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Pandemics and other Catastrophes: managing the impact on your life and health portfolio

Changing Risks, Expecting the Unexpected

17th Global Conference of Actuaries & 2015 AGFA

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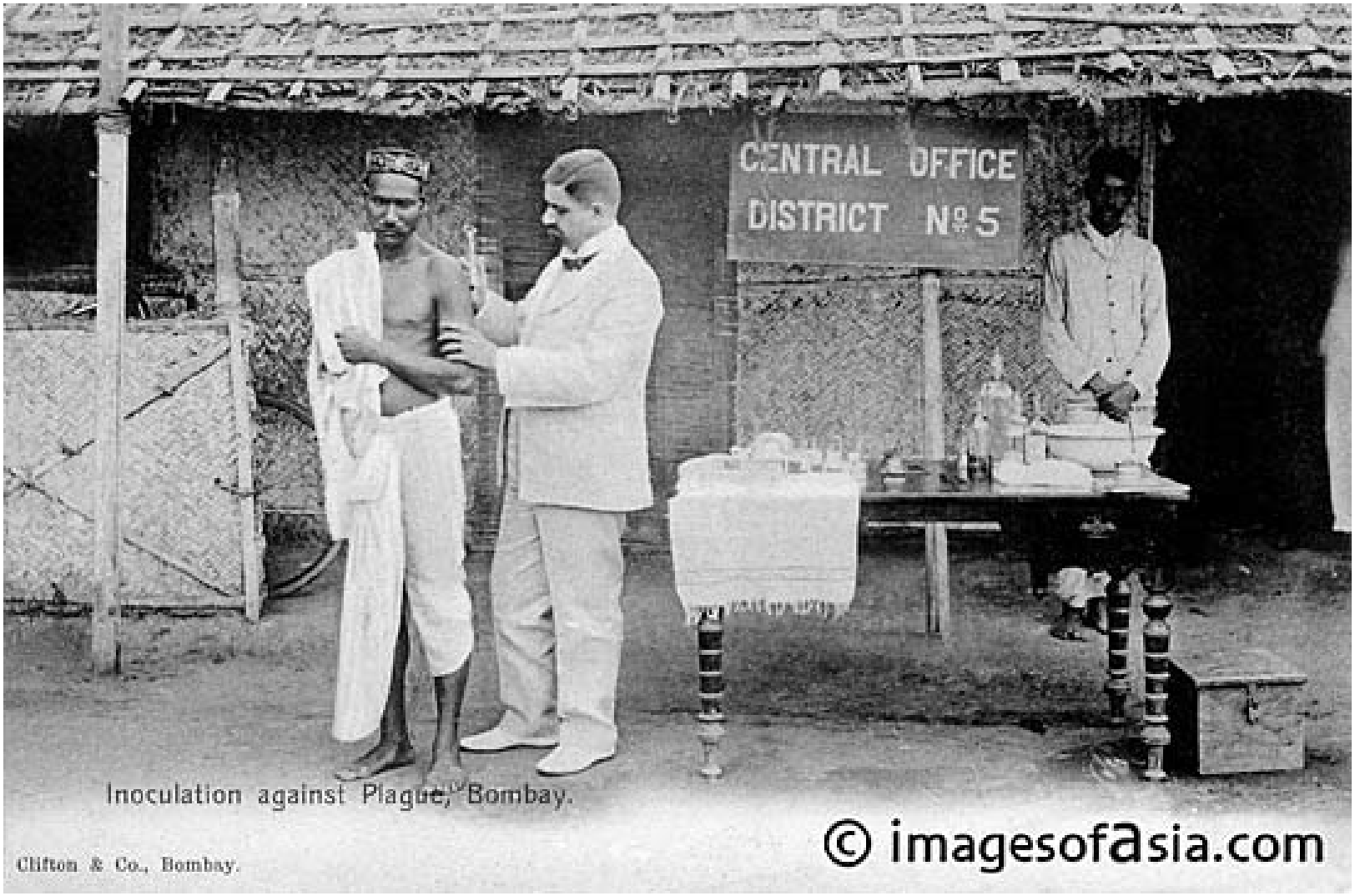
Agenda

- Section 1: Pandemic Risk
  - Introduction
  - Why is this a risk?
  - Modelling the risk?
- Section 2: Catastrophe Risk
- Section 3: Which “risk-transfer” solutions?

Section 1: Pandemic

Introduction


CENTRAL OFFICE
DISTRICT Nº 5
Inoculation against Plague, Bombay.
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Pandemic: Definition

- **Pandemic** (from Greek pan "all" + demos "people") is an **epidemic** of **infectious disease** that has spread through human populations across a **large region**; for instance multiple continents, or even **worldwide**.
  - A widespread endemic disease that is stable in terms of how many people are getting sick from it is not a pandemic.
  - Focusing on Influenza:
  - Throughout history there have been a number of pandemics, such as smallpox, tuberculosis, or HIV.
  - By pandemic we now often refer to flu (influenza) pandemic, such as the H1N1 pandemics of 1918 and 2009. Flu pandemics normally exclude recurrences of seasonal flu.

Pandemic: History

Approx. 30 influenza pandemics in last 500 years

In the last Century

- Most sources conclude that:
  - **a pandemic approximately occurs every 15 to 30 years**
  - thus, annual probability of a pandemic is between 3% to 7%
- **1918/1919 – Spanish flu** – Influenza A (H1N1)
  - Over 40 million (up to 100 million ?) deaths in the world
  - India alone around 17 mil deaths (5% of the population)
  - 20 to 40 year-old people in particular (50% of the death)
- **1957/1959 – Asian flu** – Influenza A (H2N2)
  - 1 to 4 million deaths in the world
  - Pandemic occurred in 2 waves following virus mutation
- **1968/1970 – Hong Kong flu** – Influenza A (H3N2)
  - 1 to 2 million deaths in the world

Sources:

1 http://en.wikipedia.org/wiki/2009_flu_pandemic

2 http://www.flupandemic.gov.au/internet/panflu/publishing.nsf/Content/history-1

3. http://wwwnc.cdc.gov/eid/article/18/2/10-2042_article.htm

Pandemic

- **A (flu) pandemic may occur if three conditions** are met:
  - a new influenza virus emerges
  - the virus infects humans
  - the virus spreads efficiently and in a sustained manner from human to human

- WHO – The World Health Report 2007:

  "Scientists agree that the threat of a pandemic from H5N1 continues and that ***the question of a pandemic of influenza*** *from this virus or another avian influenza virus is still* ***a matter of when, not if****."*

