

A Practical Approach To Climate Risk

Agenda

- Quick overview of climate change
- Helpful tools for Insurers
- Mortality and morbidity considerations
- Challenges
- Practical approach

Quick overview of climate change

What in the world is going on?

Most of the world is much hotter than normal

2019

- 2nd hottest year on record
- 14 individual billion-dollar weather-related disasters in the US
- Catastrophic wildfires in Australia

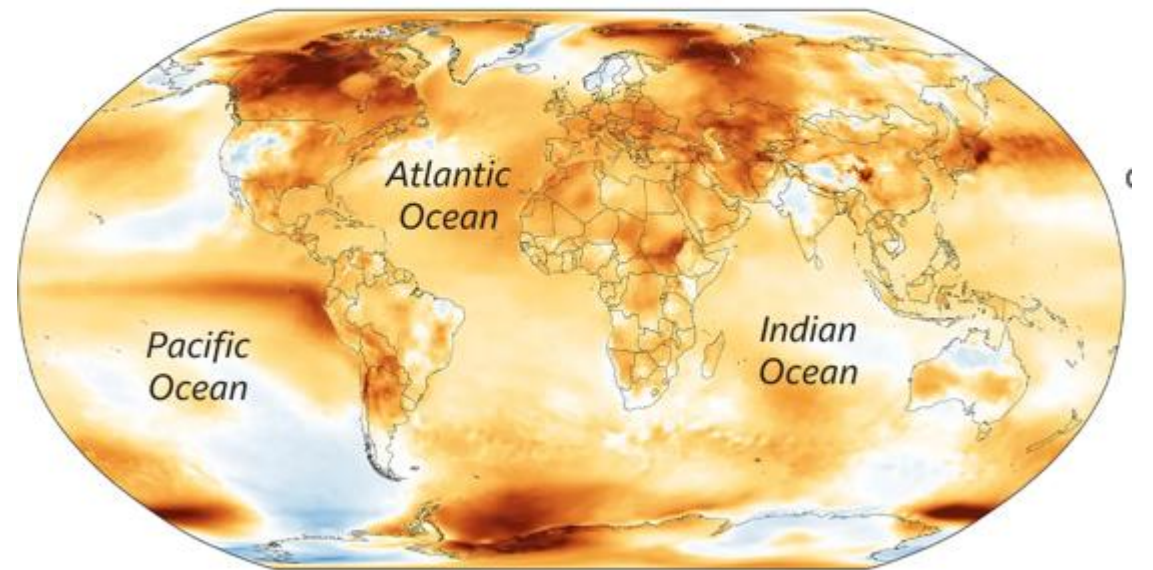
2020

- Largest single year ocean temperature increase on record
- Emergence of COVID-19
- CO2 levels continue to rise despite shutdowns

2023

- Hottest year on record
- Getting closer to breaching key international climate targets
- Intensifying of extreme weather events (heat waves, floods, droughts and wildfires)

Average surface air temperature in 2023 compared with 1991-2020 average



Source: ERA5, C3S/ECMWF



Causes of Climate Change

Human activity is releasing heat-trapping gases, called greenhouse gases (GHG) into the earth's atmosphere.

The most emitted GHG is Carbon Dioxide (CO₂).



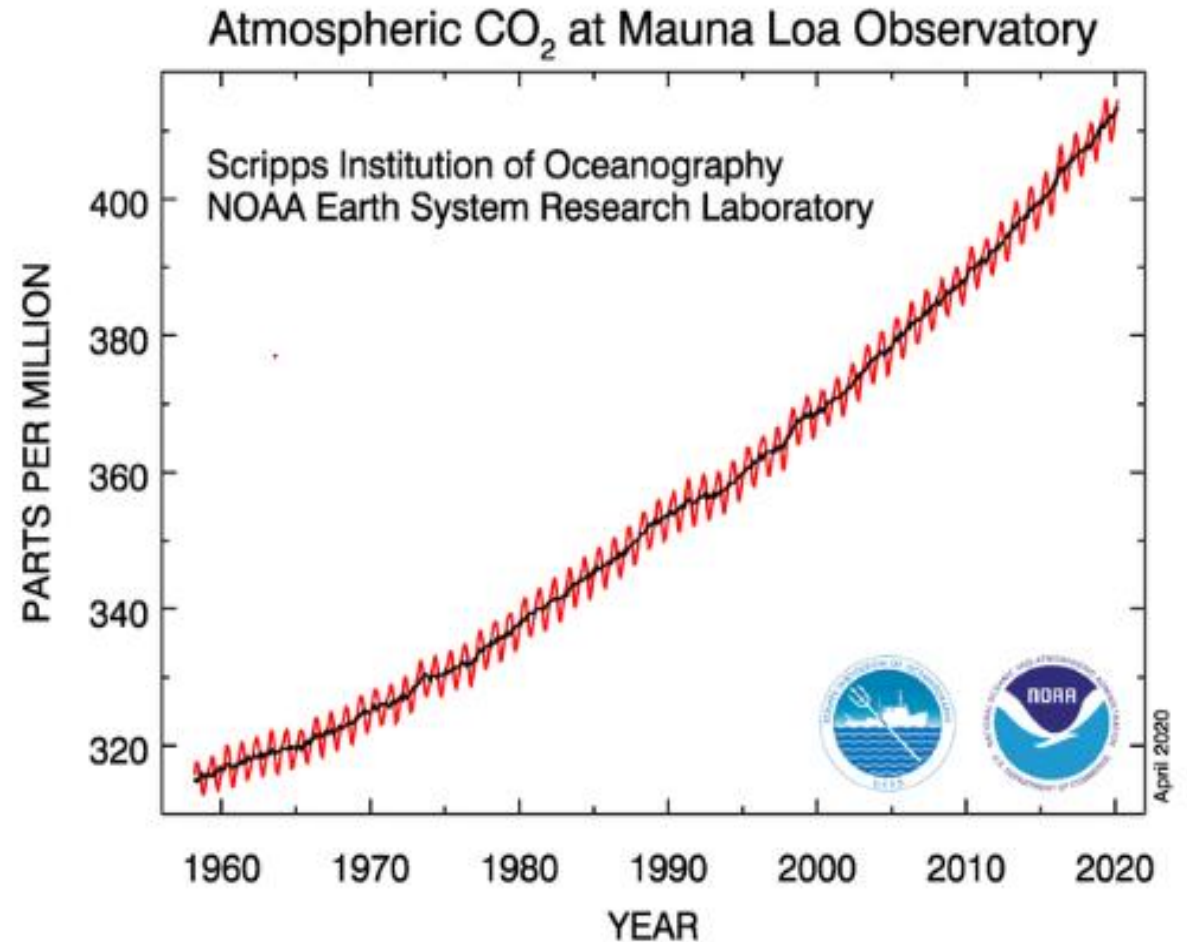
Other GHG are responsible for climate change: water vapor, methane, ozone, etc.



