Should Life & Health insurers worry about the weather?

Are Life & Health insurers immune to climate of change?

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Please refer to their website for the final publication

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1. Executive Summary

The imminent health threat that climate change pauses to our societies is widely recognised. Very few question the relation between rising temperatures, changing atmospheric conditions, chronic diseases and elevated mortality risk. Each new drought or hurricane exposes our societal vulnerabilities. European heat waves are a case in point, reminding us that wealthier societies are also at risk.

Despite the onslaught of societal impacts, life and health insurers, representing 4 trillion USD in revenues, have yet experienced significant impacts. Therefore, the market is just starting to evaluate its climate change related risks. Several factors help understand what on the surface looks like a contradiction. First, while everyone might be exposed to climate driven events, a majority of the current and projected impacts happen in the developing world. Insurance penetration is still very low in most areas impacted. Secondly, the insurance industry perceives climate change as a progressively emerging concern rather than one capable of generating systemic shocks. Careful underwriting and continuous incremental portfolio management should suffice to adjust to the shifting risk landscape.

We argue that those two assumptions are will be challenged in the future. First, risk patterns are likely to change over time. For instance, the last decade has shown the spread of several vector-based diseases to new areas. Areas exposed to chronic and acute events are also likely to evolve over time, placing additional populations as risk. Secondly, the insurance industry defines shocks in the context of their solvency, and therefore from the standpoint of claim and loss experience. We argue that insurers could face shocks of a different nature, capable of stressing their business model, their ability to retain insureds and acquire new ones, and their ability to balance underwriting and investments. In the absence of shock losses, threats to the working capital itself can put a balance sheet at risk.

It is not too early for L&H insurers to strengthen analytics and risk management processes. The long tail nature of pension exposure for instance mean that policies in-force today are already at risk. Over time, the continued aggregate can become a systematic risk.

With this in mind, we offer here a framework that L&H insurers can use to evaluate, quantify and address climate change related risks. The framework relies on the same principles applied in other insurance segments. It covers risk identification, the assessment of societal vulnerabilities and ultimately the translation into financial impacts. We apply the framework to three case studies to highlight the difficulties that insurers will invariably encounter. We look at the spread of Lime disease in Canada, a region where the first case was reported less than 20 years ago. We evaluate the impacts of water resources and droughts in South America, connecting to Amazonian deforestation. We discuss pension insurance in the context of European heat waves, with a focus on life expectancy.

The case studies reveal the need to better understand the attribution of health impacts occurring during severe events. In order to understand the risk, insurers need to be able to sort out the proportion due to climate change. Methods exist to assign events to climate change but further assigning the health impacts is in its infancy. Data availability and completeness might therefore emerge as the most critical issue. Comprehensive evaluations of climate risks require the use of forward-looking information such as climate scenarios. This information is not readily usable for insurers. Adapting scenarios to fit financial risks faced by insurers will not come without difficulties. And unlike hurricanes, health crises are in part man-made. Decisions taken at the policy level can and will impact societal vulnerabilities and therefore insurers financial exposures. Many of these actions are out of the control of insurers and therefore near impossible to project.

Despite all the difficulties that will be encountered, it is time to start the journey for those who have not yet. It is good risk management, but will also benefit societies and contribute to a more stable

transition into a future climate. Ultimately, offering piece of mind and economic stability are the primary missions of the insurance industry.

2. Are Life & Health insurers immune to climate change?

The insurance's focus on climate change related risks has increased significantly in recent years. Frameworks such as the Task Force on Climate-Related Financial Disclosures (TCFD)[1] proposed in 2017[2] by the Financial Stability Board have helped crystallise the need for forward-looking risk assessments. Recent frameworks have also highlighted the pro-active role that insurers and other financial actors can play in facilitating a fair, rapid and stable transition towards a carbon neutral economy.

Multiple industry initiatives have come to life in the past few years, resulting in the publication of key methodological standards aimed to address climate-change related risks and opportunities. The focus on risk, investments and now underwriting has increased with each iteration. The recently founded Net Zero Insurance Alliance (NZIA)[3], a group of more than 20 insurers *committing to individually transition their underwriting portfolios to net-zero greenhouse gas (GHG) emissions by 2050* show how the industry is migrating towards full accountability at a balance sheet level.

Yet the focus to date has primarily been on Property & Casualty (P&C) insurance. For instance, the United Nations Environmental Program Financial Initiative (UNEP FI) Principles for Sustainable Insurance (PSI) report[4] published in 2021 proposed a technical framework for the assessment of physical, transition and litigation risks that primarily focused on Property risks. Property insurance risk is clearly linked to projected changes in the frequency and severity of acute weather. The impacts are measurable using concepts already in place in traditional risk analytics frameworks.

The 2019 Chief Risk Officer (CRO) Forum paper "The heat is on"[5] stands as one of a few recent exceptions. The publication provides an overview of potential considerations for Life insurers under various temperature scenarios. Most noteworthy, the CRO Forum states that both in-force and new business might be impacted by climate change, with insurers potentially experiencing adverse claim patterns along with potential deteriorations in investment returns and changes in the potential population of insureds.

