



Institute  
and Faculty  
of Actuaries

# Practical Guide to Climate Change for Health, Care and Protection Actuaries

Health and Care Climate Change Working Party



Presented to the IFoA Sustainability and Health &  
Care Boards

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# 1. Introduction

The purpose of this guide is to provide a practical framework for actuaries practising in the Health, Care and Protection ("H&C") sectors when considering the potential impact of climate change on morbidity in their actuarial work.

The Intergovernmental Panel on Climate Change's (IPCC) 2021 report<sup>1</sup> on the physical impacts from climate change unequivocally attributes global warming to human activities. Emissions must reach net zero to stabilise temperatures and limit the irreversible human-induced effects on the climate system. The report clearly outlines warnings with greater conviction and certainty than previous reports on the subject. Without rapid, large-scale emissions reductions, outcomes aligned with the Paris Objective of limiting average global warming to levels of 1.5 °C or 2.0 °C will move beyond our reach.

The report clearly outlines that physical risks from climate change are expected to continue to emerge, even with significant reductions to future emissions.

The size and scale of actions needed to try to limit global average temperature rise to 1.5 °C or 2.0 °C are potentially disruptive, particularly where action is delayed. Sustained changes across all aspects of the economy are needed alongside coordinated global responses. This unprecedented level of change will impact on firms' markets and operations.

Actuaries therefore need to incorporate climate change considerations into their work.

While there remains uncertainty over the ways that climate risks will emerge, how they will impact, and the timing and magnitude of that impact, economic and actuarial projections that do not allow for these risks do not reflect the scientific evidence.

In April 2022 the IFoA issued its second Risk Alert on climate change and sustainability related issues<sup>2</sup> highlighting that there "is a risk that actuaries may not appropriately consider, or communicate clearly, the impact of climate change and sustainability related issues in their actuarial work".

There is a vast array of literature available - from the IFoA as well as hundreds of other institutions and researchers - and the evidence, insight and forecasts are constantly evolving.

While actuaries have the responsibility of ensuring that they take the impacts of climate change into account in their work, it isn't practical for all actuaries to be specialists in this field or to conduct their own detailed research.

This guide aims to provide:

- A broad overview of the climate change related risks as they may impact morbidity, especially in the context of 'living benefits' provided by the Health, Care and Protection sectors,
- Practical suggestions on how these might be considered in actuarial work, and
- Signposting to additional sources of relevant information.

The guide is structured as follows:

- **The nature of climate change risk** - providing an overview of climate change and the associated risks with an emphasis on health and morbidity related elements
- **Potential impact of climate change on the Health, Care and Protection sectors** - providing

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<sup>1</sup> <https://www.ipcc.ch/report/sixth-assessment-report-working-group-i/>

<sup>2</sup> <https://actuaries.org.uk/media/btbbojz/2022-climate-change-and-sustainability-risk-alert-final.pdf>

a framework to think about the link between health impacts of climate change and how morbidity-related insurance risks might manifest.

- **Key climate change topics and challenges for the Health, Care & Protection sectors** - describing a few specific examples of climate change impacts which are reasonably well researched and expected to have material impact, and showing broadly how these can be taken into account applying the recommendations set out in this guide.
- **How Health, Care and Protection actuaries can allow for climate change in their work** - outlining how relevant climate change risks might be identified, impacts evaluated and mitigated, and how this might be communicated and evidenced in line with the April 2022 Risk Alert on Climate Change; also outlining the potential value (and limitations) of analytical models, providing practical suggestions on allowing for the uncertainties associated with climate change risk.
- **Practical Suggestions** - a list of practical steps that actuaries and firms could take to support the application of the recommendations in this guide.

This guide intentionally **does not** set out to:

- Provide specific guidance for actuaries in enterprise risk management roles - a separate guide - "A practical guide to climate change for risk management actuaries" has been published<sup>3</sup>. However this guide may be useful to actuaries performing risk management roles in the Health, Care and Protection sectors. It is recommended that actuaries work collaboratively with their colleagues in the risk management function of their organisation when addressing climate change issues in their work.
- Cover the considerations relating to 'liability risk' - exposure to climate-related litigation risk.
- Cover climate-related reporting standards and requirements.

This guide is one of several produced by the IFoA for actuaries working in various financial services sectors, all supported by the IFoA publication - "Climate Change for Actuaries: An Introduction"<sup>4</sup>.

This guide isn't mandatory professional guidance.