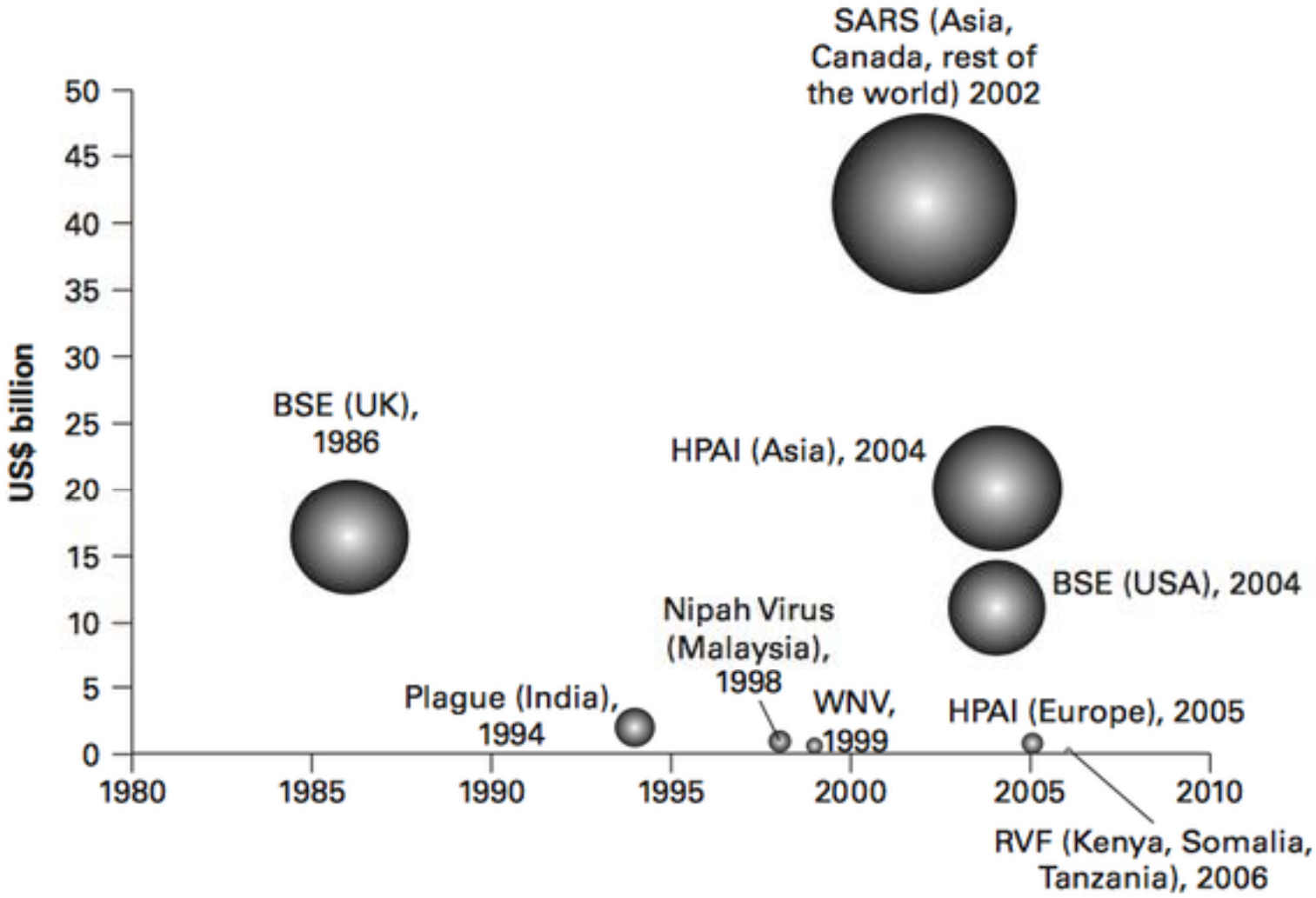
- We don't know when the next pandemic will occur - Avian Flu ? or Ebola ??
- We don't know how infectious and deadly the new virus will be
- Will the next pandemic be more or less lethal than the 1918 flu ?

Potential factors attenuating flu virulence / mortality	**Potential factors aggravating flu virulence / mortality**
Improvement in medical care **Establishment of global surveillance** and Crisis/emergency **preparedness plans** **Improved socio-economic environment**	**higher population density** / megacities Greater and faster **global air travel**

Section 1: Pandemic

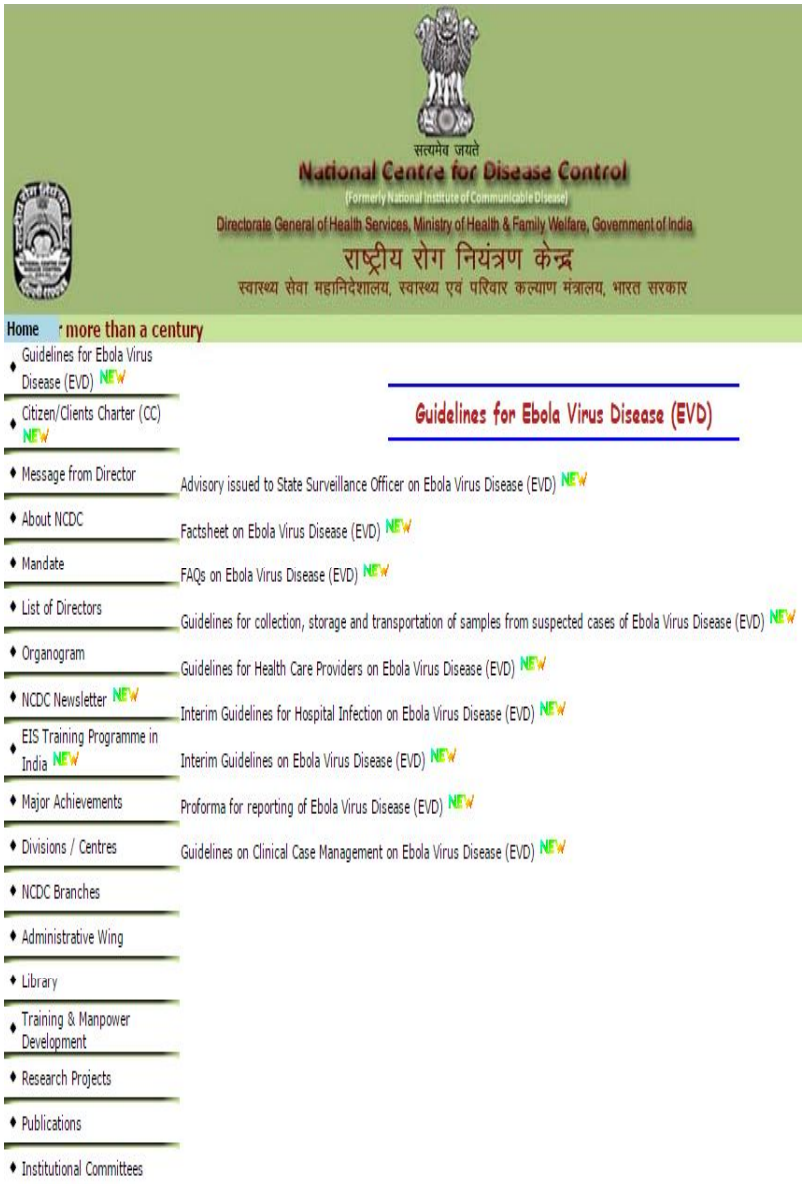
Why is this a risk ?

Economic Effect of Zoonotic disease



Estimated Costs of Emerging Zoonotic Diseases (1986–2006). Figure 1.1: People, Pathogens and Our Planet, The World Bank.

