Managing Influenza Pandemic Risk

Antibody

Virus

HA Antigen

Mutation

Viral RNA

Mutation of HA Gene

Risk Management Solutions TM
Many companies now recognize that a severe influenza pandemic could pose a threat to the continuity and viability of their businesses. Insurance companies are particularly vulnerable as they could experience unprecedented losses from claims, downturns in their investment portfolio, and reduced staff productivity from sickness. Understanding pandemics helps companies make decisions about the best ways to protect themselves.

Science-based Modeling

A wealth of scientific information about influenza and pandemics is available. Virology provides insights into the influenza virus, how it mutates, and how it causes illness in humans. Epidemiology shows how disease spreads through a population. Historical studies assess the frequency and impacts of past influenza epidemics.

Catastrophe Model Framework

Risk Management Solutions (RMS), the leading provider of catastrophe risk models for property and casualty insurance, has been developing analytical models since the early 1990s. The RMS® Influenza Pandemic Risk Model employs many of the techniques pioneered by RMS to quantify catastrophe risk.

World-leading Expertise

RMS has benefited from the advice of some of the world’s leading authorities in developing an influenza pandemic risk model. A modeling framework has been created using the best medical science to estimate potential losses to the financial services industry. New medical research, case history, and pandemic surveillance data also add to our understanding. The model provides a framework for evaluating new medical developments and refining risk assessments over time.

Probabilistic Risk Analysis

A stochastic event set of nearly 2,000 pandemics provides a representative suite of permutations of all the major variables affecting their impact, together with their probability of occurring. The likelihood and severity of pandemic losses to life and health portfolios can be assessed in over 30 countries. Portfolio-specific risk metrics help companies understand the scale of risk they face, and inform decisions about risk transfer and portfolio management.

Scenarios and Timelines

Business continuity planning requires an understanding of the likely levels of absenteeism, disruption to suppliers, and loss of market demand. Representative pandemic scenarios are modeled in detail to provide timeline data on the likely numbers of employees, customers, or policyholders suffering different degrees of illness each week. An additional narrative of events provides context for decision-makers.

Investment Strategies

Pandemics can have a severe impact on the economy, causing direct losses, supply shock as the labor force is debilitated by illness, and a reduction in demand as consumers stay home. Investors who understand the likely impacts of pandemics across the economy, their timing, and sectoral differentials are able to develop strategies to minimize the effects of a pandemic on an investment portfolio.

RMS Products and Services

The RMS® Infectious Disease Model is a desktop software system available for licensing by insurance companies to manage the risk of pandemic influenza and other infectious diseases. This model enables companies to maintain a database of their exposure and to monitor their risk as the portfolio changes or as new scientific developments improve our understanding.

RMS modeling expertise is also available for consulting projects, including analytical support and creative solutions for the management of influenza pandemic risk.

Some strains of the influenza virus, like H5N1, are so virulent that medical teams require full protective gear to treat victims. A potential pandemic with a virulent virus would cause an unprecedented impact on populations and the world economy. (Image: www.info.gov.hk)

Scientific knowledge about infectious diseases is continually developing. Accounting for the latest scientific developments can improve business management decisions. (Image: USDA Photo by Peggy Greb)
The 1918 Pandemic

Just as World War I was ending, a virulent flu virus spread from country to country, killing over 40 million people worldwide. Unusually, half of the deaths were of young, previously healthy adults. In most flu epidemics, children and the weak or elderly are at greatest risk. However, in 1918 the new H1N1 strain of flu caused a response known as cytokine storm that affected young adults, over-stimulating their immune systems and causing organ failures.

Counting the Cost

The 1918 pandemic touched nearly every country in the world. Mortality varied considerably, with less developed countries being most affected. India, where both living conditions and health care were poor, may have accounted for up to 40% of worldwide mortality.

