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Identifying, Quantifying and Mitigating the Risk of Epidemics

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November 23, 2017

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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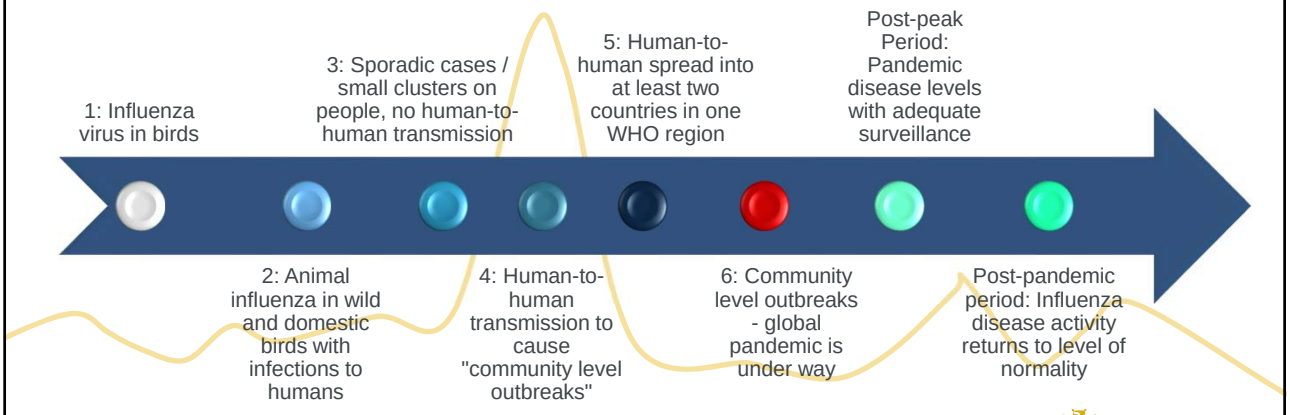
The Phases of Infectious Disease: When Animals Intersect Humans



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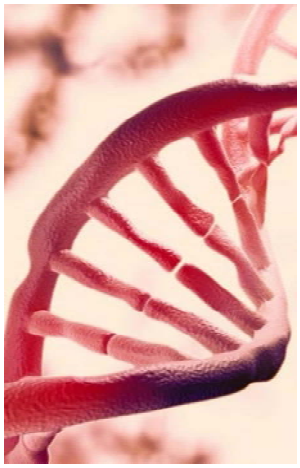
WHO: The Phases of An Influenza Pandemic

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

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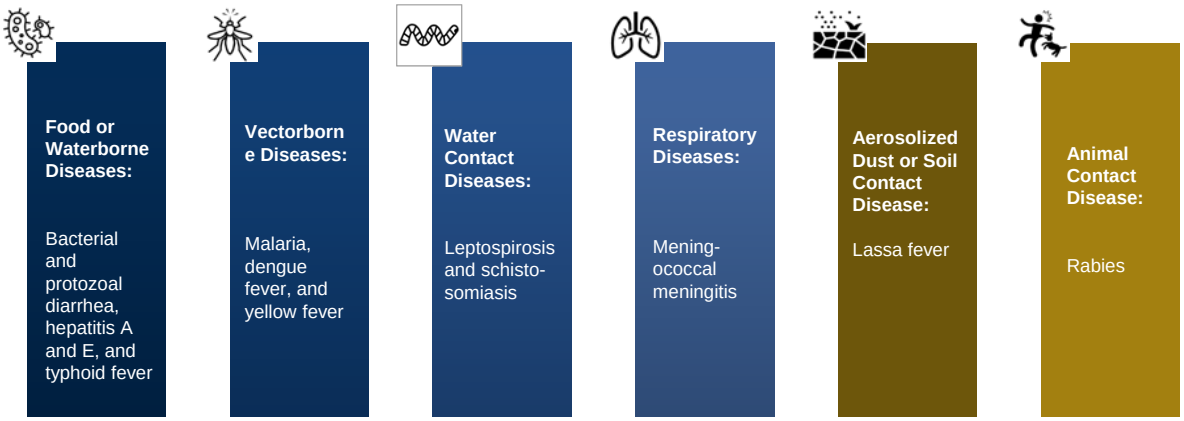
Case Study: Nigeria's Major Infectious Diseases



