



November 29, 2017 Webcast

Climate Change and Mortality

Sam Gutterman FSA, FCAS, MAAA, CERA, HonFIA

Co-Vice Chair, IAA Resources & Environment Working Group



- The report
- Effects of climate change
- Vulnerable populations
- Potential mortality consequences
- Case study
- Role of actuaries

Background to the report



- An IAA Working Group Discussion Paper – at:
www.actuaries.org/ClimateChange&Mortality
- Prepared by the Resources & Environment Working Group of the International Actuarial Association (IAA)
- Completed in September 2017
 - Will be posted shortly on the IAA website
- Addresses an important potential result of climate change

Effects of climate change

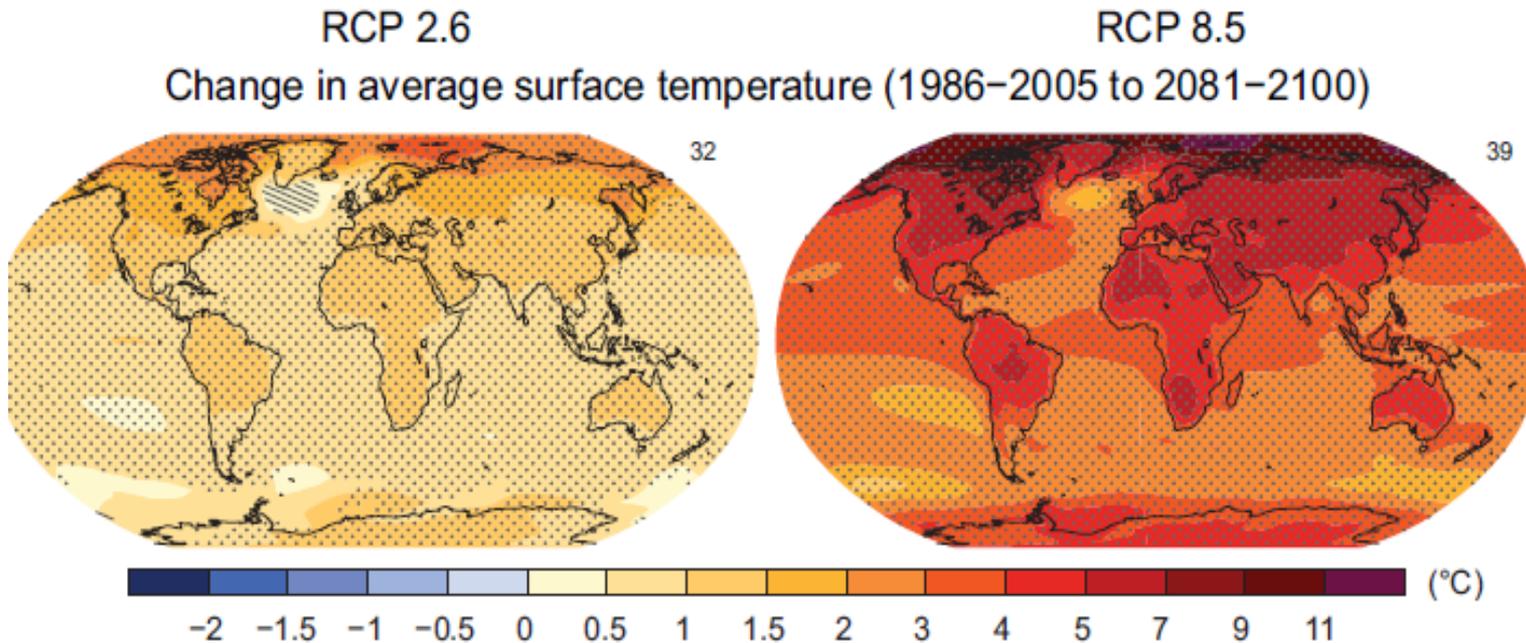


- Level and variability in climate
 - Atmospheric and oceanic temperature
 - Other factors include precipitation and humidity
- Natural climate-related events
 - Increased volatility and severity
 - Storms, extreme heat
- Slow onset conditions
 - Sea level and ocean acidification
 - Desertification
- Secondary effects
 - Deteriorated water quality, air pollution and food security
- Affects geographical areas differently