Pandemics in History

A pandemic – a wave of infection engulfing several countries – is caused by a mutation of the influenza virus to overcome human immunity. Humans gradually adapt to the new virus and develop increasing immunity over time. Eventually a new strain that beats the immunity evolves, triggering the next pandemic. Records show that this cycle of influenza pandemics has occurred throughout history.

One of the earliest pandemics attributable as influenza struck Africa, Europe, and the Americas in 1580. Diseases that were probably influenza can be chronicled as far back as 412 BCE. During the past three centuries, pandemics have occurred every 10 to 60 years, averaging every 24 years. There is no indication that pandemics are becoming any more frequent, but some of the conditions that foster the mutation of the influenza virus, such as the ‘reservoirs’ of domestic pigs and poultry, have increased greatly during recent decades.

Variation in Pandemics

The historical record shows that there is considerable variety in the types of pandemics that occur, including how fast they spread, virulence of the virus, types of victims, and other characteristics. Estimating the severity of a possible future pandemic means understanding how these characteristics could occur in a new virus strain.

The severity of a pandemic is largely a function of how infectious the virus is, and how virulent it is in those it infects.

Infectiousness

Infectiousness controls the speed with which a pandemic spreads through the population and the total number of people infected. The infectiousness of a virus is indicated by its initial reproductive number, $R_0$ (the average number of new infections caused by each infected case). $R_0$ depends on contact rates with other people, duration of infectiousness, and likelihood of contacts becoming infected.

Virulence

The virulence of a virus determines how severely ill it will make a patient. It is measured by the case mortality (the proportion of infected people who die). Viruses affect their hosts in different ways according to their genetic structure, and vary considerably in their virulence.

Seasonal flu has a low case mortality (around one person per 1,000 cases), but even so, around 40,000 Americans die of seasonal flu each year. The 1918 virus had a case mortality over twenty times higher than seasonal flu. The H5N1 influenza virus in birds causes severe illness when it infects humans – over one third of human cases die. However, in its current form is not easily transmitted between humans.

Clearly a pandemic virus with a high case mortality could be an unprecedented disaster for humankind. There is some evidence that a flu virus may lose some of its virulence as it evolves to become human-to-human transmissible.
Future Pandemic Characteristics

The next pandemic, whenever it occurs, will be the result of another mutation of the influenza virus. Influenza strains are evolving all the time, and each year our seasonal flu has a subtle new variation, requiring a new vaccine each season to combat it. The jump to a new strain (antigenic shift) cannot easily be predicted, as it is essentially a random process, and the characteristics of the new strain cannot be known until it occurs. History and underlying science help us estimate the probability distribution of the infectiousness and virulence of a future pandemic virus. Understanding the likelihood of different characteristics of a pandemic virus enables risk managers to plan appropriate and cost-effective preparedness measures.

Future Pandemic Impacts

The world has seen vast changes since 1918. Public health has been transformed: diet, hygiene, and life expectancy have improved. Medical science has found ways to combat many of the ailments and diseases of previous generations. Anti-viral drugs and antibiotics are available to combat future pandemics. Yet in some ways the world has become more at risk from pandemics – international air travel volumes means that a pandemic will spread far faster, modern cities provide large, dense clusters of population for disease transmission, and society is far more inter-dependent and vulnerable to disruption than in previous generations.

A future pandemic could have different characteristics of infectiousness and virulence to those seen before, in addition to taking place in an environment that is radically different than those of the past. The RMS® Influenza Pandemic Risk Model provides risk managers with an analysis of how potential future pandemics will affect the world today.
The RMS® Influenza Pandemic Risk Model uses epidemiologic modeling known as SIR modeling to determine how a pandemic virus would impact today's population. The model uses proven epidemiological techniques to explore key variables, such as how vaccines, anti-viral drugs, and other response plans will reduce potential impacts.

**SIR Modeling**

SIR modeling calculates the number of people in a population that are susceptible, vaccinated, have been exposed, are currently infected, or have recovered or died from the flu at a given time period. This modeling enables an understanding of the transmission dynamics of flu and how variables such as vaccination, geography, immunity, treatment, and viral characteristics affect the spread through a population.