Their levels are higher now than at any time in the last 800,000 years.



The **Keeling Curve** is a daily record of global atmospheric CO₂ concentration.

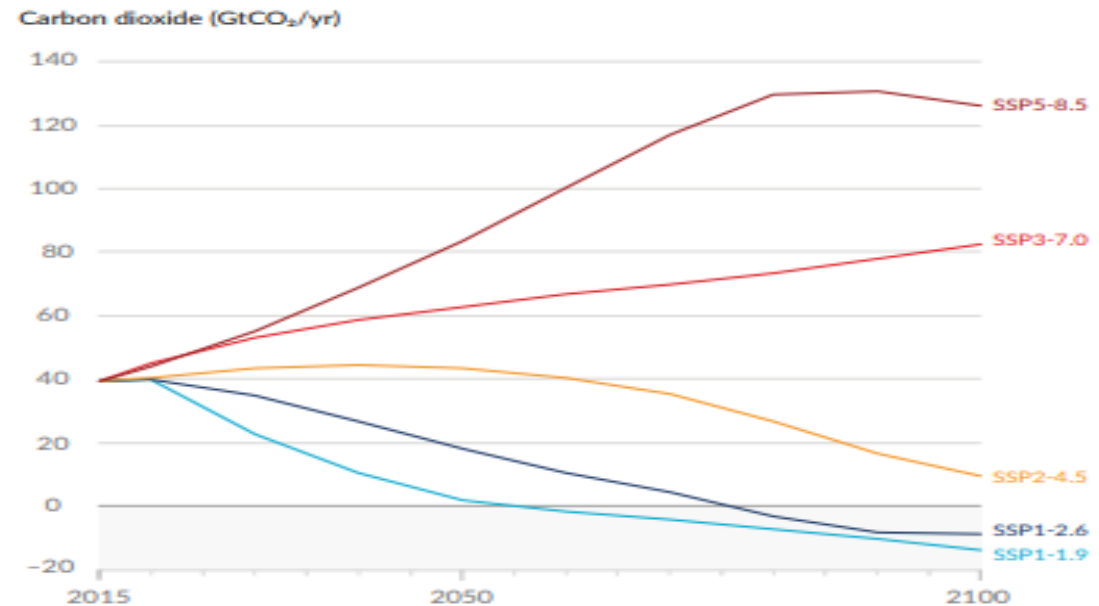


Helpful Tools

The Intergovernmental Panel on Climate Change (IPCC) Pathways

The Intergovernmental Panel on Climate Change (IPCC) is the United Nations body assessing the science related to climate change.

- The latest IPCC Assessment Report (AR6) published in 2023.
- SSP-RCP pathways are used for climate modeling.
- Each describe a future climate scenario considered possible depending on the volume of GHG emitted in the years to come.
- The pathways can be translated to global warming increases as well.



Scenario	Near term, 2021–2040		Mid-term, 2041–2060		Long term, 2081–2100	
	Best estimate (°C)	Very likely range (°C)	Best estimate (°C)	Very likely range (°C)	Best estimate (°C)	Very likely range (°C)
SSP1-1.9	1.5	1.2 to 1.7	1.6	1.2 to 2.0	1.4	1.0 to 1.8
SSP1-2.6	1.5	1.2 to 1.8	1.7	1.3 to 2.2	1.8	1.3 to 2.4
SSP2-4.5	1.5	1.2 to 1.8	2.0	1.6 to 2.5	2.7	2.1 to 3.5
SSP3-7.0	1.5	1.2 to 1.8	2.1	1.7 to 2.6	3.6	2.8 to 4.6
SSP5-8.5	1.6	1.3 to 1.9	2.4	1.9 to 3.0	4.4	3.3 to 5.7

<https://www.ipcc.ch>

INFORM Climate Change Tool

Description

- INFORM Climate Change tool provides insight on every country's climate change risk.
- It allows to see the results for the (current) baseline scenario and also to navigate climate change impacts under different emissions scenarios and time horizons.
- Results are available for 191 countries.
- The final score is made of 50 indicators.
- Results are updated annually by the European Commission Disaster Risk Management Knowledge Centre.
- The tool and results are free.

