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Beating the Odds: Redefining Risk

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Climate-Driven Mortality, Morbidity and Disability in Australia:

Implications for Life and Disability Insurance

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Today's Agenda

01

Australia's Risk Context

High adaptive readiness, but intensifying heat, fire, flood and smoke tail events

02

Health pathways

Mortality, morbidity, mental health, work capacity and recovery pathways.

03

Insured-lives translation

Not automatic: selection, socioeconomic mix, occupation and adaptation matter.

04

Munich Re evidence

What internal L&H analyses say about data requirements and credibility.

05

Actuarial response

Monitoring, segmentation, claims strategy and climate stress testing.



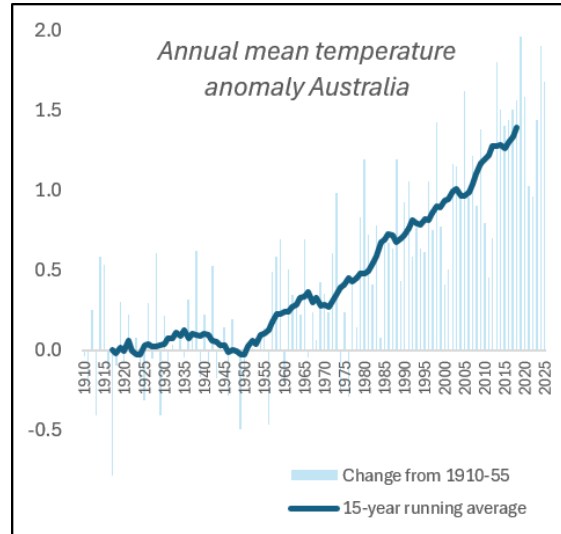
Australia: less about whether climate risk exists, more about tail events

A highly insured, highly urbanised market with strong adaptation capacity — but concentrated exposure



Density

~85% live near the coast, concentrating exposure to coastal hazards.



Warming since 1910

Already ~1.5°C increase, with extremes rising more than the average¹ compared to global average increase of 1.2%²



Key hazards

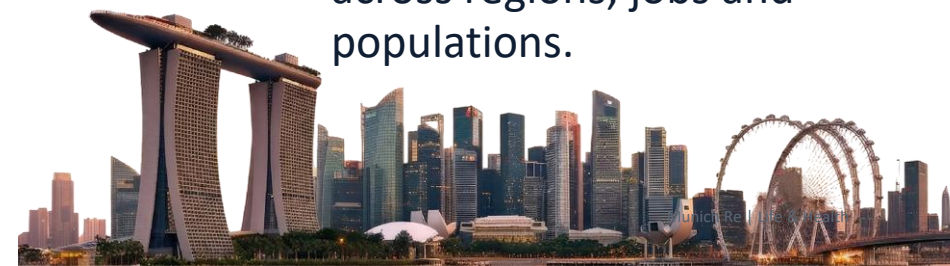
Heat, bushfire, flood with drought and smoke interactions. Vector borne diseases also increasing.



High readiness

Adaptive, but climate impact will not be even across regions, jobs and populations.

¹ Source: CSIRO and Bureau of Meteorology 2024; ² IPCC Sixth Assessment Report
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Australia's climate risk is about intensifying extremes, where heat, fire, flood and smoke events place pressure on health, infrastructure, and mental wellbeing.

Australia has warmed by $\sim 1.5^{\circ}\text{C}$ since 1910, which is *already the limit targeted by the Paris Agreement in 2015*. Volatility of annual average temperatures has also increased since 1910.

Both maximum and minimum temperatures are increasing, with night-time temperatures rising sharply, contributing to *heat stress and reduced recovery during heatwaves*.

Australia is experiencing simultaneous climate extremes: severe multi-year **droughts** PLUS east-coast **flooding**; **bushfires** PLUS **smoke** exposure PLUS **water** stress PLUS **power** shortage PLUS **health** system overload.



