



Society of Actuaries Research Brief

Impact of COVID-19

March 16, 2020





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Section 1: Introduction

In late December 2019, doctors in the Wuhan province of 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. As the Lunar New Year banquet tradition occurred in Wuhan in mid-January 2020, infections began to rapidly increase. By January 23, over 600 cases had been confirmed and Wuhan and other areas in China instituted quarantines.

Through the month of February to early March, the epidemic spread. The number of confirmed cases involving the novel coronavirus now named “SARS-CoV-2”, and causes the respiratory disease now named “coronavirus disease 2019” (COVID-19), has reached over 180,000 world-wide with general agreement that the number is higher due to delays in full testing and reporting in many countries. Well over 100 World Health Organization (WHO) countries/regions have reported cases as of the writing of this report, and over 7,000 deaths world-wide have now occurred. On March 11, WHO publicly characterized COVID-19 as a pandemic, and shortly thereafter, the United States declared the COVID-19 outbreak a national emergency.

Large gathering events across many countries, such as spectator sports events, concerts, religious services, have been cancelled or postponed to potential future dates. Schools and universities have transitioned to online learning. The United States Centers for Disease Control and Prevention (CDC) established guidelines that gatherings of 50 or more people should be postponed or cancelled in order to curb the spread of the virus.

The health, mortality and economic focus has become one of international concern with more than a dozen countries reporting over 1,000 confirmed cases. Increases in reported case count in these markets, as well as the growth in other locations, may occur depending on implementation of testing protocols. A key differentiation among some countries is the speed at which they can ramp up testing and identification processes across their populations.

The impact of travel and shipping restrictions in a modern, interconnected international economy has had an exacerbating effect of the outbreak into logistics and the financial markets. Financial markets have seen high volatility 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 ever-more connected across continents.

The result in mid-March 2020 has been one where a confluence of risks has come together. Additional operational and financial risks may emerge as additional events compound on 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. Morbidity, mortality, asset/liability management and operational risks are all a part of the initial and evolving story. This update to the Society of Actuaries Research Brief 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.

Section 2: Key Statistics

Reported Cases

National health organizations around the world have been fast at work in connecting with health care providers to collect current case information. Confirmed case are a function of the ability for any public health agency across countries to distribute, administer and collect results from their respective health systems. As of March 16, 2020, over 170,000 cases have been reported world-wide, and these countries have all reported over 1000 cases of COVID-19:

| Country | Confirmed Cases | Percentage of World-Wide Cases |
|--------------------------|-----------------|--------------------------------|
| China | 81,032 | 45.2% |
| Italy | 27,980 | 15.6% |
| Iran | 14,991 | 8.4% |
| Spain | 9,428 | 5.3% |
| South Korea | 8,236 | 4.6% |
| Germany | 7,174 | 4.0% |
| France | 5,397 | 3.0% |
| United States of America | 4,200 | 2.3% |
| Switzerland | 2,200 | 1.2% |
| United Kingdom | 1,551 | 0.9% |
| The Netherlands | 1,414 | 0.8% |
| Norway | 1,312 | 0.7% |
| Sweden | 1,103 | 0.6% |
| Belgium | 1,058 | 0.6% |
| Austria | 1,018 | 0.6% |

Case Fatality and Mortality Rates

World-wide mortality is currently crudely estimated at first using a statistic known as the “case fatality rate” (CFR), which divides the known deaths by the identified number of cases. Using this methodology, the CFR across the world-wide set of case information is approximately 3.9% and is generally reported by health and media publications in the 3.0% – 4.0% range. These estimates, however, often are adjusted to produce updated rates, due to the strong likelihood of under-reporting of actual cases. 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, asymptomatic and mild cases of the disease may not actively seek treatment in the local health care systems. Initial CFRs in the U.S. started in the 3.5% - 4.5%, slightly higher than the world-wide rate, primarily due to the disease initially being seen in higher age groups. As more cases have been identified, the CFR has trended downward to the 1.5% - 2.0% range. CFR and mortality rates appear to be emerging as very dependent on age, with much higher mortality rates being seen for patients over ages 70, especially for those with health conditions that weaken the lungs and immune system. Estimates of the case fatality rate for older age groups have been estimated in the 8% - 10% range from various health officials and media sources.

