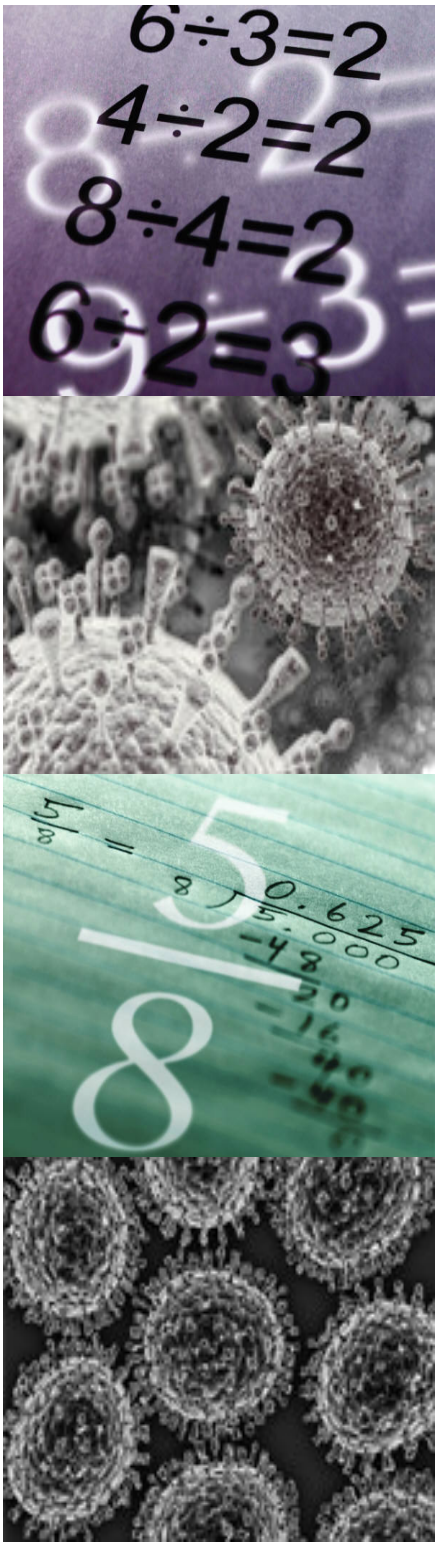
Assessing the Impact of a Pandemic on the Life Insurance Industry in South Africa



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Abstract

In a presentation by the American Council of Life Insurers (ACLI) at the United States Congress in June 2006, the following statements were made:

> "The life insurance industry, with over $4 trillion in assets, is well-positioned to absorb the impact of an influenza pandemic without jeopardizing its commitments to policyholders and their beneficiaries…"

and

> "…they [insurers] can predict with considerable accuracy how many of those insured people will die the next year. Insurers also know with near certainty that someday another disaster will occur."

The statement by the ACLI goes on to say:

> "Financial planning for high impact, low frequency disasters, such as a possible bird influenza pandemic, is an integral part of our business processes."[1]

What about South Africa? How ready is this country and our insurance industry for avian influenza, Extra Drug Resistant Tuberculosis (XDR TB) or any other possible pandemic that nature may have in store for us?

In this report, we investigate the history of pandemics, with a particular focus on influenza (flu)[2] pandemics. We attempt to understand the frequency of such pandemics and assess the industry's readiness for another pandemic. In doing so, we revisit the most severe pandemic recorded in human history – the Spanish Flu of 1918 – and we investigate responses from the industry when questioned about its levels of preparedness.

Our paper also attempts to quantify the potential impact of such a pandemic on the life insurance industry. Although the paper suggests a possible distribution of pandemic disease incidence and case fatality rates for the insured population, and how this differs from that of the general population, it assumes the appropriateness of epidemiological modelling for the South African population already done by other writers.

This paper is an updated revision of a similar paper, in title and content, presented to attendees of the Actuarial Society of South Africa (ASSA) Convention on 12 October 2006.

[1] Source: http://www.acli.com
[2] Throughout this paper, the terms flu and influenza will be used interchangeably.

1. Scope

The re-emergence of the H5N1[3] influenza virus in late 2005 has been touted by many experts as the build-up to the next major pandemic[4] to confront humanity. Pandemics are expected to occur about every 30 years (Bonheure, K, Keller, P & Somers, K, 2006), although some suggest a longer interval, and the extraordinary run of events since H5N1 emerged – the culling of entire bird colonies, human deaths, emergency policies and plans being put in place – has made more than a few people wonder how this could affect them. As recently as February 2007, the largest turkey producer in the United Kingdom was faced with large scaled culling of its live stock and exports banned to many parts of Europe, South Arica and several other countries. One just needs to visit a website such as www.uksurvive.com to get an idea of how the risk avian flu poses, is capturing the imagination (one can buy bird flu masks online).

In fact, discussions about this threat inevitably include references to the Spanish Flu and other similar, but more moderate flu pandemics such as those experienced in 1957 and 1968. But the broader question for our consideration is: what will be the impact of *any* pandemic on the financial services industry? Or more pertinently, the life insurance in South Africa? Diseases of epidemic proportions are rare but when they hit, the effects can be devastating.

This paper considers the impact that a pandemic could have on the life insurance industry in South Africa, also with specific reference to disability, short-term and medical insurance. The definition of a pandemic is investigated and considered in a wider sense, including current pandemics (HIV/AIDS) and so-called "good pandemics" (the arrival of penicillin and the discovery of antibiotics).

Our research focused on "shock" pandemics, showing how this is different to other forms of pandemics and to assess the robustness (or otherwise) of South African life insurance companies in the wake of such shocks to mortality in particular. Appointed actuaries to several life insurance companies contributed to this paper as to the courses of action available to them, and what actions they may already have taken, to ensure adequate solvency for the companies.

An attempt is also made to model the impact of pandemics on populations and insured benefits.

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[3] H5N1 is an Influenza A virus subtype. The name H5N1 refers to the subtypes of surface antigens present on the virus: hemagglutinin type 5 and neuraminidase type 1. Source: http://en.wikipedia.org/wiki

[4] A **pandemic** (from Greek *pan* all + *demos* people) is an epidemic (an outbreak of an infectious disease) that spreads worldwide, or at least across a large region. In epidemiology, an **epidemic** (from Greek *epi-* upon + *demos* people) is a disease that appears as new cases in a given human population, during a given period, at a rate that substantially exceeds what is "expected", based on recent experience (the number of new cases in the population during a specified period of time is called the "incidence rate"). Source: http://en.wikipedia.org/wiki

2. Background

During October of 1918 alone, what later became known as Black October, about a quarter of a million South Africans died of influenza, resulting in additional deaths of some 4.4 per thousand lives in that year (Johnson, N & Mueller, J, 2002). It was during this month that the second of three waves of the Spanish Flu that had wreaked havoc around the world, hit South African shores. Sick funds (medical aids or medical schemes as we would call them today) and benefit societies encountered difficulty when confronted with the flood of influenza claims and several were depleted (Phillips, H, 1990). South African insurance companies estimated that £1.3 million were paid out in respect of flu-related death claims within a period of 4 months[5]. If one were to assume an average inflation rate of 5% over the past 88 years, a figure of R95m is obtained in today's money terms. However, there are many aspects of the insurance industry that changed over this period of time, which makes it difficult to deduce anything from this number in itself.

Worldwide, anywhere between 20 million and 100 million people died of the Spanish Flu, depending on which source you believe, with many, many more affected, be it sick or otherwise. Johnson & Mueller (op. cit.) estimate that in the order of 50 million people died worldwide, but add that even this vast figure may be underestimating the real toll, "…perhaps as much as 100 percent…". Fact is, this may well have been the worst pandemic in recorded history. The Black Plague killed almost a quarter of the European population during the Middle Ages, but in terms of numbers it was incomparable to the Black Death of 1918 (Barry, 2005). Astonishingly, South Africa was proportionally the third hardest hit by this pandemic, not counting some islands that were pretty much annihilated, according to Johnson & Mueller (op. cit.). Two other African countries, Cameroon and Kenya, had even higher death rates per 1 000 lives. However, if anything, one can suspect that in Africa, like many other regions in the underdeveloped world (and even the developed world during this time), fatalities were underreported and death rates may have been even higher.

Another startling finding from our review of the Spanish Flu as a background study to researching the possible threat of the current scenario, is that the Spanish Flu was "a pandemic that has been noted for the way it has eluded the memory" (Crosby, 1989). Phillips (op. cit.) came to the same conclusion in the introduction to his study of the impact on South African social, medical and administrative history, stating:

> "General histories of the country [South Africa, *own inclusion*] overlook it entirely or refer to it in a sentence or less…"

[5] Source: *Insurance*, 01/02/1919, p.3027

and

"…there are few serious studies by historians of its impact elsewhere in the world."

Our study is wider than simply reviewing the history of pandemics. It should be noted that more than 20 years after Phillips' work there is a lot more information available, mostly due to the influence of the Internet, but as stated earlier, with varied accounts of the full impact of that pandemic. Our goal is to make as much sense of the history as possible, epidemiologically and otherwise, to best assess what the impact of a similar recurrence might be today. At least as far as the impact on insurance is concerned! Note that wider consideration of its impact falls outside of the scope of this study.

Avian influenza is not something new. During the decade leading up to 2007, various scares of bird flu epidemics had been reported, mostly in Asia and spreading rapidly into Europe and Africa. There have also been a number of major influenza pandemics in the past, notably the Spanish Flu, the Asian Flu during the late 1950's and the Hong Kong Flu a decade later. This section examines some of the worst pandemics recorded in history, in particular drawing attention to influenza pandemics, in order to provide an historical positioning of similar pandemics to that which is threatening us now.

Pandemics and notable epidemics through history[6]

Wikipedia, the online encyclopaedia, provides a valuable insight into pandemics and epidemics, both past and present, with a view as to what possible future pandemics might be in store for us. Zoonoses[7] have been identified as one of the major causes for a number of significant pandemics in human history, believed to be brought on with domestication of animals. Influenza and tuberculosis are two such examples. Below is a summary, with more details available online.

- *Peloponnesian War*, 430BC – 426BC. Typhoid fever killed a quarter of the Athenian troops, a quarter of the population and fatally weakened the dominance of Athens. Similar to Spanish Flu many centuries later, the sheer virulence of the disease prevented its wider spread; it killed off its hosts at a rate faster than they could spread it. In January 2006, researchers from the University of Athens confirmed the presence of bacteria responsible for typhoid in the teeth recovered from a mass grave discovered underneath the city.

- *Antonine Plague*, 165AD – 180AD. This plague is believed to have been smallpox brought back from the Near East, killing a quarter of those

[6] http://en.wikipedia.org/wiki/Pandemic
[7] **Zoonosis** (pronounced zoo-e-no-sis) is any infectious disease that may be transmitted from other animals, both wild and domestic, to humans or from humans to animals. Source: http://en.wikipedia.org/wiki

infected and up to five million people in all. During a second outbreak some 70 years later, 5 000 people a day were said to be dying in Rome.

- *Plague of Justinian*, started 541AD. This is the first recorded outbreak of the bubonic plague. It started in Egypt and reached Constantinople the following spring, ravaging through the city and killing (according to the Byzantine chronicler Procopius) 10 000 people a day at its height, perhaps as much as 40 percent of the city's inhabitants. It went on to deplete a quarter of the human population of the eastern Mediterranean.

- *The Black Death*, started 1300s AD. Almost 800 years after the previous outbreak, the bubonic plague reached Europe via Asia. The disease reached Mediterranean and Western Europe in 1348, killing twenty million Europeans in six years and a quarter of the total population.

- *Cholera*, starting in 1816AD. Hitting India and China first, then in a second pandemic reaching London, Ontario and New York in 1829. It had reached the Pacific Coast of North America by 1834. Five more cholera pandemics would reach out to all corners of the earth over the next 100 years or so, from Russia to Africa, to Indonesia, Europe and the United States (again), and visiting Russia twice more. Pandemics also visited India again and infected Bangladesh in 1963.

- *Influenza*
    - The "Asiatic Flu", 1889AD – 1890AD was first reported in May 1889 in Bukhara, Russia. It rapidly spread west and hit North America in December 1889, South America, India and Australia in the following year. It was purportedly caused by the H2N8 type of influenza virus and had a very high attack and mortality rate.
    - The "Spanish Flu", 1918AD – 1919AD. Historians differ as to the origin (and exact starting and end dates) of this “deadliest plague in history” (Barry, op. cit.). Many attribute it to British troops on duty in France in 1917, but Barry puts forward a good case for its origins being in the United States. First identified early March 1918 in US troops training at Camp Funstan, Kansas, by October 1918 it had spread to become a worldwide pandemic on all continents. Unusually deadly and virulent, it ended nearly as quickly as it began, vanishing completely within 18 months. In six months, 25 million were dead; some estimates put the total of those killed worldwide over the entire period at two to four times that number. The virus was recently reconstructed by scientists at the Centre for Disease Control in the United States, studying remains of bodies preserved by the Alaskan permafrost. It is believed that a type of H1N1 virus was the cause of the pandemic, variations of which still exist today in swine flu. It is believed that up to 650 000 may have

died in the United States alone from the three waves of the pandemic (Johnson & Mueller, op. cit.).

This pandemic is regarded as the benchmark against which others are being measured. It killed more people in 24 weeks than AIDS has killed in 24 years. Global mortality rates were estimated to be between 2.5% and 5%, about 50 times the usual rates. Influenza usually kills the very young and very old (also referred to as U-shaped excess mortality). However, most of the deaths from the Spanish Flu occurred in those aged between 15 and 35, resulting in excess deaths having an odd W-shape during this pandemic. In fact, 99% of the deaths were people under the age of 65 and for those aged older than 65, less people than would normally be expected, died.[8]

- The "Asian Flu", 1957AD – 1958AD. An H2N2 virus strain caused about 70 000 deaths in the United States. First identified in China in late February 1957, the Asian Flu spread to the United States by June 1957.
- The "Hong Kong Flu", 1968AD – 1969AD. An H3N2 strain (Influenza A) caused about 34 000 deaths in the United States. The virus was first detected in Hong Kong in early 1968 and spread to the United States later that year. H3N2 viruses still circulate today.

The following graph, which is not to scale, demonstrates the extreme nature of Spanish Flu, relative to other pandemics over the last 300 years.

