Swiss Re Institute

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Swiss Re SONAR

New emerging risk insights

Executive summary

SONAR promotes awareness of risks that matter to insurers today and those that will in the future.

Swiss Re's annual SONAR report identifies new or changed risks that are difficult to quantify and could have a major impact on society and industry. By providing early insights into evolving risks, the report helps businesses and insurers make better-informed strategy decisions. This year's report features eight emerging risks selected through Swiss Re's regular risk identification process and seen as deserving of insurer attention for their novelty, dynamics and/or deemed urgency. The choice is based on horizon scanning through monitoring tools for early signal detection and research, in-house vetting and input from external scientists, clients and industry peers. Emerging risks reported in SONAR in earlier years feature again only if developments are deemed to be of significant degree to warrant renewed consideration.

Structural risks impacting the insurance industry already today include lack of consumer trust and excess mortality.

The report opens with an assessment of structural risks that shape insurance markets and the business environment already today. They contextualise and could exacerbate the future impact of emerging risks. This year's SONAR highlights five structural risks, including a lack of consumer trust in the industry, a challenge to the core value proposition of insurance. Another real-time structural risk is social inflation, a drag on profitability in casualty business, particularly in the US. Demand for liability insurance has been growing rapidly, a main driver being changes in the legal landscape exemplified by large verdicts. Insurers facing big increases in legal defence costs will likely pass this on to consumers through higher premiums. We also highlight the insurance significance of current elevated levels of excess mortality, ageing populations and digitalisation.

In terms of risks for the future, rising global temperatures could increase claims in many lines of business.

With respect to emerging risks, this SONAR includes deep-dive assessments of three exposures, their interactions, dependencies and associated uncertainties, and potential implications for insurers. Rising temperatures and the impacts thereof are widely recognised as a threat to communities around the world. The deep dive in this report focuses on extreme heat events specifically, given the expectation that these will occur more frequently in the coming years. The claims implications are many, stemming from more accidents, illness, chronic diseases and even death. Extreme heat can also stress healthcare systems, in turn raising the costs of medical insurance.

Plastics are another concern, given environmental and health impacts. Earliest claims traction is likely to show in liability insurance.

Still on the theme of warmer conditions, we bring to the fore that fungi are adapting to higher temperatures. Among others, this could see claims in property insurance rise on account of mould infestation. Meanwhile in agriculture, the overuse of fungicides and development of multi-drug resistant strains of fungal infection could drastically cut crop yields. Another emerging risk assessed is the harm caused by plastics. Plastic and plastic particles have already generated litigation cases on account of environmental pollution and the harm they can cause to human health. Advances in attribution science indicating causal links could fuel litigation across many sectors, hitting liability insurers most.

Ultra-processed foods could trigger liability and health claims…

SONAR also flags new exposures we deem deserving of attention, but with potentially lower impact and maturation likely more in the longer than near term. These risks include the rapidly rising consumption of ultra-processed foods. The latter could spark rising claims in liability and health, as evidence of associated negative health outcomes like obesity and diabetes mounts.

…while the broadening scope of use of digital technology in daily life presents both opportunities and challenges for insurers.

We also flag the potential insurance ramifications of digital innovation such as the deployment of deepfakes and the dissemination of disinformation through social media, and the growing role of digital technology in healthcare delivery, all of which will likely impact Life and Health (L&H) and casualty lines of business. Other technology-innovation context emerging risks are the use of drones for strategic purposes, and how artificial intelligence (AI) will likely influence workplace skill set needs in the future. In addition to more claims in L&H and casualty, the latter could also increase the cost of providing insurance in situations where automation leaves a lack of sufficient job-specific human talent and where this, in turn, leads to an increase in operational errors.

Key takeaways

Structural risks

		Impact
Across all business areas	Declining consumer trust in institutions, including insurers ↗	High
	Excess mortality variance: uncertainty for L&H claims and reserves ↗	High
	Digital technology: mostly a liability insurance story ↗	High
	Social inflation risks could expand liability claims ↗	Medium
	Aging populations: mortality protection products at risk ↗	Medium

Emerging risks (short-term)

		Impact
	Extreme heat: the insurance fallouts* ↗	High
	Deepfakes and disinformation: enabling insurance fraud ↗	High
	New frontiers in fungi-related loss potential* ↗	Medium
	New technologies in healthcare delivery ↗	Medium
	The expanding horizons of drone technology ↗	Low

Emerging risks (medium-term)

		Impact
	Plastics: a new wave of litigation?* ↗	Medium
	Emerging workforce gaps and skillset shortages ↗	Medium
	Ultra-processed foods: health and liability risks ↗	Low

*Deep dive

Most affected business areas

Property lines · Specialty lines · Casualty · Life & Health · Financial markets incl. insurers' assets · Operations incl. regulatory changes

Structural risks

Existing challenges (and opportunities) for the insurance industry

Structural risks arise from fundamental trends shaping the economy, society and the environment, such as shifts in demographic and climate conditions. Managing these risks is crucial for insurers to protect policyholders, support macroeconomic resilience and safeguard their own operations. Here we highlight five structural risks that matter for the insurance industry today: declining trust in institutions, aging populations, social inflation, mortality risks and digitalisation.

Figure 1
Structural risks and their underlying drivers

Source: Swiss Re Institute

Surveys indicate eroding trust in businesses and institutions.

Declining consumer trust in institutions, including insurance companies

A sense of unfairness can erode trust. As many as 61% of respondents to the 2025 *Edelman Trust Barometer* expressed a moderate to high sense of grievance against businesses and governments.[1] Forty percent went as far as to endorse hostile activism, including violence and damaging property, to drive change.

Trust is critical for insurance buying decisions.

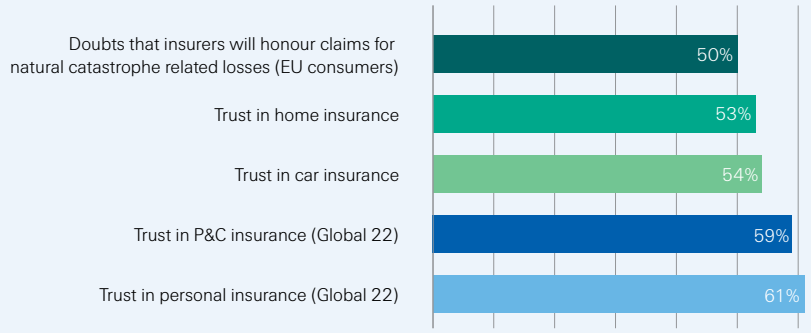
Surveys show that in most markets, trust is an important determinant in consumers insurance purchasing decisions. For instance, more than 80% of commercial buyers say trust is an important factor influencing the decision get their business insured.[2] Lack of consumer trust can impact insurers at many levels. Policyholders may seek to change providers or not buy insurance at all for certain risks. When there is distrust, for instance with consumers not convinced that insurers will pay out on claims submissions, or because of complex policy wording that is difficult to understand, it is harder for insurers to close sales.

Lack of consumer trust could bring reputational risk for insurers.

Lack of trust could also entail reputational risks for insurers. The insurance sector has not been immune from grievance-driven trust deficit. Several recent surveys indicate that less than two thirds of consumers trust insurers. Specifically, a survey by the European Insurance and Occupational Pensions Authority (EIOPA) last year found that only 50% of consumers trust that insurers would pay out on claims for losses resulting from natural catastrophes (see Figure 2).[3] With insured losses from natural catastrophes rising by an annual long-term trend of 5-7% in inflation-adjusted terms, sustaining trust will require ongoing efforts.[4]

1 *2025 Edelman Trust Barometer,* Edelman Trust Institute, January 2025.
2 *The value of insurance in a changing risk landscape,* The Geneva Association, November 2023.
3 *Measures to address demand side aspects of the natcat protection gap*, EIOPA, 29 February 2024.
4 *sigma* 1/2025 - Natural catastrophes: insured losses on trend to USD 145 billion in 2025, Swiss Re Institute.

Figure 2
Low levels of trust in institutions



Source: Swiss Re Institute, based on data from *Edelman Trust Barometer, EIOPA, Insurity AI in Insurance, Fairer Finance Trust in Insurance Index*

Social inflation risks could expand liability claims

Fifty-seven percent of the rise in liability claims in the US over the last decade was driven by non-economic factors.

As a broad term, we define "social inflation" as encapsulating those factors leading to increased insurance claims severity beyond that explained by economic drivers. Over the past decade, such factors have accounted for 57% of the increase in liability claims in the US.[5] Since 2020, the number of nuclear verdicts (defined as awards over USD 10 million) in the US have more than quadrupled, while the median verdict value has more than doubled to USD 51 million.[6] Due in part to higher litigation awards, US liability lines exposed to bodily injury claims saw profitability deteriorate over the five years to 2024, with cumulative underwriting losses mounting to USD 43 billion.[7] In 2024, the average award in cases against a corporate defendant in the US rose to USD 65.7 million, up from USD 41.7 million in 2023, according to data from LexisNexis, as reported by the Financial Times.[8]

The outcome can be significant reduction in risk transfer capacity.

Social inflation is difficult to measure and predict and can significantly reduce the overall risk transfer capacity of the insurance industry. It is particularly disruptive in liability insurance business and affects longest-tail lines disproportionally, these typically being more exposed to legal system developments. Median limits purchased for liability towers[9] declined by an average of nearly 25% in nominal terms and by 46% in inflation-adjusted terms between 2014 and 2023, a period of increasing loss costs.[10]

We see scope for rising social inflation pressures in other jurisdictions.

Though to date mostly an US issue, we expect other regions, particularly Europe, will see an increase in the size of legal settlement awards within the next five years, driven by easier access to litigation, expansion of collective redress and broadening of the product liability landscape (see Table 1). Third-party litigation funding (TPLF) could an important driver, more so in the absence of TPLF specific regulation.[11] The European Union (EU) supports and is promoting collective actions across various areas such as data privacy, environmental, social and governance (ESG), and product liability. The *Product Liability Directive*, for instance, eases the possibility of mass litigation by altering the burden of proof, particularly in complex digital and AI cases.[12] While collective redress is still uncommon in many EU countries, it is rising steadily, driven by new regulation like the *Digital Markets Act* and *General Data Protection Regulation* (GDPR).[13]

5 Social inflation refers to the rising costs stemming from an increase in insured liability claims and legal settlements that exceed standard inflation rates.
6 *Corporate verdicts go thermonucluear - 2025 edition*, Marathon Strategies, May 2025.
7 *sigma* 4/2024: Social inflation: litigation costs drive claims inflation, Swiss Re Institute, 2024.
8 *Companies faced record average damages from US lawsuits last year*, Financial Times, 2 March 2025.
9 These are tailor-made liability insurance programmes consisting of general liability, umbrella and excess policies stacked on top of each other. This allows for the insurability of large limits for large corporations.
10 *Liability Limit Benchmark & Large Loss Profile by Industry Sector 2024*, Chubb Limited, 17 June 2024.
11 *Comprehensive report on third-party litigation funding (TPLF) across the EU*, European Commission, March 2025.
12 *Liability for defective products*, European Commission, December 2024.
13 *The Impact of Increased Mass Litigation in Europe*, European Centre for International Political Economy, March 2025.

Table 1
Future drivers of social inflation across select countries

	US	Australia	UK	Canada	Netherlands	France	Germany	Japan
Claims penetration	H	M	H	M	L	M	M	L
Income inequality	H	M	M	M	L	M	M	M
Third-party litigation funding	H	H	H	M	H	M	M	L
Contingency fees	H	M	M	H	L	L	L	L
Collective redress	H	H	H	H	H	M	M	L
Case law	H	H	H	H	L	L	L	L
Jury based	H	L	L	L	L	L	L	L

High risk | Medium risk | Low risk

Source: Swiss Re Institute

Excess mortality rates have remained positive in post COVID times.

Excess mortality variance: uncertainty for L&H claims and reserves

In the US and UK, excess mortality from COVID-19 is expected to remain positive at least until 2027, and possibly until 2033. The degree of this positive excess mortality varies by scenario.[14] Recent experience in the US shows that life expectancy rose by 0.9 years to 78.4 in 2023, still slightly below the pre-pandemic high of 78.8.[15] Mortality rates in the UK, meanwhile, were reported to have returned to pre-pandemic levels in 2024.[16] In the euro area, excess mortality stood at 3% at end 2024, with fluctuations through the year and between member states (see Figure 3, left).[17] Australia too has seen continued excess mortality since COVID-19, the latter accounting for 2.2% of deaths in 2023-24.[18] Meanwhile, mortality rates in the UK were reported to have returned to pre-pandemic levels in 2024.[19]

Excess mortality impacts life insurers' risk pricing, claims and reserves.

Elevated levels of excess mortality are a potential challenge for L&H insurance, with potentially several years of elevated mortality claims ahead, depending on how general population trends translate into the insured population. Ongoing excess mortality can have implications for L&H claims and reserves. Excess mortality that continues to exceed expectations may affect the long-term performance of in-force life portfolios, and also the pricing of new life policies.

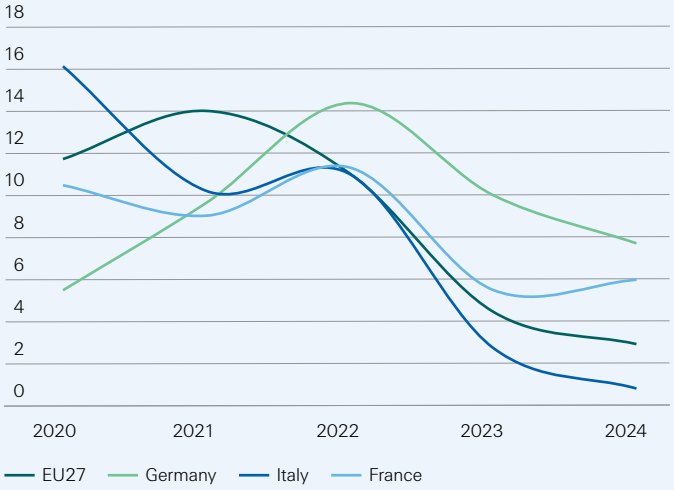
Cardiovascular deaths, drug overdoses, firearm-related homicides and suicides, and road accidents contribute to variance in degrees of excess mortality.