Recent data from the Chinese Center for Disease Control and Prevention have shown the evolving CFR curve for COVID-19 within the local population, with some benefit that the early onset of the disease and broader

availability of testing allow for some broader volume of observations. The overall CFR rate most currently was reported at 2.3%, with the following breakdown by age groups:

| Age Group | Estimated Case Fatality Rate in China |
|--------------|---------------------------------------|
| Under Age 10 | 0.0% |
| Age 10 – 19 | 0.2% |
| Age 20 – 29 | 0.2% |
| Age 30 – 39 | 0.2% |
| Age 40 – 49 | 0.4% |
| Age 50 – 59 | 1.3% |
| Age 60 – 69 | 3.6% |
| Age 70 – 79 | 8.0% |
| Age 80+ | 14.8% |

Reports from experts who have studied the data in China in detail are currently settling in on the range of 2.0% to 2.5% for the overall case fatality rate in that market. The ultimate rate of mortality from COVID-19 will evolve over time. 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 denominator of the calculation, to settle in the 0.5% - 1.0% range.

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 in China, 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.

As happens with other viruses such as influenza, climate conditions have an impact on the ability of the virus to survive. Viruses often survive better in cold weather due to coatings that allow them to survive in the air and be passed on from person to person. These features degrade in warm temperatures. The risk exists that the spread of COVID-19 may deteriorate in the late spring in the Northern hemisphere, but also then come back as a second wave in the late months of 2020.

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

Comparison to Past Pandemics and Influenza

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 have been more prominent in their impact on human illness and mortality. The SARS-CoV virus caused the severe acute respiratory syndrome (SARS) outbreak of 2003 and the MERS-CoV virus created the Middle East Respiratory Syndrome (MERS) in 2012.

The following table 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, using data as of March 16, 2020.

| 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 – 2020) | 60+ | 7,000 | 180,000 | 3.9% |

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.

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. 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 depending on the severity of the season.

Additionally, in 1918 the world faced an 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. 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. Since 1918, the world has experienced three additional pandemics, in 1957, 1968, and most recently in 2009. 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.

Health Care Cost and Utilization

Data on the cost and utilization of treatment for individuals who are diagnosed with COVID-19 still appears to be emerging. An issue in some countries, including the U.S., is that the supply of products needed to perform tests is lower than the current demand. Testing for the virus involves collecting respiratory specimens from a patient and running it through test kits at public health 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 is appearing to grow, but one constraint may also be the amount of public and clinical lab capacity that can be used or increased.

Countries around the world are looking to find ways to improve their ability to meet the demand for test and to process them efficiently. For example, in recent days medical centers within the University of California system have been converting laboratory space into in-house coronavirus testing centers. To encourage early detection and treatment, some U.S. health insurers announced that they would waive copays and cost sharing for COVID-19 detection tests. Several pharmaceutical companies have been developing and testing treatments for COVID-19, though results are still preliminary. 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. Some estimates indicate that it may take up to 12 – 18 months to know the effectiveness and safety of any proposed vaccines.

Some countries have dramatically increased capacity for testing over recent weeks, leveraging off past investments in health care infrastructure. As an example, South Korea has had a high number of detections of SARS-CoV-2 but have also seen the number of new cases decline since the start of March 2020. Approximately 250,000 tests have been administered since the outbreak started. Estimates place the daily capacity around 15,000 tests. In many parts of the country, drive-through test centers have been established to expedite the process and extend testing ability. These methods also help limit health care workers from having extended direct exposure to the virus. The United States has also commenced this process through health facilities in some states and is also eyeing expansion to private sector pharmacy partners.

Overall health care cost and utilization in many countries will also be impacted by the decisions individuals choose to make surrounding other typical illnesses that may arise and elective procedures that have been scheduled. Some patients have 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. With more encouragement by public health officials to reduce social interaction, however, and individuals potentially nervous about entering into a hospital setting where the virus may be present, more deferrals of services may occur, and minor ailments may not be seen as frequently. Telemedicine providers may see an expected rise in utilization. Low utilization of telehealth services in the U.S. to date have been typically attributed to lower consumer awareness and higher comfort with traditional methods but are expected to grow with increased emphasis on technology for social engagement and remote work.

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. 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. 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.