For life & health (L&H) insurance, the link between potential climate impacts and risks is not as straightforward as they are in P&C insurance. Acute impacts capable of raising solvency concerns are not as prominent. The broad consensus is that the risk will likely evolve slowly and that relying on past loss experience will continue to provide accurate risk perspectives. Insurers have not seen direct climate impacts yet and estimate that management processes will suffice to face future changes in risk levels.

In contrast, the potential health impacts of climate change on societies are undeniable. In its COP-26 special report[6], the World Health Organisation (WHO) describes climate change as *the single biggest health threat facing humanity*. Climate change has the potential to drastically impact how our societies function, by exacerbating existing food and water security concerns, by challenging how we manage the propagation of diseases, and by threatening our ability to shelter in the face of more frequent and more pronounced weather-related catastrophic events.
The health risk related to climate change are also not just a future problem anymore, as *health professionals worldwide are already responding to the health harms caused by this unfolding crisis*,

[1] https://www.fsb-tcfd.org
[2] https://assets.bbhub.io/company/sites/60/2021/10/FINAL-2017-TCFD-Report.pdf
[3] https://www.unepfi.org/net-zero-insurance/
[4] https://www.unepfi.org/psi/insuring-the-climate-transition-the-final-report-on-the-project-of-un-environment-programmes-principles-for-sustainable-insurance-initiative-to-pilot-the-tcfd-recommendations/
[5] https://www.thecroforum.org/wp-content/uploads/2019/01/CROF-ERI-2019-The-heat-is-on-Position-paper-1.pdf
[6] https://www.who.int/publications/i/item/cop26-special-report

according to the WHO report. And while today this risk is mostly faced by the poorest nations, over time it is likely to spread towards developed countries and its large population of insureds.

So on one hand climate change represents a well documented, widespread current and projected risk for societies, while on the other hand the consensus among life and health insurers is of a gradually emerging issue. Does this apparent contradiction mean that L&H insurers are immune to climate change?

We believe that what is considered risk might driver this gap. It is likely that climate related life and health losses will continue to emerge gradually as the risk increase, backing insurers perception that climate change will not represent a shock to their portfolio. Over time however, the market could experience a reduction in the available population of potential insureds, as a result of changes in insurability, affordability and coverage. Therefore, the market could be exposed to a new type of shock, capable of impacting its entire entire business model. While historical data might indeed enable an adequate estimation of the claim risk in the short term, the amount of business that can be written could be reduced to the point where it threatens the viability of some businesses.

Expansions in premium over time have been possible because of rapid advancements in treatments and related improvements in lifestyles. The industry then, to some extent, banks on the assumption that progress will continue at a similar rate. Climate change impacts might alter historical trends and create indirect pressure on insurability. The idea of dealing with the issues when they happen might be challenged in that context. The global Life & Heath insurance market today is close to 4 trillion dollars in premium[7], making this issue a potential systemic risk for our societies.

We are not setting out to address the question of insurability, but rather to provide a perspective on why this risk matters and how to formally evaluate it. Sound decisions, whether or not resulting in an active response, will need to be supported by sound long term views of risk. Analyses are needed today even if the risk seem immaterial based on past claim experience.

Health impacts are not only physical but also mental, and the social divide might play a critical role in their severity and frequency. Compounding effects should be expected, pushing not just the less fortunates but also segments of the population that are currently insurable towards uninsurability. As part of this analysis, we are starting to focus on this issue in conjunction with climate considerations. We acknowledge that a lot more work is needed in that context. But more importantly, we recognise that a paradigm shift is needed. With this work, we aim to change the view that L&H exposures are immune to the type of rapid changes that could be observed on the Property side. While the risk might unfold on longer time frames, it will likely reach higher levels of impacts, worth preparing for today.

[7] https://www.swissre.com/institute/research/sigma-research/Economic-Insights/global-life-health-insurance-2021-after-covid-19.html

3. Contrasting businesses

Life & health coverages differ significantly from those can be obtained for Property & Casualty (P&C) risks. The differences help explain the different approach to and focus on tackling climate change related risks.

Firstly, one of the most dramatic demonstration of climate change is in how it affects catastrophes. More frequent droughts and floods are expected as a rainfall of greater variability in global precipitations. Elevated temperatures and dry conditions also combine to alter the occurence and severity of wildfires, with many more properties and people at risk in fire prone regions as well as in areas traditionally classified as low risk. Heat waves are putting pressure in infrastructures, power generation and our means of communication.

P&C insurance is directly impacted by catastrophes and stand to see increasing risk with every fraction of a degree of temperature increase. Financially protecting properties and businesses against the adverse impact of weather is core to the business. This led to the development of catastrophe models in the early 1990s. In turn, the same methods have been instrumental to the development of forward-looking analyses at the core of climate risk assessments. Catastrophes also result in loss of lives, physical injuries and even mental health issues. The resulting claims however have historically remained low compared to the size of the business, and therefore the have not represented an area of comparatively intense focus.