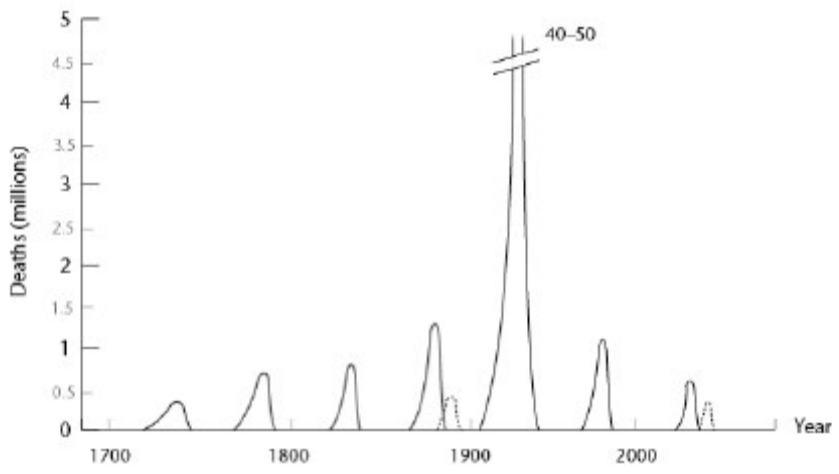

Figure 1: Spanish Flu relative to other pandemics
Source: A history of Influenza, C W Potter, Journal of Applied Microbiology, Volume 91, 2001

[8] Source: AON

- *Typhus*, also known as "camp fever", "gaol fever" and "ship fever". Emerging during the Crusades, it had its first impact in Europe in 1489AD in Spain. During fighting between the Christian Spaniards and the Muslims, the Spanish lost 3 000 to war casualties and 20 000 to typhus. It is believed that during times of war it is generally accepted that during times of war, more deaths will result from disease and epidemics than as a result of warfare, sometime as much as 10 times more (Barry, op. cit.). In 1528AD the French lost 18 000 troops in Italy to typhus. In 1542, 30 000 people died of typhus while fighting the Ottomans in the Balkans, in 1812 it played a major role in the destruction of Napoleon's *Grande Armée* and also killed numerous prisoners in the Nazi concentration camps during World War II.

- *Effects of Colonisation*. Encounters between European explorers and populations in the rest of the world often introduced local epidemics of extraordinary virulence. Disease killed the entire native population of the Canary Islands in the 16th century. Smallpox halved the native population of the island of Hispaniola in 1518AD and ravaged Mexico in the 1520s (killing 150 000 in the capital of the Aztec empire alone, including the emperor), and Peru in the 1530s, aiding the European conquerors. Measles killed a further two million Mexican natives in the 1600s. As late as 1848 – 1849, as many as 40 000 out of 150 000 Hawaiians are estimated to have died of measles, whooping cough and influenza.

There are also a number of unknown diseases that were extremely serious but have now vanished, so the aetiology[9] of these diseases cannot be established. The cause of English Sweat in 16th-century England, which struck people down in an instant and was more greatly feared even than the bubonic plague, is still unknown.

Concern about possible future pandemics

Ebola virus and other quickly lethal diseases
Lassa fever, Rift Valley fever, Marburg virus, Ebola virus and Bolivian hemorrhagic fever are highly contagious and deadly diseases with the theoretical potential to become pandemics. However, genetic mutations could occur at any time which could elevate their potential for causing widespread harm, thus close observation by contagious disease specialists is merited.

Antibiotic-resistant superbugs may also revive diseases previously regarded as "conquered".

[9] **Aetiology** is the study of causation. It comes from the Greek meaning 'concerned with origins' so can refer to myths as well as medical and philosophical theories. Source: http://en.wikipedia.org/wiki

SARS
In 2003, there were concerns that SARS, a new highly contagious form of pneumonia, might become a pandemic. It has since been declared 'eradicated' by the World Health Organization (WHO).

Avian Influenza
In February 2004, avian influenza virus was detected in pigs in Vietnam, increasing fears of the emergence of new variant strains. It is feared that if the avian influenza virus combines with a human influenza virus (in a pig, since they can also contract human influenza, or a human) through reassortment[10], the newly mutated strain created could be both highly contagious and highly lethal in humans. Such a subtype could cause a global influenza pandemic, similar to the Spanish Flu, or the lower mortality pandemics such as the Asian Flu and the Hong Kong Flu.

In April 2005 NewScientist.com reports that between October 2004 and February 2005, some 3 700 test kits of the 1957 Asian Flu virus were accidentally spread around the world from a lab in the US. In May 2005, scientists urgently call nations to prepare for a global influenza pandemic that could strike as much as 20% of the world's population.

In October 2005, cases of the Avian influenza (the deadly strain H5N1) were identified in Turkey. Relationships were drawn with viruses found in Russia, Mongolia and China. Cases of bird flu were also identified shortly thereafter in Romania, and then Greece. Possible cases of the virus have also been found in Croatia, Bulgaria and in the United Kingdom. Wikipedia reports that the low number of deaths, 67 by the end of October 2005 as per their report, was atypical of previous influenza pandemics. However, the high fatality rate amongst those infected remains a concern if the strain were to mutate.

HIV
HIV, the virus that causes AIDS according to most experts, can be considered a global pandemic, but it is currently most extensive in southern and eastern Africa as well as India. It is restricted to a small proportion of the population in other countries, where it is spreading more slowly. This is because it is somewhat more controllable, with education, than H5N1 and SARS since its human-to-human spread is much more limited.

[10]**Reassortment** is the fragmentation and reassembly of the genetic material of two similar viruses that are infecting the same cell. Typically, this could happen when an avian flu virus and normal flu virus both infect the same carrier, e.g. a human or pig, which will pose a high risk of avian flu mutating to a human-to-human transmissible virus. Source: http://en.wikipedia.org/wiki

Avian Flu in Countries at Risk of AIDS
Who knows…? It is believed that a country like South Africa with a high incidence of immune deficiency diseases such as HIV/AIDS and TB is at higher risk than other countries.

XDR-TB
According to the WHO, MDR-TB (Multidrug Resistant TB) describes strains of tuberculosis that are resistant to at least the two main first-line TB drugs - isoniazid and rifampicin. XDR-TB, or Extensive Drug Resistant TB (also referred to as Extreme Drug Resistance) is MDR-TB that is also resistant to three or more of the six classes of second-line drugs.

By February 2007, the mortality rate amongst known cases of XDR TB continued to be close to 60%. Reuters reports in March 2007 that XDR-TB could spark a "practically uncontrollable" epidemic among HIV/AIDS sufferers in areas like Africa. This is of particular concern given the weak immune systems of AIDS sufferers.

Tuberculosis is an airborne disease spread like the common cold, killing 1.6 million of about 9 million people afflicted each year. It is normally treatable with antibiotics but drug-resistant strains have emerged in past years, complicating a U.N.-backed drive to stop the spread of the disease by 2015.

XDR-TB has been identified in 28 countries worldwide, with cases concentrated in the United States, Latvia and South Korea[11].

In South Africa, the XDR strain has killed nearly 200 people since September 2006, mainly HIV patients unable to fend it off. Figures released by the National TB Control Unit in Johannesburg, South Africa, indicate that 328 cases of XDR-TB have been identified by February 2007.

<u>What is the likelihood of an influenza pandemic in the near future?</u>

According to the WHO, the outbreak of a pandemic requires three conditions to be met. First, a new influenza subtype needs to emerge. This has happened. Second, the virus must affect humans and cause serious illness. This has happened. Finally, the virus needs to become human to human transmissible. This condition has not yet been met. However, the probability that the virus acquires this ability to spread between people is increasing as more human cases emerge. According to the WHO, the risk of pandemic influenza is serious.

Most authors on the subject would also believe that the risk of a pandemic occurring is high – however, the likelihood of a severe pandemic is thought to be unlikely. Osterholm (2005) suggests that the probability of pandemic happening

[11] www.scientificamerican.com

in any given year (of any level of severity) is believed to be 3% - 4%. But it is thought that the chances of a severe pandemic happening are as low as 0.3%.

How severe could the pandemic be?

The WHO has used data from the 1957 pandemic for projections to arrive at estimates under a "mild" scenario; between 2 and 7.4 million deaths are estimated. Projections for more serious scenarios result in much higher expectations. The remainder of this paper considers these scenarios.

When combining the likelihood of a pandemic occurring with the severity of said pandemic, Swiss Re had estimated that, with a 0.5% probability, the excess population mortality during a pandemic is projected to be 1.3 per mille.[12]

The discovery of antibiotics, penicillin and other medical advance

In an earlier section of the paper we defined a pandemic as an epidemic that spreads worldwide or at least across a very large region. This study would venture further that some medical advances, such as the discovery of antibiotics and penicillin, Avery's defining human DNA and pioneering medical science's exploration and use thereof, mapping of the human genome and so many other brilliant discoveries have an equal, but opposite effect to that of the "negative" pandemics identified in the previous section.

In our view, many million lives are saved as a result of these advances. In a similar way, "x number of 1 000 lives" are saved and should be regarded as pandemics with a positive impact.

Defining such "good pandemics" poses a bit of a problem when it comes to modelling the "negative pandemics" of yesteryear and hoping to learn something from this. Would the one cancel out the other, and to what measure? The answer to this is not clear, but what is clear is that despite major improvements in health systems, the discovery and promotion of these "good pandemics", increased knowledge sharing and unified, global efforts to fight disease, to this day there is no vaccine for influenza. At least not for the myriad strains that continue to evolve through antigen drift or shift, causing millions of new virus sub-types to evolve.

To add to this, the impact of antivirals and antibiotics on influenza patients, when treated for pneumonia and other symptoms, is questioned by many critics and hence open to debate.

Our search for current literature exploring the idea of "good / positive" pandemics yielded no sources. The concept of pandemic therefore seems to be reserved

[12] Swiss Reinsurance Company Presentation, 13th IAIS Annual Conference, *Influenza Mortality – Capital Requirements*, October, 2006, Beijing

for the "negative" effects associated with disease. In fact, our earlier definition of an epidemic states the "outbreak of infectious disease in humans". Hence, for the remainder of this work, we will focus on pandemic in the sense of disease, allowing as far as possible for all medical and other advances to offset the negative effect that these pandemics are expected to have on mortality and morbidity. We have, however, not attempted to model for this in an explicit way.

The current Avian Flu strain

This section looks specifically at the history of the avian influenza strain, how it spreads and how it affects individuals.

What is avian influenza?

Avian influenza is a type of virus carried by birds. Influenza is carried by many wild birds in their intestines. Infected birds shed the virus via saliva, faeces and nasal secretions. Other birds are infected by coming into contact with these excretions and secretions, or by coming into contact with infected birds.

Wild birds do not get sick. However, the virus can spread to domestic birds – once infected, domestic birds die within 48 hours. [13]

The history of avian influenza in people

As at March 2007, 277 cases of human infection of the H5N1 avian influenza strain had been reported to the WHO, of which 168 had been fatal. Since the eruption of this disease, the most chilling aspect has been its fatality rate – with a mortality rate of almost 60% amongst reported cases, the chance of survival after infection is relatively low. More concerning is the increase in this rate over the last few months. Since 2003, reported case death rates dropped from 100% of the first 4 reported cases in 2003, to 70% of the 46 reported cases in 2004, 43% of 97 reported cases in 2005; an apparent weakening of the virus, which is typically expected. However, in 2006, 116 cases had been reported with a case mortality rate of 69%, whilst in 2007 to date the rate has climbed to over 70%.[14] Although the numbers are relatively small, inhibiting clear conclusions to be drawn, the trend remains concerning.

The current virus first appeared in people in Hong Kong in 1997. The virus found its way into poultry markets and infected 18 people. Six people died. The outbreak was halted by destroying 1.5 million birds in three days.[15]

The virus re-emerged in 2003. A family was infected after a trip to southern China. A group of 11 children were infected in Vietnam in January 2004. By

[13] Source: CDC, www.cdc.gov
[14] Source: WHO, www.who.int
[15] Source: American Academy of Actuaries, www.actuary.org

February 2004 the virus had been found in China, Indonesia, Cambodia, Laos and Korea. Over 120 million birds were culled and the virus stopped spreading for a few months.[16]

Between July 2004 and March 2005 more outbreaks were reported in all of the above countries, as well as in Thailand and Malaysia. Evidence emerged that the virus was mutating and becoming longer-lasting in the environment.

Human cases have since emerged in North Africa and infected birds have been found across many countries in Western Europe.[17]

How does avian influenza affect individuals?

Influenza is a highly contagious viral disease of the respiratory tract. While some people experience symptoms within hours, symptoms usually emerge a few days after exposure to the virus. Symptoms include headaches, chills, muscle aches and exhaustion. Stitt (unpublished) has compiled a comprehensive listing of how this affects individuals. Complications can include pneumonia and Reye's system, both of which can be fatal (Stitt, op. cit.).

A big difference between avian influenza and seasonal flu is that no-one has prior immunity to avian influenza. Furthermore, deaths from seasonal influenza (about 34 000 a year in the United States) are usually due to a secondary bacterial pneumonia infection that takes advantage of the host's weakened immune system. During the 1918 pandemic (see below) many of the deaths were due to a primary pneumonia. This involves no bacterial infection and is caused by a combination of the virus and the host's response (Stitt, op. cit.),

The positive feedback loop in the host's immune response can lead to death. The immune response is usually kept in check. However, it is possible that the many immune responses activate too many immune cells in one place. The reason for this is not understood. If this happens in the lungs, for example, the host's air passages can become blocked. This immune response phenomenon tends to be most prevalent in young and healthy individuals and is referred to as a cytokine storm. This resulted in the deaths of many young men in World War I between ages 20 and 40 (Stitt, op. cit.).

What is the WHO doing about a possible pandemic in the near future?

"It's obvious that a pandemic will occur, all the conditions are in place. The problem now is time."

- Dr Lee Jong-Wook
Director General, WHO, 21 September, 2005

[16] Source: American Academy of Actuaries, www.actuary.org
[17] Source: Public Health Agency of Canada, http://www.influenza.gc.ca

WHO's pandemic alert

WHO has a global influenza preparedness plan. The plan has six stages of pandemic alert, with each phase calling for more intense preparedness activities. Each phase also corresponds with actions that should be taken by governments, industry and the international community. WHO is presently at stage three and will move to stage four if evidence is found of human-to-human transmission.

What about a vaccine or drugs for treatment?

There are vaccines for seasonal influenza and one for the known H5N1 avian influenza strain has recently been developed.[18] However, if it were to mutate and become a pandemic, the WHO expects it to take several months from the onset of the pandemic until vaccines are commercially available.

GlaxoSmithKline have reported that a vaccine they developed has been effective in clinical trials. However, manufacturing the vaccine in commercial quantities may take some time.

