



2018 SOA Asia-Pacific Annual Symposium

Session 5A, Mini-pandemics

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Mini-Pandemics more worrying than you think

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Agenda



- Pandemics and Mini-pandemics: past, present, future
- How do pandemics impact insurers?
- Mitigating the impact from pandemics & mini-pandemics
- Case study – Dengue Fever
- Closing Thoughts

Agenda



- Sick & dying, Meltdown, Society collapse, Bankruptcy
- Insurers: “What’s the point doing anything anyway?!”
- Spending money on inadequate solutions
- Look how bad it can get! OMG!!
- Sigh



Introduction

Mini-Pandemics: Past, Present and Future



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Pandemics/Mini-Pandemics: Past, Present, Future

What is a pandemic?

“

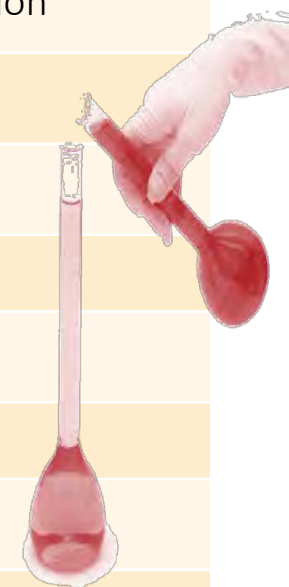
... an epidemic disease that has spread across populations over vast areas such as continents or even globally.

”

Source: <https://www.news-medical.net/health/What-is-a-Pandemic.aspx>

10 Deadliest Pandemics in History

Rank	Pandemic	Year	Cause	Death Toll (approx.)
1	The Black Death	1346 - 1353	Bubonic Plague	75 – 200 million
2	“Spanish Flu” Pandemic	1918	Influenza	20 – 50 million
3	HIV/AIDS	2005 - 2012	HIV/AIDS	36 million
4	The Plague of Justinian	541 - 542	Bubonic Plague	25 million
5	Antonine Plague	165 AD	Unknown	5 million
6	Asian Flu	1956 - 1958	Influenza	2 million
7	Flu Pandemic	1968	Influenza	1 million
8	Flu Pandemic	1889 - 1890	Influenza	1 million
9	3 rd Cholera Pandemic	1852 - 1860	Cholera	1 million
10	6 th Cholera Pandemic	1910 - 1911	Cholera	1 million



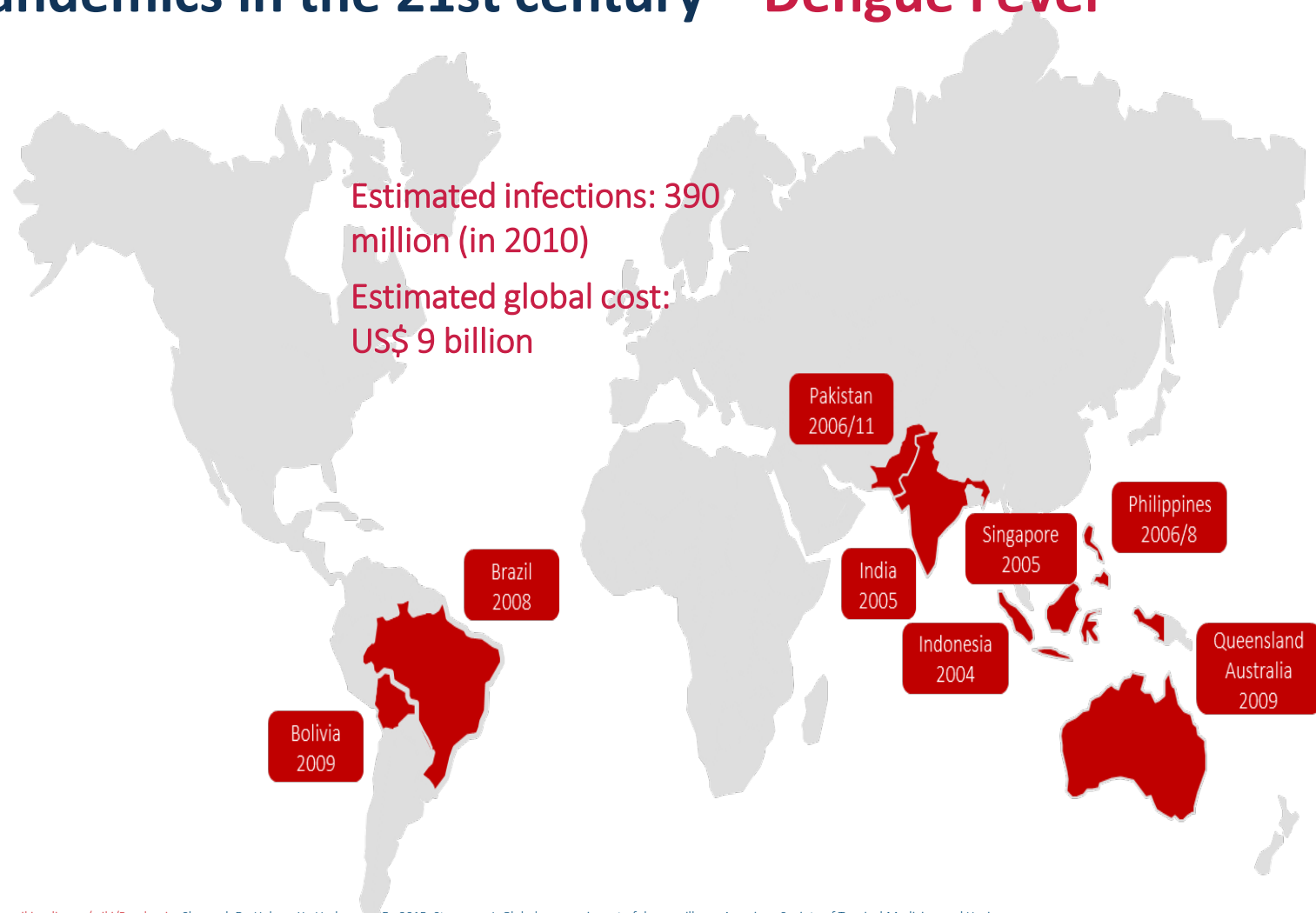
Source: <https://www.mphonline.org/worst-pandemics-in-history>

Pandemics in the 21st century – Cholera



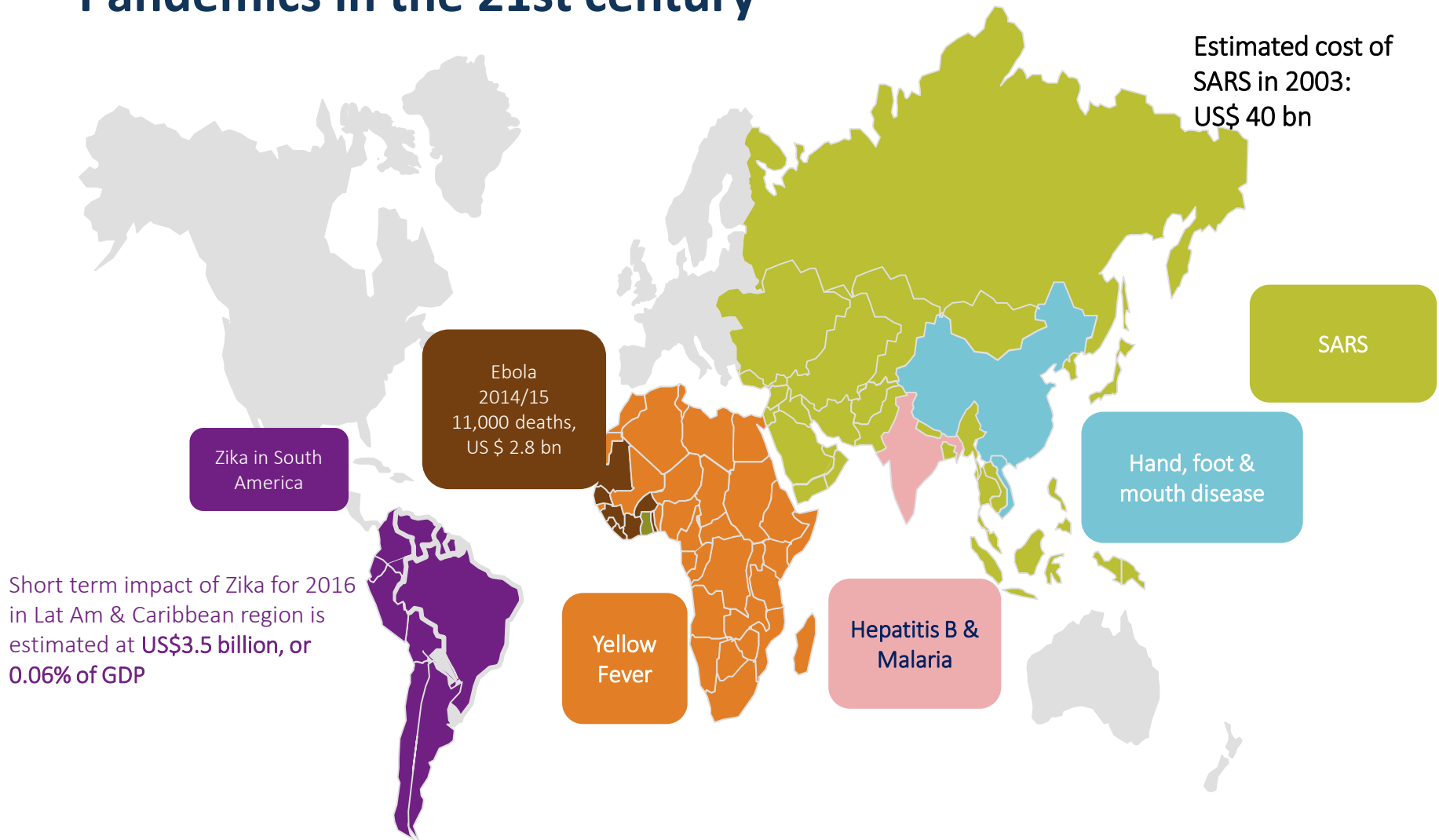
Source: <https://en.wikipedia.org/wiki/Pandemic>; Ali M, Nelson AR, Lopez AL, Sack DA (2015) Updated global burden of cholera in endemic countries. PLoS Negl Trop Dis 9: e0003832 doi: 10.1371/journal.pntd.0003832 [PMC free article] [PubMed]

Pandemics in the 21st century – Dengue Fever



Source: <https://en.wikipedia.org/wiki/Pandemic>, Shepard, D., Halasa, Y., Undurraga, E., 2015. Stanaway J. Global economic cost of dengue illness American Society of Tropical Medicine and Hygiene. Philadelphia, USA

Pandemics in the 21st century



Source: <https://en.wikipedia.org/wiki/Pandemic>, <https://www.ncbi.nlm.nih.gov/books/NBK92473/>

This is not the problem we're addressing today



Source: IMDB.COM, fair use principles

Pandemics/Mini-Pandemics: Past, Present, Future

What actually is a mini-pandemic*?