Results



Country	Baseline (current) risk (B)	MID-CENTURY (~2050) CRISIS RISK						END-CENTURY (~2080) CRISIS RISK					
		PESSIMISTIC (P) climate and socio-economic scenario			OPTIMISTIC (O) climate and socio-economic scenario			PESSIMISTIC (P) climate and socio-economic scenario			OPTIMISTIC (O) climate and socio-economic scenario		
	INFORM CC Risk Index 2022	INFORM CC Risk Index	Change in risk	Vulnerability gap	INFORM CC Risk Index	Change in risk	Vulnerability gap	INFORM CC Risk Index	Change in risk	Vulnerability gap	INFORM CC Risk Index	Change in risk	Vulnerability gap
United States of America	3.1	3.2	0.1	0.1	3.2	0.1	0.1	3.3	0.2	0.1	3.3	0.2	0.1

<https://drmkc.jrc.ec.europa.eu/inform-index/INFORM-Climate-Change>

World Risk Index

Description

- The World Risk Index indicates the disaster risk from extreme natural events and negative climate change impacts for 193 countries in the world.
- The final score is made of 100 indicators.
- A new report is produced annually by the Institute for International Law of Peace and Armed Conflict (IFHV) of Ruhr-University Bochum.
- The report is free.

<https://weltrisikobericht.de/en>

Results



10 countries with highest risk

1. Philippines	46.86
2. Indonesia	43.50
3. India	41.52
4. Mexico	38.17
5. Colombia	37.64
6. Myanmar	36.16
7. Mozambique	34.61
8. Russian Federation	28.20
9. Bangladesh	27.29
10. China	27.10

10 countries with highest exposure

1. China	64.59
2. Mexico	50.08
3. Japan	43.67
4. Philippines	39.99
5. Indonesia	39.89
6. United States of America	39.59
7. India	35.99
8. Colombia	31.54
9. Australia	31.21
10. Russian Federation	28.35

10 countries with highest vulnerability

1. Somalia	73.63
2. South Sudan	72.19
3. Central African Republic	70.67
4. Chad	70.25
5. Democratic Republic of Congo	69.11
6. Niger	66.49
7. Mali	66.43
8. Mozambique	66.17
9. Ethiopia	65.44
10. Yemen	65.24

ND-GAIN Country Index

Description

- The Notre Dame Global Adaptation Initiative (ND-GAIN) Shows a country's current vulnerability to climate disruptions. It also assesses a country's readiness to leverage private and public sector investment for adaptive actions.
- The ND-GAIN Country Index uses 45 indicators to rank 181 countries.
- The report is updated annually by the Notre-Dame University.
- The report is free.

Rank countries by ND-GAIN Country Index, Vulnerability and Readiness.

Scores for 2021

ND-GAIN INDEX VULNERABILITY READINESS

Rank	Country	Income group	Score
1	Norway	Upper	75.0
2	Finland	Upper	73.9
3	Switzerland	Upper	72.5
4	Denmark	Upper	71.9
5	Singapore	Upper	71.5
6	Sweden	Upper	71.4
7	Iceland	Upper	70.6
8	New Zealand	Upper	70.3
9	Germany	Upper	70.2
10	United Kingdom	Upper	70.1

<https://gain.nd.edu/our-work/country-index/>

Other tools from within the insurance industry

Description

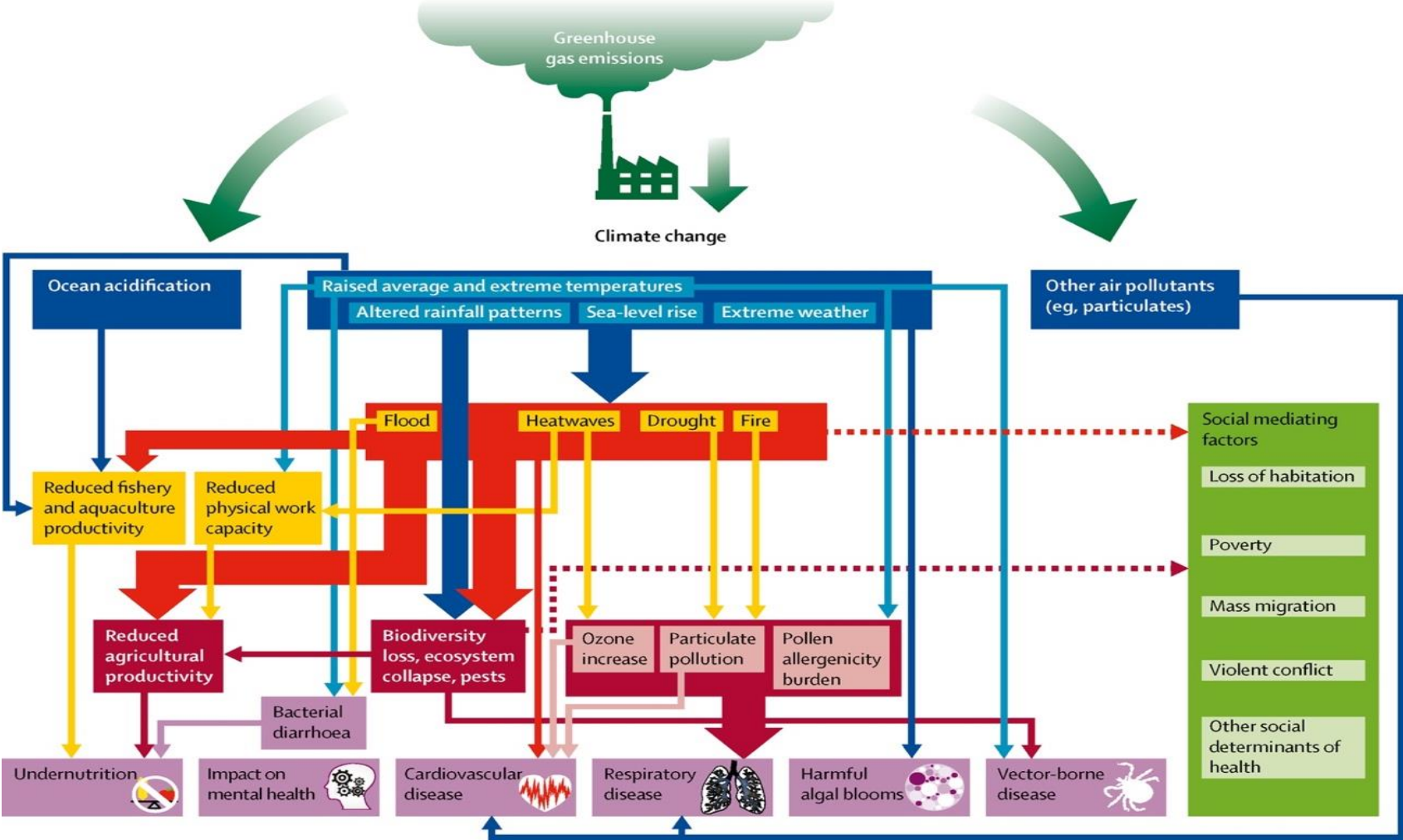
- The insurance industry is developing tools to better assess climate change risk.
- The effort is led by reinsurers.
- Both MunichRe and SwissRe have developed climate change platforms that allows to assess the current risk from diverse weather-event, as well as the projected risk.
- These tools primary benefit the P&C industry but can also be useful to life insurers.