As for the above, it is the opinion of medical experts that:

- there have been ongoing efforts to prepare an effective vaccine against the existing H5N1 avian influenza virus;
- it is still not known yet whether this manufactured vaccine will be administered in advance or only in response to a possible pandemic should it occur;
- we need to remember that we do not know if this H5N1 vaccine will be beneficial against a new mutated flu virus;
- the world continues to prepare and vaccine production will be important should we be confronted with a contagious global pandemic; and
- while Glaxo is certainly not claiming that this vaccine will prevent a pandemic, at least it is reassuring to know that the world is not truly helpless against a potential avian influenza pandemic.[19]

Two drugs, Tamiflu and Relenza, reduce the severity and duration of seasonal influenza. These drugs may improve prospects of survival in avian influenza sufferers, but clinical data is limited. Furthermore, these drugs need to be administered within 48 hours of onset of the symptoms. Also, should a new strain of the virus emerge, these drugs are likely to be ineffective.[20]

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[18] Source: http://uk.biz.yahoo.com/26072006/140/bird-flu-vaccine-humans-works.html
[19] Source: RGA Medical Directorate, July 2006
[20] Source: WHO, www.who.int

Global capacity to produce the vaccine or drugs, should a pandemic break out, falls far short of that required. For example, at present capacity it would take a decade to produce enough Tamiflu for a fifth of the world's population.[21]

McKinsey predicts that only 10% of a population need to be affected before an economy comes to a standstill. Inoculations will be focused on key people and it is not foreseen that enough vaccines will be available.

Evidence of the first mutation of H5N1[22]

By October, 2006, scientists had discovered a new strain of bird flu that appears to sidestep vaccines developed up to that point in time. It was infecting people as well as poultry in Asia, and some researchers fear its evolution may have been steered by the vaccination programmes designed to protect poultry from earlier types of the H5N1 flu. Researchers called the new strain H5N1 Fujian-like, to distinguish it from earlier Hong Kong and Vietnam variants. They remain flummoxed as to the cause of this new strain, and emphasized that it will mean that new vaccines will have to be developed to contain this virus.

The emergence of this new strain may encourage the belief that previous vaccination programmes had encouraged the virus to evolve resistance, but high-quality vaccines are thought to reduce the level of illness and prevent emergence of variants.

While the new virus has infected people, there is no evidence that it can pass easily from person to person. However, the virus is continuing to drift.

Public health authorities fear that the virus will mutate into a form that can spread easily among people, raising the potential for a worldwide pandemic like the one that killed millions in 1918.

[21] Source: WHO, www.who.int
[22] National Academy of Sciences, http://www.pnas.org

3. Modelling the Pandemic

The virulence of a pandemic is typically measured in terms of infection rates[23] and excess deaths per thousand as a result of the pandemic.

It is tough to predict the impact of a new pandemic. Stracke and Heinen (2006) suggest that it's "impossible to reliably predict the outbreak or effects of a new pandemic: on the one hand, medical care has improved since 1918/1919[24]; on the other, the increased mobility of today's population would cause the virus to spread much faster."

Most authors therefore model various scenarios, mostly based on the three severe pandemics of the 20th century:

- Severe: global excess mortality of 3.77 per mille 1918
- Moderate: 0.28 per mille 1957
- Mild: 0.07 per mille 1968

Modelling of South African Pandemic Infection and Excess Death rates

For the purposes of this paper, infection and excess death rates need to be derived for the South African population, and then specifically for the insured population.

Population infection and death rates

Our financial impact analysis is based on the results of an epidemiological model of a severe avian flu pandemic that was constructed for the South African population by Stipp, Staples, Hamman and Van der Merwe (2006).

The multi-state model is based on 8 stages of infection (from "Healthy but not Vaccinated", to "Flu Death" and "Other Death"). Furthermore it also distinguishes between AIDS status, urban/rural, province, gender and age band for transition probability purposes, with a cap placed on the total number of available hospital beds (25 000) and ICU beds (1 500). The total starting population (47 390 900) is assumed to be "Healthy but not Vaccinated" at outset. Over the course of 25 weeks, transitions are made to the different stages of the disease, with transition probabilities kept constant with respect to time. The merits of these and other assumptions used in this modelling are not discussed here, as the model is the subject of a separate paper by Stipp, presented at the ASSA conference, 2006.

[23] Infection rate is defined as the number of people infected out of the total number of people exposed to disease.
[24] The Spanish Flu pandemic is arguably the worst pandemic in recorded human history.

Note that our research has not been updated with enhancements made to the epidemiological model since its presentation in October 2006 (enhancements had not been published at the time of writing of this report – March 2007).

The Deloitte model yields the following outputs at the occurrence of a pandemic:

- Overall infection rate of **20.3%**.
- Excess death rate (flu deaths / start population) of **2.1%**.

This models the local flu pandemic epidemiology by assuming a single wave impact. The Spanish Flu was known to hit in three waves; the second of which having the biggest impact. It was the second wave that really hit South Africa in October 1918. It is unclear how the historic results of South Africa reflect the various waves and it is believed that recorded results reflect a combination of the various waves; hence, modelling a single wave and comparing the results against the overall effect of three waves remains meaningful. Some detail will go missing though, as a result of:

- not allowing for different virulence patterns similar to those observed in 1918-1919 (first wave moderate, second severe, third mild, which can be referred to as a "moderate-severe-mild" pandemic, referring to the three stages of the pandemic);
- not allowing for immunity development between waves, which is important if a new pandemic were to have different severity levels in subsequent waves, e.g. a severe-mild-mild, or any other combination of a similar 3-wave pandemic or any other number of waves. The concept of **herd immunity** comes into its own when a pandemic hits in waves: the phenomenon by which members of a community who are not immune to a disease are still protected from it, provided sufficient numbers of people in that community are immune. This is because when enough people are immune to a certain disease, it has little opportunity to spread and so find a non-immune person. Herd immunity only applies to diseases that are caught from other people.[25] The immunisation referred to here is built-up immunisation as a result of previous exposure to the virus.

The above rates are for the population as a whole. One can therefore argue that these rates need adjustment to arrive at **insured lives** infection and excess death rates. However, it should be noted that such adjustments will be subjective and are rarely attempted in the literature. A study that is currently underway in the United States has been the first to highlight this as a major pitfall in modeling to date, but noting at the same time that it is very difficult to make such adjustments.

[25] Source: NHS Immunisation Information, *Immunisation for Life,* http://www.immunisation.nhs.uk

Insured infection and death rates

The main factors driving differences between the mortality and morbidity experience of the insured vs. general populations are underwriting (selection and risk classification) and economic self-selection (need for discretionary income and protection for goals, assets and lifestyle). This argument is even true for group life arrangements due to the actively-at-work condition.

Economic self-selection is accentuated by the fact that people with life insurance coverage generally have health insurance as well. These individuals may be expected to be healthier at the outset of the pandemic and have a better chance of receiving quality care, because they have access to health care financing. However, health insurance is not necessarily advantageous during the pandemic as health care systems will be overwhelmed. Similarly, one may argue that during a pandemic, individuals may not **want** to access health care facilities, but to rather stay at home, effectively placing yourself under quarantine.

Without historical data reflecting the differences between insured and non-insured infection and mortality rates, it is difficult to make adjustments to population projection in order to arrive at an impact on the insured population. Allowing for differences in age distribution between the insured and general populations is one obvious adjustment that can be made, whilst an assumption of overall differences in excess death rates can be derived from comparing such rates for higher and lower socio-economic classes. Our research has made an attempt at such adjustments, details of which can be found in Section 4 of this paper.

Historical Records

In order to asses the reasonability of our population modelling shown above, the best resource would be to look at historic records. Pandemics have been reliably documented since the 16th century, although it should be handled with caution as historical data collection methods were not very accurate and complete.

In documented history, the Spanish Flu pandemic was the most severe by far. Different sources quote the following numbers for South African excess mortality as a result of the Spanish Flu pandemic of 1918:

Barry (2005)

- Barry's estimate is placed at 40 per mille excess deaths for people living in Cape Town and surroundings.
    - 0.82% of white South Africans would die according to his sources.
    - At least 2.72% of non-white South Africans die, likely many more.

- Infection rates varied from 1 in 3 for white South Africans, to almost every second non-white South African in 1918.

Phillips (1990)

- Phillips provides very similar results to Barry and be regarded as a source to Barry's work.
- He estimates that between 23 and 44 per mille excess deaths were attributable to the Spanish Flu.
- A 32% infection rate amongst white South Africans is observed, with a resulting 0.82% of the total white population dieing.
- 40% infection rate amongst non-white South Africans; 2.4% of total non-white population is believed to have died, but it is likely many more.

Johnson & Mueller (2002)

- In the ground-breaking paper by the two authors, they attempt to recalculate the total number of lives lost during the Spanish Flu pandemic.
- This follows an international conference held in Cape Town in 1998, where previously estimated numbers were revisited.
- Since the conference was initiated by Howard Phillips, it is again believed that his research, an extensive historical study of Spanish Flu's impact on South Africa, serves as basis for the authors' estimated 44 per mille excess death rate during the time of the Spanish Flu.

Although the most recent studies suggest an estimated 44 per mille excess deaths in South Africa during the Spanish Flu, a wide range of between 20 and 50 per mille is effectively proposed by the above sources. It is therefore debatable whether the Deloitte model is suggesting as severe a pandemic today as was the case in 1918. It is, however, significantly more severe than what could be described as a mild or moderate pandemic.

The above figures can be compared with excess mortality figures of 0.65% for the USA, 0.38% for Germany and between 0.25% and 0.50% worldwide (Johnson & Mueller, op. cit.).

It should be reasonable to believe that the excess deaths from Spanish Flu should provide upper bound results for our modelling. However, evidence derived from the early H5N1 death rates suggest that mortality rates of infected cases are currently 50% and higher with the disturbing presence of cytokine storm amongst young and apparent healthy people. This is considerably higher than flu pandemics over the last century. However, for it to become human-to-human transmissible, it is expected to tone down significantly.

Given the wide range of possible scenarios for a new pandemic, we model four scenarios of excess deaths for the South African population as a whole, with application to the insured population as described in Section 4:

- a central assumption of 20 per mille;
- a mild scenario of 4 per mille;
- a moderate scenario of 15 per mille; and
- an ultra severe scenario of approximately 100 per mille.

4. Impact on insurance industry and individual insurance companies

This section starts with a summary of the broader financial impact that an avian influenza pandemic may have. The financial impact of the pandemic on South African life insurers is then discussed. This discussion includes a financial model that calculates the financial impact based on estimated excess mortality. Industry feedback showing what the industry perceives the impact to be (financial and otherwise), concludes the section.

Broader financial impact

According to Standard and Poors (S&P), worldwide insured losses could be anywhere between US$15 billion (optimistic scenario) and US$200 billion (worst-case scenario). Almost all insurance sectors would be affected. How seriously insurers are affected depends on how long the pandemic lasts.

The closure of public areas (cinemas, restaurants, shopping centres, etc.) and public transport systems as well as the disruption of supply chains can result in massive claims for general insurers that write business-interruption cover.

The impact on life insurers can be just as large. Mortality and morbidity rates would be expected to increase significantly. However, the extent of the increases within different socio-economic groups would be difficult to quantify. For example, many affluent individuals with life cover (i.e. potential impact on life insurance) have access to better medical treatment (i.e. not necessarily as severely affected). However, most of these individuals live and work in large cities, areas likely to be most affected should the virus spread between people, relative to rural people[26].

Not only would insurers be exposed to large liabilities, but their assets may lose value when needed most. Equity and bond investments are likely to suffer as business is affected by the pandemic. Economies could move into a recession for a number of years following the pandemic.

The SARS outbreak in 2003 demonstrated how even a short-lived pandemic could impact on consumer spending, consumer confidence and investment. The economic cost of SARS was estimated to be about $40 billion (Curson, unpublished). Some analysts expect a pandemic of similar severity to the 1918 Spanish Flu would create insured losses of $100 billion. In September 2006, Jim

[26] Some commentators believe it best to escape to the countryside during a pandemic, away from crowds, and effectively placing yourself under quarantine. Australia managed to escape much of the first wave of Spanish Flu by implementing quarantine on incoming ships. And they are very much out of the way from the rest of the world.

Adams of the World Bank suggested that the global economy could suffer losses of between $1 trillion and $2 trillion dollars – this is more than 3% of the world's GDP and would mean a full blown recession.[27]

The effect on each insurer would be different. Some would certainly be liquidated, and others hardly affected. A comment from Pugh's article suggests "reinsurers would drop faster than people."

USA

Weisbart (unpublished) suggests that a moderate outbreak would result in US life insurance claims of US$15 billion, whilst a severe pandemic looks at US$155 billion. Others suggest that these numbers are not credible and that much lower numbers are applicable in both scenarios. It is believed that reinsurers would be worst hit, but that even the most severe scenario would not kill the industry.

Germany

Stracke and Heinen suggest that between €2.3 billion and €43.5 billion could be payable as a result of a pandemic, depending on its severity, with the latter number being as a result of a pandemic with a virulence equivalent to that of SARS. This is an interesting variation from the commonly used worst case scenarios, mostly being based on the Spanish Flu. They argue the current bird flu has case fatality rates of around 50%, several times higher than Spanish Flu. Although they also suggest that its virulence would decrease before human-to-human transmission is possible, a case fatality rate of 9.6% equivalent to SARS, about double that of Spanish Flu, should be regarded as worst case, since many older people in Spanish Flu had some immunity after a similar strain pandemic in 1889. This is evident in excess mortality rates for those older than 65 being almost non-detectable.

Stracke and Heinen also go on to comment on the expected impact on reinsurers, saying that the advantages reinsurers have over primary insurers due to geographical diversification cease to apply in the event of a flu pandemic. The net risk-bearing capacity of a reinsurer, per region, is lower and primary insurers should take care to ensure that its reinsurer either has its pandemic exposure well under control, or has a very strong capital base.

A concluding comment from Spanish Flu and its impact on the SA life insurance industry in 1918: within four months after hitting the coastal towns and cities of SA, £1.3 million in life insurance claims had been paid out. John X. Merriman suggested after a meeting of the Board of Old Mutual that there was a "…good deal of anxiety as to the future…". However, the large number of young families left destitute by the death of a breadwinner had driven home the need for life

[27] Source: World Bank, www.worldbank.org

insurance with extraordinary sharpness and according to Philips, there was no doubt that the life insurance industry more than recouped what it had paid out through policy sales in the aftermath of the Spanish Flu pandemic! (Phillips, op. cit.)

Financial impact on South African Life insurers

Several authors attempt to model the financial impact on insurance industries, including Rudolph, Weisbart, Stracke & Heinen and Stitt amongst others.

To date, no published paper has attempted to project the possible implications for insurers. An internal circular of a South African insurer noted: "...the designing of the type of scenarios that could evolve as a result of an avian influenza pandemic will necessarily involve a degree of arbitrariness and subjective judgment, and their results should therefore be regarded as indicative rather than definitive." We agree with these comments wholeheartedly.

The impact on life insurers can be considered in two parts – the impact on assets and the impact on liabilities.

The impact on insurers' assets

The impact that a pandemic would have on the asset side is less clear than that on the liability side. This paper does not try to quantify the impact on the assets.

Conventional wisdom suggests that a serious global pandemic would lead to a worldwide recession. In the United States, the Congressional Budget Office estimates the macroeconomic effect of a severe influenza pandemic as roughly equivalent to a loss of 5% of GDP, compared to what it would otherwise have been.[28] The duration and severity of the recession is likely to be a function of the duration and severity of the pandemic. Stitt (op. cit.) continues by saying that "...it appears a severe pandemic is likely to cause commercial lenders a significant increase in credit losses, broadly in line with the equivalent impact of the recessionary effect of a pandemic."

