Institute and Faculty of Actuaries

Mitigating the Risk of Epidemics

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Date: Wednesday 19 October 2017
Time: Workshop D Stream 16.40-17.30

Agenda

- Epidemic Primer
  - Epidemic risks leading to a pandemic
  - WHO risk definition
  - From HIV to Zika
- Large Scale Risks in Reinsurance
- Economic Losses of Epidemic Risks
  - Some use cases
- Mitigating the Un-Seeable Risks of Epidemics
  - From prevention to insurance coverage

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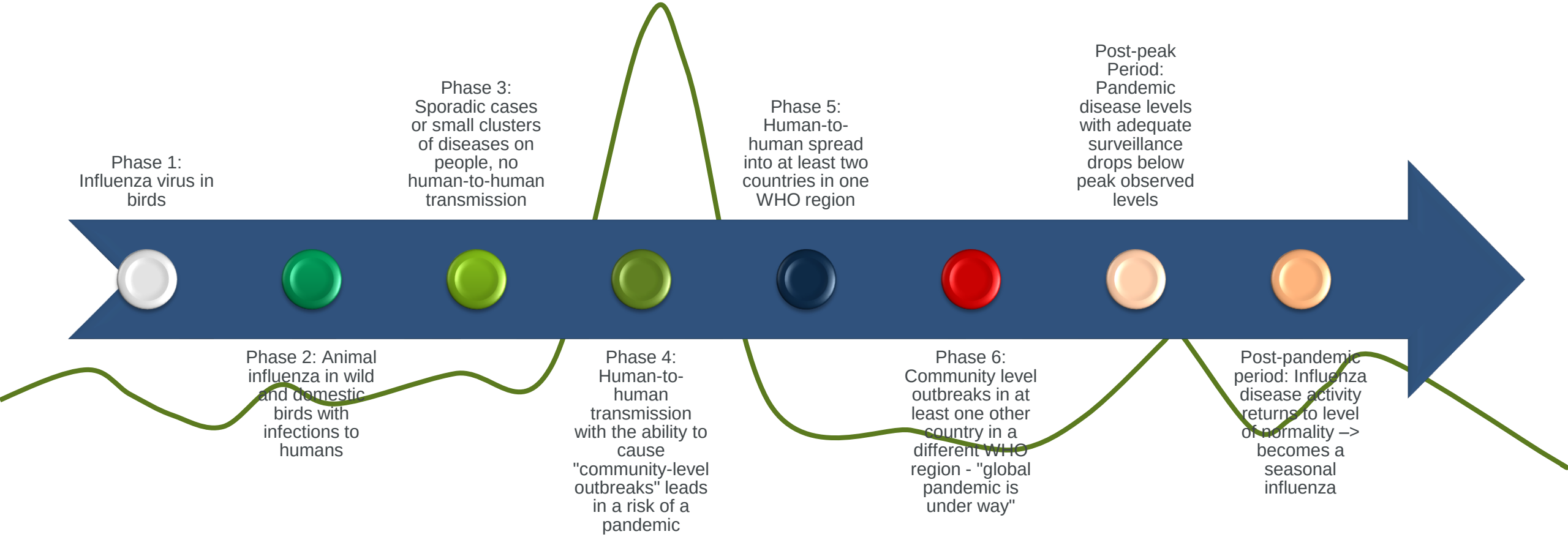
The Phases of Infectious Disease: When Animals Intersect Humans

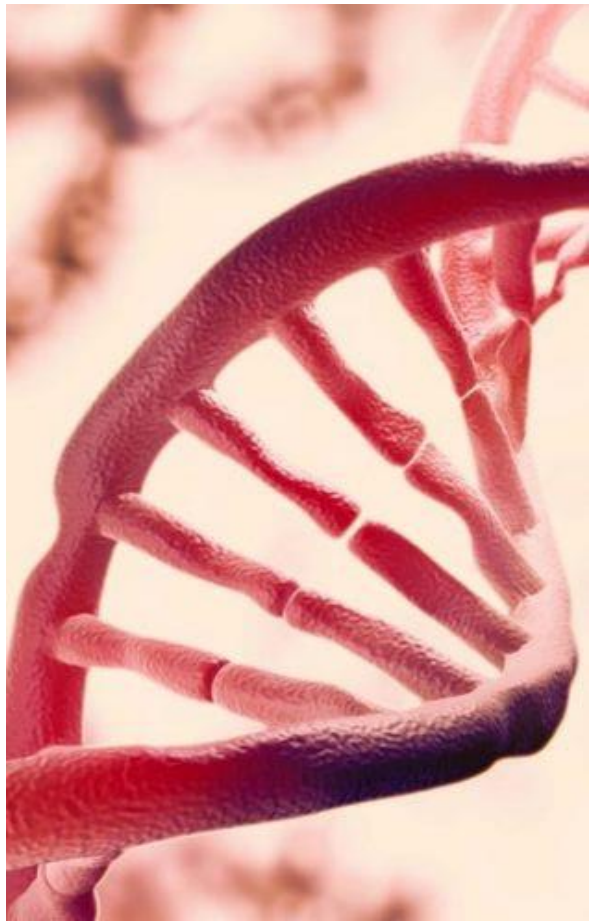


WHO: The Phases of An Influenza Pandemic

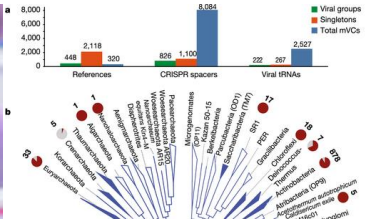
The Threat of Zoonotic Diseases

- Zoonoses are infectious diseases of animals that can naturally be transmitted to humans
- Major modern diseases include Ebola virus disease, salmonellosis and influenza
- HIV started as a zoonotic disease in the early 20th century; evolved to a human-only disease
- Zoonoses can be caused by a range of disease pathogens (1,415 pathogens known to infect humans; 61% are zoonotic)
  - Viruses
  - Bacteria
  - Fungi
  - Parasites

The Global Virome Project



- A COLLABORATION to document and characterize virtually all the viruses circulating in wildlife that pose a threat humans
- A bold and doable visionary project
- The potential to change the way we do science



Case Study: Nigeria's Major Infectious Diseases

Food or Waterborne Diseases:

Bacterial and protozoal diarrhea, hepatitis A and E, and typhoid fever

Vectorborne Diseases:

Malaria, dengue fever, and yellow fever

Water Contact Diseases:

Leptospirosis and schisto-somiasis

Respiratory Diseases:

Mening-ococcal meningitis

Aerosolized Dust or Soil Contact Disease:

Lassa fever

Animal Contact Disease:

Rabies

Source: CIA World Fact Book, 2016

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Key Principles of Insurance

Moral Hazard

- Incentive to guard against risk

Risk

- Uncertainty about future loss (timing, size, occurrence)

Peril

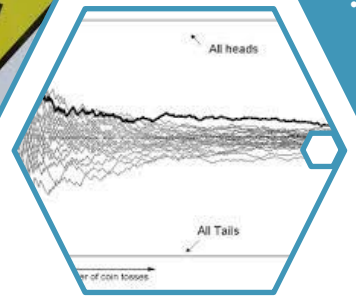
- Cause of loss

Adverse Selection

- Those with greater risk more willing to pay to transfer it

Information Asymmetry

- Entities know more about their individual risks than insurance companies

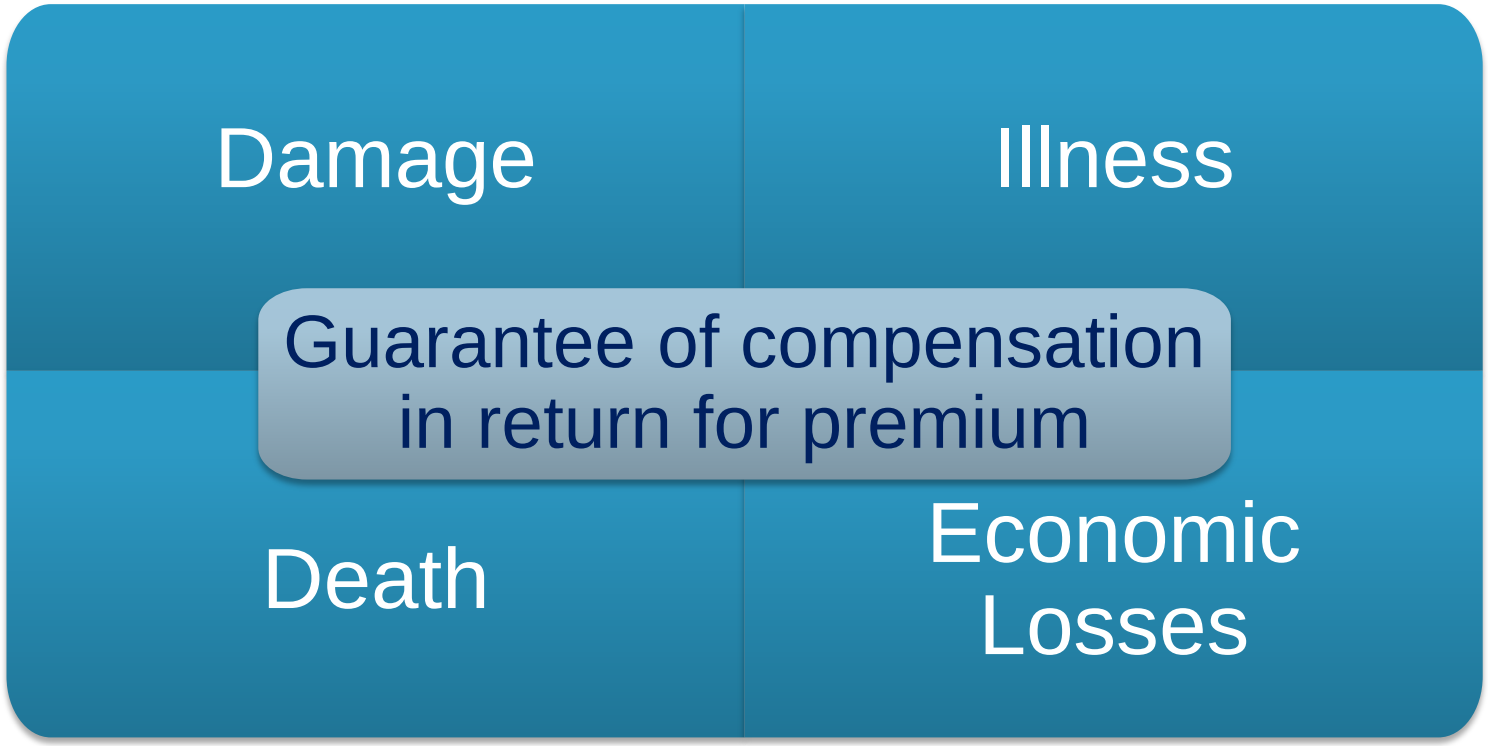


Law of Large Numbers

- Large, homogenous groups allow for greater certainty in estimating risks

Risk Transfer

Various methods, beyond the control of insurance, by which a pure risk and its potential consequences are transferred to other parties