Factors other than COVID-19 drive variances in mortality trends across markets too (see Figure 3, right). The US continues to diverge on its different mortality trend from other developed nations. Recent studies show rising "avoidable mortality" in the US (by 32.5 avoidable deaths per 100 000 people), but a decrease in the EU and Organisation for Economic Co-operation and Development (OECD) countries (by 25.2 and 22.8 avoidable deaths per 100 000 persons, respectively).[20] Last year a study highlighted how the US and the UK had quite different life expectancies at birth, mostly due to higher rates of preventable deaths in the former. These were mostly on account of higher rates of cardiovascular related deaths, followed by drug overdoses, firearm-related homicides and suicides, and motor vehicle crashes.[21] The proportion of the causes of death differ by socioeconomic groups.[22]

14 *The future of excess mortality after COVID-19*, Swiss Re Institute, September 2024.
15 *US Life Expectancy Turns Back Up*, The Wall Street Journal, 23 December 2024.
16 *UK death rate 'reaches record low'*, BBC, 3 March 2025.
17 Eurostat data describe the actual number of deaths and are not adjusted for age or per capita. Countries that managed COVID-19 poorly will have seen many frail patients die during the pandemic. Now those countries will likely have lower levels of excess mortality as these more vulnerable patients have since died.
18 *2024 Population Statement*, Australian Government Centre for Population, 2024.
19 *UK death rate 'reaches record low'*, BBC, 3 March 2025.
20 Papanicolas I, Niksch M, Figueroa J, *Avoidable Mortality Across US States and High-Income Countries*, JAMA Internal Medicine, 2025.
21 *A Tale of Two Countries: The Life Expectancy Gap Between the United States and the United Kingdom*, Bloomberg American Health Initiative, December 2024.
22 Deaths from suicide, drug overdoses and alcoholism have increased dramatically. For more, see Case A, Deaton A, *Deaths of Despair and the Future of Capitalism*, Princeton University Press, 2020.

Figure 3

Tracking excess mortality in Europe over the years



Dispersion of factors driving excess mortality across countries, age-standardised death rates (per 100 000 population)

Country	Road accidents	Cardio-vascular disease	Drug overuse	Violence	Suicide
Australia	4.0	69.2	5.0	0.9	11.9
France	2.7	61.4	1.1	0.7	11.5
Germany	2.6	118.5	1.5	0.4	8.4
Italy	3.3	94.6	0.6	0.3	4.3
Japan	1.6	65.1	0.2	0.2	14.4
UK	1.7	90.8	7.4	0.3	8.1
US	11.7	133.0	25.3	8.0	13.6
Median, all countries	4.6	121.7	0.5	1.1	8.3

High mortality risk | Medium mortality risk | Low mortality risk

Note: the mechanisms by which excess mortality is calculated and where the expected baseline is set varies by countries. Hence cross country comparisons cannot be readily made.
Source: *Eurostat* (left), WHO Mortality Database Portal, WHO Global Health Observatory, Swiss Re Institute (right)

Medical innovations should work to reduce mortality in the future.

Innovations like GLP-1 weight-loss medications and the use thereof are becoming more widespread. Medical advances that reduce obesity should help reduce mortality in the future. Long-term data is still emerging and early results are promising. However, studies indicate that many individuals regain a significant portion of the weight they have lost when they stop taking the medications.[23] In the long term, positive mortality improvements will rely on advancements in cardiovascular disease and developments for the treatment of cancer. These remain a major causes of mortality and critical illness among the insured population.

Aging populations: mortality protection products at risk

The world's ageing population will impact mortality protection business.

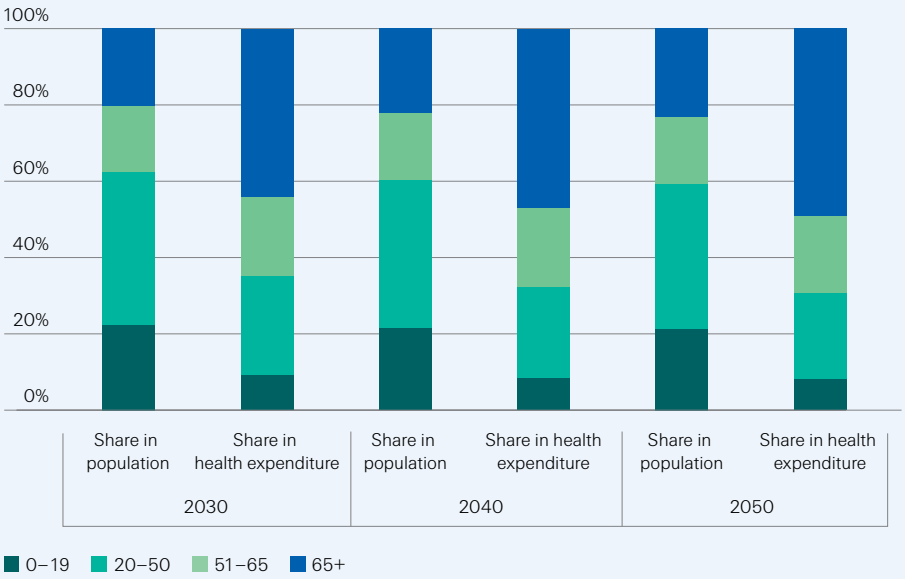
The world's ageing population is being driven by increases in life expectancy and declining birth rates. According to data from the UN, the share of persons aged 65 and above in high-income countries is forecast to trend up through to the mid-2040s. The number of 25 to 49 year-olds is expected to shrink 5% by 2050.[24] As life events like birth of a child can spur life insurance purchases, a population that is ageing implies lacklustre growth in demand for mortality protection and accumulation savings premiums. Fewer and later family formations magnify this headwind.

Longevity risk pools present a growth opportunity L&H insurers.

For the L&H industry, growing longevity risk pools (ie, ageing populations seeking health and retirement security) are a large premium opportunity. A 65-year-old stopping work today faces a 16% longer retirement than one who left the workforce in 2000, and nearly 40% more than someone who retired in 1975. This will continue as life expectancy post age 65 may rise to 20 years by 2050 (compared to 16.8 in 2020).[25] Using per capita medical expenses and proportion of population in age categories, we calculate that by 2050, the 65+ population in the US will account for almost 50% of health expenditure (see Figure 4).[26, 27] In Japan, the 65+ age group already accounts for more than 60% of total spending on healthcare services.[28]

[23] Bin Ahmed I, *A Comprehensive Review on Weight Gain following Discontinuation of Glucagon-Like Peptide-1 Receptor Agonists for Obesity*, Journal of Obesity, 2024.
[24] Source: *World Population Prospects 2024*, United Nations, 2024.
[25] Population Division Department of Economic and Social Affairs, United Nations, 2024.
[26] Jones C, Dolsten M, *Healthcare on the brink: navigating the challenges of an aging society in the United States*, npj Aging, vol. 10, 2024.
[27] Swiss Re Institute calculations based on Peter G, *How Does the Aging of the Population Affect Our Fiscal Health?*, Peterson Foundation, 2024.
[28] *Demographics: an analysis of their impact on insurance activity*, MAPFRE Economics, July 2024.

Figure 4
Growing burden of healthcare expenditure in the US due to demographic shifts



Source: UN Department of Economic and Social Affairs, Peter G. Peterson Foundation, Swiss Re Institute

The growing use of AI could see a rise in litigation cases.

Digital technology: mostly a liability insurance story

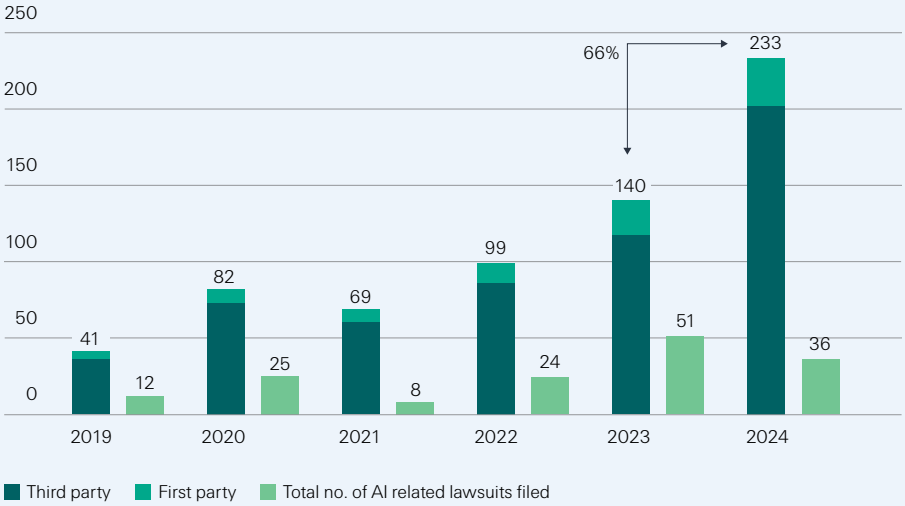
The evolution of digital technologies is reshaping the risk landscape and could prompt to more demand for first- and third-party liability covers. The number of AI incidents reported has been increasing. From 2023 to 2024, it grew by more than 60% (see Figure 5).[29] A third of these incidents occurred due to AI systems failure. As more people and businesses engage with AI, there may be a corresponding increase in lawsuits.[30] Recent spikes in litigation have been based on allegations of intellectual property infringement and defamation lawsuits (some due to large language models such as ChatGPT). This is not a risk in isolation. The lawsuits could be contributing factors to social inflation in the future.

Insurers have some way to go to develop products for AI-inspired fraud.

Newer approaches such as GenAI can also be vulnerable to sophisticated fraud like deepfakes, as well as heightened liability concerns.[31] Losses can be categorised into four broad risk categories: 1) fairness, bias & discrimination; 2) legal & regulatory compliance; 3) malicious use & safety; and 4) unintended outcomes & malfunctioning products. Over the years, the share of incidents due to fairness, bias and discrimination has declined, while those of malicious use have risen (see Figure 6). The insurance industry is in initial stages of the associated product development cycle and clarity around coverage, exclusions and standardised wordings remains pending.

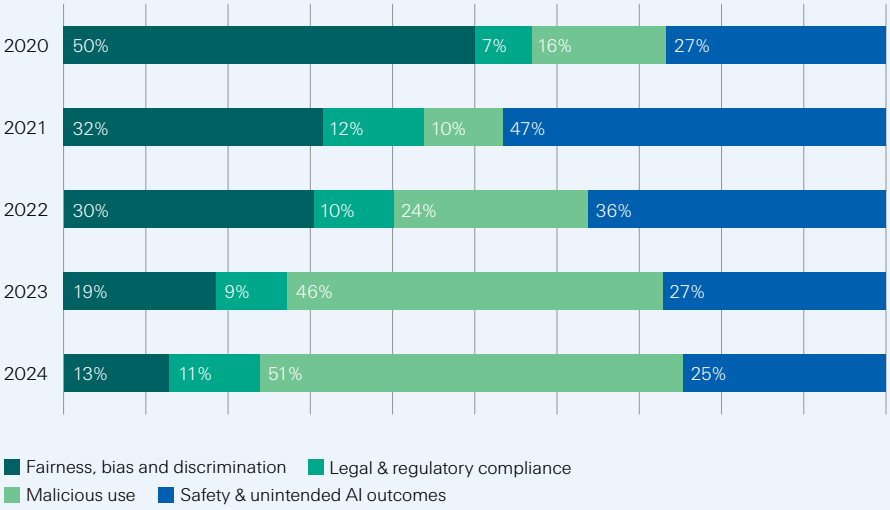
[29] *AI Incidents Database*, Waking UP Foundation, accessed 30 March 2024.
[30] *DAIL – the Database of AI Litigation*, George Washington University, accessed 30 March 2024.
[31] Ladva P, Grasso A, *AI brings a major change to insurance risk landscape*, Swiss Re, 23 May 2024.

Figure 5
Number of AI incidents



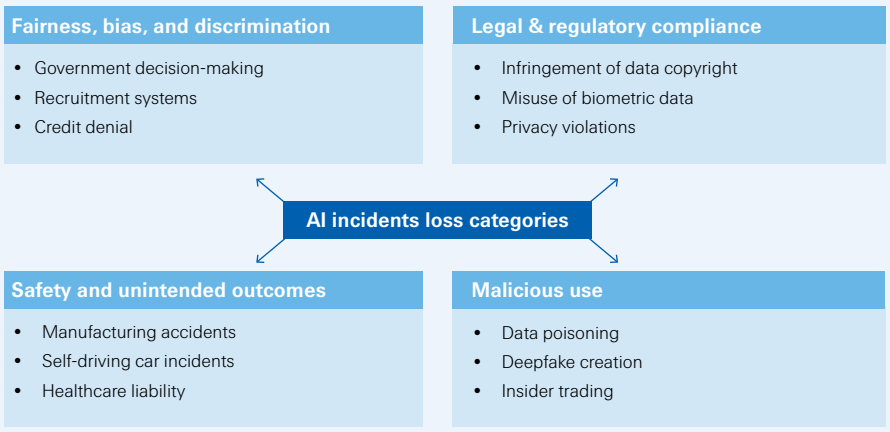
Note: Swiss Re Institute's classification of incidents into first or third party; total incidents is the sum of first- and third-party incidents. Source: AI Incident Database, AI Litigation Database

Figure 6
Loss categories' share of total losses



Source: AI Incident Database, AI Litigation Database

Figure 7
Loss drivers



Source: AI Incident Database, AI Litigation Database

Emerging risks – deep dives

Extreme heat: the insurance fallouts

Extreme heat poses a growing threat to the insurance industry, with property, specialty and L&H business most exposed. It increases the risk of electrical outages and wildfire risk, and can damage and cause disruption to transport, water and energy infrastructure, thus driving up property and specialty claims. Heat-related health impacts can also increase medical, life, and workers' compensation claims, particularly among vulnerable and outdoor-working populations. Extreme heat can put additional stress on healthcare systems. Liability exposures may also rise as employers and institutions face legal risks for failing to provide employees and others with duty-of-care mitigation measures.