We have already mentioned before that the World Bank hints at a contraction in the world economy of more than 3% in the instance of a severe pandemic.

However, the SARS outbreak sheds some doubt on this thinking. The SARS outbreak peaked during the second quarter of 2003. The Shanghai composite was only slightly down for this quarter while the Hang Seng index rose nearly as fast as S&P. Of course, the scale of the SARS outbreak cannot be compared to the scale of an influenza pandemic (Weisbart, op. cit.).

[28] Source: US Congressional Budget Office, www.cbo.gov

Old Mutual Asset Managers demonstrated the apparent short-nature nature of health scares such an avian flu pandemic, by reference to the following graph, which highlights the effect SARS had on Chinese, Canadian and Hong Kong economies.

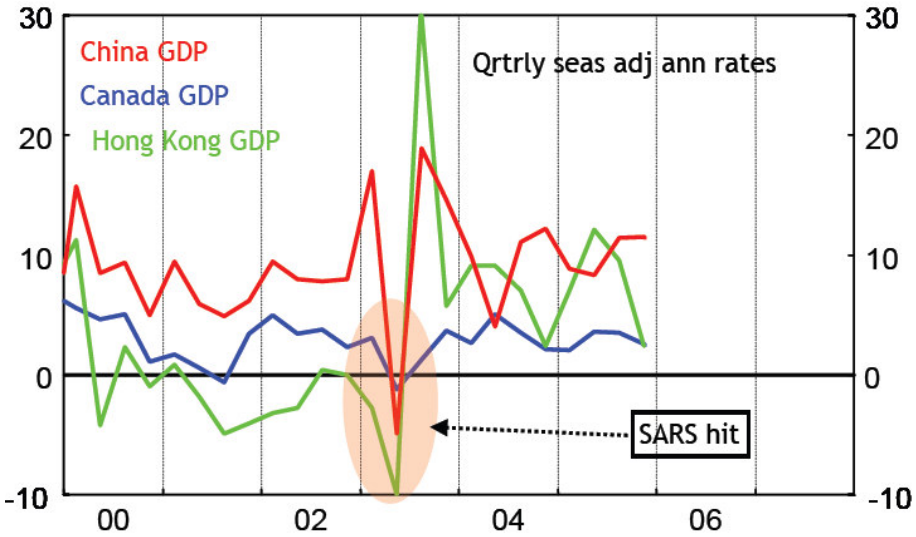

Figure 2: Impact on assets

It would certainly appear as if the economy would make a rapid recovery after a pandemic. In fact, further research suggests that this was the case during the Spanish Flu as well. According to Weisbart the Dow Jones Industrial Average virtually ignored the staggering number of people infected and the high death toll that was evident during the autumn months of 1918 in the USA.

The impact on insures' liabilities

A financial model can be constructed to convert expected excess mortality into the financial impact on life insurance industry. This can be done for both individual companies and the industry as a whole. Our paper focuses on the industry as a whole. Individual companies' experience would likely be variations of that of the entire industry.

Attempts to model the potential impact of a pandemic on the results of insurers in the South African insurance industry face several obstacles. Data at an industry level is scarce and that which is available, is at a very high level. We have made extensive use of investigations by the Continuous Statistical Investigations Committee (CSI), notably their Assured Lives Mortality Investigation, 1995-1998 and Assured Lives Funeral Mortality Investigation, 2001-2002 in order to derive exposure for individual life and funeral insurance business.

A summary of the working of our model is explained in Annexure C, with output shown in Annexure D.

Our constructed model is built around the impact as recorded for the Spanish Flu on South Africa during 1918, set as the "severe" scenario. This appears to be consistent with most attempts at modelling the severity of a pandemic. Three variations of this "severe" pandemic are then assessed separately, namely a "mild", "moderate" and "ultra severe" pandemic.

We have modelled the impact on insurers' liabilities in 4 categories:

- Individual life insurance (large sums assured)
- Funeral business
- Group Life Assurance

Disability Insurance

We have not attempted to explicitly model the impact of a pandemic on disability income and capital disability business. In most cases, it is believed that recovery from a case of influenza, even if severe, is relatively quick and full recovery can be expected within a few weeks at most. However, there is a school of thought that influenza, and especially bad bouts of influenza, can lead to long-term psychological and other physical defects (Barry, op. cit.), which may well result in an increase in disability claims. On the other hand, nowhere in the literature have we been able to find sufficient evidence to expand this theory further. In fact, in all our research we have found very limited research on the impact on disability insurance business. Where research was tracked, it was found to be weak.

Barry (op. cit.) sighted some instances where more than 10 years had elapsed after the occurrence of the Spanish Flu pandemic before disablement in later life had become apparent. No attempt to quantify such a connection was made in any of the documents that we researched.

Stipp (op. cit.) models the impact of an Avian flu pandemic on the working population in South Africa, who will (in part) be covered by disability insurance, and suggests that absenteeism from work be adversely affected. In the graph that follows, he suggests that absenteeism rates will spike within the first 10 weeks, but then reduce significantly within 25 weeks of the onset of the pandemic. However, in the event of a severe pandemic, a significant proportion of lives are expected to remain absent from work after 25 weeks. This will represent longer term illness, as well as cumulative deaths.

Unfortunately, it is not clear from the study by Stipp to how the remaining absenteeism within the working population after 25 weeks is made up of deaths, remaining illnesses and possibly disability cases.

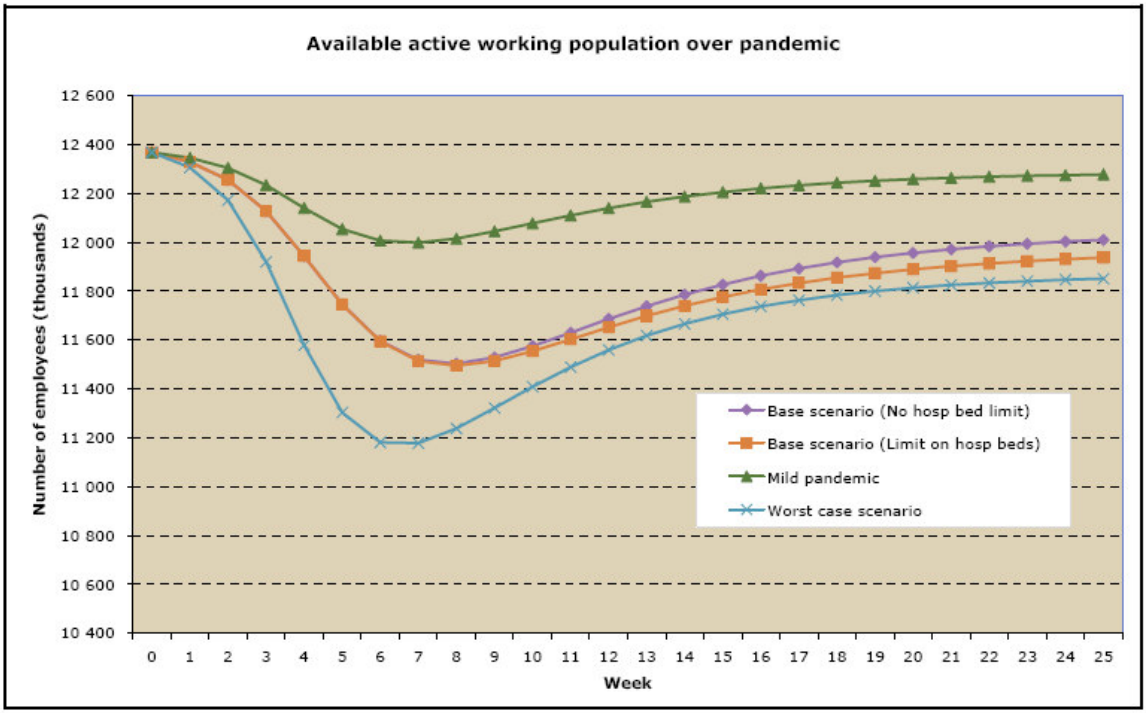

Figure 3: Available active working population over pandemic
Source: The Potential Demographic Impact of an Avian Flu Pandemic in South Africa, Sept. 2006

For pandemics in general and possibly also with avian flu, disability insurance will be affected to the extent that illness or disablement may result from infection. The impact of such disablement will be affected by:

- INCREASE in costs as an increase in disability incidence rate over and above that expected; and / or
- INCREASE or DECREASE in costs as recovery rates from temporary and permanent disability are affected (e.g. unavailability of necessary treatment where medical care is inundated with sick people); and / or
- DECREASE in costs with any increased deaths to existing disability claimants, as would be expected with disability payout recipients (weaker individuals in the population being particularly exposed to the virus).

An interesting secondary consideration with the onset of a pandemic, relating to disability insurance, would be the potential increase in fraudulent claims and claims assessment costs.

Due to limited information available and the opposing interactions affecting this form of insurance, as outlined above, our study does not develop the idea further and assumes that an influenza pandemic will have a minimal impact on long-term disability insurance.

Individual Life Assurance

The CSI study included whole life and endowment insurances during 1995-1998, covering a total of 16.5 million policies. More recent studies had not been considered, since this study was deemed the most comprehensive in terms of contributing offices. For the period, we have calculated the average number of policyholders at 4.3 million and assumed that to be a reasonable number for 2006, given a fairly stagnant insurance market.

All insured benefit payments will experience an increased level of incidence for the duration of the pandemic. Our central assumption is that the pandemic will be similar in nature to that which hit South Africa in 1918. To this extent, insured lives are expected to experience additional mortality of 8 per mille, relative to additional population mortality of 20 per mille.

With an estimated R1.1 trillion sum at risk, a pandemic of the nature of 1918 is expected to cost the insurance industry approximately R13.8 billion in additional life insurance claims in one year.

Funeral Business

This product is aimed at a lower socio-economic class of the insured population, where HIV/AIDS is much more prevalent. This results in a reduced immune system and potentially a much higher case mortality rate amongst this group of policyholders.

During the 1918 pandemic, excess mortality for the population was estimated at between 20 and 44 per mille. This was broken down into 8 per mille for the white population, and between 2.4 and 5.3 per mille for the remainder of the population. If one were to assume that the white population represented the majority of the higher socio-economic population in 1918, one could further argue that lower socio-economic classes suffered excess mortality of between 2.5 and 7 times that of the higher socio-economic classes.

It is impossible to determine what exact multiple of individual life insured mortality should be used for funeral business. Following from our reasoning above, and applying national population excess mortality to this class of business, multiples of insured live population of 1918 of anywhere between 3 and 7 could be used. For our analysis a multiple of 3 is used.

Exposure for this line of business was obtained from the most recent CSI investigation, consisting of some 7.2 million lives insured. These are all individually administered lives and exclude group administered lives, of which we had none of the important details required in order to perform this analysis (age distribution, dependent details, etc.).

Our modelling suggests that in the event of a pandemic of similar magnitude as 1918, excess mortality costs for funeral business would be approximately R1.5 billion.

It is our belief that HIV/AIDS will have its biggest effect on claims in this line of business, along with Group Life assurance. Our assumption is that this is accounted for in using higher than normal insured life excess mortality for both this and the GLA lines of business.

Group Life Assurance

The Group Life Assurance market is a very price sensitive market that has become extremely commoditised. It is generally accepted in the various sourced cited elsewhere in this document, that margins are thinner for this line of business than for individual life insurance. This will result in excess deaths, not allowed for in the pricing of this business, having a larger impact on this class of business. However, this business is annually renewable. This means that rates could be adjusted within a year to at least reflect expectations of a worsening mortality rate trend. However, it is debatable whether insurers would be in a position to recoup past losses.

We have estimated the group life market sum assured at risk at R1.3 trillion. In the event of a severe pandemic, our estimate is that excess deaths will result in additional claims costs of R22 billion.

Annuity Business

We have not attempted to model the impact of a pandemic on annuity business. Although the intuitive argument is that a saving will be achieved on such business in the event of a pandemic, which can be offset against excess costs in mortality benefits, it is not that simple.

For example, with deferred annuities any guaranteed death benefits immediately causes large sums at risk, especially at early ages of the insured and exacerbated by the possible fall in fund value (associated with falling stock markets at the time of a pandemic), which could result in serious exposure to the insurer. The extent to which insurers offer such guarantees should be considered when assessing individual insurers' exposure to a pandemic.

It is clear that with immediate annuities, one could expect an increase in profits in times of pandemics, if longevity were to be affected. The presence of living annuities in the South African market will reduce this effect to the extent that insureds may increase their income withdrawal at times of hardship. It is doubtful, however, whether this would be significant due to the rapid onset of disease and subsequent death of insureds in the event of an influenza pandemic.

Sensitivity analysis

We have modelled three scenarios, to demonstrate the range of results that may be possible from a pandemic, based on the severities of other influenza pandemics of the last century as well as the speculations by some commentators that an ultra severe pandemic could evolve. Starting with the central assumptions are results, each scenarios, with assumptions and results are shown below.

Central scenario – Severe pandemic

- Assumed to be of similar nature to that in 1918 Spanish Flu.
- Excess mortality assumed to be 20 per mille for the population and hence funeral business, 14 per mille for GLA and 8 per mille for other individual life business.
- Excess mortality costs:

Individual Life	=	R13.8 billion
Funeral	=	R 1.5 billion
Group Life Assurance	=	R22.3 billion
Total	**=**	**R37.6 billion**

Mild pandemic

- Assumed to be of similar nature to that in 1957 Asian Flu.
- Excess mortality assumed to be 2% of that of central scenario, being the severe scenario.
- Excess mortality costs:

Individual Life	=	R277 million
Funeral	=	R 29 million
Group Life Assurance	=	R447 million
Total	**=**	**R753 million**

Moderate Pandemic

- Assumed to be of similar nature to that in 1967 Hong Kong Flu.
- Excess mortality assumed to be 7% of that of central scenario, being the severe scenario.
- Excess mortality costs:

Individual Life	=	R1.0 billion
Funeral	=	R0.1 billion
Group Life Assurance	=	R1.6 billion
Total	**=**	**R2.7 billion**

Ultra Severe Pandemic

- Assumed to have case fatality rates of similar nature to that of SARS.
- Excess mortality assumed to be 5 times that of central scenario, being the severe scenario.
- Excess mortality costs:
  - Individual Life = R 69 billion
  - Funeral = R 7 billion
  - Group Life Assurance = R112 billion

Total	**=**	**R188 billion**

The above sensitivity analysis suggests a very wide range of potential results; our aim is to demonstrate the potential extremes that such a pandemic could have as effect, in addition to what we believe would be a best estimate, central assumption.

What do South Africa Life Insurance Companies Expect?