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<sup>3</sup> <https://www.actuaries.org.uk/practice-areas/sustainability/sustainability-practice-area-practical-guides>

<sup>4</sup> <https://www.actuaries.org.uk/system/files/field/document/Climate-change-report-29072020.pdf>

## 2. The nature of climate change risk

This section provides a brief overview of climate change, the likely and potential impacts on the natural and human worlds, providing context for the next section which describes the consequential risks and impacts on the Health, Care and Protection ("H&C") sectors.

The potential ways in which climate change might manifest in the natural and human world and the resulting impacts on the H&C sectors are multiple, varied, inter-related and difficult to predict in terms of timing and magnitude.

In exploring the potential consequences of climate change for the H&C sectors (or any other sector) it can be useful to consider:

- the way in which climate change is likely to manifest in the human and natural world (e.g., higher temperatures, greater flood risks, new vector borne diseases),
- how each of these might impact the H&C sectors (including insurance/funding, and the provision of and demand for healthcare services), and ultimately
- the implications of this for H&C actuaries performing various roles.

The risks associated with climate change can be further categorised into the risks which arise directly from the changing climate and the risks driven by the actions taken to limit or adapt to climate change. The following definitions are suggested in the Task Force on Climate-related Financial Disclosures (TCFD) Overview booklet<sup>5</sup>:

**Physical risks:** Physical risks resulting from climate change can be event-driven (acute) or longer-term shifts (chronic) in climate patterns. These risks have potential financial implications, such as direct damage to assets, and indirect effects via supply-chain disruption.

**Transition risks:** Transitioning to a lower-carbon economy may entail extensive policy, legal, technology, and market changes to address mitigation and adaptation requirements related to climate change. Depending on the nature, speed, and focus of these changes, transition risks may pose varying levels of financial and reputation risk to organisations, through different rates of changing customer or community perceptions of an organisation's contribution to or detracting from the transition to a lower-carbon economy.

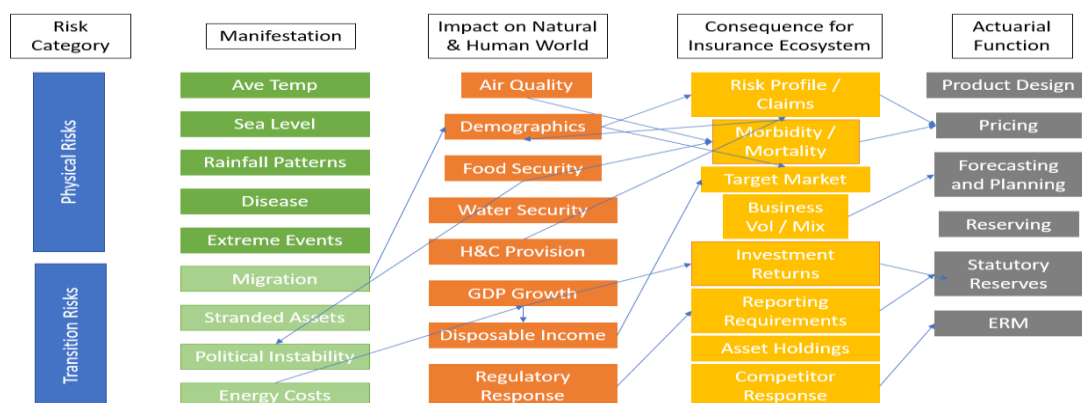
There is a third category of risk, sometimes referred to as liability risks, that captures the reputation risks and other franchise impacts these risks may carry from exposures to climate-related litigation risks, regulatory censure, or adverse customer and other stakeholder perception of the enterprise. As mentioned in the Introduction, this category of risk is outside of the scope of this guide.

This working party developed the following conceptual model of climate change impact that may be useful in this context and which can be used in combination with the physical/transition risk perspective.

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<sup>5</sup> <https://assets.bbhub.io/company/sites/60/2022/12/tcf-2022-overview-booklet.pdf>

**Fig 1 - Impacts of Climate change on the human and natural world, the H&C environment, and actuarial functions in that environment**



The structure of the guide broadly follows this conceptual model.

