EXTREME WEATHER

HEALTH IMPACTS ON THE GLOBAL WORKFORCE

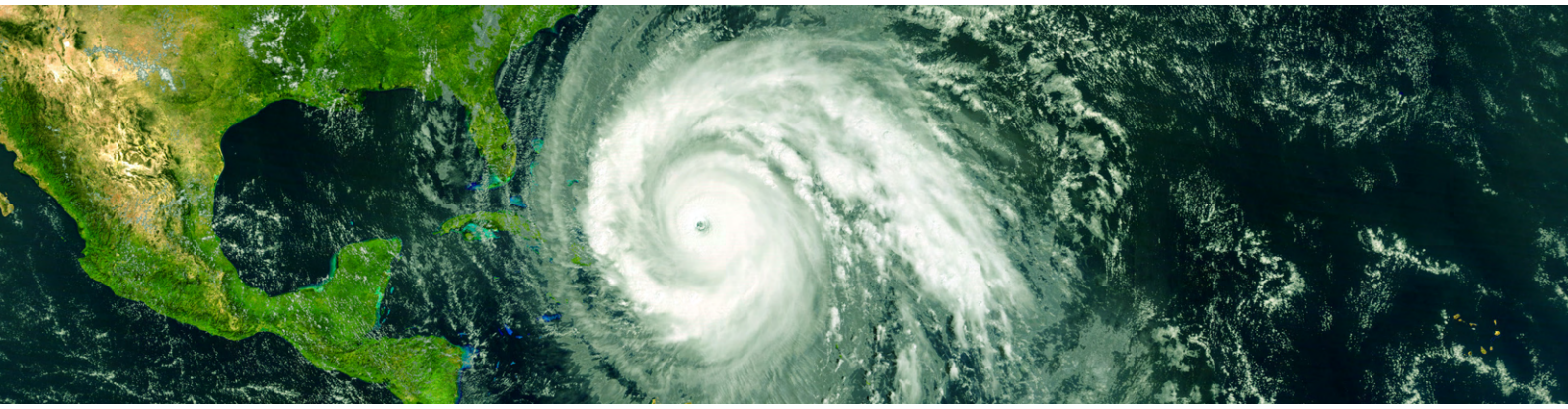
COMPILED AND PRODUCED BY
INTERNATIONAL SOS FOUNDATION

TABLE OF CONTENTS

EXTREME WEATHER

EXECUTIVE SUMMARY

FOUNDATION EXECUTIVE DIRECTORS



We are living in the Anthropocene, the geological age shaped by human activities, driving risks to our health and potentially our existence. Organisations are now facing more climate and weather-related challenges than ever before, and these challenges are projected to increase in frequency and severity.

Extreme weather events impact organisational operations and, critically, the health and wellbeing of employees in the short and longer term, as well as their security.

As ambassadors of Duty of Care, the International SOS Foundation has been at the forefront of driving research, training, and events to harness and grow the importance of Duty of Care worldwide. As the risk environment continues to evolve amongst geopolitical tensions, natural disasters, civil unrest, infectious diseases, and technological threats, it brings uncertainty to organisations' business continuity plans.

Our mission is to garner the most relevant research and thought-provoking information to help instill confidence in stakeholders to address the risks impacting their organisation. Since our inception over a decade ago, we have launched hundreds of guidance documents, whitepapers, and case studies alongside various legal, health, financial, and security experts.

International SOS Foundation recognised the need for research into extreme weather and its health impacts on organisations and their employees, and we, therefore, commissioned research. We are thankful to the 216 respondents from 40 geographies who took the time to provide their insight and experience, making this paper relevant and thought-provoking.

The aim is for this paper to not only spark conversations and thought on a very important topic but also to drive organisational change in a space that is critical to the successful future of organisations, and most importantly, the health and wellbeing of their people.

This paper is part one, focusing on health and wellbeing, and part two of the series will focus on the security issues brought about or exacerbated by extreme weather. As an evolving topic, the International SOS Foundation will continue to monitor and provide insight into this critical area to help support organisations in protecting their people.

We hope you find this paper informative and that it helps drive change within organisations worldwide. We would like to recognise Sancroft for their collaboration and contribution into this paper, as well as Resilience First for their support.

We would like to thank Dr Irene Lai, Group Medical Director at International SOS, and Dr Kate O'Reilly, Regional Medical Director at International SOS, for authoring this paper. We would also like to recognise Sancroft for their collaboration and contribution on this vital topic.

Kai Boschmann,
Executive Director,
International SOS Foundation

Laurent Fourier,
Executive Director,
International SOS Foundation

FOREWORD

This timely paper sets out the compelling case for managing the impacts of extreme weather. It also sounds the alarm that businesses are behind in their efforts to do so, even where the risks and the rationale are well understood.

Business is already facing the consequences of climate change in real time. It is well-documented that extreme temperatures reduce productivity, especially in such sectors as agriculture and construction, and can significantly raise the risk of accidents due to impaired cognitive function. Weather events such as flooding and long-term trends such as poor air quality create hazards, both acute and chronic, that undermine the safe, efficient and productive exercise of business as usual.

All of this adds costs, but more importantly, these impacts are borne by employees: real people who may not consider themselves on the front lines of the climate emergency, but whose health, wellness, and even their very lives may be at risk through the inevitable consequences of a warming planet.

This paper, therefore, comes at a crucial moment for business leaders facing the coming decades, in which we must simultaneously make rapid, radical progress toward decarbonising our economies and industries, and prepare for the changes already here and those yet to come. The challenges of climate change adaptation will certainly remake our workplaces.