Large-Scale Risks Assigned to Reinsurers

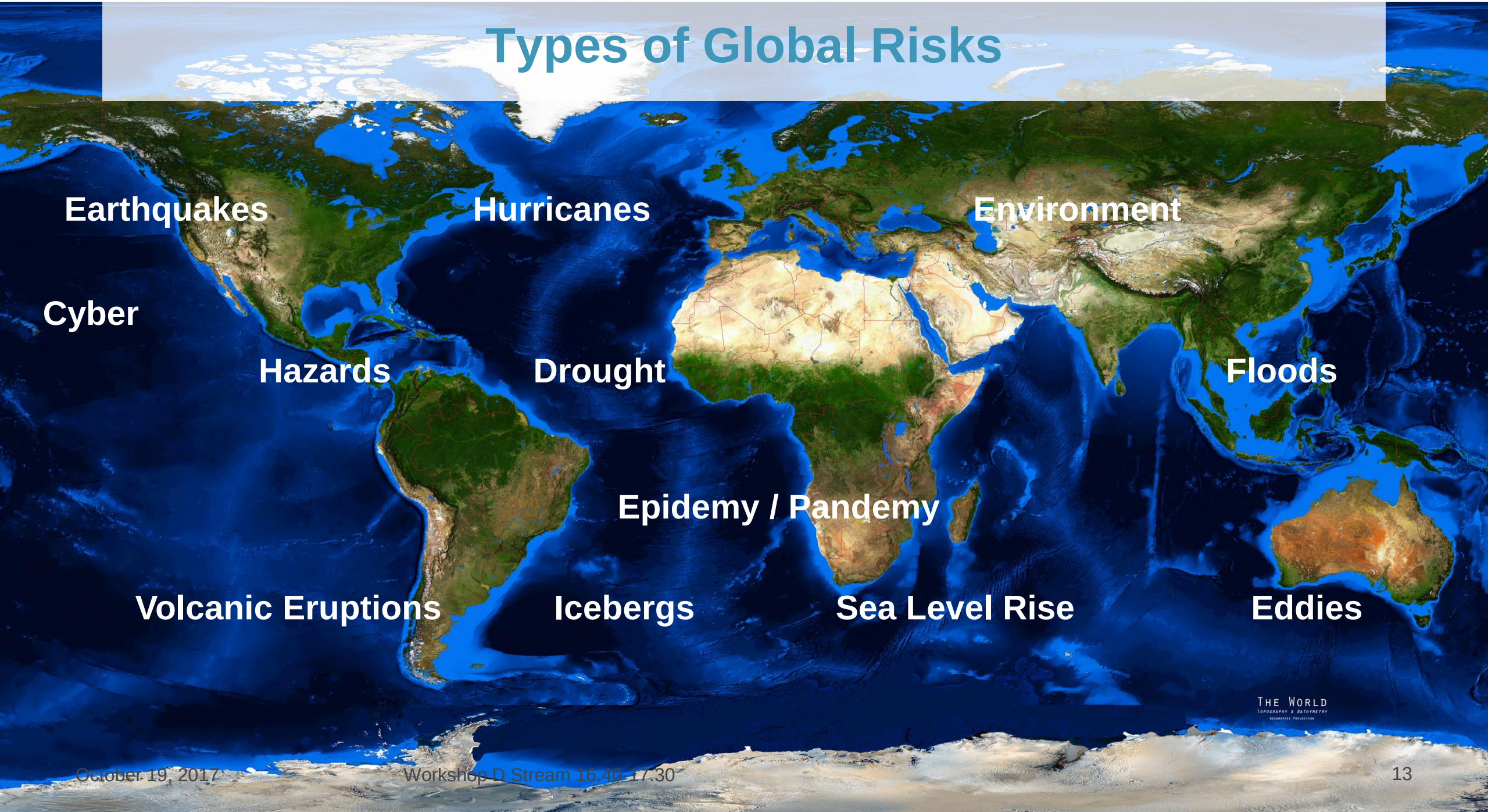
- Cover large risk-bound geographical areas
  - Mostly all are affected, once one is affected; but exceptions for individual items
- Prevent effective use of normal-based distributions
  - Introduction of correlations
  - Change of traditional insurance distributions
- Extending beyond boundaries of a single region or country
  - Multi-national and globally joint efforts
- Challenges
  - Different national entities with different regulations, facilities, capabilities and profiles
  - Considerations such as international traffic and quarantines, public immunizations and vaccinations

Classes of Reinsurance

- Coverage intended for insurance providers
- Reinsurance policy reduces the losses sustained by insurance companies by allowing them to recover all, or part, of the amounts they pay to claimants
- Reinsurers help insurance providers avoid financial ruin
  - When many policyholders make claims during a catastrophic event
  - When few policy holders make concurrently very large claims

Facultative	Treaty	Proportional	Non-proportional	Excess-of-Loss	Risk-Attaching	Loss-Occurring
• individual risk • specified risk • contract	• specified period of time • all risks within the coverage	• prorated share of the premium • portion of losses • agreed percentages for premium and losses • ceding commission	• exceeding a specified limit	• losses exceeding a retained limit • "catastrophic " events • per occurrence or accumulative	• covers all established losses	• type of a treaty coverage • all losses occurred

