Emerging Risks Scenarios for Risk Management Cambridge Centre for Risk Studies Seminar 20 March 2014

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Scenario 3 - Human Pandemic São Paolo Virus Pandemic

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Scenario São Paolo Virus Pandemic

Pandemics as an Emerging Risk

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The Black Death of the 1300s killed >30% of Europe's population

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De. Doctor Schna-

Quis non deberet fehr erfchre für feiner Virgul oder stecken, qua loquitur, als war er stumm

1918 Spanish Flu: Worst Pandemic in Modern History

Pandemics: Still an emerging risk today?

- Understanding germ theory
- Modern medicine, including antibiotics
- Public health advances, sanitation
- Vaccines

- Pathogen mutation
- Globalized world
- Human/wildlife contact
- Human behavior
- Climate change



Emerging Infectious Diseases





RMS Infectious Disease Model (IDM)

Event set of ~4500 unique infectious disease scenarios





Probability of Population Infection Rate in a Pandemic based on RMS Infectious Disease Model



Different Types of Pandemic Scenarios Considered

Highly Infectious Disease – Moderate Virulence

- e.g. an influenza pandemic that infects a high % of population
- Absenteeism and scale of medical treatment demand is key societal issue
- Would touch many areas of commercial activity and potentially multiple lines of insurance coverages

Virulent Disease – Low Infection Rate

- Could potentially impact at around 1-in-100; e.g. SARS
- Kills high percentage of those infected, but spread is limited
- Fear of being infected shuts down commercial activities
- Direct impacts would be low, but could be highly disruptive

New variant of contagious pathogen for which medical science has no initial treatment

- e.g. Laboratory gain-of-function H5N1, AIDS, or haemorrhagic virus
- Extremely low probability (well beyond 1-in-100)
- Could combine high virulence with high infection
- Could also have additional features that make response more complex (e.g. lengthy incubation period, asymptomatic spread, age-significant response)

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São Paolo Virus Pandemic

The Scenario and Its Consequences

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Dr. Andrew Coburn

Director of External Advisory Board Cambridge Centre for Risk Studies

An Outbreak of Mystery Illness in Brazil Poultry Farmers

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Virus warning for Brazil

Mystery virus spreads as government warn citizens to avoid Brazil

Wednesday, Nov 12

Sao Paolo (1048 GMT – 0648 BRT) -The UK Foreign & Commonwealth Office and US State Department have issued a travel advisory warning for Brazil following an outbreak of an unidentified deadly virus.

Brazilian government officials have condemned the moves, calling them a "reckless, irresponsible and expensive overreaction", but UK officials point to



Sport

WHO specialists arrive in Brazil to investigate the mystery virus that has caused over 100 deaths.

The Mystery Virus Kills Many of its Initial Victims

Over 100 deaths are reported in 10 days Many deaths are in teenagers and young adults Case Fatality Rate estimates are wildly variable (nobody knows how many people are infected) Some reports suggest that 10% of people who catch the virus die **Contact tracing of infected contacts puts 8,000**

people into quarantine in São Paolo

WHO Officials Identify it as 'H8N8'

A completely new strain of influenza virus Mutated in poultry populations and jumped into humans Appears to be highly infectious No vaccine exists to prevent infection Antiviral drugs like Tamiflu are the only treatment

Stockmarkets React

Fear of a potential pandemic hits trading Latin American currencies are badly hit Flight to quality – emerging markets punished Airline stocks decline Healthcare providers stocks go up

Regional Tourism Impacted

Brazil Soccer World Cup 2014 is cancelled **Doubts raised about hosting Olympics in Rio in 2016 Brazil tourism industry severely** impacted in the Other parts of Latin America see major downturn in tourism and business travel





Sick Travellers Spread the Infection Worldwide



Sao Paolo Virus sweeps across globe

Cases of the deadly new virus reported in US and Europe

Thursday, Nov 27

Atlanta, US (1454 GMT – 0954 EST) – Fear is gripping the world as hospitals struggle to cope with increasing numbers of sick people. Researchers at the CDC are "making progress" in identifying the genetic characteristics of the Sao Paolo Flu Virus.

Much is still unknown about Sao Paolo Virus, although health officials have stated it is one of the most infectious



Business and tourism is trying to continue as usual but economists say productivity is down by a significant amount.