South African life insurers and reinsurers, including multinationals, were requested to participate in a survey of the level of preparedness of the insurance industry for a pandemic. A questionnaire was sent to statutory actuaries during the month of June 2006, to assess, amongst others:

- what level of concern the current threat of a pandemic poses to insurance companies;
- what measures insurers have in place to protect their insurance practices against such a risk, including reserving, product design and other possible measures;
- to what extent companies have been attempting quantification of the risk; and
- to what extent profitability and solvency are threatened by such threats of a pandemic.

Our assessment of their responses follows below, combined for insurers and reinsurers. We conclude this section with a general discussion about the potential impact on reinsurers, given the material impact a pandemic could have on their businesses.

Commentary on insurer feedback

Seven offices' statutory actuaries responded to our invitation. Together, they represent approximately R93 billion of gross life insurance premium in 2005, more than 50% of an industry premium of R177 billion[29] for the same year.

According to their LT2000 statutory returns submitted for 2005, they held liabilities to the value of R650 billion at the end of the year.

[29] Source: FSB, Seventh Annual Report of the Registrar of Long-Term Insurance

Our analysis indicates that a large proportion of the liabilities is in respect of investment type business, or has a unit-linked underlying product structure, where mortality charges can more easily be varied if not guaranteed. On average, 44% of liabilities were unit linked or market-related.

Our estimate of the total risk exposure of all life companies in South Africa is R2.5 trillion; we suspect that amongst the companies who had responded to our survey, the majority of this exposure is covered.

Several South African insurance companies will have exposure from other countries in which they do business as well. These companies need to assess the impact of a pandemic on their worldwide business portfolio, especially the levels of concentration in countries in Asia and Africa, two continents that are believed to be especially vulnerable to pandemic disease. Companies who submitted information for the sake of this research did so for predominantly their South African operations.

A copy of the questionnaire and a summary of the insurers' responses, via their appointed actuaries, are included as Annexures A and B to this report.

Below follows the key findings from our survey:

1. In general, insurers feel that their assets cover regulatory minimums sufficiently in order to allow for a pandemic, other than AIDS, which is already allowed for in statutory reserving.

   Companies realise that their CAR is not meant to cover a pandemic, but rather a general volatility in claims experience.

   The compulsory use of margins and selective use of second tier margins act as a further buffers, providing a sense of comfort for insurers in their ability to address the risk of another pandemic hitting our shores.

   It is worth noting that at least one insurer's appointed actuary felt that guidance in this respect would be welcome, something that ASSA may wish to consider.

2. Most insurers have really just been doing research and "continue to monitor the risk closely". Some have attempted modelling their results under stress testing, but other than for some limited modelling very little has been done.

   This is of concern and needs to be considered at industry level. As elsewhere in the world, it would be beneficial for an industry body such as the Life Office Association (LOA) to consider implementation of a readiness audit of all member offices, in order to assess the financial and

operational impact that such, or any shock pandemic, may have on insurers delivering on policyholder promises.

Current market capacity in the form of avian influenza / pandemic / stop loss reinsurance does not appear to exist.

3. Taking straight averages of the responses (one respondent did not provide analyses):
    a. roughly 12 additional deaths per 1 000 lives insured will eliminate these companies' total profits in 2005 (min. of 0.6 lives required for one company, max. of 19 for another);
    b. this would cost approximately R12.4 billion in pre-tax claims;
    c. the respondents' free assets will be extinguished if, on average, an additional 28 deaths per 1 000 lives insured were to occur, accounting for some R33.3 billion in pre-tax claims.

    Our modelling has shown that, depending on the mix of business concerned, in a mild pandemic scenario an additional insured mortality rate of between 0.1 per mille and 0.7 per mille can be expected. It would appear that based on the above responses, the industry as whole would comfortably meet additional claims from such a pandemic.

    However, as one increases the intensity of the pandemic, additional insured deaths could rise to between 0.6 and 3 per mille (moderate scenario for high sums assured and funeral business respectively), 8 and 41 per mille (severe) and 41 and 206 per mille in the ultra severe scenario.

    From this, it would appear that the industry's one-year profitability would be at risk only in a severe pandemic, although smaller companies / companies with highly exposed portfolios may suffer earlier, whilst an ultra severe pandemic would wipe out the industry's free assets.

    Note again that these are very broad assessments and will depend on the actual make-up of the industry's and individual companies' portfolios of risks.

4. All companies agree that a pandemic will have operational and wider economic impact – no surprises there. However, it is not clear from the survey responses to what extent companies are preparing for this, other than one respondent indicating that their business continuity team and risk committee have considered this.

5. As expected, companies are faced with the problem that existing products, with guaranteed rates, will in all likelihood never be able to recoup losses incurred as a result of a pandemic. Even where rates are annually

reviewable, "…it would probably not be feasible to recover these losses in future premiums".

This would mean that companies' balance sheets will in all likelihood have to withstand this once-off shock (if we're lucky and have a single wave, or the entire pandemic is over within a year).

One respondent has noted that its investigation into the catastrophe cover it had in place does not include pandemics. The hours clause in such policies will typically prevent this from being covered. Recent developments in the "cat" market suggest that new policies, with an extended hours clause of up to 30 days may soon be available. However, this is still expected to only cover a portion of the risk, and is expected to be expensive.

6. In terms of new products, little has been done to anticipate future pandemics. Some companies suggest that no long-term guarantees are offered, that AIDS loadings are conservative "…and incorporates an implicit margin for other pandemics…" whilst others suggest discretionary margins and other risk management processes have been considered to cover this form of risk.

   It could be argued that little has been done in this regard.

7. All insurers agree that annuity "savings" will protect some of the insurers' assets in the event of a pandemic. It is worth noting that several respondents had little or no annuity business and that the offsetting would thus be relatively small.

   One respondent questioned the much touted W-shape of a pandemic, and believes that it would in all likelihood rather be U-shaped as most diseases are expected to be (affecting infant and pensioner ages) – the result would be minimal impact on life insurance and insured ages and a significant impact at annuitant ages. Hence, significant savings should be achieved. The mix of living annuities vs. other annuities, guaranteed benefits and importantly, the likelihood of either shape of mortality curve make this a highly debatable point and one that experts disagree on worldwide.

8. In terms of knowledge of reinsurer preparedness, and their potential exposure to pandemic risk, it is noteworthy that very little research has been conducted by participants. Other than a reinsurer diversification strategy, no alternative solution to a potential failure of reinsurers has been considered by direct writers.

   Some insurers were of the opinion that reinsurers were probably worse off than they would be, given their global exposure, and that diversification

would not be of any help; all reinsurers would be expected to be a pretty similar position (i.e. that one would not be better off than another).

9. No respondents knew what their reinsurers' strategy in the event of a pandemic would be. This is of concern and may have to be addressed by the risk committees of life insurance companies, as part of their due diligence assessment of reinsurers. Rating agencies have not yet included such risk in their rating of insurers, and reinsurers in particular, but it would be reasonable to expect that if such a risk is incorporated into their rating, insurance companies will be in a position to rely on their assessment thereof.

10. All respondents agreed on the possible negative effect on investment values, but that several existing measures such as CAR resilience requirements, terminal bonuses, liquidity and investment strategy would protect mismatching liabilities with falling asset values. No measures in the form of hedged investment instruments have been put in place to mitigate this risk.

11. Respondents agreed that the scenarios provided in terms of excess pandemic deaths would materially impact on Financial Soundness and Value of Future Profits. Responses were not in a standard format, but Embedded Values are expected to deteriorate by as much as 700% in some instances.

Reinsurers

The ultimate liability for insurance claims lies with the direct writer, even in the case of reinsurance failure.

Should a major reinsurance company become insolvent, it would have ripple effects throughout the industry and global capital markets.

Our modelling in this report considered the macro impact of a pandemic on the insurance industry, and was not modelled separately for insurers and reinsurers. However, depending on the reinsurance arrangements in place, there is valid reason to believe that reinsurers will be worse affected than insurers.

Mortality reinsurance risk is typically concentrated with much fewer reinsurers active in a particular market than direct writers.

Stop loss reinsurance would be the natural product for covering pandemic risk, but this product is typically either not available, or costly.

It is believed that large sum assured products are highly leveraged with reinsurance and will as a result mean that reinsurers will carry the majority of risk

for these policies rather than the direct writer. It is debatable whether the risk here is as high as in the general population or at lower sums assured.

It may well be argued that reinsurers will be more exposed than direct writers, because of being exposed on more "fronts" (most reinsurers have exposure to Asian markets where the risk is material if a pandemic were to arise).

Towards the end of 2006, more than one reinsurer had suggested that they believed the risk of a severe pandemic is extremely small and that their capital adequacy would account for any additional risk that a pandemic would pose.

The Aftermath

It is commonly believed that the insurance sector could be better off after a pandemic. Sales in insurance policies were at unprecedented levels in South Africa in 1919 and stock markets have been shown to recover strongly. There is a theory that suggests a material improvement in mortality after a pandemic. One can even call it survival of the fittest.

This would bode well for the insurance industry in the years following a pandemic. That is to say, for those insures which survive the pandemic in the first place.

Financial impact on South African short-term insurance, medical aid and medical insurance

Covering these topics falls outside the scope of this paper. However, our research has covered several sources that deal with these topics and for the sake of completeness we make a few comments here relating to this topic:

Short-term Insurance

- Short-term insurers (known as General Insurance in the UK market and Property and Casualty in the US market) are likely to face business interruption claims as global trade, travel and tourism will be affected.
- Workers compensation carriers may be severely exposed to a risk of claims as a perceived result of negligence on behalf of the employer, in the event of this airborne disease being contracted at the workplace.
- In the next section we address the issues of business interruption and loss of productivity as a result of a pandemic – all of these would result in business losses and potential insurance claims.
- ASPN, a business unit of AON, launched the first Avian Flu Insurance Program in the USA providing business interruption insurance for poultry integrators and farmers if an avian influenza pandemic were to break out in the USA. Up to a maximum of $100 000 coverage per location is offered.

Medical Aid and Insurance

- In an article by Howell Pugh, he estimates that in a severe scenario pandemic about 42% of infected individuals will require some form of medical treatment, typically on an outpatient basis, whereas 1% would need hospitalisation.
- This would mean that hospitalisations would outnumber deaths by 4:1, and outpatient to hospitalisations 42:1 (Pugh, 2005).
- It is obvious that any country will see severe strains being placed on infrastructural and medical resources support.
- It is estimated by some that in the USA, hospital beds run at present at an 80% capacity – in even a mild pandemic scenario 100% will be exceeded.
- Wolak reasons that most individuals would not be able to claim from workers compensation for pandemic influenza-induced medical costs (Wollak, 2005), although one can imagine that some claims will be lodged against such systems as well.
- He continues to suggest that private health insurance (medical aids and some forms of health insurance in South Africa) will bear the brunt of such health related claims, and clearly the financial strength of such benefit funds will be seriously stretched.
- In Wolak's words, "…medical resources would be shifted from caring for the aged to tending to the pre-65 population, with the subsequent claims being financed more by private insurers and less by public plans". He is specifically referring to Medicare and Medicaid programmes, US government programmes aimed at caring for the frail and elderly.
- A 2004 report prepared by Risk Management Solutions (RMS) modelled the losses that would be incurred for a pandemic that resulted in 200,000 deaths and $30.6 billion of health insurance losses. Extrapolating that projection to 700,000 U.S. deaths, losses to the health insurance industry are estimated at between $30 billion and $106 billion, or more than three times that of the cost to the life insurance industry (according to this study).
- Medical aid loss would be impacted by:
    - The length of time that an influenza virus impacted health. If the infectious period was relatively short, the limits to healthcare resources would hold down costs,
    - Number of seriously ill patients requiring extended hospital care,
    - Impact of virus on working population versus the elderly and the uninsured, and
    - Impact of virus on reducing the number of available healthcare workers.

It would therefore be reasonable to draw the following conclusions:

- Health insurance carriers are insulated from incurring significant losses from catastrophes due to limited non-occupational health risk exposure to the under age 65 population covered by private medical aid.

- When compared to other types of insurance, health insurance and medical aid are "just in time" benefits, where supply is matched to expected demand. A spike in demand in one area as a result of a catastrophe may go unmet by additional capacity or may be met by special government agencies. This seems to be true in the case of man-made or natural disasters.
- Health insurance carriers would, however, appear to have significant claim risk from a large-scale pandemic. In such a case, the spike in demand could occur nationally rather than being localized (Wollak, op. cit.).

To prepare for such an event, Howell Pugh in his article suggested that the American Academy of Actuaries and the Society of Actuaries could work to develop a way to stress test a health insurance carrier's strength. Similar tests can be designed for medical aids in South Africa to assess their ability to withstand such a pandemic.

5. Possible solutions and actions available to the industry

There has been a lot written on pandemic preparedness by experts in a many fields. The ideas are similar and often focus on what individuals can do in the event of a pandemic. But how can insurance companies prepare? It is believed that governments and their agencies have little other choice than to prepare for the worst form of pandemic. However, it is further believed that insurers should be able to prepare for the most likely event occurring, which may (or may not) be a severe pandemic.

Given the views of many experts, the next influenza pandemic is inevitable and we are closer to a pandemic today than at any time in nearly 40 years. The question is therefore when, not if, the next influenza pandemic occurs. Dr Susan Tamblyn, a public health consultant in Ontario, commented at a recent conference: "The pandemic clock is ticking; we just don't know what time it is."

This section deals with the issues that need to be considered to reduce the impact of a pandemic on mortality, morbidity and social disruption, as well as the questions that need to be addressed during the recovery process.

Preparedness

There is much awareness of the threat of pandemics globally. We are today far better prepared than we were a year ago, and the more time we have to plan and prepare, the more effective a global response will be. Every moment and rand spent planning for a pandemic improve our defences, and preparedness will pay dividends against this threat.

A critical area of preparation is local health care systems (Cowen, 2005). Even if an avian influenza pandemic does not occur, our health care infrastructure should be of such a standard that any catastrophe, whether it is a natural disaster or terrorism, can be managed. It is apparent that such an ongoing preparedness project should be politically and economically sustainable. This report does not go into the detail of the preparedness of the South African health care system, but any shortcomings in this respect will directly impact on claims (more deaths). The effectiveness of the health care system's administration process will also play an important role during a pandemic. Life and health insurers will need to rely on the effectiveness of services such as death registers in order to know which claims to pay.

Would insurers be ready to pay claims as they arise? Pertinent to life insurers' contingency planning for pandemics, a recent report in the USA of the Government Accountability Office explored the life insurance industry's ability to recover critical operations after a terrorist attack or natural disaster. The report

concluded that life insurers have taken sufficient steps to ensure business continuity and to minimize effects on their service to policyholders. The report also stated that since life insurers operate independently of one another, difficulties at one insurer are not likely to impact the rest of the industry.[30] In section 4 we drew attention to South African insurers agreeing that a pandemic will place administrative functions under pressure – there has been no coordinated effort to review the readiness of this industry here to the extent that the Americans have verified their readiness.