However, business leaders need not be defensive in facing these challenges nor simply treat them as costs to be avoided. The opportunity is to reimagine the workplace of the future – safer, more productive, supportive of the holistic wellbeing of employees in their communities. It is an opportunity that will benefit business if seized proactively.

A particular gap can be seen in the consequences of extreme weather on mental health – already a major issue for employers and set to become even more consequential as today's extreme weather becomes tomorrow's 'new normal'. The truth is that no one is insulated from the dangers of climate change, and this creates a whole new range of stresses with which people may be ill-equipped to deal. Climate-related extreme weather events can be traumatising but so can the cumulative impacts of smaller, day-to-day trends that affect people's comfort and safety at work. Recent research shows that climate change has had a direct impact on mental health for people around the world, including that which stems from their fears for their future livelihoods.

It seems likely that employers' attention to this critical issue has not yet reached a level commensurate with the need nor are they making the decisions necessary for the effective management of the inevitable transition. This will involve, among other things, ensuring a resilient infrastructure, maximising energy-efficient technologies, promoting biodiversity, and creating flexible work policies that take extreme weather conditions fully into account. In this way, companies can make adaptations on their terms rather than being forced by circumstances.

Organisations should also consider integrating mental health support into sustainability strategies. By simply focusing on better communicating with employees around issues that raise concern or anxiety, including climate change, companies can strengthen their mental health safety nets and ensure that people do not feel helpless.

Recognising and responding to the health impacts of extreme weather must now be a key pillar in any organisation's climate transition plans. Doing so brings its own challenges, for example, related to the feasibility of alternative energy sources, the need for greater flexibility in working patterns both in-house and in supply chains, and recognising and acting on the need for resilience in the wider community.

Above all, businesses must recognise that change is coming. If we act now, we have the opportunity to build the businesses and workplaces of the future, together with employees, and make the most of the transition. We can still make it happen in a careful, orderly and conscientious manner and not leave ourselves to the mercies of ill-thought-through legislation and regulation.

My congratulations to the International SOS Foundation for this very important paper.

Rt. Hon John Gummer, Lord Deben
Chairman
International SOS Foundation

ORGANISATIONS ARE SUFFERING FROM

EXTREME WEATHER EVENTS

Many organisations have already experienced the impacts of extreme weather events on their operations and their people. This was clearly identified as a key issue in International SOS's Risk Outlook[1].

To gain a deeper understanding specifically of the impacts on the health and wellbeing of the workforce, the International SOS Foundation carried out a global survey. Over 200 decision-makers from 40 countries participated in the survey during April/May 2024.

The data shows that the challenge of extreme weather events is not new and is anticipated to continue to threaten business operations and workforces in the coming years.

Over half of the survey respondents

65% stated that extreme weather events had impacted their organisation in the last five years.

77% expect an increase in extreme weather cost expenditures in either the short term (1 to 5 years) or longer term (5 to 20 years).

The research found that flooding due to heavy rain is the leading impact of extreme weather across the organisations. The research findings further define the type of flooding, with over

72%

Respondents reported other extreme weather events to impact their business were:

Extreme heat	**41%**
Heavy precipitation	**37%**
Cyclone / Hurricane / Typhoon	**30%**

1. International SOS' 2024 Risk Outlook report, launched in December 2023, found that extreme weather events were the highest-rated perceived health risk for organisations in the following 12 months, followed closely by natural disasters and new pandemics.

INTERNATIONAL SOS FOUNDATION

ORGANISATIONS ARE SUFFERING FROM

EXTREME WEATHER EVENTS

As extreme weather events become more severe over time, the impact on organisations' operations and workforces can potentially be more damaging. Many organisations currently operate in high-risk areas where increases in rainfall, rising tides, and sea levels may be anticipated and planned for. However, increasingly there are flooding events in areas traditionally not considered at high risk, such as Dubai and Spain, both of which experienced devastating flash floods in 2024. This underlines the importance of risk mitigation planning for high-impact extreme weather events, even if considered unlikely.

THE RESPONDENTS TO THE SURVEY WERE ASKED TO WHAT EXTENT EXTREME WEATHER EVENTS HAD IMPACTED THEIR ORGANISATION. HALF SURVEYED SAID THE IMPACT HAD BEEN MODERATE.

62%

said it had been moderate or **significant**

80%

said their business operations had been **disrupted**

54%

said the infrastructure suffered **damage**

24%

said employees and/or their families had been physically injured

The respondents to the survey were asked to what extent extreme weather events had impacted their organisation. Half surveyed said the impact had been moderate, and over 12% said it had been significant. For those who considered the extreme weather events to have been 'moderate' or 'significant,' 80% said their business operations had been disrupted and 54% said the infrastructure suffered damage. Nearly a quarter said that employees and/or their families had been physically injured.

International SOS regularly witnesses the impact of extreme weather on organisations. Compared with 2022, in 2023, 80% more medical climate-related alert issues were issued to its clients, 30% more security climate-related alerts were issued, and four-fold more climate-related special advisories were issued (International SOS' highest level of client alert).

This insight shows that extreme weather impacts are already disrupting business operations and workforces and that there are opportunities to plan for and mitigate this risk to business operations and the workforce.

80% **more medical climate-related alert issues were issued**

30% **more security climate-related alerts were issued**

THE HEALTH RISKS OF EXTREME WEATHER ARE

BEING OVERLOOKED

Risk mitigation strategies are key to minimising the negative impacts of extreme weather, including disruption of operations through infrastructure damage and injuries and fatalities of employees and their families. Over a third (36%) of respondents to the survey said they did not have organisation-wide plans and policies to prepare and respond to extreme weather events. Even more concerning, 57% stated that their organisation had not conducted a comprehensive risk assessment of extreme weather. It is clear from these findings that risk mitigation planning and processes related to extreme weather events need to be addressed by a significant proportion of organisations.

