plans.¹⁷²

In Canada, there are increased restrictions on commuted values transfers and annuity purchase transactions based on jurisdiction and impact of change in funded status. A full freeze on portability transfers and annuity purchases relating to DB provisions of pension plans has been implemented for federally regulated private plans.¹⁷³ However, as of May 7, 2020, portability transfers are allowed for certain retirement-eligible members, but with stipulations on the payment amount or required deficiency contributions from the employer.¹⁷⁴ Saskatchewan has also implemented a full freeze on portability transfers and annuity purchases for Saskatchewan-registered pension plans.¹⁷⁵ Quebec now requires that a commuted value payment be based on an up to date funded position.¹⁷⁶

Less obvious concerns for single employer plan sponsors include the potential for a corporate or plan event that must be reported to the PBGC. Such reportable events may signal financial problems that could potentially put pensions at risk, and include, among other events, significant reduction to active participant populations, missed required contributions and plan sponsor loan default.¹⁷⁷

Because plan demographics may be more volatile now than is typical, actuaries may want to pay special attention to non-economic actuarial assumptions, such as turnover and retirement. In addition, plan sponsors that have been hoping to purchase annuities—whether buy-ins or buy-outs—may reconsider given lower interest rates, greater economic uncertainty and the potential impact of COVID-19-related events on the health of the life insurance companies that offer these annuities.

Faced with a decline in the business climate and potentially deteriorated plan financial status, plan sponsors may seek to minimize plan costs by reducing benefit accruals, or by freezing benefit accruals. Making such a change offers the maximum opportunity to improve their future cash flow flexibility related to the plan in the short-term, though in the longer term, employees are likely to expect enhanced defined contribution retirement benefits.

MULTIEMPLOYER DEFINED BENEFIT RETIREMENT PLANS

U.S. Federal funding regulations for multiemployer plans differ from those for corporate plans.¹⁷⁸ In addition to concerns about eroded funded status, potential reportable events and the potential need for closely examining demographic assumptions, a more pressing concern for multiemployer pension plans may be a significantly reduced contribution base. Multiemployer pension plan contributions are negotiated and codified in collective bargaining agreements as an amount per unit of work, such as an amount per hour or week worked. Consequently, multiemployer plans that cover workers in industries for which COVID-19 has caused significant unemployment will receive far fewer contributions than previously expected. Even though laid-off employees are no longer earning benefits under the plans, most of the plans have unfunded liabilities and depend on contributions to fund them. It is unclear at this time which industries will recover quickly, and which will suffer longer-lasting impairment.

While many multiemployer pension plans were in good financial positions prior to the pandemic, it is well documented that more than 100 multiemployer plans are likely to run out of money within 20 years, including in a research report by the SOA: *U.S. Multiemployer Pension Plan Pending Insolvencies*.^{***} In turn, the collapse of these plans is expected to cause collapse of the multiemployer side of the Pension Benefit Guaranty Corporation, the

*** Schilling, Lisa and Patrick Wiese. (2018 May). U.S. Multiemployer Pension Plan Pending Insolvencies. Society of Actuaries. <https://www.soa.org/resources/research-reports/2018/us-multiemployer-pension-plan/>.

government agency that serves as a financial backstop to private-sector defined benefit pension plans.¹⁷⁹ The sharp market downturns in the current economy will likely hasten the demise of some of the troubled plans. Although some drafts of the bills that became the CARES Act included multiemployer pension plan relief, the law that was enacted did not provide any sort of relief for multiemployer pension plans.¹⁸⁰

On a positive note for multiemployer plans, plan funded status does not affect PBGC premiums for multiemployer plans.¹⁸¹

PUBLIC DEFINED BENEFIT RETIREMENT PLANS



U.S. corporate and multiemployer pension plans funding are subject to federal regulation, but U.S. public pension plans are not. In Canada, public plans are subject to the same federal and provincial regulation as corporate plans.

While market downturns clearly result in increased unfunded liabilities, the most pressing concern of public pension plans may be the funding of contributions due in 2020. Because of the widespread COVID-19-induced downturn in economic activity, states and local governments are generally expecting significantly reduced revenue during 2020. At the same time, increases in unemployment claims and related human needs call for increased spending, resulting in budget crises.¹⁸² In an effort to give New Jersey an opportunity to rework its budget for the upcoming fiscal year, New Jersey Governor Phil Murphy extended the state's current fiscal year end from June 30, 2020, to September 30, 2020.¹⁸³

Increased contribution needs resulting from increased unfunded liabilities are less pressing concerns for a couple of reasons: actuarial smoothing techniques and timing lags.

Most public pension plans employ actuarial smoothing techniques when determining contribution needs, including asset smoothing and amortization approaches. Asset smoothing details vary from plan to plan, but the intent is universal: to spread over time the impact of both positive and negative asset volatility. While most plans will likely have asset losses stemming from recent market downturns, they will spread those losses over time. In addition, many plans have not yet fully recognized asset gains of recent years, which will also help cushion the blow to increased contribution needs.

Amortization approaches also vary, and many plans may consider lengthening their amortization period or changing their amortization approach to reduce contribution needs in the shorter term. However, modifying amortization schedules may have longer-term consequences, such as much slower funding.

Plan sponsors will want to work closely with their actuary to determine the most appropriate actuarial smoothing techniques for the plan.

To accommodate their budget cycle needs, most state and local governments have a lag between the fiscal year actuarial valuation that determines contribution needs and the fiscal year during which the contributions are paid. Lengths of lags vary, but two years is most common among state-based and large-city plans. While the lag does not reduce the need for increased contributions, it gives sponsoring governments some time to plan for them.

Many large public pension plans are in a financial position to weather the COVID-19 storm battered but intact. A few state-based or large-city may be at greater or more immediate risk, especially plans with both a low funded ratio and a severely negative cash flow. In mid-April, the president of the Illinois state senate asked the federal government for a grant of more than \$40 billion, including \$10 billion for its troubled state pension plans.¹⁸⁴ Currently, federal bankruptcy code does not allow state governments to declare bankruptcy, although political subdivisions of states are allowed to declare bankruptcy.¹⁸⁵

DEFINED CONTRIBUTION RETIREMENT PLANS

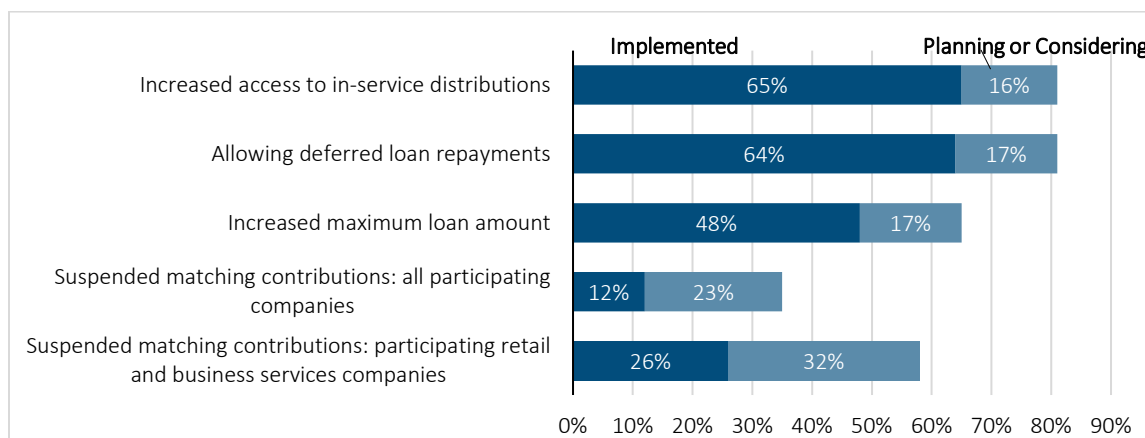
The recent market downturns have caused most defined contribution plan account balances to decline. Participants who remain actively employed and have many years before retirement may be able to adjust future contributions or planned retirement age, accordingly. However, many plan sponsors may lower contributions in the current economic environment, including suspending matching contributions to improve corporate cash flow. In addition, if employees delay retirement, employers will need to manage workforce changes accordingly.

