CRObriefing

Emerging Risks Initiative – Position Paper

Influenza Pandemics

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Influenza pandemics

A prominent example of a mortality shock event

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The Chief Risk Officer (CRO) Forum's Emerging Risks Initiative is committed to continuously improving the understanding and management of risks.

This document provides a consolidated view of the potential impact of the 1918 "as if" scenario. The publication shows an approach to simulate a mortality shock event such as a pandemic. It also investigates the question of which excess mortality would likely arise today if an influenza pandemic as severe as the Spanish flu of 1918 were to occur.

It is concluded that excess mortality today would be much lower, and that a simple extrapolation of the excess mortality rate observed in 1918 to today's global population is unrealistic. Nonetheless, an influenza pandemic would represent a material tail event for the insurance industry.

The paper seeks to address rating agencies, analysts, governments, regulators, intermediaries and risk-modelling firms alike.

This study is non-binding and for reference purposes only.

Executive summary

Experts believe a pandemic event will occur in the foreseeable future, but their views vary widely regarding how it will unfold and what excess mortality figures will result. Although analyses of past pandemics provide an insight into possible future scenarios, a simple extrapolation of statistics can be highly misleading. However, the 1918 Spanish flu is often used as a basis for projecting the possible impact of a severe pandemic. Looking at the overall circumstances under which the 1918 influenza broke out, the authors seek to draw realistic comparisons with the current situation and to assess the potential impact of an influenza pandemic on the (re)insurance industry as well as to identify steps toward better preparedness.

With today's medical technology and hygiene practices, populations are now far better equipped to deal with life-threatening disease. In addition, global health monitoring and aid organisations (notably the World Health Organization, WHO) have developed sophisticated alert systems to cut reaction times and boost efficiency in the event of an outbreak. Taking into account many relevant factors, the authors conclude that in projecting excess mortality of a flu pandemic to today's world, 1918 figures should be substantially reduced. Nonetheless, the impact of a pandemic could still be profound. Urban areas are more densely populated now, and human mobility is substantially increased, making containment of a disease more difficult. By the time a pandemic is classified as such, it may have spread into multiple and unknown locations.

The insurance industry must evaluate the financial repercussions on both sides of its balance sheet. Expenditures on claims can be expected to rise, with major losses concentrated in a company's life insurance portfolio, while asset values may fall due to market (over)reaction – to what degree is largely dependent on the magnitude of the pandemic event.

An insurance company's risk management should include reliable business continuity planning (BCP) to ensure that operations can keep running despite a pandemic event. In addition, insurers can apply risk-modelling methods and stress tests to help better understand the potential impact of adverse scenarios such as pandemics. Based on this knowledge and depending on its risk tolerance, a company can reach an informed decision on which risk-mitigating measures to take.

The staff members of the Shijiazhuang Epidemic Prevention Station do the sampling from a simulative patient during an anti-bird flu drill in Shijiazhuang, North China, November 2005.

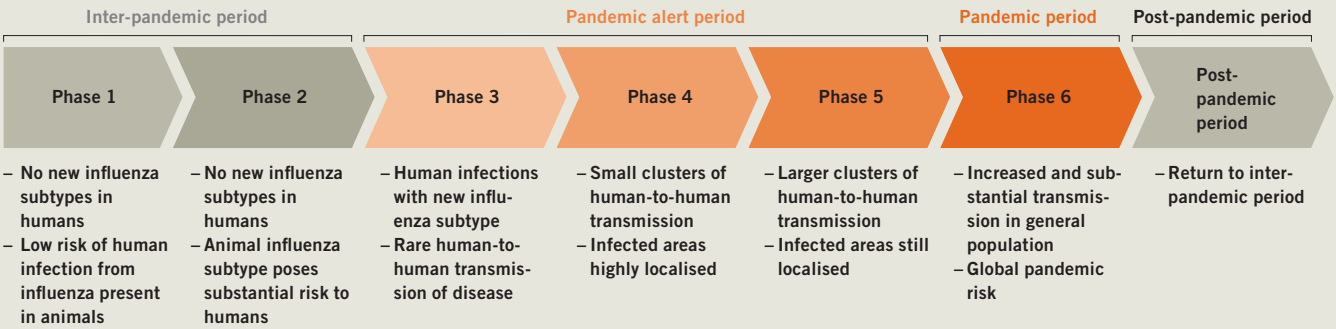
01
Influenza pandemics – A continued threat under changed conditions

There has been much speculation about the likely timing and severity of the next influenza pandemic, with some of the scenarios presented simply extrapolating the excess mortality experienced in the 1918 influenza pandemic to today's global population. The Chief Risk Officers of the Emerging Risks Initiative have thus assessed the threat posed by a pandemic flu and its potential impact on the insurance industry. Their conclusions are presented in this paper.

An influenza defined as a pandemic is different: depending on the influenza strain, a pandemic may be significantly more widespread than seasonal influenza, with faster onset and transmission, as well as sustained peak activity, resulting in higher mortality rates. In addition, it can occur in more than one wave of infections. Usually, the human immune system has no sufficient pre-existing defence, which increases the likelihood of life-threatening disease in those infected. In addition, today's globalised world may even enhance the spread of a pandemic virus, e.g. via increased travelling and transport activities.