The technology of vaccine development is an essential part of our preparation process. The five major manufacturers of winter flu vaccine (Bonheure, 2006) are based in the United States (one) and in Europe (four). The aim is to have stockpiles of vaccines available in order to minimise the process of prioritising people into categories in need of vaccination and other medication, for example medical workers, people critical to the manufacturing of vaccines, and the elderly. As with any scarce good, limited amounts of vaccine will be available on the black market, and it is likely that the well-off would benefit from any limited availability.

The main problem with vaccine development is that a sample of the pandemic influenza strain itself is required before production of the vaccine can commence. This means that vaccines would only be available around 3 months after the outbreak of the pandemic influenza virus, and this process could take even longer than 6 months depending on the speed with which the strain can be isolated and samples produced, checked and the vaccine produced. Pre-pandemic vaccines will not be a perfect match, but could possibly help to improve immunity.

A British company reported during July 2006 that it has achieved the best results ever seen on an experimental human vaccine for avian influenza and said mass production might be possible from 2007. "It changes the whole complexion of the issue that we have to face of getting enough vaccine for people who might need it in a pandemic," said Dr. Anthony Fauci, director of the National Institute of Allergy and Infectious Diseases in the United States. The vaccine includes an immune-system booster that allows it to use less of the main active ingredient, meaning that greater quantities could be produced if the H5N1 bird virus mutates into a form that spreads easily among people and causes a global epidemic. The vaccine uses an inactivated version of the newer strain of H5N1, which was isolated in Indonesia last year.

Another field of intense study is the production of antiviral medication. Antivirals are not a cure to influenza: they reduce transmission rates and relieve the complications and severity of illness of those already infected. However, antivirals are in short supply, their efficiency is questioned, and a strict treatment

[30] Source: http://www.acli.com

routine is required. These medicines only work if the course is started within 48 hours of the onset of symptoms, that is during a period in which it is generally impossible to tell the type of virus.

Vaccine and antiviral drug production capacity is an important area where development is required. There are still many countries worldwide that do not have any production capacity, and should a pandemic break out, vaccine-producing countries will first look at their domestic requirements before exporting.

But why is planning essential, and will it actually add value? The following examples of what will go wrong help illustrate the need for planning:

- The health care system will be running beyond surge capacity, and significant shortages in medical personnel, hospital space, equipment and medical products will occur. Auxiliary locations such as schools, community halls and hotels will need to be converted into health care centres. This could potentially raise the question as to whether health insurers are liable to pay claims if patients are not treated in hospitals.
- There will be prolonged power and utility outages, and prolonged periods without any government services. This could result in periods without Internet access, telephone service, cash machines, working petrol stations, fresh food, functioning hospital equipment, waste removal, etc. Hospital equipment such as dialysis and respiratory machines will not function at times, resulting in increased mortality rates for such patients.
- Borders might be closed, and the free flow of goods, services and people will be prohibited. In our current environment of international supply chains, no country is self-sufficient anymore. Countries that have had discussions about possible border close-offs include, amongst others, Australia and New Zealand. During the 1918 influenza pandemic, Australia introduced a stringent maritime quarantine that delayed the outbreak of the virus until early 1919, that is by just less than a year. By then the strain was much less lethal, and the Australian influenza death rates were far less than in any other Westernised nation.
- Schools will be closed, and there will be large scale absenteeism from work as people will stay home to care for the sick and to avoid exposure to the virus. This could lead to huge backlogs in administration of hospital and death records and claims settlement.
- Fear and panic will break loose, and this could lead to unruly or criminal behaviour, especially when shortages of water, food and vaccines and / or antivirals emerge. Safety and security would be a primary issue.
- Many businesses will close, and in some cases leaving employees will not receive pay cheques. Sectors that will be most affected in this regard include poultry, tourism, travel, transport, hospitality, luxury goods and life and health insurers.

Keeping all Parties Informed

A well-planned communication plan is of utmost importance during a pandemic. Not only should clients such as policyholders, shareholders and regulators be kept informed, but from an internal perspective, it is important to keep employees updated with the latest available information on the position of the company and the status of the disease.

Especially during the early stages of the pandemic, official records of the severity of the disease will be delayed (Barry, op. cit.). This can be ascribed to poor communication infrastructure between hospitals and public health facilities, or deliberate suppression of information, and could result in an initial underestimation of the impact of a pandemic.

Maintaining Trust in the Insurance Industry

The purpose of the insurance industry is to provide customers with peace of mind in the event of adverse exposure to risk, and to honour long-term commitments. This is the promise of the industry, and it is in terms of this promise that a pandemic poses the greatest risk.

This will inevitably impact on the image of life insurance as a whole. Given that under a severe scenario, a big majority of the population will survive, and that these survivors will probably place an increased priority on having life insurance, the industry cannot afford to be bankrupted or have a bad name due to non-payments (Phillips, op. cit.).

Financial Reporting

A pandemic will create serious problems in terms of accounting and solvency. Employment disruptions and the society's challenged claims reporting infrastructure will cause extraordinary claim delay patterns, which coupled with a non-normal claim amount distribution will create serious challenges in terms of financial reporting. A further contributing factor in this regard is the fact that the short supply of personnel will be faced with rising numbers of applications for new policies.

Reliance on Reinsurers

Both direct writers and reinsurers are affected in the event of a pandemic, but how would a reinsurer's insolvency affect the insurance industry?

In non-pandemic times, reinsurers have a diversification advantage over direct writers: a reinsurer's portfolio is geographically spread (Stracke & Heinen, op. cit.) more widely than a direct insurer's, so that a reinsurer is less exposed to regional natural disasters. But this advantage ceases to apply in the event of a

pandemic, and reinsurers can be expected to be affected equally, if not more, when a pandemic occurs, especially in the light of a geographical spread that will more likely include exposure to Asia.

A direct insurer seeking protection against pandemic risk should therefore be very careful in choosing a reinsurance partner. Should a major reinsurance company become insolvent, it would have ripple effects throughout the industry and global capital markets. Although the prudence of statutory reserves might quite likely result in a failed reinsurer still being able to honour most of its liabilities, the priorities for this settlement process would be decided by different courts, quite likely in different countries, and such a process could take years. This will put the industry in a liquidity predicament.

Challenges to the Companies' Preparedness Initiatives

In terms of individual companies, the greatest challenge to overcome is a lack of realisation of the urgency to plan ahead. It is not easy to take steps today of which the benefits will only be reaped in a number of years[31]. But a company's risk mitigation process for a possible pandemic should be incorporated within a broader strategic plan that prepares the company for all sorts of risks: the pandemic planning should be just one component of the company's overall approach to risk management. Most companies conduct annual risk assessments, but these seldom go into the detail of low-probability, high-impact events.

Although we are in a race against time to prepare for the next influenza pandemic, current efforts lack both funding and coordination. Integrated country programs that are complemented by regional and global coordination are required, as is a robust response from international donors. As all countries could potentially be affected if a pandemic occurs, all countries share a common responsibility to counter the spread of the disease, and they should put resources behind the effort. Countries with different income levels are likely to require different levels of donor support. If the international community does not support these critical control measures now, the potential cost to the world could be disastrous.

Under the auspices of the United Nations, estimates were calculated for the short-term financing gap at country, regional and global levels and a total figure of roughly $1.2 billion[32] was obtained.

[31] Source: Avian Flu: What to expect and how companies can prepare for it. www.mba.co.za
[32] Source: World Bank, www.worldbank.org

Recovering from a Pandemic

The road to recovery for the insurance industry is a function of, amongst others, the following factors:

- the preparedness of the international community as a whole;
- the preparedness of the international insurance industry; and
- the severity of the pandemic.

This recovery process will take place in a post-pandemic environment, and companies without well thought-through planning and recovery plans will be at a disadvantage compared to their competitors.

Opportunity for Acquisitions

Companies that are under regulatory scrutiny are likely to become insolvent in the event of a pandemic, and some of the weaker solvent companies might move into an environment where they face regulatory scrutiny. Such companies will be looking for capital while companies with capital will be looking for investment opportunities to diversify their portfolios. This might lead to multiple acquisitions and/or mergers in the South African life insurance industry.

Given the numerous consolidations in the South African market during the past few years (Sanlam – Safrican, Investec – Liberty, Momentum – Southern Life, Capital Alliance – Liberty, Old Mutual – Nedcor, etc), a pandemic will most likely consolidate the insurance market even further.

Other

Various other items will also have to be considered, including impact on new business, during and post pandemic, and the possible introduction of legislation at the peak of a pandemic.

6. Conclusion

Avian influenza is just one form of a new threat that faces insurers and communities alike – pandemics of short duration with a potentially devastating effect.

Pandemics are nothing new and have been recorded in history to occur every 30 to 40 years. Influenza pandemics have been the most noteworthy in the 20th century, with the Spanish Flu of 1918 killing between 50 million and 100 million people worldwide. Experts believe that the next pandemic will again be some form of influenza pandemic, with the current threat of avian influenza touted as a possible forerunner of the next big killer.

History shows that South Africa is particularly at risk of a new pandemic as a result of its highly sophisticated infrastructural network in a country of relative poverty and lack of healthcare service. In 1918, South Africa was one of the worst hit countries in the world and it is believed that this would be the same, if a new pandemic were to hit.

It is debatable whether South Africa's insured population will have similar or different lever of exposure to a pandemic relative to the general population.

HIV/AIDS is a pandemic. But it differs from an avian flu pandemic threat in that it's a slow pandemic. The Spanish Flu has killed more people in 24 weeks than the number of deaths as a result of AIDS in 24 years.

Our modelling suggests that a mild pandemic would cost the insurance industry about R1.1 billion in claims (excluding any annuity savings).

For a severe pandemic of similar magnitude as that experienced in 1918, risk claims are expected to exceed R55 billion.

Individual insurance companies will be differently impacted upon by such a pandemic, depending on various factors such as their portfolio at risk, liquidity, level of free assets, reliance on reinsurance, protection that its reinsurers have in place, etc.

A study of local insurers suggests that:

- companies typically have little in terms of a quantifiable feel for the extent of the risk of a pandemic;
- little modelling had been done to assess the various scenarios that companies may face;
- few measures have been taken, with very much a watch-and-wait approach;

- a mild pandemic is expected to make a serious dent in a single year's profits, but will not close down more than a few smaller, highly exposed (and probably not properly reinsured) direct insurers;
- it would have to take an ultra-severe pandemic to threaten the entire industry; and
- with even the mildest of pandemics business operations will be affected; reinsurers are heavily exposed to pandemic risk, possibly more so than direct writers, and direct writers should consider this in placing reinsurance.

However, it is not all doom and gloom. The American Council of Life Insurers (ACLI) believes that their industry is geared for a pandemic and that they will deliver on policyholder promises. This is based on sound reserving and well thought out business contingency plans, following well established recovery planning that has become a trademark of well prepared countries and industries.

Although our study has shown that neither South Africa as a country nor our life insurance industry are doing particularly well in the planning and preparedness arenas, it is believed that this can be achieved if driven at the appropriate levels. For life insurance, it is proposed that industry bodies such as the LOA take this responsibility.

We may not yet have reached that point where:

"I felt the first inkling of a thing that presently grew quite clear in my mind, that oppressed me for many days, a sense of dethronement, a persuasion that I was no longer a master, but an animal among the animals … the fear and empire of man had passed away."

H.G. Wells
The War of the Worlds

References

AON White Paper (unpublished). Pandemic Influenza: Managing the Risks of an Invisible Threat, www.aon.com/uk, 31/10/2005

Barry, JM (2005). *The Great Influenza: The Epic Story of the Deadliest Plague in History*, Penguin Group, USA

Bonheure, K, Keller, P & Somers, K (2006). Avian Flu: Expanding global vaccine production. *The McKinsey Quarterly*

Centre for Disease Control and Prevention (unpublished). Key Facts About Avian Influenza (Bird Flu) and Avian Influenza A (H5N1) Virus, http://www.cdc.gov, 30/6/2006

Continuous Statistical Investigations Committee (unpublished).
Assured Lives Funeral Mortality Investigation, 2001-2002.

Cowen, T (2005). *Avian Flu: What should be done,* Mercatus Center, George Mason University

Crosby, AW (1989). *America's Forgotten Pandemic: The Influenza of 1918,* Cambridge University Press, Cambridge

Curson, P (unpublished). Pandemic Insurance Jitters, ON LINE Opinion, http://www.onlineopinion.com.au, 01/12/2005

Financial Services Authority (unpublished). Insurance Sector Briefing: ICAS – One Year On, http://www.fsa.gov.uk 30/11/2005

Johnson, NP & Mueller, J (2002). Updating the accounts: global mortality of the 1918-1920 "Spanish" influenza pandemic. National Center for Biotechnology Information (NCBI), *Bulletin of the history of medicine*

Knapp, D (2006). *Avian Flu: Bracing for a Pandemic*, CrossCurrents magazine, Ernst & Young

Lambert, S (unpublished). Are You Ready for Bird Flu? This is Money, http://www.thisismoney.co.uk, 19/11/2005

MacInnes, L (unpublished). TB strain threatens "uncontrollable" epidemic, http://www.scientificamerican.com, 06/03/2007

O'Malley, BR, Dorrington, RE, Jurisich, SC, Valentini, JA, Cohen, TM & Ross, BJ (2005). An investigation of the mortality of South African assured lives, 1995–1998. *SAAJ* 5, 27 - 59

Osterholm, M (2005). Preparing for the next Pandemic, *Foreign Affairs*

Patterson, KD (1986). *Pandemic Influenza 1700 - 1900,* Rowman & Littlefield

Phillips, H (1990). *'Black October': The Impact of the Spanish Influenza Epidemic of 1918 on South Africa,* Archives Year Book for South African History, Government Printer, Pretoria

Potter, CW (2001). A history of Influenza. *Journal of Applied Microbiology*, Volume 91

Public Health Agency of Canada (unpublished). Current Avian influenza (H5N1) affected areas, http://www.phac-aspc.gc.ca, 01/09/2006

Pugh, H (2005). The Cost of Avian Influenza, *Contingencies – American Academy of Actuaries*

Reid, Kenneth (2005). *Avian Armageddon*, Spear's Security Industry Analyst http://www.forbes.com

Stitt, A (unpublished). Pandemic: What every Actuary advising and Australian financial services organization should know. Third Financial Services Forum, Institute of Actuaries of Australia, 2006

Stipp, E, Staples, G, Hamman, C & Van der Merwe, J (unpublished). The Potential Demographic Impact of an Avian Flu Epidemic in South Africa. Convention, Actuarial Society of South Africa, 2006

Stracke, A & Heinen, W (2006). Influenza Pandemic: The Impact on an Insured Lives Life Insurance Portfolio, *Assets & Liabilities, Gen Re Issue 1*

The World Health Organization (unpublished). Epidemic and Pandemic Alert and Response (EPR): Avian influenza, http://www.who.int/en, 10/09/2006
The World Health Organization (unpublished). Avian influenza: assessing the pandemic threat. http://www.who.int/en, 31/01/2005

Weisbart, S (unpublished). Pandemic: Can the Life Insurance Industry Survive the Avian Flu? Insurance Information Institute, www.iii.org, 20/06/2006

Wollak, DL (2005). When…not if the impact – The impact of a catastrophe on private health insurers. *Risk Management Matters, An Online Journal*, Volume 3, Issue 4

Annexure A: Questionnaire to Appointed Actuaries

Dear Statutory Actuary

Research Paper on Avian Flu:
ASSA Life Assurance Committee in association with RGA South Africa

The re-emergence of the H5N1 influenza virus in late 2005 and the extraordinary impact it has had in the culling of entire bird colonies, human deaths and other extreme measures have caught the world's attention and is a regular topic in today's headlines and public debates. Discussions about this threat inevitably include references to the Spanish Flu and other similar, but more moderate pandemics such as those in 1957 and 1968. But the crucial question for financial services providers is really this: what will be the impact of any pandemic on the industry?