Types of Global Risks

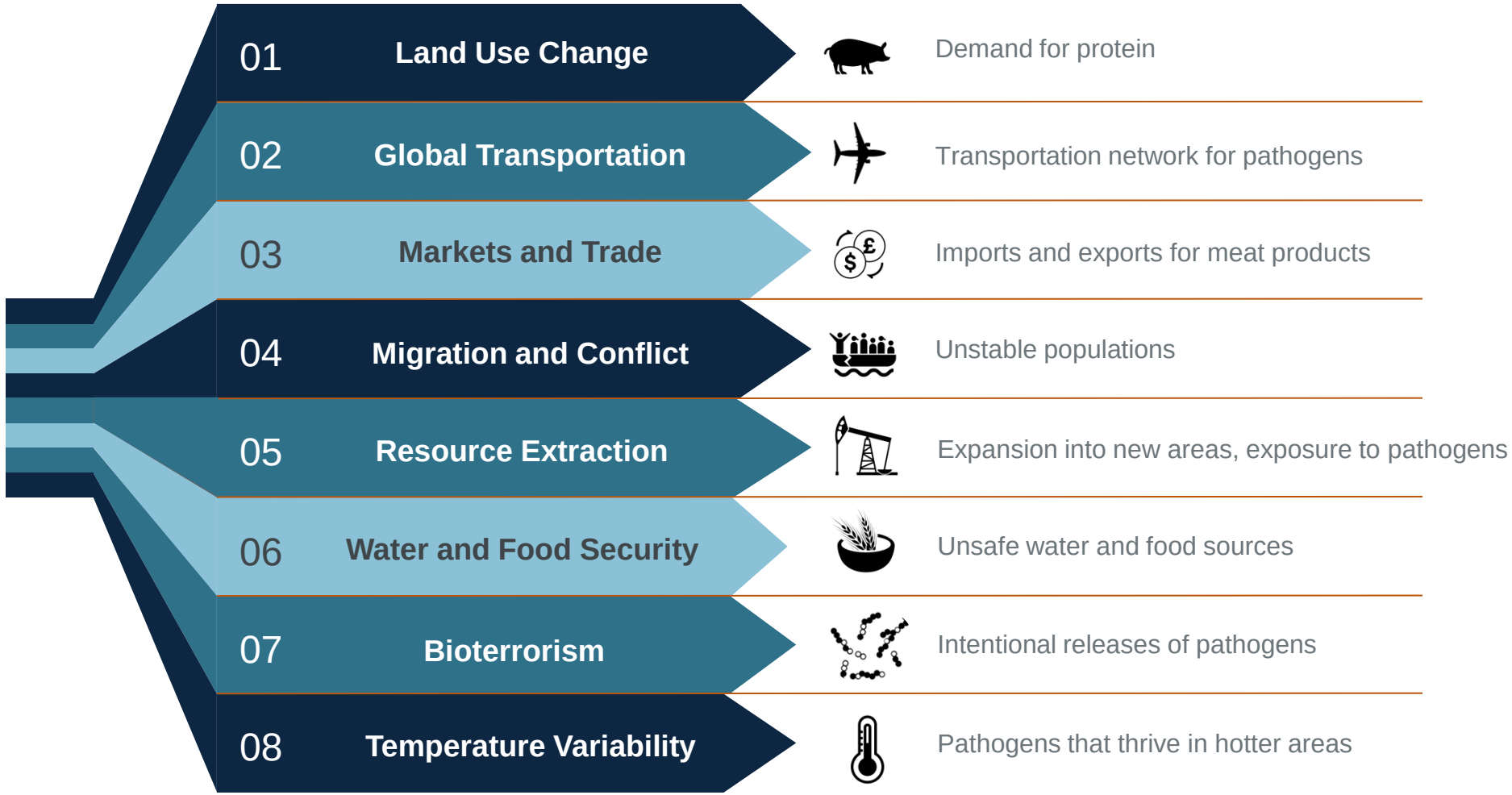


Capital and Catastrophic Events

- Catastrophic events are by definition long-tail
- Insurers covering such infrequent events collect premiums that may be insufficient to cover
- Regulations must prevent this from occurring
- Insurers must hold reserves invested in safe (usually low return) asset classes
  - Use combination of accumulation management and reinsurance to carefully manage capital levels
- Reinsurance
  - “Insurance for insurance companies”
  - Trade underwriting risk for counterparty/financial risk
  - Lower capital requirements
  - Increase ability to write more business
  - Smooth earnings
  - Retrocession is reinsurance for reinsurance companies

Why are Epidemic and Pandemic Risks of Concern

Factors driving the emergence of infectious disease

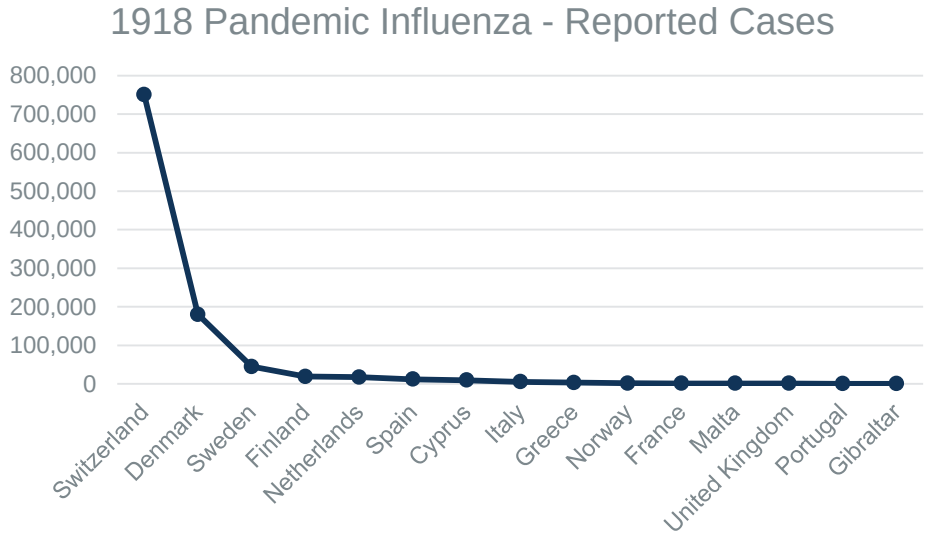


Pandemic Influenza – Events which are underestimated

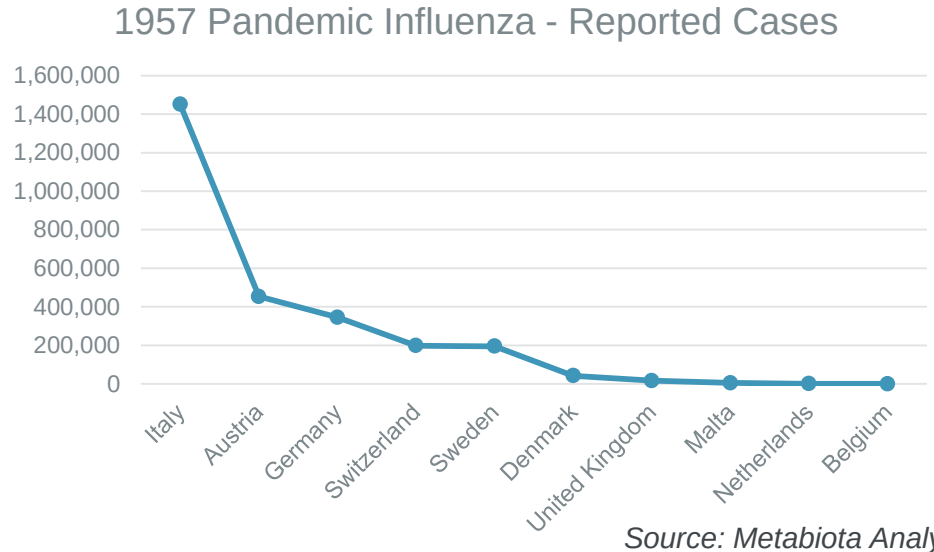
For outbreaks occurring from **Pandemic Influenza** in **35 countries** for the duration of **91 years** from **Jan 1918 to Dec 2009** , with **1 to 1,450,807 reported cases** and **0 to 13,562 reported deaths**, there are:

1	4	4,237,194	40,522	91 YRS
PATHOGEN	EVENTS	REPORTED CASES	REPORTED DEATHS	TIME FRAME

1918 – 1921: More than one million reported cases with 23 thousand deaths



1956 - 1958: More than two million reported cases with 14 thousand deaths



Source: Metabiota Analytics Platform

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Five Deadliest Pandemics in History

There are more pandemics reported in all countries worldwide

The Spanish Flu

- March 1918
- US soldiers carried the flu from a camp in Kansas to all continents
- between 20-100 million died, one billion people infected

The Black Death

- 14th century
- from caravan trading routes used by merchants and soldiers
- 25 million died