**Spread of Disease**

At the start of a pandemic, most of the population is susceptible. Infected 'index cases' spread the disease to their close contacts, who then become infectious and pass it on to others. Those who are infected either die or recover, possibly after treatment. A person who recovers from influenza usually develops antibodies that make them immune from a repeat infection.

Individuals with natural or acquired immunity have an important role in containing spread. As the pandemic progresses, infected people come into contact with fewer people who are still susceptible and more who are immune, slowing the spread of the disease until the pandemic fades.

**Limiting Spread**

The spread of the disease depends on the infectiousness of the virus itself as well as on the number of contacts an infected person makes. Infections spread faster through communities with large families, and...
through dense cities where citizens come into close contact (such as on public transport). Infections also spread through schools, workplaces, and other contact places. Disease spread can be reduced by good quarantine measures and ‘social distancing’ to decrease contact possibilities in the general public.

**Vaccination**

Vaccination provides immunity from infection. Large scale vaccination is an extremely effective way of reducing a pandemic impact. However, influenza vaccines need to be specific to the strain to be the most effective, and the strain is only known after the outbreak has occurred. It may take several weeks to isolate the virus, several more months to produce large numbers of vaccination doses, and additional time to vaccinate the population. Pandemic protection efforts are focused on speeding up vaccine availability and slowing the spread of the disease long enough for the vaccine to become available.

The current worldwide capacity to manufacture vaccine, mainly based on incubating cultures in chicken eggs, is insufficient to combat a global pandemic. Many countries are investing in new vaccine production capabilities. New processes, such as cell culture, ‘whole-virus,’ and adjuvant technologies promise big improvements to vaccine production, but may take some years to be effective.

Generic or poorly matched vaccines may be of some assistance. Some countries feel it is worthwhile to stockpile a vaccine for the worst strains, such as H5N1, just in case.

**Anti-viral Drugs**

The first wave of the pandemic will likely have to be contained without a vaccine. Anti-viral drugs, such as Oseltamivir (Tamiflu®) and Zanamivir (Relenza®) combat the severity of influenza infection symptoms. Anti-virals reduce the likelihood of deaths, and by reducing the viral load of the infected person, can also reduce the likelihood of them infecting others. Many governments have decided to stockpile anti-viral drugs to combat a future pandemic.

**Quarantine and Social Distance**

Initial outbreaks of infectious disease are treated by isolating known cases, tracing and treating their contacts, and quarantining a disease cluster. Pandemic response plans commonly include social distancing. This includes closing schools, suspending public events, and minimizing social contact between families and at work. Travel restrictions or closure of borders may also be enacted.

Such measures may slow the spread of the pandemic through a territory and postpone its peak, but on their own may not reduce the eventual number of infections unless vaccines become available during that time.

**National Preparedness Plans**

Although a pandemic is global, response to it will be managed by each individual country in their own way. There is wide variation in the approach, resources, and prioritization of the pandemic preparedness plans of different countries. Modeling the effects of each country’s strategy informs the risk assessment.

**Public Reaction**

If the pandemic is severe, or if the virus is virulent, people will take their own measures to avoid becoming infected, such as keeping their children home from school, reducing social contact, and possibly staying away from work. Absenteeism could become a major problem and cause businesses to suspend operations. The economic impact could be extensive, creating a period of shortages and severe social disruption.

**A Multi-year Event**

A pandemic typically recurs in waves. The original virus mutates and returns, causing subsequent waves of infection, usually milder, until it displaces the previous strain as the seasonal flu virus. Risk management plans should expect this cycle to take several years.
Timeline of a Pandemic

Fictional Pandemic Influenza Scenario
Fast Spread, High Virulence
Initial Rₚ of 2.75, Initial DpC of 2.5%