Asbestos losses in the United States over the past few decades show that the business is not fully immune to acute events however. The timelines over which this event unfolded however are very different than those experienced in natural catastrophes. The event is seen as a unique set of circumstance rather than being one draw from an underlying distribution, such as is the case with hurricanes for instance.

Secondly, and in contrast to that first point, life & health insurance can generally reliably rely on large population of insureds and accident data to estimate, price and underwrite there risk. The data is generally consistent over time and any trends can be captured within the data itself and projected forward. Life & health coverages therefore lend themselves better to traditional actuarial reviews. Stochastic analyses used to estimate the risk of infrequent risks are not as embedded in the risk analyses. Comfort levels deals with the inherent uncertainty of forward-looking information is not as developed, except when it comes to financial projections.

This leads us to the third aspect worth noting. For a large segment of the L&H market, investments are a crucial component of the profitability of a policy. Life insurance ion particular is usually a long tail business. The premium is earned over time and often invested over periods of years or even decades. The returns ultimately help fund the potential loss and also contribute to making the business profitable over time. Duration of assets and liabilities are oftentimes set to similar timelines to ensure that the business is able to pay claims when there occur. Therefore, L&H businesses rely heavily on premium volumes, risk diversification and on a full grasp of investment risks. The latter could present them with increasing challenges linked to transition risks.

Long term perspectives are probably more relevant to L&H insurers than they are to P&C insurers. While P&C insurers are worried about disconnects between past probabilities and current risks, L&H insurers also need to project future returns and the long term economic trends. The impact of climate change on hazard, the indirect consequences on health as well as the inter-related potential transition risk need to be considered. It is therefore a more complex issue to address.

L&H insurers could however have a greater opportunity to affect change at the policy level. Health crises are in part man-made given the importance our health infrastructures play in responding to emerging health threats. By quantifying and communicating the risk, L&H insurers can hope to influence policy decisions and therefore the level of risk itself. Insurers at large also have a chance

to affect change among their customer base. Many companies already offer incentives to exercise more. Why not add incentives to help protect the environment, by for instance choosing soft mobility alternatives. L&H insurers might be best positioned to create this type of impact, as any shifts would directly contribute to their core business loss ratios.

Fourthly, both insurance sectors are regulated, however at least in some market flexibility around base coverage is more prescribed in the health insurance space. In contrast life insurance is usually discretionary and so are coverages such as content on the P&C side. In cases where minimum coverages are prescribed, the degree to which insurance can affect change could be more limited.

4. A proposed analysis framework

4.1 Conceptual approach

In the previous section, we have highlighted differences between L&H and P&C insurance that might help explain how each approach climate change related risks. We mentioned the differences in analytical approaches driven the data available in each line. In the context of climate change related risks, methods have to converge across insurance lines, at a minimum in order to provide consistent information for external stakeholders, including regulatory bodies. Relying exclusively on past experience can not provide a full representation of the potential future risk. That fact is well known to P&C insurers, who for several decades have relied on stochastic modelling to quantify catastrophic risks.

The proposed framework therefore draws from recent climate-change related work conducted in the P&C market. The assessment starts with an analysis of environmental impacts. Those set the stage for health impacts, such as injuries, mental traumas or loss of life. Ana analysis of the proportion of impacts driven by climate change itself must be realized, using for instance attribution methodologies. Last, the expected health impacts need to be translated into insurance losses, accounting for policy terms and conditions. Given terms and conditions, take-up rates considerations and insurability, a fraction of the total expected health impact (the total might be defined as gross loss) will be insured and represent a direct risk for insurers. This fraction will vary by region, by peril and based on the structure of a policy itself (resutling in a net loss).

1

The first step is common to both P&C and L&H. Using forward-looking climate scenarios, central to the TCFD framework for instance, a set of potential future conditions can be derived, each leading to a range of environmental impacts. Risks can be either acute or chronic. In contrast to P&C, chronic risks are likely to be more material for L&H insurers than acute risks. L&H insurance brings the additional complexity of mental health issues, which impacts may exist long after a particular event take place. Mental health issues can arise even in the absence of a specific triggering events and instead reflect a general ambient stress or fear of the unknown. Transition risks, both linked to and affecting economic conditions are likely to also amplify the potential impacts. Deteriorating economic conditions can for instance impact lapse rates for existing illnesses.

2

Once future climate macro- and event- conditions are assessed through climate scenarios, potential economic losses can be projected using societal exposures and vulnerabilities. In the catastrophe space, models have been developed over the past several decades to estimate potential economic losses from weather events. Furthermore, for more than a decade, methodologies have been developed to attribute losses to climate change in recent events[8]. The focus has mostly remained on property exposures, but recent analyses have attempted to attribute health issues as well[9]. The question of attribution in L&H is made more complex because of time frames and the potential impact of various overlap causes.