Today's global health community is better equipped than ever to respond to a pandemic, due to medical progress, in addition to reaction plans, communications and alert systems. For example, the WHO divides the development of potential pandemics into six phases (see chart below). The current global status is defined as a Phase 3 pandemic alert: a new influenza virus subtype (H5N1) has emerged, predominantly affecting birds but already causing disease in humans. However, human-to-human infection is extremely limited, occurring only in cases of close contact with livestock. Should the virus undergo a series of genetic changes, it could begin spreading efficiently among humans and thus become the origin of a human influenza pandemic. Still, the insurance industry is well aware that the next pandemic does not necessarily have to be caused by an avian flu virus, nor does it have to be an influenza virus at all. Pandemics caused by other pathogens may be equally – if not even more – severe. In this paper the focus is on influenza pandemics only – as an example of a mortality shock event and its potential impact on the insurance industry.

Phases of the WHO pandemic alert system



Present status in Phase 3, with rare human-to-human transmission of the disease.

Source: Roche, WHO

1918/19: Between 25 and 50 million people went down with Spanish flu. Most of them died from acute pneumonia within a matter of hours.

02
Flu pandemics in the 20th century

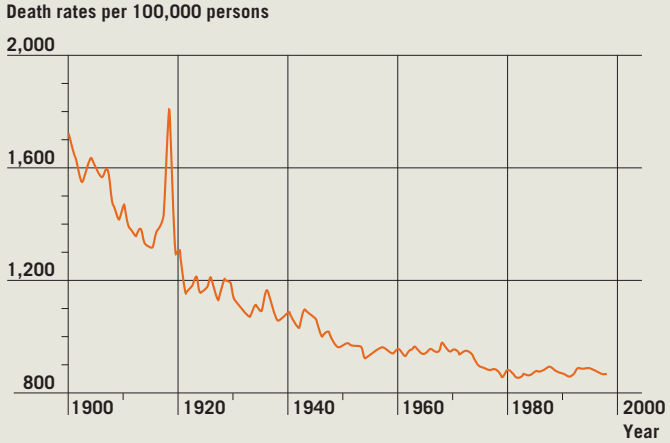
An analysis of past scenarios is an essential prerequisite for a realistic evaluation or forecast of a potential future threat. For this reason, the three flu pandemics that occurred in the 20th century are examined here. The mortality rates in industrialised countries caused by two of these, the Asian flu in 1957/58 and the Hong Kong flu in 1968/69, are statistically barely noticeable. The effects of the two pandemics in the latter half of the century vanish in the context of average mortality fluctuation throughout the century.

The mortality impact of an earlier flu pandemic, the Spanish flu of 1918/19, is on an entirely different scale. In fact, the world had seen nothing comparable for centuries. The Spanish flu was characterised by infection rates of up to 25% of a country's population – in some countries even higher – and an estimated global death toll of 25 to 50[1] million people, or 2–4% of the world's population at that time. Estimates of excess Spanish flu mortality in the US range between 5 and 6‰, depending on the source. This represented an increase in baseline mortality of around 30%.

Precise data from non-industrialised countries is scant. Information is often inconsistent and of questionable accuracy and robustness, and estimates are not always based on reliable interpretations of historical data. Recent projections – particularly by revisiting data from Asia – result in global estimates even beyond 50 million deaths.

Another aspect that sets the 1918 flu apart from the other flu pandemics is that it disproportionately affected healthy young adults aged 20 to 45, resulting in an unusual W-shaped mortality curve, as shown in the graph on page 5. This pattern is relevant to the (re)insurance industry, as the younger ages are represented to a higher extent in insurance portfolios than in the overall population.

Death rates in the USA



Only the 1918 Spanish Flu mortality peak clearly protrudes from crude death rates in the US during the last century.

[1] Niall P. A. Johnson and Juergen Mueller, "Updating the Accounts: Global Mortality of the 1918–20 'Spanish' Influenza Pandemic", in: Bull. Hist. Med. 76, 2002, pp. 105–115.

The Spanish flu in 1918 was also unique in that it came in three waves in little less than a year. It consisted of a northern spring and fall wave in 1918, and a winter wave in early 1919. However, the pattern was not universal, with pronounced regional differences; for example, Australia experienced only a single but longer wave. In most areas, it was the second wave that exhibited the highest attack and mortality rates. The third wave was also severe in some regions, but did not reach the proportions of the second wave.

The Spanish flu appeared nearly simultaneously in North America, Europe and Asia. Within Europe, it first hit Germany, France and Spain. It then emerged in the UK and occurred last in Switzerland, in early summer. In the USA, it spread from east to west. Global transmission occurred within 4–5 months.

Why was 1918 so severe?

A full understanding of what made the Spanish flu of 1918 so devastating would be extremely useful in assessing the impact of future flu pandemics. Unfortunately, scientific and historical information on the event remains incomplete, but a number of factors that contributed to the severity of the disease have been determined or reliably deduced.

Firstly, the 1918 influenza virus subtype is believed to have been unusually aggressive compared to other pandemic strains in the past. Evidence suggests a highly active immune system overreacting to the viral attack and leading to high and rapid lethality[2] in particular among otherwise healthy young adults, i.e. in the 20–40 age group. In contrast, the attenuated immune system of the elderly responded less vigorously, which could explain the unusual W-shaped mortality curve. Another possible explanation for this pattern is that the older age groups could have acquired immunity through exposure to an earlier similar virus. This could have been the case with the 1847–1848 pandemic, whose viral strain remained the dominant circulating strain in subsequent seasonal influenza periods until the next pandemic in 1889–1890.

Secondly, the Spanish flu coincided with the end of World War I. Four years of armed conflict, displacement and hardships had left entire populations in poor general health and pushed healthcare capacity beyond its limits, which would lead to higher morbidity and lethality in any disease. Furthermore, soldiers were quickly relocated and then barracked together, providing a perfect environment for spreading a disease and passing it on to the civilian population. And finally, censorship suppressed necessary public notification and information on the severity of the disease and how to avoid infection.