The Plague of Justinian

- 541-542 AD
- outbreak within Constantinople
- 10 thousand died per day

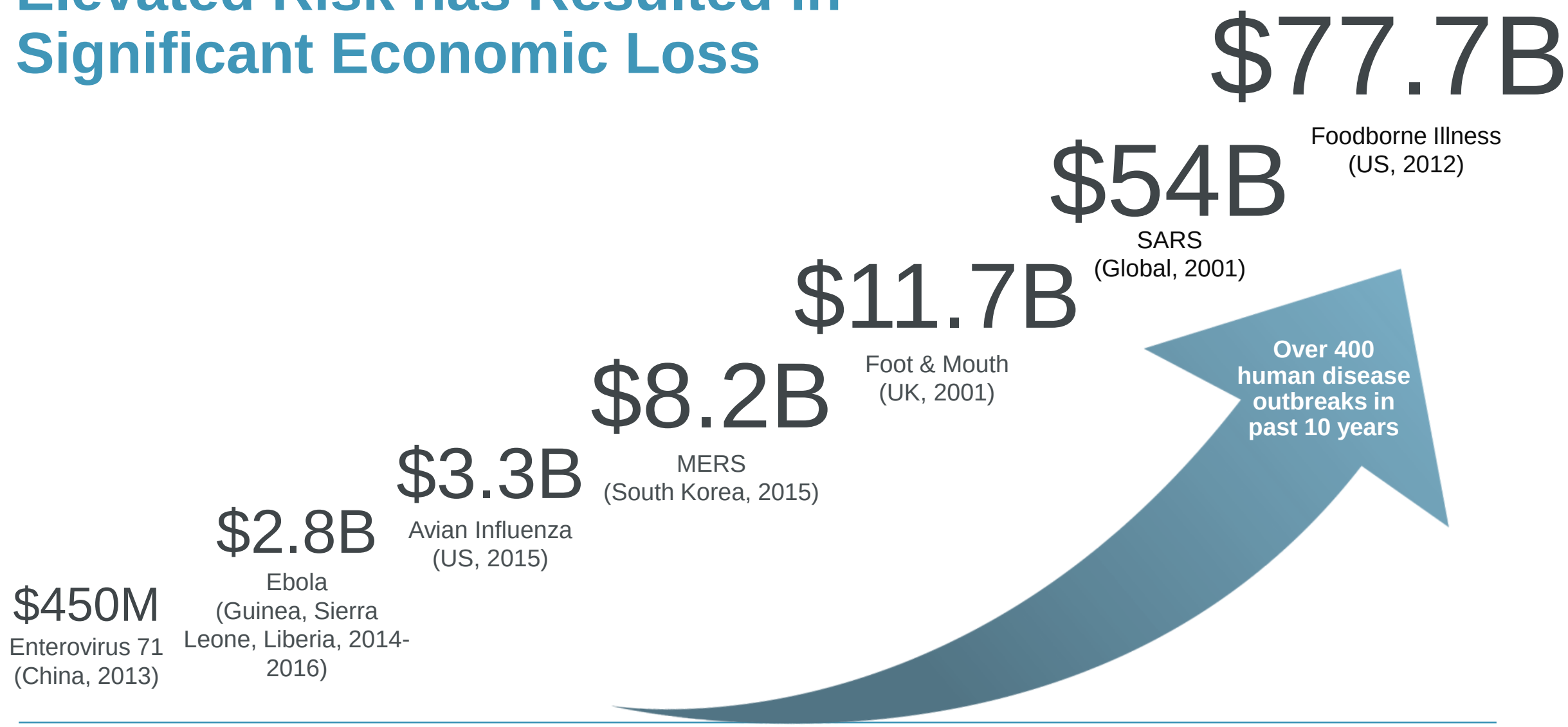
The Antonine Plague

- 165 AD
- bought to Rome by soldiers from Mesopotamia
- 5 million died over 15 years

The Peloponnesian War Pestilence

- 430 BC
- during the Peloponnesian war between Athens and Sparta
- 30 thousand died

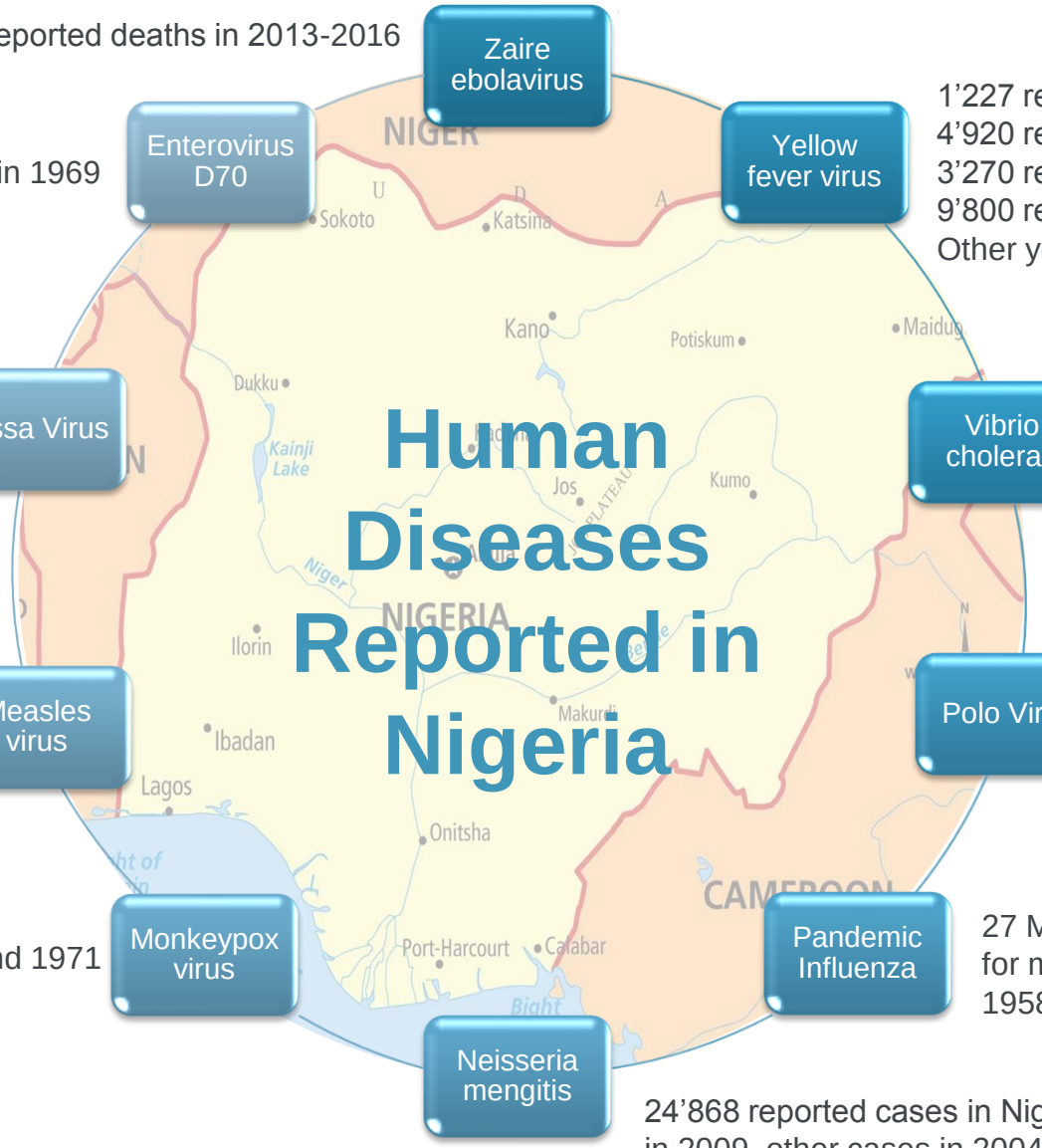
Elevated Risk has Resulted in Significant Economic Loss