- Perhaps a 'narrower' impact

Pandemics are expected to affect a wide range of countries, while mini-pandemics could have significant impact only in one country or region

- Could be less deadly or infectious

In HK's SARS, one person infected 183** following toilet visits

- It might be kept under some control

Antibiotics, isolation & quarantine, etc.

- Maybe a greater impact on uninsured lives

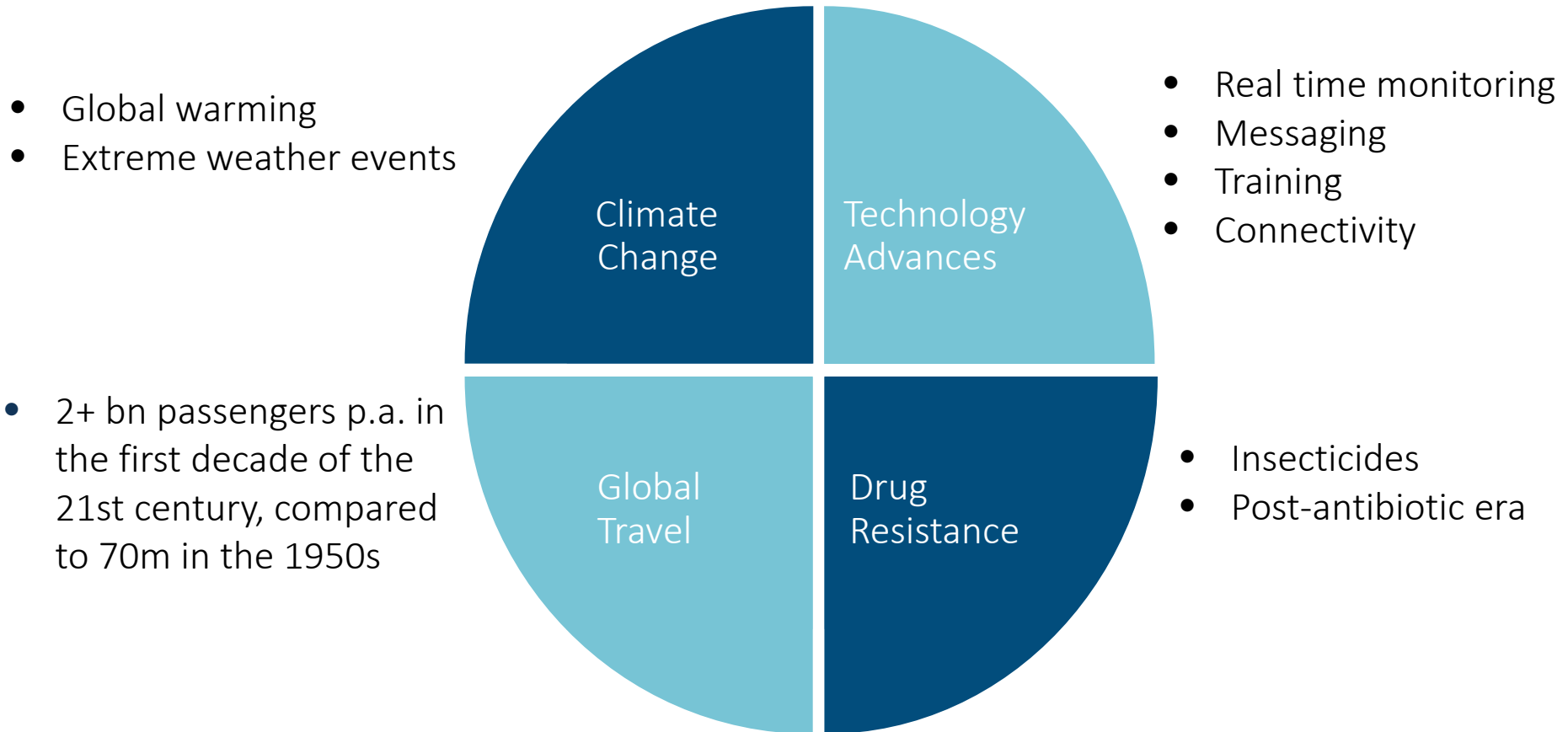
A pandemic might still be affecting many lives, but if they are uninsured, then from an insurance point of view, it might just be deemed to be a mini-pandemic

** source: <https://www.nejm.org/doi/full/10.1056/NEJMoa032867>

**You won't find this in the dictionary*

Pandemics/Mini-Pandemics: Past, Present, Future

Trends influencing the future of (mini)pandemics



Source: Gubler, D.J. 2011. "Dengue, urbanization and globalization: The unholy trinity of the 21st century". *Tropical Medicine and Health*

Pandemics/Mini-Pandemics: Past, Present, Future

Some numbers – more worrying than you thought?

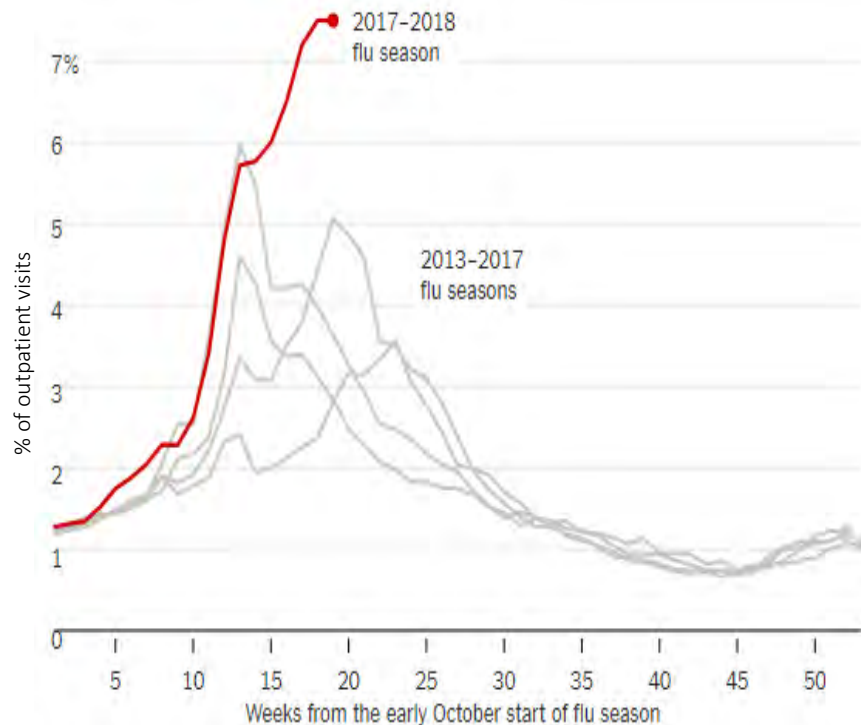
- MERS cost South Korea USD10bn in 2015
- 2003 SARS breakout in Asia
 - MSCI Pacific ex Japan Index fell by 12.8% from 14 January to 13 March
 - Asia-Pacific carriers saw revenue plunge \$6 billion; Singapore Airlines cut capacity by 71%; Tourism to Singapore fell 70% and GDP fell by \$400 million that year
 - World Bank estimated China's SARS-related losses at \$15 bn, and globally at \$30-40 bn
- And in the US
 - Flu hospitalization at one point in 2017-2018 was the highest the CDC has ever recorded
 - In a mild year, flu kills about 12,000; In a bad year, it kills up to 56,000
- Globally connected ... an epidemic spreading to 9 countries could cost the US \$8-41 bn

Source: <http://www3.asiainsuranceview.com/News/View-NewsLetter-Article/id/41519/Type/ARM/New-global-pandemics-feared-experts/1/sid/197957>; <http://www-stat.wharton.upenn.edu/~steele/Pandemic/Resources/FidelityPandemic.pdf>; <https://www.reuters.com/article/us-reutersmagazine-davos-flu-economy/flu-economics-the-next-pandemic-could-trigger-global-recession-idUSBRE90KOF820130121>; <https://www.nytimes.com/2018/01/18/health/flu-season-facts.html>