Interestingly, of those who stated that they had organisation-wide plans and policies for such events, a quarter said the plans and policies did not specifically address employee health risks and impacts. This is a significant finding, as it means that one in four organisations are not planning for health impacts caused by extreme weather, which means they would be ill-equipped to deal with illness, injury or fatalities of employees and their families in such an event.

One of the most significant findings from the research is that almost 26% of respondents said their organisations would be unable to locate their employees, including travellers, in the event of an extreme weather incident. This is a worrying statistic, as locating employees during a crisis is critical to effective, successful crisis management.

36%

said they did not have organisation-wide plans and policies to prepare and respond to extreme weather events.

57%

stated that their organisation had not conducted a comprehensive risk assessment of extreme weather.

24%

of those with plans and policies in place said that these did not specifically address employee health risks and impacts.

26%

of respondents said their organisations would be unable to locate their employees, including travellers, in the event of an extreme weather incident.

MISSING

MENTAL HEALTH SUPPORT

An extreme weather event can be traumatising as it unfolds and can also have devasting consequences for those impacted, physically and mentally. Housing and belongings can be destroyed, injuries sustained and lives lost. The aftermath of an extreme weather event can be equally challenging.

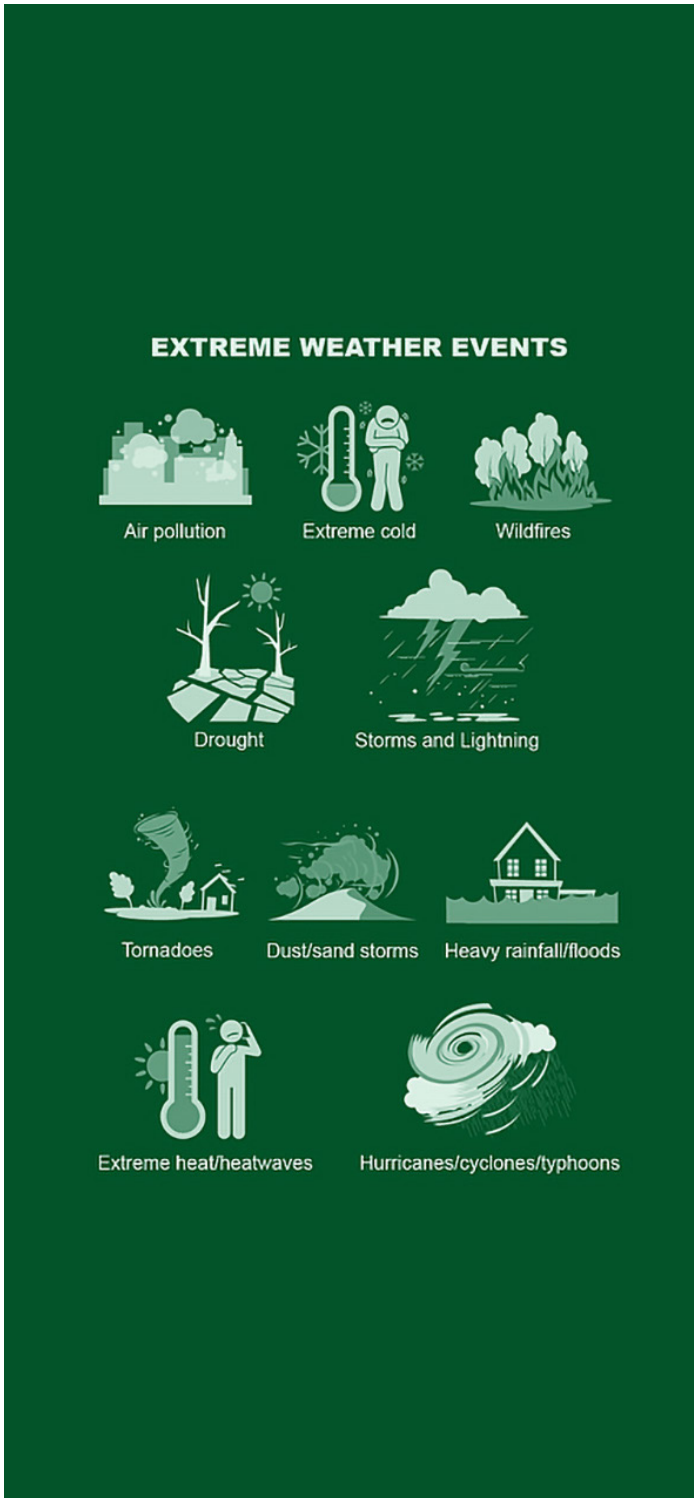
International SOS Foundation's research found that 40% of organisations do not offer mental health and wellbeing support to their employees and families in the aftermath of extreme weather events.

40%

This is a stark statistic, as mental health is on many board agendas, and great progress has been made in the recognition and support of mental health in the workplace. However, this finding demonstrates that mental health impacts are often overlooked in the aftermath of an extreme weather event, and support is not provided.

It is not uncommon for extreme weather events to cause lasting mental health challenges. These may be greatly reduced, or even resolved, through the appropriate mental health support being given in a timely manner.

IMPACTS OF EXTREME WEATHER



While the drivers and contribution of climate change to extreme weather events may be debated, there appears to be a consensus that they are increasing in frequency and magnitude and that their impacts on health are growing. In 2023, the World Health Organization Regional Office for Europe declared the climate crisis and related extreme weather events a public health emergency[2].

Over the last twenty years, the team at International SOS has experienced this trend, which impacts not only our own but also our clients' operations and workforces. The implications of extreme weather conditions on human health are a crisis often overlooked amidst the more visible destruction caused by weather-related events.