To generate enough cash to pay bills or to fulfill federal required minimum distributions (RMDs), retirees who depend on distributions from their retirement account balance may be forced to recognize recent market losses. However, the CARES Act allows plans to waive RMDs for 2020.¹⁸⁶

Not-yet-retired participants facing unemployment or reduced income in the current environment may seek relief through a loan or early distribution from their retirement plan account. The CARES Act allows greater access to retirement funds for participants who meet specific criteria for having been directly affected by COVID-19. For such participants, certain taxes have been eliminated or relaxed, and the maximum loan from such participants' retirement accounts has been increased.¹⁸⁶ While access to retirement funds may seem attractive, it also increases the risk of insufficient retirement funds when a participant is ready to retire.

Willis Towers Watson conducted a pulse survey during the week of April 20, 2020, about changes related to COVID-19 and their 401(k). More than 800 employers with a total of 12 million employees participated. In general, more employers have eased restrictions to accessing 401(k) funds than have suspended or are considering suspending matching contributions. However, a markedly greater proportion of retail and business services companies, which have especially suffered during COVID-19, have employed or are considering suspending matching contributions (Figure 35).¹⁸⁷

Figure 35
PERCENTAGE OF EMPLOYERS MAKING 401(k) PLAN CHANGES



Data source: Willis Towers Watson

Impact on Social Insurance

U.S. SOCIAL INSURANCE PROGRAMS

Social insurance in the U.S. is comprised of five programs covering three benefit areas.



RETIREMENT

Retirement: Old-Age, Survivors and Disability Insurance (OASDI), commonly known as Social Security, provides retirement benefits for workers and is funded through payroll taxes up to a maximum amount of pay per employee, the Social Security wage base (\$137,700 for 2020).¹⁸⁸ Initial benefits are computed based on an employee's compensation history, up to certain amounts which change each year as the Average Wage Index changes. Subsequent benefits are increased based on the Consumer Price Index for Urban Wage Earners and Clerical Workers (CPI-W) determined by the Department of Labor.¹⁸⁹

COVID-19 affects Social Security benefits in two ways. Directly, the CARES Act provides for stimulus checks to Social Security recipients.¹⁹⁰ Indirectly, and perhaps less obviously, future initial Social Security benefits are likely to be smaller than they would have been without COVID-19 because the Average Wage Index (AWI) is likely to fall because of COVID-19-related layoffs. The AWI uses compensation reported for federal tax purposes, which includes unemployment benefits.¹⁹¹

Because Social Security is funded through payroll taxes and unemployment has increased dramatically during COVID-19, Social Security revenues will be reduced during COVID-19. In addition, with a decline in the AWI, the Social Security wage base will decline, which will further reduce Social Security revenues. The 2020 board of trustees' annual report, which did not reflect the impact of COVID-19, projected that the OASDI trust fund will be depleted of funds in 2035.¹⁹² The combined impact of lower revenues and slightly lower benefits in the future remains to be seen.



HEALTH CARE

The U.S. public health care program includes the following benefits:

- Medicaid provides health care benefits for low-income persons and is jointly funded by state and federal general tax revenues.¹⁹³
- Medicare provides health care benefits for retired workers and is also financed through federal payroll taxes of 2.9% of taxable earnings, split evenly between employers and employees—self-employed people pay both portions. Unlike for OASDI, there is no limit on the amount of taxable wages. Further, employees with wages more than \$200,000 for individuals—or \$250,000 for joint tax returns—pay an additional tax of 0.9% of earnings.¹⁹⁴
- Workers' compensation covers health care costs incurred because of a work-related injury or illness, and details of coverage vary by state. Financing methods also vary by state, but the program is funded by employers and premiums are generally tied directly to payroll, whether through state-run programs, private insurance companies or self-funded.¹⁹⁵

During economic downturns, more people lose income and qualify for Medicaid, causing strain on state budgets because of increased benefit payments since more people are enrolled. The Families First Coronavirus Response Act provided for a temporary increase in federal government's share of Medicaid support during COVID-19. The Kaiser Family Foundation anticipates that the magnitude of coverage changes and fiscal impact on Medicaid will exceed the impact during the Great Recession of 2008–2009.¹⁹⁶

About 85% of Medicare beneficiaries are aged 65 or older, and about 37% of beneficiaries are aged 76 or older, Medicare claims are likely to increase for COVID-19 cases.¹⁹⁷ However, like private health care insurance trends, Medicare beneficiaries may be deferring non-emergent health care needs for fear of contracting COVID-19 in a medical environment where the coronavirus may be present. Consequently, the overall impact of the cost of Medicare claims during COVID-19 remains to be seen. However, because Medicare is partially funded through

payroll taxes, the dramatic increase in unemployment during COVID-19 foretells decline in Medicare revenues. The 2020 board of trustees' annual report, which does not reflect the impact of COVID-19 on revenues and expenses, anticipates that the Medicare hospital fund will deplete its assets in 2026.¹⁹⁸



LOST EMPLOYMENT

Benefits payable in the event of involuntary loss of employment are provided via two programs: Unemployment Insurance and workers' compensation. Unemployment Insurance (UI) provides income to workers who become involuntarily unemployed and meet specific eligibility requirements. UI programs are run as state-federal partnerships that are financed through employer payroll taxes.¹⁹⁹ Workers' compensation covers a portion of lost wages incurred because of a work-related injury or illness.

COVID-19 has caused dramatic increases in unemployment, leading to greater numbers of UI claims, which increases total benefit payments, at the same time as reducing payrolls, which reduces UI revenues. In addition, the CARES Act provides for a temporary increase of \$600 in weekly UI benefits as well as an additional 13 weeks of UI benefits payments. These expanded benefits are funded through general federal tax revenues.²⁰⁰ With the increased levels of unemployment, total U.S. taxable income for 2020 will likely be reduced, which will reduce state and federal general tax revenues.

Although viruses are typically not considered occupational diseases, many states have deemed or are considering deeming COVID-19 an occupational disease for workers who are likely to have caught the disease as the result of their work, such as police, firefighters, health care workers and grocery store workers.²⁰¹ Workers' compensation systems in those states will likely see an increase in medical claims and survivor benefits—how much will depend on the ultimate number of infected workers and fatalities. However, a lack of workers' compensation claims from workers at businesses that have been partially or fully shut down may dampen the overall impact. On the revenue side, premiums are tied to payroll and total payroll, which has decreased because of COVID-19, so revenues to fund the benefits will be reduced.