Mortality and Morbidity

Climate Change Impact on Health

Climate change can impact human health in several ways



Pathway between **climate change and human health** illustrated by **Lancet's Countdown project**, a global effort to quantify and monitor climate change effects.

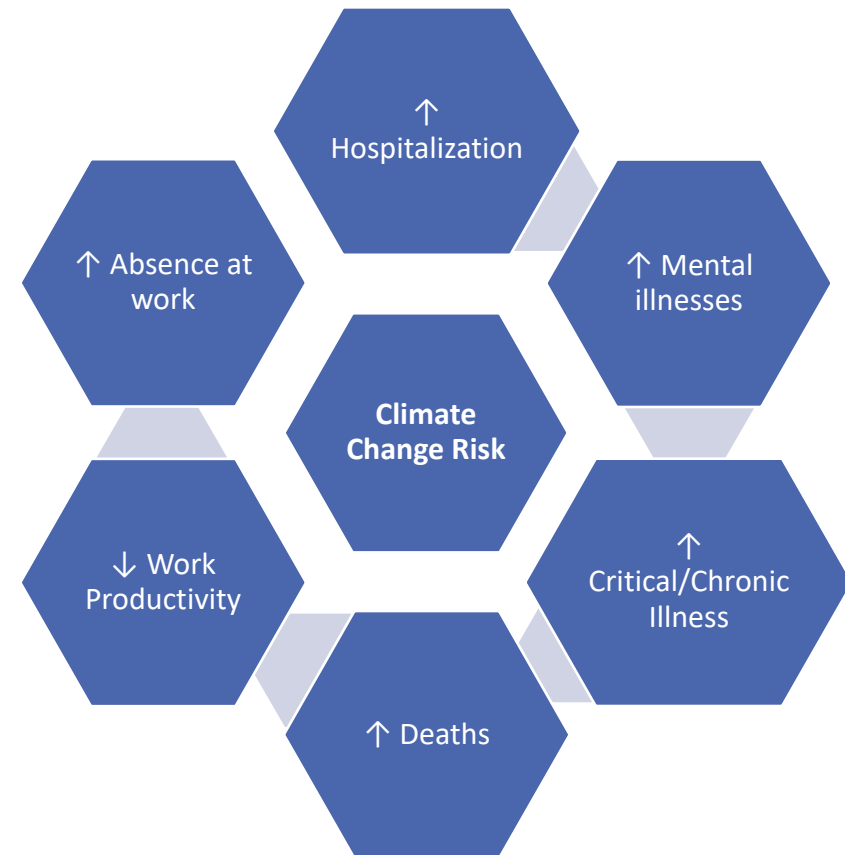
Impact of climate change on Human Health

One must consider both the direct and indirect impact of climate change to get a full view of the issue

Discussions on the impact of climate risk on human health quickly turn to mortality.

However, when it comes to human health, this is just the tip of the iceberg.

Let's look at the direct and indirect impact of a heat and its impact on human health...



Heat – direct impact

Too hot to handle?

At what point does heat become lethal to humans?

The wet bulb index combine temperature and humidity into one value. At theoretical wet-bulb temperatures, evaporation and cooling can no longer take place because the atmosphere is fully saturated with water.

Researches have found that when the wet-bulb temperature reaches 35C (95F), it crosses a threshold at which humans can no longer lose internal body heat and cool themselves.

Sustained exposure up to for six hours could be deadly.

Excess deaths are expected particularly with RCP 8.5, the impact is expected to be much greater in Africa and Asia, but Europe and North America will also be impacted.

Heat-related Mortality

Heat affects us at a cellular level

- Extreme heat can affect the heart, lungs and kidney function.
- It is expected that these events will become more frequent and last longer in duration.

The 2021 western North America heatwave resulted in had a death toll exceeding 1,400 people.

- A death toll of 800+ in western Canada
- A death toll of 600+ in western in Washington and Oregon.