Extreme weather is used loosely to describe any unusual weather pattern. The World Meteorological Organization defines an extreme weather event as "rare at a particular place and time of year, with unusual characteristics in terms of magnitude, location, timing, or extent. The characteristics of what is called extreme weather may vary from place to place in an absolute sense."[3]

2. World Health Organization Europe, Climate Crisis: Extreme Weather https://www.who.int/europe/emergencies/situations/climate-crisis-extreme-weather
3. World Meteorological Organization https://wmo.int/topics/extreme-weather

HEALTH

IMPACTS OF EXTREME WEATHER

From heatwaves causing dehydration and heat stroke to floods increasing the risk of waterborne diseases and hurricanes leading to injuries and mental health issues, extreme weather events pose a significant threat to our health[4,5]. Furthermore, they exacerbate existing health disparities, disproportionately affecting vulnerable populations such as the elderly, children, and those with pre-existing health conditions.

We need to understand the links between extreme weather events and our health. This will allow us to develop effective strategies to mitigate these impacts, adapt to our changing environment, and safeguard our future health. Illness, injury, and death due to extreme weather are often preventable or can be minimised with planning, forewarning, and prompt action.

Whilst the overall outlook appears grim, there are meaningful changes that indicate an increasingly risky world is not inevitable. In addition to the numerous commitments and activities to address climate change, the technology to monitor, forecast and disseminate information is leaping ahead every year.

Over 100 countries have early warning systems in place, while the Early Warnings for All initiative, launched in 2022, aims to ensure universal coverage of advance notice of hazardous weather events by 2027[6].

Our landscape review of the health impacts of extreme weather events identified some recurring themes that we will explore: Direct, indirect, and long-term physical and mental impacts, impacts on health systems and communities, occupational health considerations, and mitigation measures.

Limited and Fragmented Data

In putting together this whitepaper, it became clear there is relatively limited data on the health impacts of extreme weather. German researchers highlighted the problem in 2023, stating “One difficulty in recording the health impacts of extreme weather events is often inadequate data – both with regard to the events themselves and the health consequences. Especially the indirect consequences that unfold via cascading risks are not systematically recorded.”[7]

The World Health Organization reports “critical gaps” and “lack of evidence” regarding the impact of climate change on infectious tropical diseases.[8]

The United Kingdom Office for National Statistics and the UK Health Security Agency, along with the African Institute for Mathematical Sciences (AIMS) Rwanda, the Regional Institute for Population Studies (RIPS) at the University of Ghana, the Cochrane Climate-Health Working Group, the UN Global Data Platform and DataKind, are undertaking a project, supported by Wellcome, to propose standards for official statistics on climate-health interactions and promote research.[9]

Extreme weather is one of the eleven categories that will be included in the proposed Standards for Official Statistics on Cliimate-Health Interactions (SOSCHI).

The project is expected to be completed in **2026**

4. United States National Institute of Environmental Health Sciences. Health Impacts of Extreme Weather https://www.niehs.nih.gov/research/programs/climatechange/health_impacts/weather_related_morbidity
5. Veronika Weilnhammer, Jonas Schmid, Isabella Mittermeier, Fabian Schreiber, Linmiao Jiang, Vedran Pastuhovic, Caroline Herr, Stefanie Heinze, Extreme weather events in europe and their health consequences – A systematic review, International Journal of Hygiene and Environmental Health, Volume 233, 2021,113688, https://www.sciencedirect.com/science/article/pii/S1438463921000018
6. United Nations Climate Action: Early Warnings for all https://www.un.org/en/climatechange/early-warnings-for-all
7. Butsch C, Beckers LM, Nilson E, Frassl M, Brennholt N, Kwiatkowski R, Söder M. Health impacts of extreme weather events - Cascading risks in a changing climate. J Health Monit. 2023 Sep 6;8(Suppl 4):33-56. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC10548486/
8. World Health Organization New research flags the urgent need for research and evidence on the impact of climate change on neglected tropical diseases and malaria 22 May 2024 https://www.who.int/news/item/22-05-2024-new-research-flags-the-urgent-need-for-research-and-evidence-on-the-impact-of-climate-change-on-neglected-tropical-diseases-and-malaria
9. United Kingdom Office for National Statistics. Standards for official statistics on climate-health interactions https://www.ons.gov.uk/aboutus/whatwedo/programmesandprojects/standardsforofficialstatisticsonclimatehealthinteractions