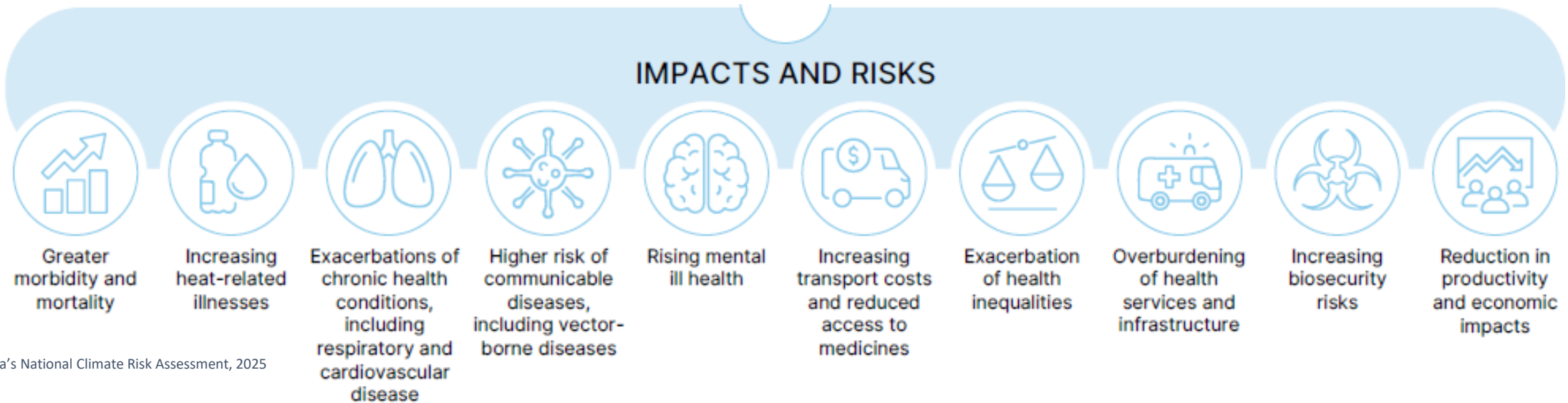
Rainfall is becoming more variable, with fewer but more intense rainfall events, meaning *droughts and floods occur in close succession*.

Australia generally meets WHO PM2.5 guidelines ($<5 \mu\text{g}/\text{m}^3$) in non-fire years however, bushfires can cause short-term PM2.5 spikes *far above health thresholds*.

Australia has a high base mental health burden, almost *half of Australians expected to experience a mental illness* during their lifetime, and climate-related disasters worsening anxiety, depression, and PTSD.



Potential Impact on Australian insured lives



Source: Australia's National Climate Risk Assessment, 2025

Many of these risks have a direct negative impact on the likelihood and cost of claim under:

- Life
- Disability and IP
- Critical Illness and
- Health insurance policies.



Other risks have a second order effect, such as increasing transport costs and reduced access to medicines; overburdening of services and economic impacts.



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Each on their own may only represent a moderate increase in the overall cost of claims. But being systemic risks, we are faced with many effects all at once.



Many of the risks will impact insured lives in a similar way to the general population, albeit to a reduced extent. Research on insured populations is needed.



Findings from population studies indicate potential life/health insurance claims

Causes² illnesses such as:

- dehydration, heat cramps, heat exhaustion, heatstroke

Chronic illnesses worsened:

- Heart disease, diabetes, renal & respiratory illnesses

Negative impact also on:

- Bipolar disorder, depression, stress, anxiety

Riverine and flash flooding³ affect physical and mental health – potential drownings and trauma from exposure to event including loss of possessions and income.

Drought³ affects physical and mental health when required to move to secure water sources – employment and income suffer.