The ASSA Life Assurance Committee, in association with RGA South Africa, will examine the potential impact of an influenza pandemic on the South African life and health insurance industry. The financial effects of different pandemic scenarios on risk and investment business will be evaluated, with the focus predominantly on the risk side.

In order to conduct an investigation that reflects the entire industry's views, your detailed feedback to the following questions will be appreciated:

1. What reserving philosophy is followed, in particular with regard to the use of planned margins, to cater for the risk of a pandemic? To what extent is CAR coverage deemed to be sufficient, and why?

2. What other measures have you, as appointed actuary (a) considered and (b) put in place to allow for this risk?

3. What modelling has been done in terms of allowing for a pandemic? Can this be made available for research purposes for this paper?

   In order to have some form of consistency between company responses, we will appreciate the completion of the following schedule of possible scenarios in order to assess the possible impact of a pandemic on the financials of the company to which you are appointed.

Scenario	**Additional deaths per 1 000 lives**	**Additional pre-tax claims (R million)**
Eliminate Total Profit on sheet C7 of latest LT 2000		
Eliminate Total Individual and Group Life Mortality Experience Profit on sheet C7 of the latest LT 2000		
Amount of Additional Mortality that would equate to the current CAR Amount on sheet C3 of latest LT 2000		
Eliminate Free Assets on sheet C3 of latest LT 2000		

4. Do you believe that there will be any second order effects such as higher claims costs due to poor productivity, a smaller policy book, higher management costs and business interruption at the insurer's offices?

5. For existing products, is there any flexibility to adjust rates, should this be necessary, or are there specific allowances to accommodate adverse experience due to pandemics?

6. For new products, to what extent is allowance being made in pricing, underwriting, claims management and other risk management processes in order to minimise the possible impact of such a pandemic? For pricing, this should be particularly relevant where longer-term mortality and morbidity guarantees are being provided.

7. In your opinion as the appointed actuary, to what extent is the expected impact of a pandemic expected to be offset between the various decrements, e.g. annuity vs. life business?

8. What reinsurance diversification or alternative strategies are being considered in the event of such a pandemic placing unexpected stress on a single reinsurer?

9. Do you know what measures the applicable reinsurers are putting in place to circumvent unexpected financial stresses?

10. How do you expect the insurer's assets to be impacted in event of such a pandemic and what protective measures are being put in place?

11. Please provide current sensitivity testing in respect of FSV and EV figures for changes in the mortality, as per the following scenarios:

Additional mortality per mille for one year:

Mild	Moderate	Severe	Ultra
0.22	2.2	11	22.1

12. Can you please provide us with the following in respect of the CAR calculation as per your latest LT2000:

	Value of p	Value of n
45p/√n		
65p/√n		
135p/√n		

13. Finally, the details of the following sections of the latest submitted LT2000 return in respect of the company to which you are appointed will provide us with additional information about the companies' exposure to such a risk:
    B1 – B5,
    C9,
    G3 and G4.

    (Should you not be prepared to provide us with all the details of section C9, could you please provide us with the proportion of non-investment premiums which are reinsured, as well as the amount of total gross and net policy liabilities.

    We believe that all the publicly available information, although not specific, will be valuable in our analysis. We would welcome all of this information, although not specifically requested.)

Our aim is to complete the data collection exercise by 28 July 2006.

Please note that all the information received from the participating Life Offices and their officers and analysed by RGA, its employees and contractors will be kept completely confidential at all times. At no time will the identity of any of the participating Life Offices be disclosed in the presentation of the results or confidentiality of their information compromised.

The requested information should be forwarded to Grete Kritzinger, mailto: gkritzinger@rgare.com

We would be very pleased to have you, as well as the companies to which you are appointed, participate in this survey and believe this review will be incomplete without your participation. We trust that a credible market research paper, outlining the specific circumstances of life insurance companies in South Africa, will add value to you. Any company-specific analysis will be made available to the relevant contributing company, whilst aggregate industry information will be contained in a research paper that will be presented at the ASSA Convention.

Yours sincerely

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Annexure B: Statutory Actuaries' Responses

1. What reserving philosophy is followed, in particular with regard to the use of planned margins, to cater for the risk of a pandemic? To what extent is CAR coverage deemed to be sufficient, and why?

Insurer A
The reserving basis includes all compulsory margins, while second tier margins are included to ensure that shareholder entitlements to profits emerge in the years in which they are earned, rather than capitalised at inception. No other specific allowance has been made for the risk of a pandemic apart from AIDS, which is allowed for in terms of ASSA models and guidance notes.

Insurer A is on a TCAR basis and therefore some coverage is implied by the difference between TCAR and OCAR (i.e. an addition can be made to our OCAR without increasing the TCAR.).

Insurer B
FSV liabilities and CAR do not allow for pandemics – only statistical fluctuations in mortality. We hold approximately twice the level of compulsory margins on main product lines to ensure profits emerge in line with product design. These margins act as a "general" provision against adverse claims experience.

Insurer C
No specific reserves have so far been set up for the risk of Avian Flu. I am satisfied that the compulsory and discretionary margins would cover the potential claims. However, I would like some guidance in this regard and would prefer to put up specific reserves.

Insurer D
There is no explicit allowance for a possible future pandemic apart from AIDS. In addition, this company has a significant terminal bonus "cushion" which can be reduced in case of any pandemic. Furthermore, the risk rates on the Universal business are also reviewable; hence, these can theoretically be reviewed in case of a pandemic.

Insurer E
Our reserves include some discretionary mortality margins, but not specifically for this pandemic. We have sufficient capital (cover CAR and in excess of CAR) to cover the possible increase in claims due to bird flu. Mortality CAR itself does not reflect Bird Flu risk.

Insurer F

There is no explicit allowance for a possible future pandemic apart from AIDS. The company's CAR coverage is well in excess of the minimum which provides some margin for the impact of a pandemic. In addition the claims scenarios envisaged in the CAR formula are fairly conservative for this company whose claims experience has been fairly stable over the last few years and is unlikely to change significantly unless there is a pandemic.

Insurer G

Insurer G does not make any specific provision for the risk of a pandemic. It is felt that the CAR cover and planned margins are sufficient to cover this risk.

2. What other measures have you, as appointed actuary (a) considered and (b) put in place to allow for this risk?

Insurer A
To obtain as much information as possible regarding Avian Influenza and the various possible scenarios, work is underway to investigate:

- underwriting risk;
- operational risk;
- market risk;
- etc.

The outcomes will dictate what is put into place to allow for these risks.

Insurer B
a) We've applied a number of shock tests to see what the impact of a pandemic could be. b) No measures put in place

Insurer C
Reinsurance was considered, but (other than normal quota share) does not seem viable at this stage. At this stage we are just monitoring the developments.

Insurer D
Rates are generally reviewable and rate guarantees generally do not exceed five years. Experience is monitored on a regular basis.

Insurer E
Research has been done on the pandemic, and we have investigated the use of stop-loss and catastrophe reinsurance cover - although reinsurers have confirmed that no cover will be offered at this stage. No other measures have specifically been put into practice to allow for this risk.

Insurer F
Rates are generally reviewable and rate guarantees generally do not exceed five years. Experience is monitored on a regular basis.

Insurer G
At a global level Insurer G's parent company has catastrophe cover. On a statutory basis a large portion of our risks is [reinsured] ... within the group so we are still at risk as a whole. The bulk of our business is on higher sums assured ... Generally these are lives in the higher socio-economic classes who would have access to better medical care and would possibly survive the pandemic.

3. What modelling has been done in terms of allowing for a pandemic? Can this be made available for research purposes for this paper?

Insurer A
We have done a limited amount in terms of this possible pandemic and thus nothing can be made available as yet.

Insurer B
None, other than scenario tests mentioned in 2 above.

Insurer C
We have done rough estimates of possible impacts, but no detail modelling. The work would not have much value for research purposes.

Insurer D
None at this stage.

Insurer E
Profit impact tests have been done similar to that requested by the survey. We are not prepared to make this research available.

Insurer F
None at this stage.

Insurer G
Some modelling has been done.

In order to have some form of consistency between company responses, we will appreciate the completion of the following schedule of possible scenarios in order to assess the possible impact of a pandemic on the financials of the company to which you are appointed.

[Due to the confidential nature of this information and to ensure anonymity of respondents, the authors have been requested not to display the detailed responses to this question.]

4. Do you believe that there will be any second order effects such as higher claims costs due to poor productivity, a smaller policy book, higher management costs and business interruption at the insurer's offices?

Insurer A
Yes, specifically:

- staff shortages;
- underwriting issues;
- effects on distribution channels; and
- general business continuity issues.

Insurer B
Yes, but these aspects form part of a broader approach dealing with operational risks. Our business continuity team and risk committee have considered these.

Insurer C
I believe there will be second order effects e.g. cost of absenteeism and lower new business sales/higher lapses because of the economic impacts of the epidemic. I have not quantified the potential impact.

Insurer D
Yes, depending on the severity of the pandemic.

Insurer E
Yes - we would expect to have service centre and claim centre over-run costs as well as staff absenteeism.

Insurer F
Yes depending on the severity of the pandemic.

Insurer G
I think that there may be second order effects on the economy depending on the severity of the pandemic. But in most instances I would expect this to be small.

5. For existing products, is there any flexibility to adjust rates, should this be necessary, or are there specific allowances to accommodate adverse experience due to pandemics?

Insurer A
All policies which allow rates to be reviewed on an annual basis would provide some flexibility. Some other types of policies have reviewable mortality charges / premium rates at future dates. However, this ability is unlikely to be particularly useful as a pandemic of this nature is likely to be of a reasonably short duration.

Insurer B
Most universal life policy contracts allow us to increase risk premiums. The extent to which risk premiums can be increased during the guaranteed term is in practice constrained by the guarantee. On recently written business, i.e. the new generation risk business, premiums may not be adjusted before expiry of the guarantee term. On employee benefits business, there is of course a lot more scope to change rates, usually one year after the previous rate revision.

Our catastrophe clauses do not cover pandemics.

Insurer C
Individual Products – some have flexibility, but some are fixed for a guaranteed period.
Group Products – can be adjusted on an annual basis. The immediate impact would mostly flow through to shareholders, possibly with some recoupment over time.

Insurer D
Rates are generally reviewable or have limited guarantees (up to five years)

Insurer E
In theory some premium rates can be adjusted, but in practice bird flu is expected to cause a temporary increase in claims, and it would probably not be feasible to recover these losses through an increases in future premiums.

Insurer F
Rates are generally reviewable or have limited guarantees (up to five years).

Insurer G
All our products have the ability to increase rates after a guarantee period which can be up to 15 years. To the best of my knowledge there is no additional protection against pandemics. Some of our business is annually renewable and on this we would increase rates.

6. For new products, to what extent is allowance being made in pricing, underwriting, claims management and other risk management processes in order to minimise the possible impact of such a pandemic? For pricing, this should be particularly relevant where longer-term mortality and morbidity guarantees are being provided.

Insurer A
Nothing in particular on new business, however, other risk management processes have been described above.

Insurer B
Normal charges in premium rates (and reserving bases) for guarantees apply. These charges were not increased recently, i.e. no adjustment was made in response to bird flu threat.

Insurer C
No specific provision is made for a pandemic. Will be covered implicitly by the discretionary margins.

Insurer D
No long term guarantees are offered. The AIDS allowance used for pricing is slightly conservative and thus could be seen to incorporate an implicit margin for other pandemics.

Insurer E
No specific changes are being made to new products to allow for bird flu risk at this stage.

Insurer F
No long term guarantees are offered. The AIDS allowance use for pricing is probably slightly conservative and incorporates an implicit margin for other pandemics.

Insurer G
No explicit allowance is made for pandemics.

7. In your opinion as the appointed actuary, to what extent is the expected impact of a pandemic expected to be offset between the various decrements, e.g. annuity vs. life business?

Insurer A
There will clearly be some offset between annuity and assured business. However, this will depend greatly on whether the pandemic affects different population age groups differently.

There could also be an offset with the anticipated decrements due to AIDS.

Insurer B
Although much has been said and made about a possible W-shaped excess mortality curve, the most likely outcome is still a U-shaped excess mortality curve, in which case annuity the business there will be a hedge.

Insurer C
There will be some offset between annuity vs. life business. However, there is quite a bit of uncertainty regarding the possible outcomes.

Insurer D
Will not be much offset. No annuity business.

Insurer E
There will be some offset if pensioners are exposed to the same extent as other policyholders, however the offsetting effect will be relatively small because the life book is much bigger than the annuity book.

Insurer F
Will be some offset. Possibly may have bigger impact on annuitants because they are generally older category of lives. However for this company annuity business is not a significant enough category to have much impact.

Insurer G
For Insurer G there will be some release of reserves on our disabled lives portfolio but this will be very small relative to the effect on the life business.

8. What reinsurance diversification or alternative strategies are being considered in the event of such a pandemic placing unexpected stress on a single reinsurer?

Insurer A
Currently, we try to follow a reinsurer diversification strategy and will continue to try and follow that approach.

Insurer B
We would like to be able to get reinsurance protection, but seems unlikely currently. Even if pandemics are added to the existing catastrophe reinsurance, the lines available are not large enough to protect solvency – it's not even large enough to protect one year's earnings.

Insurer C
Given that there are only a few reinsurance players in South Africa, concentration is an issue. On the other hand a worldwide pandemic can hit all the major reinsurers. We have not changed our reinsurance strategy in view of a possible pandemic at this stage.

Insurer D
None.

Insurer E
Our reinsurance is already spread over different reinsurers. Further reinsurer diversification to reduce the impact of bird flu is not currently being considered. The relative size of our reinsurance is in any event fairly low.