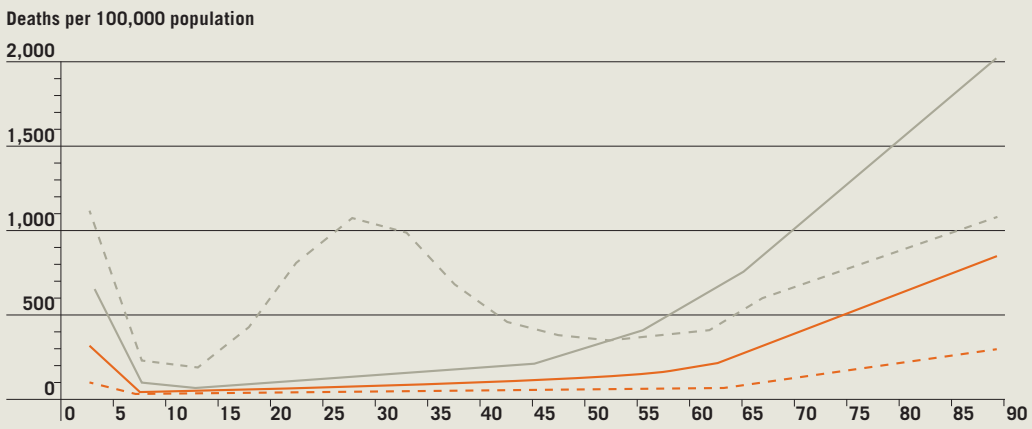
It has to be noted that there were large variations in regional mortality, in particular between industrialised and developing countries.

1918 revisited: Reliable public information, credibility of authorities' actions, swift public health responses and profound medical knowledge were key to limiting the impact – Reality often proved to be different

- Every country engaged in World War I tried to control public perception. To avoid hurting morale, the press in countries fighting in the war did not mention the outbreak. Officials also wanted to prevent enemies obtaining knowledge on how weak the groups were, due to illness or death of soldiers. Therefore, most of the public information was filtered. Only the press in neutral Spain covered the disease without restrictions.
- Another aspect was the disconnection between what public authorities said and reality perceived by the people. Officials initially told the public not to worry, that public health measures would prevent the disease from striking them. Then, officials routinely insisted that it was only ordinary influenza, not the Spanish flu. As infection rates and death figures exploded, officials almost daily assured the public that the worst was over.
- Medical treatment such as antibiotics, vaccines or antiviral drugs were not yet available at that time. Nor had the causative agent of the flu already been identified. Therefore, recommendations for preventive measures from governments/healthcare institutions were not always efficacy-proven and sometimes strange. They varied from good personal hygiene, utilisation of disinfectants (especially in public transportation and when using public phones) and wearing face masks to closing public institutions. Some countries even fined or jailed people for unprotected coughing or sneezing in public.
- In the beginning, the disease was so severe and its clinical course so unfamiliar that influenza was not considered as the cause at first glance. Doctors suspected cerebrospinal meningitis or the return of the Black Death.
- The general health status of the population was affected by World War I especially due to malnutrition.
- In consequence of the low number of health personnel in proportion to the population, doctors were overwhelmed with patients. Moreover, there was not enough capacity available for hospitalising severely diseased patients. Doctors and nurses were overworked and sick themselves; the loss of nurses and doctors was an outrageous number in itself.
- Crowded army camps enabled an easy spread of the disease. And warship routes were a source of infection for the civilians, too.

[2] Kobasa et al., "Aberrant innate immune response in lethal infection of macaques with the 1918 influenza virus", in: Nature 445, pp. 319–323.

Pneumonia and influenza mortality by age in certain epidemic years



Only the 1918 pandemic shows the W-shaped mortality curve

Source: CDC; 1968 data not shown but curve shape is similar to 1957

How would a pandemic comparable to the 1918 event unfold today?

It is inappropriate to simply use unadjusted data to project and estimate the consequences of a disease outbreak like the Spanish flu for today's world. A wide range of changes in circumstances must be taken into consideration.

Medical progress is evident: bacterial pneumonia, the typical and finally deadly secondary disease occurring often as a complication of viral influenza, can be treated effectively with modern antibiotics. No reliable therapies are available for most viral infections themselves: once acquired, only their symptoms can be treated. A new class of anti-viral drugs termed neuraminidase inhibitors represent an exception. These have shown good results in combating seasonal influenza and are currently being stockpiled by governments and the WHO to prepare for a pandemic.

Prevention remains an important aspect in stemming the spread of highly contagious viral infections. Consistent application of personal hygiene standards help to halt the spread of a virus, while vaccines limit severity. The time needed to produce the required amounts of a vaccine – which in case of a pandemic would be enormous – and to distribute it globally remains a problem. Based on current production technology and capacity, it is doubtful that vaccines would be available in time to significantly impact sickness or death rates in the first wave of a pandemic.

Potential factors attenuating influenza mortality

– Improvement in medical care and technology: antibiotics, vaccines, anti-viral drugs
However, shortages in drugs are possible and a lead time is required for vaccine production.

– Establishment of global surveillance and early-warning systems, e.g. by WHO, CDC
However, sometimes data, information or virus samples are delayed.

– Crisis/emergency preparedness plans, e.g. close-down of central airport hubs and/or mass vaccination
However, quarantine measures may not be effective.

– Improved socio-economic environment incl. hygiene conditions, nutrition and health status
However, this may preferably be the case in industrialised countries.
However, pre-existing and chronic medical conditions may render certain populations more vulnerable to an influenza virus than others.

Potential factors aggravating influenza mortality

– Greater number of areas with high population density like megacities
However, this may only affect speed of spread and not necessarily impact ultimate mortality figures.