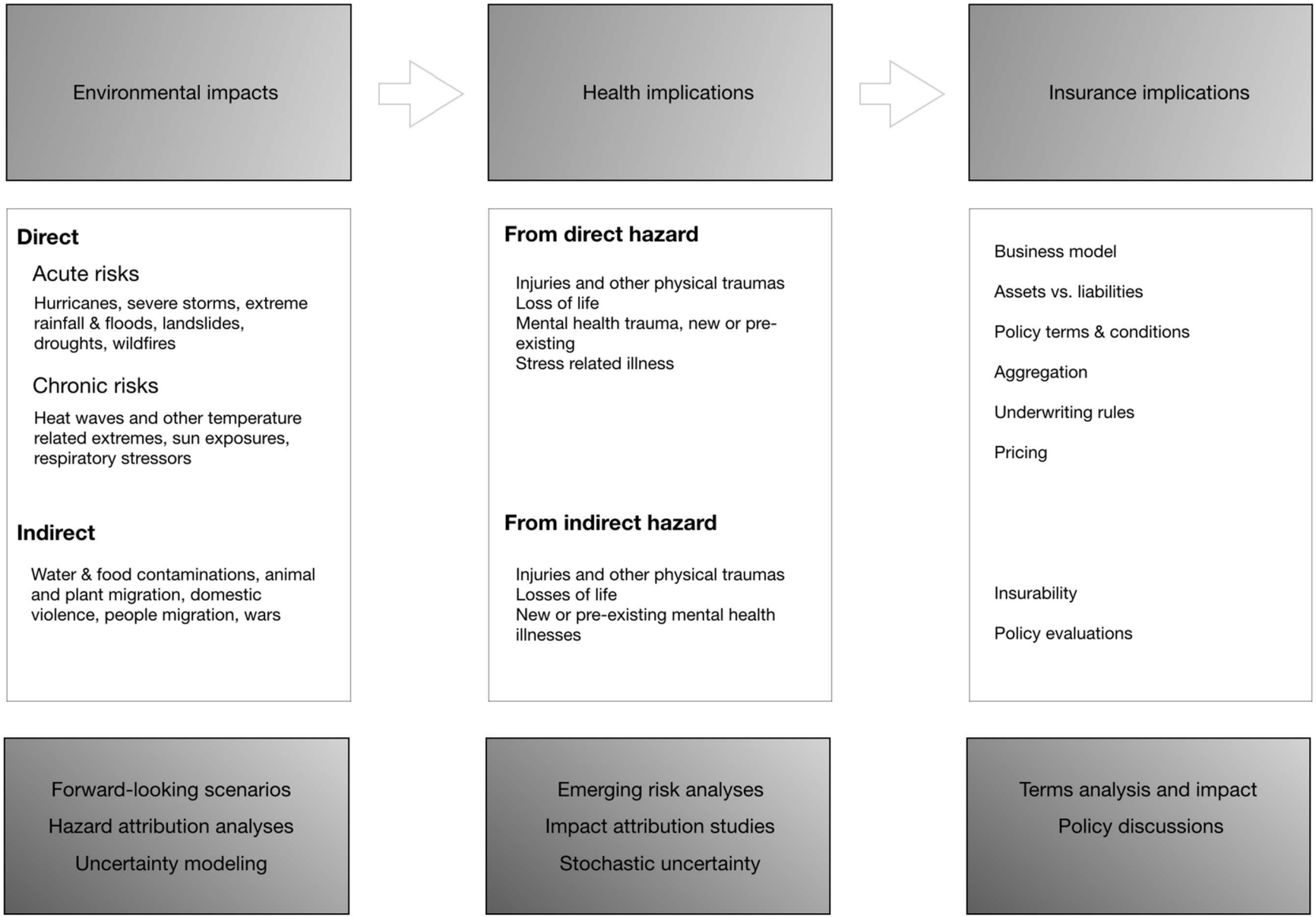
3

Lastly, the societal losses have to be translated into insurance losses to support risk assessments and insurance disclosures. Difficulties here arise not only with respect to the calculation of expected net losses (losses after the application of terms and conditions), but also with the projection of potential terms and conditions into the fu-

[8] https://www.annualreviews.org/doi/abs/10.1146/annurev-environ-102016-060847
[9] https://iopscience.iop.org/article/10.1088/1748-9326/11/7/074006

ture, the extent to which those terms with hold insight of policy changes, considerations of future trends in investments as well as with considerations of investment returns given transition risks. Additionally, long lasting impacts can be registered years after a triggering event, and might have multiple causes. In the P&C, situations with compounding effects are rarer, but demonstrate the difficulty at stake (2005 hurricane seasons with areas of Florida affected by multiple hurricanes, challenging contractual terms and conditions related to the application of event vs seasonal deductibles, for instance). As weather, climate and economic conditions evolve, the clash of various causes and their impacts on life and health issues could have a significant impact of losses and might be nearly impossible to quantify.