São Paolo Pandemic Spread



Week

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Number of People Infected in City



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Pandemic Scenario Timeline



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Schools Are Closed as Part of Pandemic Response Plans



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NEWS WHO declares global pandemic

Some countries declare martial law to contain the outbreak

Tuesday, Dec 23

Geneva (1723 GMT – 1123 CDT) -The WHO finally declared a global pandemic, requiring governments around the world to shut down public areas and prioritise medical attention

Critics argue that this announcement is coming weeks later than it should have done causing tens of thousands of unnecessary deaths and millions of extra infections.



Mexican army drafted in to contain virus outbreak in Mexico City

Thus far, casualties have been much lower in the west, where anti-viral

Typical Infection Severity Rates

Sao Paolo Virus Pandemic Typical European Country For a sample of 10,000 people

0	Uninfected	5,500
1	Infected with minimal or no symptoms	1,000
2	Self-medicating	1,400
3	Needing Physician/GP Attention	2,000
4	Hospital Treatment Required	50
5	Critical Care Required for Recovery	10
6	Fatalities	7



Healthcare Resources Are Overwhelmed

UK

Normal GP consultations per week: Pandemic demand in peak week:

Total Hospital Beds in UK: Normal Occupancy Level: Pandemic Hospital Bed Demand: 136,486 86% 312,000

3,770

58,000

85%

© Evevi

4,672,200

3,778,900

Total Intensive Care beds in UK: Normal Occupancy Level: Pandemic Intensive Care Bed Demand:

Sickness Levels Increase in the Workplace

- Absenteeism comes from illness, caring for dependents, and fear of becoming infected
- At absenteeism levels above 10%, productivity drops off disproportionately
- At 20% absenteeism, many businesses cannot operate and are likely to suspend operations
- Managers may take precautionary measures to close offices preemptively before their staff are ill
- Companies that deal with general public are more at risk
- Highest risk are healthcare providers

Average Absenteeism in Workforce



Around 1 in 8 organizations will be hit by infection rates of **twice the national average** in their workforce (Around 1 in 50 will have 3x the national average)

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Pomegranate is Hit Hard (as usual)





- Pomegranate suffers above-average absenteeism in United States throughout December and January
- Forces closures in home office and retail activity, missing key Christmas retail window
- Pandemic-related absenteeism hits its SEAsia operations in Feb-March, crippling manufacture and supply chain
- Pomegranate loses market share to competitors in its vital 'Persephone' tablet product launch
 - Pomegranate sees 25% stock price fall...



Vaccine Arrives!



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Vaccinations begin for Sao Paolo Virus

Pharmaceutical companies struggle to meet demand for new drug

Wednesday, March 30

London, England (1029 GMT) - The NHS unveiled its vaccination plan today, prioritizing health workers and the most vulnerable people to receive the first wave of vaccines. The UK death toll has already reached 40,000 but authorities believe that the worst may already be over.

Despite long queues and some angry exchanges, most countries are managing the vaccination process in a



Chicken eggs are used to create the vaccination for the Sao Paolo Virus, also known as H8N8.

Getting Back to Business



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'Open for business' as Sao Paolo fades

WHO: "Infection rates are slowing but there is still a threat"

Tuesday, April 5

New York (1438 GMT – 0938 EST) -The head of the WHO rang the opening bell on the NYSE with gusto this morning. It was a signal that the city is open for business, but not without caution.

The threat of Sao Paolo Virus still lingers on the streets of New York, as it does on most of the world's cosmopolitan hubs. Their multicultural blend of everything created a



Sport

Facemasks are required on the NYC and London transport systems

The return to normal has been inconsistent though, with several

Headline Death Toll

Worldwide: 19 million deaths
 United States: 425,000 deaths
 UK: 70,000 deaths



Global Life Insurance Industry Exposure Database

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CAMBRIDGE

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A joint development project between Axco and the Centre for Risk Studies



Number of life insurance policies in cities with populations over 100,000 people

- · 563 100,000
- 100,001 500,000
- 500,001 1,500,000
- 9 1,500,001 3,500,000
- 3,500,001 8,000,000
- 8,000,001 14,278,464



- \$2.4 Trillion of Life Insurance Premium worldwide
 - 1.2 Billion Life Insurance policies
 - Total aggregate value of life cover: \$78 Trillion

Total Payout by the Life & Health Insurance Industry

	Total Payout	Loss Ratio (% of annual PI)
Life Insurance Payouts	\$99.2 Bn	4.0%
Personal Accident & Health	\$92.7 Bn	9.2%
Total	\$191.9 Bn	5.5%