- 15 Jan: Newspaper headlines announce the news. Stock markets worldwide react badly. The Rₚ is thought to be 2.5-3.2, but the virulence can not be measured yet.
- 22 Jan: A suspected case is reported in Singapore. WHO issues anti-viral drugs to health authorities in SE Asia.
- 28 Jan: 22 are dead in Vietnam, 400 in hospital. Death rate appears to be 1 in 40. The media now refer to it as 'Hanoi Killer Flu'.
- 12 Feb: Several hundred cases suspected in Hong Kong, others throughout SE Asia.
  - Japan issues Tamiflu to primary healthcare workers and everyone over 75 or under 15. Distribution of 4m doses takes 8 days.
  - 26 Feb: U.S. government bars travel to worst-affected SE Asian countries. Australia closes borders to all air travel except that 'essential to national security'.
  - 5 Mar: WHO declares global pandemic, 1,000 die in Vietnam in a week; 10,000 cases in China; death toll in Japan is 20.
  - 12 Mar: Clusters of cases in Los Angeles.
- 19 Mar: First death in U.S. Schools in California close. Absenteeism increases in West Coast businesses.
- 25 Mar: Japan has 30 cases and 12,000 dead; mortality is 1 in 100. Reduced by Tamiflu. U.S. sports events and public gatherings are canceled; NCAA basketball championships played for TV to empty stadium.
- 2 Apr: U.S. death toll reaches 42, with outbreaks in several major cities. Schools suspended and many offices closed.
- 9 Apr: First cases in Europe, UK issues Tamiflu to 169 doctors.
- 16 Apr: Hanoi flu strain isolated by L’Institut Pasteur in Paris.
- 23 Apr: Tamiflu stocks running low in U.S.; black marketers prosecuted.
- 14 May: U.S. reaches 2m cases. Many businesses suspend operations.
- 21 May: First test batches of vaccine produced; testing begins. Stockmarkets lift.
- 28 May: 20m deaths in each week in China; death toll passes 1m there. Extensive quarantine and travel restrictions in China.
- 4 Jun: Death rate dropping in Vietnam; a quarter of a million have died.
- 25 Jun: Pandemic peaks in U.S., with 15% of population already affected, 100,000 dead.
- 2 Jul: Vaccine approved, but two doses needed for effective protection. 40m doses released.
- 9 Jul: U.S. death toll reaches 1m.
- 23 Jul: Vaccination campaign announced in U.S. It will take 9-12 months to vaccinate everyone.
- 28 Aug: Deaths in China have peaked at 10 million.
- 8 Oct: Demand for life insurance increases.
- 19 Oct: Second wave of infection starts.
- 26 Nov: WHO announces world pandemic again.
Influenza pandemic is a long-term, inherent risk, rather than a new, transient threat. Periodic headlines about a new flu virus appearing in birds or other animals may suggest that pandemic risk has suddenly increased, but the threat of a novel human influenza strain emerging is always present.

It is also clear that pandemics have the potential to cause losses far beyond the range of the average volatility of annual mortality – they have to be analyzed as rare physical events, not as a statistical variation.

The risk of an extreme pandemic event needs to be managed in the same way as other potential extreme losses to which an insurance company is exposed. The risk needs to be well understood, and systems put into place to ensure that it is routinely monitored and managed.

**Probabilistic Modeling of Loss**

The RMS® Influenza Pandemic Risk Model simulates large numbers of different pandemics to explore the potential impacts of all major variables, weighted by their likelihood of occurrence. The likelihood of a pandemic occurring is incorporated based on how often pandemics have occurred in history, and using modern virology to understand the mutation of the influenza virus. The model provides insurance companies with the frequency and severity of losses to their portfolio.

Each life or health insurance portfolio will experience different levels of loss in a pandemic. To analyze the risk to a specific portfolio, the insurer needs to input the geographical distribution of policy-holders and financial compensation terms. Death rates vary by age so the age demographics of the policy-holders must be factored in. Other characteristics of the portfolio that influence pandemic losses, such as its underwriting selection process and resultant general mortality performances, can also be considered.