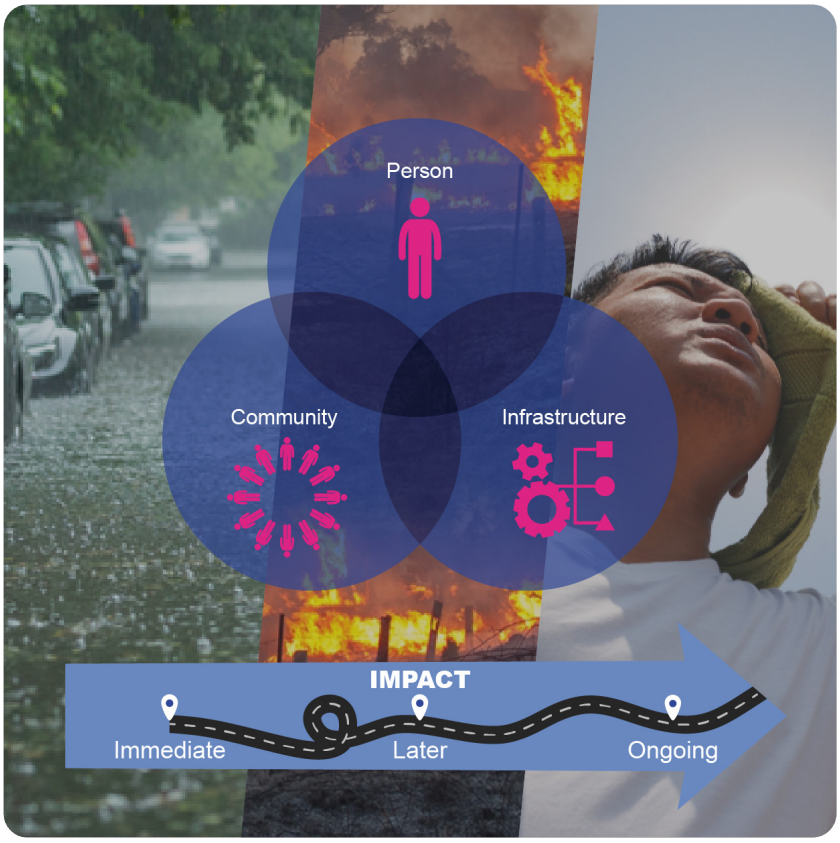
IMPACTS OF EXTREME WEATHER

Cascading Risks

Research to date highlights the interconnectedness of extreme weather and health and the complexity of the factors that determine health outcomes. These are described as "cascading risks" beyond the initial event. There are measurable direct impacts that manifest during the course of the event, such as physical injury due to a flood or other disaster, followed by downstream impacts that occur for days, to years after the event, for example, damage to the environment and health care infrastructure leading to an increase in, and poorer outcomes from, infectious diseases and non-communicable diseases. Infrastructure systems are interdependent, and "cascading failures", while rare, can lead to disruptions which change the incidence of diseases[10].

Chatham House's 2021 Climate Change Risk Assessment[11] discusses the interdependencies of ecosystems and weather "which, combined with heatwaves and drought, will likely drive unprecedented crop failure, food insecurity and migration of people." These impacts, in turn, lead to further negative health impacts, including a rise in infectious diseases.

Climate Change Risk Assessment[11] discusses the interdependencies of ecosystems and weather



10. United States Global Change Research Program, Climate Health Assessment, Chapter 4 Extreme Events https://health2016.globalchange.gov/extreme-events
11. Chatham House Climate change risk assessment 2021 4. Cascading systemic risks https://www.chathamhouse.org/2021/09/climate-change-risk-assessment-2021/04-cascading-systemic-risks

HEALTH CONDITIONS CAUSED OR EXACERBATED BY EXTREME WEATHER

Physical Injury

In the United States, encouragingly the trend shows that although the number of weather events has increased since 2018, related injuries and deaths have fallen[12].

The most "dangerous" events in 2022 were heat, winter weather and floods, causing over 400 deaths, while the most injuries were caused by winter weather, drought and tornado, accounting for over 1,000 injuries.

Country data on extreme weather-related direct physical injury, hospitalisations and death are likely a significant underestimate

Texas has the most weather-related deaths. In 2023, authorities implemented a new method of tracking traffic deaths due to dust storms and concluded "dust events caused comparable life losses to that from other weather hazards such as hurricanes, thunderstorms, lightning, and wildfires."[13]

Australian data indicated an average of 912 hospitalisations annually as a direct result of injury caused by extreme weather[14].

This is considered a significant underestimate and does not include injuries that were managed without hospitalisation.

Indirect physical injury includes carbon monoxide poisoning, which often results from power outages leading people to use generators indoors, as well as heating and cooking appliances.

In Europe, heat is the leading cause of weather-related death. The 2023 report from Copernicus, the European Union's Earth Observation Programme, estimates "Heat-related mortality has increased by around 30% in the past 20 years and heat-related deaths are estimated to have increased in 94% of the nearly 1000 European regions monitored"[15]

This also holds true globally, with the World Meteorological Organization warning, "Extreme heat causes the greatest mortality of all extreme weather, yet heat warning services are provided to health decision makers in only half of the affected countries."[16]

The Health Effects of Climate Change in the UK report expects "Extreme heat will lead to an increase in the number of deaths and other health effects due to warming temperatures and an aging population.

Up to
10,000
deaths per year

due to extreme heat by the 2050s under a high-warming scenario without adaptation have been estimated."[17]

Cardiovascular illness and death, including heart attacks, are linked to extreme weather events[18]. Extreme heat and cold, dust storms, and hurricanes increase the risk of cardiovascular events, although the exact mechanisms are not fully understood. The duration of extreme temperature events influences the degree of risk, while disasters such as hurricanes are linked to an increase in risk that persists for months after the event. Some research links an increase in **cardiovascular and respiratory** deaths not only with extreme heat but also with drought[19].