Insurance regulators across many markets will be discussing in coming days how claim handling and insurance premium processing may need to change in the face of the current virus pandemic. 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. On Friday March 20, the National Association of Insurance Commissioners will hold a full-day special session to discuss state response, coordination and potential guidance for the U.S. insurance industry around 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 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 quarantines. The quarantines vary broadly, including limitations on entering the country to full regional or national quarantines of the population.

In early March, the Italian government declared the entire country a "red zone," meaning people should stay home except for work and emergencies. Currently, many more countries are following suit to reduce or restrict the ability for crowds to gather in close proximity. Several U.S. states implemented earlier this week plans to close nightclubs, bars and restaurants until the end of March, with only carry-out food options available.

With these trends, the concept of "social distancing" has become common vocabulary. People have been encouraged to maintain distance between themselves and others to reduce the spread of the disease. Actuarial model simulations can illustrate the impact of social distancing. In conjunction with this SOA Research Brief, we make 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.

The following graphs, created from the model, illustrate the potential impact over time of low social distancing (Figure 1) compared to increased social distancing (Figure 2). For this modeling exercise, the healthy state includes persons who have contracted and recovered from the disease. Through these examples, one can observe the potential benefit of moderating the disease's overall impact by spreading the strain of health care systems across time. The maximum peak of both the mild illness and severe illness states are lowered, and also pushed out further in time, helping defer onset and spread the stress on the health care system. In the current environment, this phenomenon has been referred to as "flattening the curve" through a much slower pace and accumulation of ill patients.

These examples are for illustration only and do not represent actual estimates of probabilities for transition between health states due to COVID-19 or any other virus.

Figure 1
LOW SOCIAL DISTANCING

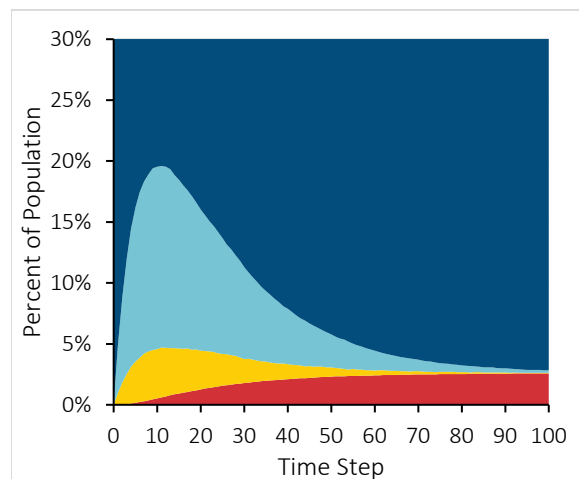
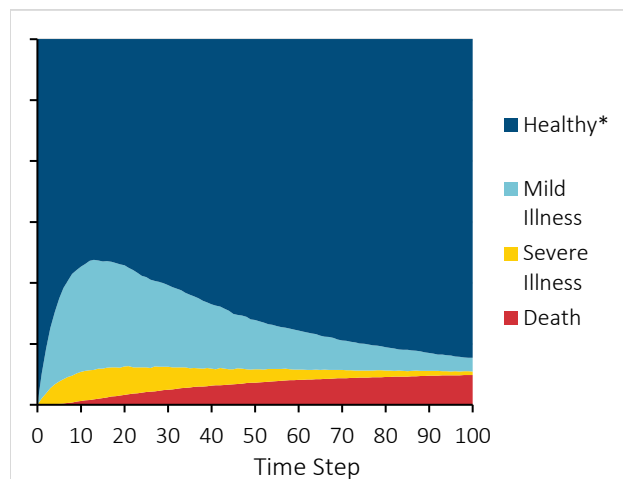


Figure 2
INCREASED SOCIAL DISTANCING



*Healthy includes individuals who have recovered as well as those not yet infected.

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.

Health and public officials have responded in several cases by canceling spectator events that would bring large groups of individuals into close proximity. 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 many world-wide professional sports leagues such as the National Basketball Association, National Hockey League, and football (soccer) matches in the English Premier League.

Section 3: Economic and Asset Impact

Macroeconomic Variables

With COVID-19 impacting business around the world, domestic and international financial markets have reacted to reflect potential lower levels of economic activity. Travel restrictions across many countries have been implemented with intentions to slow the spread of the virus. In cases where citizens and legal permanent residents are returning to countries from high-risk areas, their return often has been required to be to designated airports set up to review and inspect the returning travelers.