3


Environmental impacts
Health implications
Insurance implications
Direct
Acute risks
Hurricanes, severe storms, extreme rainfall & floods, landslides, droughts, wildfires
Chronic risks
Heat waves and other temperature related extremes, sun exposures, respiratory stressors
Indirect
Water & food contaminations, animal and plant migration, domestic violence, people migration, wars
From direct hazard
Injuries and other physical traumas
Loss of life
Mental health trauma, new or pre-existing
Stress related illness
From indirect hazard
Injuries and other physical traumas
Losses of life
New or pre-existing mental health illnesses
Business model
Assets vs. liabilities
Policy terms & conditions
Aggregation
Underwriting rules
Pricing
Insurability
Policy evaluations
Forward-looking scenarios
Hazard attribution analyses
Uncertainty modeling
Emerging risk analyses
Impact attribution studies
Stochastic uncertainty
Terms analysis and impact
Policy discussions

4.2 Case study #1: The propagation of vector-borne diseases

The ability for vector-borne diseases to spread into new areas might be accentuated in a changing climate. Temperature, humidity and precipitation are critical factors for the reproduction and spread of mosquitos and ticks. Changes in those factors will likely modify breeding grounds, potentially triggering new health risk[10]. The risk should be expected to broadly increase, however, some regions might experience easing (i.e. in regions where temperatures become too high or atmospheric conditions too dry to support vector propagation).

The El Niño Southern Oscillation (ENSO) already offers some insights into possible risk patterns. In a recent study[11] published in the proceedings of the American Academy of Science, Fisman and co-authors show increased levels of risks for vector-diseases in the Western U.S. during El Niño phases. The increase in risk does not necessarily translate into an increase in insurance losses however. The connection would need to be analysed. A study of loss experience may shed light on that aspect. To the extent that sufficient data is available (i.e. covering several ENSO cycles), it may also help draw some conclusions on the strength of the relationship ans how new extremes might impact public health and insurance economics. Of course, ENSO episodes are cyclical rather than permanent. Similar but persistent conditions might produce different results.

Recent examples of vector-borne diseases that have spread outside of their normal regions of activity include Zica[12] and Lyme diseases[13]. Exposure to the Zica virus during pregnancy has been associated to neurodevelopment abnormalities in newborns. During the recent Latin America outbreak (2015 through 2016), nearly 2% of studied infants and foetuses in Colombia[14] were affected. During the same outbreak, a rate of infection of 7% was documented in French territories[15]. The rate of infection was as high as 15% during the first trimester in a U.S. study[16]. The virus has life long consequences, including the potential for brain damage. The 2016 outbreak was unique in that it became a global pandemic, affecting areas where the virus had never been observed before[17,18]. It is possible for a virus to rely on a wider regional reach to scale globally, including in regions where the vector is not present at all.

The combined effect of meaningful infection rates and a geographic expansion via carriers can result in a measurable, near-acute risk for an insurer. With increasing temperatures and precipitation conditions, one might expect the risk to spread further and outbreaks to occur more frequently. In that case, past claim and loss experience would not be a reliable indicator of future risk. Recent studies evaluating the risk using forward-looking climate scenario have highlighted the potential for spread and increased severity, including in what we know as temperate climates[19,20].

The risk for insurance resides with pre-natal and family policies covering the children automatically, potentially including mortality clauses. Sadly, statistics show that infants with microcephaly have a 20% chance of dying during their fist year. The life expectancy then is only 35 years. Economic costs of the 2015 outbreak have been estimated at more than USD 10B[21]. Insurance does not bare

[10] https://www.healthaffairs.org/doi/10.1377/hlthaff.2020.01125
[11] https://pubmed.ncbi.nlm.nih.gov/27791069/
[12] https://www.sciencedirect.com/science/article/pii/S1755436521000426
[13] https://www.canada.ca/en/public-health/services/diseases/lyme-disease/surveillance-lyme-disease.html
[14] https://www.nejm.org/zika-virus
[15] https://www.nejm.org/doi/full/10.1056/NEJMoa1709481?query=featured_zika
[16] https://pubmed.ncbi.nlm.nih.gov/28384133/
[17] https://www.who.int/publications/m/item/zika-epidemiology-update
[18] https://www.eurosurveillance.org/content/10.2807/1560-7917.ES.2019.24.45.1900655
[19] https://royalsocietypublishing.org/doi/10.1098/rspb.2020.0119
[20] https://pubmed.ncbi.nlm.nih.gov/29500926/
[21] https://www.undp.org/content/dam/undp/library/HIV-AIDS/UNDP-Zika-04-03-2017-English-WEB.pdf

all costs and actual industry level estimates are hard to find, however it is likely to reach a significant level over time as each case develop.

Lyme disease represents another case of a vector-borne health risk that has shown the capacity to spread into new territories with evolving climate conditions. Lyme disease is a tick transmitted disease that can have debilitating consequences if not treated rapidly. It is most associated with the U.S. northeast and the town of Lyme where it was first identified in the 1970s. The tick responsible for carrying the disease lives in temperate climates.