Pandemics/Mini-Pandemics: Past, Present, Future

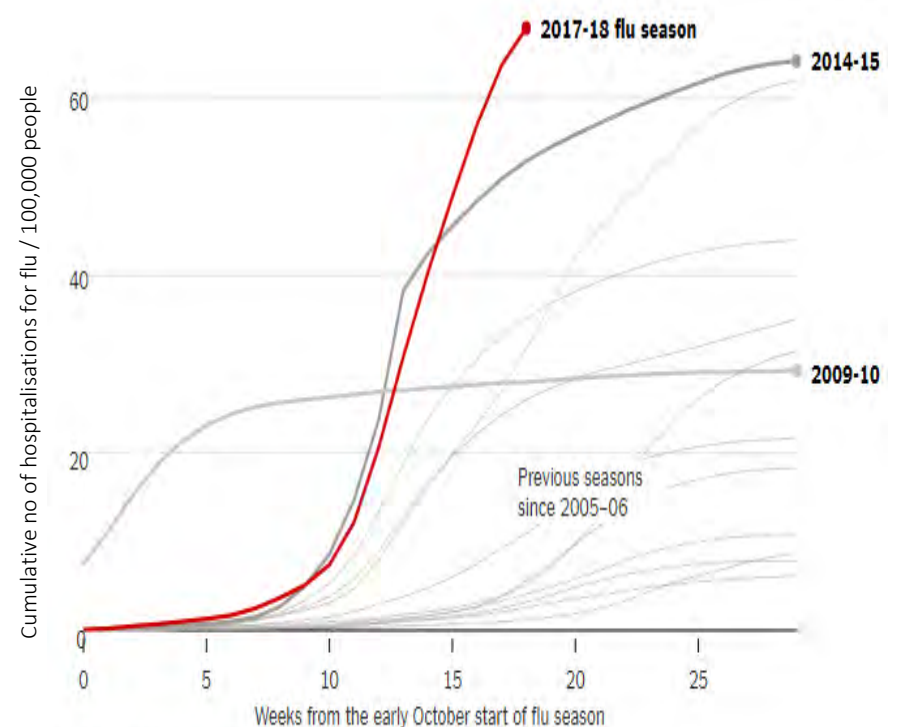
Extent of latest US flu season

% of outpatient visits for flu-like symptoms



By Audrey Carlsen | Source: Centers for Disease Control and Prevention

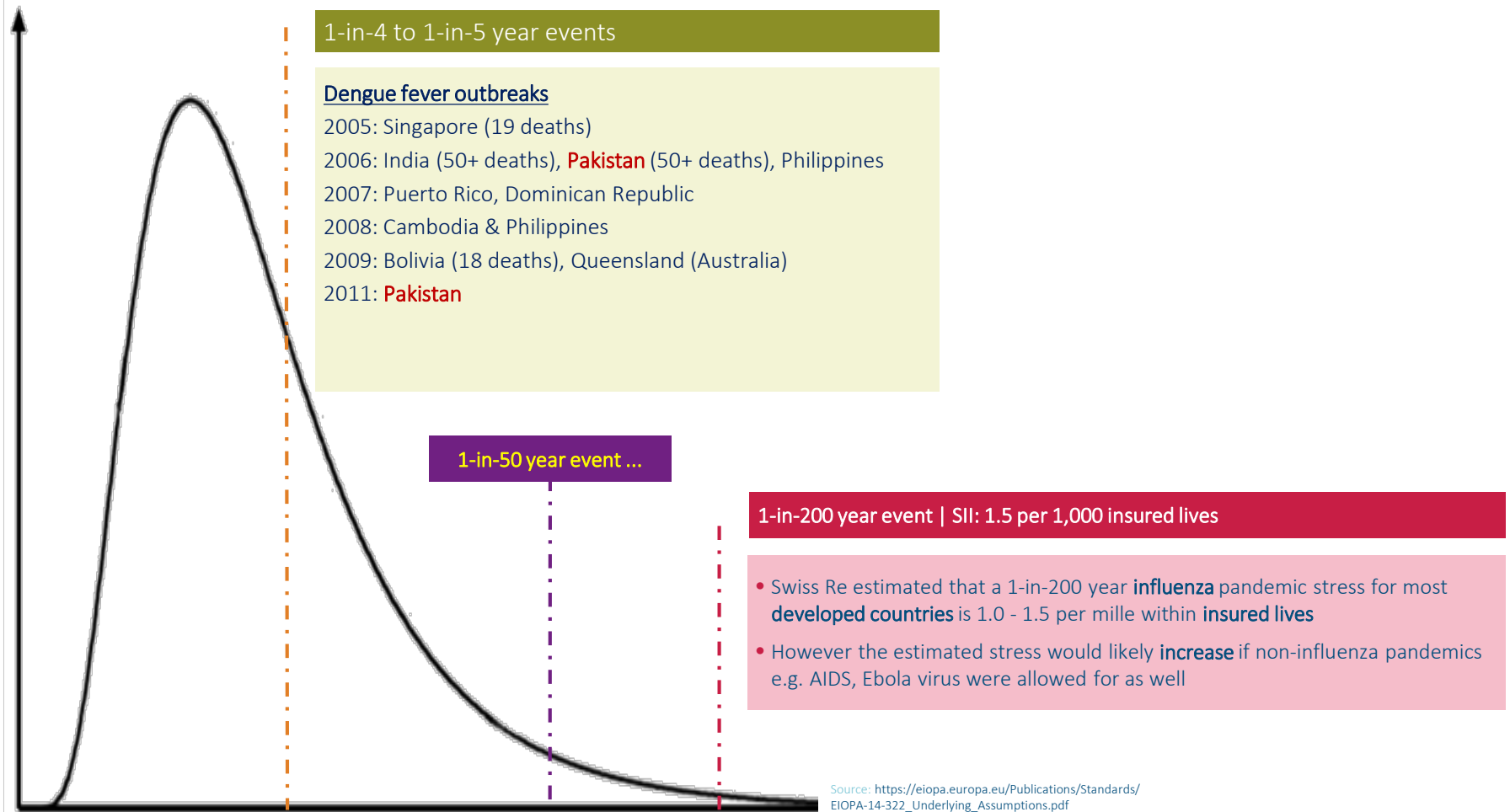
Cumulative no of hospitalisations for flu



By The New York Times | Source: Centers for Disease Control and Prevention

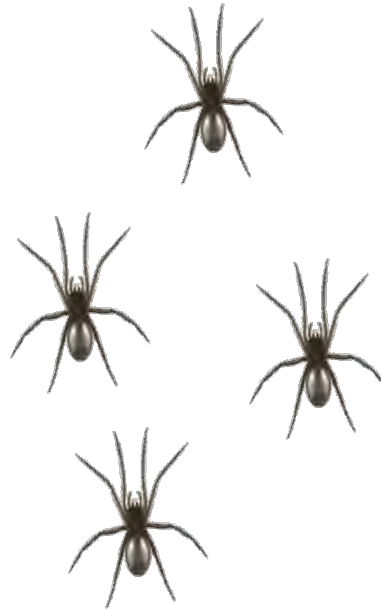
Pandemics/Mini-Pandemics: Past, Present, Future

More frequent, Less severe



Pandemics/Mini-Pandemics: Past, Present, Future

But ... even mini things can be scary!



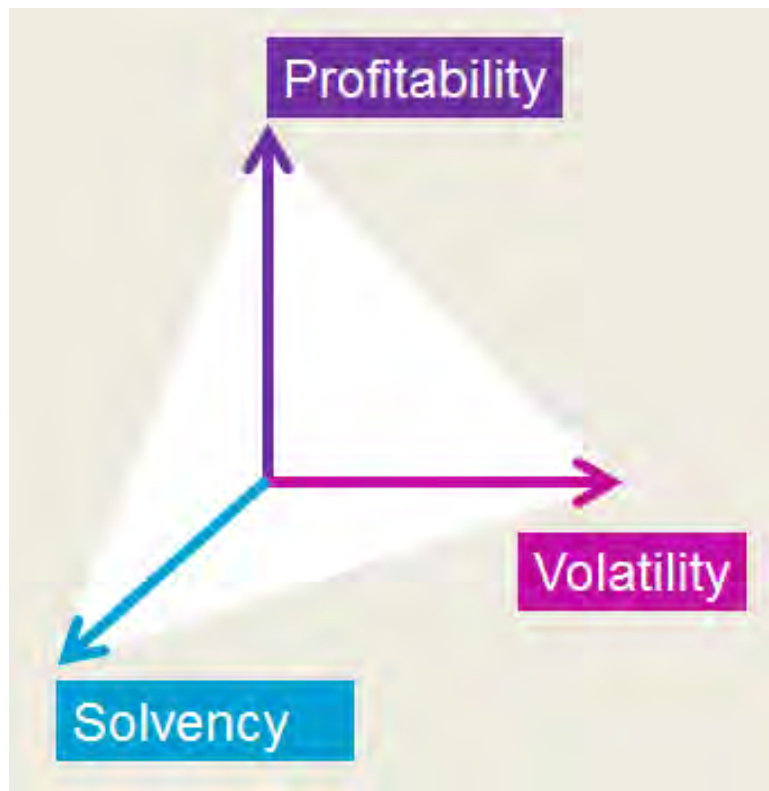


How do pandemics impact insurers?



Quantifying the Impact

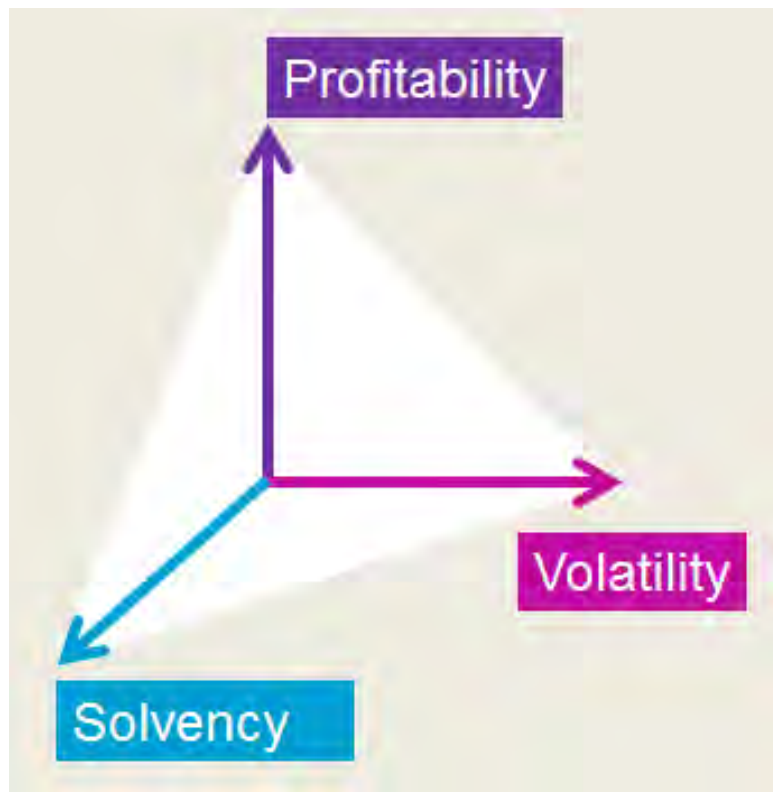
Actuarial Vectors – definition



- Profitability: average year
Volatility: 1:20? 1:50?
Solvency: 1:200
- It's how companies optimise their ALM programs; It's how M&A transactions are evaluated; It should be how reinsurance is optimised
- It can help determine whether a mini-pandemic should worry you