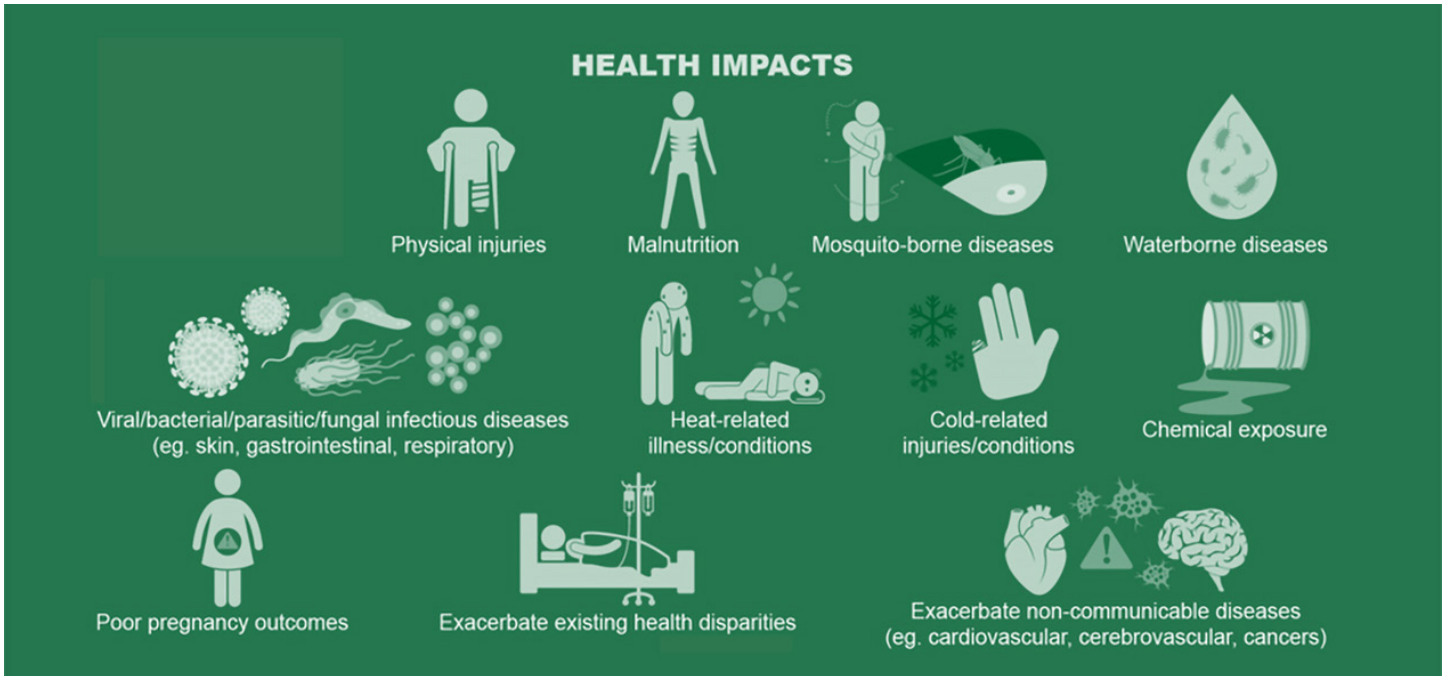
Since the 1980s, a condition referred to as "thunderstorm asthma" has been documented – an outbreak of sudden constriction of the airways (wheeze cough, shortness of breath) following a thunderstorm, with a resultant surge in urgent healthcare presentations. The exact mechanism triggering these asthma attacks is under study. However, the storm is presumed to spread pollens (particularly grass pollens) in the air. The highest risk is during spring and early summer, and so far, the ability to predict risky events is limited[20].

Respiratory infections can increase in the immediate aftermath of an extreme weather event. Crowded shelters can experience outbreaks of viruses such as COVID-19 and influenza or whooping cough and pneumonia. The immunisation status of the population before the event influences the risk and extent of these outbreaks. In the aftermath of extreme weather events, such as floods, there is a risk of fungal respiratory infections during clean-up activities associated with mould growth.

12. United States National Safety Council, Weather-Related Deaths and Injuries https://injuryfacts.nsc.org/home-and-community/safety-topics/weather-related-deaths-and-injuries/
13. https://journals.ametsoc.org/view/journals/bams/104/5/BAMS-D-22-0186.1.xml Tong, D., I. Feng, T. E. Gill, K. Schepanski, and J. Wang, 2023: How Many People Were Killed by Windblown Dust Events in the United States?. Bull. Amer. Meteor. Soc., 104, E1067–E1084, https://doi.org/10.1175/BAMS-D-22-0186.1.
14. Australian Institute of Health and Welfare, Extreme weather related injuries in Australia over the last decade
2 July 2024 https://www.aihw.gov.au/reports/australias-health/extreme-weather-injuries
15. Copernicus, European Union https://climate.copernicus.eu/esotc/2023/extreme-weather-and-human-health
16. World Meteorological Organization, 2023 State of Climate Services: Health https://library.wmo.int/records/item/68500-2023-state-of-climate-services-health
17. UK Health Security Agency. Climate change: health effects in the UK https://www.gov.uk/government/publications/climate-change-health-effects-in-the-uk
18. Kazi, DS., Katznelson, E. et al. Climate Change and Cardiovascular Health
A Systematic Review JAMA Cardiol. June 12, 2024 https://jamanetwork.com/journals/jamacardiology/article-abstract/2820068
19. Extreme weather events in Europe and their health consequences – A systematic review https://www.sciencedirect.com/science/article/pii/S1438463921000018
20. Kevat, A. (2020). Thunderstorm Asthma: Looking Back and Looking Forward. Journal of Asthma and Allergy, 13, 293–299. https://doi.org/10.2147/JAA.S265697

HEALTH CONDITIONS CAUSED OR EXACERBATED

BY EXTREME WEATHER



Mosquito-borne diseases, including malaria, dengue and chikungunya, can increase following flood events, higher than usual rainfalls, and heat events[21,22]. In addition, storage of water during drought conditions can lead to an increase in mosquito-breeding sites. The vast majority of the 100 infectious disease experts[23] who took part in a 2024 survey, believe that the expanding and changing range of insects, which is accelerated by climate change, will make outbreaks of infectious diseases more frequent and severe. Mosquito-borne diseases were ranked the highest infectious climate threat, above tick, avian and animal-borne infections.

Outbreaks of **gastrointestinal infections** increase following extreme weather events that impact access to safe food and water, including drought, flooding and hurricanes. These infections include cholera, shigellosis, typhoid, campylobacter and cryptosporidiosis[24].