During 2007-17¹:

- During the warm season (Oct-Mar) heatwaves caused 2% of deaths
- Largest in major cities:
 - Adelaide – 8%
 - Hobart – 6%
 - Melbourne/Sydney – 3%
- However results may be understated due to inconsistent attribution

During 2009 Vic Heatwave:

- Mortality ↑ 62% (374 xs deaths)
- Ambulance callouts ↑ 25%
- Hospital admits ↑ 81%, A&E ↑ 12%

Health service demands increase¹:

- 3-3.5% increase in Emergency Dept. presentations
- 4% increase in GP consultations
- 5-8% increase in ambulance callouts (Adelaide only)

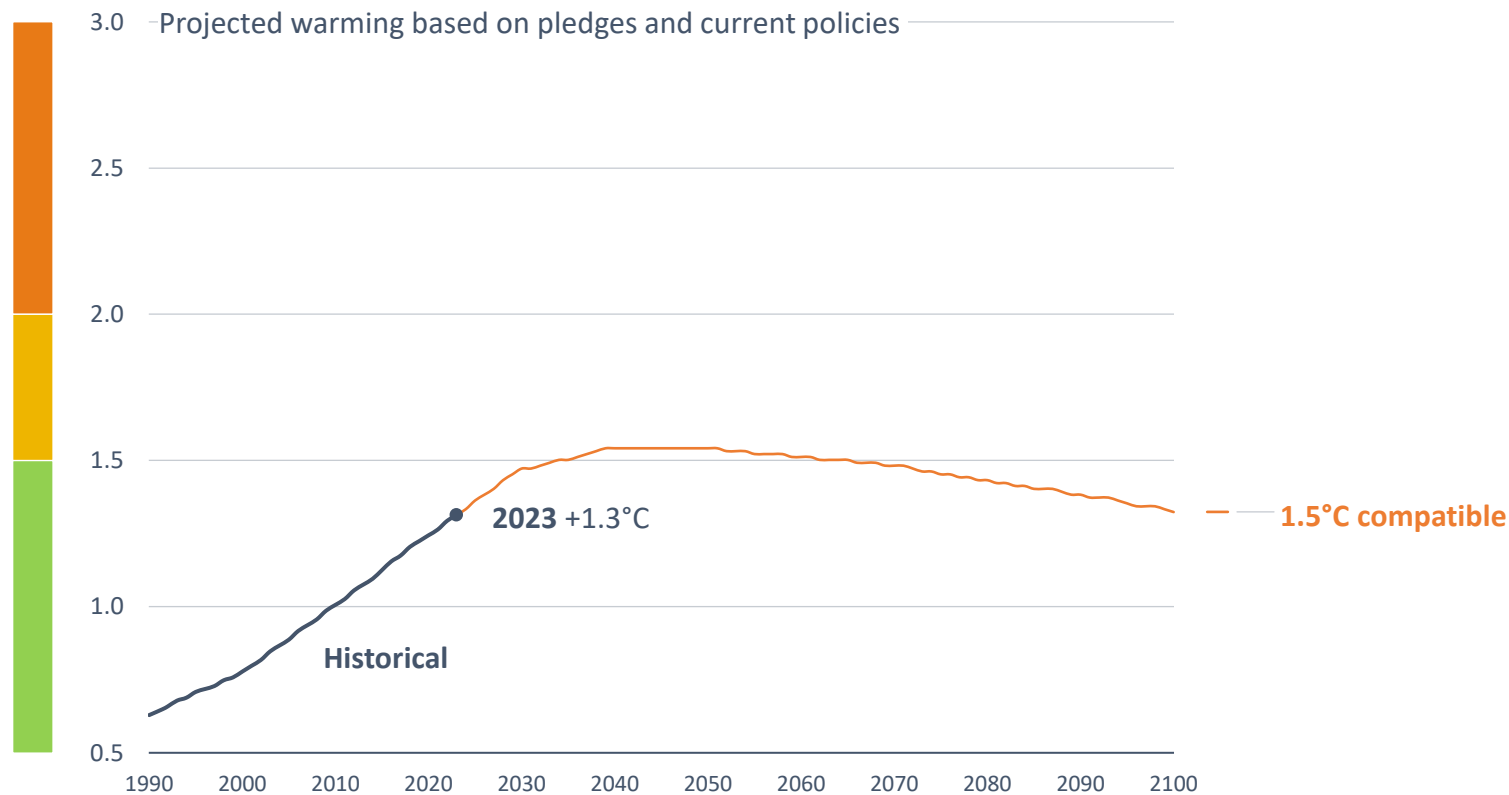
Communicable diseases³:

- Salmonellosis (55,000 cases pa) linked to 15% increase with 1% temp rise
- Avian influenza pandemic surges associated with periods of high rainfall

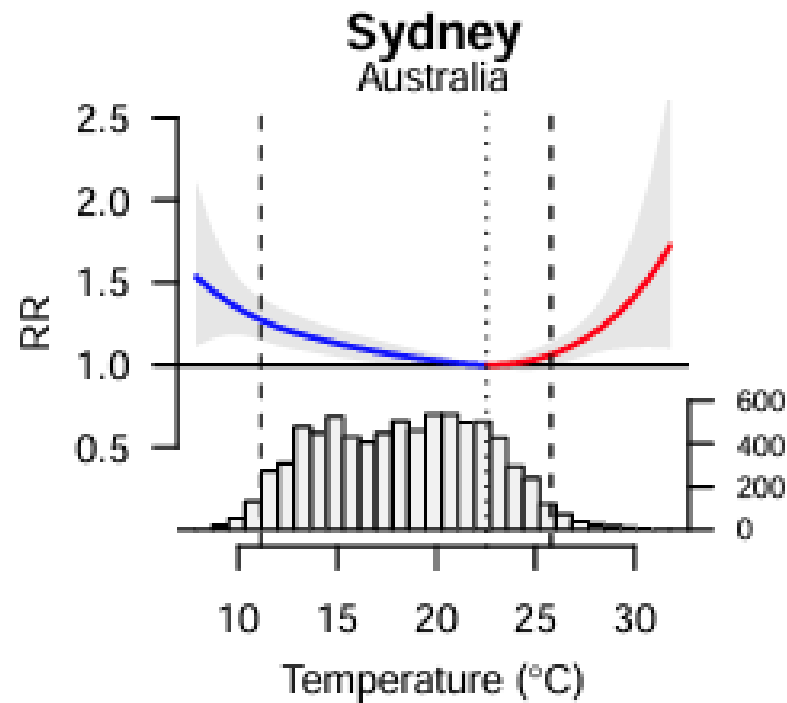


What is our base case?

Global temperature increase in 2100 (°C)



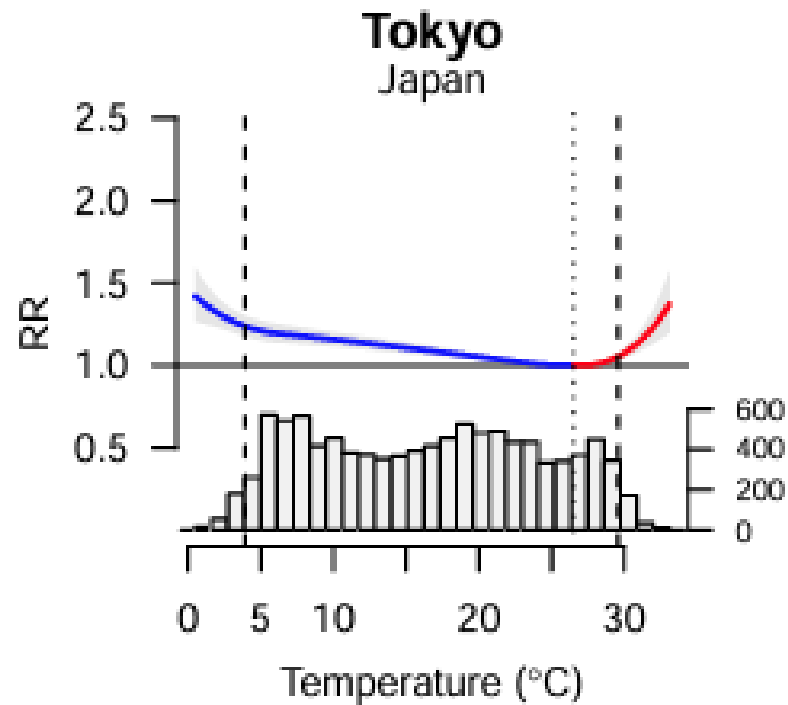
Heat is visible — but the temperature story is not one-dimensional