– Greater and faster global air travel
However, this may only affect speed of spread and not necessarily impact ultimate mortality figures.

Factors that could reduce or increase influenza mortality today compared to 1918.

Compared to 1918, the spread of a pandemic today would be faster as a result of the increase in long-distance travel between major cities, which have grown in number, size and connectivity (so-called "megacities"). Travel between Asia – considered the most likely birthplace of a pandemic virus – and other regions could simultaneously create several epicentres of infection scattered around the world. A more rapid spread of the pandemic virus does not necessarily mean a material impact on the ultimate death toll of a pandemic. However, the increased velocity of virus spread is considered to put vaccine production and distribution – and its efficacy as a counter-measure – under even greater pressure.

Today's healthcare provision is quantitatively and qualitatively superior to that of 1918. Hygiene conditions today are also far better than at the turn of last century and during the war-weary period that saw the emergence of the Spanish flu. Furthermore, the public would be promptly informed today about an imminent pandemic and how to respond to it. The WHO, for example, in its global surveillance function, constantly monitors the development of outbreaks and is responsible for appropriate alerts.

Some of the above-mentioned factors impacting a pandemic's mortality profile may affect base as well as disease-specific excess mortality rates. The rapid spread of the disease around the globe, for example, may not allow for effective or timely preventive measures to be implemented. Good hygiene not only contributed to reducing base mortality in the past but also reduces virus transmission and may thus also affect excess mortality. If extremely virulent pathogens kill their host too early, they usually cannot spread excessively – there is a natural trade-off between transmission rate and lethality of a virus.

The major challenge in modelling an influenza pandemic involves transferring 1918 data and information to the situation today, in particular with respect to the pandemic excess mortality rate. One aspect is that (original) data and information sources are inconsistent and forecasts communicated are not always based on reliable interpretations of data. The other, more important aspect is that baseline mortality has changed so significantly, making it extremely difficult to extrapolate from the past. To give an example, baseline mortality for a 30-year-old male in 1910 was about 5‰, whereas today it is only around 1‰ due to significant mortality improvements.

In order to understand the impact the 1918 Spanish flu would have on an insurer's or reinsurer's portfolio today, we have to consider an approach that would simulate a shock event such as a pandemic in a balanced way. As a consequence, the CRO Forum's Emerging Risks Initiative – while aware of potential flaws of the methodology – suggests the following procedure[3]:

– Excess mortality derived from the historic Spanish flu scenario in industrialised countries (e.g. the USA) to be adjusted for medical progress and any other factors potentially impacting a pandemic, based on expert opinion.[4]
– The resulting figure is to be applied to all ages the same way, i.e. adding a flat increase in the death rates of all age groups on a per mille basis.
– Alternatively, the application could vary according to age bands.
– Depending on the portfolio and based on medical expertise, a differentiation can be made between population and insured mortality.
– In addition, effects from other lines or segments such as health and P&C can be considered, too, if material to the respective company.
– As a last step in a stress test, a correlation to the asset side should be taken into account on an economic basis.

It is recommended to carry out sensitivity tests for the key input parameters such as excess mortality or infection rate. Although it is possible that a highly virulent pandemic virus may cause a similar death toll (or even higher) as recorded in 1918, it needs to be emphasised that such an event is considered highly unlikely (including the particular characteristics of this singular event). This is supported by the scientific community, which considers a 1957- or 1968-like event the most probable one.

The following table gives an overview of published parameters for simulating a pandemic shock event and meaningfully demonstrates a wide range of possible options on how to deal with the challenge. The tables show two different aspects:

– The mortality shock assumption prescribed by regulators, and derived by the Group Consultatif, is for solvency purposes. In some cases (e.g. SST), regulators specify an excess level of mortality, and in other cases (e.g. FSA) they specify a return period.
– The examination of the industry's or insurers' ability to withstand different levels of excess mortality, based on illustrative scenarios used by rating agencies or suggested by insurance/actuarial associations.

[3] A similar approach could be made to calculate morbidity effects.
[4] It has to be mentioned that qualified experts often widely differ in their opinion on how to best model a pandemic event.
[5] C. J. L. Murray, et al., "Estimation of potential global pandemic influenza mortality on the basis of vital registry data from the 1918–20 pandemic: a quantitative analysis." in: Lancet 368, 2006, p. 2211.

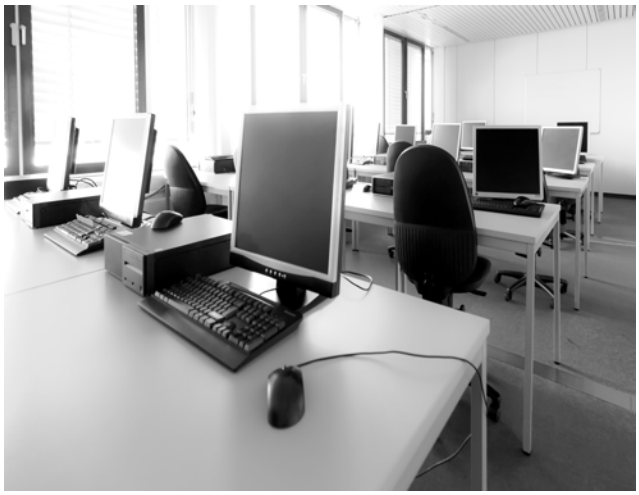
To sum up, flu pandemics will continue to constitute a threat to society for the foreseeable future. However, mainly due to medical progress and better hygiene conditions, we do not predict death tolls on the scale seen in 1918. In addition, baseline mortality has changed significantly since 1918, which does not allow us to simply extrapolate from historical data. A simple stress test on the basis of a fixed excess mortality figure – but adjusted to today's situation – should be added to portfolio mortality to give a realistic estimate of the impact of a 1918-like pandemic on an insurance portfolio today.