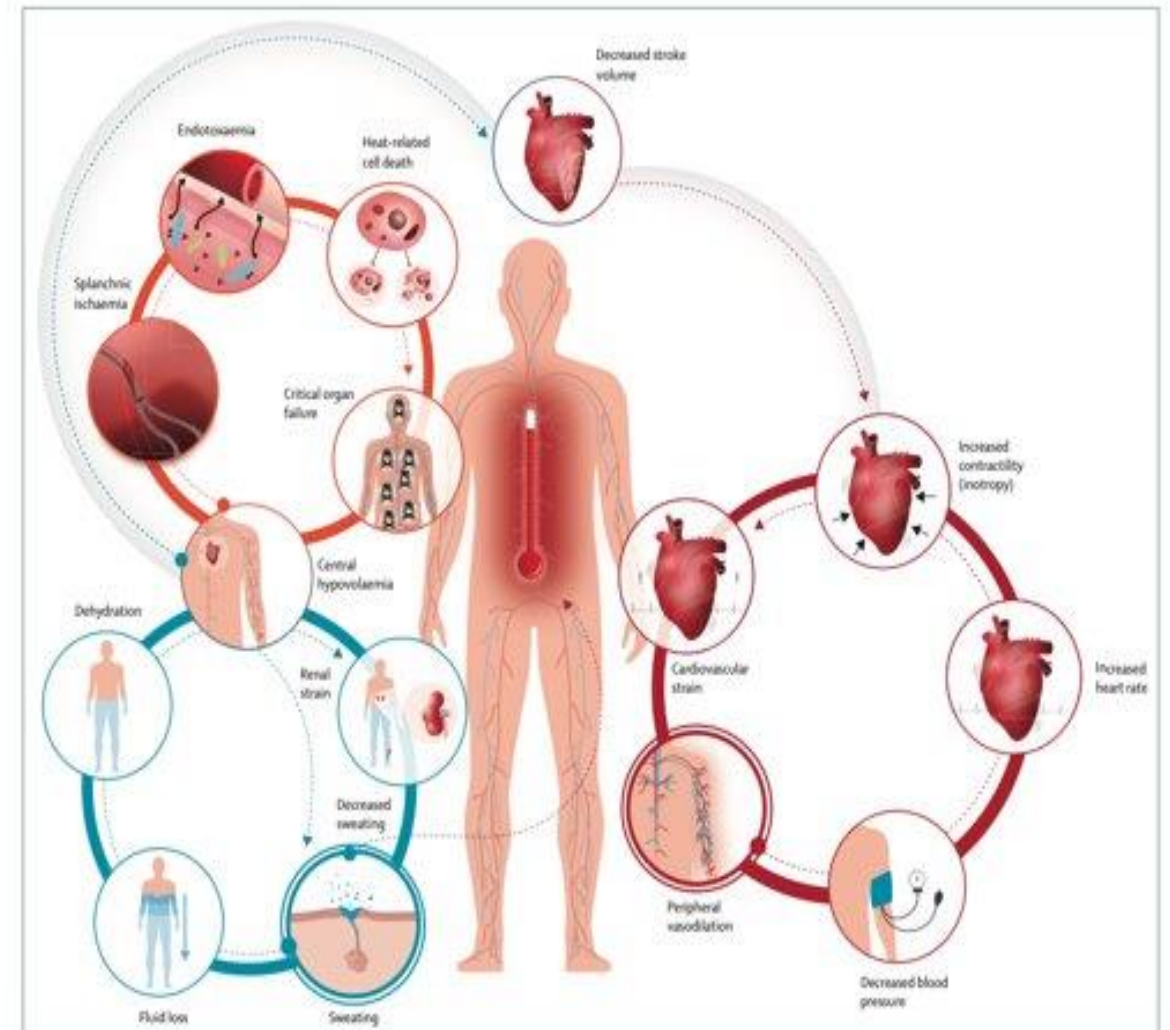
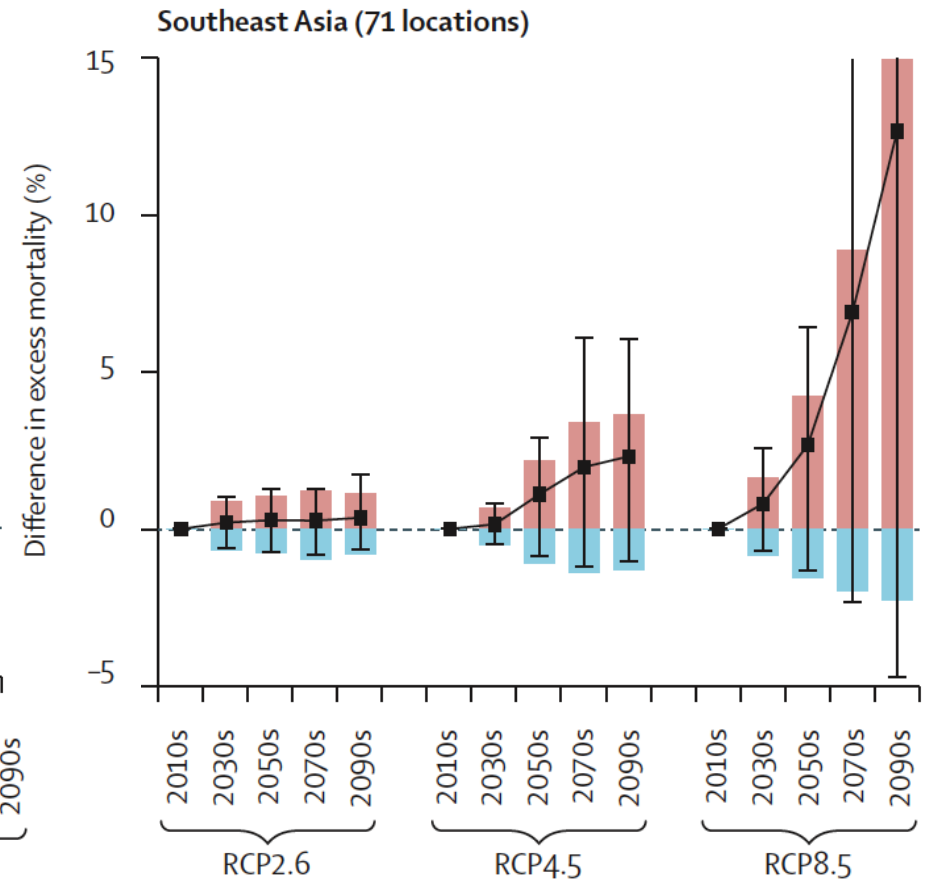
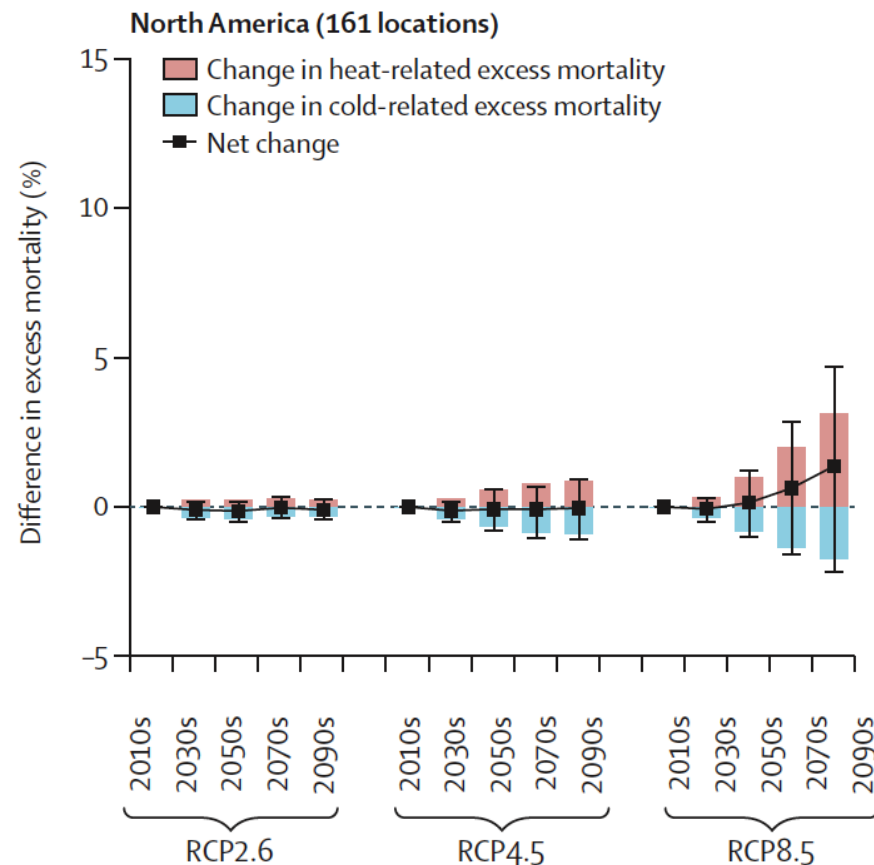