Quantifying the Impact

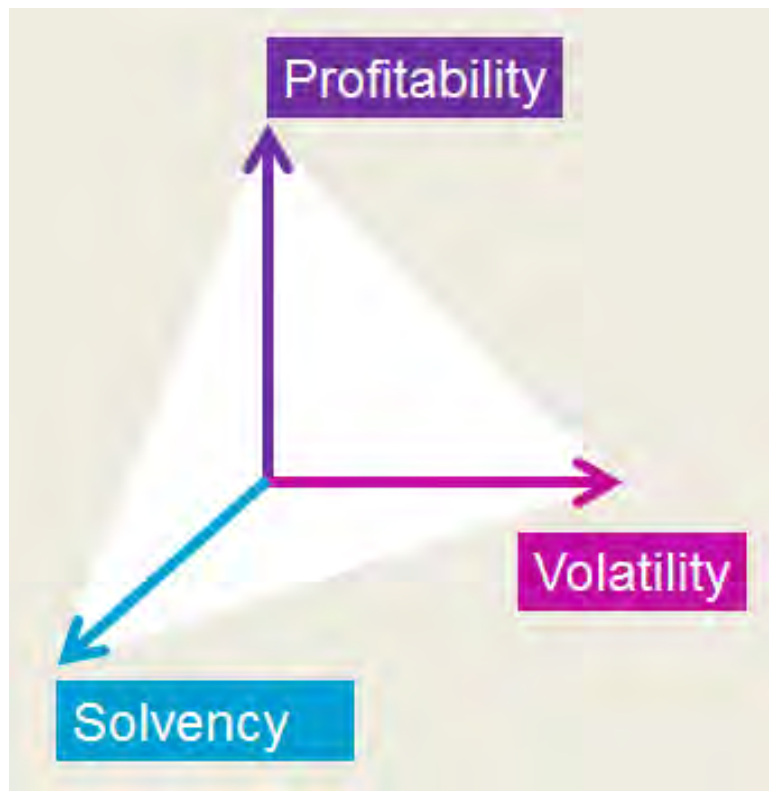
Actuarial Vectors – different dimensions



- **Profitability:** average year
Targetting a specific ROE/RoC; Less focused on up- and downside
- **Volatility:** 1:20? 1:50?
What if things go a little wrong? What would the CFO not want to explain away? Management action
- **Solvency:** 1:200
This determines capital allocation; Try not to go insolvent

Quantifying the Impact

Actuarial Vectors – evaluation framework



- **Pandemics:** people appear to be concerned about whether it might bankrupt them. And if it really is meltdown, then why bother?
- **Mini-pandemics:** It might not 'destroy' your balance sheet, but a material hit to your P&L would not help the CFO's career, could force you to cut back on new business, reduce par bonuses, reputation risk

Quantifying the Impact

Are we still at risk?

Lassa fever: The killer disease with no vaccine

By Dr Charlie Weller
Head of Vaccines, Wellcome Trust

5 March 2018

f t s e Share

100 years after 'Spanish flu', new global pandemics feared

The Independent January 26, 2018 Health, WORLD Leave a comment 627 Views



HEALTH NEWS JANUARY 21, 2013 / 8:11 PM / 5 YEARS AGO

Flu-conomics: The next pandemic could trigger global recession

HEALTH • FLU

The Flu is Killing Up to 4,000 Americans a Week

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South Africa's listeriosis toll continues to rise; 28 percent dead

BY NEWS DESK | APRIL 7, 2018

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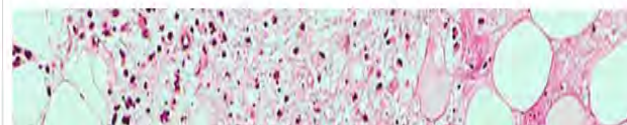
Sport Culture Lifestyle More v

International ed
The Guardian

s Asia Australia Middle East Africa Inequality Cities Global development

Flesh-eating ulcer spreading rapidly in Australia

Buruli ulcer cases surging and now at epidemic proportions in parts of Victoria, researchers say



most viewed in US



Scientists accidentally created mutant enzyme that breaks down plastic bottles



Judge rejects Trump's bid to view Cohen's papers before prosecution



A real-life Lord of the Rings

Financially, it's not just about people *dying*

- Yes, people will die, unfortunately
- But people will also get sick, and that costs money
 - diagnosis, treatment, vaccines, hospitalisation, etc.
- And assets values will be impacted
- Persistency, including policyholder-driven choices
- And financial services groups will have multiple impacts
 - Non-life claims like travel interruption, business interruption, looting
 - Banking problems like loan defaults
- Absenteeism, human cost, etc.

Market Risk

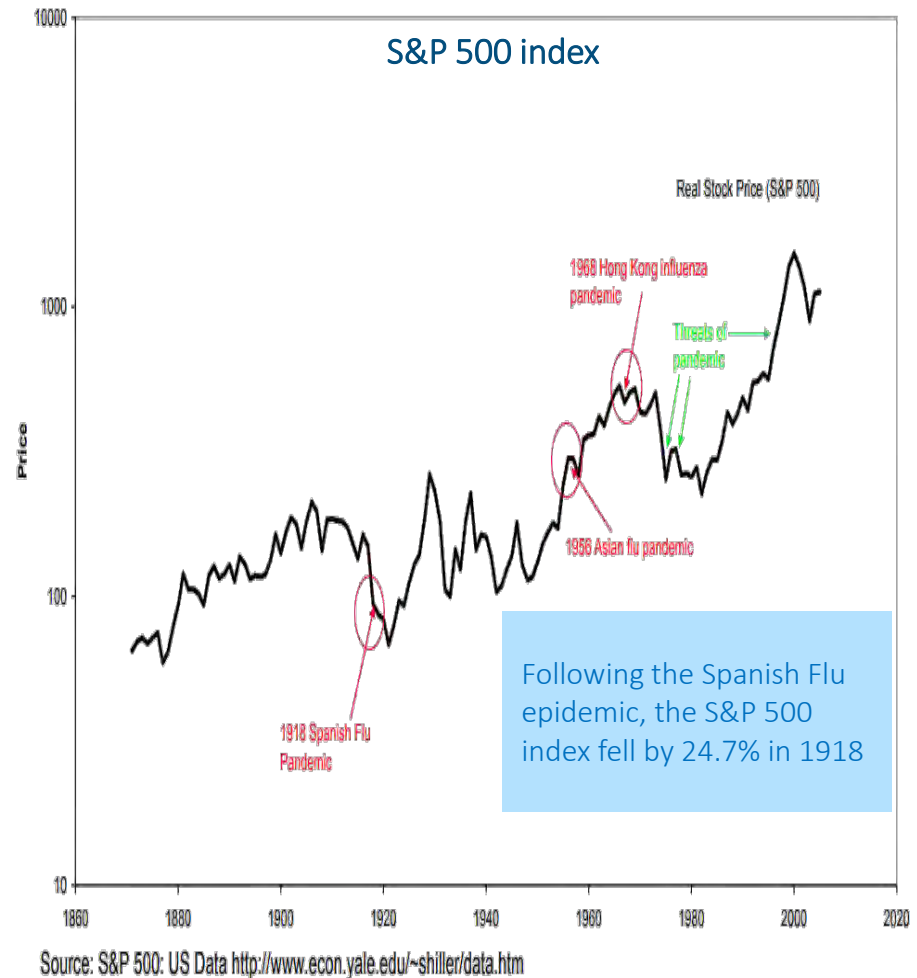
Market Risk

Pandemics may lead to economic uncertainty, leading to unexpected market movements

Possible economic impacts of a flu pandemic

Change in GDP (1 st year)	Mild	Severe
World	-0.7%	-4.8%
High-income	-0.7%	-4.7%
Developing	-0.6%	-5.3%
Deaths (millions)	1.4 m	71 m

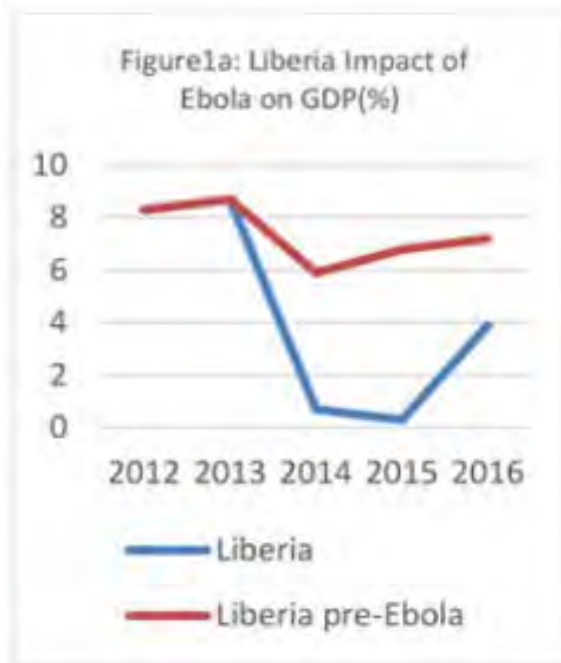
Source: World Bank calculations based on McKibbin & Sidorenko (2006)