Potential insurance impacts

Impact rating (0 = no impact; 4 = high Impact)

- **Time horizon:** Long-term impacts to mount as climates continue to warm.
- **Property:** Heat-related impacts on infrastructure assets and damage to physical structures could lead to business disruption and property claims. Where wildfires are triggered, potential for property damage is significantly higher. There could also be claims in engineering insurance on account of inadequate heat tolerant design of buildings and machinery.
- **Specialty:** Crop and livestock losses could result in rising claims in agriculture insurance.
- **Casualty:** More workplace accident due to heat stress, resulting in rising workers' compensation claims. Failure to provide adequate working and/or duty-of-care measures could see a rise in employer liability claims.
- **L&H:** An uptick in morbidity and mortality, leading to higher medical and life claims.
- **Insurer assets and financial markets:** Productivity loss in specific sectors (eg, agriculture, energy) in regions exposed to conditions of extreme heat could cause financial market volatility.

The world is getting warmer

Extreme heat events have become more extreme and widespread...

2024 was the hottest year on record.[32] Likewise, July registered the three hottest days on record.[33] With temperatures rising, so too is the incidence of extreme heat events (ie, temperatures hotter than the 90% percentile of those recorded locally). During June 2023-April 2024, there were 76 heat waves in 90 countries.[34] More than 6 billion people (about 78% of the global population) experienced at least 31 days of extreme heat. Since 1991, such conditions have become twice as likely to occur.

...and are a severe threat to human health.

The first symptoms of heat stress may be light but prolonged exposure can have severe health effects. These can include exhaustion, heatstroke, kidney problems and exacerbate pre-existing conditions like cardiovascular and respiratory diseases (and even death).[35] The incidence, intensity and length of heat waves are increasing. Vulnerability factors include advanced age, pregnancy and lower socioeconomic status.[36, 37] One study estimates that currently around 489 000 people in the world die

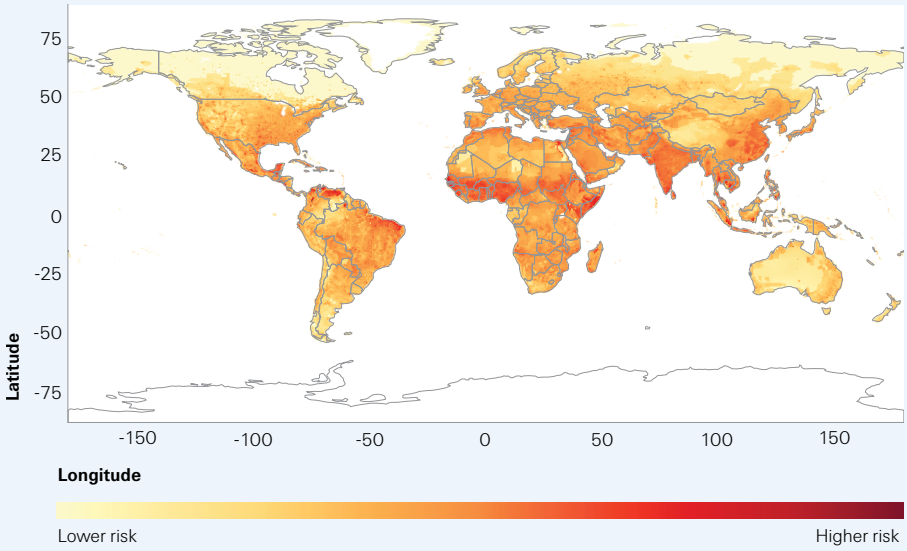
[32] *WMO confirms 2024 as warmest year on record at about 1.55°C above pre-industrial level*, World Meteorological Organization (WMO), January 2025.
[33] *NASA Data Shows July 22 Was Earth's Hottest Day on Record*, NASA, 29 July 2024.
[34] *Climate Change and the Escalation of Global Extreme Heat: Assessing and Addressing the Risks*, Climate Central, 28 May 2024.
[35] *The risk of a lifetime: mapping the impact of climate change on life and health risks*, Swiss Re Institute, 3 January 2023.
[36] Taylor J, *Ten questions concerning residential overheating in Central and Northern Europe*, Building and Environment, vol 234, 2023.
[37] *Public health impacts of heat*, UK Parliament, 23 May 2024.

annually as a result of conditions of extreme heat.[38] This makes heat the deadliest natural peril, more so than floods, hurricanes and earthquakes combined.[39]

The frequency of heatwave events is increasing.

In the US, the frequency of heat waves has increased steadily from an average of two to six per year during the 2010s and 2020s. The average heat wave in major urban areas – cities being hotspots of heat risk – is now four days long, about a day longer than in the 1960s. Heat wave season length has also grown in many locations, including in cities.[40, 41] Timing matters, as heat waves occurring earlier in spring or later in the autumn can catch people off guard.

Figure 8
Regions of extreme heat risk by 2040*



*Note: as a function of a) population in 2040 (as a proxy for people and assets exposed; this would exclude agricultural assets and nature) and b) change in number of days per year above 35°C between 2005 and 2040 for "intermediate" climate change scenario SSP2-4.5.
Source: Gao J. *GeoTIFF_SSP2_total_2010-2050.zip", Global 1-km Downscaled Population Grids, SSP-Consistent Projections and Base Year, v1.01 (2000 - 2100)*, Harvard Dataverse, vol 1, 2020; *CMIP6 climate projections*, 2021 and *ERA5 hourly data on single levels from 1940 to present,* 2023, Copernicus Data Store, Climate Change Service; Swiss Re

Lines of business most impacted: Property, specialty, L&H

Extreme heat events have become more extreme and widespread...

Property and specialty: According to the World Economic Forum (WEF), conditions of extreme heat will likely cause damage to corporate fixed assets, driving annual losses of USD 404 billion to USD 448 billion across all listed companies by 2035.[42] Disruption to infrastructure systems such as power delivery, and damage to roads, bridges and buildings can bring property damage and also business interruption claims. Extreme heat is leaving its own, subtle mark on the built environment. Called an "invisible hazard" given the not readily obvious impacts,[43] extreme heat can cause infrastructure problems in very hot places like Arizona. It can also do so in historically cooler locations like the Pacific Northwest that today experience unprecedented high temperatures. Often, local infrastructure has not been designed to withstand changing climates. High temperatures

38 Zhao et al., *Global, regional, and national burden of mortality associated with non-optimal ambient temperatures from 2000 to 2019: a three-stage modelling study*. The Lancet Planetary Health, vol 5, 2021.
39 *Insuring against extreme heat: navigating risks in a warming world*, World Economic Forum (WEF), 17 January 2025.
40 Arias et al., Technical Summary in *Climate Change 2021: The Physical Science Basis. Contribution of Working Group I to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change*, Cambridge University Press, 2021.
41 *Climate Change Indicators: Heat Waves*, US Environmental Protection Agency (EPA), June 2024.
42 *Business on the Edge: Building Industry Resilience to Climate Hazard*, WEF, 11 December 2024.
43 *The Hidden Ways Extreme Heat Disrupts Infrastructure*, Scientific American, 2 August 2024.

can cause damage to and disrupt transportation, water and energy systems, among others. Ongoing risk assessment is necessary to ascertain how resilient infrastructure is. Assets that are poorly maintained are more vulnerable (see *Impacts of extreme heat by sector,* for the scope of potential damage that extreme heat can cause).

...increasing the likelihood of wildfires.

Droughts and heatwaves can increase the likelihood of wildfires.[44] Global insured losses due to wildfires have increased dramatically in the last decades, accumulating to USD 74 billion during 2014-2023.[45] Droughts and heatwaves, co-occurring strong winds, and increased development in the wildland-urban interface are fueling property damage, business interruption, injury, death, air pollution, loss of harvestable lumber and land for agriculture losses. In agriculture, temperature extremes can cause animal and crop mortality and reduce yields, leading to livestock and crop insurance claims.

Populations in regions more vulnerable to heat risk are often less well-served by insurance.

L&H: Extreme heat effects on health and safety could spark rising claims in life and medical insurance, and also workers' compensation. As of 2020, around 71% of the world's working population was exposed to excessive heat.[46] Populations more vulnerable to heat risk are often in areas less well-served by L&H insurance; at the same time mortality is typically more modest for insured populations. Extreme heat can stress healthcare systems, leading to an increase in hospital admissions, putting additional burden on facilities and equipment. Hot weather has impacted ambulance call-out response times, and led to cancellations of surgeries and overheating in surgical theatres.[47,48] Heat stress on electrical grids increases the risk of blackouts, in turn increasing mortality and morbidity risks, particularly when vulnerable groups rely on air conditioning to *not* be at risk.[49] Further, disruptions to cold-chain storage and transit infrastructure may cause active medical ingredients to degrade, leading to financial losses and outbreaks of vaccine-preventable diseases.[50]

Heat-related accidents could lead to liabilities claims against employers for failing to perform duties of care.

Workplace accidents are more likely to occur when staff operate under conditions of heat stress. This could see an increase in medical and workers' compensations claims. Employers failing to provide adequate hydration, rest breaks and other preventive measures may face employers' liability claims. Similarly, organisers of outdoor events, municipalities and schools etc. could be exposed to liabilities if they do not provide corresponding duty-of-care measures. In helping to prevent such situations, insurers can offer innovative covers like parametric insurance for earnings protection during extreme heat events.[51]*sector,* for the scope of potential damage that extreme heat can cause).

Liability claims based on extreme heat are adding to a trend of climate change-related lawsuits.

Liability: There could be litigation against those having alleged responsibility for the causation of extreme heat events and its impacts. As in the case, for example, of a lawsuit filed by a county in Oregon (US) in 2021 against fossil fuel companies and a consulting firm.[52] A heat dome event had led to at least 69 associated deaths. The plaintiff claimed USD 52 billion for losses caused by the effects of climate change on extreme weather events. Liability lawsuits based on extreme heat add to the larger trend of climate change-related liability lawsuits.[53] Along similar lines, engineers could face construction professional liability claims in cases where infrastructure design shows to be not heat tolerant.

44 *sigma* 1/2025, Swiss Re Institute, op. cit.
45 *Focus on natural catastrophes: Wildfires*, Swiss Re, 22 January 2025.
46 *Heat at work: Implications for safety and health*, International Labour Organisation, 2024.
47 Thornes et al. *Ambulance call-outs and response times in Birmingham and the impact of extreme weather and climate change*, Emergency Medicine Journal, vol 31, 2014.
48 *Elective surgical services need to start planning for summer pressures,* British Journal of Surgery, vol 110, 2023.
49 Stone et al., *How Blackouts during Heat Waves Amplify Mortality and Morbidity Risk,* Environmental Science & Technology, vol 57, 2023.
50 Nidhee et al., *Climate and health strategies must take vaccination into account,* Nature Microbiology, vol 8, 2023.
51 *Extreme heat triggers novel payout for over 46 000 women in India*, Swiss Re, 12 June 2024.
52 *US climate change lawsuit seeks $50 billion, citing 2021 heat wave*, Reuters, 23 June 2023.
53 *Climate change litigation: [Re]thinking our approach based on the latest developments*, Swiss Re, 24 May 2023.

There can be sector and country specific adverse impacts on asset values.

Financial markets & insurers' assets: Extreme heat waves are increasingly recognised as a material risk to asset valuations and financial markets. Prolonged heat events can disrupt energy supply, reduce labour productivity, and reduce agricultural output, directly affecting company earnings and asset valuations.[54] Utilities face strain from surging electricity demand for cooling systems, while higher temperatures reduce the operational capacity of power plants.[55] The power grid may falter under thermal stress, increasing maintenance costs and operational downtime while increasing the risk of wildfire ignition.[56] As frequency and severity of extreme heat events intensify, markets will likely increasingly price in the risks posed by extreme heat events. Heat-induced economic disruptions may also weaken sovereign credit profiles, particularly in emerging markets where adaptation capacity is lower.[57]

Impacts of extreme heat by sector

Energy
- Extreme heat increases demand for electricity, which can stress the power grid and increasing the risk of blackouts and power shortages.
- It also affects thermoelectric power generation by impacting water availability and temperature, both critical for cooling operations.
- Power transmission becomes inefficient in high temperatures, reducing the capacity of generators, transformers and transmission lines.
- Solar panels and wind turbines also experience reduced efficiency.

Transportation
- High heat can cause road ruts, buckling and pavement cracking, leading to damage to rail tracks, bridges, and power cables for railways and streetcars.
- Train rails and bridges are vulnerable to heat-induced deformation.

Telecommunications
- High risk due to sensitivity of data centres and network infrastructure to extreme heat, more so where access to water is limited.
- Fixed asset losses projected at USD 518 million to USD 563 million/year by 2035.*
- Extreme heat can cause terrestrial cable materials to expand and contract, leading to sagging, equipment malfunction and insulation degradation.
- Strain on data centre cooling systems, potentially leading to overheating or equipment failure

Batteries
- Prolonged exposure to temperatures above 30°C can cause pre-mature degradation of lithium-ion batteries.
- Battery degradation can reduce electric vehicle range by 20%. Elevated risk of thermal runaway, which can potentially lead to battery fire or explosion.**

Construction
- Extreme heat can damage building materials, accelerate rust, and cause steel and iron beams to expand, leading to structural vulnerabilities.

Agriculture
- Extreme heat and drought cause economic losses in forest productivity, and also crop and livestock farming.

*Source: *Business on the Edge: Building Industry Resilience to Climate Hazard*, WEF, 11 December 2024.
**Source: Meng D. et al., *Effects of environmental temperature on the thermal runaway of lithium-ion batteries during charging process*, Journal of Loss Prevention in the Process Industries, vol. 83, 2023.

[54] Diffenbaugh, et al. *The impact of extreme summer heat on economic output*, Nature, 2021.
[55] *Climate Risks in the Power Generation Sector,* International Energy Agency, 2024.
[56] *Power System Wildfire Risks and Potential Solutions: A Literature Review & Proposed Metric,* National Renewable Energy Laboratory, 2023.
[57] *Climate Change and Long-Term Sovereign Credit Risk*, IMF, 2020.