It is noted, however, that while the wealthy populations in the industrialised world will be able to protect themselves better against a pandemic, populations in developing countries will still bear a major burden of the excess mortality arising from an influenza pandemic.[5]

Suggesting organisation	Scenario	Excess mortality	Probability	Comment
APRA	Set of stress test parameters provided for a wide range of scenarios.			APRA has provided an information paper and prudential practice guide to assist APRA-regulated institutions with their business continuity planning for a potential pandemic. APRA's existing prudential standards only cover business continuity planning requirements in the event of a major event or crisis.
FSA	99.5% VaR		1-in-200-year event	
Group Consultatif Actuariel (May 2006)		Population: 2.5‰ Insured: 1.5‰	"It also assesses the probability of a pandemic in the next ten years to be high."	"This means that the solvency capital (confidence level 99.5%) for calamity risk should be based on an age-independent excess mortality of 0.15%, assuming that a pandemic is the most important threat for life and pension insurance."
Swiss Solvency Test (SST)	99% Tail VaR	Biometric effects Extramortality corresponds to approx. a doubling for Europe, an increase by approx. 60% for North America and by up to 1,000% for Asia or as modelled internally.	The probability of the pandemic scenario is 1%.	Also considers hospitalisation, bed days and financial market effects
Solvency II QIS3	99.5% VaR: 1.5‰	1.5‰		
Moody's (April 2007)	Moderate (1958/1968-like)	0.5‰	No probability assigned to scenario – intended only to illustrate impact of scenario on US life insurers rated by Moody's	Based on Health and Human Services estimates of US deaths in the absence of interventions
	Severe (1918-like)	2.0‰	No probability assigned to scenario – intended only to illustrate impact of scenario on US life insurers rated by Moody's. "Some experts would argue that the influenza of 1918 is the worst pandemic in terms of virulence over the past 500 years, making it a 1-in-500-year event."	Based on Health and Human Services estimates of US deaths in the absence of interventions, after adjustment down by Moody's to reflect their belief that "a virulent 1918-type influenza would not be as deadly (today) as it was in 1918"
Fitch (March 2006)		0.7‰	No probability assigned to scenario – intended only as an illustration of impact of scenario on US and European life insurers	
S&P	Scenario A: Scenario B:	0.625‰ 1.5‰	No probability attached	
SOA	Moderate:	Population: 0.7‰ Insureds: 0.4‰	No probability assigned to either scenario – intended only as illustrations of impact of scenarios on US life insurance industry	The moderate scenario assumes a "U"-type distribution of extra mortality on the portfolio, the severe scenario assumes a "W"-type distribution.
	Severe:	Population: 6.5‰ Insureds: 5.0‰		

A wide range of parameters has been suggested by different stakeholders to model an influenza pandemic. There is no single truth.

A significant proportion of employees would be unable to come to work.



03 Consequences for the insurance industry

Due to the potentially profound impact of a pandemic, the insurance industry must evaluate the financial impact of a pandemic event on both sides of its balance sheet: liabilities will increase due to a rise in claims, and asset values are likely to fall due to market (over)reaction. As with other industries, insurers will also have to manage business continuity issues.

Products affected

On the liability side of the balance sheet, benefits due to policyholders affected by a pandemic must be analysed. The most obvious and probable source of major losses for a company is its (term) life insurance portfolio (individual and group life policies). However, consideration should also be given to the fact that average mortality rates among life policyholders is still usually significantly lower than in the population as a whole, mainly due to financial and medical underwriting. Depending on a product's terms and conditions and countries, this may not be the case where large proportions of the population obtain life cover as part of mortgage protection. Like the difference in baseline mortality between 1918 and today, the potential discrepancy between insureds and the entire population may lead to evaluation uncertainty. The effects on group life business might be different from those on individual life business: less underwriting has taken place and the state of health of the individuals in the portfolio is not so well known, but various risk-mitigation features like profit-/loss-sharing agreements are frequently in place to compensate the financial effect of weaker underwriting standards. However, there could also be risk-concentration issues on the group life business. Depending on the portfolio structure and population insured, annuities may provide a natural hedge to the mortality shock caused by an influenza pandemic in individual and group life policies due to the higher-than-expected mortality rates.

In aggregate across the global insurance industry, a flu pandemic could lead to life insurance losses in double-digit billion euro figures. Fitch has estimated the aggregate life insurance payout on deaths in the USA at US$ 18bn or 8% of statutory surplus, given 209,000 fatalities. Applying similar payout ratios to the European market, Fitch estimates that if an event caused 400,000 deaths in Europe, the total additional claims arising could be approximately €30bn.[6] These payouts do not directly translate into insurance losses as a share would be funded via reserve releases. Moody's[7] differentiates between a moderate and a severe scenario, with an approximate gross loss for US-domiciled, rated primary life insurers of US$ 6bn and US$ 24bn respectively, or 3% and 13% of its statutory capital and surplus.

Private health (re)insurance (including group health policies) would also be affected to a certain extent, varying from country to country. As health insurance penetration is considerably less widespread than life (re)insurance, overall losses would be lower. An accurate assessment is difficult, due to the wide variety of policy terms and payment triggers that exist in the different markets. In contrast to life insurance, some saturation effects can be expected in the event of a large-scale pandemic, as healthcare provision capacities are limited. For example, a hospital bed can only be allocated once at any given time, and medicine supplies may run short. However, medical staff may be considered as a higher at-risk group, inparticular at the onset of a pandemic.