## Climate change impacts on the human and natural world

There is a wide range of ways in which climate change will manifest in the human and natural world, each of which is a potential driver of impacts on the H&C sectors. Each should be considered separately as they may impact in different ways, and with varying timing, geographical spread and magnitude. Examples include:

- Average temperature - rising in many areas, potentially falling in others
- Temperature extremes - greater extremes, potentially with higher frequency
- Rainfall patterns
- Mean sea level
- Extreme weather events
- Wildfires
- Air quality
- Lifestyle changes
- Reduced disposable income
- Health and care provision

## Impacts on the H&C environment

Each of the climate change impacts above can be mapped to one or more elements of the health, care and protection sectors which they in turn impact. The nature of potential magnitude of these impacts can be explored. Examples include:

- Frequency and severity of various diseases
- Demand for healthcare services and health insurance

## Implications and actions for H&C actuarial functions

And finally, the impacts on various elements of the H&C environment can be mapped to actuarial functions, giving those functions visibility of the climate change impacts they need to take into account in their work.

The following section outlines the potential impact of climate change on the H&C sectors, with a focus on morbidity.

# 3. Potential impact of climate change on the Health, Care and Protection sectors

Morbidity risks arising from climate change will affect many different products in the health, care and protection sectors and emerge in different ways. Typical short-term products might include hospital or health cash, medical expense indemnity or accident insurance, while typical longer term products might include critical illness sold as a life rider or stand-alone, income protection/disability insurance or long term care. All these products will have exposure to changes in morbidity risks arising from climate change, as well as potentially exposure to climate change through transition risks that may affect product demand, government policy and supply side costs (i.e. the costs incurred by H&C providers which will ultimately be passed onto funders). The nature of the impact will differ substantially depending on geography, demographics of the covered population, the time frame considered and the covered benefits, as well as broader macro-economic and political landscape.

For physical risk impacts, there are multiple conceptual models that establish links between climate and health/morbidity. Some examples are:

- The World Health Organisation model of climate-sensitive health risks<sup>6</sup>
- CDC model of Climate change and health from the Fourth National Climate Assessment<sup>7</sup>
- For the UK, the King's Fund cites a report from the Department for Energy, Food and Rural Affairs, which is somewhat outdated, but also provides some quantification of effects on mortality<sup>8</sup>
- The June 2021 UK Climate Change Risk Assessment (CCRA) Health and Social Care Sector Briefing (noting that these are not based on extreme scenarios)<sup>9</sup>

To understand the impact on specific populations, it can be useful to separate the impacts on health between acute and chronic and to consider both demand and supply side effects and short-term effects versus longer term trends, where small changes each year may add up to significant impacts over the policy duration. For example:

- a) **Demand** for certain health and care services may increase as a result of one-time weather events, which become more common or more severe, such as injuries from flooding, or short-term heat waves, thus increasing frequency and potentially severity of certain types of claims. This is both a short term and long-term impact.
- b) **Demand** for some health services may increase as a result of an increased prevalence of chronic diseases. this could be due to higher average temperatures combined with changes in air pollution, or the long-term effects of severe weather shocks - a good example might be higher prevalence of mental health conditions following flooding, which could affect both the use of health services and sickness rates. Small changes in the prevalence of chronic diseases can have relatively large impacts on claims frequency and severity for morbidity-related claims. This is typically a longer-term trend, with small changes each year leading to significant changes in morbidity rates over the

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<sup>6</sup> <https://www.who.int/news-room/fact-sheets/detail/climate-change-and-health>

<sup>7</sup> <https://nca2018.globalchange.gov/chapter/14/>

<sup>8</sup> <https://www.kingsfund.org.uk/projects/time-think-differently/trends-broader-determinants-health-climate-change>

<sup>9</sup> <https://www.ukclimaterisk.org/independent-assessment-ccra3/briefings/>

long term.

- c) Epidemics and/or new chronic conditions may emerge as a result of climate change, leading to higher **demand** for health and care services. These may not be specifically excluded by existing health and care policies and therefore can lead to higher frequency and changing severity of claims over both the short and long term.
- d) Transition risks may result in changes in income distribution and inequalities, which affects health and **demand** for healthcare, as well as demand for health insurance, leading to changes in insured versus general population utilisation rates and changes in the pattern of healthcare use by type of service and provider. In addition, pressure on public finances may lead to a different split between publicly and privately funded risk management solutions for morbidity risks over the long term.
- e) De-carbonisation and transition costs may affect the **supply** side, for example through increased costs for hospitals and other health and care settings, which will have to be passed onto funders. This might take the form of a sudden shock if there is a policy or regulatory imperative for providers to de-carbonise quickly or may be a slower long-term trend. If the increased costs of supply cause private insurance solutions to become unaffordable and unsustainable, the impact of changing demographics due to selective lapsing in the portfolio over time will need to be considered.
- f) If hospitals or other care providers are also affected by acute severe weather events and are unavailable, the patterns of normal healthcare **supply** and use may be disrupted, with consequent higher or lower severity of claims.
- g) For countries where there is a significant interaction between private insurance and state provision or social insurance, it is important to consider the impact of climate on state-provided morbidity risks, as that may have knock on effects on the private sector, both on the **demand** and **supply** side. Lack of resilience to climate risks in state-provided services could mean a shift to greater use of private insurance. In addition, migration patterns due to climate change may have a significant impact on the profile of covered populations.