Source: CIA World Fact Book, 2016

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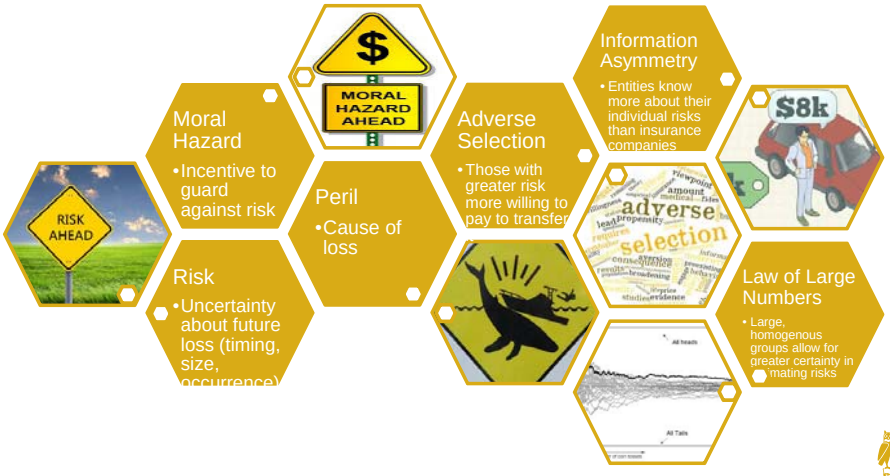
Key Principles of Insurance



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Types of Global Risks

Earthquakes
Hurricanes
Environment
Cyber
Hazards
Drought
Floods
Epidemy / Pandemy
Volcanic Eruptions
Icebergs
Sea Level Rise
Eddies

Insurance Industry Business Lines

Economic Losses due to epidemic and pandemic risks can be included in CAT coverages.

Epidemic outbreaks can arise due to catastrophic events, such as:

- Failure of power grid supplies
- Cyber attacks or loss of power grids, especially for health services, in particular for hospitals
- War and Terrorism - use of conventional or chemical weapons
- Breakouts of pandemics in mass public gatherings

Figure 4: Insurance industry loss estimation

We estimate that claims would be triggered under a wide range of classes of insurance, as illustrated below:

CLASS	LINE OF BUSINESS	
Property		
	Personal Lines/Homeowner	0
	Personal Contents	2
	Commercial Combined	5
	Construction & Engineering	1
	Commercial Facultative	4
	Binding Authorities	0
Casualty		
	Workers' Compensation	1
	Directors & Officers	3
	Errors & Omissions	3
	Financial Lines	3
	General Liability	4
	Healthcare Liability	0
	Professional Lines	1
	Professional Liability	2
Auto		
	Personal Lines	-1
	Commercial & Fleet	-2
Marine & Specie		
	Cargo	0
	Marine Hull	0
	Marine Liability	1
	Specie	1
Aerospace		
	Airline	2
	Airport	3
	Aviation Products	1
	General Aviation	1
	Space	0
Energy		
	Downstream	5
	Energy Liability	5
	Onshore Energy & Power	0
	Upstream	0
Specialty		
	Accident & Health	1
	Aquaculture Insurance	0
	Contingency – Film & Event	4
	Equine Insurance	2
	Excess & Surplus	1
	Surety	0

CLASS	LINE OF BUSINESS	
Life & Health		
	Life Insurance	0
	Health Insurance	2
	Income Protection	2
	Death & Disability	0
	Hospital Cover	-3
Pension and Annuities		
	Standard Annuities	0
	Variable Annuities	0
	Enhanced Annuities	0
	Life Settlements	0
War & Political Risk		
	Kidnap & Ransom	0
	Political Risk	2
	Political Violence & Terrorism	1
	Product Recall	3
	Trade Credit	4
Agriculture		
	Multi-peril Crop	0
	Crop Hail	0
	Livestock	0
	Forestry	0
	Agriculture	1
Cyber Cover		
	Standard Data Breaches	1
	Advanced Property	5

KEY TO CHANGE IN INSURANCE CLAIMS	
Major decrease in claims	-5
	-4
	-3
	-2
	-1
No change in claims	0
	1
	2
	3
	4
Major increase in claims	5

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Puerto Rico – Leptospirosis from unsafe water following the power grid damage due to Hurricane Maria

The Associated Press reported 74 cases of leptospirosis—a bacterial infection where the urine of infected animals enters a water supply—since Maria hit the island in September, while health care professionals report cases of dehydration and pink eye.