[6] S. Peakin, "Bird Flu – Will It Ruffle The Industry's Feathers?", www.fitchratings.com, March 2006.
[7] S. Robinson, "Bird Flu Risk for U.S. Life Insurers: A Tail Event", Moody's Investors Service – Special Comment, April 2007.
[8] For example, making material damage a prerequisite for a claim.

P&C lines of business are not expected to contribute significantly to overall losses caused by a severe pandemic event. Some casualty claims may become payable due to closure of business operations ordered by civil authorities. Directors' and officers' coverage claims may be triggered among companies failing to plan or address pandemic issues. Businesses must thus actively plan for possible scenarios. Property/business interruption (BI) business may also be affected where a material damage proviso[8] is lacking or if BI-specific extensions are in place. Credit insurance could be triggered in the event of bankruptcies among insured companies, e.g. in the travel and tourism industry.

In general, the sectors likely to be affected most include those servicing large congregations of people (travel/tourism, public transport/events, restaurants/shopping malls, schools) and sectors involved in treating the disease (hospitals, healthcare facilities). If the current avian influenza were to intensify, classes engaged in the poultry business would be affected by the animal virus itself before it acquires efficient human-to-human transmission capacity. In addition, some P&C lines may be triggered in individual cases if the animal pathogen infects people in close contact with poultry.

Asset portfolios

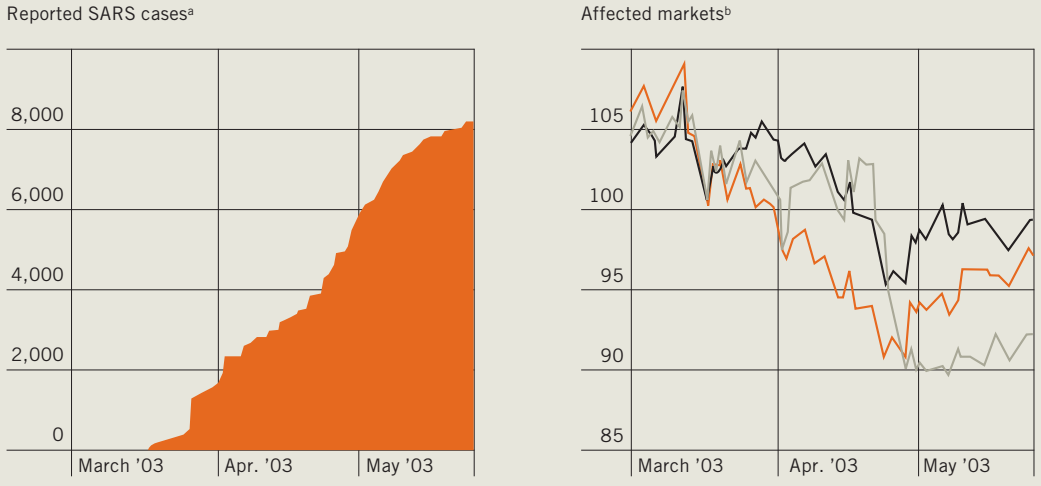
How the asset side of an insurance company's balance sheet would be affected is hard to estimate and is largely dependent on the magnitude of a pandemic event. Generic market reactions can be expected to follow more or less the same course as in other crisis scenarios. Depending on the severity of the event, financial market reactions could be temporary only or have long-lasting effects.

Due to underlying macroeconomic effects as well as market psychology ("fear factor"), falling equity markets could be expected. However, provided consequences for daily life and business are not truly devastating or long lasting, quick recovery from a downturn could also be expected. Clearly, some business sectors (tourism, aviation) would be affected more than others.

Again, a comparison with past events is problematic. Despite its staggering death toll, the 1918 flu pandemic did not produce a significant reaction on the American equity market. On the other hand, we need to take into account that the outbreak came during wartime and that global equity markets have undergone numerous structured changes since then. Markets might react more strongly in today's globalised world.

In a situation of crisis, the risk aversion of investors typically rises, leading to a shift from equity to bond markets. However, in specific cases, the risk may also be attached to the underlying business, for example the travel industry's equity will doubtlessly be affected in the time of a pandemic. Increased bond prices and lower interest rates can be expected, along with expansive monetary policies of central banks. These higher bond prices must be evaluated in conjunction with changes in the economic value of the liabilities to capture the impact due to the asset-liability mismatch in an insurance company. To what extent changes in interest rates may lead to economic losses depends on the quality and accuracy of the asset-liability management strategy of the insurer.

Pandemics and markets (SARS and stock prices)



[a] Cumulative number of total reported probable cases.
[b] Ratio of country index to MSCI World Index: 17 March 2003 = 100.

Learning from SARS – market reactions. Results could be skewed, as the war in Iraq began during the same period.

Sources: Bloomberg; Datastream; World Health Organization; E.M. Remolona and P.D. Woldridge, Bis Quarterly Review, 2003

Higher risk aversion may also lead to wider credit spreads within the bond markets between different rating classes. Lower-rated corporate bonds would lose value in relation to top-rated government bonds. This "flight to quality" would – according to the IMF[9] – lead to a widening of credit spreads for both corporations and emerging markets. Moreover, central banks will need to ensure that banks can meet a sudden increase in the demand for liquidity. The need of companies to sell investments to pay claims may also lead to a widening of credit spreads.

A pandemic flu outbreak would place markets in a state of greater than usual uncertainty about future developments. A rise in volatility in all market segments should thus be expected. Furthermore, claims must be paid on a timely basis. This means that, even if market reactions are short-lived, it might be necessary to sell assets in an unfavourable environment.