The above list is not exhaustive, and actuaries should seek to understand the local context in which they are working to understand the applicable risks to human health. More than one effect can occur simultaneously and may amplify risks overall.

The impacts of climate change do not exclusively present downside risk for insurance companies and it is therefore important to also consider potential upsides. Some examples of potential advantageous outcomes could be an increased awareness amongst consumers of risk which drives demand for insurance coverage, requirements for new products which can create new business opportunities, and positive changes in policyholder behaviour.

Understanding the local context and portfolio needs to be done at a relatively granular level and is geographically and socio-demographically specific. It can be helpful to look at segmenting portfolios, not just by local geography and understanding the climate-related perils for that geographical region, but also to understand that the effect of a physical or transition risk on different parts of the portfolio by age/sex/prior health or chronic disease status, can be very diverse. This implies that it is useful to consider the effect on different sub-populations within a portfolio, whether that segmentation is by age band, socio-economic groups, or some other population segmentation that relates to disease status.



# 4. Key climate change topics and challenges for the Health, Care and Protection sectors

The below Climate Change issues are well researched and directly affect mortality and morbidity (including mental health) across different aspects of actuarial work:

- 1. Changes in air quality** - This is observed worldwide and can have both immediate and longer-term impacts on mortality and morbidity of populations. Air pollution can lead to a rise in chronic conditions which in turn can lead to higher use of medical services and put a strain on both national health systems and private providers.  
Efforts to improve air quality may have marked impacts on the health of populations. This could occur at both local and national scales.
- 2. Changes in average temperature including extreme events** - The impact of an increase or decrease of average temperature is considered in both the Resource and Environment Issues for Pension Actuaries, and the Life Practical Guide. The main consideration for H&C actuaries is that this may impact morbidity rates within a region due to changes in patterns of illness and diseases due to warmer weather.  
This could have both positive effects- a fall in the cold-related death rate- and negative impacts due to an increase in heat-related death rates and a greater prevalence of transmittable diseases.  
Extreme weather events such as prolonged heat waves are also likely to impact the demand for and provision of healthcare acutely or even more permanently depending on the nature of the event.
- 3. Epidemics/ Pandemics**- These are distinguished from Diseases by the extent of the outbreak. Epidemics/ Pandemics can arise with greater frequency and/or severity as a result of climate change due to shifts in regional climate, and also due to changing land use which is leading to an increase in human exposure to animal and zoonotic diseases. While the impact can be catastrophic and acute, the frequency is low. When epidemics and pandemic do occur, the impact on national health systems is extreme with spill-over to private insurance sector. Health Insurance provision may be restricted by financial uncertainty and capital being consumed in other parts of the insurance industry.
- 4. Deterioration of water and food security caused by climate change** - While the impact is not immediate, it can lead to a deterioration in the health of the general population including putting a strain on national health systems which will need to redirect their resources to those most affected and vulnerable. This effect can also give rise to population movements with higher concentrations in urban areas where water and food security is perceived to be higher. This in turn can have significant side effects to mortality and morbidity as well as changing the insured population profile.
- 5. Fertility rates and infant mortality** - Both lower fertility rates and increased infant mortality rates in certain countries can be associated with environmental factors such as rising temperature. Both can lead to increased morbidity either due to directly associated claims (fertility treatments, infant respiratory treatments) or indirectly associated claims such as for mental health treatments or increased co-morbidities in later life. Such changes may lead to a wider target market and revised product designs.
- 6. Extreme weather events including flooding, wildfires and drought** - Such events which could be directly attributable to climate change, can have an acute impact on mortality and morbidity while also affecting the state and private provision of healthcare. Claim rates may



increase due to illnesses caused by such events. In addition, these events may lead to "climate immigrants" adding more strain in the provision of care. They may increase insurance awareness to the population - however this would be mostly for non-life than H&C products.

Assuming that relevant and credible historical data are available, a few practical steps could be useful in considering certain key Climate Change issues, noting that consultation with the chief medical officer is advised.

## **Changes in air quality**

For most regions we can expect good availability of historical data and air quality models.