"There was contamination from mudslides, urination, animal carcasses, the effects of the storm," union president Randi Weingarten tells *Newsweek*. "The water systems have not been up and running because there is no electricity."

"Frankly, the water purification is not a long-term solution either," Weingarten tells *Newsweek*. "It's getting the water systems back and the water treatment centers back."

UPDATED | Americans are growing ill and bacteria outbreaks are spiking in hurricane-ravaged Puerto Rico as people use dirty water—sometimes contaminated by urine and hazardous waste—for drinking and bathing.

One month after Hurricane Maria struck Puerto Rico, about 25 percent of its 3.4 million citizens lack clean water and 80 percent still live without electricity.

Volunteers working on the ground with the American Federation of Teachers tell *Newsweek* they have treated several counts of pink eye and dehydration in children, among a growing number of reports of water-related illnesses.

Source: Newsweek

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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

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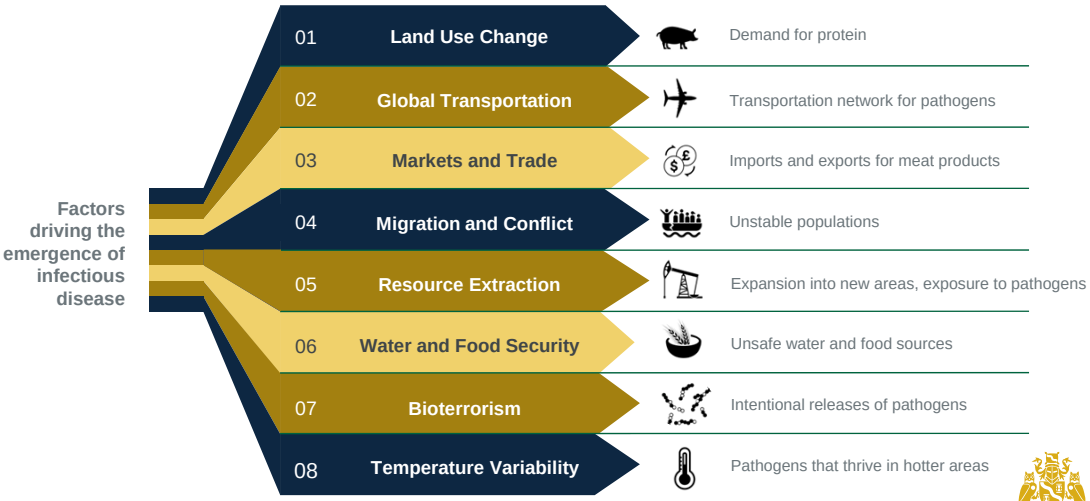
Why are Epidemic and Pandemic Risks of Concern



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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

Source: Metabiota Analytics Platform

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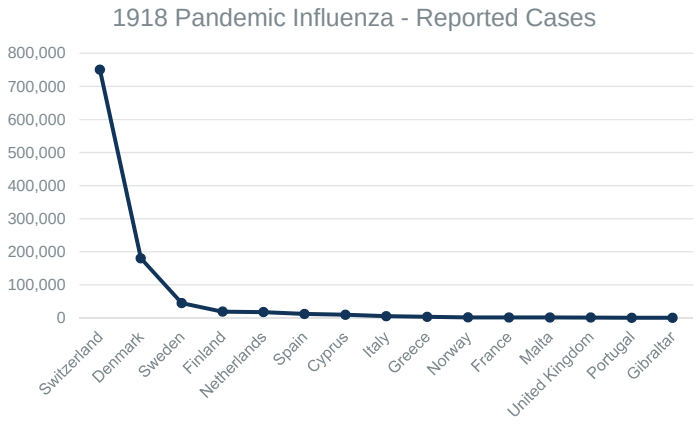
Pandemic Influenza – Events which are underestimated