Wide regional variations



Two possible surface temperature scenarios

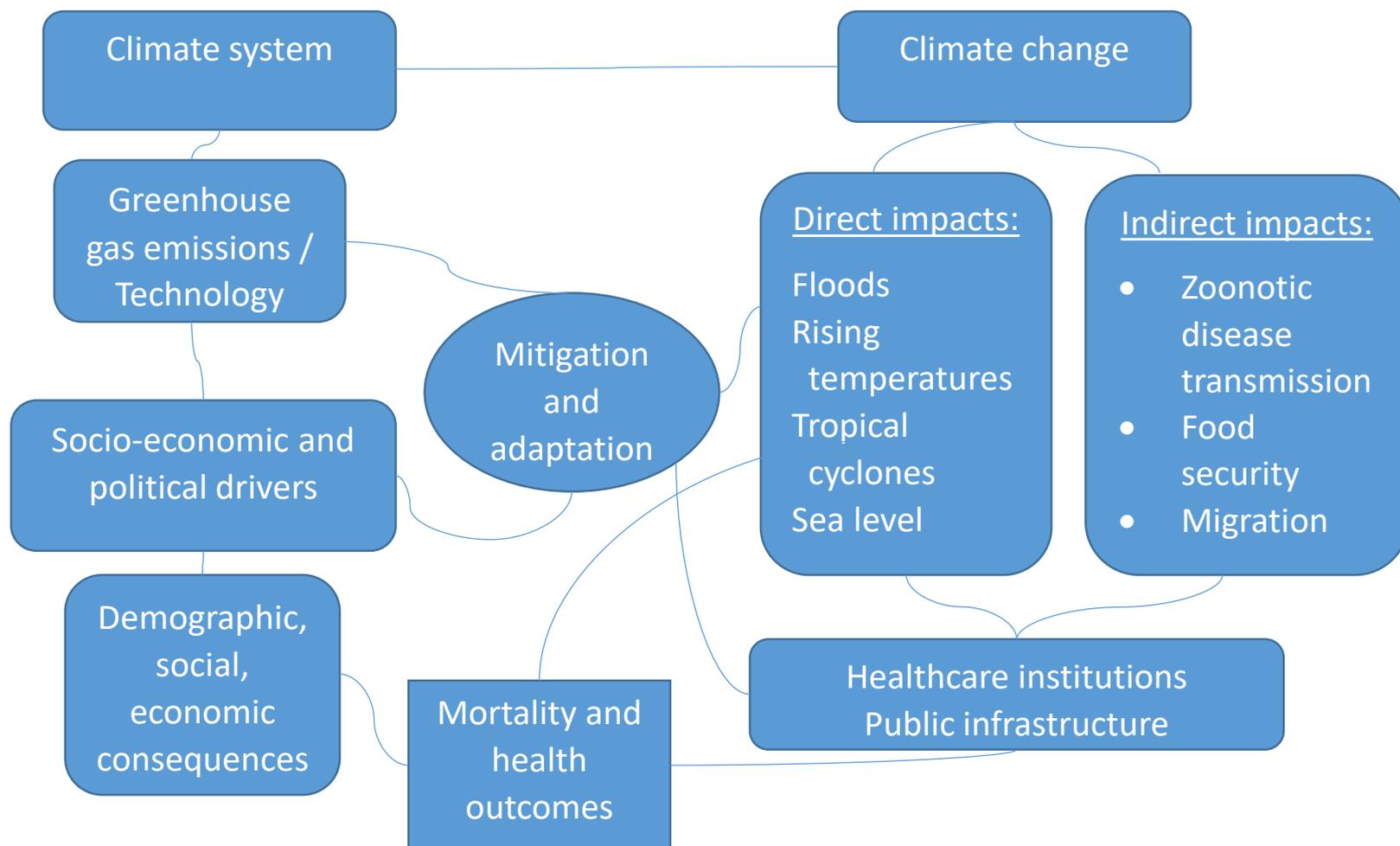


Very substantial mitigation
rapidly put in place

Little change in emissions

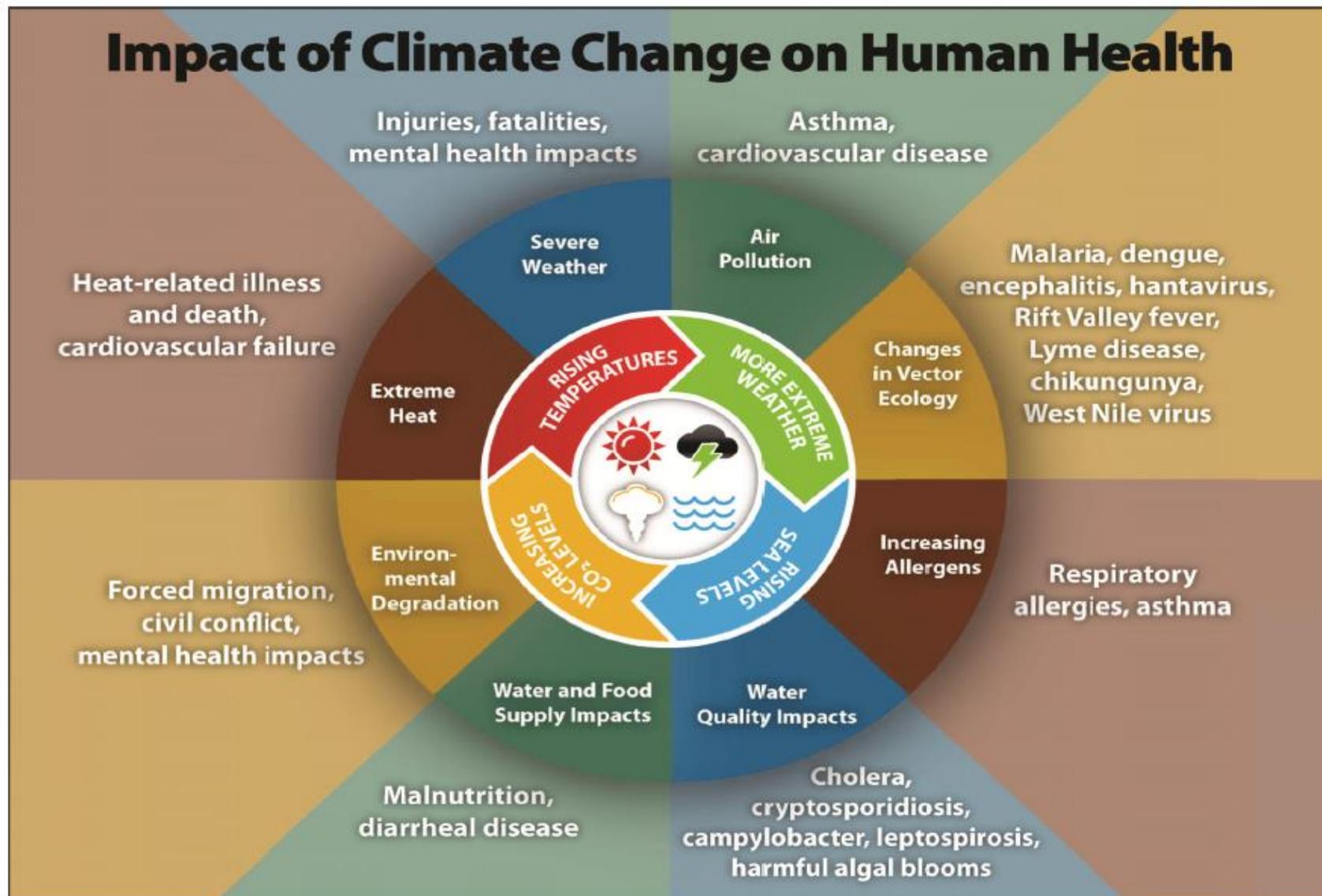
Source: Intergovernmental Panel on Climate Change (IPCC) 5th assessment report (Working Group 1, Summary for Policymakers)

Climate-to-damage process



The REWG paper deals with mortality outcomes from a complicated process

Multi-faceted effects



Source: George Luber, U.S. Center for Disease Control and Prevention

Vulnerable population



- Especially hard-hit
- In less-developed countries, regions, population segments
 - Depends on type of effect, e.g., heat & extreme ages & location
- May not be able to afford
 - To move elsewhere
 - When affected by drought, sea level change, conflicts or other catastrophe
 - Mitigation to prevent or minimize losses in advance
 - For example, infrastructure
 - Adaptation
 - For example, dykes
 - If severe post-event or condition