**Risk Transfer Decisions**

The analysis of the frequency and severity of losses to a particular portfolio provides vital information for risk management. A company can assess the adequacy of its surplus capital to meet the likely losses at key return periods. Many companies manage their portfolios and capital to ensure that they have sufficient resources to meet their losses at specific benchmarks. For example, the loss with a 1-in-100 or 1-in-250 chance of occurring each year. In addition, the company could assess how much risk transfer protection it might need, in terms of additional reinsurance or alternative risk transfer (ART). Risk transfer arrangements should be multi-year since pandemics waves can recur for some time.

If an ART solution is needed, the probabilistic output of the modeling can be used to design a bond that will prove attractive to investors, balancing risk returns with the level of protection provided.

**Portfolio Management**

The model output also shows which demographic sector, territory, and business unit within the portfolio is contributing the most risk, and the characteristics of pandemics that pose the greatest threat. These can be used to diagnose the risk and to develop risk management. New underwriting strategies can rebalance the demographics and geographical spread of a portfolio over time, to avoid the worst concentrations of high-risk.

Urban populations may be more at risk. Insurance companies need to know the profile of their portfolio since their losses will depend on the age, socio-demographics, and location of their policy-holders.
Urban Concentrations

Many portfolios of life and health insurance have an urban bias, making them more vulnerable to a pandemic. In general, urban populations are expected to suffer higher sickness rates than the national average, due to denser populations that provide more social contacts to spread the infection. In addition, cities are often major travel hubs that will receive the infection first and more severely.

Age Distributions

In milder influenza pandemics, the age groups worst affected are likely to be the old and the very young, suffering from lung infections and respiratory difficulties. However, as occurred in the 1918 outbreak, some pandemic viruses are likely to trigger ‘cytokine storm’ reactions in which over-stimulated immune systems cause organ failures. This reaction may preferentially affect healthy young populations with the strongest immune systems. Insurance portfolios with a higher representation of younger people could find that they do better than the general public in mild pandemics, but are more affected by severe pandemics.

Systems and Monitoring

Pandemic risk is a standard part of offering life and health insurance. It should be an explicit component of the pricing of insurance products that are exposed to it and incorporated into the catastrophe risk management of a company. All portfolios change over time and by routinely updating exposure data and monitoring its pandemic risk, management can track how the risk is changing. A multi-business unit assessment will ensure that the correlation of risk in different books of business is quantified. Improvements to the data captured during underwriting may be required, and portfolio management systems may need to be modified to incorporate influenza and other infectious disease susceptibility.

Once a Pandemic Breaks Out

Having good exposure data will enable an insurer to make forecasts of their likely losses some time in advance once a pandemic has started. The characteristics of a pandemic can be identified within weeks of the initial outbreak, and these can be modeled to give the likely severity and demographics of expected losses. This will support preparedness planning, may facilitate steps to mitigate the losses, help with claims management, and provide a strong analytical basis for reporting to shareholders and analysts.

A Shared Risk

Pandemic risk is shared among several stakeholders: insurers, government agencies, health care providers, and the general public. Insurers can work with these other groups to minimize future risk. For example, insurers can try to make sure that their insureds are fully aware of how best to respond if a pandemic hits, or even ensure that they will have access to anti-viral drugs and other health care. In other areas of risk, such as terrorism and natural catastrophe, insurers work with government agencies, co-share in risk transfer mechanisms, and lobby for government resources for mitigation. In collaboration, these groups reduce the risk that everyone shares.

The RMS® Influenza Pandemic Risk Model uses an event tree to produce probability-weighted scenarios.
Business Continuity Planning for a Pandemic

The next pandemic could be mild, moderate, severe or very severe. It could be a rapid event that is over in weeks, or it could be drawn out over many months. It could be virulent and frightening, killing some of its victims and terrorizing the population, or it could be debilitating, making large numbers of people sick. It could strike hardest at the old and young, or it could have its worst impact on young workers.

Preparedness for a pandemic means being aware of how each of these different characteristics might unfold and affect the population and the workforce. It is useful to consider a range of different scenarios when preparing for a pandemic.