From Past to Today - We Face Big Epidemic Risks

- Humanity is locked in a millennia-old battle to the death with diseases.
- The outbreak of Ebola remind us that as our cities get bigger and international travel easier, therefore the risks in an outbreak grow even higher.
- The Black Death swept into Europe on boats from the East in the 14th century, killing as much as half the population of the continent between 75 and 200 million people worldwide.
- The Spanish flu of 1918, killed between 50 and 100 million people – many more than died in the First World War itself, and maybe more than have died in any war.

Human Diseases Reported in Nigeria



Zaire ebolavirus

19’663 reported cases, 25 reported deaths in 2013-2016

Enterovirus D70

800 reported cases only in 1969

Yellow fever virus

1’227 reported cases, 415 reported deaths in 1994
4’920 reported cases, 1’502 reported deaths in 1990
3’270 reported cases, 6180 reported deaths in 1989
9’800 reported cases, 5’600 reported deaths in 1986
Other years are: 1969, 1991

Lassa Virus

Cases reported in 2017, 2016, 2012, 2008, 1989, 1974, 1969

Vibrio cholerae

29’115 reported cases, 1’191 reported deaths in 2010

Measles virus

17’428 reported cases in 2011
Other year: 2005

Polo Virus

Smaller cases, no deaths but on a near-yearly basis from 2008-2016

Monkeypox virus

1 or 2 cases in 1978 and 1971

Pandemic Influenza

27 Mill reported cases, 38 thousand deaths for many countries including Nigeria in 1957-1958

Neisseria mengitis

24’868 reported cases in Nigeria and Niger, 1’513 reported deaths in 2009, other cases in 2004 and 1996 in many African countries

Source: Metabiota Analytics Platform

Factors Crucial to Determine Epidemic Severity

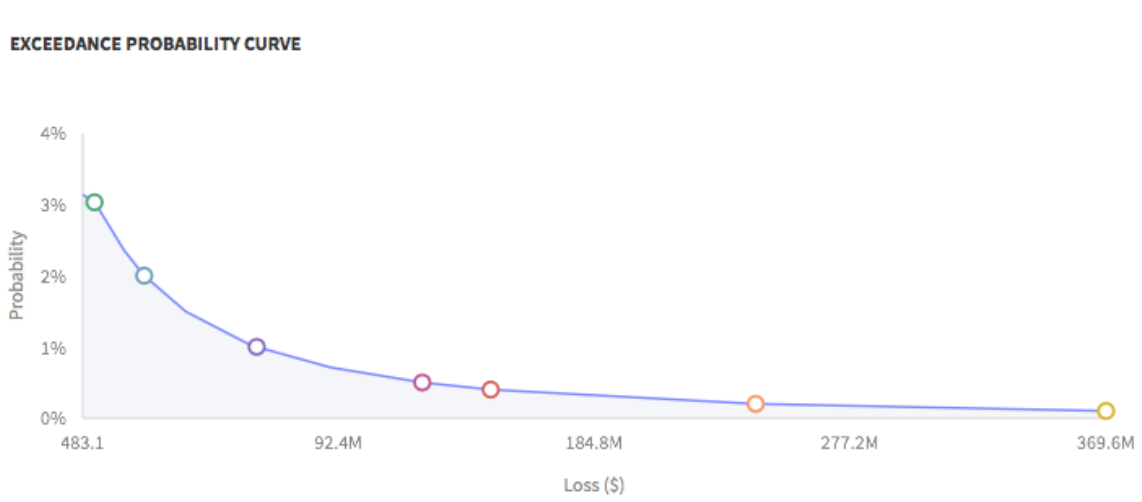
Source: Prof. Dr. Christophe Fraser, Medical Research Council for outbreak analysis, Imperial College, London

What Will We Face In The Future?