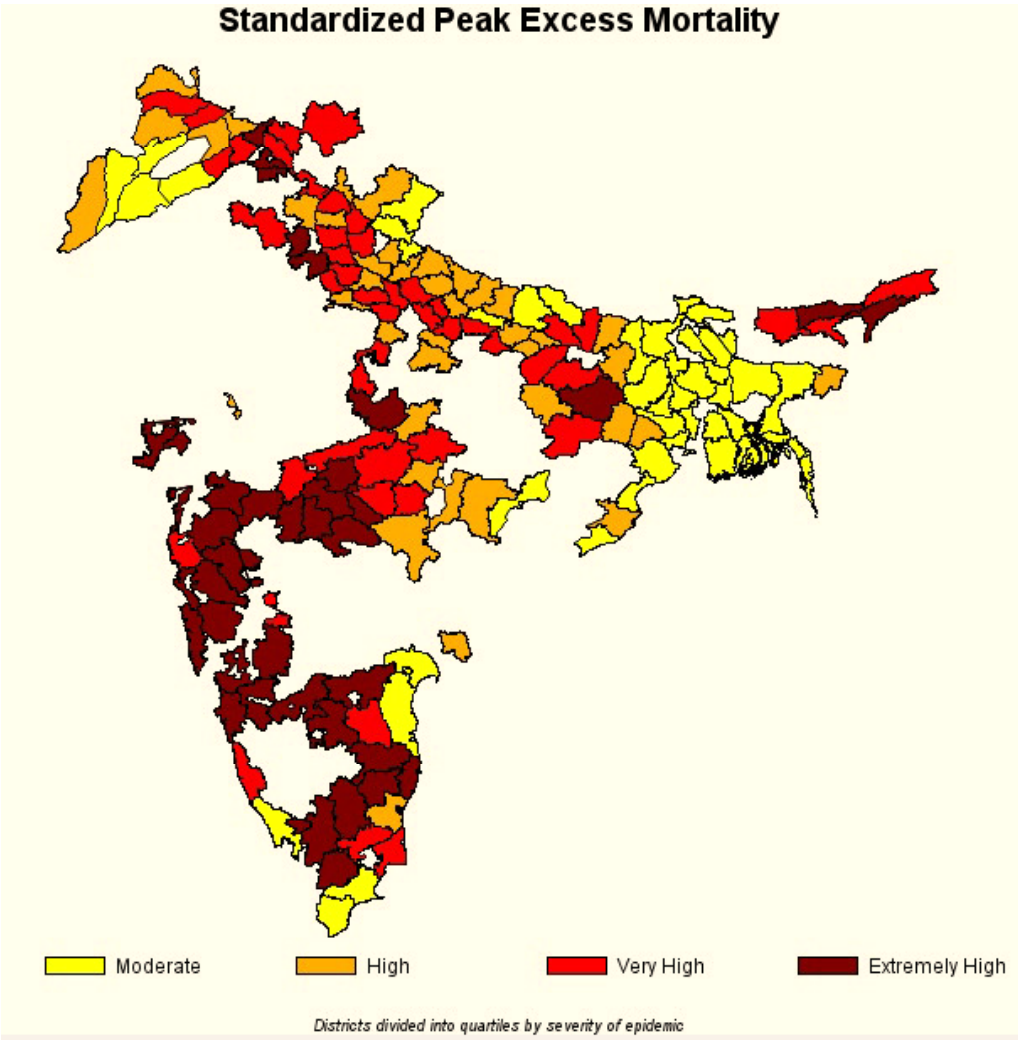
Indian Health Management for Pandemic Influenza



Pandemic Influenza in India: potential impact?

*If we were to experience **a pandemic as severe as the one that occurred in 1918** and we were **not prepared and unable to respond**, an estimation of the effect in India could be:*

- *40 per cent of the population (0.5 billion Indian) could show clinical signs of infection during a pandemic*
- ***2.5 per cent of those affected would die (around 12.5 million people)***
- *50 per cent of the population may not go to work at the peak of the pandemic*
- *several waves each lasting up to 12 weeks could occur*
- *disruption to services could last as long as two years.*



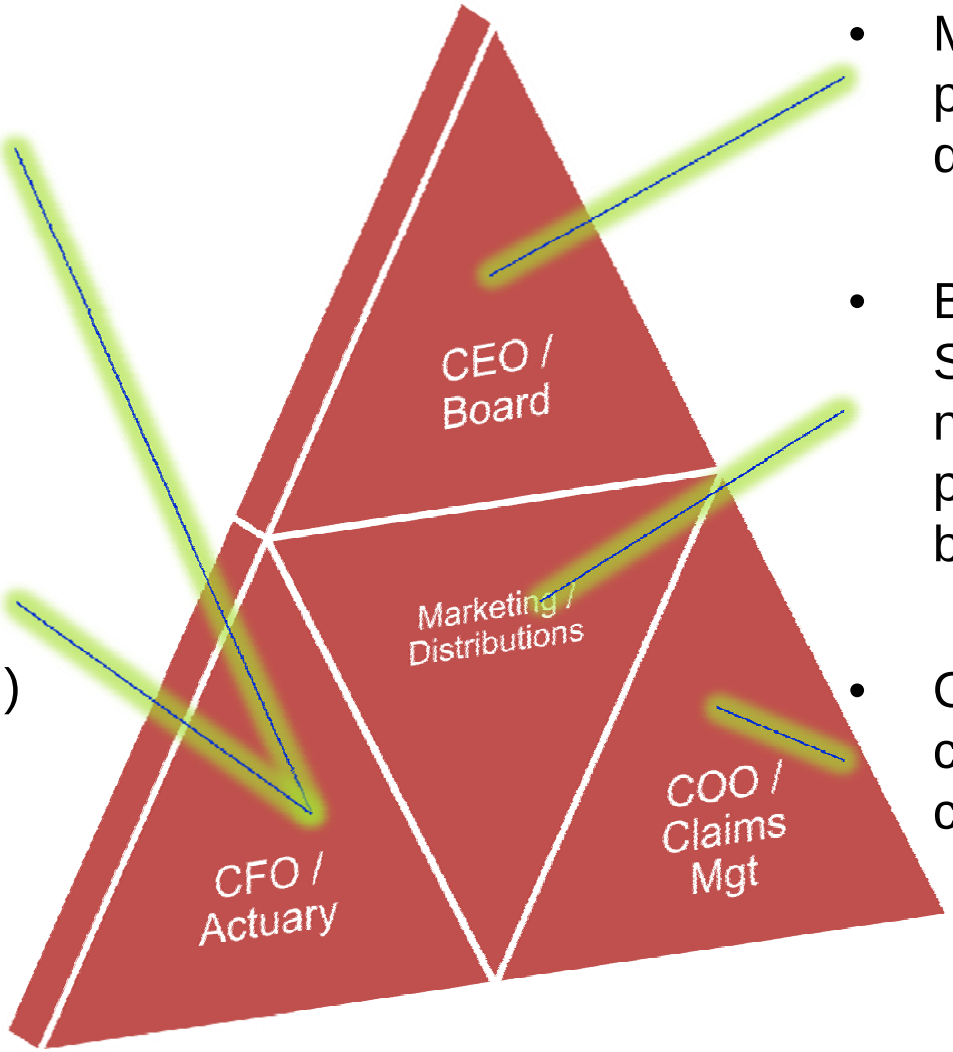
Pandemic Influenza in India: potential impact?

Clearly, we can assume authorities are planning to respond and reduce the impact of this type of pandemic. It can be estimated that if we were unfortunate enough to experience ***a pandemic as severe as that in 1918****, but we* ***were prepared and were able to respond*** *effectively, then:*

- *the number of cases could be reduced from 40 per cent clinically affected, to 10 per cent clinically affected, that is around 120 million Indians*
- ***death rates could be halved to 1.2 per cent of those clinically affected, that is around 1.4 million people may die***
- *absenteeism at the peak could be 30 to 50 per cent*
- *the duration of the pandemic in India could be 7–10 months, in a single wave*
- *the level of disruption across all sectors would be reduced (although persisting for a longer period at a more manageable level).*

Insurance Business – Everyone should be afraid?

- **Insurance Risk** (i.e. mortality, morbidity)
- Regulatory Risk (i.e. solvency, capital, reserving etc.)



- Market Risk (i.e. share price volatility, market downturn, recession etc.)
- Brand management and Sales Volatility (i.e. boost new business for life policies causing new business strain)
- Other Risks (i.e. business continuity and counterparty)

Potential Impact on Insurance Risk

- increase in Death claims (however, more deaths than expected may provide relief to other insurance risks such as longevity and claim termination rates)

- possible increase in Disability claims ?
  - temporary disability claims ? subject to waiting periods
  - potentially lower recovery rates for open claims ?