Cases of leptospirosis can also increase after floods and heavy rain[25,26,27], due to contact with flood waters. People may have to wade through contaminated water or use it for bathing or drinking.

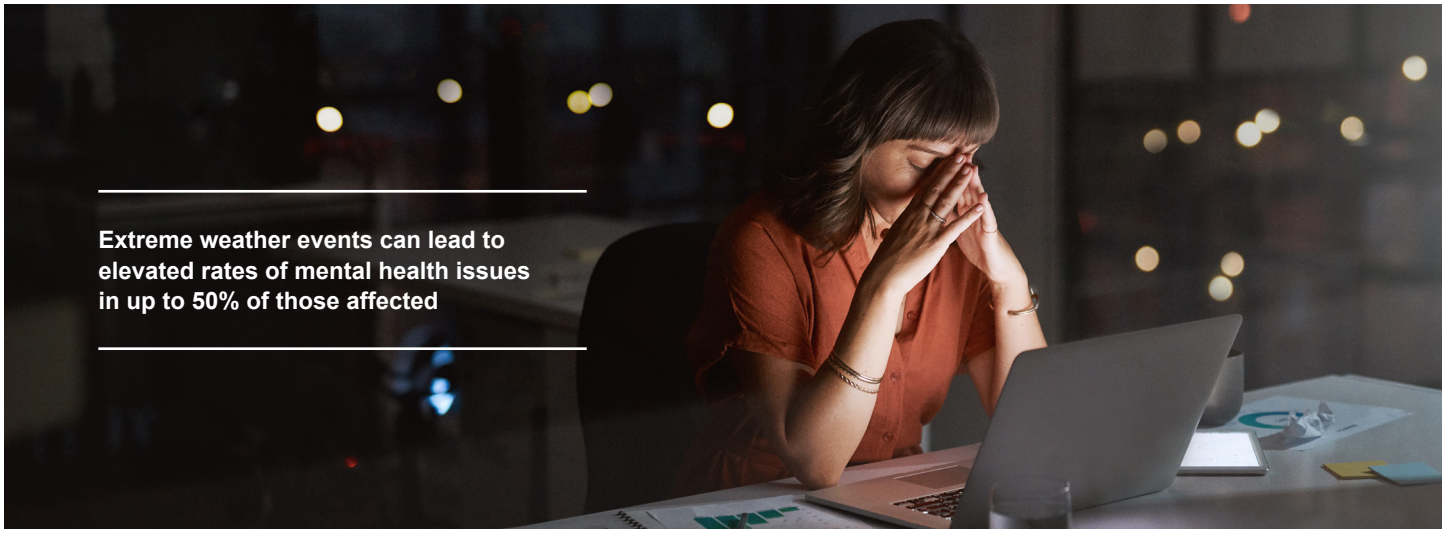
Heat and humidity increase the risk of common **skin infections** caused by bacteria, fungi and viruses. Extreme heat can also influence behaviour, leading to people spending more time outdoors, increasing their exposure to air pollution, UV radiation and insects. Skin injuries, infections, and worsening of inflammatory skin disorders are associated with floods and wildfires[28].

Harmful **chemical exposure** is a possibility following extreme weather events, which damage facilities handling these substances – whether small-scale releases from household stored chemicals or large-scale from manufacturing or commercial storage facilities. Chemicals released can cause skin irritation or burns, and there may be immediate respiratory tract injury from inhalation or poisoning if the chemicals contaminate food and water[29].

21. World Mosquito Program Explainer: How climate change is amplifying mosquito-borne diseases https://www.worldmosquitoprogram.org/en/news-stories/stories/explainer-how-climate-change-amplifying-mosquito-borne-diseases
22. What climate change means for mosquito-borne diseases Lowy Institute, 11 Nov 2021 https://www.lowyinstitute.org/the-interpreter/what-climate-change-means-mosquito-borne-diseases
23. Abbott Pandemic Defense Coalition September 2024. Sustaining Readiness: Expert insights on pandemic preparedness. https://www.abbott.com/content/dam/corp/abbott/en-us/hub/Abbott-Pandemic-Defense-Coalition-2024-Survey-Report.pdf
24. Cann KF, Thomas DR, Salmon RL, Wyn-Jones AP, Kay D. Extreme water-related weather events and waterborne disease. Epidemiol Infect. 2013 Apr;141(4):671-86. https://pmc.ncbi.nlm.nih.gov/articles/PMC3594835/
25. United States Centres for Disease Control and Prevention. Preventing Leptospirosis after Hurricanes or Flooding 25 April 2024 https://www.cdc.gov/leptospirosis/prevention/index.html
26. Chadsuthi, S., Chalvet-Monfray, K., Wiratsudakul, A. et al. The effects of flooding and weather conditions on leptospirosis transmission in Thailand. Sci Rep 11, 1486 (2021) https://www.nature.com/articles/s41598-020-79546-x
27. Ehelepola NDB, Ariyaratne K, Dissanayake WP. The correlation between local weather and leptospirosis incidence in Kandy district, Sri Lanka from 2006 to 2015. Glob Health Action. 2019;12(1):1553283. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6327921/
28. Belzer A, Parker ER. Climate Change, Skin Health, and Dermatologic Disease: A Guide for the Dermatologist. Am J Clin Dermatol. 2023 Jul;24(4):577-593 https://pubmed.ncbi.nlm.nih.gov/37336870/
29. World Health Organization Chemical releases caused by natural hazard events and disasters
Information for public health authorities 22 August 2018 https://www.who.int/publications/i/item/9789241513395#cms