The tick has traditionally not been unable to spread in areas farther North because of the presence of drier and colder conditions. It has however recently spread into southeastern Canada, with the number of annual cases increasing ten-fold over the past decade, according to statistics maintain by the Canadian government[22]. In fact prior to 2000, only one known population of the I. scapularis species, which carries the disease, had been documented in Canada. It was located on the North Shore of Lake Erie, at the time the northern most latitude of the species. The number of cases is still low in absolute terms, amounting to several thousands per year in Canada. However, as people lack awareness, the number of cases might be underestimated and people might not be conscious of the risk.

Lyme disease in Canada has been the subject of recent climate attribution studies[23]. Leighton et al.[24] in particular successfully correlated locations with tick populations with warming trends in average temperatures. They also demonstrated that population increased faster in areas with larger temperature changes.

As the effects generally remain mild, the insurance implications are still limited. Severe cases are still rare. Given the conditions in which the tick prospers, and climate scenario projections for chronic risks in the region, the disease is likely to continue to increase in northern regions such as south and southeast Canada. Thankfully risk awareness is likely to increase as the disease spreads. Heightened knowledge is likely to balance some of the increase in frequency and severity.

4.3 Case study #2: Water and food security in South America

Climate change is expected to impact water resources everywhere, altering not only weather patterns and ecosystems but also food productions and power infrastructures. Water issues therefore can impact our societies at a systemic level. Droughts are a key manifestation of potential impacts and consequences for health and life insurance.

Climate change is making droughts more frequent and more severe[25] in many regions of the world. Recent events can offer a comprehensive testbed to understand the potential risks of increasingly frequent and severe drought events. The focus here is in Brazil, which has recently experienced devastating events along with a long term trend in water supply losses. In Brazil, half of all natural disasters are droughts[26], diving a majority of human impacts from catastrophes in the region. It is hard to measure accurately the full scale of impacts, which can range from stress on water consumption and sanitation, to population displacements and disruptions of local health services. In the pat 20 years, the country has lost 15% of its surface fresh water supply as a result of deforestation and climate changes[27], including shifts in the occurence and severity of rainfall events. Deforestation reduces the regional ability to absorb CO2. In fact, the Amazon is now nor more a

[22] https://www.canada.ca/en/public-health/services/diseases/lyme-disease/surveillance-lyme-disease.html
[23] https://pubmed.ncbi.nlm.nih.gov/28796635/
[24] https://besjournals.onlinelibrary.wiley.com/doi/10.1111/j.1365-2664.2012.02112.x
[25] https://www.ipcc.ch/report/ar6/wg1/#FullReport
[26] https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4211003/
[27] https://mapbiomas.org/en/superficie-de-agua-no-brasil-reduz-15-desde-o-inicio-dos-anos-90?cama_set_language=en

CO2 sink. Deforestation also means a lesser ability for the soil to retain water and therefore result in less moisture retention. Deforestation at the scale of the Amazon affects weather patterns, such as the strength, location and occurence of the Amazonian flying rivers[28]. The water situation in Brazil has recently been described in a Nature article[29] as *a crisis to be treated as a national security priority, in need of a drought plan*.

Reduced fresh water levels are impactful to the local agriculture, which over time can result in regional food security concerns. As Brazil continue developing as a regional and global food supplier, any systemic stresses in the country food production can intensify elsewhere in the world. Brazil grows 30% of the global sugar crop production, for instance.

The impacts are not just food related. The country electricity is largely dependent on hydroelectric facilities with a share of 65% in 2020[30]. Recent droughts have led to energy price increases, affecting the economy, the cost of goods and therefore contributing to inflationary trends. Blackouts also represent a major risk to health. Besides the daily inconvenience of disruptions in transportation and communication infrastructures, blackouts have the potential to disrupt the health apparatus including the ability for hospitals to function properly. Risks related to chronic illnesses are amplified during power outages.

A number of studies have highlighted connections between water shortage issues, and human risks, for instance in the way shortages connect to contamination risks[31]. Impacts on agriculture and in particular crop yields can lead to malnutrition and nutritional deficiencies. Mental health can also be affected by droughts with increased risk of psycho-social stress, chronic stress, elevated rates of violence and aggression[32]. Mental diseases can undermine people capacity for work and subsistence. In some cases, alcoholism risk can spread and in the most extreme situation, the rate of suicides can increase.

Health consequences have been documented in specific events, at least qualitatively, despite the difficulty to accurately measure the impacts, What is missing to quantitatively connect to insurance risk is an understanding of impacts and how they might change over time in light of policy terms and conditions. Insurers need to start tracking the impact of climate risks on their health policies to properly consider the potential long term implications of climate change related health risks, rather than assume the risk will only change gradually.