**Business Continuity Plans**

Pandemic contingency plans for an organization should aim to ensure continuity of essential operations during an extended period of high illness rates in the workforce, suppliers, and customers. It should ensure that employees are not exposed to a high risk of infection in their workplace, and aim to resume operations rapidly and competitively as soon as the pandemic cycle is over.

Plans need to be made well in advance – by the time staff are becoming ill, it may be too late for improvised measures to be effective. Having escalating stages and guidelines in place beforehand will help managers time their actions effectively. Objective criteria, such as the number of cases reported in the same city, are useful to trigger plan implementation stages, such as if and when to close offices.

Timeline scenarios of likely impacts per week for different types of pandemics can be useful to develop and test preparedness plans, and to rehearse them in management training exercises to improve operational effectiveness in dealing with a pandemic.

**Critical Business Processes**

Critical business processes can be protected by allocating additional back-up personnel, diversifying activities across multiple locations, and maximizing home-based working. Additional investments in spare workplace capacity might be needed, training more personnel to take over essential roles, and improving IT capability. Plans should anticipate that suppliers, equipment providers, and support companies will be unable to function for some time, and stockpiles of essential supplies established. Telecommunications infrastructure may be unable to cope with the greatly increased demand from everyone trying to minimize face-to-face meetings. In an addition, life and health insurance companies may need claims management strategies to deal with the expected peak loads of claims during the pandemic.

**Protecting the Workforce**

During a pandemic, employees are likely to become infected from their families, their children, or contact outside the workplace. Social contacts in the workplace then spread infection through the workforce. Lower-contact work environment practices that minimize the risk of infection spread include a well-informed workforce, fewer face-to-face meetings, rigorous hygiene, and frequent biological cleaning of common area surfaces. Reduced contact between staff and the general public or customers, along with review of the company travel policy, will also help. Ultimately it may be necessary to close offices – well before staff are infected – to prevent spread of a virulent virus.

Health care access for staff is essential. Policies to ensure access to medical care as well as availability of anti-viral drugs, vaccines, and other medication will minimize both the chances of infection and the severity of illness. Keeping track of the health of the workforce and monitoring those infected will be essential business management information.

**Returning to Work**

Staff who recover from a case of the pandemic influenza are unlikely to catch it again and are no longer infectious to others. Vaccines will likely become available after some time. Recovered and vaccinated staff can return to work. As the pandemic subsides, resuming operations rapidly and efficiently could become a competitive issue. After the pandemic, functioning companies may experience above-normal rates of business from deferred orders.

**Justifying Investments**

Preparedness measures may involve time, cost, and investment. In the event of a pandemic, they could have significant benefits in terms of reduced staff sickness, improved business continuity, and better competitive positioning. Modeling analysis and qualitative assessments using scenarios can help in assessing and prioritizing the benefits resulting from an operational plan, to decide what investments are justified. The potential liability associated with taking no action or making no preparation may be difficult to quantify, but should also be considered.
Any significant pandemic will hit the population and economic workforce of key countries driving the global economy, likely causing losses in the financial markets. Investment managers need to understand the dynamics of pandemics and their likely impact on economic assets in order to develop effective strategies to minimize investment loss.

The economic impact will be driven by the overall severity of the pandemic across different economic sectors, the geographic markets affected, and the perception of analysts and investors at different points in the pandemic cycle. The modeling of pandemics can be used to support an investment strategy to minimize losses to an investment portfolio during a pandemic.

**Downturn Duration**

Several analyses suggest that while moderate pandemics will cause a temporary downturn, in time markets should recover without long-term devaluation. For many investors, the key issue will be waiting out the spike of the market downturn until it recovers. Modeling the dynamics of employee sickness shows the duration of productivity loss and how this varies with different characteristics of the pandemic.

Early indications of the infectiousness of the pandemic may provide a guide to the coming duration of economic impact.