Figure: Illustration of the physiological pathways of human heat strain

Heat-related Mortality

Three Lancet Papers were published on the topic of heat-related mortality

Heat related mortality is of particular concern with projections into the future as excess deaths in parts of the world that could exceed 10% under certain scenarios.



Heat - indirect impact

Respiratory illnesses

Heat waves often lead to poor air quality.

The extreme heat and stagnant air during a heat wave increase the amount of ozone pollution and particulate pollution.

A few statistics

Deaths related to air pollution (presently)

- China: 1 million deaths/year
- India: 177,000 deaths/year
- Air pollution from burning fossil fuels alone is directly tied to 8.7 million deaths annually.

Air pollution is associated with a broad spectrum of acute and chronic illness, such as lung cancer, chronic obstructive pulmonary disease (COPD) and cardiovascular diseases.

Heat - indirect impact

Waterborne diseases

Increased temperatures can contribute to increase in Water Related Illness

Pathogen or Toxin Producer	Exposure Pathway	Selected Health Outcomes & Symptoms	Major Climate Correlation or Driver (strongest drivers listed first)
Algae	Shellfish Fish Recreational waters (aerosolized toxins)	Gastrointestinal and neurologic illness caused by shellfish poisoning or fish poisoning. Asthma exacerbations, eye irritations caused by contact with aerosolized toxins.	Temperature (increased water temperature) , ocean surface currents, ocean acidification, hurricanes
Cyanobacteria	Drinking water Recreational waters	Liver and kidney damage, gastroenteritis (diarrhea and vomiting), neurological disorders, and respiratory arrest.	Temperature , precipitation patterns
Enteric bacteria & protozoan parasites: (Salmonella, Giardia, etc.)	Drinking water Recreational waters Shellfish	Enteric pathogens generally cause gastroenteritis. Some cases may be severe and may be associated with long-term and recurring effects.	Temperature (air and water; both increase and decrease), heavy precipitation, and flooding
Enteric viruses: enteroviruses; rotaviruses; noroviruses; hepatitis A and E	Drinking water Recreational waters Shellfish	Most cases result in gastrointestinal illness. Severe outcomes may include paralysis and infection of the heart or other organs.	Heavy precipitation, flooding, and temperature (air and water; both increase and decrease)
Leptospira and Leptonema bacteria	Recreational waters	Mild to severe flu-like illness (with or without fever) to severe cases of meningitis, kidney, and liver failure.	Flooding, temperature (increased water temperature), heavy precipitation
Vibrio bacteria species	Recreational waters Shellfish	Varies by species but include gastroenteritis, septicemia through ingestion or wounds, skin, eye, and ear infections.	Temperature (increased water temperature) , sea level rise, precipitation patterns

