Actuaries' Club of the Southwest
Mortality / Avian Flu / Catastrophe Bonds

Tim Hill, FSA, MAAA
Consulting Actuary & Principal
Milliman, Inc.

A MILLIMAN GLOBAL FIRM

Milliman

Consultants and Actuaries

Mortality

- More “Important” than a few years ago
  - Underwriting
  - Reinsurance
  - Sales to older individuals
  - Market competition
  - Securitization
  - Principal-Based Reserving

Mortality

- What do we know?
  - Early duration value of preferred risk underwriting
- What don't we know?
  - Later duration value of preferred risk underwriting
  - Old age mortality
  - Predictors of life expectancy at older issue ages
    - Cognitive impairment and ADL's better tests than cholesterol?
- Slope and level of mortality
  - 75/80 versus VBT

Mortality

- Underwriting
- Hot Topics
  - Blood
    - Evasive – Are there alternatives?
    - Number of tests done expanding
      - Looking for disease markers
  - Older ages
    - Frailty index – BMI, mobility, blood testing, cognitive
  - Prescription check
    - Why are they taking certain meds and interactions
- Underwriting generally seen as tightening

Mortality

- Reinsurance
  - Tight and remaining tight
    - Reinsurance is cyclical
    - Cycles may lengthen due to industry consolidation
  - Higher prices and more restrictive treaties
    - Back-end underwriting review
    - Detailed audits
    - Reduction / elimination of table shaving
  - Less “free” offerings
    - Still looking to reinsurers for X-factor and mortality info
  - Product development relying more on actual mortality, less on reinsurance

Mortality

- Sales to older individuals
  - Popularity of ULSG continues
  - Wealth transfer
- Market Competition
  - Slim margins leave little room for error
- Securitization
  - Increasing importantly tool
  - Significant focus on mortality issues
- Principal-Based Reserves
  - Use of “own” mortality in reserving vs table

Avian Flu

- In the news every day
- Wall Street Journal has an Avian Flu Tracker link on its website

Avian Flu News Tracker
March 14, 2006 10:50 a.m.

Updated regularly with news on avian-flu precautions, research and outbreaks. All times EST.

Tuesday, March 14

10:45 a.m.: The CEO of Tyson Foods Inc., the world's largest poultry producer, said that bird-flu fears still haven't hurt its U.S. business, though acknowledged that exports of chicken-leg quarters (drumstick, thigh and portion of back), are down. In addition to U.S. consumers not being as worried about chicken consumption, Tyson is more insulated than other poultry producers because it is diversified in other products such as beef and pork. See a products & profits report on chicken-leg quarters.

10:40 a.m.: In the latest HHS update on avian-flu spending, the U.S. agency reports that nearly half of the government's $3.3 billion pandemic-preparedness budget will be spent on vaccines. The next highest category is antiviral medications, for which $731 million has been earmarked, followed by state and local preparedness at $350 million. Read the report.

10:30 a.m.: The U.N. Food and Agriculture Agency sent US$40,000 in emergency assistance -- including protective gear and laboratory facilities -- to Myanmar, after an H5N1 outbreak in the impoverished Southeast Asian nation. Afghanistan's cash-strapped government pleaded for outside help to acquire similar emergency assistance amid concerns that the war-torn country may have its first case of bird flu.

10:20 a.m.: Sweden reported than an eagle owl has tested positive for an H5 strain of bird flu, and India has reported H5 in chickens. Further tests are required in both countries to determine if the cases involve the deadly H5N1 strain. Tests are also being conducted in Afghanistan to determine if poultry that tested positive for H5 had the H5N1 strain.

2:30 a.m.: The WHO officially confirmed that three people who died in Azerbaijan indeed had bird flu. These are the nation's first deaths from the disease, and raise the WHO's global human toll to 101. More. Plus, see the WHO's list of human cases.

Avian Flu – SOA Resources

Expand Your Knowledge-Top 20 Papers on Avian Bird Flu

What should an actuary read if he/she has only one or two hours to understand avian influenza from a personal and professional perspective?

The SOA's Flagship Pandemic Research Study

With this study, the SOA expects to provide insight into the potential impact a pandemic could have on life and health insurers.

ERM for Pandemics-Expert Roundtable

A roundtable of leading experts was held on March 21, 2006. Click here to view the transcript of this event.

Upcoming Actuarial Meetings/Previous Meeting Handouts Focused on Avian Flu

A variety of opportunities to attend meetings on pandemics exist, including the SOA Health Spring Meeting, featuring Dr. Michael T. Osterholm, a renowned CIDRAP pandemics expert.

Avian Influenza Links to Other Organizations

Learn more about pandemics and catastrophic events. **Pandemic News**
INTERNATIONAL / ASIA PACIFIC | May 24, 2006 Bird Flu Case May Be First Double Jump By Donald G. McNeil Jr.

SOA Press Release
Canadian Underwriter and *Insurance Journal* both published the announcement of the SOA's upcoming research.