For companies faced with a need to call on assets, such as life insurers needing to pay claims on pandemic victims, it may be possible to plan or delay the timing of calls or arrange bridge financing for liabilities.

**Hedging**

Some sectors and assets will be more affected than others during a severe pandemic. The economic impact of a pandemic will be felt through:

- **Direct cost** – the costs of responding to the crisis, providing care and compensation to those afflicted, and repairing damage
- **Supply shock** – loss of productivity due to absenteeism of labor
- **Demand shock** – reduction in demand for goods because of consumer sickness

Different sectors of the economy are vulnerable to each of these economic effects. Large labor industries will suffer supply shock. Consumer businesses will be more affected by demand shock. Certain types of pandemics will have different relativities: a slowly spreading, deadly virus will cause panic, resulting in massive demand shock, but may not have a great impact on supply shock. By contrast, a fast low-virulence virus will cause a substantial supply shock, but only moderate demand shock. Investment assets can be assessed relative to their vulnerability to these pandemic characteristics. A hedging strategy involves diversification of the investment portfolio to offset the assets that will be worst affected with those that will be least affected or positively impacted.

**Market Dynamics**

Information about the pandemic will be a key asset in determining the likely outcomes. As the pandemic progresses, its characteristics will become clearer over time, and market estimates will drop and correct in reaction to the news. The characteristics of the pandemic – its infectiousness, its virulence, its demographic impact, and ease of developing a vaccine – will become apparent in a number of stages that can be expected weeks apart. Markets will move as each of these new aspects are revealed. There is potential for investment optimization by anticipating market movement based on assessments of the likely pandemic development.

**Investment benefits**

By understanding the characteristics of pandemics, the different types that could occur, and the potential timelines of their impacts, investors can develop a strategy that balances geography, asset classes, timing, and sectoral exposure. Modeled scenarios enable investment managers to know what to expect. Investors will then be able to interpret breaking information to manage their portfolios optimally through the crisis of a pandemic.
**Infectious Disease Model**

The RMS® Infectious Disease Model is a desktop software system that enables insurers to analyze and manage catastrophe risk to life and health portfolios. The first model released within the model is the Influenza Pandemic Risk Model, which covers loss and casualties from nearly 2,000 influenza pandemic events in over 30 countries worldwide.

**Consulting Solutions**

RMS consulting services provide assistance with using scientific and modeling insights in the business management of pandemic risk, including quantification of potential losses and company planning scenarios. RMS has helped insurers, reinsurers, brokers, corporations, health care providers and government bodies perform the following:
- Loss modeling for life, health, and workers compensation lines of business
- Evaluation of pricing structures
- Assessment of underwriting guidelines and risk scoring
- Influenza pandemic risk securitization

**Business Continuity Planning**

Business continuity planning ensures:
- Essential services and operations continue during an extended period of high illness rates in the workforce
- Employees do not suffer higher rates of infection through office interaction than the general population
- Company resumes operations rapidly and competitively when pandemic cycle is over

**Investment Strategy**

RMS solutions can also help the investment community to:
- Understand how pandemics of different characteristics will affect different investment assets
- Develop timelines for investment action
- Keep abreast of timely information

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**Model Highlights**

**Geographical Scope**

Australia, Austria, Belgium, Canada, China, France, Germany, Hong Kong, India, Indonesia, Ireland, Italy, Japan, Malaysia, Netherlands, Philippines, Poland, Russia, Singapore, South Africa, South Korea, Spain, Sweden, Switzerland, Taiwan, Thailand, Turkey, United Kingdom, United States, Vietnam. Other countries by request.

**Modeled Insurance Lines:**

Life (Individual, Group, Other), Health, Workers Compensation, Other

**Deterministic (scenario) and Probabilistic loss analysis options:**

A suite of influenza pandemic scenarios capturing the permutations of key variables including virus infectiousness and virulence, morbidity age profile, location of outbreak, and pandemic life cycle. The model also factors in vaccine production and efficacy, as well as various national counter-measures.