New frontiers in fungi-related loss potential

We see two main areas of new fungi-associated loss potential. The first is on account of fungi adapting to and thriving in warmer temperatures, including in humans and other warm-blooded animals. The second is overuse of fungicides, leading to the development of more multi-drug-resistant fungal pathogens. Specialty insurers face elevated risks from crop losses and commodity disruptions, while property insurers may see more mould-related claims on account of flooding and damp conditions. Casualty lines are exposed to liability losses from product recall and environmental impairment claims, due to inadequate containment or misuse of fungicides. In L&H, the spread of drug-resistant fungal infections potentially poses a growing risk to vulnerable populations.

Potential insurance impacts

Impact rating (0 = no impact; 4 = high Impact)

- **Time horizon:** L&H and property impacts are expected to maintain an ongoing upward trend. Impacts in agriculture could happen anytime.
- **Property:** Higher claims for toxic mould infestation in buildings as warming climates foster damp environments susceptible to toxic mould.
- **Specialty:** Mould spread in crops as climates warm and the development of multi-drug-resistant fungal pathogens could increase claims in agricultural insurance.
- **Casualty:** Over- and improper use of fungicides could increase product recall, environmental liability, professional indemnity and workers' compensation claims.
- **L&H:** A potential uptick in morbidity, mortality and associated claims due to fungal infections and the development of multi-drug-resistant fungal pathogens.
- **Insurer assets and financial markets:** Food shortages/rising prices due to crop losses could spark social and geopolitical uncertainties, fuelling market volatility.

Fungi are adapting to warmer temperatures.

Adapted fungi meet a more vulnerable world

To feed a growing world population, the green revolution of the 1960s promoted cultivation of fewer food crops and crop varieties on larger plots of land.[58] This has led to the scenario in which key staples, cereals and root-crops have high genetic uniformity, which in turn has facilitated rapid spread of fungi. The response of overuse of fungicides in agriculture has only led to more virulent strains.[59, 60] Today, fungal diseases cause 10–23% of global harvest losses each year. The excessive use of fungicides in agriculture have resulted in the spread of more virulent strains to livestock and humans. There are already cases of multi-drug resistant fungi limiting medical treatment options for those affected. While currently still on small scale, the development of anti-fungal resistance to drugs could contribute to higher mortality rates, perhaps more so during natural disasters and in the midst of other disease outbreaks.[61, 62, 63, 64]

[58] Khoury C, Brush S, Costich D et. al., *Crop genetic erosion: understanding and responding to loss of crop diversity,* New Phytologist, vol 233, 2022.

[59] Fungi are an individual class of biological organisms that digest organic matter externally before absorbing it into their body. They live in soil, water and within other organisms either in symbiosis or as parasites. There are currently 144 000 known species, but it is thought around 2.2 – 3.8 million exist.

[60] Karunarathna S, et. al., *Editorial: Emerging Fungal Plant Pathogens,* Frontiers, 17 September 2021.

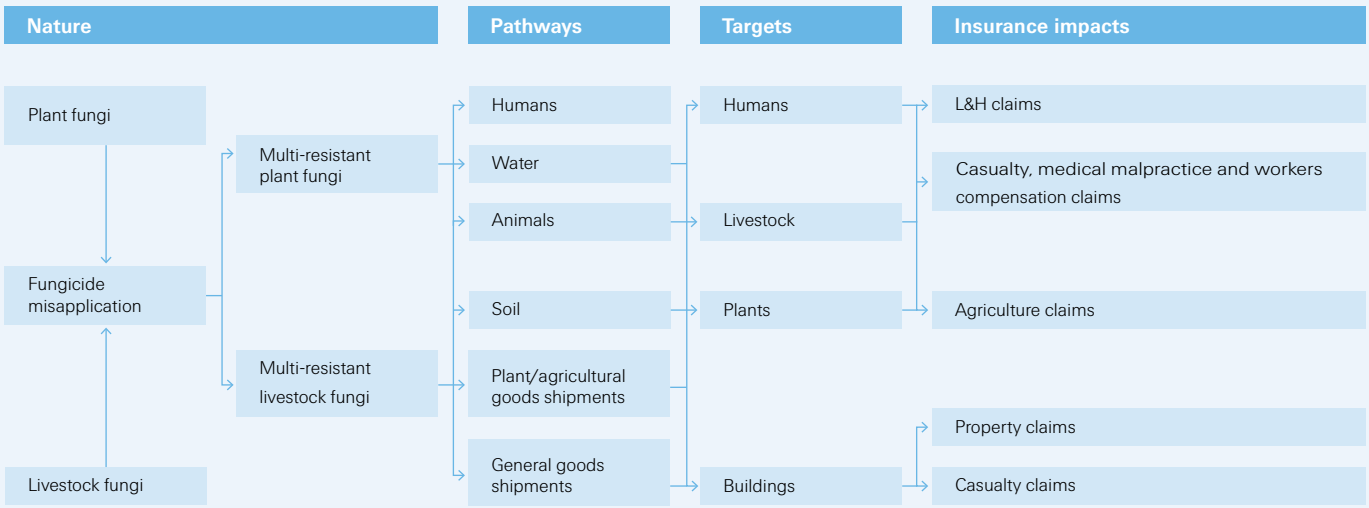
[61] Seidel D, Wurster S, Jenks J et. al., *Impact of climate change and natural disasters on fungal infections*, The Lancet Microbe, vol 5, June 2024.

[62] Denning, D, *Global incidence and mortality of severe fungal disease,* The Lancet Infective Diseases, vol 24, July 2024

[63] Shah K, Deshpande M, Shah P, *Healthcare-associated fungal infections and emerging pathogens during the COVID-19 pandemic,* Frontiers in Fungal Biology, 23 February 2024.

[64] Seidel D, Wurster S, Jenks J, op. cit.

Figure 9
From fungi to insurance claims



Source: Swiss Re SONAR

The call is to reduce vulnerabilities to fungal spread...

Prevention is better than cure

A first step to manage the risks inherent in the spread of fungi is to monitor new and multi-drug-resistant outbreaks in agriculture and humans, in order to reduce vulnerabilities in the first place. This should include the impacted targets and the identification of pathways by which fungi distribute. To facilitate such monitoring and guide related research, the World Health Organization (WHO) has published a "fungal priority pathogens list" (FPPL) to systematically list fungal pathogens of perceived public health importance.[65] Second, containment procedures to minimise spread are needed. Border controls of goods and people may be necessary, depending on the fungi concerned. At the same time, workers in the agriculture, construction and healthcare sectors should be trained to spot signs of fungal infection early on and to take relevant actions. Many incidents of fungal infection are discovered too late or not at all, leading to larger losses than would otherwise be the case.[66] In agriculture specifically, biodiversity and the inclusion of certain plants or crops can help prevent the spread of infections without needing fungicides, keeping crops uncontaminated from chemicals.[67]

...and a cross-functional risk management process.

All such new tools must be used sparingly and appropriately to fend off the development of new multi-drug resistant fungi, this calling for cross-functional risk management in all areas of application. Currently agricultural, construction and healthcare applications are approved and managed by different regulatory bodies. To avoid resistance development in one area of application spilling into another environment, a common approach is needed.[68] In their risk assessment, insurers should remain cognizant that, in a world where international collaboration is declining and state budgets are shrinking, a global response to fungal spread may not be forthcoming and at the very least be inadequate. And in this environment, it could be that insurers need to shoulder a higher claims load.[69]

65 *WHO fungal priority pathogens list to guide research, development and public health action,* World Health Organization, 25 October 2025.
66 *Clinical aspects and recent advances in fungal diseases impacting human health,* Journal of Antimicrobial Chemotherapy, 14 March 2022.
67 *Emerging alternatives to control fungal contamination,* Current Opinion in Food Science, vol 61, February 2025.
68 See *Resistance undermines treatment of fungal infections,* Health Council of the Netherlands.
69 Fisher M, Burnett F, Chandler C, et. al., *A one health roadmap towards understanding and mitigating emerging Fungal Antimicrobial Resistance,* npj, 2024.

A toxic mould crisis in the US in the late 1990s/early 2000s reshaped property and underwriting practices.

In the late 1990s and early 2000s, a toxic mould crisis in the US reshaped parts of P&C underwriting, similar to the impacts of asbestos and lead paint in earlier decades. It highlighted the industry's vulnerability to emerging environmental and indoor air quality risks, and reinforced the importance of clearly defined policy language. There was a surge in mould-related claims, particularly in states like Texas and California. High-profile lawsuits, such as the 2001 case where a Texas jury awarded USD 32.1 million to a family in a mould-related lawsuit, highlighted the financial risks associated with mould claims.[70] In response, insurers began to exclude or limit mould coverage in standard homeowners' policies. For the long term, mould coverage became a niche or add-on product with limited coverage. The market stabilised as exclusions and limitations for mould coverage became standardised, and consumer awareness grew. By 2003, insurance departments in around 40 US states had approved mould exclusions and/or limitations on homeowners' insurance policies. Insurers promoted timely repairs of water intrusions to mitigate mould growth.

Lines of business most impacted: specialty and casualty

Fungi can destroy agricultural products...

Specialty: Fungi can destroy agricultural products.[71] In warmer climes, mould becomes more prevalent in crops, including in new geographies. The spread into new environments also opens new pathways for distribution, for instance by enabling spread of spores via air and water to new geographies and hosts in which fungi can survive.[72] Fungal infection can have severe impact on crop yields, the result of which could be food shortages and higher food prices. This could spark social, macro and geopolitical uncertainties. Economic slowdown could reduce insurance demand, while uncertainties can fuel market volatility, complicating the role of asset managers (including insurers).

...including non-food commodities.

Agriculture is not about food alone. Mould can also impact non-food commodities like latex, which is used in a wide range of products from tires to medical gloves. There have been cases where newly emerging plant diseases have hampered growth of plantation crops and reduced yields.[73] The supply chain ramifications of a severe outbreak of new diseases are many. For instance, a shortage of supply of natural latex could spark significant business interruption losses.

Overuse of fungicides can lead to the development of multi-drug resistant fungal strains.

Casualty: Over- or improper use of fungicides and/or failure to action procedures to contain fungal spread could increase product recall, environmental liability and/or professional indemnity claims. This is in cases where mould and the development of multi-drug resistant fungal strains lead to property damage, bodily injury and subsequent financial loss, and where precautions taken by producers and distributors are deemed to have been insufficient. Insurance covers for product recall are available if producers meet certain risk management criteria.[74] In addition, overuse of fungicides can lead to accumulation of fungicides in soil and water. This could potentially generate environmental impairment liability and workers' compensation claims should employees fall ill on account of contact with drug-resistant strains of fungi.

Toxic mould thrive in damp conditions.

Property: One outcome of warming climates could be more severe and frequent flood and storm surge events, including in areas not previously impacted. Water and damp conditions in buildings fosters growth of toxic mould, even more so in warmer temperatures. As more areas become susceptible to flooding and damp, so too will more properties (private and commercial) be vulnerable to mould. This could lead to an increase in claims for damages caused by mould. And if mould contaminations related to natural perils are covered, claims severity could increase in more geographies.

Fungi are adapting to warmer temperatures in humans.

L&H: Fungi are adapting to higher temperatures, including in humans and other warm-blooded animals.[75] In clinical settings, incomplete treatment cycles for fungal infections

[70] *Jury Sends Message to Insurance Industry in Toxic Mold Case,* Insurance Journal, 18 June 2001.
[71] *Emerging alternatives to control fungal contamination*, Current Opinion in Food Science, vol 61, February 2025.
[72] Seidel D, S. Wurster S, Jenks J et. al., op. cit.
[73] Nusaibah S, Aliya S, Sapak Z, "Emerging Rubber Disease and Potential Factors Contributing", in Wong Y (ed), *Advances in Tropical Crop Protection,* Springer, 1 July 2024.
[74] See *Crisis Management Product Recall and Contamination*, Swiss Re Corporate Solutions, 2025
[75] Huang, J, Hu P, Ye, L, et al., *Pan-drug resistance and hypervirulence in a human fungal pathogen are enabled by mutagenesis induced by mammalian body temperature*, nature microbiology, vol 9, 2024.

can promote the development of multi-drug-resistant fungal pathogens.[76, 77] There have already been cases of multi-drug-resistant fungi limiting medical treatment options for patients.

The development of fungal resistance to drugs could drive mortalilty rates higher.

While currently still on small scale, the development of fungal resistance to drugs could contribute to higher mortality rates, perhaps more so during natural disasters and in the midst of other disease outbreaks.[78, 79, 80, 81] This mirrors the trajectory seen with drug-resistant bacteria, where over-prescription, antibiotic misuse and incomplete treatment cycles have led to widespread resistance and a growing public health crisis. However, anti-fungal resistance is still at a much earlier stage, offering a crucial window to intervene and prevent a similar health threat.

Fungi-related L&H claims from more vulnerable populations are likely.

Fungi could also be a contributory factor behind increased L&H claims in periods of acute health crises, as evidenced by reports during the COVID-19 pandemic that fungal infections increased the morbidity and the death rate among immuno-compromised patients.[82] This coincides with indications that the average temperature of the human body decreases 0.03º C per birth decade.[83,84] Given that fungi are adapting to warming temperatures, it could be that fungi are better able to survive in humans, perhaps more so in persons with pre-existing conditions.[85]

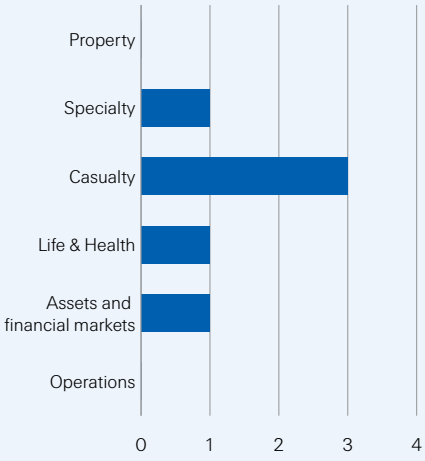
76 D. Seidel, Wurster S, Jenks J, et. al., op. cit.
77 Hi S, Gifford H, Rhodes J, *Emerging Antifungal Resistance in Fungal Pathogens,* Current Clinical Microbiology Reports, 9 February 2024.
78 Seidel D, Wurster S, Jenks J, et al., op. cit.
79 Denning D, op cit.
80 Shah K, Deshpande M, Shah P, op. cit.
81 D. Seidel, Wurster S, Jenks J, et. al, op. cit.
82 Stukenbrock E, Gurr S, *Address the growing urgency of fungal disease in crops,* Nature, May 2023.
83 Protsiv M, Ley C, Lankester J, et al., *Decreasing human body temperature in the United States since the Industrial Revolution,* Stanford University, 7 January 2020.
84 As observed in the US since the industrial revolution. See Seidel, D, S. Wurster, J. Jenks, et. al., op. cit.
85 Cohen J, Venesky M, Sauer E. et al. *The thermal mismatch hypothesis explains host susceptibility to an emerging infectious disease,* Ecology Letters, 23 January 2017.