Business continuity

It is essential for the insurance industry – as any other industry sector – to ensure that business operations can keep running properly during and after such a pandemic event. Thus, business continuity plans – as part of every insurance company's risk management – must also include preparedness for a pandemic. In the event of a pandemic influenza, businesses will play a key role in protecting public (staff) health as well as in limiting negative impacts on the economy and society. As a disease escalates, a significant proportion of employees would be unable to come to work regularly, either because they are ill or have to care for sick family members. Some may even argue that a high absenteeism rate may lead to a lower overall death toll. However, "staying at or working from home" should primarily be considered a precautionary measure to stop the spread of the disease. In a severe scenario, governments might even ban employees from going to work for a limited period in industries not regarded as vital for society. The (re)insurance industry might be better prepared for such an event than others, given that modern telecommunications allow employees to continue working from home. In most production-orientated industries, physical presence is essential for operations. However, continuity planning must consider strains on network infrastructure due to overload caused by employees required to telecommute.

Most organisations have business continuity plans (BCP) in place for relatively small-scale events like fire, but few companies are prepared for a crisis lasting several months and resulting in extended absence of up to a third of their employees. The crisis management know-how the insurance industry possesses could be passed on to industrial and commercial clients to help them improve their BCPs, with the added benefit of reducing losses should a pandemic occur.

Essential considerations in preventing the spread of disease and limiting impact on business operations

- Work from home is certainly a good strategy, but it cannot be the only one. It requires advance preparations, such as ensuring that the organisation of business processes is suitable and infrastructure is in place to facilitate remote working. It is important to apply the social-distance principle, i.e. maintain a distance of 1–3 metres between people and avoid unnecessary close contact. Besides masks, gloves, disinfectants and special suits for high-risk areas should be kept handy. Employees should also be educated to practise higher standards of personal hygiene, and the work environment must also be kept clean.
- Some businesses' medical offices may even consider stockpiling anti-viral drugs to help cover expected demand surges.
- Additional security measures may be needed to enforce access restrictions and security of closed offices and premises.
- Communications measures and awareness campaigns are important for keeping employees informed, as well as keeping track of the status of employees during an extended pandemic phase.
- Illness among employees and their immediate family members would result in high levels of absenteeism that may last for extended periods.

[9] International Monetary Fund (IMF), "The Global Economic and Financial Impact of an Avian Flu Pandemic and the Role of the IMF", Prepared by the Avian Flu Working Group1 (in consultation with Departments and the Joint Bank-Fund Health Services Department), Approved by Mark Allen, 28 February 2006.

Stress testing of portfolios for pandemic risks should become a routine activity.

04
How the insurance industry prepares for the risk

A flu pandemic is not the only threat an insurance company's balance sheet faces. Natural and man-made disasters or rapid movements in the asset markets demand constant surveillance by the risk community. Methods developed to prepare for these events can be useful in finding ways to prepare for a pandemic.

The insurance business model relies on the principle of diversification, generally in two dimensions: geographical diversification (e.g. a hailstorm affects insurance in one area of the world at one time only) and diversification across lines of business (a hailstorm mainly produces losses in property insurance business but not losses in life insurance business).

In the case of pandemic risks, geographical diversification is not as effective as with other major loss events, as all regions will be affected. Healthcare is very similar in the industrialised countries, where the majority of life insurance is written. Diversification over lines of business also possibly weakens to some extent: health and other non-life lines of business would also be affected by a pandemic flu, in addition to life business. Furthermore, adverse movements in capital markets must be considered. However, annuity business as a potential natural hedge – depending on the portfolio – may be the rare example, in this case making a positive contribution to diversification.

Risk modelling

Insurance companies assess the potential impact of events, such as pandemics, with risk-modelling techniques and stress tests. Nowadays, internal risk models exist in many companies that capture the full range of risks an insurance company is exposed to, and also take into account complex dependency structures between the different risks and exposures. These models play an important role in the steering of the companies, helping also to better understand adverse scenarios like pandemics.

While there is a well established history of mathematical and statistical modelling relating to the transmission and spread of infectious diseases, a large number of uncertain variables are required in these so-called epidemiological models. For example, as pandemics are relatively rare events, today's models can only be calibrated against the last three or four pandemics. This situation is in stark contrast to natural catastrophes, for example, where a much larger body of data is generally available to estimate frequency.

Uncertainties in pandemic models are dealt with through sensitivity testing that shows which of the assumed parameters make the most difference to the results.

The performance of simple stress tests concentrating only on the isolated event of a pandemic will indicate whether companies will be able to withstand certain stress scenarios.

The CRO Forum would also like to highlight the importance of seeking robust expert opinion on low-frequency/high-impact insurance risks, such as pandemics, where we consider a simplistic mathematical extrapolation from historical events (e.g. the 1918 Spanish flu) to be inappropriate.

Risk mitigation

Effective risk modelling allows a company to decide which risk-mitigating measures to take, depending on its risk tolerance. In the case of the pandemic flu risk, these measures are comparable to those implemented to prepare for other threats to the insurance industry's profitability.

One common underwriting measure, in particular for some P&C lines of business, is the exclusion of the risk in question. However, in countries such as the USA exclusions require regulatory approval and in some segments or lines of business exclusion is simply not practicable, for instance due to a legal requirement.

Risk transfer may be the preferred option: for example, a primary life insurer can reduce its business exposure by reinsuring its portfolio. This implies – to a minor extent – substituting mortality risk for credit risk. However, in general, this normally shifts the risks from a smaller and less diversified company to a typically larger reinsurer with a more diversified portfolio.