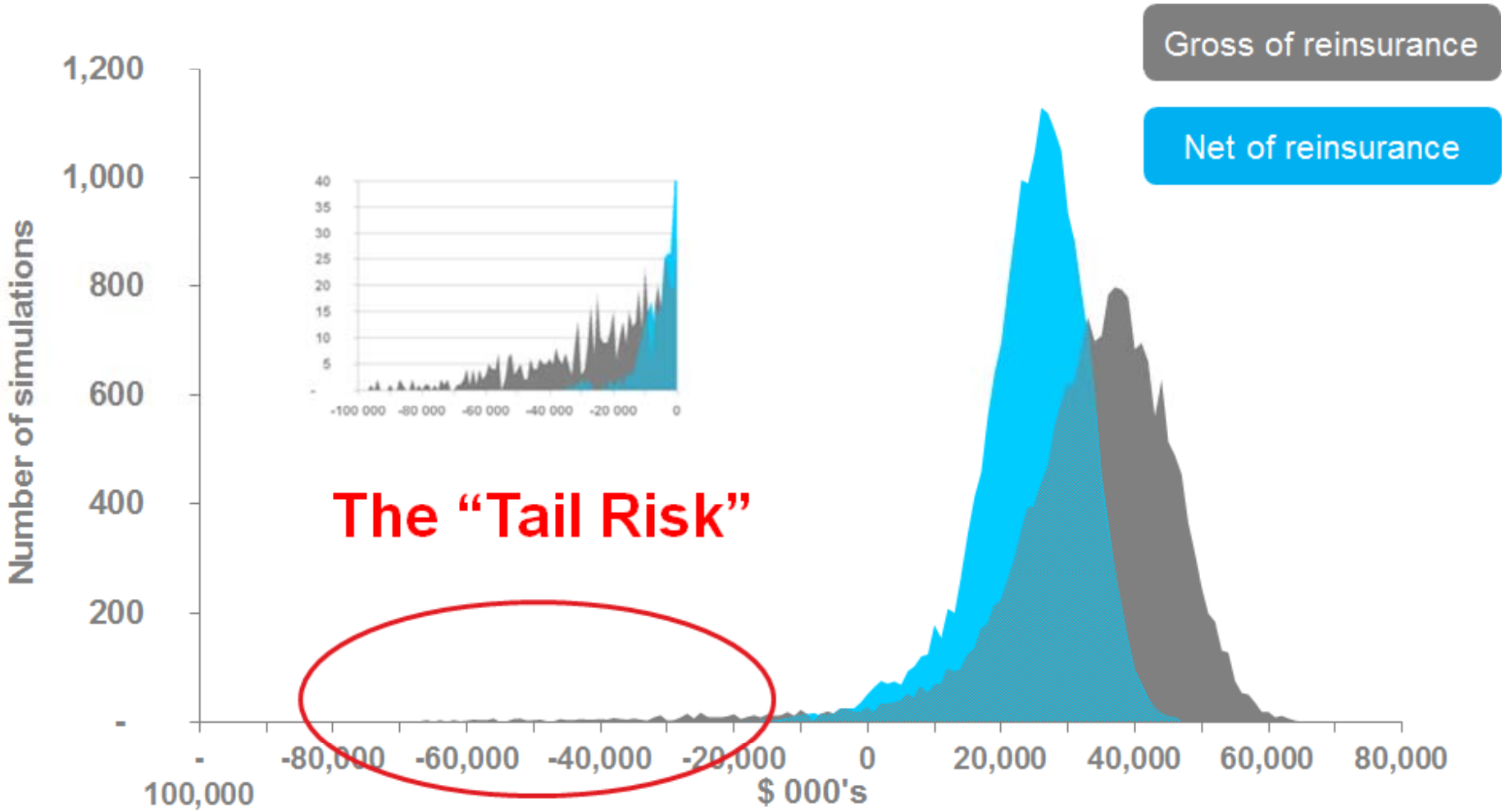
- increase in Medical claims (Inpatient / Outpatient). Negatively correlated with the effectiveness of a nationwide vaccine program run by the Government

- Regulatory requirements?

Section 1: Pandemic

Modelling the Risk

Modelling the risk



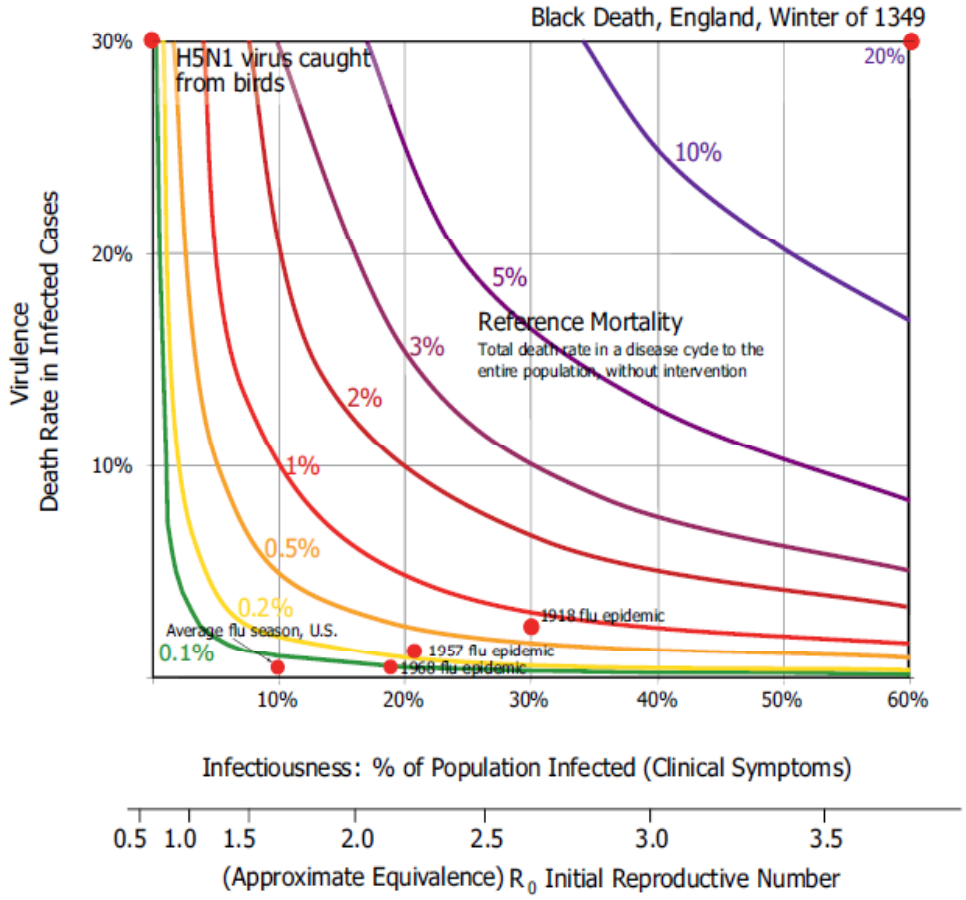
Pandemic Risk – Assumptions

- WHO (2008): Epidemiological indicators for pandemic influenza

Indicators	Estimates from past pandemics	Estimates for crowded, low-resource settings
Attack rate	15–35% (of the general population)	Up to 50–60%
Secondary bacterial pneumonia	2.5–5% (of those ill)	5–10%
Health-care seeking - outpatients	30–50% (of those ill)	30–50%
Hospitalization rate - inpatients	1–2% (of those ill)	Up to 10%
Case-fatality rate	1–2% (of those ill)	4% or more