CANADIAN SOCIAL INSURANCE PROGRAMS

Canada's public retirement program provides the following benefits:

- Canada Pension Plan (CPP) provides retirement and long-term disability benefits for workers in all provinces and territories except Quebec, where similar benefits are provided by the Quebec Pension Plan (QPP). Both CPP and QPP are funded via payroll taxes shared by employees and employers.²⁰² Beginning in 2019, benefit and contribution levels have been undergoing expansions that will be complete in 2025.²⁰³
- Old Age Security (OAS) program provides monthly income to seniors aged 65 and older who meet residence requirements and whose income falls below a certain threshold, regardless of their work history.²⁰⁴
- Guaranteed Income Supplement (GIS) provides monthly income to low-income Canadian seniors receiving the OAS pension.²⁰⁵

The provincial and territorial governments have most of the responsibility for delivering health and other social services. The publicly funded health care program is financed through federal, provincial and territorial taxation, such as personal and corporate taxes, sales taxes, payroll levies and other revenue.²⁰⁶

Canada's Employment Insurance (EI) program is financed almost exclusively through mandatory payroll premiums paid by employers and employees.²⁰⁷ EI provides benefits for persons who are no longer working because of:

- Involuntary termination through no fault of their own and who are available for and able to work, but cannot find a job;
- Medical reasons, including illness, injury, quarantine and other medical conditions;
- Maternity or parental care for a newborn child; or
- Providing care or support to someone who is critically ill or injured or near the end of life.²⁰⁸

Because of sharp increases in unemployment because of COVID-19, Canada has added the Canada Emergency Response Benefit (CERB), a temporary, enhanced employment insurance benefit for workers who involuntarily stopped working because of COVID-19.²⁰⁹ Individuals who would have become eligible for EI benefits on March 15, 2020 or later will receive the CERB instead of the typical benefit. Under EI, most recipients will receive 55% of their average insurable weekly earnings up to a maximum of \$573 per week, whereas under the CERB, they will receive \$500 per week regardless of prior earnings level.²¹⁰

While COVID-19 health care claims are new and therefore an increase to total claims, many Canadians are deferring surgeries and other medical procedures.²¹¹ The overall impact on health care claims remains to be seen.

On the revenue side, with decreased payrolls, funding that depends on payroll taxes will be down. In addition, with the associated decrease in taxable income, general government revenues will be down.

Operational and Emerging Risks

As businesses around the world work with their employees to minimize the impact of COVID-19, new operational risks and concerns begin to emerge. The following risks have been identified as key ones to watch through discussions with actuarial profession thought leaders.

HOSPITAL OPERATIONS

A significant portion of the risk for public health systems in combating the virus outbreak and for private health care providers and insurance carriers to monitor has been the ability for hospitals to contend with the large number of cases. In addition, equipment that is critical to responding to respiratory diseases has been in strong demand, straining capacity. Equipment such as ventilators are key to the health care response and treatment of COVID-19, especially as the disease strains the breathing of patients who are already weak or have other health conditions.



Questions of adequate hospital capacity depend partly on the timing of the need for it. Research suggests that more densely populated areas are more likely to experience longer, more diffuse influenza seasons than smaller cities with less residential density, where influenza infections are more likely to occur in shorter, more sharply defined surges. The longer, more diffuse seasons in densely populated areas presumably stem from higher rates of personal contact.²¹² Further research is required to understand whether the same dynamics apply to COVID-19. In March, Governor Andrew Cuomo of New York issued an emergency order to hospitals in New York State to increase capacity by at least 50% to contend with the sharp increase in cases.

Some countries took early measures to convert available spaces into hospitals, construct pop-up hospital settings or provide services to health care workers. The number of hospital beds per 1,000 people in the U.S. is 2.8 and lags Italy (3.2 per 1,000), China (4.3 per 1,000) and South Korea (12.3 per 1,000).²¹³ Large, empty spaces such as convention centers were converted to house temporary hospital units.²¹⁴ The 1.8 million square foot Javits Center in New York City was converted, adding an additional 1,000 hospital beds.²¹⁵ In Chicago, McCormick Place, North America's largest convention center, was converted to a 3,000-bed alternative care facility designed to treat non-COVID-19 cases and relieve pressure on city hospitals.²¹⁶

In addition, hotels in some cities like Chicago have been renting empty hotel rooms to isolate individuals and patients who need to be quarantined.²¹⁷ In London, the National Health Service (NHS) was granted use of the Millennium Hotel at Stamford Bridge by the Chelsea Football Club to support medical staff who had become accustomed to working long shifts and would otherwise have to make long commutes to their residences.²¹⁸

Many health care systems have taken advantage of technology to prevent the spread of the virus, using telemedicine for non-emergent care diagnosis and care when possible.²¹⁹

Hospitals, pharmacies and other health care providers have also experienced supply chain issues, because international shipping and delivery services play a vital role in getting pharmaceutical drugs from their manufacturing source to the site of use. The U.S. may be a key example. Research and development of new pharmaceuticals is often done within the U.S., but manufacturing is often done outside the country. High proportions of commonly used drugs such as antibiotics, ibuprofen, hydrocortisone, acetaminophen and heparin are produced outside the U.S., often in the Chinese market. Many other countries such as India, South Korea and Germany are reducing the amount of medical supplies and protective gear they export to retain supplies in their local market.

On March 18, the U.S. 1950 Defense Production Act was invoked to empower private industry to ramp up production of supplies in the name of national security if needed. Private industry, for the most part, has voluntarily stepped up to help the situation, and the need to enforce the 1950s act has not been needed. Distilleries are converting their gin, whiskey and rum production lines to the production of hand sanitizer.²²⁰ Auto and truck manufacturers are looking into producing ventilators.²²¹ Other private businesses are looking to make face masks.²²² However, for the first time on March 27, the power of the 1950 act was used when the U.S. president required General Motors to accept, perform and prioritize federal contracts for ventilators deemed necessary by the health and human services secretary amid the coronavirus pandemic.²²³

Estimates of the date or range of dates at which the outbreak will peak or will have peaked have been closely followed at all governmental levels. These estimates varied based on the numerous statistical models that have been built to provide projections and the techniques the models use. The models provided no consensus as to when the peak would occur. White House coronavirus task force adviser Dr. Deborah Birx mentioned these models at press briefings, singling out projections by the Institute for Health Metrics and Evaluation (IHME) at the University of Washington in Seattle, suggesting that model may be close to how government experts were viewing the situation.²²⁴

In conjunction with the anticipated capacity strains on hospital utilization due to COVID-19, hospitals, clinics, and other freestanding facilities have significantly curtailed elective procedures. This was done in conjunction with recommendations from the Centers for Medicare and Medicaid Services (CMS) and the American College of Surgeons. CMS put out guidelines on deferring care on April 7 which split services into three different tiers ranging from those which could be postponed to those that required immediate treatment.²²⁵ The ACS put out four sets of guidelines on triaging elective surgeries from March 13–25, 2020. As COVID-19 cases began to stabilize, the ACS released two roadmaps on resuming elective surgeries on April 17 including one that was jointly issued with the American Society of Anesthesiologists, the Association of periOperative Registered Nurses, and the American Hospital Association.²²⁶

The roadmaps for resuming elective surgeries were largely driven by patient and provider factors. As COVID-19 patient risks dropped due to lower new case rates and hospitalizations. At the same time, risks were increasing for patients that had been postponing needed services and treatments leading to the potential of worsening conditions due to these delays. Provider capacity also increased as COVID-19 case rates and hospitalization rates diminished. Many of those providers experienced severe financial losses due to the deferral of a large portion of their previously

provided elective services. In fact, these deferrals of services were the leading cause of the 4.8% first Quarter of 2020 drop in GDP. According to an article by CNBC, 2.25% of the GDP drop came from health care spending.²²⁷

The IHME model defined the peak as the point of greatest demand for resources—for example, hospital beds, ventilators and health care workers—needed to care for coronavirus patients. Projected peaks varied by state in the model. The model estimated that the peak for the U.S. had occurred on April 19 for the U.S. using its hospital resources measure.²²⁸

A comparison done by the Chicago Tribune for when the virus will peak in Illinois showed a prediction of April 17 from the IHME model versus an estimate of May 14–26 by another model from a group called COVID Act Now.²²⁹ The estimate range of the COVID Act Now model varies based on the level of compliance with stay-at-home measures.