The U.S. Bureau of Labor Statistics released its initial report for February 2020 on March 6 and noted that the U.S. labor markets were little changed from previous months. Nonfarm payroll employment rose by 273,000 in February, the unemployment rate was relatively unchanged at 3.5%, and the number of unemployed persons in the U.S. remained at 5.8 million. This reflected the continuing general steadiness within the U.S. labor market prior to trade and commerce disruptions that resulted as impacts of COVID-19 emerged in international trade.

On Tuesday March 3, in an attempt to limit the economic and financial fallout from COVID-19, the Federal Reserve reduced the benchmark U.S. interest rate by half a percentage point to just below 1.25%, down from about 1.75%. In a similar move, on March 11 the Bank of England reduced used by banks and lenders by 0.50%, from 0.75% to 0.25%, to tackle the impact the coronavirus outbreak is having on the economy.

These moves were then followed up by an additional round of quantitative easing on Sunday March 15 as The Federal Reserve announced dropping the benchmark interest rate to 0.00%. With an anticipation of volatile financial markets, the Federal Reserve makes funds to banks available at these benchmark rates to support the liquidity and stability of the banking system and the effective implementation of monetary policy and to support the flow of credit to individuals and businesses. Upcoming reports on labor markets may start to indicate the level of unemployment changes, and the types of industries that could be subject to lower capital levels and taking advantage of financial assistance from government sources.

As the impact of the epidemic was seen to impact global economic activity, the Organization for Economic Cooperation and Development estimated that global growth could slow to 1.5% in 2020. This was approximately half the rate it projected in November 2019. Similarly, the International Monetary Fund indicated it expected global growth could slow to 2.9%, following an estimation of 3.3% in January 2020. Similar reductions in expected growth in Gross Domestic Product (GDP) for high GDP countries have been made over the past weeks, with estimates for 2020 GDP reduced by approximately 1.0%. Investment firms that project economic growth continue to revise downward expectations for output and production in the coming quarters.

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. Equity trading at the New York Stock Exchange was halted for 15 minutes early in the session on Monday March 9 as the Standard & Poor's 500 Index fell 7% from its previous close.

The week of March 9 saw one of the most volatile swings since the worldwide financial crisis of 2008. Major financial indexes ended the week with a 9% surge on Friday March 13 following a 10% decrease the day before. For the week of March 9, indexes were generally down 4 – 5%, and over 20% recent highs seen in early February 2020. The downturn continued in equity markets on Monday March 16, with circuit breakers being hit in early

trading due to initial losses on indexes and ending with a nearly 12 - 13% drop in the main U.S. equity market indexes.

Low Interest Rate Environment

Low Interest rates in major international financial markets have been more the norm over recent years, and the current impact of COVID-19 has further driven down interest rate levels. Benchmark Treasury yields in the U.S. fell nearly 100 basis points in early March since levels seen in mid-February, with the benchmark 10-year Treasury yield temporarily reaching a record low of under 0.40% and the 30-year Treasury moving below 1.00% for the first time ever. While some widening of corporate spreads was initially seen as interest rates fell in late February 2020 to maintain reinvestment yields, spread widening has not kept up with the decline in Treasury yields in more recent observations. Some reversion has occurred since the lowest interest rate levels, with the 10-year Treasury yield moving closer towards 1.00% and the 30-year Treasury yield near 1.50%.

Reinvestment Risk

With the material drop in interest rates to even lower levels, the opportunity to reinvest maturing assets becomes even more difficult for financial institutions. Maintenance of fixed income portfolio yields that support fixed interest crediting rates will pose a continuing challenge as the prolonged low interest rate environment continues.

Section 4: 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 portion of the risk for public health systems in combating the virus outbreak and for private health care providers and insurance carriers to monitor is the ability for hospitals to contend with the increasing cases. The volume of hospital beds and rooms in some national and local markets may be stressed by the outbreak, and equipment that is critical to responding to respiratory diseases may be in strong demand. 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 may already be weak or have other health conditions. Some countries have taken early measures to convert available spaces into hospitals, or additionally construct pop-up hospital settings. Hospital beds per capita in economically developed countries around the world outside the U.S. tend to average slightly above 5.0 beds per 1000 people, while recent averages in the U.S. have been approximately 3.0 beds per 1000.