Insurer F
This hasn't been considered at this stage. Most reinsurance is on a quota share basis. I am not convinced that diversification will help that much as all reinsurers will presumably be in the same position.

Insurer G
None at the moment. The bulk of our [reinsurance] is internal to the group and the remainder is widely diversified.

9. Do you know what measures the applicable reinsurers are putting in place to circumvent unexpected financial stresses?

Insurer A
We cannot comment on our reinsurers' mitigation strategy

Insurer B
No

Insurer C
I do not know the measures the reinsurers are taking, but will be quite interested in hearing about it.

Insurer D
No

Insurer E
They are certainly not providing catastrophe cover for this risk! We are not aware of any other measures.

Insurer F
No

Insurer G
I am unaware of any measures being put in place by our [reinsurers].

10. How do you expect the insurer's assets to be impacted in event of such a pandemic and what protective measures are being put in place?

Insurer A
This is difficult to try and quantify. However, the majority of our policies are linked policies where the investment risk is shared with the policyholder. The OCAR calculation takes account of sudden changes of asset values in the resilience tests.

Insurer B
N/A

Insurer C
The effect on assets will depend on the severity and the length of the epidemic. We do not believe that the impact will be worse than already allowed for in the resilience CAR scenario.

Insurer D
There would be liquidity pressures if the pandemic is serious. This company has terminal bonuses that can be dropped; however, there could still be a strain. No additional measures have been put in place yet.

Insurer E
The secondary impact of widespread absenteeism could affect company earnings and share prices. No protective measures have been put into place for this specifically.

Insurer F
There would be liquidity pressures if the pandemic is serious. This company fortunately has substantial liquid assets given the significant free assets currently available. However there would likely still be a strain. No additional measures have been put in place yet.

Insurer G
Our assets are all held in government bonds or money market instruments. As such a run on the stock market would not affect us but any changes in interest rates could affect the value of assets. If there was a slight economic downturn it is likely that interest rates would be dropped to encourage economic revival. As such this would increase our asset values. However if there was complete economic melt down and the government defaulted on the bonds, we would be in a very serious situation.

11. Please provide current sensitivity testing in respect of FSV and EV figures for changes in the mortality, as per the following scenarios:

Impact of scenario (R'm)	Mild	Moderate	Severe	Ultra
Additional deaths	**0.22**	**2.2**	**11**	**22.1**
FSV profit impact				

[Due to the confidential nature of this information and to ensure anonymity of respondents, the authors have been requested not to display the detailed responses to this question.]

12. Can you please provide us with the following in respect of the CAR calculation as per your latest LT2000?

[Due to the confidential nature of this information and to ensure anonymity of respondents, the authors have been requested not to display the detailed responses to this question.]

13. Finally, the details of the following sections of the latest submitted LT2000 return in respect of the company to which you are appointed will provide us with additional information about the companies' exposure to such a risk:
B1 – B5,
C9,
G3 and G4.

(Should you not be prepared to provide us with all the details of section C9, could you please provide us with the proportion of non-investment premiums which are reinsured, as well as the amount of total gross and net policy liabilities.

We believe that all the publicly available information, although not specific, will be valuable in our analysis. We would welcome all of this information, although not specifically requested.)

All of the sheets requested were received by from the insurers that responded, with the exception of:

- Insurer A did not provide sheet C9, and
- Insurer E only provided part of sheet C9.

Annexure C: Modelling Methodology

Demographic Model

Method

- For a description of the epidemiological model used for assessing the impact on the South African population, refer to the paper "The Potential Demographic Impact of an Avian Flu Pandemic in South Africa" by Stipp, Staples, Hamman and Van der Merwe, presented at the ASSA Convention, 2006.

Financial Model

Method

- Analyze financial impact over one year time horizon, i.e. if pandemic strikes in next year.
- The model is based on current industry in-force data according to CSI investigations.
- The model allows for mortality only, split between group and individual life products, with the latter split again by low and high sums assured business.
- Unisex age banded distributions of exposure were applied to pandemic infection rates.

Mortality rates

- The model determines excess pandemic-related deaths for the duration of the disease.
- Population excess deaths as derived from Deloitte model for South Africa in case of a pandemic to be adjusted to apply to insured populations, assuming:
    - Impact of Spanish Flu on SA white population in 1918 to be used for high sums assured lives.
    - This to be adjusted this for funeral and group life business.

Exposures

- Obtain average sums assured for IL business from CSI data and RGA database.
- Assume R10 000 average sum assured for funeral cover for principal life assured, R10 000 for spouse, R4 000 for adult dependants and R5 000 for children.
- For GLA, assume 3x annual salary average multiple

Results

- Industry mortality cost = age band exposure * excess qx
- Industry annuity savings =age band industry reserves * excess qx

Sensitivity tests

- The central scenario is set to be according to SA 1918 data, with Mild, Moderate and Ultra Severe scenarios as percentages of this.

Annexure D: Model Output

Population Modelling

Model Output

	Flu Deaths	Lives	Pandemic excess mortality
0 – 14	55,112	15,189,364	0.0036
15 – 19	35,941	5,267,500	0.0068
20 – 24	32,108	4,540,879	0.0071
25 – 29	47,699	4,160,667	0.0115
30 – 34	45,167	3,532,552	0.0128
35 – 39	69,641	3,247,987	0.0214
40 – 44	79,007	2,769,730	0.0285
45 – 49	75,793	2,207,127	0.0343
50 – 54	66,985	1,731,983	0.0387
55 – 59	59,465	1,274,408	0.0467
60 – 64	67,684	1,126,404	0.0601
65 – 69	66,303	833,127	0.0796
70 – 74	71,458	667,691	0.1070
75 – 79	56,025	388,626	0.1442
80 – 84	54,470	286,489	0.1901
85+	55,820	166,365	0.3355
Total	**938,675**	**47,390,900**	**0.0198**

Age Band	All deaths	Lives	Pandemic excess mortality
0-19	91,053	20,456,864	0.0045
20-29	79,806	8,701,547	0.0092
30-39	114,808	6,780,539	0.0169
40-49	154,799	4,976,857	0.0311
50-59	126,450	3,006,392	0.0421
60-69	133,987	1,959,531	0.0684
70+	237,772	1,509,171	0.1576

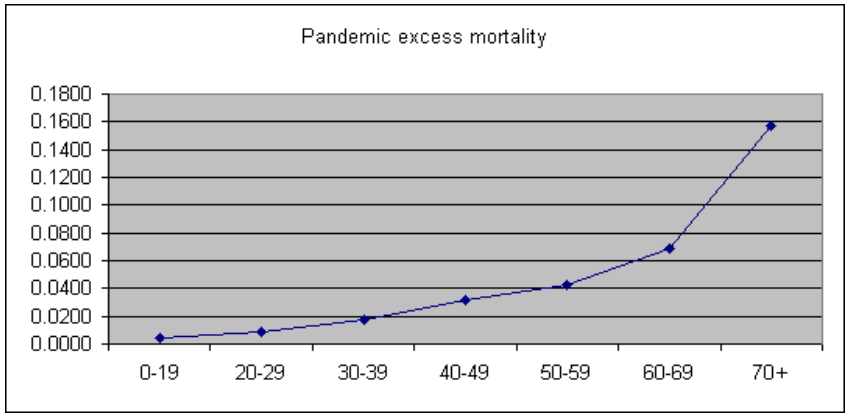

Figure 4: Model output for extra deaths as a result of a possible Flu Pandemic

- Assumptions
  - For the Severe scenario, we assume the model output outlined above.
  - For Mild, 2% of Severe scenario is calculated
    - 0.07/3.77 ~ 2%
    - 0.07 = US death rate in mild influenza pandemic of 1968
    - 3.77 = severe US death rate in 1918
    - the ratio of these and other variations are the best possible indicator of severity between different pandemics
  - For Moderate, 7% of Severe scenario is calculated
    - 0.28/3.77 ~ 7%
    - 0.28 = US death rate in moderate influenza pandemic of 1957
  - For Ultra Severe, assume 5 x Severe Scenario [SARS death rate is approximately 5 times worse, so is several other deadly diseases. Initial death rates for Avian Flu are 10 times worse than Spanish Flu].

Financial Impact Modelling

Individual Life Insurance Policies

- Assumptions
  - General population excess mortality derived from Severe scenario.
  - Excess mortality shape of curve for insureds in year 2000 similar to that of assumed insured population in 1918, i.e. white South Africans.

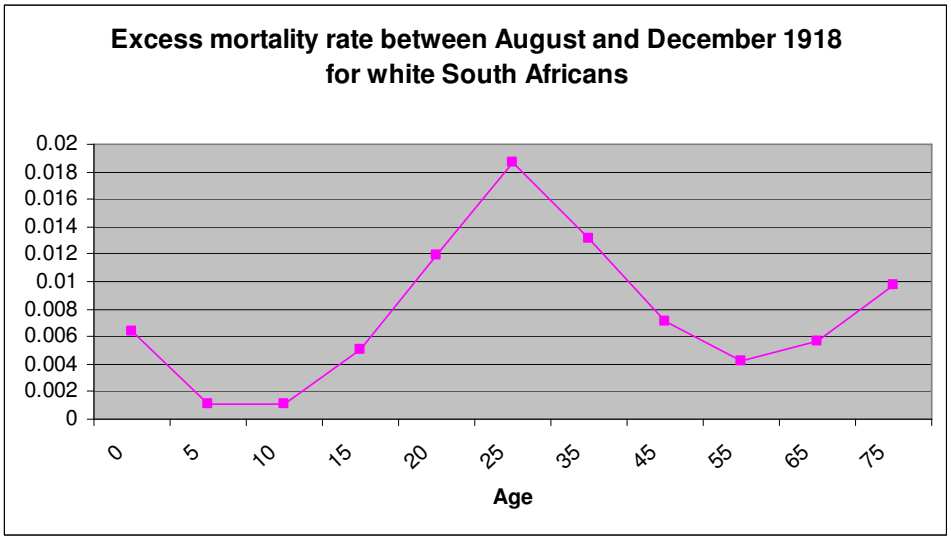

Figure 5: Excess mortality for with South Africans during the Spanish Flu

  - For the Severe scenario, overall level of excess mortality for insured population is set equal to that of white South Africans in 1918.
  - Data from CSI used to determine exposure in life years for insured population, determining the distribution of insured lives, which is expected to be different to that of general population.

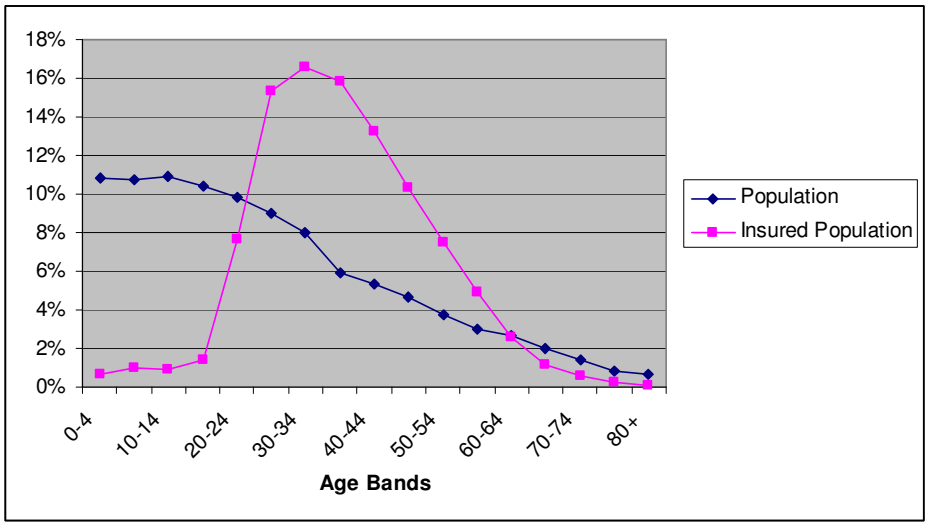

Figure 6: Distribution of insured lives, compared to that of the general population
Sources: South African Census, 2005
CSI Mortality Investigation, 1995-1998

- Average sum assured at risk at each set of age intervals assumed to be 70% of RGA Reinsurance Company of South Africa's experience, based on the weighted average of RGA's larger sums assured from recent placed business.

Age Band	Sum at Risk (R)
15-19	136,066.15
20-24	187,328.00
25-29	237,251.19
30-34	285,600.36
35-39	310,309.77
40-44	315,138.46
45-49	295,223.32
50-54	280,297.07
55-59	270,416.37
60-64	273,914.96
65-69	259,742.22
70-74	238,531.92
70-79	220,868.62
80+	125,292.36

- Output
  - Total mortality sum at risk is R 1 119 billion.
  - Total excess mortality cost estimated at R13.8 billion as a result of a pandemic of the severity of 1918.

Funeral Insurance Policies

- Assumptions
  - Excess mortality deaths assumed to be consistent with the general population excess mortality rate derived from the population model.
  - Excess mortality shape of curve for insureds set to be similar to that of assumed insured population in 1918.
  - Data from CSI used to determine exposure in life years for insured population, determining the distribution of insured lives, which is expected to be different to that of general population.

Total Age Distribution of Exposure	
0 to 15	11%
15 to 25	10%
25 to 35	17%
35 to 45	24%
45 to 55	17%
55 to 65	11%
65 to 75	6%
75+	4%

  - Note that exposure data was only availably for individually administrated policies, as per the CSI investigation. We have not attempted to calculate the exposure of business administered on a group basis.
  - Sums assured assumed as follows:
    - R10 000 for principal life insured.
    - R10 000 for spouse.
    - R5 000 for children and other / unknown relations.
    - R4 000 for parents.
- Output
  - Total sum at risk estimated at R49 billion.
  - Total excess mortality cost estimated at R1.5 billion as a result of a pandemic of the severity of 1918.

Group Life Insurance Policies

- Assumptions
  - General population excess mortality derived from Severe scenario.
  - As before, the excess mortality shape of curve for insureds in year 2000 is similar to that of assumed insured population in 1918.
  - In order to determine the exposure for GLA benefits, we have made the following assumptions:
    - size of labour market in South Africa (those aged 15-64) is 29.7 million lives;
    - number of employed individuals equate to 12.3 million lives;[33]

[33] Source: September 2005 Labour Force Survey

        - of those employed, it is assumed that 50% have GLA benefits;
        - an average annual salary of R70 000 is assumed;
        - GLA benefits are assumed to be 3 times annual salary.
    - Overall level of excess mortality for insured population 1.7 times that of white South Africans in 1918, which acts as proxy for 2006 insured population excess deaths. This is assumed in order to allow for the reduced underwriting within group business relative to individual insured live business.
    - The overall exposure for GLA business is assumed to be distributed in a similar age profile as that which RGA has on its risk book.
- Output
    - Overall exposure of R1.3 trillion in sums assured.
    - Excess deaths due to a severe pandemic of R22.3 billion.