Pandemic Risk – Assumptions

Historical Combinations of Severity and Attack rate



- Frequency
- Severity
- Attack Rate
- Age groups

Source: RMS

Pandemic Risk – Assumptions

- Stress testing across case-fatality rates and infection rates
- For Example:

Excess Mortality Rate			
Case - Fatality (Mortality Rate once Infected)	**Infection Rate**		
	10%	**20%**	**30%**
0.2%	**0.02%**	**0.04%**	**0.06%**
0.5%	**0.05%**	**0.10%**	**0.15%**
1.0%	**0.10%**	**0.20%**	**0.30%**
2.0%	**0.20%**	**0.40%**	**0.60%**

Solvency II min. pandemic/cat charge

1918/1919 Spanish Flu "mild"

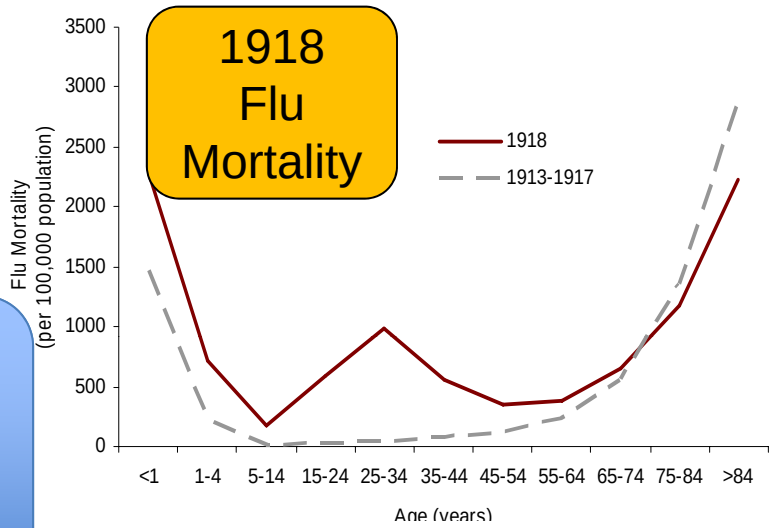
What if the next one is more deadly?

What if the next one is more contagious?

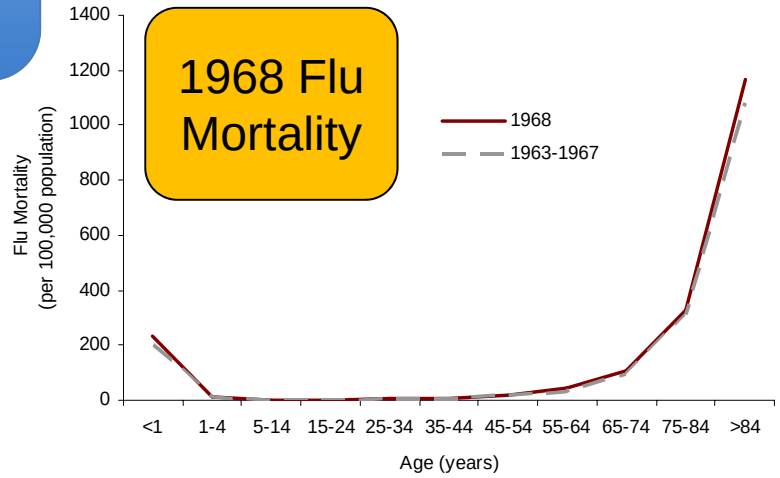
Pandemic Risk – results

Example of assumption setting ranges:

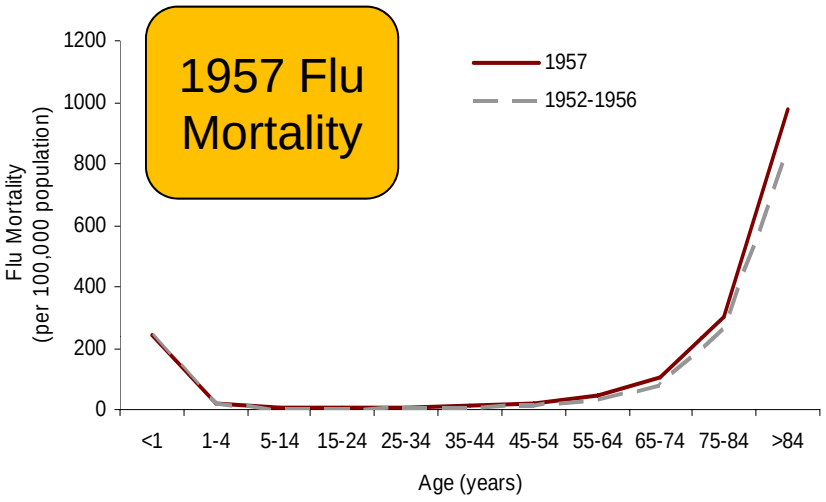
1918 Flu Mortality



1968 Flu Mortality



1957 Flu Mortality



Pandemic	Excess Deaths ('000s)	US Population (millions)	Excess Mortality
1918	700	104	0.67%
1957	70	175	0.04%
1968	33.8	200	0.02%

Frequency: 3 per century
Attack rate: 10 – 60%
Severity: 1x to 6x normal mortality

Section 2: Catastrophe Risk

Catastrophe Risk

Catastrophe Risk

- The main perils which shall be considered in India when looking at catastrophe risk for Life, Accident and Health insurance portfolios

  - Earthquake / Tsunami
  - Flood
  - Transportation Accidents
  - Industrial Accident / Explosions
  - Terrorism / NBC risk




Types of Terrorism Attacks

4

Nuclear

100 kiloton
20 kiloton
10 kiloton
1 kiloton

7

Conventional

Cruise missile
Multiple aircraft
Single aircraft
Large truck bomb
Small truck bomb
Car bomb
Human bomb

7

Radiological

Cruise missile
Multiple aircraft
Single aircraft
Large truck bomb
Small truck bomb
Car bomb
Human bomb