Plastics: a new wave of litigation?

The widespread use and poor disposal of plastics are driving an increase in litigation across different lines of business, particularly in the US, on account of the potential harm that plastics and plastic particles cause. Alongside evolving legal frameworks, scientific advances regarding causation and source attribution could spark a rapid increase in environmental and product liability claims against producers, users and waste managers of plastic. Insurers may see rising demand for pollution-related coverage amid tightening regulations. In L&H insurance, potential health effects from micro- and nano-plastics could lead to increased morbidity risks and associated claims.

Potential insurance impacts

Impact rating (0 = no impact; 4 = high Impact)



- **Time horizon:** Plastics have become a major environmental and health concern. From an insurance industry perspective, earliest traction is likely in casualty.
- **Specialty:** Projects to diminish plastic pollution, boost recycling and provide alternatives may provide insurance opportunities.
- **Casualty:** Producers, manufacturers and retailers may see an increase in liability claims for environmental impacts. Litigation costs may rise in cases around public nuisance, false labelling or greenwashing claims (eg, with respect to bio-degradability or recycling). The increasing use of the term "Big Plastic" (analogous to "Big Tobacco") highlights the litigation focus on a whole industrial sector. Waste management, recycling organisations and water suppliers can become litigation targets, Claims costs around product liability could also rise. If causal relationships between plastic particles and adverse health impacts can be established, higher claims in bodily injury, workers' compensation and product liability lines of business can be expected.
- **L&H:** Mortality and morbidity claims impact from plastic particles could become significant. The scale of exposures may currently be underestimated, in our view.
- **Insurer assets and financial markets:** Pollution by plastics can negatively impact property values and investments in water or recycling schemes. Similarly, vested interest in plastics made from fossil fuels and their waste disposal could raise sustainability and reputational concerns.

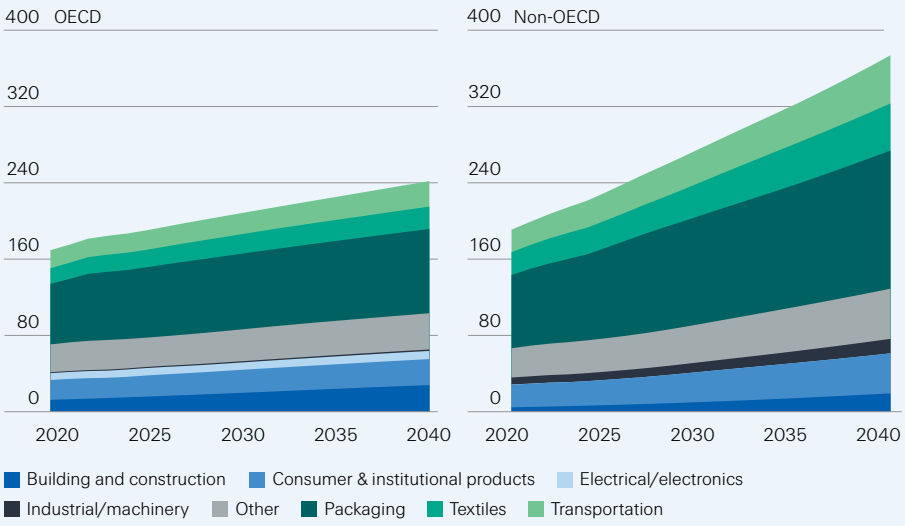
There is too much plastic in the world.

The environmental impact of plastics

Plastics are all and everywhere. The OECD projects that global production of plastics will reach 736 million tonnes by 2040, up 70% since 2020.[86] Made mostly from fossil fuels, production of plastic is paired with inadequate disposal and waste management systems. Almost half of all plastics are used only once (eg, for food packaging, grocery bags, bottles etc), and less than 10% of single-use plastics are recycled. Around two-thirds are incinerated or landfilled in a controlled manner, and more than 25% leak into terrestrial or aquatic environments.[87] The "Great Pacific Garbage Patch" in the Pacific Ocean, about three times the size of France, is just one shocking example of plastic waste accumulation in the marine environment.

[86] *Policy Scenarios for Eliminating Plastic Pollution by 2040*, OECD, 2024.
[87] Ibid.

Figure 10
Projected evolution of plastic waste



Source: OECD

Plastic particles are leaking into the environment and food chains.

Another side to the plastic risk equation is the slow decomposition into small particles at micro- (<5mm) or nano- (<0.1mm) scale. Large amounts of microplastics originate from tyre wear and from paints. Plastic particles are produced for commercial applications, such as in cosmetics and personal care products (microbeads). Increasingly, micro- and nanoplastics are being found in the environment, in waterways, food chains and even in geological formations.[88]

The production of plastics from fossil fuels accentuates GHG emissions.

Concern around the role of plastics made from fossil fuels as a driver of still-increasing greenhouse gas (GHG) emissions is becoming more prominent as the related impacts rise, and become more complex and self-reinforcing.[89] To mitigate environmental impacts, international and jurisdiction-specific programmes have been introduced to curb production, drive recycling, and to promote use of plastic substitutes (degradable plastics made from renewable sources). Further, an UN-led global treaty on plastics with 175 countries is under negotiation. Uniform standards remain lacking. That authorities in different jurisdictions are pushing in different directions could see a rise in cases of plastics-related climate change litigation.

Adverse impacts on the environment and human health

Plastics are a major ecological concern.

Plastics are a major ecological concern. Environmental harm stems from the carbon footprint left by the production of plastics from fossil fuels, physical plastic waste, and chemical additives such as per- and polyfluoroalkyl substances (PFAS) or bisphenols, used to produce softeners, plasticisers, flame retardants and antioxidants, among others.[90] These additives can harm plant and animal life if leaked into the environment and/or if they enter food chains. There is also evidence of the presence of plastics and related substances such as endocrine-disrupting chemicals in the environment. These can disturb reproduction processes.

There is growing research about the negative impact of plastics on our health.

Of late, there has been more research into the potential harm of plastic particles to human health. Findings include increasing presence of plastic particles in the body, including in the digestive system, blood stream, liver, kidney and even the brain.[91]

88 Rangel-Buitrago N, Galgani F, Neal, *The geological footprint of plastics*, Science of The Total Environment, vol 940, 2024.

89 When sourced from fossil fuels, the production of plastics is emissions intensive, and hence correlated with GHG emissions and global warming. Incineration of plastics or decomposition by sunlight and bacteria additionally releases gases like methane and ethylene. By absorbing sunlight, microplastics can reduce ability of plants and plankton to fix carbon dioxide by photosynthesis. *Sustainability series: Tackling the microplastics challenge Article information and share options*, Swiss Re, 15 August 2022.

90 For an overview of important plastics-related chemicals of concern see *Chemicals in plastics: A technical report*, UN Environment Programme, 2023.

91 Nihart A et al., *Bioaccumulation of microplastics in decedent human brains*, naturemedicne, 31 March 2025.

Unsurprisingly, public concern is also rising.[92] The negative health impacts of larger (micro-) particles found in digestive systems (but assumed to be largely excreted) are thought to stem from toxicity of chemicals, such as PFAS, phthalates or endocrine disruptors. These can disturb hormonal systems and in turn fertility, weight and more.[93] Recent studies indicate particular danger from plastic particles at nanoscale. These can pass through cell membranes and the blood-brain barrier. Such particles are even accumulating in the tissue of a foetus, entering via the placenta.[94]

Insurance lines of business most impacted: casualty

Expect a ramp-up in litigation cases if casual relationships between plastic and plastic particles and adverse health outcomes are established.

Casualty: Scientific progress in causation and source attribution with respect to quantifying the sources and impacts of plastic pollutants will play a crucial role in litigation. If causal relationship between pollutants and their sources is established, this will provide plaintiffs with evidence of pollution emanating from specific industries and/or companies. Producers and manufacturers of plastic products, additives, distributors, but also entities responsible for recycling, waste management and water supply could be hit by environmental liability, property damage or bodily injury claim. In the US, emerging litigation trends are around public nuisance (expansion of liability with lighter burdens of proof), deceptive labelling and advertising, and product liability. Cases of contested labelling and advertising include producers of bottled mineral water and baby bottles being sued for marketing products as safe, but from which microplastics and additive chemicals have leaked.[95]

Waste management and recycling organisations are prime litigation targets.

The recycling sector is also under scrutiny. In 2024, California's Attorney General filed a lawsuit against Exxon Mobile for misleading the public on the recyclability of plastics and the potential for environmental pollution.[96] There has been a significant rise in plastics litigation in the US, particularly with class action and consumer protection lawsuits. The US exit from the Paris Agreement, and the deregulations and dismantling of federal governmental agencies in the US is unlikely to reduce environmental liability litigation. Instead, the role of enforcing environmental protection will likely shift from federal regulators to courts, consumers and state attorneys general, potentially increasing litigation risk and insurance claims. A rise in litigation awards is a general driver to consider in the context of plastics' claims scenarios.[97]

New consumer protection regulations make litigation cases more likely.

In Europe too, consumer protection regulations are increasing propensity for plastics-related litigation. The 2024 revision of the EU *Product Liability Directive*, which shifts the burden of proof to producers, increases the likelihood of compensation payouts and increases the likelihood for expanding liability.[98] In Asia, national authorities are still developing their regulatory and legal approaches. Some countries are adopting measures to reduce plastic pollution, but litigation is still only in early stages.

Commercial sector demand for pollution-related insurance covers could rise.

Specialty: Projects to diminish plastic pollution, boost recycling and provide alternatives may provide insurance opportunities, with rising demand for covers for pollution-related events. Companies may seek cover for associated legal defence costs and potential settlements.

Impacts on L&H insurance books could also be significant.

L&H: While direct causal links between plastic exposure and specific diseases or deaths have not yet been firmly established, growing evidence suggests plausible ways by which plastics could contribute to both morbidity and mortality. There has been

92 In 2023, for example, German consumers rated microplastics in food as their top environmental health concern. See M. Kozlov, *Your brain is full of microplastics: are they harming you?*, Nature, 11 February 2025.

93 Potential health impacts from plastic-related chemicals have been mapped out by comparative review of available research in B.J. Seewoo et al., *The plastic health map: A systematic evidence map of human health studies on plastic-associated chemicals*, Environment International, vol. 181, 2023.

94 Ibid.

95 Ongoing lawsuits claim, for example a mineral water is not as pure as advertised, or that baby bottles are intoxicating contained liquids when heated. See, for example *Fiji Water Lawsuit Raises Concerns About Microplastics*, Newsweek , 5 February 2025; *Baby bottle maker says microplastics inescapable, health risks unproven, in bid to toss lawsuit*, Reuters, 9 September 2024.

96 *Attorney General Bonta Sues ExxonMobil for Deceiving the Public on Recyclability of Plastic Products*, State of California Department of Justice, 23 September 2024.

97 *sigma* 4/2024, op. cit.

98 European Commission, December 2024, op. cit.

correlation between particles lodged in blood vessels and increased propensity for heart attacks, stroke or death,[99] and neurotoxic effects on the brain.[100] If evidence is established, L&H business may be affected via several different causes of mortality and morbidity, though no mitigation measures exist at present. In our view, this risk is perhaps one that is currently underrated

Litigation, regulation, and stranded asset concerns shape investment risks.

Financial markets & insurers' assets: Financial market exposure to plastics and microplastics is a growing concern for investors due to accelerating regulatory, legal and reputation risks. Litigation is mounting, as exemplified by the aforementioned California state lawsuit against ExxonMobil for misleading claims on plastic recyclability, underscoring legal exposure across the plastics value chain.[101] Emerging class actions and consumer protection litigation, mostly in the US and the EU, are raising litigation risks, especially for petrochemical, packaging, and consumer goods firms. Long-term asset values are also at risk as fossil-fuel-based plastic production faces declining demand, regulatory penalties and policy driven phase-outs.[102] Current ESG indices and ratings often fall short in adequately capturing plastic-related sustainability risks, long-term demand risk and stranded assets.[103]

[99] R. Marfella et al., *Microplastics and Nanoplastics in Atheromas and Cardiovascular Events*, The New England Journal of Medicine, vol 390, March 2024.
[100] Huang H et al., *Microplastics in the bloodstream can induce cerebral thrombosis by causing cell obstruction and lead to neurobehavioral abnormalities*, Science Advances vol 11, J 22 January 2025.
[101] *Attorney General Bonta Sues ExxonMobil for Plastics Deception*, California Dept of Justice, 2024.
[102] *Global Plastics Outlook: Economic Drivers, Environmental Impacts and Policy Options*, OECD, 22 February 2022.
[103] *Beneath the Surface: How ESG Ratings Fall Short in Addressing the Risks and Impacts of Plastics*, Fair Finance International, 2024.

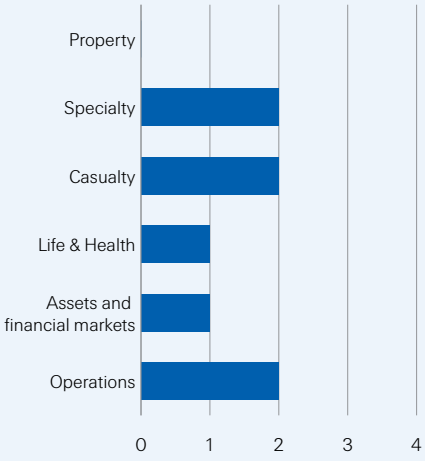
Emerging risks – flagging new exposures

Deepfakes and disinformation: enabling insurance fraud

Digital technology including AI can facilitate varied forms of criminal activity, including submission of fraudulent insurance claims. Insurers face heightened operational demands and costs to detect and mitigate the risks that deepfakes can bring. AI can also facilitate widespread disinformation that can erode trust in the insurance industry and impact legal proceedings.