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



Source: Metabiota Analytics Platform

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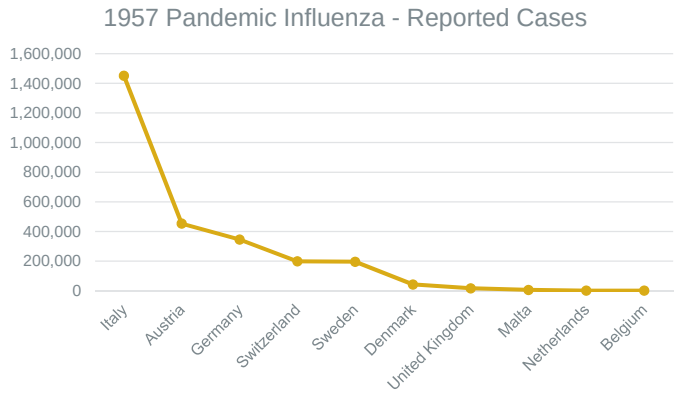
Pandemic Influenza – Events which are underestimated

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

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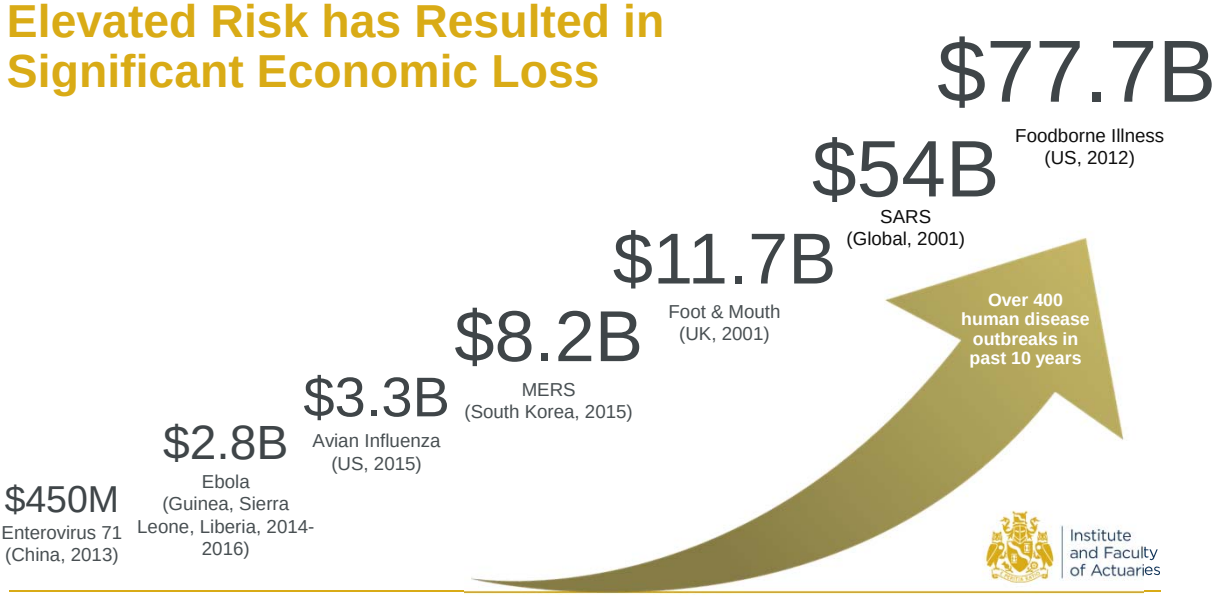
Elevated Risk has Resulted in Significant Economic Loss



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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.