The CDC tracks several COVID-19 forecasting models and compiles their weekly forecasts on its website. As a lesson from the comparison that the Chicago Tribune did, it is important to study multiple forecasts to help understand how they compare with each other and how much uncertainty there is about what may happen.²³⁰

In general, there are two main types of COVID-19 forecasting models:

1. Outbreak curve models, and
2. Susceptible-infected-recovered (SIR) models.

The IHME model uses an outbreak curve approach, while the COVID Act Now model uses an SIR approach. An outbreak curve model focuses on the time series of COVID-19 deaths, separately by city or geographic region, and fits this data to a curve that describes the anticipated rise, peak and fall of the number of daily deaths.

An SIR model, in contrast, requires estimates of the transmissibility and lethality of the virus and uses this information to project shifts in the population from “susceptible” (i.e., not yet infected) to “infected” and from “infected” to either “recovered” or deceased. A description of these modeling approaches is available in a recent SOA brief that compares forecasts of the COVID-19 outbreak for the U.S: *Projections of Covid-19 Hospitalizations and Deaths*.⁵⁹⁵

FOOD SUPPLY RISKS

COVID-19 disruptions in the U.S. have resulted in some farmers being unable to get their produce to market.²³¹ The dairy industry was the first to feel the impact because of the short shelf life and perishable nature of dairy products. Restaurant and school closures have forced a shift from those wholesale markets to retail grocery stores, where demand remains high. However, because of disruptions in the trucking industry, some dairy products are not getting to stores before they perish. This results in a unique situation where there is high demand and shortages at the grocery stores at the same time there is an excess supply at the farms.²³²



COVID-19 is also impacting meat production. Since the start of March, about two dozen U.S. meat processing plants have temporarily closed because of COVID-19 outbreaks among workers.²³³ On April 28, 2020, President Trump signed an executive order to keep meat packing plants open under the Defense Protection Act.²³⁴ Nonetheless, many remain temporarily closed. While cattle prices in the U.S. have fallen, retail beef prices have risen.²³⁵ Prices for

⁵⁹⁵ Wiese, Patrick. (2020, April). Projections of COVID-19 Hospitalizations and Deaths. Society of Actuaries. <https://www.soa.org/globalassets/assets/files/resources/research-report/2020/covid-19-hospitalizations-deaths-04-24.pdf>.

other groceries have also risen. The Consumer Price Index for All Urban Consumers (CPI-U) for food showed its greatest increase in April 2020 since February 1974.²³⁶ Nonetheless, the food supply currently remains robust, although U.S. residents may have fewer options or may not be able to get a specific product when they want it.



Outside the U.S., as of April 3, global cereal stocks are at comfortable levels, and the outlook for wheat and other staple crops is positive.²³⁷ The growing issue broader than food supply may also be on behavioral change over food security. If bulk buyers believe they won't be able to get wheat or rice shipments in May or June, it could result in negative consequences for low-income countries in Africa and the Middle East where people spend the largest share of income on food.

REMOTE WORK

Many employers around the world have encouraged remote work environments. In this setup, employees work from a remote location outside the normal office setting, often from their own personal residence. This helps maintain physical distance and reduce the chance of spreading disease among an employee population.²³⁸

While remote work is not a new concept, the volume of remote work that is expected to be implemented due to COVID-19 may greatly exceed previous expectations. Employers will be looking to maintain productivity and keep processes moving.

A mitigation to this risk is that many employers have already implemented some form of remote work, ranging from arrangements that allow employees to periodically work remotely up to full-time remote work. The previous investment of these work arrangements may be beneficial to companies in any prolonged transition for their employees.

Physical asset and information security risk also increases as remote work becomes more the norm. Organizations are often encouraged to remind staff of basic security practices, like ensuring that they do not leave company assets, documentation, confidential information or property unattended in public places and to be aware of others who may be working around them.

Some employees may feel uncomfortable if asked to work in a large corporate environment during a time of pandemic, though employers in some countries may not have an obligation to allow telecommuting unless they would be required to accommodate an employee disability. Employers in most countries generally may have the right to ask employees to work in a remote setting if they are not discriminatory in their practices or infringe on protected classes.

Complicating the remote work phenomenon for many individuals is the fact that many schools, universities and daycare facilities closed or instituted "distance learning" methods. Many parents have been juggling the need to do work for their employer while also ensuring their children have appropriate care or focus on school activities.

EMPLOYMENT LAW

In many countries, employment law is being amended to adjust how paid leave will work for employees impacted by the pandemic. In the U.K., the Coronavirus Job Retention Scheme was implemented giving employers the ability to apply for grants to keep employees on the payroll if they're unable to operate or have no work for employees due to economic impacts from COVID-19. The minimum time that an employee can be furloughed is three weeks, and companies cannot rotate furloughed workers.

Effective April 1, the Families First Coronavirus Response Act was enacted in the U.S., applying to businesses based in the U.S. with fewer than 500 employees. The law ensures that employees who can't work due to symptoms

associated with COVID-19 or under quarantine or isolation obligations must receive up to two weeks of paid sick leave. Additionally, if the employee is caring for a quarantined or isolated person or child due to the pandemic, up to two weeks of leave must be granted at a rate equal to two-thirds of normal pay rates. The requirements are currently applicable until December 31, 2020.

An additional side effect of employment law and practices under COVID-19 stems from the dwindling capacity for commercial laboratories to process standard drug testing for employees. With the focus and allocation of space of time higher on testing new coronavirus patients, labs may be deferring on slowing down their process rates for employers testing current employees or looking to add additional hires.

INTERNET SERVICE PROVIDER AND VIRTUAL PRIVATE NETWORK CAPACITY AND FRAUD

With the growth of remote work, many employers are looking to determine if there will be any new or different strains on ISP capacity. Remote work in large volumes across many organizations may put different pressure loads on ISPs. Organizations and their employees will be monitoring connection speeds needed for a range of work, especially if work is done using a remote desktop connection. VPN bandwidth adds to the concern, because some companies may consider advising employees to use cellular phone methods to join on conference calls as opposed to using voice-over-internet through a computer connection.