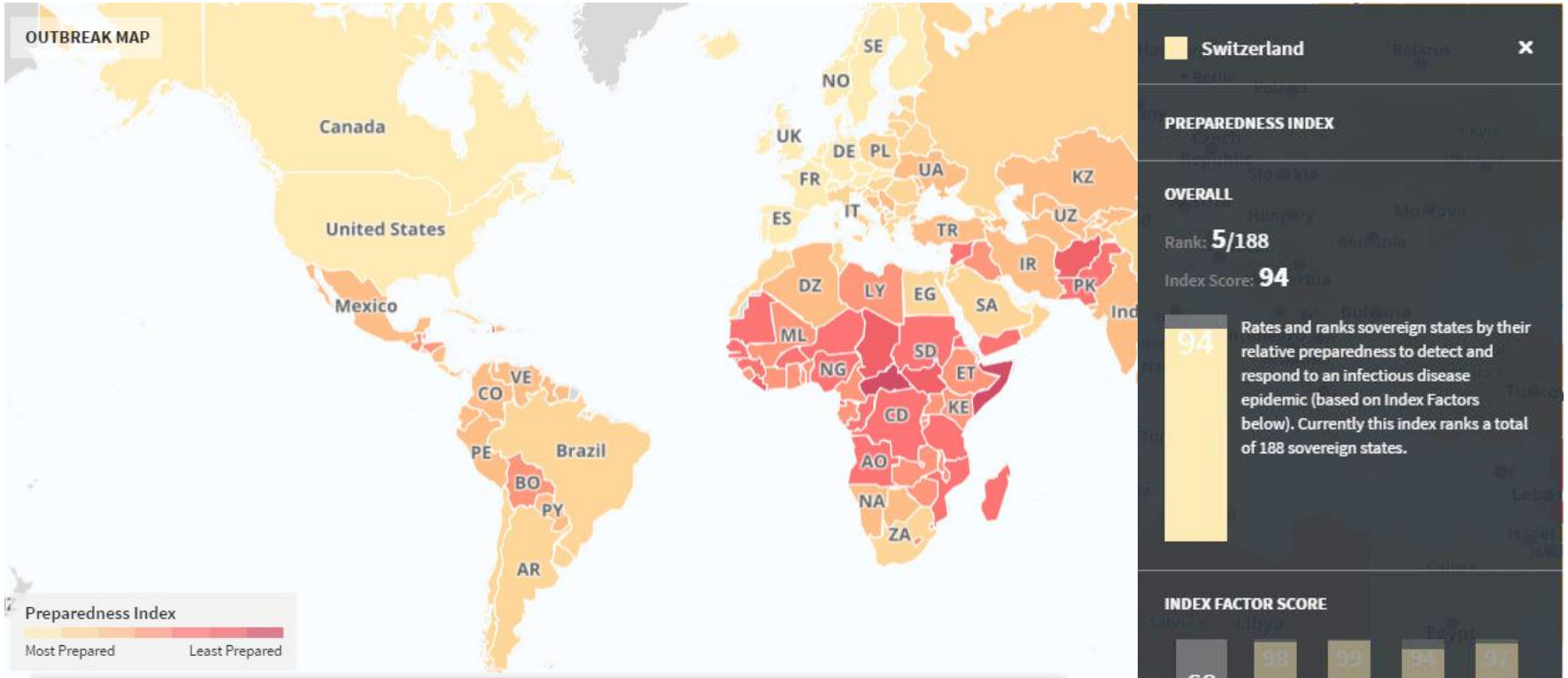
- Viruses can learn to propagate in a new host
- Genetic mutations
- Brand new viruses
- Hybrid of several viruses (example: HIV)
- Lack of vaccinations and treatments
- People denying vaccines for their children (example: Measles are back in Europe)
- Experts think that a likelihood for a pandemic is a strain of influenza
- Lack of preparedness (example: No one was prepared for Ebola in Africa)

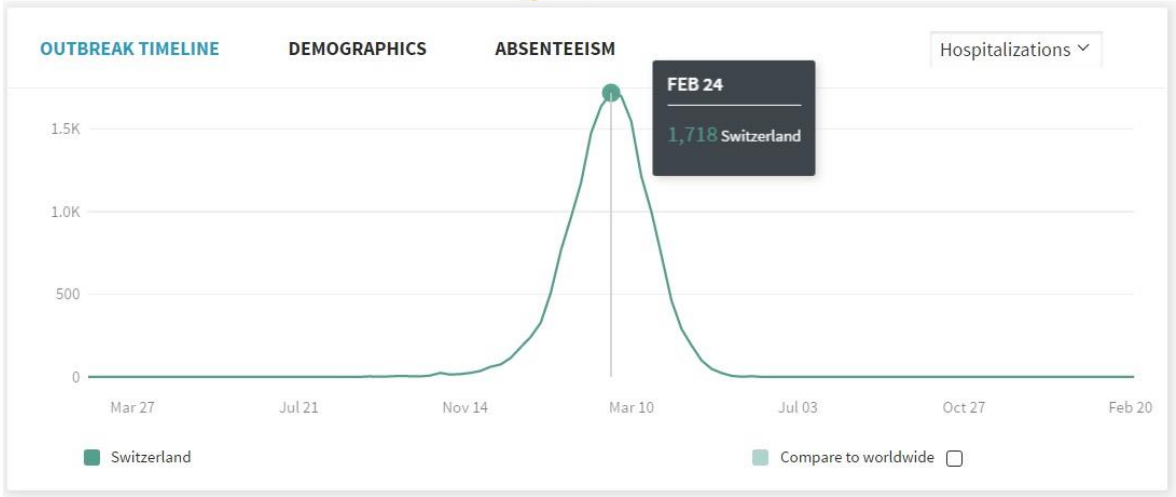
Prevention, Forecasting and Mitigating the Risk

- Evaluate the losses of epidemics from the past
- Prevention done by governance and bilateral political agreements
- Including insurers for long tail coverages to obtain medication, treatment and vaccinations or handle travel restrictions for identified countries of risk



Return Period	Exceedence Probability	Loss	TVAR
1/ 1000	0.10%	**$369,577,340**	$733,282,892
1/ 500	0.20%	**$243,047,314**	$514,728,434
1/ 250	0.40%	**$147,339,846**	$351,125,516
1/ 200	0.50%	**$122,635,605**	$307,751,850
1/ 100	1.00%	**$62,833,732**	$197,655,100
1/ 50	2.00%	**$22,205,449**	$118,280,537
1/ 33	3.03%	**$4,241,947**	$82,378,074





Insurability & Risk Differentiation

Insurers need to understand: Preparedness of a country and its neighbor countries to handle outbreaks, frequency and severity of events, and likely absenteeism for an event with a 20-50 year return period.