CDC Health Alerts

Antival Drugs and Influenza

CDC Recommends Against the Use of Amantadine and Rimantadine for Treatment or Prophylaxis of Influenza in the United States during the 2006 Influenza Season

Avian Flu - Estimates

- Many "Numbers" on impact are being offered
  - HHS Pandemic Influenza Plan based on two scenarios
    - Moderate scenario (1958/68 like)
      - 209,000 deaths
    - Severe scenario (1918 like)
      - 1,903,000 deaths
      - Our impression is = 1918 death * 3 for increase in population
- Insurance Information Institute article sited by journal said 1918 pandemic would result in $133 billion in life insurance losses
  - Issues with article that would seem to place estimate at more like $60 billion

Avian Flu – What makes a Pandemic

- World Health Organization Global Pandemic Phases
  - Phase 1: No new influenza in humans, subtype in animals that may cause human infection
  - Phase 2: No new influenza in humans, circulating animal subtype poses substantial risk
  - Phase 3: Human infections with new subtype, no human-to-human spread (or only close contact)
  - Phase 4: Small clusters with limited human-to-human spread, highly localized
  - Phase 5: Large clusters but still localized
  - Phase 6: Pandemic phase: increased and sustained transmission in general population

Avian Flu – 2005 vs 1918
Pros (less severe)

- World War I
  - Transport ships and living in close quarters\
  - Medical supply and staff shortages
  - News Blackout
    - US population thought it was a localized illness
    - Spanish Flu – No news blackout
    - Compare to WSJ coverage of Avian Flu or WHO coverage of SARs
- Uncertain of transmission
- General medical care
  - In 1917, there were 170,000 flu deaths (a regular year)
  - In a regular year now, there might be 25,000 flu deaths with 3 times the population ($1/20^{th}$ the 1917 level)
- Changes in agriculture
  - Transmission from animal to human is often through agriculture contact
  - In 1918 30.6% of population farmed
    - Chickens and pigs were largely in open
  - In 2005, less than 0.7% of population in farming
    - Chickens and pigs raised in containment primarily

Avian Flu – 2005 vs 1918
Cons (more severe)

- Transportation
  - 1918:
    - New York to London - 6-7 days
    - Hong Kong to San Francisco – 28 days
  - 2005
    - New York to London – 5.5 hours
    - Hong Kong to San Francisco – 12.5 hours
- Population density
  - 1918:
    - 51.3% of population in urban areas
  - 2005:
    - 80.3% live in urban
    - 30% in cities > 5 million people

Mortality Events and Life Insurance Industry

- There are at least two ways to look at an increase in mortality
  - Proportional: results in increase in mortality proportional to base mortality
  - Per thousand: results in level increase in deaths per 1,000 across all groups of people
- Life Insurance industry exposure not proportional to population
  - General more exposure to 35 – 55, little exposure to very young and old
- Mortality rates
  - Individual versus Group
  - Underwriting

Mortality Events and Life Insurance Industry – 1918 Pandemic in 2005

	Percent	Per 1,000	Total Deaths
1917		13.8	1.42 million
2003		8.4	2.52 million
1918 (Flu deaths)	50.0%	5.9	603,000
1918 (Flu excess)	30.6%	4.2	430,000
2003 Impact Proportional	30.6%	2.6	771,000
2003 Impact Per 1,000	50.0%	4.2	1,260,000

Mortality Events and Life Insurance Industry – 1918 Pandemic in 2005

	Percent	Per 1,000	Total Death Benefits
1917		13.8	
Insurer		3.0	$100 million
1918 (Flu deaths)	50.0%	5.9	
1918 (Flu excess)	30.6%	4.2	
Insurer Impact Proportional (total)	30.6%	0.9	$131 million
Insurer Impact Per 1,000 (excess)	240.0%	4.2	$240 million

Avian Flu - Other

- Workforce
  - Process Claims
  - Work remotely
- Investment portfolio
  - Reaction of stock market
  - Bond portfolio defaults and downgrades
  - Liquidity
- Other lines
  - P & C
  - Annuity
  - Pension
  - Health

Terrorism

- Terrorism is of course a concern when it comes to extreme mortality
- However, it takes a very large terrorist act to kill 100,000 people
  - 9/11 had 3,000 deaths
  - Likely to take a nuclear weapon or weaponized biological agent and a optimal delivery
- Generally not expected to be as likely to cause large (relative to pandemic) loss of life

Mortality Catastrophe Bonds

- Very similar to Natural Disaster Catastrophe Bonds
  - Measurable “index” is created
    - To date this has been population mortality in a variety of countries
    - Country, age, gender weights defined to represent insurer’s exposure
  - A trigger/exhaustion event is defined
    - Percentage increase in index
    - Cumulative measure of some type
  - If trigger occurs, a portion of bond principal is paid to insurance company by special purposes vehicle

Mortality Catastrophe Bonds

- Risk assessment by independent third-party
  - Milliman performed this role in prior two issues
- Stochastic model built that reflects three components
  - Base index volatility
  - Disease model – Primarily pandemic
  - Terrorism model
- Large number of scenarios – 1,000,000
- Separate module overlays different type of cat bond structures

Mortality Catastrophe Bonds Motivation

- Transfer catastrophic increase in mortality to capital markets
  - Markets have been receptive
  - First two deals over-subscribed
- Concerns about credit exposure to reinsurers or retrocessionaire market
  - If extreme mortality event occurs, will they be able to pay
- Direct writers starting to look at issuing
  - Retaining more risk
  - Avian flu concerns
  - “Last man standing”
  - Potential earnings call questions

Mortality Catastrophe Bonds

Series	Attachment Point	Exhaustion Point	Pricing Interest Rate
First Issue	130%	150%	Libor + 140 bps
Second Issue	Used two year average for index calculation		
A	125%	145%	Not Placed
B	120%	125%	Libor + 90 bps
C	115%	120%	Libor + 140 bps
D	110%	115%	Libor + 190 bps
Third Issue	Used two year average for index calculation		
A	115%	120%	Libor + 19 bps (wrapped to AAA)
B	110%	115%	Libor + 300 bps

Mortality Catastrophe Bonds Alternative Designs

- Variety of indices
  - Population has the advantage of independence but also has basis risk
- Creative trigger definitions
  - Annual trigger
  - Two year rolling average
  - Cumulative
    - Add up all index excess over period
  - Tranche structures for each of these
  - Multi-peril
    - If multi-line company, consider a joint (2 event trigger)
    - Can cover hurricane or increase in mortality, but not both