- Check insured population exposure by location and accumulation of risk by industry
- Check age distribution as impact is expected to vary by age
- Calculate prevalence of respiratory diseases over the last 5 years
- Collect air quality index over the last time period
- Estimate the link between air quality index and respiratory diseases for the specific population or assume that existing models apply to the exposed population
- Consult experts to validate assumptions at each step
- Project claims frequency/ severity using the above models
- Test impact on total annual claims and include a factor for accumulation in certain industrial areas
- If there is no established existing model, assume a central scenario and stress test the impact on total claims
- Consider premium adjustments for the following year and gradually over the years
- Present impact on reserves to reserving committee in order to decide reserve adjustment

## **Changes in average temperature including extreme heatwave events**

The thought process would be similar to above with a few modifications due to the acute impact of the events.

- Check insured population exposure by location and if available clinical/health status, socio-economic status
- Identify population cohorts for accumulation of risk
- Check age distribution and clinical/ health status, as impact is expected to be higher on older ages and for populations with pre-existing chronic diseases
- Check seasonality of the claims experience and link it with documented weather events
- Consider that some of the impact may appear with some time delay
- Consider impact on providers due to fewer staff but more patients. This would be hard to quantify but data from previous events could give an indication
- Consult experts to validate assumptions at each step
- Assume that increased frequency of such weather events may or may not continue in the future
- Test impact on annual claims and include a factor for accumulation in certain geographical areas to allow for transmittable diseases which thrive in high temperatures
- Stress test the above assumptions
- Consider premium adjustments for the following year and gradually over the years
- Present impact on reserves to reserving committee in order to decide reserve adjustment

For all the issues consideration needs to be given to preventative measures which can be offered to policyholders to reduce the severity of claims in known problem areas. In addition, modification of cover

and policy conditions need to be examined ensuring adherence to local regulations and company risk management principles.

# 5. How can Health, Care and Protection actuaries allow for climate change in their work?

Climate change will affect multiple aspects of an insurance company, such as the insurance risks that are underwritten, internal processes, and the external environment. There is currently no market-standard integrated tool or model to allow for the impact of climate change. Further, the risks to be considered are generally complex, context-specific and involve a high degree of uncertainty. Therefore, the approach taken will vary dependent on the actuary's role and the exercise being completed.

Once actuaries have familiarised themselves with the key aspects of climate change as detailed in the prior sections, a process to allow for climate change can be designed which considers:

- **Scope**- the need to have a clear understanding of which areas of insurance company processes will be included in the exercise,
- **Purpose of the investigations**- for example whether it is a capital-setting exercise requiring a quantitative output or a horizon-scanning exercise requiring a qualitative output,
- **Time horizon**- this can present a significant modelling barrier, as described below.

## Identify relevant risks

The next step is to identify the specific risks that are most relevant to the work. This will require significant judgement, which should be documented, including those risks which have been disregarded or considered low-priority for future investigation.

The Working Party has produced a matrix of climate change impacts which could be used as a framework for this exercise which is shown in [*signpost*]

Identifying the most relevant risks will help in focusing the analysis. Some factors which could indicate a higher risk of being exposed to climate change:

- Models that require long-term assumptions:
  - Multi-year contract length (e.g. Life technique-type contracts)
  - Modelling of portfolios with a long claim emergence and/ or settlement,
  - Assumptions around renewals and longevity of customer relationships
- Exposure to concentrations such as:
  - Risk portfolios with geographical concentration,
  - Affinity groups/ group business which may be particularly exposed to particular risks
  - Risk portfolios with socio-economic concentration, such as micro-insurance

At some level every portfolio will be impacted by climate change. Contingent on the analysis being completed, one could consider which portfolios could be impacted:

- Quickly / acutely
- Most severely
- Might go unnoticed because the change happens slowly, but steadily, and is overshadowed in the short term by other factors, but action will be needed at some point.

Therefore, it may be necessary to create an action plan or review plan to ensure that all portfolios are reviewed eventually.

## Collecting and analysing data

To incorporate climate change into the work, data on both historical and projected risks needs to be collected and analysed.

This may involve working with subject matter experts including clinicians, and collecting data on climate variables, economic indicators, and other relevant factors. Once this data is obtained, statistical models can be used to project future risks based on different climate scenarios.

Useful resources may be found in the IFoA's Climate Change Curated Library<sup>10</sup>

## Modelling

Given the difficulty of obtaining relevant datasets, the potential for complex interactions, or both, it may be that an explicit model is not possible. An alternative approach would therefore be to complete a stress test-type analysis, whereby hypotheses are formed around how climate change risks may affect the parameters of an existing model.