- Exposure-response curves illustrate the impact of extreme temperatures on mortality
- Highlight differences between locations



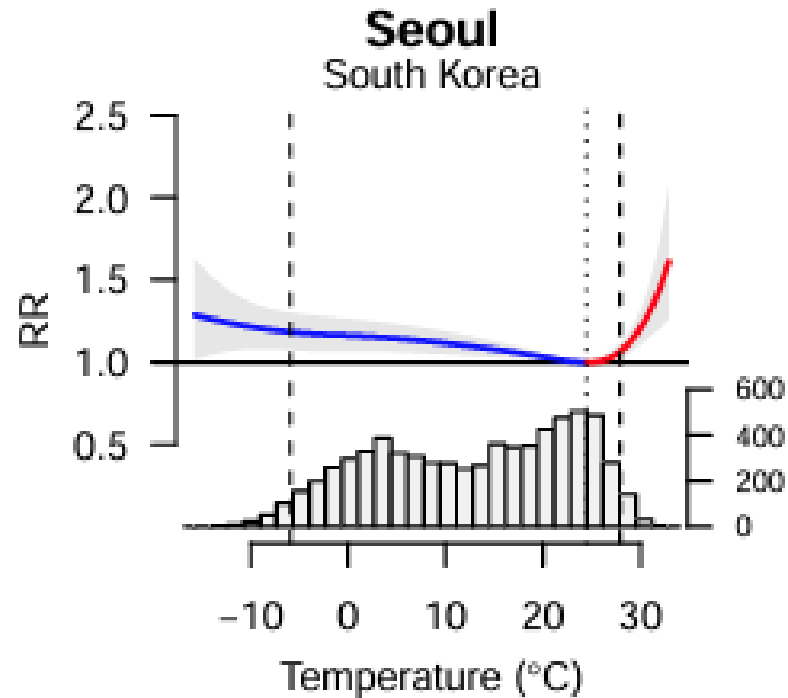
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- Tokyo has a longer period of warm weather. Appear to be less affected by extreme heat.
- Also a wider range of typical temperatures than Sydney, and less impact from cold weather.



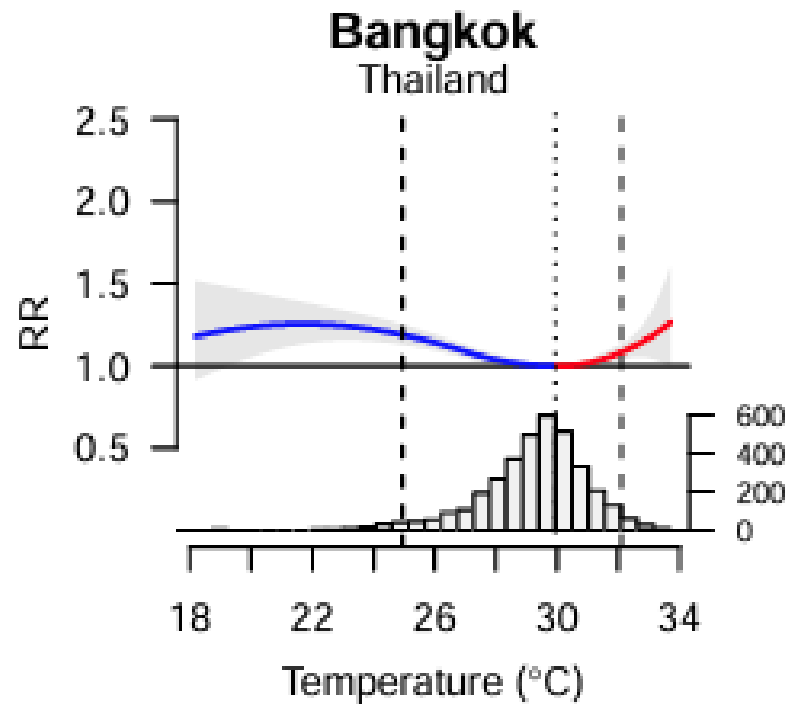
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- Seoul has a similar reaction to hot temperatures as Sydney, perhaps due to heat being less frequent.
- But with lower cold temperatures, the population has adapted well to cold and is therefore less affected.