Economic Risk

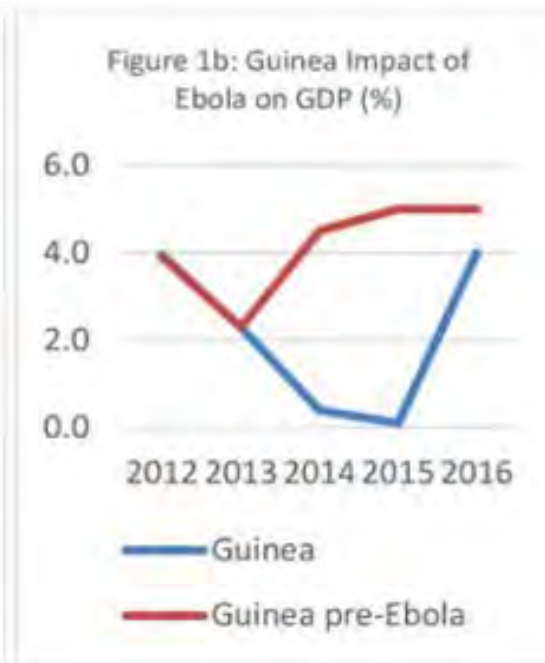
Impact to the GDPs of Liberia, Guinea and Sierra Leone from the Ebola virus

Liberia



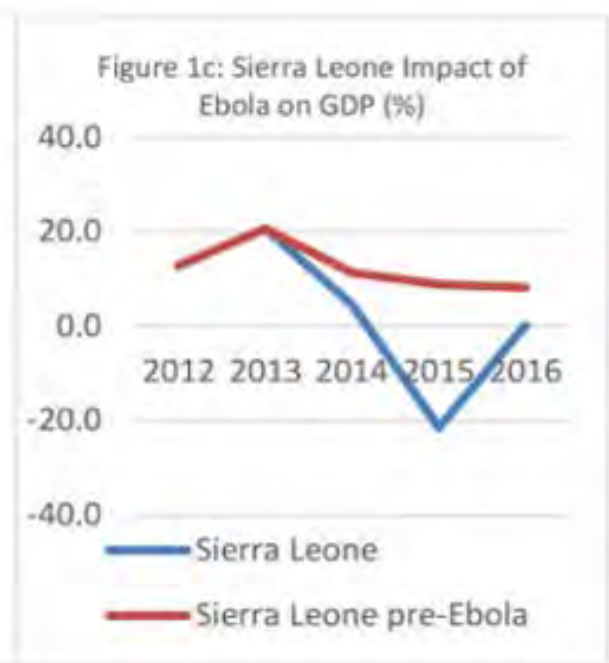
Real GDP growth slowed from 8.7% in 2013 to 0.7% in 2014

Guinea



Real GDP growth was 0.1% in 2015 compared to a Ebola forecast of 4.0%

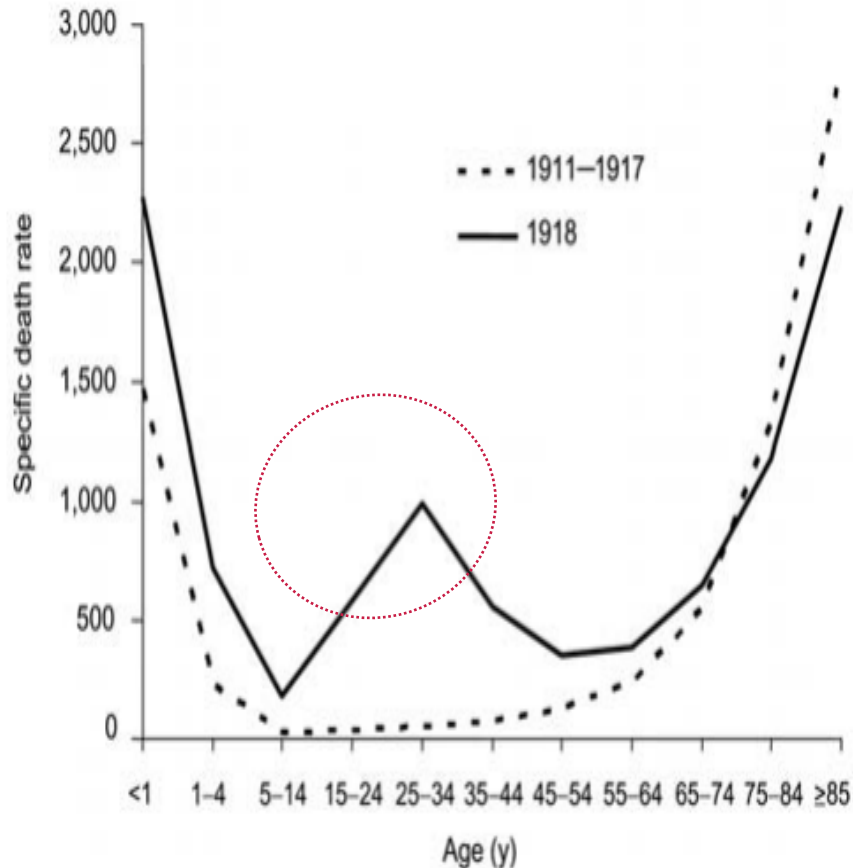
Sierra Leone



Real GDP growth decreased to 0.8% in 2014 from 5.3% in 2013

Source: <http://www.worldbank.org/en/topic/macroeconomics/publication/2014-2015-west-africa-ebola-crisis-impact-update>

Insurance Risk



Combined influenza and pneumonia mortality, by age at death, per 100,000 persons in each age group, United States, 1911-1918.

Not just life & health

- Sharp (temporary) increase in mortality & morbidity claims
- Also, temporary increase in claims from income protection, business interruption & worker's comp lines
- Operational risk? Policyholder behavior?

Source: <https://www.researchgate.net/publication/31591640>



Mitigating the impact I

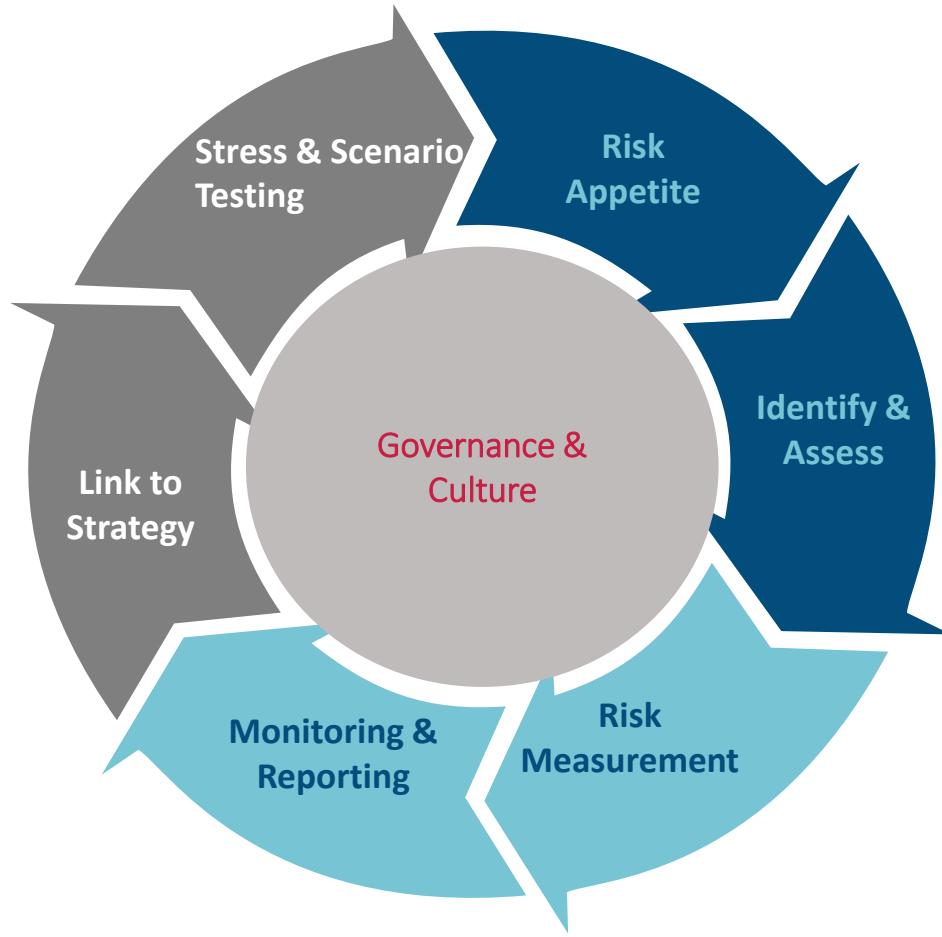
Mindful Risk Management



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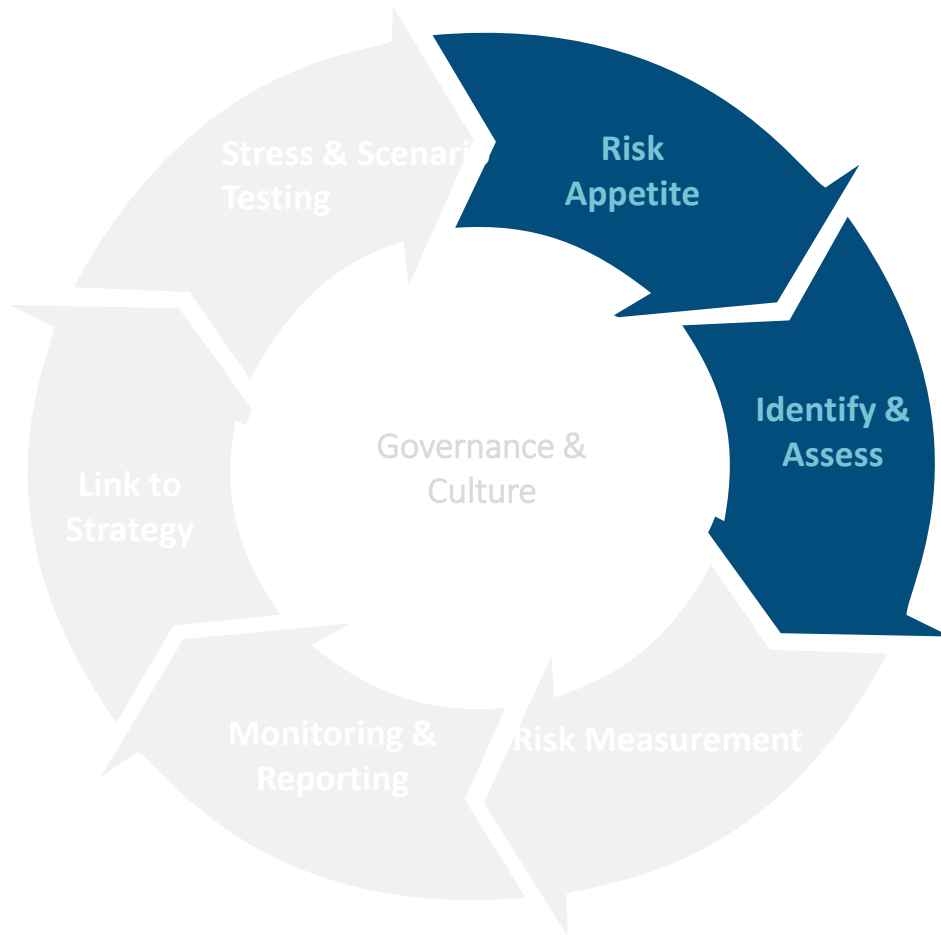
Mitigating the impact from a pandemic