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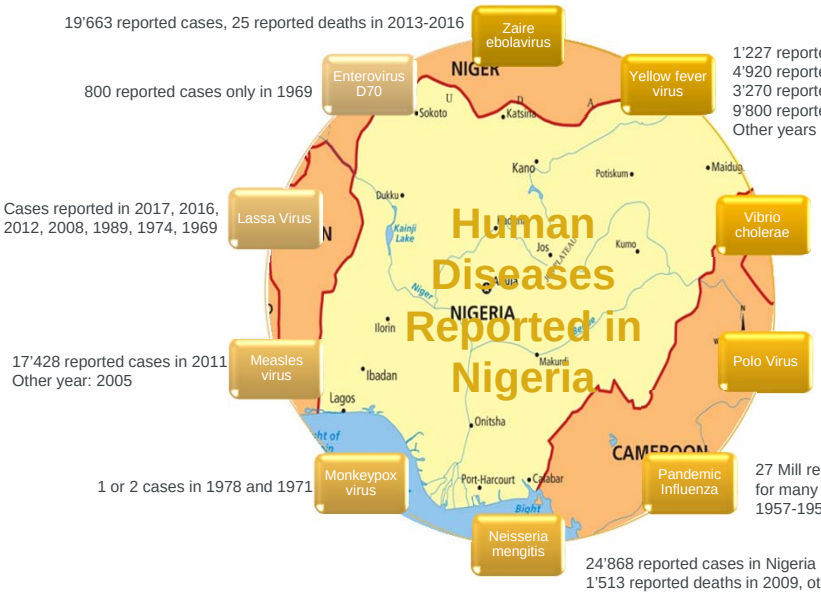
Human Diseases Reported in Nigeria



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

800 reported cases only in 1969

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

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

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

17'428 reported cases in 2011
Other year: 2005

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

1 or 2 cases in 1978 and 1971

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

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

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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

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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

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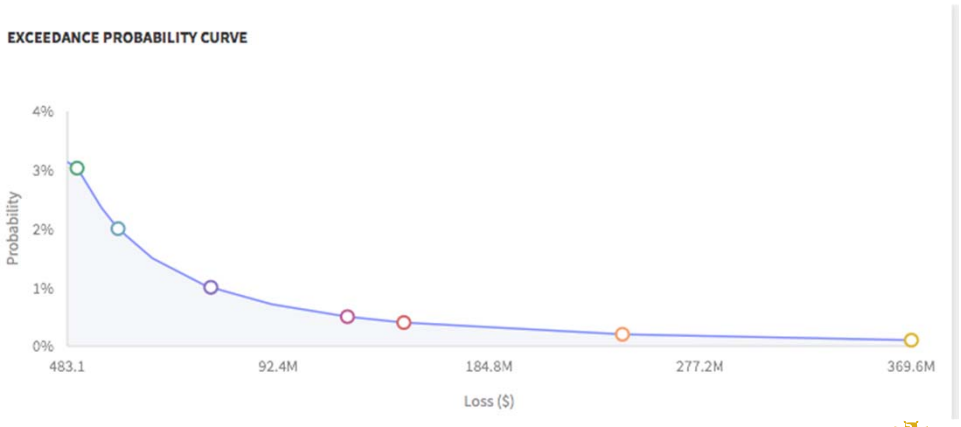
Prevention, Forecasting and Mitigating the Risk



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Prevention, Forecasting and Mitigating the 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

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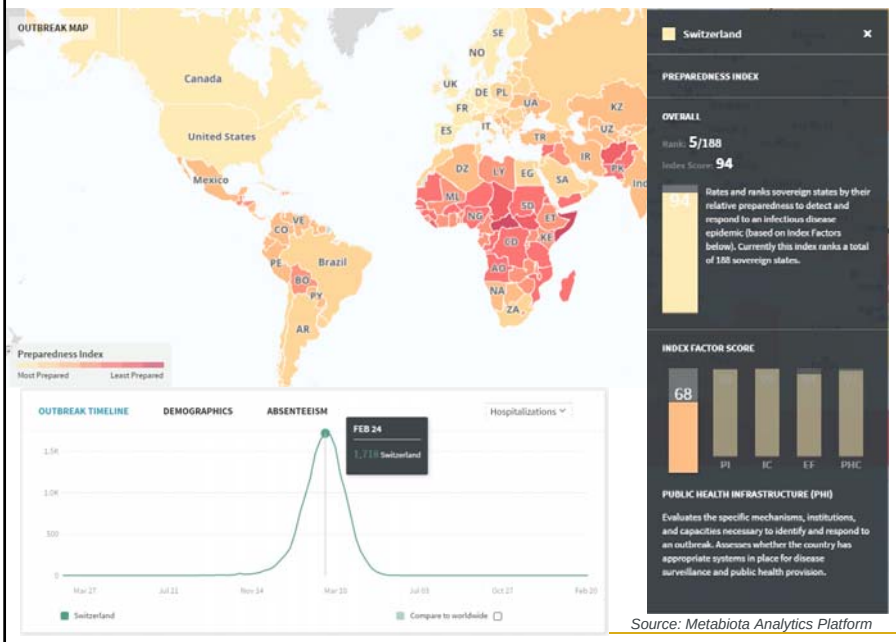