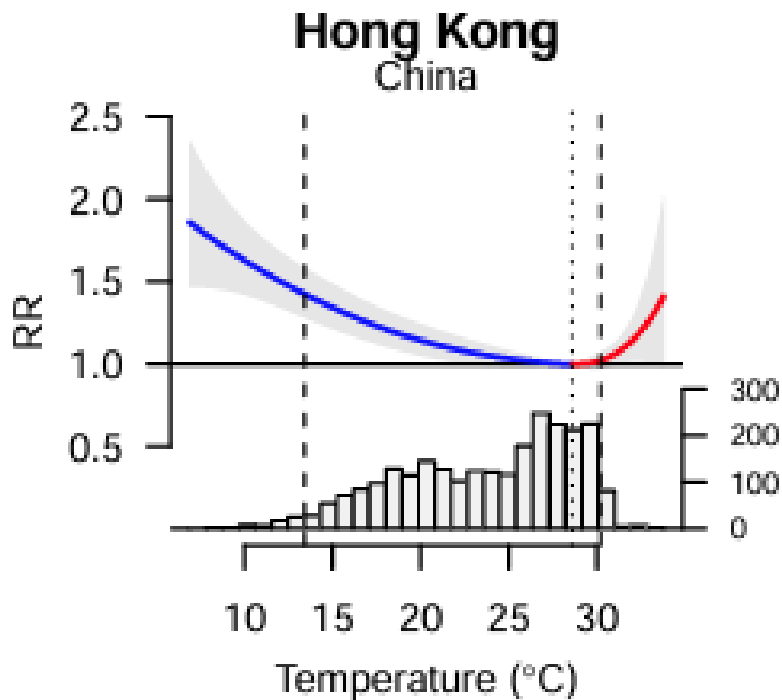
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- Very good heat tolerance
- No big impact of colder temperatures – but there aren't any!



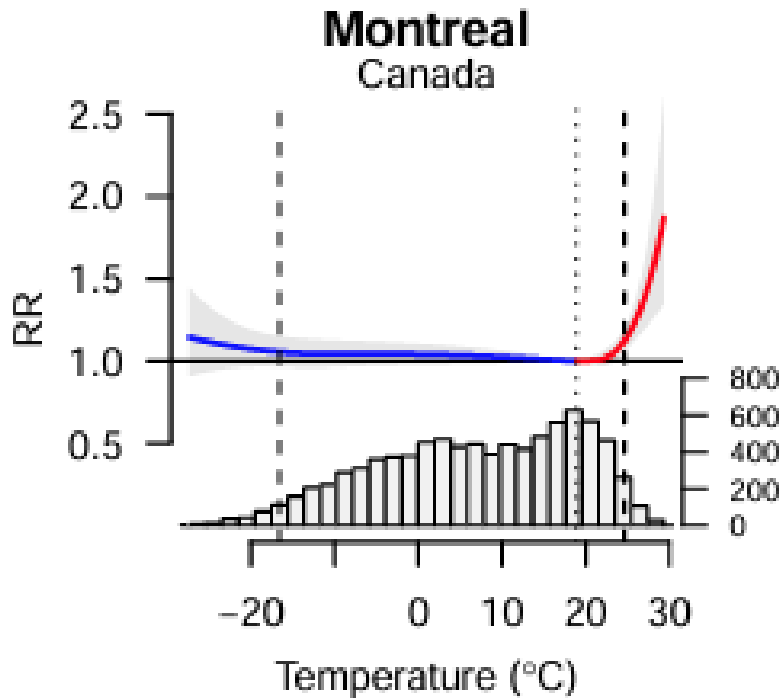
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- Very good heat tolerance
- HK does have a brief, although not very cold winter – the effect is dramatic!