Health care systems are also looking to take advantage of technology, and prevent the spread of potential virus cases, by emphasizing screening that can be done through online methods. Many healthcare systems are encouraging diagnosis through online screening methods, or through the use of chatbots that can analyze patient symptoms and give advisement on what steps individuals should take next. Through these methods, health care systems are looking to avoid the spread of the virus in common health care settings such as physician's offices and emergency rooms and avoid situations where potential virus carriers would need isolation in the hospital setting prior to formal admittance.

Supply chain risks also exist for hospitals, pharmacies and other health care providers as international shipping and delivery services play 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. Some firms are converting their facilities to begin production of medical devices that may be increasing in demand.

Remote Work

A common step implemented by many organizations around the world has been to encourage remote work environments. In this setup, employees work from a remote location outside the normal office setting, often from their own personal residence. Often, the organization will provide key technology items, such as a laptop computer or access to systems through internet connections, to facilitate a productive work environment. This helps maintain physical distance and reduce the chance of spreading disease among an employee population.

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. Many organizations may need to quickly convert paper-based processes and educate employees on effective communication through technology solutions. This has increased dramatically since the end of March as many major employers have implemented extensive remote work arrangements.

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.

Remote work also brings on new legal considerations for employers and employees, as the nature of work and requests of the employer changes in the new environment. The range of applicable laws in many countries surround how worker safety and health standards are administered, how health and disabilities laws impact employee rights, and how safety and privacy laws come into play. 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 as long as 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 have been either closing or instituting “distance learning” methods. Many parents may be juggling the need to do work for their employer while also ensuring children have appropriate care or ensuring their focus on school activities. The concern may be greatest for health care providers as they look to contend with the increasing demand of providing services, but also faced with the issue of an employee base that at the same time might be asked to attend to family care obligations. Health care systems may begin to look at alternative methods of employee benefits, such as hospital-provided or hospital-based daycare services, in order to balance the needs of their important workforce.

Internet Service Provider Capacity

With the growth of remote work, many employers are looking to determine if there will be any new or different strains on internet service provider (ISP) capacity. Remote work in large volumes across many organizations may put different pressure loads on internet service providers. 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.

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 cyber-attacks. 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 United States National Security Council acknowledged a cyber incident aimed on the U.S. Health and Human Services network.

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. Virtual Private Network (VPN) connections are expected to further increase in their usage to enable access to corporate networks remotely, but also creating a higher risk of unauthorized access and data leakage. The use of personal ISPs, and an expected growth in the use of public Wi-Fi services, create

opportunities that enhance cyber risk. In a growing era of data privacy, and the costs associated with reconciling the loss of customer data, this risk may become more prominent.

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. 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.

Event Cancellations and Restaurant Closings

Many large spectator events, concerts and professional development meetings are being cancelled around the world to prevent the spread of COVID-19 among individuals in close proximity. On March 15, the U.S. CDC expanded upon its guidance on large events and mass gatherings, and recommended that for the next 8 weeks that organizers cancel or postpone in-person events that consist of 50 people or more throughout the United States.

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 cancelled or venues are closed.

To stem the spread of the virus, especially in light of the annual celebrations of St. Patrick’s Day in many countries around the world, some jurisdictions have gone to measures to close restaurants, bars and nightclubs which are prone to larger gatherings and social interaction. As an example, in the state of Illinois, the state ordered all restaurants and bars to close to dine-in customers by the end of Monday March 16, with the closures lasting from March 16 through March 30. The state of Ohio implemented similar orders beginning at 9 PM local time on Sunday March 15. Establishments would be allowed to continue carryout and delivery services.

Impact of Property/Casualty Coverages

In addition to the impact on life and health insurance coverages, the impact of current events impacts the concepts of business interruption and personal and commercial auto coverages. Typically, business interruption policies will include mandatory exclusions to not cover virus-related losses. Some states, however, are looking to draft bills that will cause insurers to provide coverage for these types of losses. The amount of vehicle miles

traveled will be an important variable to watch over the coming months. Increased social distancing and remote work may lead to less auto coverage exposures and potentially to less auto insurance claims.

International Trade Dependency

Many manufacturing organizations around the world today are dependent on international trade and shipping systems in order 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 maintained or replaced.

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. 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.

Section 5: Previous SOA Research Highlights

Impact on the U.S. Life Insurance Industry

Over the years, many committees and sections within the Society of Actuaries (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.