4.3 Case study #3: The impact of heat waves in Europe

Europe is warming faster than the planet overall. According to the European Environment Agency[33], the average temperature in the past 10 years across the continent was nearly 2°C higher than pre-industrial levels. European temperatures have increased twice as much as the global average. Increases in the risk of heat waves correlates with increases in temperatures, and Europe has experienced many of them in recent years. During the 2018 event, temperatures in Scandinavia surpassed the recent 30-year average by 5°C, resulting in heat related fatalities as high as 100'000[34]. Similarly, one of the most extreme events of the past two decades, which slowed most of Europe to a halt in 2003, was responsible for at least 30'000 deaths[35].

[28] https://www.thelancet.com/journals/lanam/article/PIIS2667-193X(22)00067-9/fulltext
[29] https://media.nature.com/original/magazine-assets/d41586-021-03625-w/d41586-021-03625-w.pdf
[30] Brazilian Energy Balance 2021 - BEN2021.pdf (epe.gov.br)
[31] https://www.witpress.com/elibrary/wit-transactions-on-ecology-and-the-environment/191/29624
[32] https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4211003/
[33] https://www.eea.europa.eu/ims/global-and-european-temperatures
[34] https://www.preventionweb.net/news/one-hundred-thousand-deaths-year-europe-tops-mortality-league-extreme-heat
[35] https://www.unisdr.org/files/1145_ewheatwave.en.pdf

Both life and health insurance policies face increased risk during heatwaves, but the brutality of such events can be best perceived through their impacts on mortality rates. While the traditional approach to estimating the impact has been to analyse excess mortality, a recent paper[36] focused instead on reductions in life expectancy. Life expectancy is of direct interest to insurers, but also help personalise the risk for individuals in regions impacted by heat waves. The study estimates that across Europe, heat waves might cause life expectancy reductions of 3 months on average, with some countries likely to experience decreases up to 1,5 year.

The risk will only continue to increase with rising temperatures. Even if the global temperature increase is limited to 1.5°C, severe heat waves are likely to become three times more frequent across most of Europe[37]. Under pathways of 2°C and 3°C, Europe could expect to face severe heat waves every 3 to 5 years. Today's acute weather might become tomorrow's chronic risk, as events currently far into the occurrence tail might occur every few years.

The European population is also becoming older, which compounds the risk. In the past three decades, the median age has increased by several years, nearing 45 years old. Age groups between 15 and 35 have seen a significant decrease in their proportion (as much as 25%), while groups between 50 and up have increased by similar proportions[38]. Those trends are expected to continue[39]. The population overall is becoming more prone to experiencing health related illnesses and fatalities, which will stress insurers operating in the region.

[36] https://link.springer.com/article/10.1007/s11113-020-09584-w
[37] https://publications.jrc.ec.europa.eu/repository/handle/JRC118540
[38] https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Being_young_in_Europe_today_-_demographic_trends
[39] https://ec.europa.eu/eurostat/statistics-explained/index.php?oldid=497115

5. Current limitations

The use cases discussed in the previous section highlight some of the difficulties that life and health insurers will encounter in performing climate risk analyses.

Life and health coverages are not as exposed to catastrophes as property lines. Over the past several decades, the CAT modelling industry has constructed some of the foundations that are now leveraged in climate risk analyses. Life and health insurers do not benefit from that experience.

Accessing the data needed to evaluate climate risk is an issue for all insurers. However, it is likely more difficult for life and health insurers, as past data might not have been structured to answer questions related to the climate.

Below, we cover in greater details some of the key limitations that life and health insurers are likely to be encountered.

5.1 Data and methodological limitations

In recent years, methodologies have been developed to attribute weather events to climate change[40]. Attribution studies focus either on changes in an event likelihood or in its severity. Climate change has been shown to contribute to both chronic and acute events. Recent studies have furthermore looked into attributing health impacts[41], which presents additional difficulties as the causality between the event itself and the health impact also needs to be established. This work is still in its early days, and lacks the historical data that would be needed to draw statistical conclusions. Further analyses to include insurance terms and conditions are even more difficult to conduct.

5.2 Applicability of forward-looking scenarios

Forward-looking scenarios[42] are designed to capture potential future weather and economic conditions, based on temperature pathways. Scenarios exist both for acute and chronic conditions, such as severe storms and temperature changes. However, scenarios are not made to capture the specifics of a particular industry. That information needs to be developed based on industry data by domain experts, oftentimes out of reach for individual companies.

Furthermore, the outputs of forward-looking scenarios are snapshots in time. The compounding effects of multiple external stresses over time are not properly captured. Yet, they likely represent an important source of risk for the life and health coverages.

The root causes of morbidity and mortality risk might also morph in a changing climate. Climate change is likely to have an impact on mental health with in turn the potential to increase mortality rates due to for instance alcohol abuse, aggressive behaviour, insecurity, increase in stress due to weather-related events and trauma. Projecting those changes will need to be part of a forward-looking analysis.