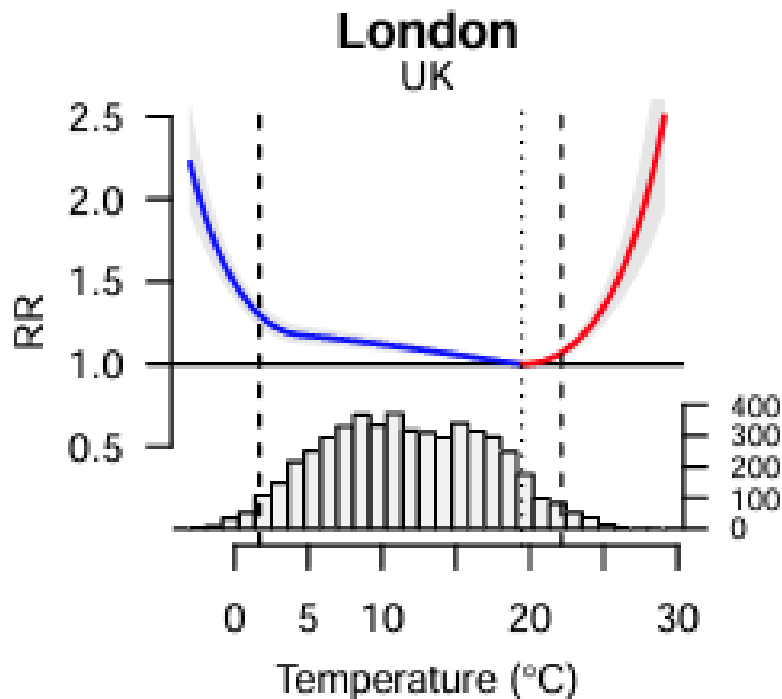
Heat is visible — but the temperature story is not one-dimensional



- Very low tolerance of heat above the high 20s,
- But the most hardy people in the cold!



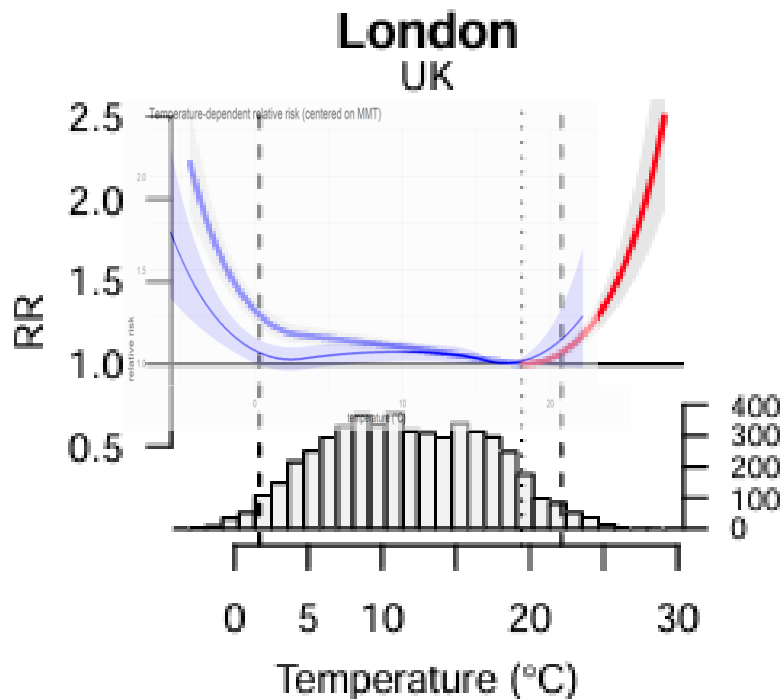
Heat is visible — but the temperature story is not one-dimensional



- At the other end of the extreme...
- Above 25 seems to be a heatwave!
- But extreme low temperatures area also problematic.