3

Biological

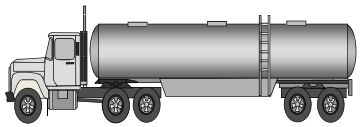
Large event
Medium event
Small event

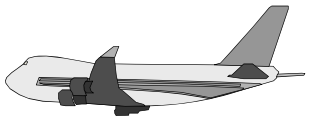
3

Chemical

Large event
Medium event
Small event

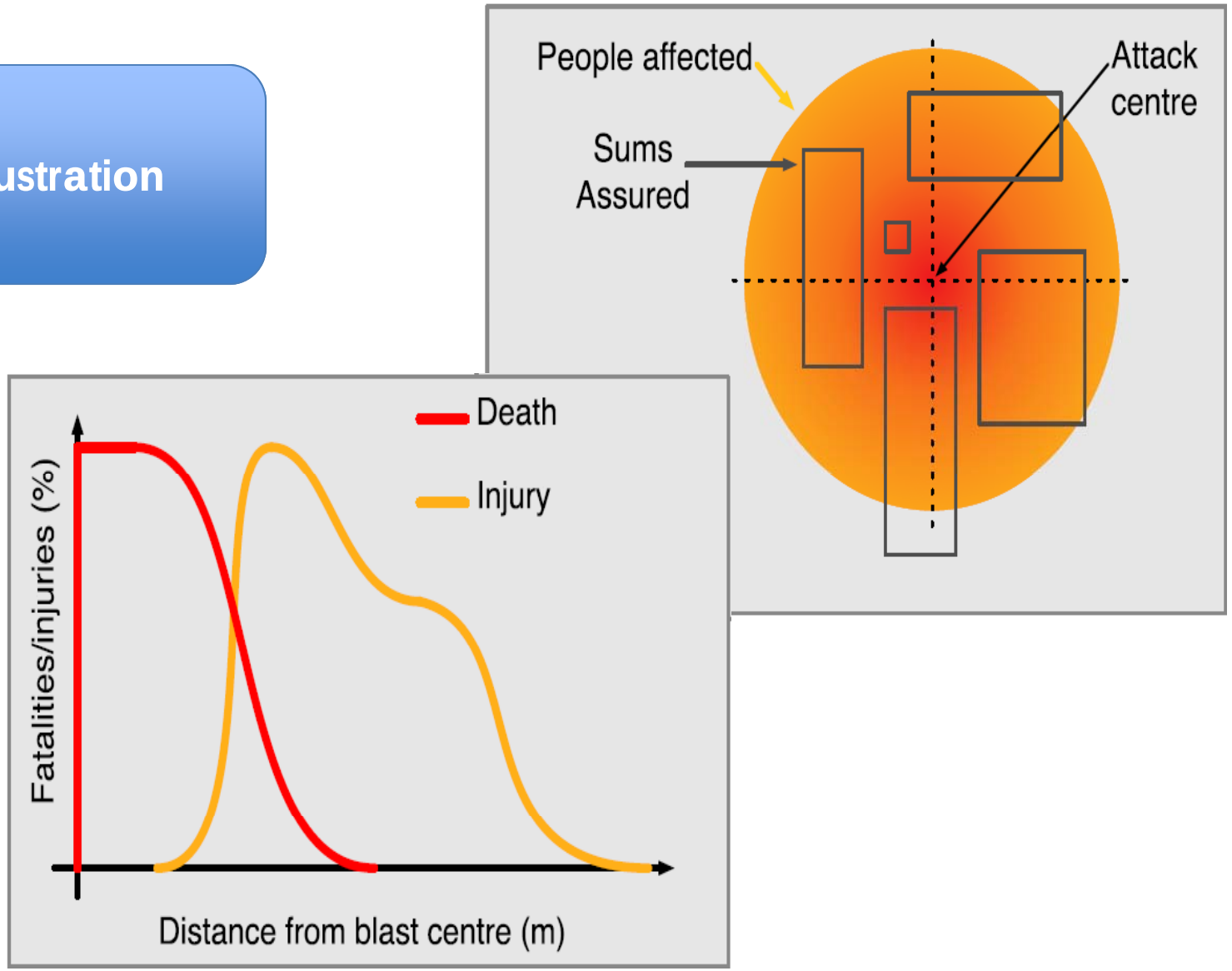
Total attack types = 24





Terrorism Risk – Modelling

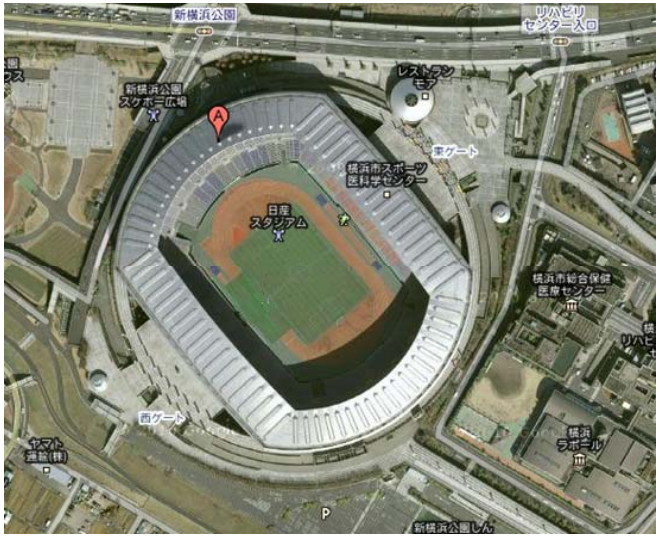
Illustration



Terrorism Risk – Modelling

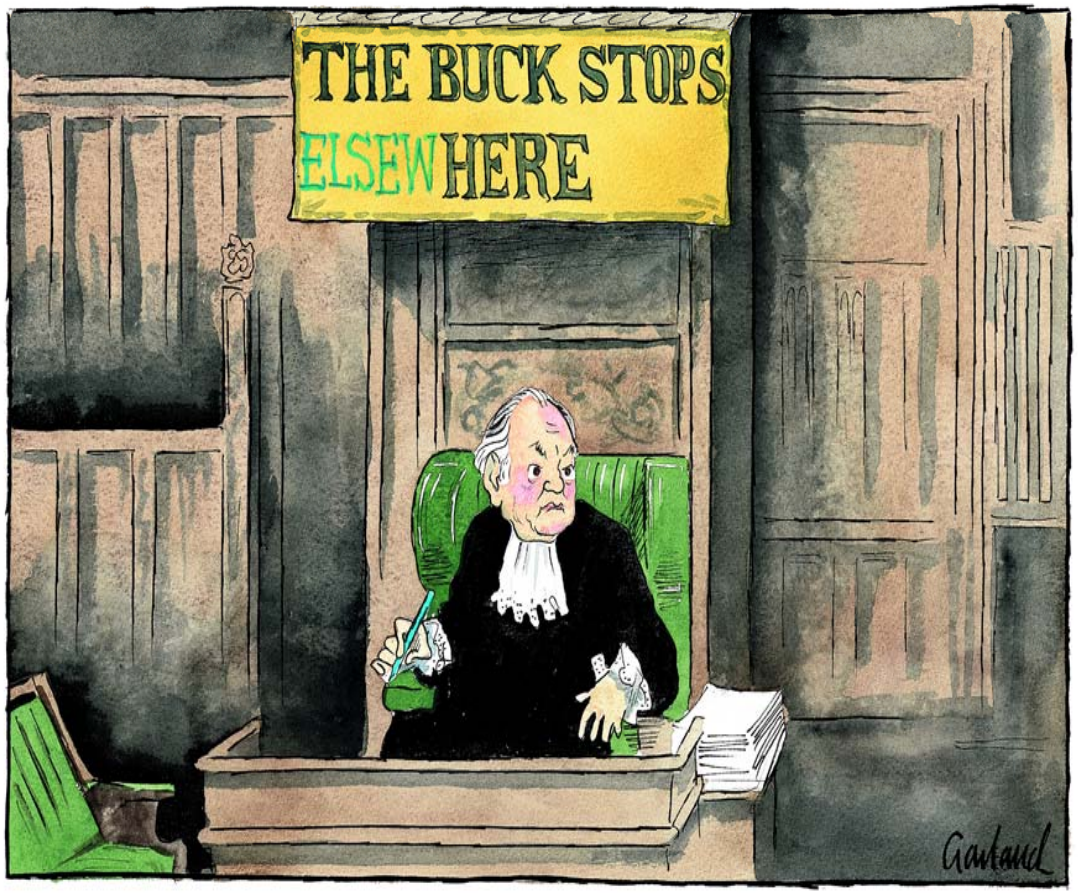
Example of a scenario, occurring in a crowded public place

Scenario assumptions : Football Arena
Insurer's share inside the Stadium
No Lives inside the Stadium
Insurer's share in surrounding area
Population Density (persons/km²)
Average Disability Loss in INR thousands
Average Death Loss in INR thousands