A third approach could be a reverse stress test-type analysis, where the key assumptions of a model are flexed to a critical point (for example capital is stressed to the point of insufficient Own Funds) and hypotheses are formed around climate change scenarios which may give rise to this situation.

### *Example:*

An annual pricing exercise is to be completed which needs to take into account the effects of climate change. When reviewing the existing model, we identify that the claims frequency is a key assumption and conclude that this is an appropriate parameter to introduce the effects of climate change.

Rolling-forward the existing model assumes that the claims frequency will be the same as this year with some adjustments applied for changes in exposure, underwriting mix etc.

To introduce a link to climate change, it would be desirable to build a model which relates the annual maximum temperature, or number of days where the temperature is above a certain threshold, to the claims frequency. In many cases, insufficient data will be available to establish a clear link given the number of other variables that affect claims frequency, the likely differing impact by different population groups and the potential lag between a climate event and the subsequent utilisation of healthcare services. However, completing this exercise may give some interesting observations that can be introduced into the modelling framework, and refined by using expert input, specifically around the likely causal pathways between climate change and health and care claims for different subgroups of the covered population.

The qualitative discussion around different possible outcomes can serve as a backdrop to decision-making and is in itself a useful tool for assessing different courses of action.

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<sup>10</sup> <https://actuaries.org.uk/learn/lifelong-learning/sustainability-and-lifelong-learning/climate-change-curated-library>

## **Mechanisms for managing risk**

Based on the analysis of the data, risk management strategies can be developed that account for the potential impact of climate change on products and risks. For example, premiums may need to be adjusted based on the projected increase in losses due to climate change, or new products may need to be developed that specifically address climate-related risks. The impact of these strategies on customers and stakeholders should be considered and any changes should be communicated transparently. It is important to consider the limitations that may exist to employing risk management strategies. For example, we might assume that if climate change causes a persistent increase in the cost of claims that we will be able to increase the premiums to maintain profitability. However, our ability to increase premiums may be constrained by explicit price guarantees, or (implicit) customer expectations of annual price changes, which may lead to excessive lapsing if breached. Therefore, the ability to update and review products for continued appropriateness remains critical.

It is also important to consider that climate change may present opportunities that should be considered and communicated, such as proactive ways to address climate-change risk and contribute to the health and wellbeing of covered populations by mitigating its effects.

## **Monitoring and adapting**

It is important to monitor and adapt risk models regularly and change pricing strategies as new data becomes available. Climate change is a rapidly evolving field, and new research and data can change the way the potential impacts of climate change on risks are understood.

Qualitative and quantitative scenarios can be a useful communication tool for exploring different possible outcomes even before there is sufficient data or confidence to assign probabilities for quantitative approaches. Using a range of scenarios will help to inform longer-term business strategy. From here, insurers can develop their approach and include climate change in their Enterprise Risk Management framework.

## **Modelling barriers**

Incorporating climate change risks and considerations into demographic modelling undoubtedly adds a layer of extreme complexity, predominantly due to the amount of uncertainty involved, which includes but is not limited to:

- Time horizon: there is significant uncertainty related to how the effects of climate change will emerge over time and differing views on how adverse the impact on demographics will be. Therefore, a flexible model that can be applied over different time horizons is needed. However, it is difficult to build a model with parameters and variables that remain suitable and stable over different time horizons.
- The choice of parameters and models: the best models are robust i.e., they react well to new information and have proven predictability power when back-tested over different time periods. If the end goal is to model impacts to morbidity and mortality, there is an intermediate step in interpreting the correlation between parameters derived from observable physical risk data collected from the wider environment and parameters concerned with the impacts on health and healthcare service use.

## 6. Practical Suggestions

1. Keep up to date on climate change impacts on human health and changes in the health metrics that are important to your organisation
2. Identify the key climate change risks and impacts for your organisation, primarily but not exclusively from the perspective of your role (e.g., pricing or reserving)
3. Explore and estimate the possible impacts - e.g., on your market, customer experience, pricing and profitability
4. Pay special attention to the known and well-researched risks
5. Communicate, consult and collaborate (internally but also external to your organisation) e.g., via participating in virtual communities of the IFoA or LinkedIn
6. Create/maintain an internal cross-functional forum to facilitate, share and ensure consistency
7. Identify someone in the organisation who is responsible overall for taking climate change into account from an insurance risk perspective.



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