Heat - indirect impact

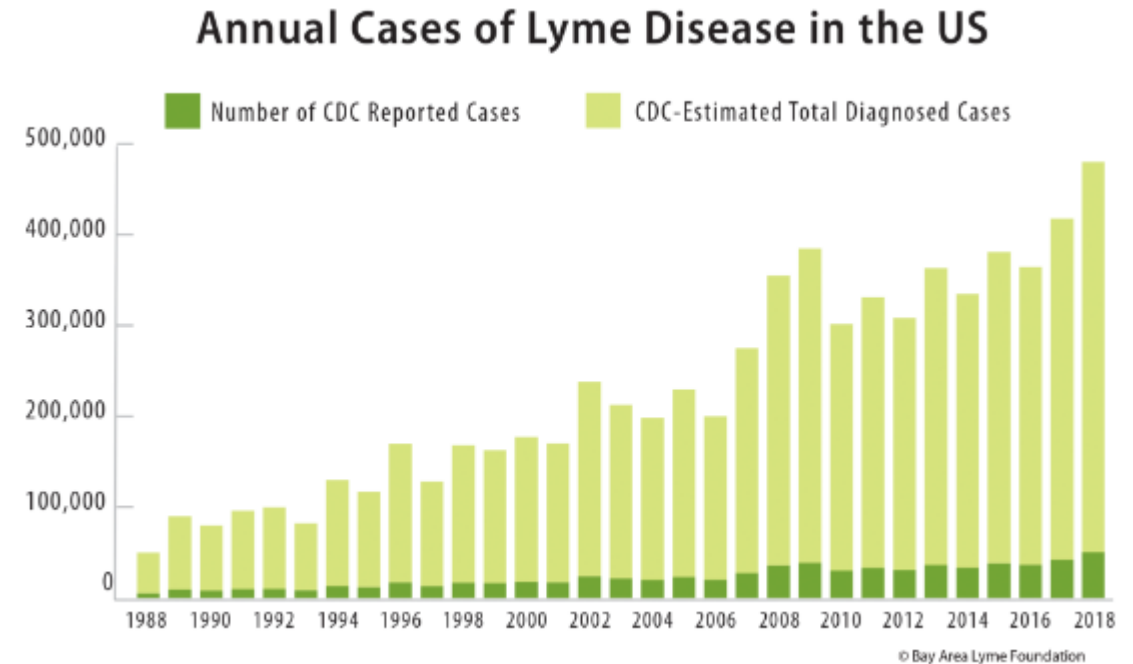
Vector Borne diseases

Increased temperatures can contribute to the propagation of vector borne diseases

As global temperature increases, ecosystems will change and potentially increase the risk of vector borne health threats such as:

- Dengue
- Hantavirus
- Lyme disease
- West Nile virus disease
- Etc.

Pandemic frequency could also increase overtime. There's currently a 2-3% probability of new pandemic each year.



Challenges for Insurers

Climate Change related mortality and morbidity for Life Insurers is complex

- A wildfire that as an acute and direct impact may claim 40 lives but may harm a million more as it pertains to cancer, cardio-respiratory and mental health. **If we think of the impact as deaths only, are we missing a very large piece of the puzzle?**
- A heat wave may result in hundreds of fatalities, but the cause of death would not mention heat and would likely be listed as cardio-respiratory, kidney failure, etc. The same would be true of morbidity claims. **How can we insurers know to what extent extreme events are impacting our claims?**
- **Are we considering other indirect impacts of the extreme events on our claims (interruption of care, mental stress, etc.)?**

Challenges

Research

- A significant amount of research required to understand the implications for life and health.
- Companies may not have the staffing, or the expertise to address the research needs.

Data

- Insurers have extensive data but not granular enough to determine if mortality or morbidity claim is related to climate change.
- **General population research studies will not accurately reflect the insured population.**

Projection

- We may never fully know indirect impact of climate change unless we consider qualitative, semi-quantitative means to arrive at meaningful conclusions in a highly uncertain future.
- New tools and methodologies might be required.

Regulators

- There is a significant push by regulators and others to quantify the cost of climate change. If we are not careful, we may understate or overstate the implications.

Scope

- Desire to provide a one-size fits all to the insurance industry (i.e. P&C and Life and health in same bucket) could have detrimental impact.

Practical approach to get started

Multi- National

Because insurers usually have exposures globally, they must consider how each area will be impacted by climate change to mitigate risks. Key considerations:

- Geographic concentration of Risk
- Service centers
- Supply chains
- Investments
- Safety and emergency response
- Product types

Increase Risk Awareness

Create a checklist to identify what are your areas of exposure and vulnerability

Assessment	Hazard types	Risk Assessment
Assessment of physical risk	Drought/Water stress	Moderate
	Heatwaves	High
	Extreme cold	Low
	Wildfires	High
	Extreme precipitation	Low
	Flood	Low
	Sea Level Rise	None
	Hurricane/Typhoon/Cyclone	Low
	Tornados	Moderate
	Earthquake	Low
	Tsunami	None
	Vector-borne diseases (Malaria, Lyme's, West Nile, Dengue, etc.)	Moderate
Business Risk Profile	Product inventory listing features that may be sensitive to CC (guarantees, extra death benefits, critical illness incident rates, etc.)	
	If Group life benefits are offered, consider concentration limits in future RCP,SSP scenarios. Some areas will present a higher risk.	
	Consider underwriting risks that are known to be more vulnerable (older ages, co-morbidities, obesity, mental health, respiratory illnesses.) Determine appropriate level of risk. Consider testing possible outcomes in various RCP/SSP scenarios	
	International sales? Which countries may be more vulnerable to climate risk? There are tools several tools to help insurers build a risk profile	