With remote work, physical distancing and a new environment for working with vendors and suppliers, many compliance officers are noting the increasing chances of financial fraud. Organizations may be looking to quickly onboard new relationships with vendors to assist with new operations or technologies or to get a new product or service to the market quickly. Vetting and screening practices may be more complicated to do through a remote work environment or corners may be cut to ensure time is not lost. Re-organizing staff roles and resources may also leave some areas with lower capacity to perform established checks on bringing new business vendors in to service. In addition, with organizations looking for cost savings, some employees may be nervous about their own future financial security and show a higher tendency to commit financial fraud.²³⁹

Government authorities are reminding organizations that the current environment increases the chances for phishing and fraudulent emails. With health concerns high on the mind, individuals are being encouraged to be cautious of unsolicited healthcare fraud schemes for testing and treatment of the disease through emails, phone calls or in person encounters. Cryptocurrency and cyber fraud may grow as well as bad actors may look to perform more blackmail, work from home scams, investment scams and prompt payment for non-existent equipment or services. As many governments are in the process of their annual tax reporting and collection process during the spring months, individuals are also being warned to be wary of unsolicited telephone calls or emails from individuals claiming to represent local tax authorities.²⁴⁰

The use of telemedicine has exploded during the pandemic, revolutionizing health care services for minor ailments without the risks associated with visiting a medical office. However, telemedicine may also provide new opportunities for billing fraud and abuse.²⁴¹

STOCKPILING

As may happen in other emergency or disaster situations, especially ones where individuals perceive that mobility and service disruptions may take place, the phenomenon of stockpiling critical goods has been seen in countries around the world. Some individuals have taken to acquiring and storing large quantities of staple goods to ensure a supply is available when needed, to have on hand over potentially long periods of isolation, or with intent to capitalize on short supply and sell goods at inflated prices.²⁴² Many stores have placed purchase limitations on key products related to the outbreak to ensure a more consistent supply for their customer population. Products being

stockpiled in the current environment include facemasks, toilet paper, hand sanitizer, disinfecting soap and canned goods, although shelves are being restocked. Complaints of price gouging and citations for price gouging have increased during the pandemic.²⁴³

EVENT CANCELLATIONS AND RESTAURANT CLOSINGS

Health and public officials cancelled large spectator events, concerts and professional development meetings around the world to prevent the spread of COVID-19.²⁴⁴ Examples are numerous, including the cancellation of the U.S. National Collegiate Athletic Association's (NCAA) basketball championships, commonly referred to as "March Madness," as well as suspension of nearly all worldwide professional sports leagues such as the National Basketball Association, National Hockey League and football (soccer) matches in the major national leagues. The International Olympic Committee has postponed the 2020 Summer Olympics in Japan until 2021.²⁴⁵ In the U.S., where 2020 is a presidential election year, the Democratic National Committee rescheduled its convention from mid-July to mid-August.²⁴⁶

The world of event cancellation insurance has evolved quickly over the past few months, with some insurance providers beginning to exclude coronavirus as a triggering event. Policyholders who procured event cancellation insurance generally before January 2020, typically would have had the ability to purchase either "all-cause" coverages, or specified coverages with options for cancellations due to infectious or communicable diseases. Beginning in early 2020, as the virus began to gain traction in China and other markets, this type of coverage began to greatly decrease in its offering. Today, many insurance companies are including specific coronavirus exclusions in newly issued event cancellation policies.

The impact of event cancellations will be noticeable in local economies that rely on spectator events, such as sports and concerts, and, in particular, on those individuals who work in service industries. In response, many high-profile sports celebrities and/or employers have been offering financial assistance commitments to assist those impacted by the cancellations, such as staff who work as ushers or security for large spectator venues. Some sports and entertainment companies are maintaining employee pay while their events are canceled or venues are closed.

To stem the spread of the virus, many jurisdictions around the world implemented measures to close restaurants, bars and nightclubs, which are prone to larger gatherings and social interaction. Subsequently, many jurisdictions tightened restrictions by issuing stay-at-home orders.²⁴⁷ Currently, some jurisdictions have begun to or are considering reopening.²⁴⁸ And some food and beverage providers have begun alternative delivery approaches. For example, in Chicago, where stay-at-home orders continue through May, a local brewery has a van driving through the streets playing ice cream truck music. While customers cannot purchase beer directly from the van, they can call the number displayed on the side of the van and someone from the brewery will deliver the beer to their door.²⁴⁹

INTERNATIONAL TRADE DEPENDENCY

Many manufacturing organizations around the world today are dependent on international trade and shipping systems to receive supplies, facilitate sales and distribute products. Financial services companies may be less exposed to these operational risks on a short-term basis, but longer-term events could cause risks when physical assets (such as computers and network servers) need maintenance or replacement.

ALTERNATIVE ENTERTAINMENT DISTRIBUTION

With the growing trend of reduced social interaction but the continuing public appetite for entertainment, new methods of dissemination appear to be occurring. With the suspension of the National Basketball Association's season, some teams have taken to their fans and players continuing to "play out the season" through internet-

connected game devices. Online streaming video services have increased their push into the markets with new releases or bringing forward anticipated future releases to meet the demand expected. With lower expectations anticipated for consumers gathering to watch movies in theaters, some film distributors have pushed releases to later dates or released directly to video on demand. Release schedules among major motion picture providers worldwide often are inflexible given the long-range planning and coordination that goes into film production, but there is anticipation that the industry will be careful not to layer large releases too close to each other to optimize attendance at theaters.²⁵⁰

As evidence of the increasing use of streaming distribution, Universal Studios released initial estimates for the April 10 digital rental release of DreamWorks Animation's *Trolls World Tour*. Initial estimates placed the release as a record weekend and opening-day digital rental. The title became the top performing entry across all major on-demand platforms, topping expectations on digital distributors including Amazon, Comcast, Apple, Vudu, Google/YouTube, DirecTV and FandangoNOW.²⁵¹

In addition, with the change in personal and entertainment services, demand has changed to a broad array of new technologies and entertainment. Jigsaw puzzle makers are struggling to keep up with a large spike in demand, with year-over-year sales reported in excess of 300%. Hair dyes have become harder to come by with increasing use at home in lieu of being able to visit professional salons. Spring religious holidays such as Passover, Easter and Ramadan are being celebrated in new and creative ways, with families and religious congregations joining together through online streaming services and remote video sessions.²⁵²



CLIMATE CHANGE AND THE RISK OF EXTREME WEATHER AND OTHER NATURAL HAZARDS

In the weeks and months to come, the COVID-19 crisis could potentially be compounded by extreme weather events, adding an additional layer of stress to a situation that is already dire. In addition, earthquakes are an ever-present risk for many areas.

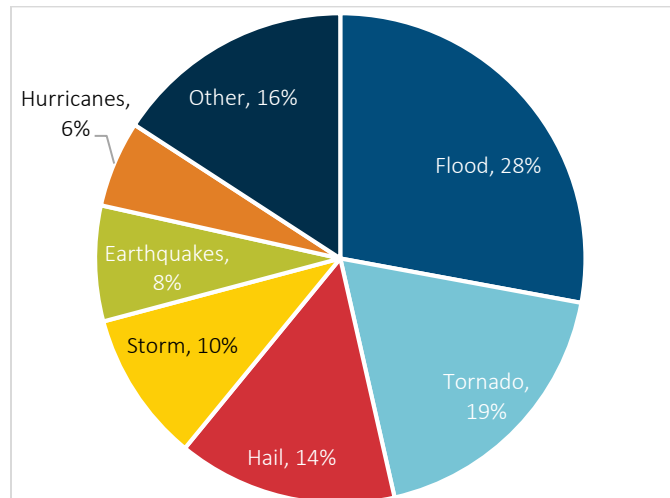
Extreme weather, earthquakes and wildfires caused an average of \$29 billion in property damage per year in the U.S. across the period from 1980 to 2018, of which 22%—or \$8.5 billion per year—occurred during the months of April, May and June (Figure 36).****

With respect to geographic region, loss data suggest that the risk posed by natural hazards during March through May is greatest across the Great Plains and the Gulf Coast (Figure 31). Given these factors, additional strain on health care resources will vary based on geography, severity of any extreme event and previous efforts to boost preparedness for such situations.