Potential insurance impacts

Impact rating (0 = no impact; 4 = high Impact)



- **Time horizon:** Impacts from deepfake events and disinformation set to continue to rise in the near term.
- **Specialty:** Deepfakes may increasingly be used in sophisticated cyberattacks and drive cyber insurance losses. Cyber crime could also boost demand for associated insurance solutions.
- **Casualty:** Deepfakes may be employed to present as legitimate professional or executive communications, exacerbating professional indemnity liabilities.
- **L&H:** Disinformation could change peoples' choice on important public health matters such as vaccinations. Those wanting to submit fraudulent claims can use deefake technology to manipulate medical records or misrepresent health conditions, this undermining the function of underwriting.
- **Insurer assets and financial markets:** False narratives about companies could harm their reputation, leading to loss of customer trust, revenue and equity market value.
- **Insurance operations:** Investments in anti-fraud technology and processes can increase the cost of providing coverage. Increasingly sophisticated cyberattacks require more resources for counter measures.

Deep fakes facilitate claims fraud.

Deepfakes

Deepfake technology can create convincing but false evidence like altered video footage or doctored documents, making it more challenging for insurers to verify the authenticity of claims. Concurrent with rising numbers and total value of fraudulent claims in the UK, insurers report rapidly rising use of deepfakes in claims fraud with a skew towards low-value claims.[104, 105] Apps have been used to manipulate real-life images, videos and documents in motor claims.[106] Paper-based claims submissions have been affected.[107] Deepfakes can also be used for cybercrime.

Disinformation can erode trust and reliability of public information.

Disinformation

Along similar lines, disinformation – the deliberate spread of inaccurate information – is an evolving threat for the insurance industry. Accurate data and a reliable information environment is crucial for insurers. Fake or misleading news can distort reality, complicating claim assessments and eroding trust both in institutions and potentially the insurance industry itself. [108] AI-powered bots and trolls engage in coordinated disinformation campaigns that are difficult to detect and combat, especially if disinformation is spread in social media groups.[109] The societal cost can be sizable if topics like vaccination campaigns (eg, during the recent COVID-19 pandemic) are affected.[110] Social media's real-time nature and convincing appearance often bypass fact-checking.

[104] *Deepfake is threatening trust in society,* SINTEF, 20 February 2025.
[105] *No let up in crack down on insurance cheats as industry detects £1 billion worth of fraudulent claims,* Association of British Insurers, 25 September 2024, See *UK Insurance Fraud Surges as AI Tools Aid in Falsifying Claims,* Insurtech insights.
[106] *Allianz prevents 29% more fraud and announces partnership with Clearspeed,* Clearspeed, 23 April 2024.
[107] *Insurance must prepare for a rise in deepfake AI fraud,* Zurich, 23 January 2024.
[108] *Using data and AI to take the guesswork – and the TV news – out of claims adjustment,* Swiss Re, 7 February 2025.
[109] *Disinformation: sources, spread and impact,* UK Parliament, 25 April 2024.
[110] *Decoding digital trust - an insurance perspective,* Swiss Re Institute, 18 May 2022.

Impacts of disinformation can spread to financial markets and legal decisions.

Recently an AI powered solution has pushed fake-news alerts that wrongly summarise reports from well-established news sources.[111] Such usage can mislead the public and potentially erode trust, spark social unrest and volatility in financial markets.[112] Moreover, fake news can mislead legal professionals and jurors by reinforcing their biases, ultimately affecting their ability to evaluate evidence objectively.[113]

Lines of business most impacted: specialty, casualty and operations

Deepfakes can be used to create fraudulent claims.

Specialty: Deepfakes can be used in claims submissions and underwriting fraud, and also as a tool in cybercrime (eg, vishing).[114] There have been cases of hackers stealing personal data and using deepfakes to apply for IT jobs to gain pivotal access to companies' IT and digital infrastructure.[115] Cyberattacks of any nature can ultimately undermine earnings, including of insurers. The growing types of digital attack surface will likely drive increased demand for innovative cyber insurance solutions in the future.

Deepfakes can cause liability losses.

Casualty: Deepfake technology can be the source of increased of litigation and claims. For example, if a policyholder is the victim of a deepfake scam and suffers financial losses, that person might seek compensation from their insurer, leading to potential disputes and increased liability for the insurer. The state of New Hampshire in the US has introduced a new law that permits victims of deepfakes to take private legal action. Granting a private right of action is particularly significant for liability insurers.[116] This development could impact general liability and homeowners' policies, as well as other specialty lines of business, if deepfake-related civil lawsuits become more common.

Costly countermeasures are needed.

Operations: Developing strategies to combat deepfakes and disinformation places additional operational demands on insurance companies, impacting efficiency and resource allocation.[117] With the rapid evolution of deepfake technology, insurers must adopt new technologies to detect falsified information and fraudulent claims. Further, false narratives about an insurer's practices or financial health could harm its reputation. This could lead to loss of customer trust, potentially influencing market demand and policyholder engagement. It could also lead to loss of market share and share price weakness. To counter fraud, regulatory bodies may impose stricter compliance requirements on insurers to ensure they take adequate measures to detect and prevent fraud. However, none of this comes for free. The investment in new technologies to comply with regulations drives up the cost of providing insurance and, ultimately, likely also premium rates for policyholders.

Fraud and disinformation could cause financial harm in various industries.

Assets and financial markets: Industries most exposed to financial loss from deepfakes and disinformation include banks, fintechs, and investment firms due to their control over large sums of money and reliance on digital transactions. In the fintech sector, there was a 700% increase in deepfake incidents in 2023, highlighting the escalating threat.[118] Other sectors like, for example, media, telecommunications, technology and pharma are vulnerable to manipulated content that can erode trust, spread disinformation, and trigger reputational and advertising losses. A 2024 survey revealed that 92% of companies experienced financial losses due to deepfake-related incidents, with 10% reporting damages exceeding USD 1 million.[119]

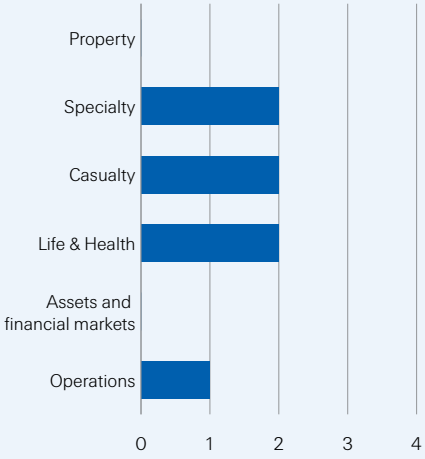
[111] *Apple AI fake news alerts highlight the tech's misinformation problem,*
[112] *Did an anonymous X account send markets reeling today?* Financial Times, 7 April 2025; and *The neural basis of confirmation bias,* Neuroscience News, 18 December 2019.
[113] Neuroscience News, op. cit.; and *Media and the Right to a Fair Trial: Juror Impartiality in the Information Age"*, Columbia Undergraduate Law Review, 20 January 2022.
[114] *AI phone scam targets Italian business leaders including Giorgio Armani*, The Guardian, 10 Feb 2025.
[115] *Staying a Step Ahead: Mitigating the DPRK IT Worker Threat,* Google Cloud Blog, 23 Sept 2024
[116] *What Is a Private Right of Action,*
[117] *Generative AI: A Double Agent Serving Good and Evil in the World of Claims*, Insurance Journal, 30 December 2024.
[118] *Deepfakes are coming for the financial sector,* Wall Street Journal, 3 April 2024.
[119] *The Impact of Deepfake Fraud: Risks, Solutions, and Global Trends*, Regula, 15 November 2024.

New technologies in healthcare delivery

The changing face of healthcare delivery involves trends like electronic health records (EHR) being used for underwriting purposes, and AI in the design of tailor-made care regimes delivered by virtual assistants. Even surgery can be performed virtually, with physicians in one location involve real-time in surgical procedures taking place on the other side of the world.

Potential insurance impacts

Impact rating (0 = no impact; 4 = high Impact)



- **Time horizon:** The rapid pace of technological adoption in healthcare is expected to materialise risks within a short period, driven by increased investments and advancements in digital health tools and platforms.
- **Specialty:** Increased demand for cyber coverage to mitigate data security and privacy risk resulting from, for instance, use of EHR.
- **Casualty:** Failures in hard- and/or software can lead to bodily injury and even death, triggering product liability and professional indemnity claims. Potential under-service, diagnostic gaps and mis-judgment from reduced doctor-patient interaction could lead to medical malpractice claims.
- **L&H:** The use of AI and virtual technologies can faciliate tailor made coverage options for policyholders, and better treatment outcomes. AI-driven personalised health monitoring can lead to healthier insured populations by enabling early detection and preventative interventions, thereby potentially diminishing claim frequencies and moderating payouts. New technologies can also introduce risks such as mis-diagnosis and the potential for tech failures or overreliance on automated systems.
- **Insurance operations:** The integration of EHRs and AI into health insurance processes could yield improved underwriting accuracy, resulting in more precise risk evaluations and pricing. However, it could also make claims adjustment more complicated, and regulatory compliance issues may complicate product offerings.

Lines of business most impacted: specialty, casualty, L&H

Data security and rivacy concerns could boost demand for cyber insurance.

Specialty: A main challenge common to the digitalisation of medical records and the use of technologies like EHR is data security and privacy, as the systems access large amounts of sensitive patient information. This raises concerns about data breaches, unauthorised access to or misuse of information, violating privacy and compromising patient confidentiality. Such outcomes could boost demand for cyber insurance covers.

Robotics and virtual reality can make for more successful and efficient surgical outcomes...

Casualty: The virtual realm extends to surgical procedures performed remotely, in real time and with advanced robotics. This is with the development of extended reality (XR) technology, including virtual reality (VR), augmented reality (AR) and mixed reality (MR) technologies. Use cases are still mostly in the early design and pilot phase. Platforms with these technologies can enable surgeons to collaborate with teams in other countries, overcoming geographical barriers and ensuring patients receive specialised care regardless of their location.[120, 121] The use of robotics in surgery could improve patient outcomes (eg, faster recovery times) and operational efficiencies for medical practitioners.

... but the integration of new technologies can also complicate procedures as practitioners adapt.

However, integrating XR technologies and robotics in surgery raises challenges too, such as hardware limitations, software complexities, computing power constraints, and wireless communication issues. Another issue is the reliability of AI systems due to limitations in the algorithms or biases inherent in training data, in situations where these

[120] Adeghe E. et al., *A review of emerging trends in telemedicine: Healthcare delivery transformations*, International Journal of Life Science Research Archive, 15 March 2024.

[121] One example is three surgeons in different countries discussing and offering guidance on a surgical procedure taking place in one of the locations, See, for instance, *Collaboration and Preparation: What Mixed Reality Surgery Affords the Operating Room*, Healthtech Magazine, 22 March 2021.

lead to wrong diagnosis or treatment recommendations. Errors like these could have serious consequences for patient health.[122]

Process failures leading to bodily injury or death could trigger product liability and professional indemnity claims.

There are also concerns around clinical validation and user acceptance as surgeons adapt to new technologies. Potential diagnostic gaps and mis-judgment from reduced doctor-patient interaction could trigger medical malpractice claims. Given the pace of technological advances and growing acceptance of robotic-assisted surgery, the associated risks could result in an increase in demand for, but also claims in, liability insurance. For instance, liability disputes involving manufacturers, software developers and medical practitioners pose challenges in pinpointing accountability in cases of error or failure. Any process failures on account of use of new technologies that lead bodily injury or even death, could trigger product liability and professional indemnity claims.

By improving patient outcomes, the use if AI and virtual assistants could reduce claims in health insurance.

L&H: The use of AI and virtual technologies can facilitate tailor made coverage options for policyholders and better treatment outcomes. AI-driven personalised health monitoring can lead to healthier insured populations by enabling early detection and preventative interventions, thereby potentially reducing claims frequency and payouts. Virtual assistants can offer personalised health advice, screening and lifestyle suggestions based on AI-driven precision medicine.[123] This supports a move to prevention rather than cure. In mental health services, AI algorithms are used to analyse features such as speech patterns, facial expressions and other behavioural cues, during virtual consultations. The analysis can add nuanced value to diagnosis and facilitate more personalised treatments for conditions like depression, anxiety and mood disorders.[124] On the downside, new technologies can also introduce risks such as mis-diagnosis, potential for failures in technology and over-reliance on automated systems.

EHR can improve risk selection and pricing.

Insurance operations: To date, EHR have facilitated better access to patient information, efficiency gains in documentation and record-keeping, and improved communication and coordination among healthcare providers.[125] Taking the utility one step further, the vast data sets in EHR, alongside images and other biomedical sources can also be used in underwriting to improve the precision of risk selection and pricing. However, as new technologies become integrated, insurers will need specialised knowledge to manage claims. For example, traditional diagnosis is based on symptoms and clinical observations. Advancements in AI and use of EHR shifts the basis to understanding of genetic, molecular and other detailed biological data.

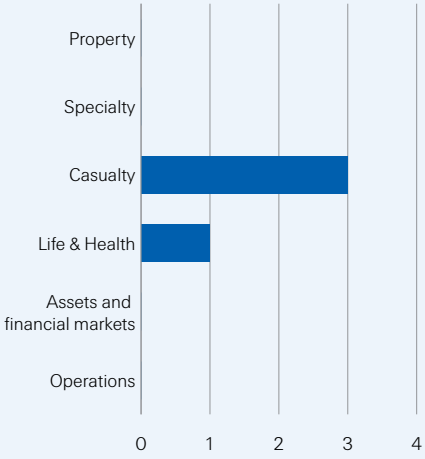
[122] Wang X. et al. *Safety challenges of AI in medicine*, National University of Singapore, 11 September 2024.
[123] *The application of artificial intelligence in the field of mental health: a systematic review*, BMC Psychiatry, 14 February 2025.
[124] Adeghe E. et al., op. cit.
[125] Adeniyi. A. et al., *The impact of electronic health records on patient care and outcomes: A comprehensive review*, World Journal of Advanced Research and Reviews vol 21, 22 February 2024.