Climate change factors that can affect mortality



- Temperature
 - Heat-stress, increase in air pollution
- Precipitation
 - Famine, flooding, forced emigration
- Extreme events
 - Increased severity of storms, heat-events, wildfires
- Slow-onset conditions
 - Sea level rise, desertification
- In some cases, climate change is only a contributor
 - The relatively new field of attribution focuses on percent of causation

Increased disease levels



- Diarrheal diseases
- Mosquito-spread: malaria / dengue
- Illness / infections: gastro-intestinal
- Asthma, respiratory, cardiovascular
- Cancers
- Cholera: from poor water quality and floods
- Heat-related, including cardiovascular, especially affecting the frail elderly

Other adverse effects



- Increased severity of droughts and famine
 - Most people can overcome the effects of a couple of days, but it can turn catastrophic if extended to months or years
 - Has been shown to contribute to conflicts and violence
 - Increase in suicides in India
- Increased ocean warmth
 - Can increase severity of extreme storms
- Air pollution
 - Increased warm weather can exacerbate
 - Several causes can also contribute to warmer temperatures
- If temperature goals (e.g., 2°C) are not achieved
 - Can result in reduced GDP, which in turn can affect overall mortality
- Can also contribute to increased illness, property damage, poverty and inequality

Some favorable effects



- Warmer winter weather
- Better agricultural outcomes in some regions
- CO₂ fertilization effect
- Adaptation efforts can at the same time also improve quality of life, as well as reduce heat-related deaths
 - For example, more air conditioners
- Mitigation efforts, including
 - More energy efficient transport
 - Lower greenhouse gas emissions
 - Reduced air pollution
- Potentially better nutrition



- Most insured and pension populations tend to be upper and middle income
- May not be as greatly affected as vulnerable populations, although there may be exceptions
 - Sudden natural disasters
 - Can affect everyone
 - Residences and workplaces may be better constructed and better placed, so fewer losses
 - Able to afford better medical care and preventive measures
- Micro/inclusive insurance, mobile phone, cooperative and social insurance can help financial recovery post-disaster
 - Separate IAA REWG project on vulnerable populations and insurance



- Challenging
- A great deal of uncertainty
 - Many aspects of climate change difficult to estimate; examples
 - Hurricane trajectory
 - Severity of famines
 - Speed of deglaciation
 - Climatic feedback loops
 - Effects can be volatile
 - Especially due to the time horizon involved and low-frequency / high severity
- Stochastic analysis may be useful



- Extreme temperature stresses
 - Techniques used include
 - Study of specific causes of death
 - Trend in or excess of seasonal or situational averages
 - One study indicated more deaths at moderate deviations from average temperature than extreme deviations
- Alternative approaches
 - Scenario analysis
 - Stress testing if the effects on an institution is being studied



- Case study in the paper addresses the effect of warmer temperature in the U.K.
 - Conclusion: fewer deaths may result, as effect of warmer winters more than offset warmer and spikier summers
 - Major benefit of the case study is the analytical process described
- However, U.K. conclusion is not generalizable
 - Various sources indicate a net increase in deaths will be likely in much of the rest of Europe
 - Lesson learned: better health and emergency preparedness can minimize deaths
 - For example, heatwaves in Paris in the last few years resulted in many fewer deaths than under corresponding conditions in 2003
 - In India over the last 50 years, a substantial increase in mass heat-related deaths (events of more than 100 deaths)



- Expected changes create uncertainty that actuaries should be aware
 - Consider the implications of climate change for assumptions made and communication of the associated uncertainty to clients
 - Especially through scenario and stochastic techniques
 - Some suggest economic/demographic uncertainties greater than those associated with climate change
- In population segments where most actuaries work
 - Relatively limited short-term impact is expected
 - Nevertheless, in some markets and countries with significant vulnerable populations, direct / indirect effects may be substantial
- Modeling presents many challenges to which actuaries may be able to contribute
- Provide objective viewpoint regarding this potentially controversial area
 - May not be a unique answer



- Expected effects of climate change on overall global mortality may be relatively small
 - But direct and indirect effects may be significant in certain geographic regions and vulnerable populations
 - Affect on public health and property may be extensive



Sam Gutterman (U.S.) FSA, FCAS, MAAA, FCA, CERA, HonFIA
co-vice chair, IAA Resources & Environment Working Group

sam.gutterman1@gmail.com

IAA Paper:

www.actuaries.org/ClimateChange&Mortality