Heat is visible — but the temperature story is not one-dimensional



- However, the picture changes when insured lives are superimposed over the top
- Munich Re study on 2003-2024 deaths in its UK portfolio



Conclusion: Population studies cannot be transferred 1:1 to insured portfolios

Vulnerable Groups

- Elderly
- Rural / outdoor workers
- Pregnant people and unborn children
- Younger people
- Lower socioeconomic cohorts
- People with disability or co-morbidities



Typical insured cohort

- Higher socioeconomic mix
- More indoor occupations
- Better health awareness
- Faster access to treatment
- Greater ability to adapt
- More likely to have air conditioning

The insured cohort most likely under-represents the most climate-vulnerable groups



Our Australian analysis so far...



Initial testing

Weekly population deaths in NSW *appeared* to show a significant impact from heatwaves for 2015-2025



Published results

Xu et al (2025) attributed 0.4% of deaths 2016-19 to heatwaves.
That doesn't sound like much...



Acute effects

But if we compress this to a shorter period, eg single heatwave or a season, the % increases (naturally).



Next steps

Analyse insured lives portfolio by postcode and other demographic factors for multiple hazards



For disability and CI products, the second-order effects may matter most

The key question is not just claim incidence — but severity, duration, loss of housing and employment

Incidence

- injury,
- acute illness,
- mental health stressors,
- smoke-sensitive conditions

Duration

- disrupted care,
- delayed treatment,
- heat-limited recovery,
- repeated events

Severity

- transition from mild to moderate/severe,
- TPD accumulation,
- comorbidity

Personal Security

- Housing security
- Job security
- Access to care

The immediate mortality signal is important, but the disability challenge is more likely to emerge through recovery, persistence and vulnerability.



Recommendations for Actuaries:

Potential changes to our **underwriting questions/focus**

- Identify exposure to climate-risks – outdoor exposure, working hours, heat exposure
- Critically assess lives with pre-existing conditions especially cardiovascular, MH history
- Consider location-based risks – flooding, sea-level rise
- Is it a good idea to remove infectious/communicable disease exclusions – what cost?



Monitor exposure to lives with higher climate risks – rural, elderly, lower socioeconomic groups.



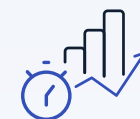
Have **higher margins** for those with **higher climate risks** or markets with greater climate exposure



Introduce a(n) (ideally industry-wide) **data framework** to capture claims due to climate events.



Think about **long-term assumptions** - mortality improvements, CI trends especially for the very young and very old and into the future.



Consider appropriateness of **cost of guarantees**, especially for our Mortality pricing but equally for living benefits.



Recommendations for Actuaries:

Climate stress testing: make it product-specific

Hot summer + smoke

mortality spike; respiratory morbidity;
IP new claims

Flood cluster

acute injuries; disrupted care;
mental health persistence new IP claims

Emergency worker exposure

occupation-specific claims;
longer recovery duration

Chronic warming

shift in disease mix; adaptation constraints;
assumption risk

Document the assumptions explicitly, eg:

- *hazard definition*
- *return period*
- *footprint*
- *exposure mapping*
- *endpoint*
- *lag*
- *adaptation*
- *uncertainty range*



Recommendations for Actuaries:

Minimum viable climate-health-postcode monitoring dashboard

Hazards

heatwave days, smoke PM2.5, flood footprint, cyclone

Exposure

policy count, sum insured, occupation class, product type

Vulnerability

age, comorbidity proxies, socioeconomic proxy

Claim impact

death, disability incidence, duration, re-openings severity

Controls

seasonality, pandemic periods, claims management changes



Governance use

Use for early warning, claims triage, assumption review, stress-test calibration and reporting.



Three closing messages

Climate health risk is visible in Australian population data, and will be to varying degrees in other countries’.

Insured-lives translation requires credibility, granularity and caution.

For life and health insurers, data gathering should start now, followed by monitoring and stress testing.

Q&A

Andy Linfoot · Munich Re Australia