The report series on **“Potential Impact of Pandemic Influenza on the U.S. Life Insurance Industry”** gives guidance through several reports on the potential impact of a disease outbreak on population and insured mortality in the United States, and additionally has information on the potential impact on financial markets, corporate bond spreads, monetary policy and economic output.

<https://www.soa.org/resources/research-reports/2007/research-impact-pan-influ-life-ins/>


Potential Impact of Pandemic Influenza on the U.S. Life Insurance Industry

Research Projects – Life Insurance

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 as a result 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

[Potential Impact of Pandemic Influenza on the U.S. Life Insurance Industry Report](#) 

[Pandemic Model Tool Documentation](#) 

[Pandemic Model Tool](#) 

[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 .7 excess deaths per

1000 of population, and the 1918 pandemic (“Severe Scenario”) produced approximately 6.5 excess deaths per 1000.

The following table summarizes the survey results in comparison to current observations under the COVID-19 pandemic:

| Estimated Asset Values | SOA Research Report | Current Environment |
|---|----------------------|----------------------------------|
| Maximum Percentage Change in S&P 500 Index within 180 days from onset; Average response for Moderate Scenario | -11% | Measuring from February 1, 2020: |
| Maximum Percentage Change in S&P 500 Index within 180 days from onset; Average response for Severe Scenario | -24% | -16.6% |
| Maximum Change in Aa Corporate Bond Yield within 180 days from onset; Average response for Moderate Scenario | Up 28 basis points | Measuring from February 1, 2020: |
| Maximum Change in Aa Corporate Bond Yield within 180 days from onset; Average response for Severe Scenario | Up 35 basis points | Up 27 basis points |
| Maximum Change in the Federal Funds Rate within 180 days from onset; Average response for Moderate Scenario | Down 27 basis points | Measuring from February 1, 2020: |
| Maximum Change in the Federal Funds Rate within 180 days from onset; Average response for Severe Scenario | Down 77 basis points | Down 150 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**” 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.

<https://www.soa.org/resources/research-reports/2010/research-pandemic/>


Potential Impact of Pandemic Influenza on the U.S. Health Insurance Industry Report

Research Projects – Health

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

[Potential Impact of Pandemic Influenza on the U.S. Health Insurance Industry Report](#) 

[Health Company Pandemic Modeling Tool Spreadsheet Documentation](#) 

[Health Company Pandemic Modeling Tool](#) 

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, To be Published March 2020](#)

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About the Society of Actuaries

With roots dating back to 1889, the Society of Actuaries (SOA) is the world's largest actuarial professional organization with more than 31,000 actuaries as members. Through research and education, the SOA's mission is to advance actuarial knowledge and to enhance the ability of actuaries to provide expert advice and relevant solutions for financial, business and societal challenges. The SOA's vision is for actuaries to be the leading professionals in the measurement and management of risk.

The SOA supports actuaries and advances knowledge through research and education. As part of its work, the SOA seeks to inform public policy development and public understanding through research. The SOA aspires to be a trusted source of objective, data-driven research and analysis with an actuarial perspective for its members, industry, policymakers and the public. This distinct perspective comes from the SOA as an association of actuaries, who have a rigorous formal education and direct experience as practitioners as they perform applied research. The SOA also welcomes the opportunity to partner with other organizations in our work where appropriate.

The SOA has a history of working with public policy makers and regulators in developing historical experience studies and projection techniques as well as individual reports on health care, retirement and other topics. The SOA's research is intended to aid the work of policymakers and regulators and follow certain core principles:

Objectivity: The SOA's research informs and provides analysis that can be relied upon by other individuals or organizations involved in public policy discussions. The SOA does not take advocacy positions or lobby specific policy proposals.

Quality: The SOA aspires to the highest ethical and quality standards in all of its research and analysis. Our research process is overseen by experienced actuaries and non-actuaries from a range of industry sectors and organizations. A rigorous peer-review process ensures the quality and integrity of our work.

Relevance: The SOA provides timely research on public policy issues. Our research advances actuarial knowledge while providing critical insights on key policy issues, and thereby provides value to stakeholders and decision makers.

Quantification: The SOA leverages the diverse skill sets of actuaries to provide research and findings that are driven by the best available data and methods. Actuaries use detailed modeling to analyze financial risk and provide distinct insight and quantification. Further, actuarial standards require transparency and the disclosure of the assumptions and analytic approach underlying the work.

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