		Insurer's Share				
		Killed		Disabled		Total
		Number	Cost (INR billion)	Number	Cost (INR billion)	Cost (INR billion)
Nuclear	100 KT	13,693	**164.3**	20,610	**164.9**	**329.2**
	20 KT	5,619	**67.4**	3,579	**28.6**	**96.1**
	10 KT	4,620	**55.4**	3,301	**26.4**	**81.8**
	1 KT	3,756	**45.1**	1,364	**10.9**	**56.0**
Conventional	Cruise Missile Attack	1,474	**17.7**	650	**5.2**	**22.9**
	Multiple Aircraft	2,202	**26.4**	658	**5.3**	**31.7**
	Single Aircraft	1,908	**22.9**	695	**5.6**	**28.5**
	Large Truck Bomb	1,288	**15.5**	630	**5.0**	**20.5**
	Small Truck Bomb	714	**8.6**	381	**3.1**	**11.6**
	Car Bomb	127	**1.5**	386	**3.1**	**4.6**
	Human Bomb	19	**0.2**	153	**1.2**	**1.4**
Radiological	Cruise Missile Attack	1,554	**18.6**	737	**5.9**	**24.5**
	Multiple Aircraft	2,323	**27.9**	902	**7.2**	**35.1**
	Single Aircraft	2,010	**24.1**	806	**6.4**	**30.6**
	Large Truck Bomb	1,358	**16.3**	708	**5.7**	**22.0**
	Small Truck Bomb	762	**9.1**	420	**3.4**	**12.5**
	Car Bomb	140	**1.7**	425	**3.4**	**5.1**
	Human Bomb	21	**0.2**	168	**1.3**	**1.6**
Biol.	Large Attack	5,319	**63.8**	6,495	**52.0**	**115.8**
	Medium Attack	2,950	**35.4**	1,463	**11.7**	**47.1**
	Small Attack	1,326	**15.9**	1,918	**15.3**	**31.3**
Chem.	Large Attack	4,663	**56.0**	6,067	**48.5**	**104.5**
	Medium Attack	2,633	**31.6**	1,386	**11.1**	**42.7**
	Small Attack	1,700	**20.4**	1,152	**9.2**	**29.6**

Section 3: What are the Risk Transfer Solutions?



Solution (Catastrophe) – Excess of Loss

Catastrophe Per Event Excess of Loss Reinsurance

Excess Claims

ABC Life retains

Event Limit

Reinsurer pays

Event Deductible

ABC Life retains

Subject to…

Event/Accident Definition e.g.
Affecting 2 or more lives
Death shall occur within 12 months

Hours Clause e.g.
within 72 consecutive hours

Solution (Catastrophe) – Excess of Loss

Catastrophe Per Event Excess of Loss Reinsurance

What is it?	What's commonly covered?	What's generally excluded?
Non-proportional reinsurance	Death and/or Disability or Death only	War Nuclear, Biological and Chemical Terrorism (NBC)
Pay-off based on **one given event** within **maximum duration**	Natural Events Fire Airplane Accident Terrorism	Pandemics, as it does not fit the Event Definition and Hours Clause

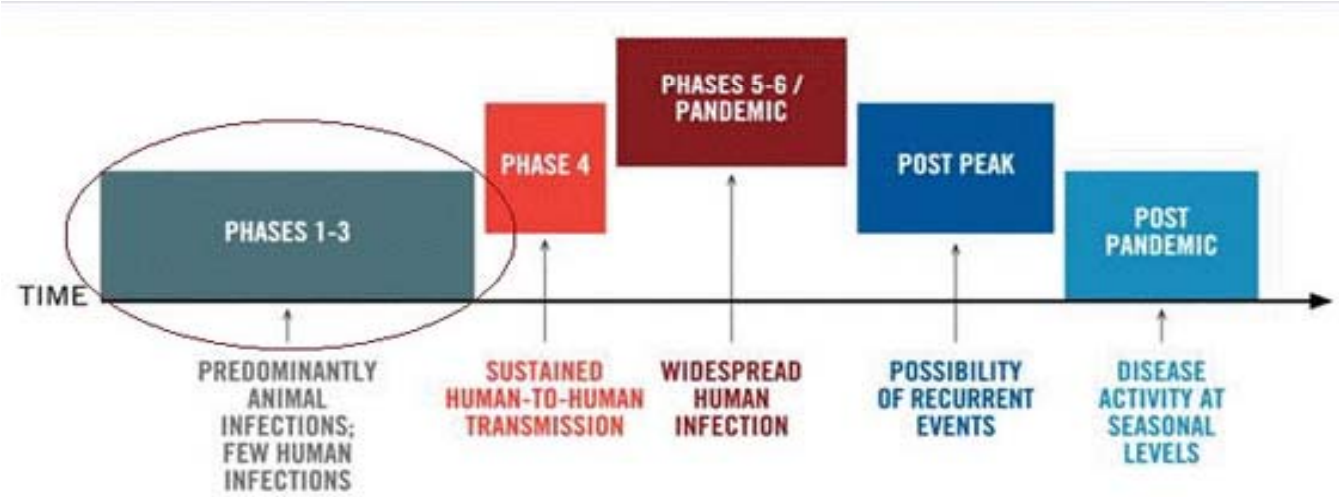
Reinsurance with NBC can also be set up

Solutions (Pandemic) – Cat XL

- Pandemic Per Event XL
  - Similar to a **standard Cat XL cover**
  - **Pandemic Event definition**: e.g. trigger on WHO (World Health Organisation) or local body declaring pandemic state
  - Aggregation of the claims that arise out of a Pandemic Event, within X consecutive days (e.g. 60 or 90 or 120 days). Needs ability to identify claims due to the pandemic event within the mass of all claims during the period
  - Cover usually more affordable than on a Stop Loss basis

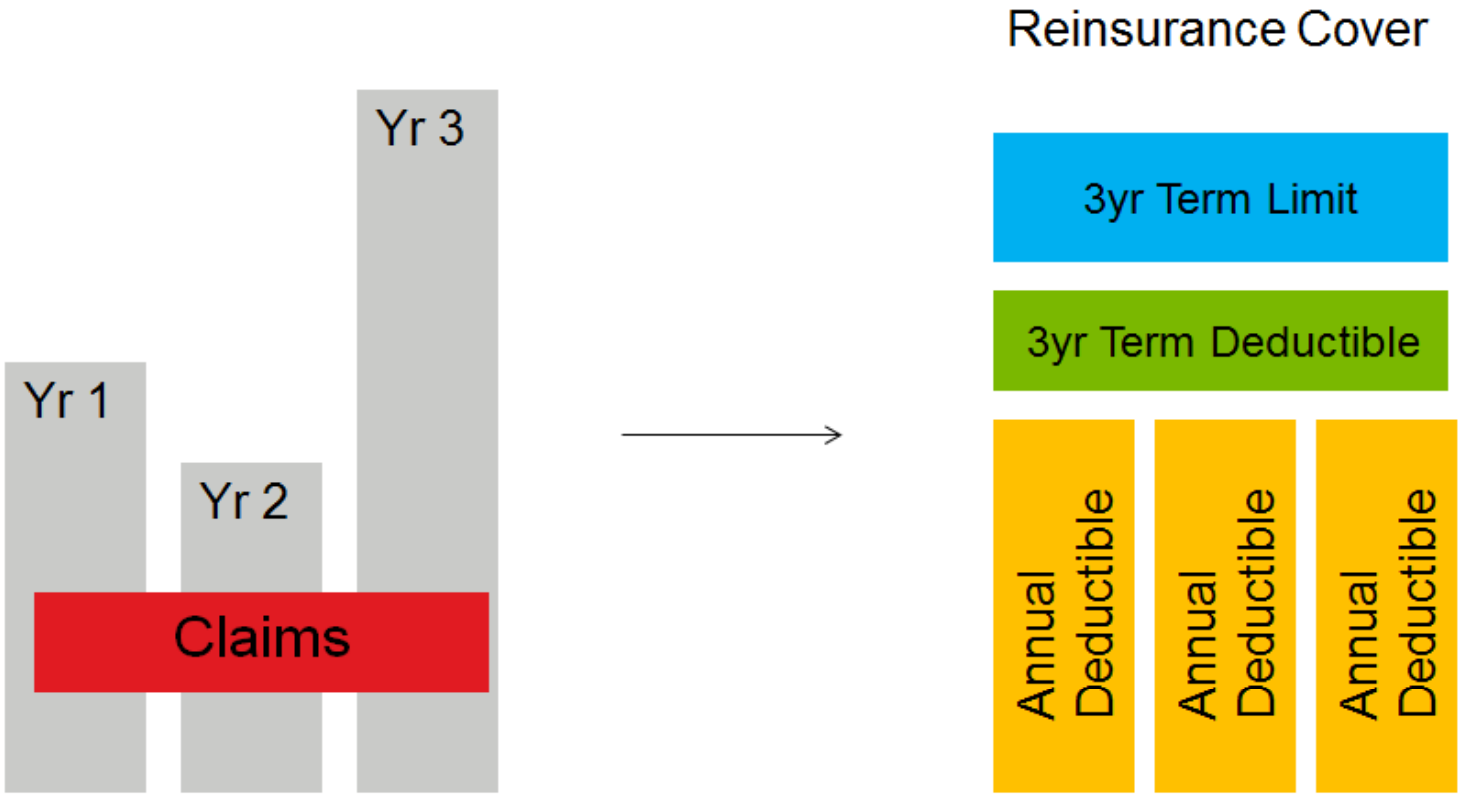
Solutions (Pandemic) – Stop Loss Reinsurance