Source: Metabiota Analytics Platform

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

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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

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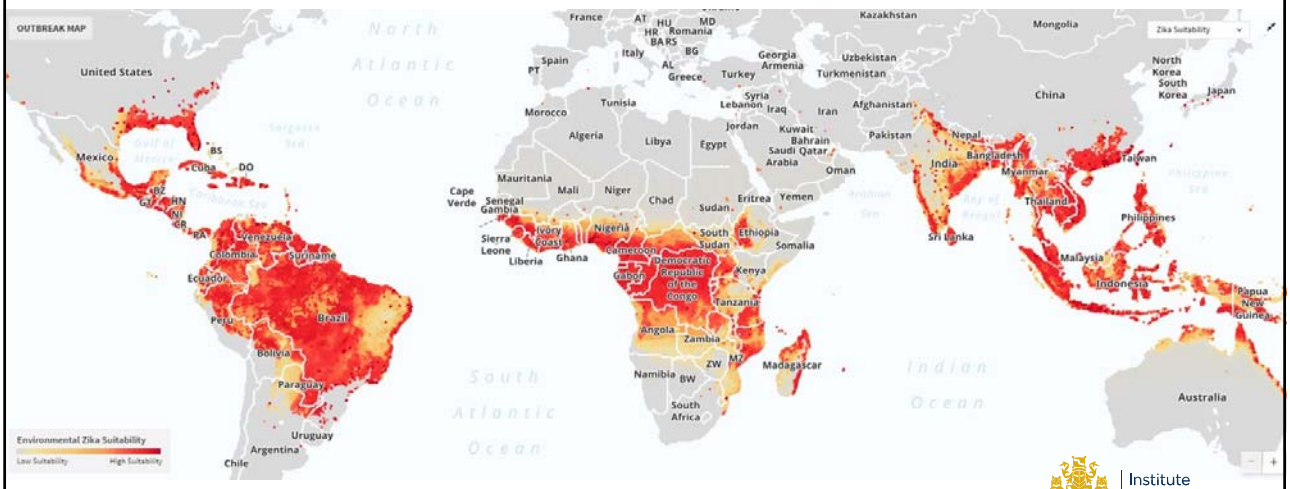
Zika – What Countries Are Vulnerable



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Accumulation & Economic impact – Comparison with CAT

Accumulation Scenario	Likelihood ranking (descending)	Max. Swiss GDP impact	Time estimation until 100% recovery	Investment [m CHF] for max. impact
CLOUD	1	0.2%	7 days	0.1
HOSPITALS	2	0.2%	21 days	0.5
TELECOMM	3	0.4%	10 days	0.5
SCADA/ICS	3	0.3%	21 days	10
POWER GRID	4	2%	21 days	10

Event (with links for further information)	Impacted Countries	Economic Loss estimation [bn CHF]	Max. GDP impact on affected countries	Insurance Loss estimation [bn CHF]
Basel earthquake, 1356 as at today	CH	100	15%	10
Thai Floods, 2011	TH	43	10%	16
Japan earthquake, tsunami, 2011	JAP	210	5%	40
Pandemic scenarios CH	CH	14.5	2.2%	n.a.
Pandemic scenario US	US	n.a.	5%	n.a.
Pandemic scenario UK	UK	70	4%	n.a.
Pandemic scenarios EU-25	Europe	n.a.	4%	n.a.
Zurich Flood worst case scenario	CHF	5.5	0.9%	n.a.
Hurricane Katrina, storm surge, 2005	USA	125	0.7%	61
Sandy superstorm, 2012	USA	70	0.4%	30
Lothar/Martin Winterstorm Dec. 1999	Europe	15	0.1%	9
European Flood 2002	Europe	15	0.1%	4
European Flood 2013	Europe	15	0.1%	4
Hailstorm Reutlingen 2013	D	4	0.1%	3

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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

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).

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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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