(Mindful) risk management



Mitigating the impact from a pandemic

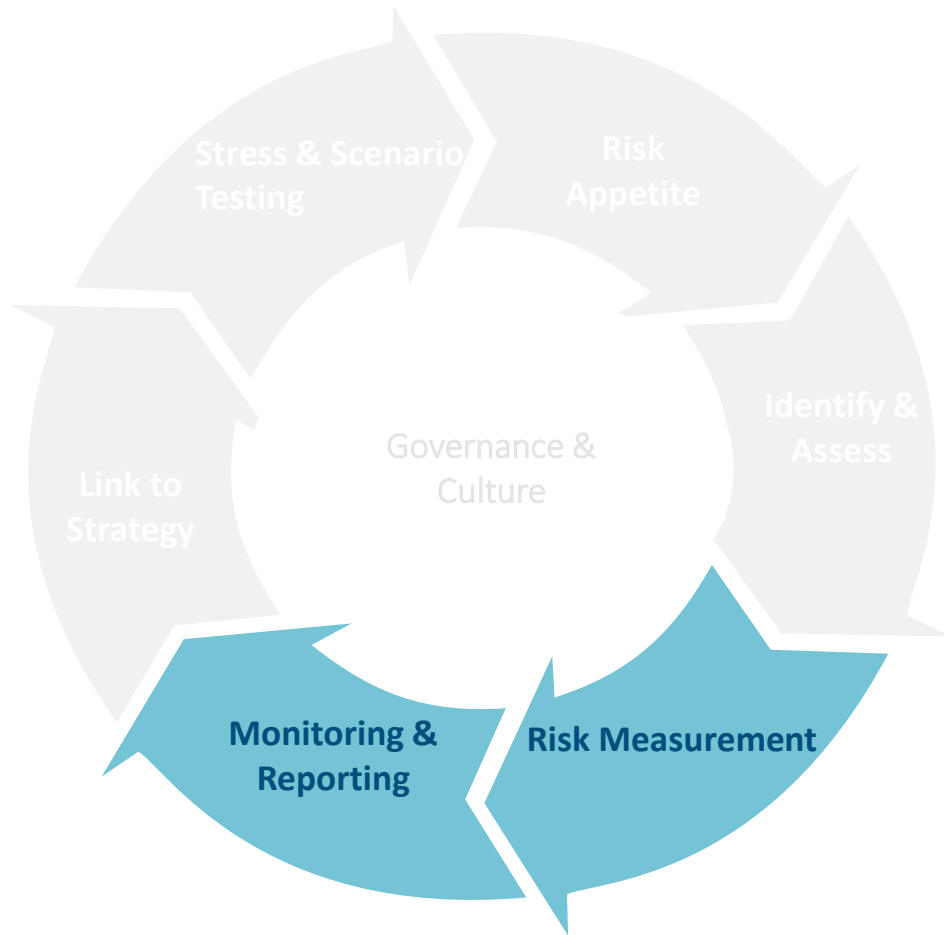
(Mindful) risk management



- Have I even allowed for pandemics?
- Risk tolerance: 1:20 year events? 1:50?
- P&L and Balance Sheet impact
- Benchmarks for severity and frequency
- Known and unknown

Mitigating the impact from a pandemic

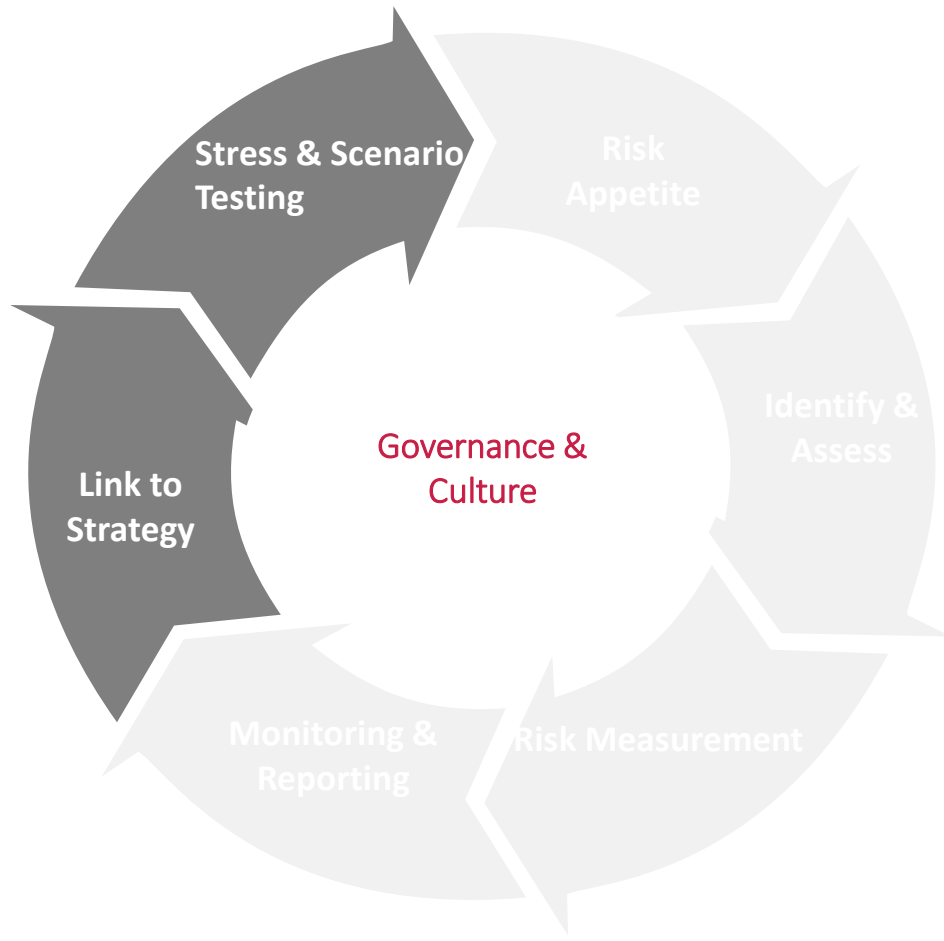
(Mindful) risk management



- Standard formula vs internal model?
- Balance sheet adequacy?
P&L vulnerability?
- Management actions
- Monitoring

Mitigating the impact from a pandemic

(Mindful) risk management



- ERM initiatives
- Stress & scenario test calibration
- Stakeholders



Case Study

Dengue Fever



What is Dengue Fever ('DF')?

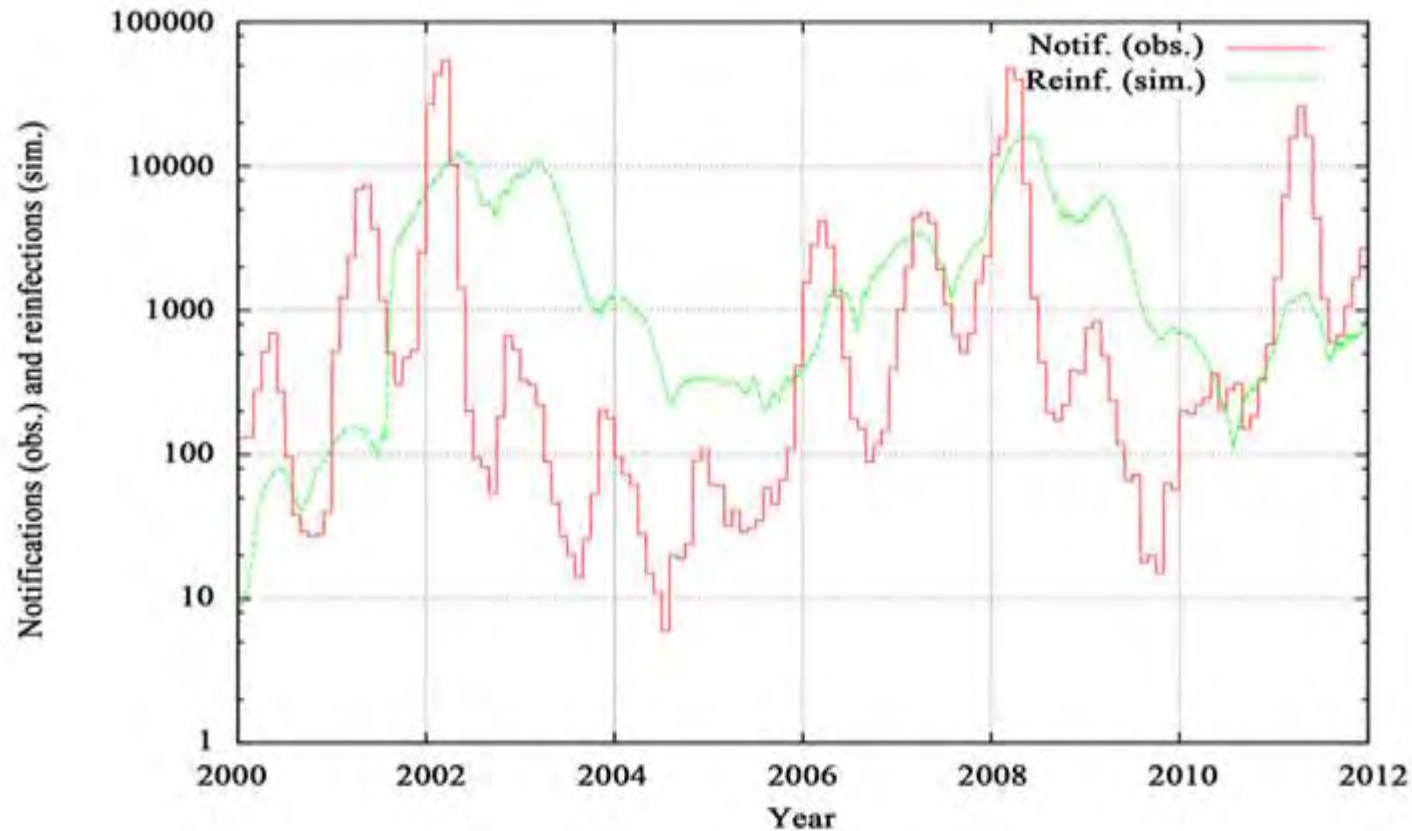
- Mosquito-borne infectious disease
- Growing global threat
 - Incidence: Increased 30x over last 50 years¹, 390 million infections/year²
 - Prevalence: 3.9 billion people in 128 countries, are at risk of infection (40% world's population)³ including Europe (France, Portugal) and the Americas (Hawaii)
- It costs societies and economies money
- It is already costing insurers: additional +5% claims/year in affected regions