April 2020 ranked as one of the most active Aprils for U.S. tornado activity in the last 30 years. Across 17 states, 243 tornadoes touched down, with 13 reaching an Enhanced Fujita scale measure of 3 (EF3) and 4 registering as EF4. Only 3 previous years in the last 30 exceeded this year's April tornado count. Alabama was hit hardest as 41 touchdowns were recorded, well above the historical April average of 12. The tornado fatality count for April in the U.S. of 40 lives, was only exceeded in recent history by 1998 (55 fatalities) and a dramatic year of tornadoes in 2011 (363 fatalities).²⁵³

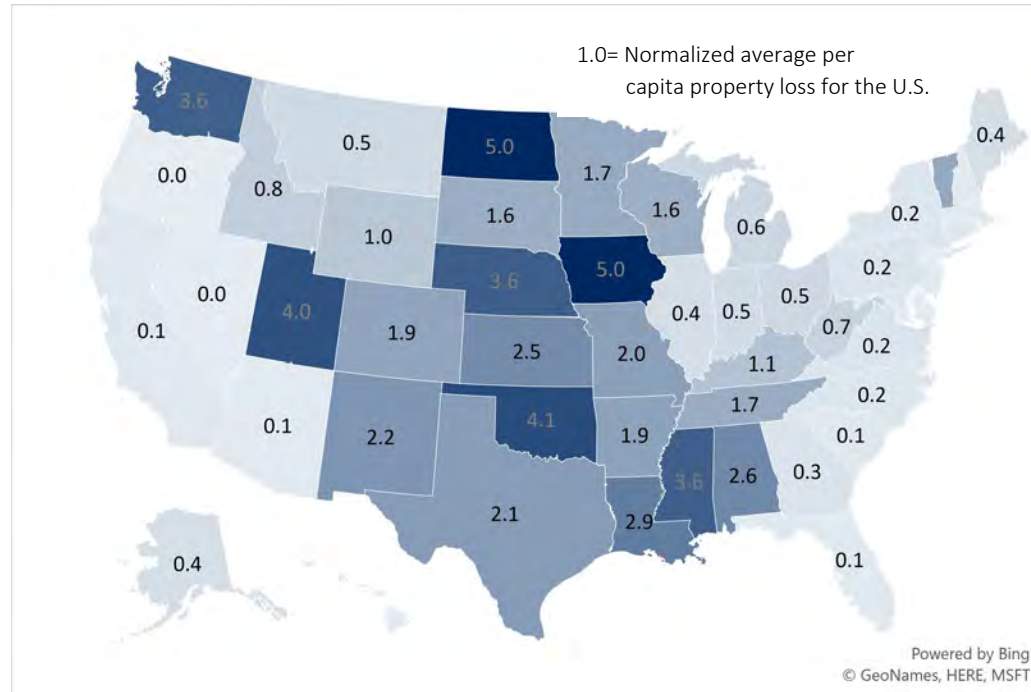
**** This result was computed using the Spatial Hazard Events and Losses Database (SHELDUS) for the U.S., which tracks property losses, crop losses, fatalities and injuries due to natural hazards in the U.S. SHELDUS property and crop losses are "economic" as opposed to insured. The \$31 billion result includes property losses from weather.

Figure 36
HISTORICAL DISTRIBUTION OF PROPERTY LOSSES BY NATURAL HAZARD DURING APRIL–JUNE



Source: authors' tabulations of SHELUDS loss data across the 1980 to 2018 period

Figure 31
NORMALIZED HISTORICAL PER CAPITA PROPERTY LOSSES DUE TO NATURAL HAZARDS, FOR APRIL–JUNE



Source: authors' tabulations of SHELUDS loss data across the 1980 to 2018 period. Note that a value of 2.0 indicates that a state's per capita historical losses are twice the national average, while a value of 0.5 indicates per capita losses of half the national average.



The COVID-19 pandemic's impact on the reduction in car and air traffic could result in the world's largest drop in emissions in the last century. Recent estimates indicate that global emissions could drop by as much as 8% in 2020.²⁵⁴ A report by the UNEP²⁵⁵ states that a 7.6% drop in emissions per year over this decade is needed to reach the 1.5 degrees Celsius limit determined by the IPCC.²⁵⁶ The reduction of carbon emissions is one of the few

positives coming out of the pandemic and given a potential link of climate change to extreme weather, may present a counter force against a continued increase of extreme weather.²⁵⁷



REOPENING

As the rate of infections, hospitalizations and deaths from COVID-19 slows, countries and states are considering how to selectively lift restrictions to return people back to work and school.

China, Hong Kong and Singapore have lifted restrictions and are seeing a resurgence of cases mostly tied to international travelers.²⁵⁸ These countries have resorted to implementing rules and requirements that are far from normal and that may have to continue until a vaccine can be developed and widely distributed. China has severely cut back on international travel. Singapore uses citizen's phone data to track whether they are complying with government-ordered quarantines. Counties and cities are tightening their borders. Hong Kong citizens returning from abroad must quarantine for 14 days and wear tracking bracelets. Punishments for breaking the rules include fines, imprisonment and invalidating passports.



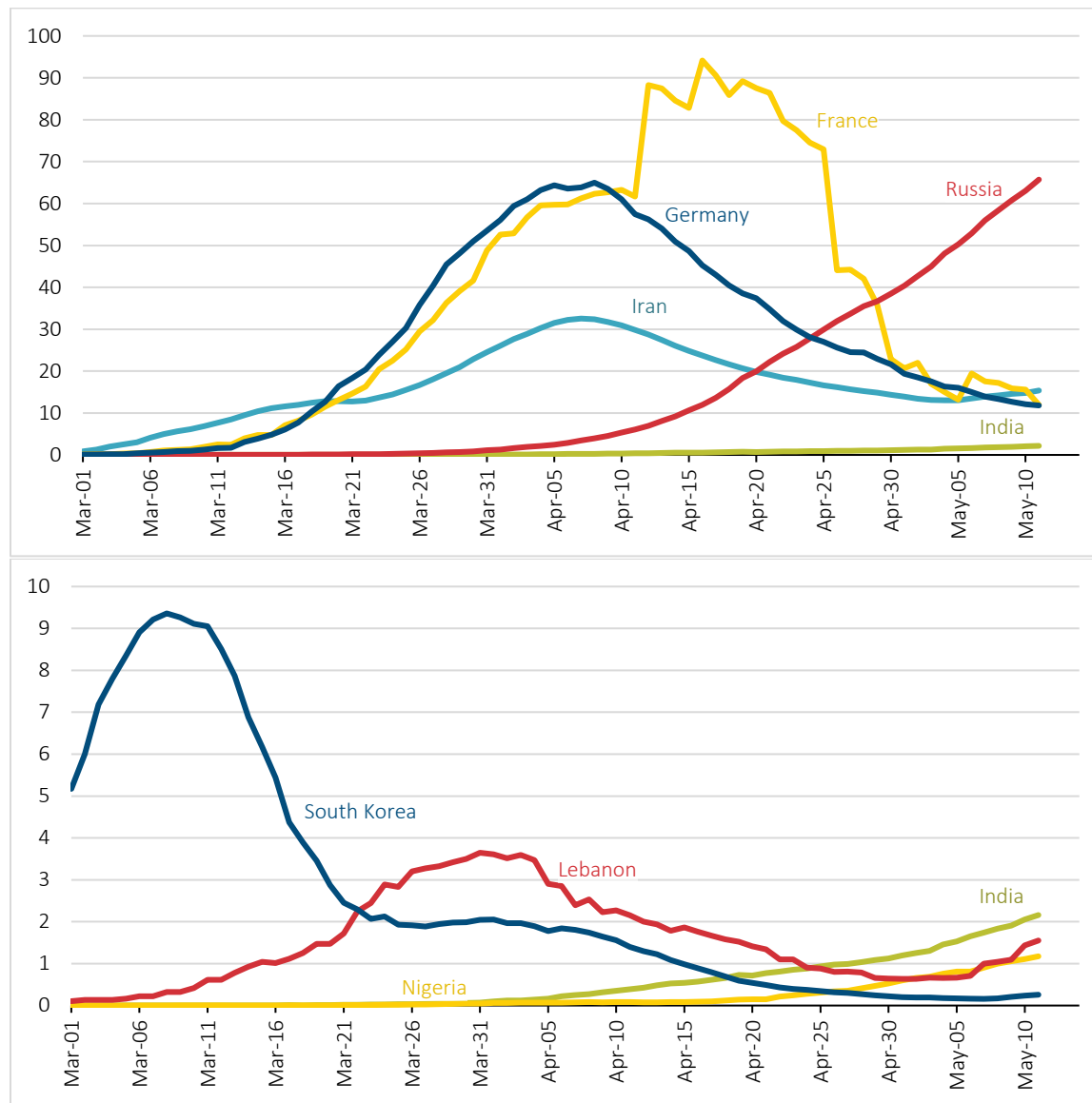
Countries that are experiencing higher levels of COVID-19 cases are continuing the debate between the benefits of increased economic activity and its impact on public health. Nigeria, Lebanon and several European countries, including Germany, have begun to reopen some regions.²⁵⁹ However, Germany's R_0 was reported on May 11, 2020, to have crept back up above 1.0 for three days in a row.²⁶⁰ On May 12, Lebanon reimposed restrictions after a surge of infections, almost two weeks after it appeared to have contained the spread of the virus and began reopening. And in Wuhan, five weeks after having apparently rid itself of the disease, a cluster of six new infections emerged.²⁶¹