- Aggregate Stop Loss
  - **Excess mortality, disability and/or medical**
  - covers aggregated losses above Deductible X dollars
  - covers up to Limit Y dollars
  - can be multi-year coverage
  - may include a Pandemic trigger
    (e.g WHO declaring phase 6 pandemic)
- overall, an appropriate **coverage for longer duration pandemics** and/or recurring waves
- **Cost**: current pricing in the range of **2% to 6% annual RoL**
(Rate on Line = reinsurance premium / limit of the cover).



Solutions (Pandemic) – Stop Loss Reinsurance (Example)

- Illustration:



Solutions (Pandemic) – Stop Loss Reinsurance (Example)

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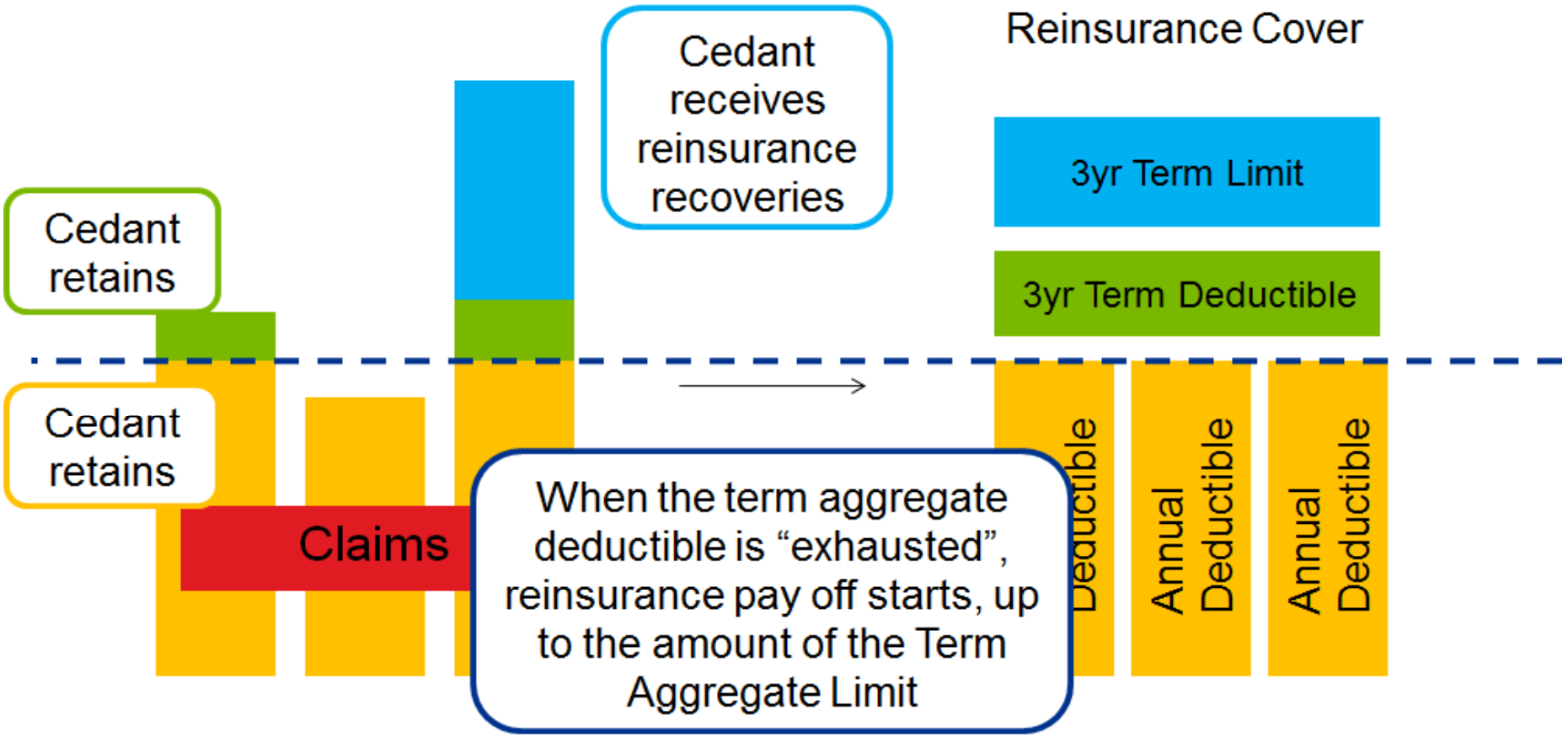

Solutions (Pandemic) – Capital Markets - Extreme Mortality Bond/Swap

Extreme Mortality Bond	▪ Multi-year coverage ▪ Lock in favourable pricing as excess capacity available for diversifying perils ▪ Legal Structure largely similar to non-life ILS
Extreme Mortality Swap	▪ Annual, retaining flexibility at renewals, but open to alteration in price ▪ Lower frictional costs ▪ Target fewer investors for smaller placement ▪ Replicate existing swap with minimal additional legal costs
Parametric	▪ Based on 2 year average mortality rate ▪ Transparent and well understood data providers
Indemnity	▪ Untested in the public ILS market ▪ Extensive disclosure requirements on underlying exposure

Conclusion

- Extreme mortality/morbidity events have by definition a (very) low occurrence probability, but several realistic disaster scenarios can/should be considered:
  - Outbreak of a “new” pandemic (influenza or others) with high affection and case-fatality or case-morbidity rates
  - Natural Calamities (e.g. Earthquake/Tsunami)
  - Accidents in densely populated areas (office towers, business districts, stations, stadiums….)
  - Terrorist Events or “War risk” type Events (Civil commotion…)
  - Nuclear, Biological or Chemical incidents
  - Transportation Accidents (less extreme / higher frequency)
- These events could cause massive stress on a life & health insurer’s balance sheet: shock on liabilities, but also assets, operations, sales…
- “Risk-Transfer” solutions, reinsurance arrangements in particular, are available to “off-load” part of the risk on insurance liabilities:
  - Effective to decrease retained “tail risk”
  - Procure economic capital benefit (and, depending on solvency regime, also regulatory capital benefit)