Source: ¹ Kristie L. Ebia, Joshua Nealon. <https://doi.org/10.1016/j.envres.2016.07.026> Dengue in a changing climate; ² Bhatt S, Gething PW, Brady OJ, Messina JP, Farlow AW, Moyes CL et al. The global distribution and burden of dengue. Nature;496:504-507

³ Brady OJ, Gething PW, Bhatt S, Messina JP, Brownstein JS, Hoen AG et al. Refining the global spatial limits of dengue virus transmission by evidence-based consensus. PLoS Negl Trop Dis. 2012;6:e1760. doi:10.1371/journal.pntd.0001760

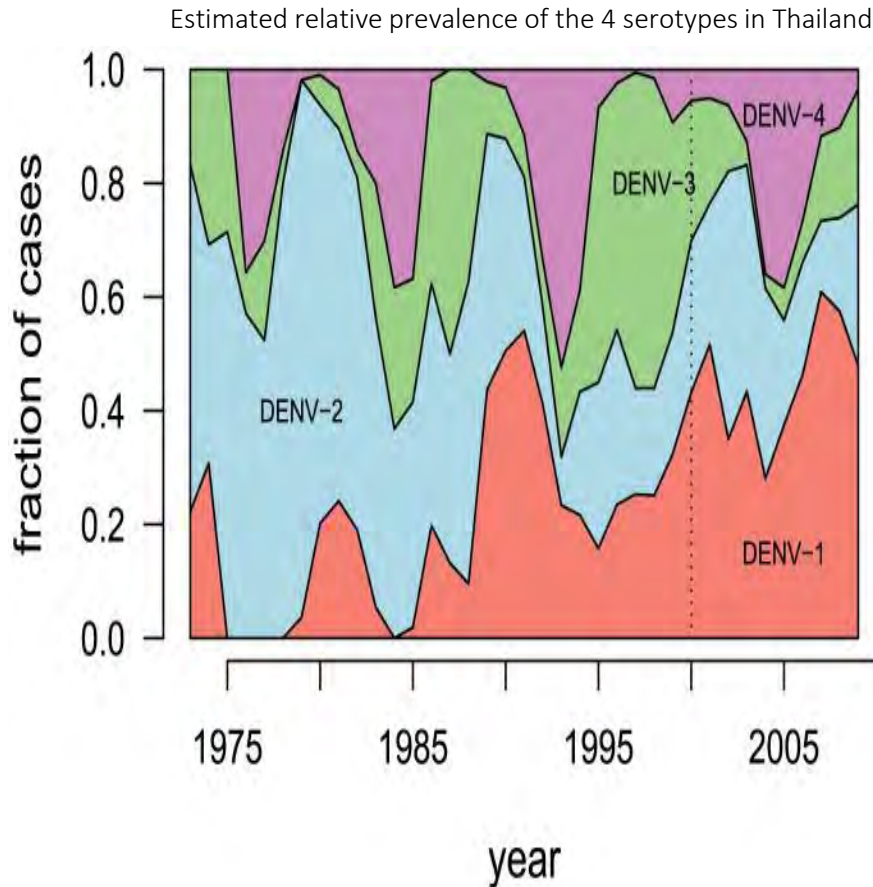
Waiting to 'break out' from a 5-year cycle

Observed notifications of dengue fever worsening and predicted reinfections number



Source: D

Why consider DF?

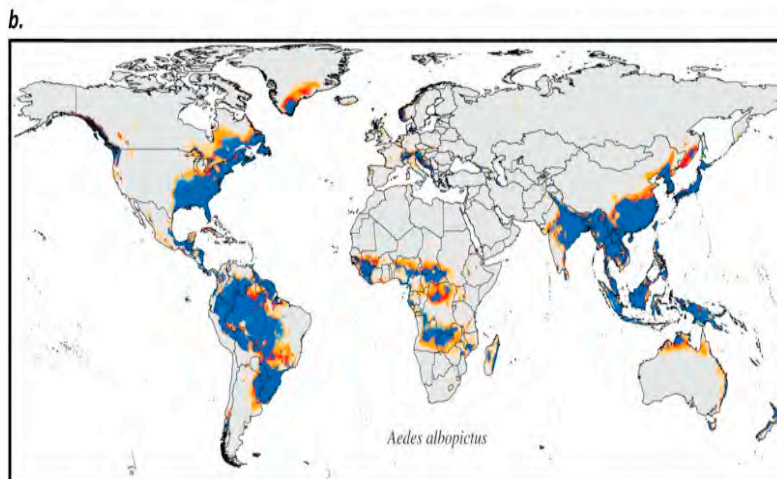
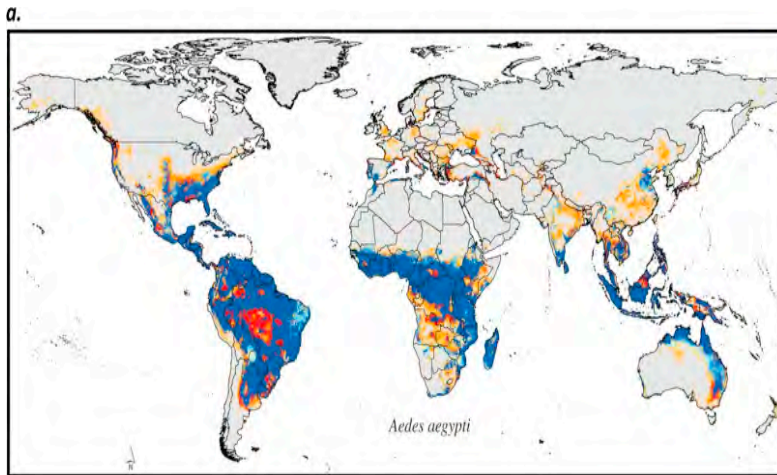


- Four serotypes
 - Changing prevalence through time
 - Changing prevalence by geography
- Infection by one serotype provides lifelong immunity from it
- Subsequent infections by other serotypes are more severe and potentially fatal
- These are also reasons why developing an effective vaccine has been challenging

Source: Serotype-specific dengue virus circulation and dengue disease in Bangkok, Thailand from 1973 to 1999. [Am J Trop Med Hyg. 2003]

Why consider DF?

Potential geographic distribution patterns of a. *Ae. aegypti* and b. *Ae. albopictus* in 2050 under a moderate emissions scenario



- Two vectors with different features
 - *Aegypti*: mainly in Asia, urban habitats
 - *Albopictus*: hardier eggs which withstand colder temperatures, higher latitudes
- Sensitive to climate change – mutations?
- Same vectors can spread other diseases

Tiger mosquitoes capable of carrying Zika spread across half of France

29 April 2018, <https://www.telegraph.co.uk/news/2018/04/29/tiger-mosquitoes-capable-carrying-zika-spread-across-half-france/>

Source: Dengue in a changing climate, Kristie L.Ebia, Joshua Nealon, <https://doi.org/10.1016/j.envres.2016.07.026> [CC BY 4.0]
Controlling Dengue with Vaccines in Thailand, Dennis L. Chao, 1 Scott B. Halstead, 2 M. Elizabeth Halloran, 1, 3 and Ira M. Longini, Jr. 4, <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3493390/> [Open access article, distributed in accordance with Creative Commons license]