Average Annual Life Insurance Payout approx \$940 Bn

Life Insurance pandemic payout represents about 11% excess



Insurance Claims on Other Business Lines

Life insurance death benefits

Excess mortality from infection

Healthcare insurance

 Increased numbers of people wanting treatments

Accident & Health coverages

Reimbursement for illness treatment

Government (Local Authority) liability

 Deaths that might be blamed on local authority decision-making

Healthcare liability

 Deaths that may be blamed on medical malpractice

Event cancellation insurance

Public gatherings cancelled by public health officials

Biotech product liability

 Vaccine deficiencies (possible waiver from government authorities)

Management Liability

 Major business losses deemed attributable to poor pandemic response decision-making by senior management

Property loss

 Increased incidence of fire, water escape damage in buildings left unoccupied during office closures

Agriculture

 Losses from untended crops and unfed animals as a result of sick farm workers

Contingent BI

 Named suppliers unable to meet obligations due to illness

Civil Authority BI

 Possible prevention of business operations (e.g. restaurants) by public health act

Auto Insurance

 Decrease in claims from lower car usage during pandemic progress

Annuity & Pensions

 Decrease in liabilities from premature deaths of annuitants



Key Macroeconomic Effects of Pandemic

- Reduction in 'Labour Participation' through absenteeism and office closures
- Consumer spending appetite is suppressed
 - Final Consumption reduces some is deferred
- Increases unemployment and 'Output Gap'
 - UK unemployment increases from 6% to 13%
- Government expenditure increases (healthcare and emergency response measures)
- Sectoral impacts include heavy impact on discretionary economy, such as tourism and travel



Impact of the Pandemic Scenario and Variants

Scenario Variant	Infection Rate	Global Death Toll	Duration of Wave	GDP@Risk
S1: Standard Scenario	43%	19 million	7 months	\$7 Trillion
S2: Poor government response	43%	22 million	8 months	\$10 Trillion
S3: Vaccine failure	43%	24 million	9 months	\$14 Trillion
X1: Poor gov response & vaccine failure	43%	25 million	12 months	\$23 Trillion

2007-2012 Great Financial Crisis	\$18 Trillion
Great Financial Crisis as if at 2014	\$20 Trillion



Global GDP Impact of Scenario and Variants





Interest Rate Changes



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Hypothetical Investment Portfolio of an Insurance Company

Portfolio structure						
	USD	GBP	Euro	Yen	Other	Total
Government med/long	8%	7%	5%	2%	2%	24%
Government short	6%	5%	4%	2%	3%	20%
Cash	2%	1%	1%		1%	5%
AAA short	2%	2%	2%	1%	1%	8%
AAA med/long	4%	3%	1%	1%	1%	10%
AA short	1%	1%	1%			3%
AA med/long	2%	1%	1%		2%	6%
A short						0%
A med/long	2%	2%	2%	2%		8%
BBB and lower	2%	2%	1%		1%	6%
Equities etc	2%	2%	2%		4%	10%
Total	31%	26%	20%	8%	15%	

Focus on

- high quality
- fixed income







Investment Portfolio Returns



Losses to Different Investment Asset Classes

Loss per \$100 of investment Q2 2014 (Peak of Pandemic)

Pandemic Scenario S1

	US	UK	Euro	Japan
Equities	-3	-17	-10	-7
Government 10-year Bonds	-1	-5	-3.5	-1.7
A-AAA Grade Bonds	-1	-5	-3.5	-1.7
B Grade Bonds	-6.2	-9.5	-8.0	-7.5
Standard Portfolio (Mix of assets in that market)	-1.2	-4.1	-2.5	-1.3



Fixed Income vs Equities







Stress Test Scenario - Conclusions São Paolo Virus Pandemic

Exploring the issues of insurance risk from a human disease threat

- Debilitation of the population is the key societal issue during a pandemic of high infectiousness
 - Death toll significant, but major social impact is absenteeism
 - Workforce absenteeism may be too high for many companies to stay operational
- Duration of debilitation is lengthy multiple months in individual countries and 8-9 months globally
- It affects everything
- Economic impact will be significant



Scenarios with their Variants: Impact Magnitude

US\$ Trillion GDP@Risk

Geopolitical Conflict	17	27		34
	9 month conflict	2 year conflict		5 year conflict
Pandemic	7	10	14	23
	43% infection	Poor response	Vaccine failure	Poor response + Vaccine failure
Cyber Catastrophe	3	5	5.2	11
Cyber Catastrophe	3 Standard scenario	5 More damage + liability	5.2 Sybil with longer latency period	11 Extreme damage & liability
Cyber Catastrophe 2007-2012 Great Financial Crisis	3 Standard scenario 18	5 More damage + liability	5.2 Sybil with longer latency period	11 Extreme damage & liability



Hope for the best. Plan for the worst.