Get Organized

Reach out to discuss climate change risk



Cross functional working groups can strengthen knowledge, create awareness and alignment

Underwriting, medical directors, actuaries, data scientists, claims, product, legal, investment and many others



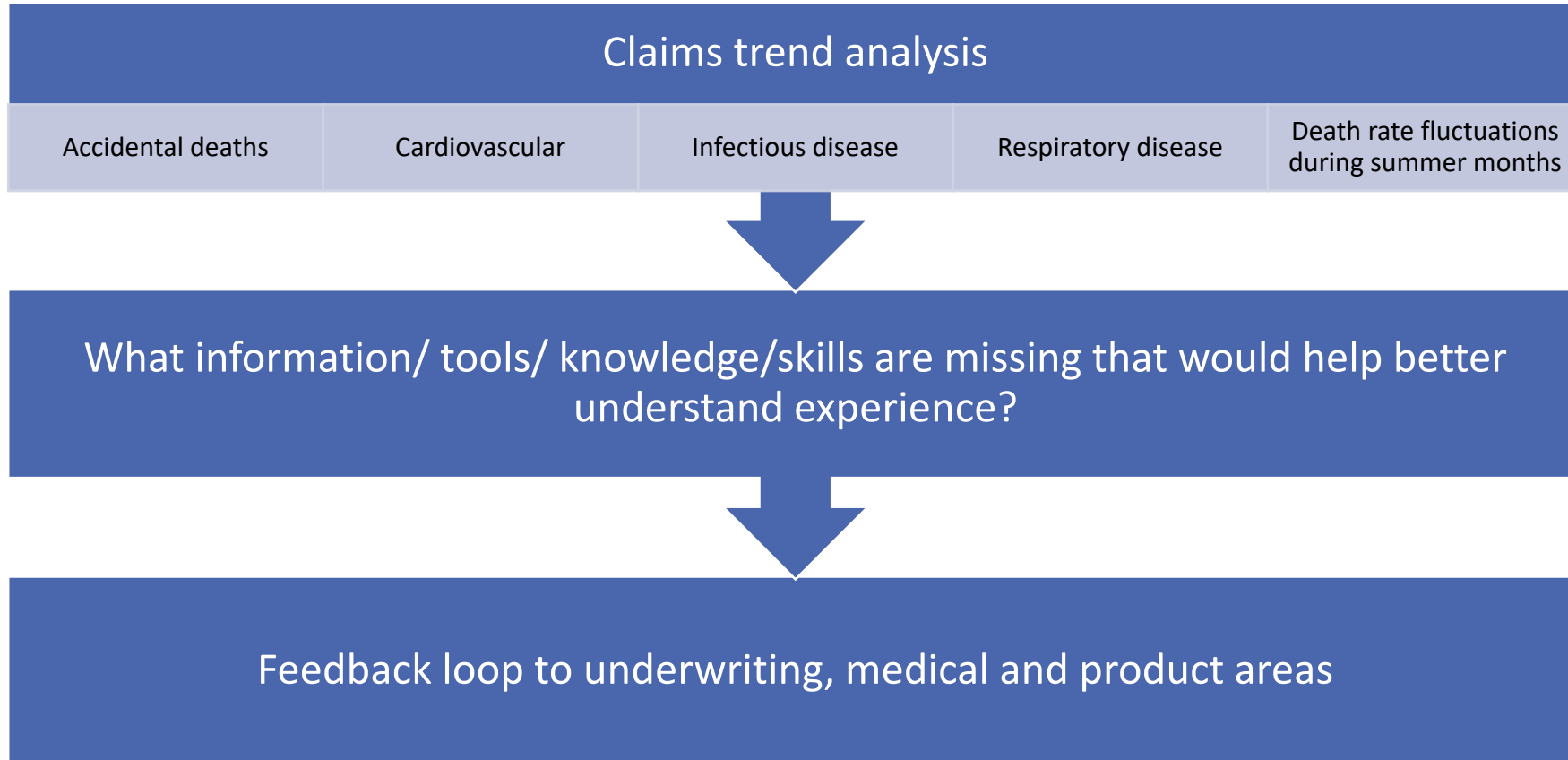
Collaboration with industry organizations, regulators, other companies



Collaboration with private sector, research academia, universities etc. Medical research is needed that will help us understand what health outcome to expect in an RCP 2.6 vs 8.5 world

Analyze Claims Trends

Understand the experience



Sensitivity testing

Businesses could identify products with the highest climate change risks and shock assumptions accordingly

Questions to ask

- What type of extreme weather events will most likely affect my insured?
- Will demand for wellness products over life increase?
- As people associate an increased value to insurance, will lapse assumptions need to be revisited?
- Are certain products or benefits not ideal to offer in a changing climate?

Assumptions to shock

- Mortality
- Mortality improvements
- Short and Long-term disability incidence and duration
- Critical Illness Incidence
- Lapse rates
- Health Product Utilization
- Product and Business Mix
- Economic Assumptions

What mitigants are in place?

- Pricing adjustability
- Reinsurance
- Shorter-term guarantee

Assumptions can be shocked individually but scenario testing (which shocks several factors at the same time) is ideal.

In Conclusion



Climate risk is already part of our experience, and one of the many risks we manage



Unlike other risks, this stands to materially change over the next decades



There are many questions that we may not have answers for today, but there are actions we can take to understand claims trends, protections and exposures in our inforce business



Collaboration and feedback mechanisms are critical to managing an uncertain future

A large window with a view of a city skyline and water. The window is divided into many panes, and the view outside shows a dense urban landscape with numerous skyscrapers and a body of water in the foreground. The overall scene is bright and clear.

Questions?