Ultra-processed foods: health and liability risks

Consumption of ultra-processed foods (UPFs) is rising globally. Research shows associations between high UPF intake and elevated health risks, including obesity, type-2 diabetes, depression, cardiovascular disease and cancer, not to mention mortality. This new evidence, combined with increased public awareness, growing regulatory scrutiny and rising litigiousness, could lead to a surge in lawsuits around inadequate warning and deceptive advertisement/labelling.

Potential insurance impacts

Impact rating (0 = no impact; 4 = high Impact)



- **Time horizon:** First claims likely to come from litigation and liability. Negative health impacts likely to continue accumulating in the long run.
- **Casualty:** Litigation and liability claims against manufacturers and distributors for food contamination and mislabelling, leading to adverse health outcomes, including bodily injury. Regulators and public authorities could also be litigation targets for failing to safeguard health. Inadequate warnings on labels could lead to D&O claims.
- **L&H:** Given the correlation between UPF consumption and poor metabolic health - and worse-off morbidity and mortality outcomes – we expect that increased consumption of UPFs globally will lead to higher incidence of diseases, and resultant claims in L&H lines of business. Whether this adverse trend is counteracted by the evolving landscape of weight loss medications remains to be seen.
- **Insurer assets and financial markets**: If a firm is found to have overpromised in public filings, its share price could be negatively impacted and there could also be related securities fraud suits.

Increasingly, UPFs are being seen as a main contributing factor to the world's obesity epidemic.

Since the 1980s, there have been multiple theories on what drives obesity. Of late, focus has moved to a novel culprit: UPFs. These are defined as foods that have been extensively altered using industrial techniques, often containing chemically-modified substances and artificial additives. The foods appeal to the senses of customers but deliver little in the way of nutrition. They are characterised by texture alterations, which reduce satiation mechanisms in the human body and lead to overconsumption. UPF classification includes a broad range of foods, which multiplies potential liability exposures. Examples include packaged snacks, sugary beverages and ready-to-eat or ready-to-cook meals, but also options generally considered to be healthy like low-fat processed foods.

Lines of business most impacted: casualty

Litigation and liability claims against food manufacturers and distributors for mislabelling and failiure to warn are most likely.

Casualty: Emerging evidence of negative health outcomes of UPF consumption, combined with increased public awareness and an increasingly litigious environment, could lead to a wave of lawsuits around inadequate warning and deceptive advertisement and labelling. Food manufacturers and distributors could be held liable for negligence, failure to warn, misrepresentation or fraudulent concealment, whilst regulatory and public health authorities might be sued for failing to take action. Contamination incidents are currently the leading cause of insurance claims associated with UPFs. Such incidents continue to rise steadily, and with them the risk of amplifying product liability and recall claims.[126]

Regulatory differences across jurisdictions creates compliance challenges for food producers and distributors.

In the US where litigation risk is high but food regulation relatively lax compared to other developed countries, we expect continued tightening of restrictions on artificial additives. Earlier this year, a ban on eight artificial food dyes was introduced in the US, citing concerns over impacts on child health.[127] Future regulatory changes and

[126] Allergen related labelling errors, and listeria and metal foreign body contamination are the top three causes of product recall at the present. See *Navigating the rise in food contamination claims: The critical role of product recall insurance and specialist legal advice*, Browne Jacobson, 22 April 2025.

[127] *Kennedy announces ban on artificial dyes in food and drinks*, BBC, 22 April 2025.

government interventions are possible, which could to create growing challenges for food companies and distributors. In the US, amongst other complications for the food sector, regulation is not uniform across the states. For instance, California and New York have recently unilaterally banned five additives commonly found in baked goods, sweets and soft drinks, but these have yet to be banned at federal level.[128] The five additives have been associated with cancer, neurological and behavioural problems, and damage to DNA, amongst others. In Europe, their use in food products has already been almost entirely banned.[129]

In the US, a first class action involving UPF was filed in December 2024.

There are also concerns about the potentially addictive nature of UPFs, which are designed to be "hyperpalatable" and thereby boost desire to eat and overconsume.[130] Potential litigation claiming intentional addictiveness of UPFs could echo the class action lawsuits rivaling those of big tobacco or the opioid crises. In the US, first class-action involving UPF was filed in December 2024, alleging that major food producers knowingly marketed UPFs that can be addictive to children. The court case is ongoing at the time of writing.

Far from benefitting, there is growing evidence that consuming UPFs can damage your health.

L&H: Though causality is difficult to establish, observational studies have found associations between high consumption of UPFs and poor metabolic health outcomes adding to the overall mortality and morbidity burden of non-communicable diseases.[131] This has been linked to the illnesses of the cardiovascular, gastrointestinal and respiratory systems, in addition to increased morbidity through cancer and poor mental health.[132] New research suggests that the sugars and other additives in UPFs can alter the intestinal microbiome, thereby affecting brain function through complex "gut-brain axis" mechanisms.[133] There are some indications that consumption of synthetic food colours in children is associated with poor attention. Such implications indicate that increased consumption of UPFs would lead to a growing number of poor health outcomes over time, and thereby higher medical insurance claims.

[128] *California and New York Could Ban 5 Food Additives Linked to Health Concerns*, The New York Times, 13 April 2023.

[129] The five are red dyes: No3, titanium dioxide, brominated vegetable oil, potassium bromate, propylparaben

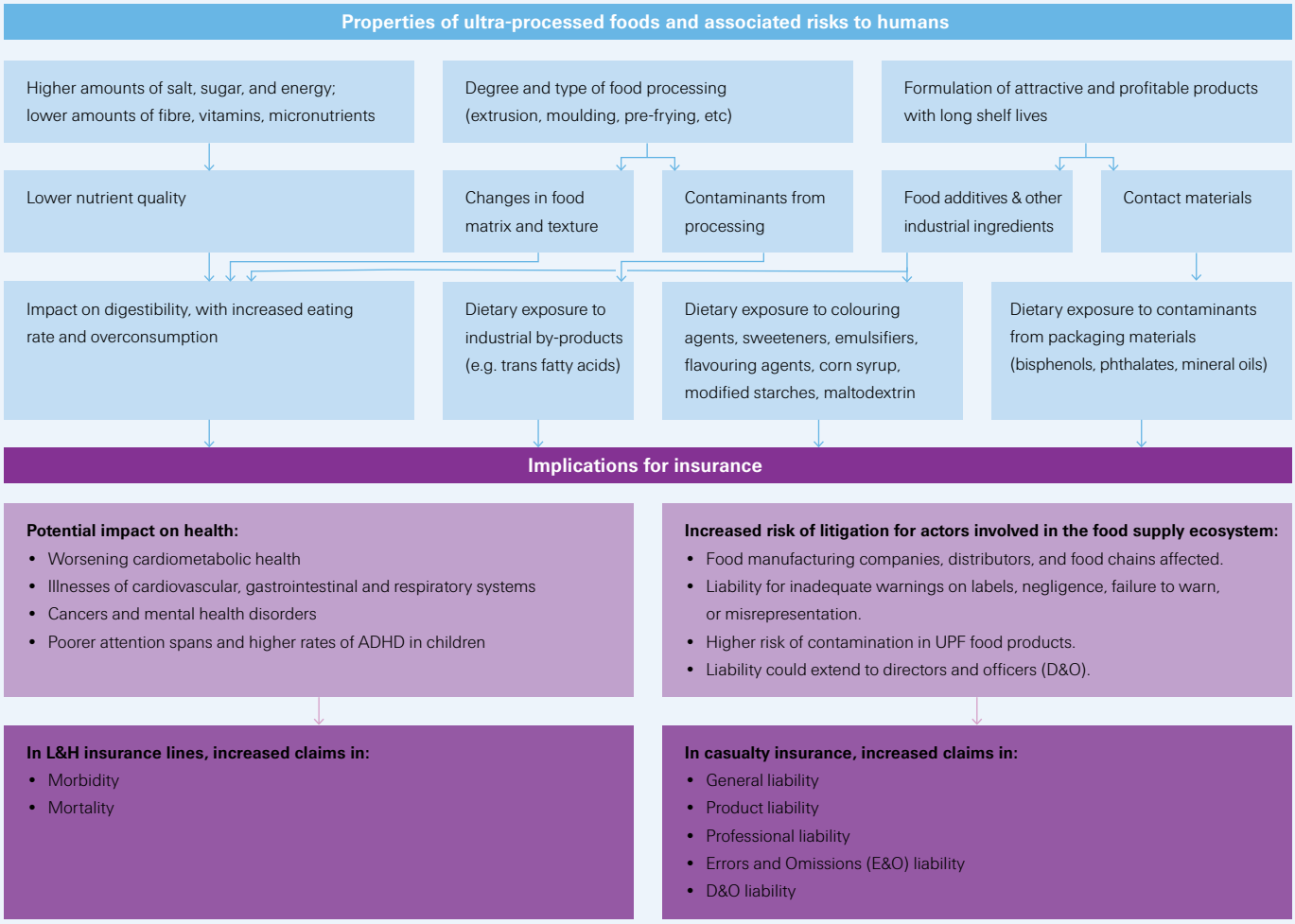
[130] Hall, K., et al. *Ultra-Processed Diets Cause Excess Calorie Intake and Weight Gain: An Inpatient Randomized Controlled Trial of Ad Libitum Food Intake*, Cell Metabolism, vol 30, 2 July 2019.

[131] Based on several sources, including Rauber, F. et al., *Ultra-Processed Food Consumption and Chronic Non-Communicable Diseases-Related Dietary Nutrient Profile in the UK*, Nutrients, vol 10, 9 May 2018; Pagliai, G. et al., *Consumption of ultra-processed foods and health status: a systematic review and meta-analysis*, British Journal of Nutrition, vol 125, 14 August 2020; Adams, J. et al. , *Public health response to ultra-processed food and drinks*, British Medical Journal (BMJ), vol 369, 26 June 2020; Lane, M. et al. *Ultra-processed food exposure and adverse health outcomes: umbrella review of epidemiological meta-analyses*, BMJ, vol 384, 28 February 2024; Chang, K. et al., *Ultra-processed food consumption, cancer risk and cancer mortality: a large-scale prospective analysis within the UK Biobank*, eClinicalMedicine, vol 56, February 2023; Visioli, F. et al., *Ultra processed foods and cancer*, The Lancet, vol 38, 12 February 2024.

[132] Liang, S., Zhou, Y., Zhang, Q. et al. *Ultra-processed foods and risk of all-cause mortality: an updated systematic review and dose-response meta-analysis of prospective cohort studies*, Systemic Reviews, vol. 14, 3 March 2025.

[133] Tristan Asensi, M. et al., *Low-Grade Inflammation and Ultra-Processed Foods Consumption: A Review, Nutrients*, vol 15, , March 2023; Song, Z. et al., *Effects of ultra-processed foods on the microbiota-gut-brain axis: The bread-and-butter issue*, Food Research International, vol 167, May 2023.

Figure 11
Properties of ultra-processed foods and implications for insurance



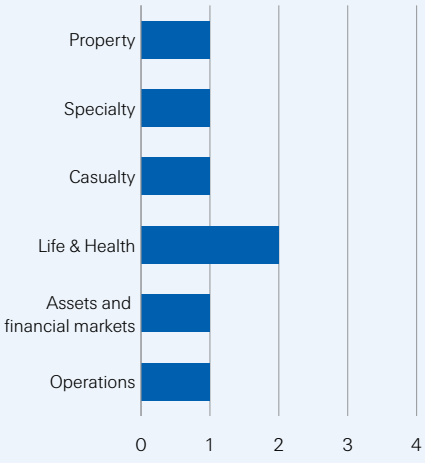
Source: Lane, M. et al. *Ultra-processed food exposure and adverse health outcomes: umbrella review of epidemiological meta-analyses*, BMJ, vol 384, 28 February 2024, and Swiss Re Institute

Emerging workforce and skill set shortages

Demographic shifts, notably ageing workers, are exerting pressure on labour markets. At the same time, the rapid evolution of AI, digitalisation and automation is transforming job profiles and skill requirements at an unprecedented pace. The result could be rising claims in casualty and L&H lines of business, among others.

Potential insurance impacts

Impact rating (0 = no impact; 4 = high Impact)



- **Time horizon:** In the medium-term, demographic changes will aggravate current skill set shortages. And while AI and digitalisation can automate many tasks, they can also introduce new risks.
- **Property & specialty:** Errors and omissions can lead to property damage and engineering project failures.
- **Casualty:** Claims for medical malpractice, treatment errors or accidents on account of sub-qualified or overworked staff. Workers' compensation claims for workplace accidents. In manufacturing, errors and omissions and recall claims on account of faulty products, in turn due to skill set shortages.
- **L&H:** Delays in medical treatment, under-diagnosis and sub-standard levels of care due to labour and skillset shortages could lead to an increase in morbidity, mortality and associated claims.
- **Insurer assets and financial markets:** Economic instability resulting from labour market pressures and social inequality triggered by workers being unable to transition to new jobs/professions, could affect insurers' investment portfolios.
- **Insurance operations:** Insurers may face challenges in talent acquisition and retention.

Certain critical sectors like healthcare are already suffering from skill shortages.

Ageing populations and technological advancements are aggravating already existing skill set shortages in many critical services.[134] One example is in health and long-term care (LTC) services, where qualified nursing staff and doctors are in short supply. As populations age, health and demand for LTC services will rise.[135] This coincides with an imminent retirement wave of medical doctors. For example, 31.5% of medical doctors in the US are aged 65 years and above. According to data from the WHO, similar patterns hold true in other countries with high insurance penetration.[136] Retiring doctors reduce the number of trained and practicing doctors, leaving behind shortage of experience and skill sets.[137]

There is potential for self-reinforcing feedback loop as increased workload leads to dissatisfaction and illness.