5.3 The “man-made” aspect of life and health issues

Life and health risks depend not only on the natural environment, but also on our governmental policies towards healthcare and on societal progress. Even in the absence of climate impacts, we partially control life and health risks with our personal and community actions. Climate change related impacts only serve to compound the effect of poor policies, the lack of investment and the

[40] https://www.ametsoc.org/ams/index.cfm/publications/bulletin-of-the-american-meteorological-society-bams/explaining-extreme-events-from-a-climate-perspective/
[41] https://www.healthaffairs.org/doi/10.1377/hlthaff.2020.01004
[42] https://www.ipcc.ch/report/emissions-scenarios/

lack of coverages. Conversely, good and effective policies can help reduce current and future risks. Shifting political landscapes are difficult to foresee and predict, but their impact can be larger than the ones caused directly by the climate. That impact can be both positive or negative. As-if scenario analyses, which consist in analysing future climate risks assuming today's policies and healthcare capabilities can help create risk guardrails and even ultimately help drive police decisions.

5.4 How to deal with the question of timelines?

Life and health insurance follows a long tail business model. Most coverages can trigger long after the time the have been written. In an evolving risk landscape, past data mean not be sufficient to understand future risks. Policies already in-force might be exposed to climate risks that are not fully known yet. Any future policies might face the same issue. The compounding effect could come to plan years out. The consensus is that this is not the case, but it is a question worth considering analytically. A simplified approach could consider stress scenarios, and could be integrated into an Own Risk and Solvency Assessment (ORSA) framework. While stress tests will generally lack a occurrence probability dimension, they will provide insight on the stability of loss projections and possibly reveal risks of shocks..

5.5 Could insurability and take up rate be at risk?

Swiss Re produces an annual take-up rate analysis of the L&H industry. While it is not clear to which extent the estimate is accurate given the complexity of the coverages and the ultimate size of the risk pool, it shows that under-insurance is a global problem (and an opportunity). While this is primarily true in developing countries, under-insurance also exists in developed countries. Climate-change related risks are likely going to amplify the issue of take-up rate, making larger segments of society potentially uninsurable. A reduction in potential insureds would fundamentally stress the insurance business model, likely reducing diversification and of course premium volumes. Here again, a model could be build to test the impact of a reduction in the number of insureds and their diversification characteristics. Current portfolios might be very stable against such stresses. Finding the point where this is not the case anymore would yield valuable information to benchmark against.

6. Conclusions

In contrast to their counterparts on the Property & Casualty side, many Life & Health insurers have spent limited time and resources on climate change and its potential impacts on their business. This is not because of a lack of understanding, but rather because there is a general belief among that group that climate change will not manifest itself as a shock to their business. The risks will rather gradually increase over time, and can therefore be managed gradually as well. There is a clear understanding that societal health impacts are likely to be very large. But the belief is that they will primarily be felt outside of insurance policies.

From a loss perspective, this assumption is not misguided. The view has merit given today's business mix, and given the small losses experienced in past events, We argue however that the confluence of various issues is likely to shift this perspective and create a new type of shock for the sector.

1. At least for a segment of the Life & Health industry, profitability is linked to investment returns. The line of business is long tail, and hence premiums can be invested over long periods of time. Investments can generate returns sometimes for many years before a coverage trigger. In a transitioning economy, investments will face climate change related pressures that may affect profitability or at least the way profitability is thought of.
2. Profitability is also linked to premium volumes. Diversification is one of the core principles of insurance. As insurers adjust terms and conditions over time to reflect what is likely to be increasing risks, are they going to see their population of insureds decrease resulting in an erosion of diversification benefits?
3. Pricing and underwriting decisions are supported by analyses performed on historical data. One implicit assumption is that the data is statistically consistent over a large enough period of time and a sufficient population of insureds. But with rapid changes occur, such as those expected from climate change, is this assumption still valid? And one might ask not just whether the data is consistent enough over time, but also whether it is a complete representation of the underlying risk. One might expect new patterns of risk to unfold, such as for instance new regions of risk for vector based diseases and new geographical and temporal extents for events such as heat waves.

In this paper, we propose an analysis framework that draws from the P&C experience assessing climate risk in the context of catastrophes and by extension climate change related risks. In the L&H space, it is likely that the risk comes as much (if not more) from chronic events while acute events are generally more important to P&C policies. We draw on recent literature to outline a methodology to attribute losses to recent acute and chronic events. Ultimately though this type of event based analyses will need to be placed in a forward-looking scenario framework to ensure additional data completeness.

We also outline current limitations. It is unquestionable that analysing the risk to L&H is more complex than it is for P&C. For instance, one might expect mental health issues to play a critical and growing role. Time horizons over which life and health losses might unfold are a lot longer than in the P&C space. All that compounds to creating data issues that will be difficult to resolve, but that L&H insurers should engage into doing as soon as possible.

Against today's portfolios, data and loss experience, climate change seems to be a moderate risk that the L&H industry will be capable of managing incrementally. However, the same uncertainty that drives the market to inaction could also drive it to solvency concerns or severe systemic economic downturns affecting all of us. It is therefore critical for this segment of the industry to lead the way and anticipate what might be become a systemic concern.