Whether it's Dengue or not, things can go wrong

X. Wu et al. / Environment International 86 (2016) 14–23

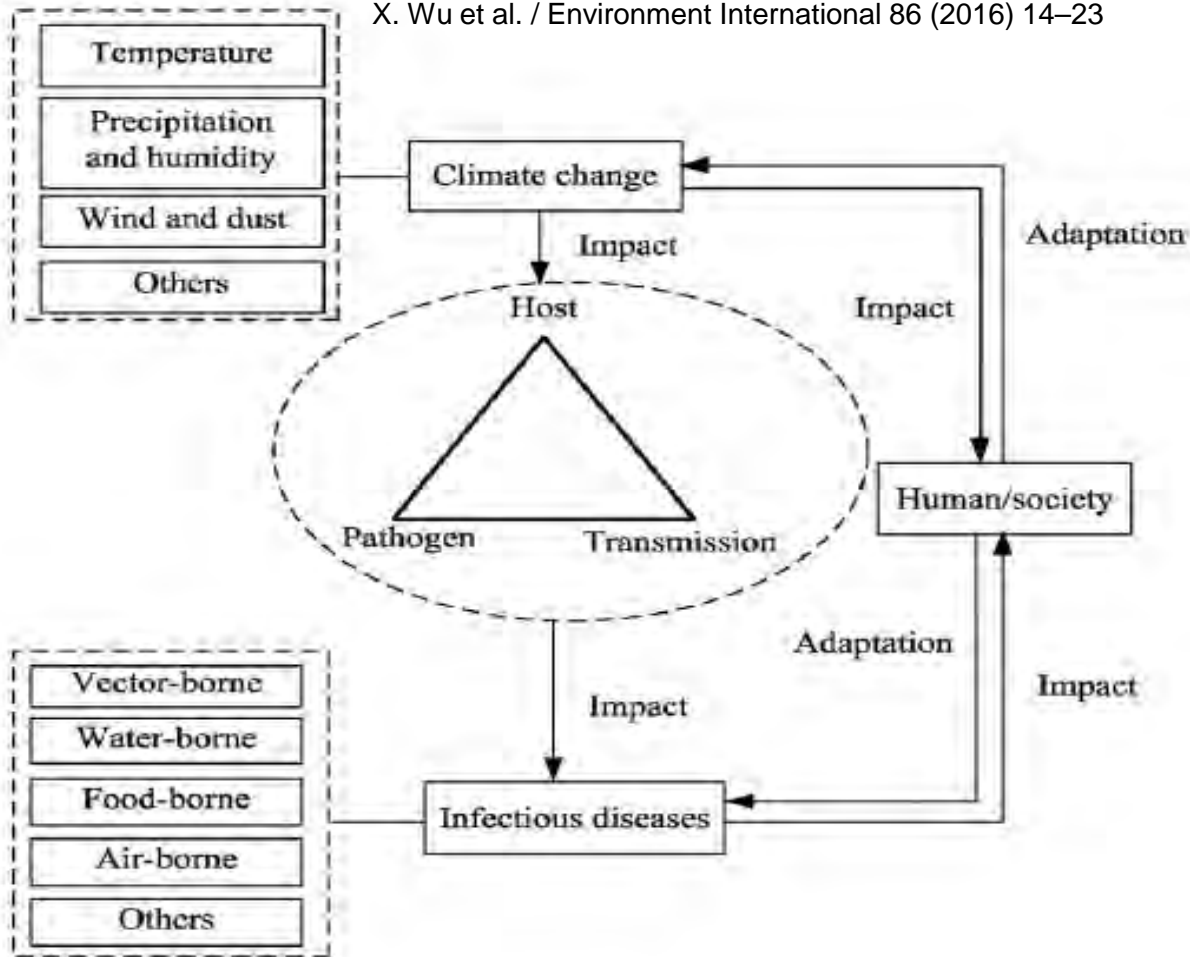


Fig. 1. Climate change, human infectious diseases, and human society.

Source: Impact of climate change on human infectious diseases: Empirical evidence and human adaptation Xiaoxu Wu, Yongmei Lub, Sen Zhou, Lifan Chen, Bing Xua (Environment International 86 (2016) 14–23

What can insurers do?



- S – E – I – R model
- Consider not just excess claims but ramifications on operations, hospital behavior etc
- Identify trends and appropriate stress scenarios
- Leverage emerging technologies and partnerships



Mitigating the impact II

Explicit (Mini-) Pandemic Solutions



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Explicit (Mini-) Pandemic Solutions

Our starting point

- Existing reinsurance solutions will provide some cover, probably in a ‘follow the fortunes’ kind of way – you will need more than that!
- Perhaps you have cat cover with an ‘infectious diseases’ inclusion
- There may be some diversification from longevity business
- Focus is on covering death and sickness, without recognition of the contaminations pandemics & mini-pandemics would have
- Some regulatory regimes require capital to be held against a 1:200 pandemic, but mini-pandemics ‘slip’ through

Explicit (Mini-) Pandemic Solutions

Solutions: cat cover extensions

- Cat cover might pay when 3 or more deaths (or sickness claims) result from the same event (usually defined wrt a 72 hour period)
- This can be extended to include infectious disease occurring within an x week period to be a valid 'cat'
- On the one hand, this is at least a relatively cheap option; On the other hand, the amount of protection is limited
- It's better than nothing, and more useful for mini-pandemics than severe pandemics

Explicit (Mini-) Pandemic Solutions

Solutions: ILS* for pandemics

- A simple example involves transferring pandemic liabilities into an SPRV**, and then collateralising the risk with assets from investors
- If there is a claim, they get back some or none of their money; If there is no claim, they get better-than-average returns
- (Some prefer ILS over reinsurance, in case the reinsurer couldn't pay claims due to the pandemic, then the cover has no value)
- These can be made as comprehensive as the buyer wants
- A number of such transactions have been done privately

*ILS : Insurance Linked Securities

**SPRV: Special Purpose Reinsurance Vehicle

Explicit (Mini-) Pandemic Solutions

Solutions: VIF* monetisation

- A portfolio has an embedded value – although actual earnings could end up higher or lower over the portfolio's lifetime
- A company that either sells (eg. 100% reinsurance) or mortgages (eg. reinsurance financing, VIF acceleration) this EV is effectively passing on future risks – if a mini-pandemic or severe pandemic hits, then the company will already have received the money
- The pandemic risk transfer can be fundamental to the transaction, or a side benefit
- RGA put something like this in place in the US

*VIF: Value In Force

Explicit (Mini-) Pandemic Solutions

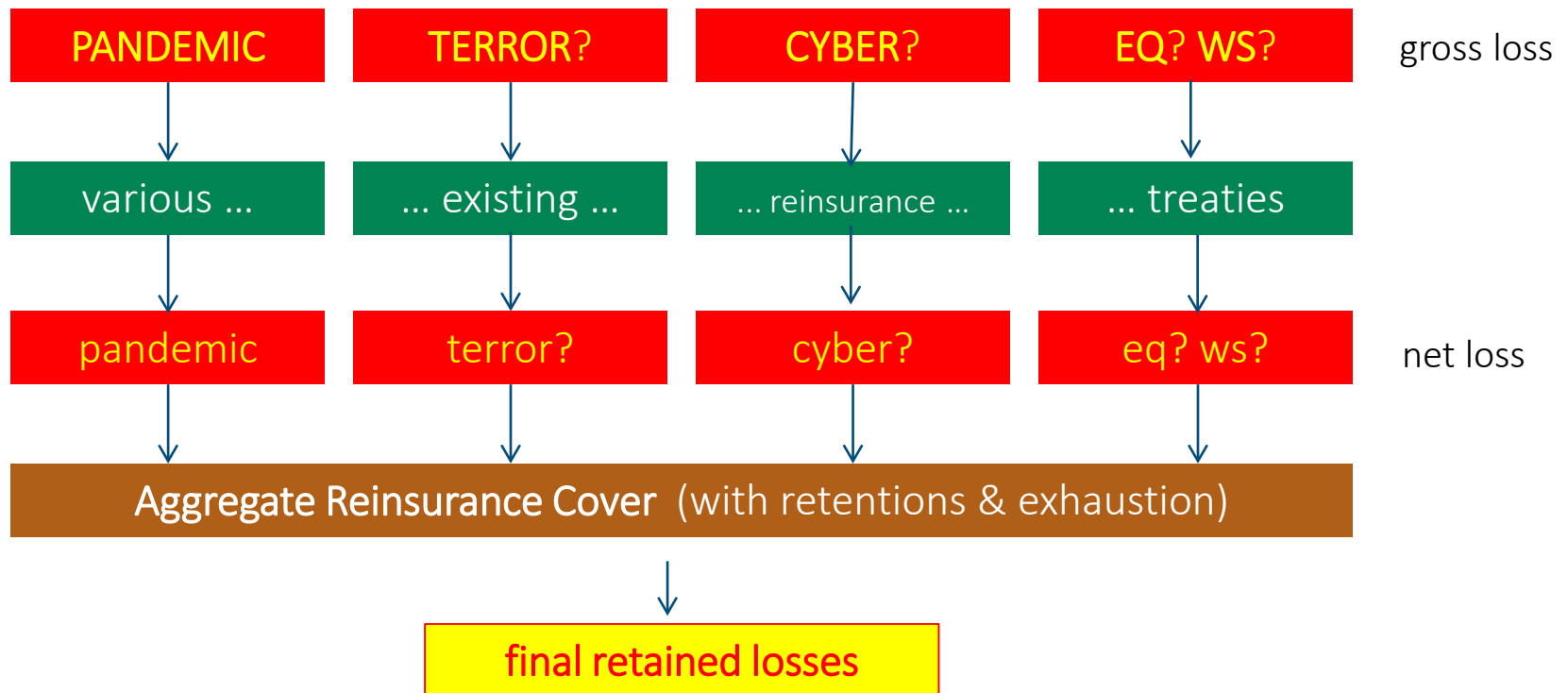
Solutions: Cat Bonds

- Swiss Re has its Vita Bonds, SCOR has Atlas IX
- Not dissimilar to ILS already described; These are publicly traded securities, structured to be interesting to various types of investor
- Trigger may be when some mortality index (which will of course incorporate all causes of death) is more than, say, 104% of expected
- This is done by non-insurers too, eg. World Bank with their IBRD CAR 111-112 issue of Class A & Class B bonds (different diseases)

Explicit (Mini-) Pandemic Solutions

Solutions: Multi-line Aggregate Covers

- Looks more like a non-life cover, and allows for the fact that several things can go wrong at the same time



Explicit (Mini-) Pandemic Solutions

Solutions: health business specifically

- There is no limit to the number of people who can die*
- But with health business there are some limitations:
 - If there are no drugs or antivirals available, then no costs will be incurred
 - If there are no doctors to prescribe or treat, then costs can't be incurred
 - If hospitals are full, you cannot continue to admit more & more patients
 - Indeed, during an 'event', many non-pandemic and non-essential procedures will be delayed, with a potentially expensive 'catch-up' after pandemic ends
- These above limits are less likely to be relied on for mini-pandemics

*Up to the total population alive



Closing Thoughts

Closing Thoughts



Closing Thoughts



- Putting aside extreme pandemics, even mini-pandemics can have **substantial impact** on insurance companies
- The impact is increased because **a lot can go wrong**
- Mindful **risk management** and allowing for this risk in your company's ERM practices and conversations are becoming increasingly important
- There are many possible outbreaks, each with its own characteristics & impact; Without **proper modelling**, we regress back to risk-management-through-guesswork
- **Reinsurance & capital markets** continue to evolve in providing risk transfer solutions



Questions?



Closing Thoughts

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Thank you



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