Another method of transferring pandemic risks is to use the capital markets. Special catastrophe bonds known as mortality catastrophe bonds enjoy increasing popularity. Catastrophe bonds default (from the investor's point of view) in the event of a major surge in catastrophe claims. Under such a structure, if the mortality index does not exceed the predetermined threshold, the (re)insurer pays back the full face amount of the bond to the investors. However, if the mortality index exceeds the predetermined threshold, the adverse mortality experience will reduce the payment of principal to investors. In the extreme case, none of the principal may be repaid upon the bond's maturity. However, these mortality catastrophe bonds typically leave the issuer of the bond with basis risk, as a bond's thresholds are usually connected to a population index and not to the issuer's portfolio.

Recently issued mortality bonds

Mortality bonds have so far been issued by Swiss Re (*Vita I, Vita II and Vita III*), Scottish Re (*Tartan Capital*) and AXA (*Osiris Capital*).

Vita Capital Ltd., which was issued in November 2003 (and expired in December 2006), was a US$ 400m facility with a three-year term that would have paid Swiss Re in the event that a predefined population mortality index exceeded 130% of its 2002 value. Vita Capital II Ltd., issued in April 2005, raised US$ 362m. The first tranche attaches at 110% of expected mortality for any two-year period over a five-year term. Vita Capital III Ltd., issued in January 2007, raised circa US$ 705m (denominated in US$ and euros). Swiss Re receives payment if during any two-year period within the four- or five-year risk period the mortality index exceeds predefined percentages of the base year's mortality. The trigger levels are 125% for Class A and 120% for Class B.

Tartan Capital's risk coverage, which raised US$ 155m in May 2006, has a two-year period and has its principal at risk if its US mortality index exceeds predefined percentages of the expected mortality level, 115% for class A notes, and 110% for class B notes.

Osiris Capital, which was issued in November 2006, raised circa €345m. The principal of the notes is at risk if mortality levels in France, Japan and the US exceed, by a certain percentage per class of note, a predefined mortality index, based on 2004/2005 mortality levels for these three countries, in any two consecutive years within the risk period (set from 1 January 2006 to 31 December 2009).

Also on the asset side there are some measures that can be taken to control the risk of adverse developments. For example, the following instruments with optional character could be considered:

– Protective put options can hedge risks from equity market exposure.
– Receiver swaptions can provide a hedge in case of interest guarantees.

Finally, adequate liquidity must be secured to pay out claims on a timely basis in the event of a pandemic. Payouts will be stretched over an extended period, as pandemics usually come in waves and last for months. Accordingly, insurers should prepare robust liquidity stress testing to ensure sufficient liquid assets are available to meet claims in a timely manner.

The CRO Forum's Emerging Risks Initiative

The Emerging Risks Initiative (ERI) was launched in 2005 to raise awareness of major emerging risks relevant to society and the (re)insurance industry. The initiative is currently chaired by Munich Re and consists of eight members representing Allianz, AXA, Munich Re, Swiss Re, Zurich Financial Services as well as Chubb, Insurance Australia Group and Royal & SunAlliance.

Emerging risks are by far the biggest challenge for the insurance industry. Emerging risks are risks which may develop or which already exist, that are difficult to quantify, and may have a high loss potential. Further, emerging risks are marked by a high degree of uncertainty; even basic information, which would help adequately assess the frequency and severity of a given risk, is often lacking. Examples of such risks include climate change, asbestos liabilities, genetic engineering and nanotechnology and terrorism. Insurers have extensive experience in assessing risks. But the ever-faster changing risk landscape and its increasingly complex and interconnected risks are making new demands on all stakeholders – be they legislators, regulatory authorities, the scientific community, the private sector or civil society – to assume their respective responsibilities in the risk-management process.

Governments bear key responsibility for risk mitigation in society, for example in the case of a pandemic – such as safeguarding preparedness of the health system, installing adequate flu sentinel systems, preparing the public sector for continuing business activities even in case of high absenteeism as well as establishing an adequate emergency/crisis management organisation. Jointly with the regulatory authorities, they play a vital role in ensuring the viability of private insurance by creating appropriate legislative and regulatory frameworks. Yet, a systematic approach to risk management has, to date, often been lacking at governmental level, affecting a nation's ability to identify, assess and manage global risks. Professional and systematic risk management would enable governments to prioritise risk mitigation and response measures more adequately. Individual or corporate insureds need to participate in sharing the risk of financial losses. A significant retention of potential loss is a powerful incentive to prevent or mitigate losses and reduces administrative costs by absorbing small, high-frequency losses. The insurance industry can create incentives for these mitigation measures by raising awareness of the cost of having undiversified peak exposures.

By absorbing financial and insurance risk, the insurance industry plays an indispensable role in today's economic system. If this is to continue in the future, the industry must minimise surprises. It is therefore crucial to identify and communicate emerging risks to a broader community, thereby fostering a stakeholder dialogue with representatives of a community bound by a shared risk.

This position paper is supported by the CRO Forum, which comprises the Chief Risk Officers of the major European and US insurance companies and financial conglomerates. The CRO Forum is a professional risk management group focused on developing and promoting industry best practices in risk management. It seeks to present large company views, with three core aims:

– Alignment of regulatory requirements with sophisticated/best practice risk management
– Acknowledgement of group synergies, especially diversification benefits
– Simplification of regulatory interaction

The CRO Forum's views are communicated through its publications and made available to wider audiences, for example through the CRO Forum webpage at www.croforum.org. The CRO Forum supports the activities of the Emerging Risks Initiative. This initiative pursues the following goals:

– Raising awareness and promoting stakeholder dialogue
– Developing best practice solutions
– Standardising disclosure and sharing knowledge of key emerging risks

Links and recommended literature

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– World Health Organization http://www.who.int/csr/disease/influenza/en/

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