METABIOTA PREPAREDNESS INDEX

Allows insurers to view risks of a country/region with respect to other countries and regions

Source: Metabiota Analytics Platform

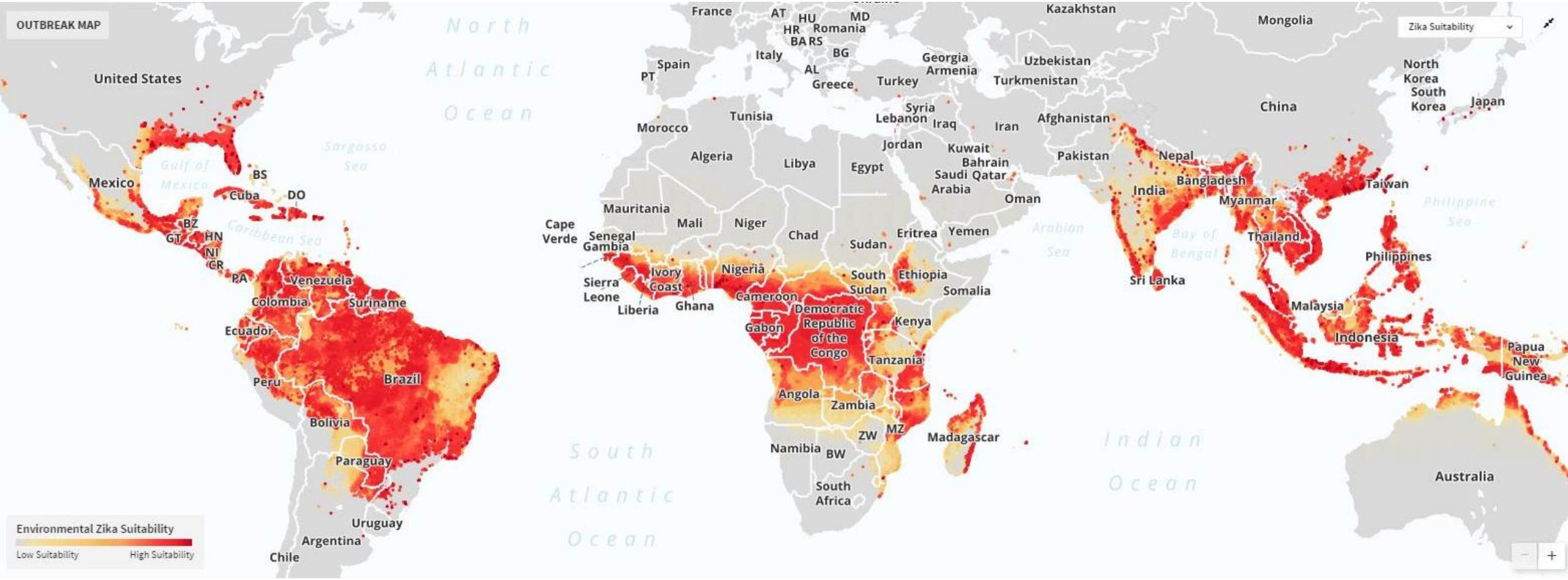
Business Interruption Case Study: Point of Sale Travel Insurance

- **Product:** Travel Insurance policy against cancellations due to Zika outbreak
- **Target Customers:** Travelers to Latin America and 2016 Olympic games visitors
- **Coverage:** Trip cancellation or re-booking to another destination if the Zika outbreak gets worse

Trigger Considerations

- The trigger should be very simple and easy to understand
  - Described in two lines next to a check-box on tour operator website
- “Zika related” should be defined generously: Zika, microcephaly etc.
- Threshold of X Zika related cases in the respective country / in Latin America
- General travel alert by the Country’s Ministry of Foreign Affairs for the respective country due to Zika
  - Is meant for everybody, not only for pregnant women

Zika – What Countries Are Vulnerable



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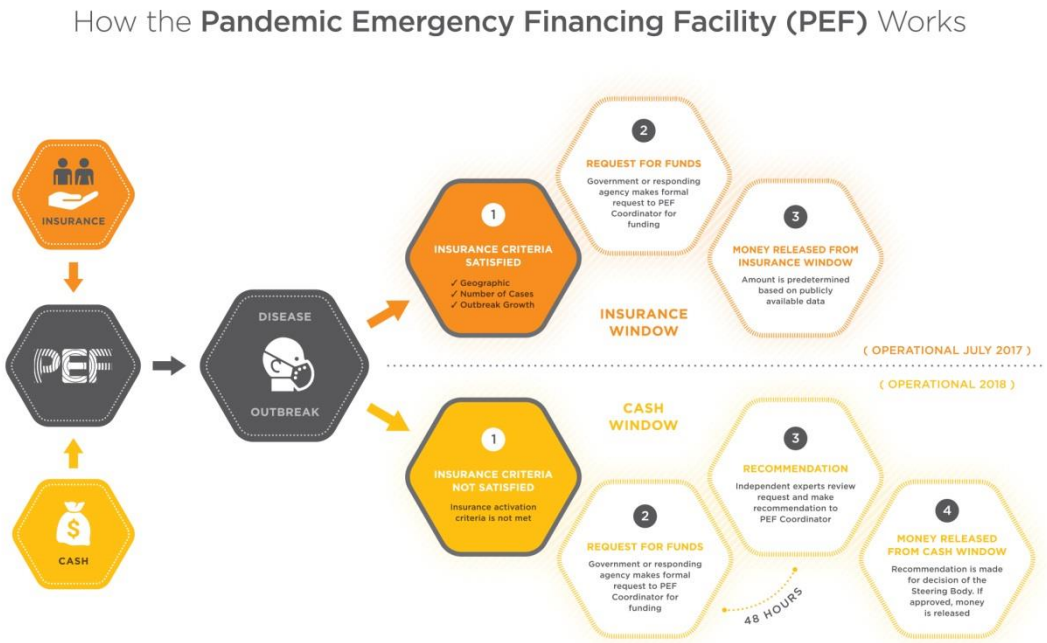
Pandemic Emergency Financing Facility (PEF) in collaboration with WHO and World Bank and supported by Japan and Germany



"Pandemics are one of the most certain uninsured risks in the world today. **There's a high probability that the world will experience a severe outbreak in the next 10 to 15 years that could destabilize societies and economies**. Recent economic work suggests that the annual **global cost of moderately severe to severe pandemics is roughly $570 billion, or 0.7 percent of global income**. The cost of a severe pandemic like the 1918 Spanish flu could total as much as 5 percent of global GDP."

Source: The World Bank Group

PEF
PANDEMIC EMERGENCY FINANCING FACILITY

The PEF covers six viruses that are most likely to cause a pandemic. These include new Orthomyxoviruses (new influenza pandemic virus A), Coronaviridae (SARS, MERS), Filoviridae (Ebola, Marburg) and other zoonotic diseases (Crimean Congo, Rift Valley, Lassa fever).

Summary

- Epidemic Risks are un-seeable risks
- Epidemic Risks follow certain types of natural disasters
- Epidemic Risks are caused when protection and prevention are low

- We are more at risk than we think:
  - Climate Change results in heat waves and flood events
  - Urbanization and change of environments
  - Civil Conflicts and lack of health systems in countries of risk
  - Global travel and new levels of communication

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Thank You !

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