Increasing staff shortages can be self-perpetuating as those still at work are required to work longer hours and shoulder greater workloads and responsibilities. This is recent experience in the UK's National Health Service (NHS), where fewer staff had to meet exceptional demands during the COVID-19 pandemic. The NHS also faces the issue of chronic underfunding.[138] Alongside professionals and leaving due to retirement or better work conditions and pay in other sectors (or countries), there has been a rise in absences

[134] The EU identified 42 shortage-professions. *Proposal for a Regulation of the European parliament and of the Council establishing an EU talent pool, EUR-Lex*, 15 November 2023. The UK has a similar list of 39 critical demand occupations. See *Occupations in demand*, Department for Education, 19 September 2024. In Japan similar professions experience shortages (*Japan: full-time employee labor shortages among businesses by industry 2024*. Statista research department, 25 March 2025). Also the US faces workforce shortages due to reduced workforce participation among others due to an ageing workforce and changes in preferences, reduced (internal migration) and a lack of access to childcare *Understanding America's Labor Shortage*, Chamber of Commerce, 18 April 2025.

[135] McKee, M. et al., *The changing health needs of the UK population*. The Lancet, vol 397, 2021; *Briefing: Health and Care of Older People in England 2019*, ageUK, July 2019.

[136] In Italy, Germany and France more than 40% of doctors are aged 55. In Japan and Spain, more than 30% are. See *National Health Workforce Accounts Data Portal*, WHO, December 2024, accessed 21 February 2025.

[137] Walensky R. P. et al. *Challenges to the Future of a Robust Physician Workforce in the United States*, The New England Journal of Medicine, vol. 392, 2025.

[138] Al-Janabi H. et al., *Is the NHS underfunded? Three approaches to answering the question*, Journal of the Royal Society of Medicine, vol. 116, 2023.

due to illness and also in the incidence of mental health problems among remaining staff. These absences, in turn, make it more likely that staff exit the NHS altogether.[139]

Lines of business most impacted: L&H

Skill set shortages in health and LTC can negatively impact mortality and morbidity.

L&H and casualty: Medical and liability insurers are most impact by staff shortages. In healthcare, a shortage of doctors can lead to worse health outcomes for patients, for example due to delayed cancer diagnosis and treatment, or the reduced capacity of a healthcare system to cope with a crisis like a pandemic.[140, 141, 142] Similarly, nurse-to-patient ratios have been found to correlate with patient outcomes in terms of mortality, re-admissions and length of hospital stay.[143] Such circumstances of skill set shortage can lead to more claims in L&H, and also in professional and employer liability business. Meanwhile those workers leaving their jobs on account of sickness, burnout and/or mental health issues could file claims for workers' compensation and disability cover.

Automation can help alleviate skillset shortages, but comes with its own set of problems.

Rapid developments in AI, digitalisation and automation can alleviate some skill set shortages. But they come with their own set of problems too. AI tools for healthcare and tele-health solutions could cause unforeseen gaps in diagnosis and care and lead to novel liability disputes.[144] Automation could result in gaps in controlling, oversight and new attack surface vulnerable to cybercrime. It could also introduce gaps and flaws in training data for automation, and the subsequent validation of this data, leading to system underperformance and governance issues.

Skills shortages in high hazard jobs could lead to claims in property and liability lines of business.

The workforce transformation also affects high hazard industries such as chemical, oil and gas, nuclear, or metal & mining. The industries already face critical skill set shortages and the prospect of more talent shortfalls after the baby boomer generation goes in retirement. Filling vacancies with inexperienced workers could increase the risk of accidents leading to professional and employer liability, and potentially also (expensive) claims in property insurance.[145]

Rapid advances in technology could accentuate skills availability in the future.

Insurance operations: Technological advances are changing job profiles and skill set needs, including in insurance business. While IT professionals are in short supply, in some sectors machines can replace humans in certain roles. Prospects of automation may already be a significant factor for people not choosing a profession given worries about job security. For example, autonomous driving is becoming more widespread, with increasing roll out in the US and China. A breakthrough in this technology could lead to drastic shifts in the HGV driver market, the latter a critical link in modern supply chains. Similar dynamics are at play in other professions such as accounting, which is already experiencing skill set shortages.[146] In insurance, should entry-level positions of claims adjusters or underwriters be automated to reduce costs, this could lead to a lack of people with sufficient job-specific work experience in the future, in turn increasing operational errors and rising costs for insurers themselves.

[139] Palmer W, *All is not well: Sickness absence in the NHS in England,* Nuffield Trust, 2023. *NHS Workforce Nutshell,* The King's Fund 18 December 2023. *NHS in England facing worst staffing crisis in history, MPs warn,* BBC, 25 July 2022.

[140] Basu S. et al. *Association of Primary Care Physician Supply With Population Mortality in the United States, 2005-2015,*. JAMA Intern Med., vol 179, 2019.

[141] Hanna T. P. et al. *Mortality due to cancer treatment delay: systematic review and meta-analysis*. BMJ, vol 371, 2020.

[142] *Ready for the Next Crisis? Investing in Health System Resilience,* OECD, 2023.

[143] McHugh M.D. et al. *Effects of nurse-to-patient ratio legislation on nurse staffing and patient mortality, readmissions, and length of stay: a prospective study in a panel of hospitals*, The Lancet, vol 397, 2023; Dall' Ora C. et al., *Nurse staffing levels and patient outcomes: A systematic review of longitudinal studies,* International Journal of Nursing Studies, vol 134, 2022; Driscoll A. et al., *The effect of nurse-to-patient ratios on nurse-sensitive patient outcomes in acute specialist units: a systematic review and meta-analysis*, European Journal of Cardiovascular Nursing, vol 17, 2022.

[144] Please refer to *New technologies in healthcare delivery* above for further discussions.

[145] Sphera found it its *Process Safety Report 2024*, Sphera 2024 that "[…] half of respondents (49%) see loss of/lack of experienced personnel as the top factor to cause risk to increase" and " […] experience is exiting hazardous industries; however, attracting new field personnel remains difficult."

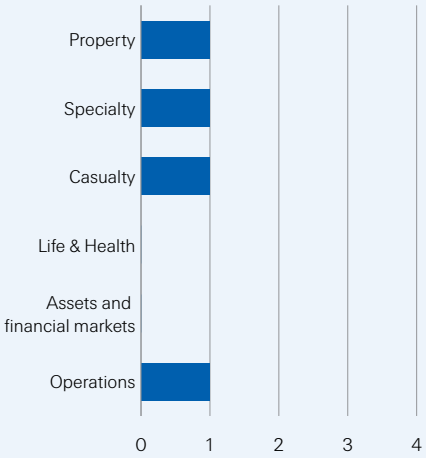
[146] EUR-Lex November 2023, op. cit., and *Occupations in demand*, UK Department of Education, 19 Sep 2024.

The expanding horizons of drone technology

The use of drone technology in new applications like cloud seeding are being piloted. Novel applications generate novel risks. For example, deployment on the battlefield could lead to unexpected outcomes such as increased risks to airspace, critical infrastructure and disruptions to trade. And privacy concerns remain.

Potential insurance impacts

Impact rating (0 = no impact; 4 = high Impact)

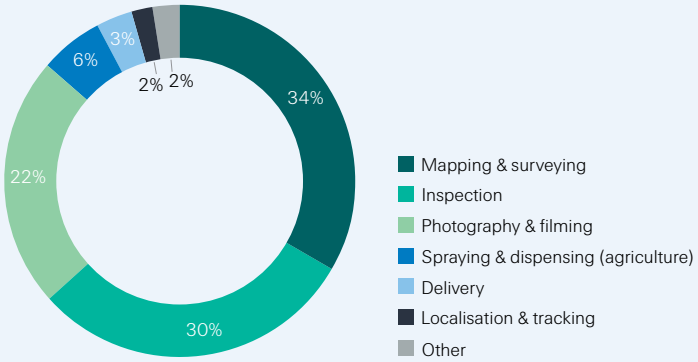


- **Time horizon:** The use of drones for strategic purposes creates short-term uncertainty about potential regulatory action, In the long term, increased use of drone across sectors could boost insurance demand.
- **Property:** Terror attacks could cause property damage and put exclusions to a test.
- **Property & Specialty:** Hull and payload insurance could be impacted should prices for drones, drone components and consumer goods experience lasting price increases, trade wars or supply chain disruptions due to sanctions/trade barriers.
- **Casualty:** With the growing scope of drone operations, related liability losses could also increase. Personal injury claims in cases deemed to be invasion of privacy.
- **Insurance operations:** Drones can be used by insurers to enhance risk and damage assessment in terms of accuracy, speed and cost. Potential sanctions regimes or ESG concerns could raise new reputational and compliance risks.

Expanding drone use cases grow insurance market opportunities.

In 2013, the US Federal Aviation Administration estimated that "we can expect 7 500 small unmanned aircraft in our national airspace in the next five years".[147] The actual numbers of registrations was 1.76 million recreational and 361 000 commercial operators (by 2023).[148] Drone technology continues to develop beyond established use-cases (see Figure 12). Novel applications such as for cloud-seeding, weather monitoring and underwater defence are being piloted.[149, 150, 151] Further adoption could create insurance opportunities, and we see strong growth potential in China in particular.[152]

Figure 12
Share of commercial drone applications 2024



Source: Drone II, Swiss Re

147 *UAS Roadmap*, Federal Aviation Administration, 7 November 2013.
148 *FAA Aerospace Forecast FY 2018-2038*, Federal Aviation Administration, 2018; *FAA Aerospace Forecast Fiscal Years 2024–2044*, Federal Aviation Administration 2024.
149 *Drones and rockets bring rainfall to China during record-breaking heatwave and severe drought*. Sky News 27 August 2022; *China Deploys Rain-Seeding Drones to End Drought in Sichuan*. Bloomberg, Aug 2022.
150 Inoue, J. et al. *Operational Capability of Drone Based Meteorological Profiling in an Urban Area*, Journal of Geophysical Research: Atmospheres, vol 130, 28 December 2024.
151 *Deutsche Marine setzt auf experimentelle Verfahren*, Bundeswehr, 27 November 2024.
152 The drone insurance market is projected to grow to USD 2.09 billion by 2028 and USD 3.5 billion by 2033. The Chinese low altitude airspace insurance market alone is expected to reach CNY 8-10 billion (at the time of writing about USD 1-1.3 billion) by 2035. See *Insuring the low-altitude airspace economy in China*, Swiss Re Institute, 25 November 2024.

Lines of business impacted

Use of drones for strategic purposes could raise compliance issues for producers and their insurers.

Property and casualty: The strategic importance of consumer-grade drones could have unexpected implications, especially as geopolitical rivalries escalate. Should drones and critical components thereof be put under sanction or trade restrictions, producers and insurance providers would face compliance issues. Rising prices would drive up replacement and repair costs, possibly impacting equipment and home insurance.

Drone software updates could raise hitherto unknown risk scenarios.

Drone technology is heavily reliant on software. For example, DJI (the world's largest producer of consumer drones based in China) recently turned off controls known as geofences that actively prevent drones from flying in restricted airspace like airports and military bases.[153] The change demonstrates how powerful such software updates can be, potentially making the airspace less secure by the click of a button. This could have grave consequences. For instance, a single aircraft accident can result in insurance claims of hundreds of millions of dollars.

Privacy remains a concern for casualty insurers.

Drones have come a long way and have a dynamic future ahead. Some initially identified insurance relevant issues have remained. Beyond regulatory hurdles, and occasional crashes,[154] privacy matters remain contentious, with several lawsuits pending and others forming, possibly triggering claims in liability insurance.[155]

There is risk that drones will be used to traffic drugs, and in terrorist acts.

Specialty: The ongoing war in Ukraine has demonstrated the strategic importance of drones and has been a catalyser for technological innovation.[156, 157] For example, deployment of cheap drones for reconnaissance and attacks has led to widespread use of jamming.[158] This, in turn has led to the development of cheap consumer grade un-jammable guidance systems using fibre optic cables. There is a risk that this novel technology may spread beyond the battlefield into the realm of terrorism or drug trafficking.[159] Along similar lines, underwater drones, which have been deployed more recently[160] are difficult to track and can operate undetected for extended periods. They are well-suited for asymmetric and hybrid warfare, and can target critical infrastructure like undersea cables and pipelines. Such usage could lead to supply chain and business interruptions, and trigger associated insurance claims including credit and surety, and (contingent) business interruption covers.

Drones can enhance insurance operations and offerings.

Insurance operations: With respect to insurance operations, drones facilitate inspection of properties and infrastructure, yielding high-resolution aerial imagery and 3D mapping that can inform more accurate risk assessment. After occurrence of a disaster event (natural or man made), drones can be deployed to assess damage quickly and safely, even in areas that are difficult to access. This accelerates the claims process payouts to policyholders and lowers insurers' operational costs.

153 *DJI Lifts Geofencing Restrictions: What It Means for the Future of Drones in the US,* Foreign Policy, 15 January 2025. Geofences actively prevent drones from flying in restricted airspace such as airports, military bases etc.

154 *Food delivery drone lands on power lines resulting in power outage for thousands*, The Verge, 30 September 2022; and *Amazon Drone Crash Sparked an Acres-Wide Fire in Oregon,* Business Insider, 24 March 2022.

155 One example is an effort to collect evidence for a class action lawsuit on insurers privacy breaches, when using aerial imagery of roofs for risk-assessment and or canceling cover *Invasion of Privacy Lawsuits: Homeowners Insurance Using Drones?*, ClassAction.org, 17 January 2025, Compare also *The Evolving Landscape of Drone Lawsuits*, Expert Institute, 13 January 2025, and *California insurers are using aerial photos to inspect homes*, San Francisco Chronicle, 26 October 2024.

156 *Germany investigating suspected Russian drones over air base,* DW, 13 January 2025.

157 *US to Give Ukraine Millions to Build More Long-Range Drones*, The New York Times, 22 October 2024; *US Reveals Once-Secret Support for Ukraine's Drone Industry,*The New York Times, 17 January 2025.

158 An electronic countermeasure (ECM) technique that deliberately emits electronic signals to overwhelm a receiver with noise or misleading information.

159 *Skies above Strangeways have been ceded to organised crime gangs*, Manchester Evening News, 14 January 2024.

160 *US to help examine drone found off Masbate*, Inquirer, 15 January 2025; and *In a Tough Year on Land, Drones Give Ukraine Some Success at Sea,* The New York Times, 20 December 2023.

Appendix

Related Swiss Re publications

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