Some countries, including Russia and India, are lifting restrictions despite growing numbers of cases and evidence that COVID-19 is far from being contained (Figure 37).²⁶¹



Figure 37
14-DAY ROLLING AVERAGE NEW CASES PER MILLION—SELECTED COUNTRIES



Data source: Johns Hopkins University and authors' calculations



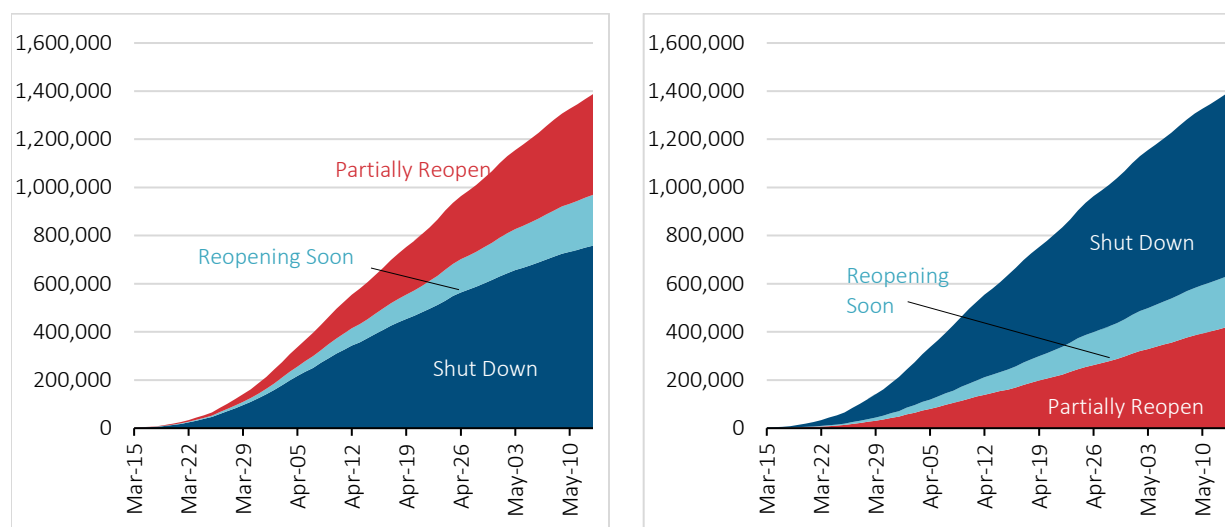
The federal Canadian government is leaving each province to develop its own plan for reopening.²⁶² On May 11, 2020, McGill University in Montreal announced that fall semester courses will start as scheduled, albeit via remote delivery platforms.²⁶³

On April 16, 2020, the U.S. government released “Guidelines for Opening Up America Again” that will help state and local officials determine when to reopen their economies.²⁶⁴ The guidelines include several gating criteria which should be satisfied before beginning to reopen a state or region. The criteria include a downward trajectory within a 14-day period of either the percentage of tests with positive results, given that the volume of tests is flat or increasing, or documented cases.

As of May 13, 2020, 32 states have partially reopened.²⁶⁵ For example, on April 20, 2020, South Carolina Governor Henry McMaster removed state restrictions on public access to beaches and provided for limited reopening of retail businesses and flea markets.²⁶⁶ Similarly, Alabama Governor Kay Ivey allowed retailers to reopen on April 30, 2020, at a 50% occupancy rate. In addition, some businesses and state beaches reopened on April 30, 2020, but social distancing must be maintained, and gatherings of 10 or more people are banned.²⁶⁷ In Georgia, restaurants were allowed to reopen for dine-in service on April 28, 2020, although many chose not to.²⁶⁸

In addition, several states have begun to reopen or are planning to begin reopening soon. are planning to reopen or partially reopen in early May.²⁶⁹ For example, Texas retail stores, restaurants, movie theaters and malls were permitted to reopen on May 1, 2020, at a 25% occupancy rate.²⁷⁰ Missouri allowed all businesses to be open beginning May 4, 2020, as long as they follow social distancing guidelines.²⁷¹ Figure 38 shows the number of confirmed cases in the U.S. split between states that have begun to reopen, those that plan to reopen soon and those that have remained shut down as of May 13, 2020. The number of confirmed cases continues to climb in shut down states as well as those that have partially reopened. As previously noted, the number of actual cases is generally understood to be greater than the number of confirmed cases. In addition, as testing increases, the number of confirmed cases is likely to increase. The two graphs in Figure 38 differ only in the order that data categories appear. The number of confirmed cases is shown through May 13, 2020.

Figure 38
NUMBER OF U.S. CONFIRMED COVID-19 CASES BY STATE REOPENING STATUS, MAY 13, 2020



Data source: Johns Hopkins University

Dr. Fauci told the U.S. Senate on May 12, 2020, that without adequate preparation for reopening, “we run the risk of having a resurgence.” And Dr. Robert Redfield, the director of the CDC, told senators, “we are not out of the woods yet.”²⁷² In another context, some economists warn that reopening economies too soon could worsen economic damage.²⁷³ A Pew Research Center poll in April showed that Americans are more concerned about reopening too quickly rather than not reopening quickly enough.²⁷⁴ And a poll by the University of Maryland and The Washington Post conducted April 28–May 3 found that Americans clearly opposed the reopening of restaurants, retail stores and other businesses.²⁷⁵

Previous SOA Research Highlights

Over the years, many committees and sections within the SOA have helped support, fund and promote research related to disease outbreaks. The following is a short highlight of key reports previously released by the SOA or highlighted at SOA professional development sessions that may be of benefit for the actuarial profession. The SOA is committed to updating these types of reports as new information emerges.

IMPACT ON THE U.S. LIFE INSURANCE INDUSTRY

The report series on *Potential Impact of Pandemic Influenza on the U.S. Life Insurance Industry* (<https://www.soa.org/resources/research-reports/2007/research-impact-pan-influ-life-ins/>) gives guidance through several reports on the potential impact of a disease outbreak on population and insured mortality in the U.S. and additionally has information on the potential impact on financial markets, corporate bond spreads, monetary policy and economic output.

Sponsored by the Committee on Life Insurance Research and the Risk Management Section's research team, Jim Toole of MBA Actuaries evaluates the financial effects of different flu pandemic scenarios on the U.S. Life Insurance industry. In addition to the research report, he has developed an accompanying spreadsheet tool for individual insurers to better understand the associated financial risks of a flu pandemic.

During this study, the Project Oversight Group conducted two Delphi studies. One study examined how excess insured mortality because of a flu pandemic might differ from that of the general population. The second study examined the potential economic effects of a flu pandemic. Results are presented in the following reports.

Materials available include:

- *Potential Impact of Pandemic Influenza on the U.S. Life Insurance Industry Report*
- Pandemic Model Tool with documentation
- *Study of the Effect of a Flu Pandemic on Economic Values Using the Delphi Method*
- *Study of the Effect of a Flu Pandemic on Insured Mortality Using the Delphi Method*

COMPARISON TO CURRENT COVID-19 EVENTS

The report series included a survey, using the Delphi Method, on the impact on various economic values should the U.S. enter an influenza pandemic. Two pandemic virulence scenarios were analyzed; a moderate scenario similar in mortality severity to the 1957 H2N2 pandemic and a severe scenario similar in mortality severity to the 1918 H1N1 pandemic. The 1957 pandemic ("Moderate Scenario") produced approximately 0.7 excess deaths per 1,000 of population, and the 1918 pandemic ("Severe Scenario") produced approximately 6.5 excess deaths per 1,000.

Table 4 summarizes the survey results in comparison to current observations under the COVID-19 pandemic, using February 1, 2020, as an approximate average start of the worldwide outbreak.

Table 4
SURVEY RESULTS COMPARED TO CURRENT OBSERVATIONS

Estimated Asset Values	SOA Research Report: Average Response for Maximum Change Within 180 Days from Onset		Actual Change: Feb. 1, 2020 to May 12, 2020
	Moderate Scenario	Severe Scenario	
S&P 500 Index	-11%	-24%	-13% (May 11)
Aa Corporate Bond Yield	+28 basis points	+35 basis points	-25 basis points
Federal Funds Rate	-27 basis points	-77 basis points	-155 basis points



IMPACT ON THE U.S. HEALTH INSURANCE INDUSTRY

The report series *Potential Impact of Pandemic Influenza on the U.S. Health Insurance Industry Report* (<https://www.soa.org/resources/research-reports/2010/research-pandemic/>) highlights the potential impact of an outbreak on health care costs, including information on how costs may vary by the site of care and the impact on operational risks to health care providers.

Sponsored by the Committee on Life Insurance Research, the Joint Risk Management Section's research team, and the Health Section, Jim Toole of MBA Actuaries evaluates the financial effects of different flu pandemic scenarios on the U.S. health insurance industry. In addition to the research report, he has developed an accompanying spreadsheet tool for individual health insurers to better understand the associated financial risks of a flu pandemic.

This is the second paper in a two-part series examining the potential impact of pandemic influenza on the insurance industry. The first paper focused on the potential impact of pandemic influenza on the life insurance industry.

Materials available include:

- *Potential Impact of Pandemic Influenza on the U.S. Health Insurance Industry Report*
- Health Company Pandemic Modeling Tool and documentation

LOW AND NEGATIVE INTEREST RATE RESEARCH

- *Sustained Low Interest Rate Environment: Can It Continue? Why It Matters*
<https://www.soa.org/research-reports/2014/research-2014-sustained-low-interest/>
- *Transition to a high interest rate environment: Preparing for Uncertainty*
<https://www.soa.org/resources/research-reports/2015/research-2015-rising-interest-rate>
- *A Low-Growth World: Implications for the Insurance Industry and Pension Plans*
<https://www.soa.org/resources/research-reports/2019/low-growth-world/>
- *Negative Interest Rates and the Insurance Industry: A Survey of Risk-Management Capabilities and Practice*
<https://www.soa.org/resources/research-reports/2020/negative-interest-rates/>

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Appendix: Additional Data

WORLDWIDE DATA

15 COUNTRIES WITH THE MOST CONFIRMED COVID-19 CASES THROUGH MAY 13, 2020

Country	Number of Confirmed Cases	Cases per Million (CPM)	Day Zero (CPM ≥ 10)
World	3,756,069	564	22-Feb
Belgium	50,781	4,678	07-Mar
Brazil	131,744	901	24-Mar
Canada	52,987	1,966	16-Mar
China	83,970	59	02-Feb
France	214,457	2,702	06-Mar
Germany	126,611	2,085	08-Mar
India	64,694	57	17-Apr
Iran	101,650	1,360	01-Mar
Italy	201,101	3,668	27-Feb
Peru	54,817	2,347	22-Mar
Russia	172,465	1,661	29-Mar
Spain	165,929	4,893	07-Mar
Turkey	168,162	1,715	22-Mar
U.K.	220,325	3,402	13-Mar
U.S.	1,229,331	4,220	15-Mar

U.S. DATA**CASES BY U.S. STATE, MAY 13, 2020**

State	Number of Cases	Cases Per Million
Alabama	10,700	2,182
Alaska	383	524
Arizona	12,216	1,678
Arkansas	4,236	1,404
California	72,798	1,842
Colorado	20,475	3,555
Connecticut	34,855	9,776
D.C.	6,584	9,329
Delaware	6,952	7,139
Florida	42,402	1,974
Georgia	35,427	3,337
Hawaii	638	451
Idaho	2,293	1,283
Illinois	84,694	6,684
Indiana	25,473	3,784
Iowa	13,289	4,212
Kansas	7,518	2,581
Kentucky	6,853	1,534
Louisiana	32,662	7,026
Maine	1,515	1,127
Maryland	34,812	5,758
Massachusetts	80,497	11,679
Michigan	48,391	4,845
Minnesota	12,917	2,290
Mississippi	10,090	3,390
Missouri	10,404	1,570
Montana	462	432
Nebraska	8,912	4,607
Nevada	6,476	2,102
New Hampshire	3,299	2,426
New Jersey	141,560	15,938
New Mexico	5,364	2,558
New York	340,661	14,418
North Carolina	16,352	1,559
North Dakota	1,647	2,161
Ohio	25,721	2,200
Oklahoma	4,858	1,228
Oregon	3,416	810
Pennsylvania	62,101	4,851
Rhode Island	11,835	11,172
South Carolina	8,030	1,560
South Dakota	3,732	4,219
Tennessee	16,370	2,397
Texas	43,020	1,484
Utah	6,620	2,065
Vermont	929	1,489
Virginia	26,746	3,133
Washington	17,512	2,300
West Virginia	1,398	780
Wisconsin	10,902	1,872
Wyoming	688	1,189

CANADIAN DATA**CASES PER MILLION (CPM) BY CANADIAN PROVINCE, MAY 13, 2020**

State	Day Zero	Cases Per Million
Alberta	6,407	3,136
British Columbia	2,376	1,062
Manitoba	290	434
Newfoundland and Labrador	261	1,207
Nova Scotia	1,024	2,387
Ontario	22,516	3,418
Quebec	39,940	8,576
Saskatchewan	577	1,023
Alberta	6,407	3,136
British Columbia	2,376	1,062
Manitoba	290	434

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