HEALTH CONDITIONS CAUSED OR EXACERBATED

BY EXTREME WEATHER



Infants, children, the elderly, women and those who are pregnant are among the most vulnerable to extreme weather events. High heat is associated with poor pregnancy outcomes, such as premature and stillbirths[30]. "Each additional 1°C in minimum daily temperature over 23.9°C has been shown to increase the risk of infant mortality by as much as 22.4%."[31]

Mental Health impacts are both acute, occuring immediately during an extreme weather event and delayed, manifesting weeks or months later. The psychological effects can become chronic issues, lingering for years. They range from minimal symptoms of stress and distress to anxiety, sleep disturbance, depression, post-traumatic stress and even suicidal thoughts[32]. "Between 20 – 50% of people who live through unpredictable and extreme weather events can develop immediate elevated rates of anxiety, depression, PTSD, sleep disruption and suicidal ideation. As many as 10-20% may experience post-traumatic stress disorder in the years following the disaster."[33]

The mental health impact of flooding can be long-term, particularly in the event of displacement. Following flooding events in England, between 1/5 and 1/3 of those affected experienced mental health issues of depression, anxiety and post-traumatic stress disorder, and these problems were still evident three years after the event[34]. The level of mental health issues of those affected by floods has been described as comparable to those displaced by conflict[35].

Flooding, drought and heat events impact crop production, reduce access to safe food supplies and overall diet diversity, increasing **malnutrition.** Children are most vulnerable, and undernutrition makes them more susceptible to infectious diseases.[36]

Extreme weather events often disrupt health systems. Relatively minor impacts include temporary loss of power and water supplies and interruption of non-essential services. Major damage with the destruction of multiple healthcare facilities can result in long-term poorer population health outcomes from acute and chronic illnesses, including cancer, through reducing access to care[37].

30. Chersich MF, Pham MD, Areal A, Haghighi MM, Manyuchi A, Swift CP, Wernecke B, Robinson M, Hetem R, Boeckmann M, Hajat S; Climate Change and Heat-Health Study Group. Associations between high temperatures in pregnancy and risk of preterm birth, low birth weight, and stillbirths: systematic review and meta-analysis. BMJ. 2020 Nov 4;371:m3811 https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7610201/
31. World Health Organization, Experts warn of serious health impacts from climate change for pregnant women, children, and older people 5 June 2024 https://www.who.int/news/item/05-06-2024-experts-warn-of-serious-health-impacts-from-climate-change-for-pregnant-women--children--and-older-people
32. Cianconi P, Betrò S, Janiri L. The Impact of Climate Change on Mental Health: A Systematic Descriptive Review. Front Psychiatry. 2020 Mar 6;11:74 https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7068211/
33. The nexus between Climate Change and Mental Health Policy Brief Black Dog Institute 2021 https://www.blackdoginstitute.org.au/news/the-implications-of-climate-change-on-mental-health/
34. UK Health Security Agency. Climate change: health effects in the UK Chapter 3: Climate change, flooding and public health https://www.gov.uk/government/publications/climate-change-health-effects-in-the-uk
35. Cruz J, White PCL, Bell A, Coventry PA. Effect of Extreme Weather Events on Mental Health: A Narrative Synthesis and Meta-Analysis for the UK. Int J Environ Res Public Health. 2020 Nov 19;17(22):8581 https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7699288/#B48-ijerph-17-08581
36. Amondo, E.I., Nshakira-Rukundo, E. & Mirzabaev, A. The effect of extreme weather events on child nutrition and health. Food Sec. 15, 571–596 (2023) https://link.springer.com/article/10.1007/s12571-023-01354-8
37. Lynch KA, Merdjanoff AA. Impact of Disasters on Older Adult Cancer Outcomes: A Scoping Review. JCO Glob Oncol. 2023 Jun;9:e2200374 https://www.ncbi.nlm.nih.gov/pmc/articles/PMC10497294/

EXTREME WEATHER TYPES AND

SPECIFIC HEALTH IMPACTS

In Europe, there is "a **97%** relative increase in the total number of person-days of heatwave exposure in the last decade (2012–21) compared with the previous decade (2000–09)"

Extreme Heat

The Lancet Countdown on Health and Climate Change and the earlier series on Heat and Health highlight the dangers of extreme heat[38,39]. In Europe, there is "a 97% relative increase in the total number of person-days of heatwave exposure in the last decade (2012–21) compared with the previous decade (2000–09)," and while there is expected to be a fall in cold-related deaths, it is exceeded by an increase in heat-related deaths.

The increase occurred in 94% of the locations studied, rising by 17·2 deaths per 100 000 inhabitants between 2003 and 2022. Women were more affected than men. "Almost half of the global population and more than 1 billion workers are exposed to high heat episodes, and about a third of all exposed workers have negative health effects. However, excess deaths and many heat-related health risks are preventable". Excessive heat increases the risk of illness death from dozens of diseases - cardiovascular (heart), respiratory (lung), cerebrovascular (brain), kidney and diabetes.

The World Health Organization points to five key indirect health impacts of extreme heat events - impacts on health services and facilities, disruption of other critical infrastructure and technology, ecosystem impacts (e.g. drought, fire), increased transmission of some infectious diseases, and impacts resulting from altered human behaviour (e.g. increased accident risk)[40].

The frequency of **Extreme Cold** events is expected to decrease associated with climate change[6]. Health impacts of cold events include the obvious direct injuries of hypothermia and frostbite. Studies have shown an "Increased risk of mortality, cardiovascular mortality and morbidity, respiratory mortality and morbidity, and mental health."[41]

Dust/sand storms can trigger a range of health issues, most notably respiratory problems and cardiovascular events. Infectious diseases, particularly pneumonia and other respiratory infections including COVID-19, as well as meningococcal meningitis and measles, are linked to dust storms[43,44,45].

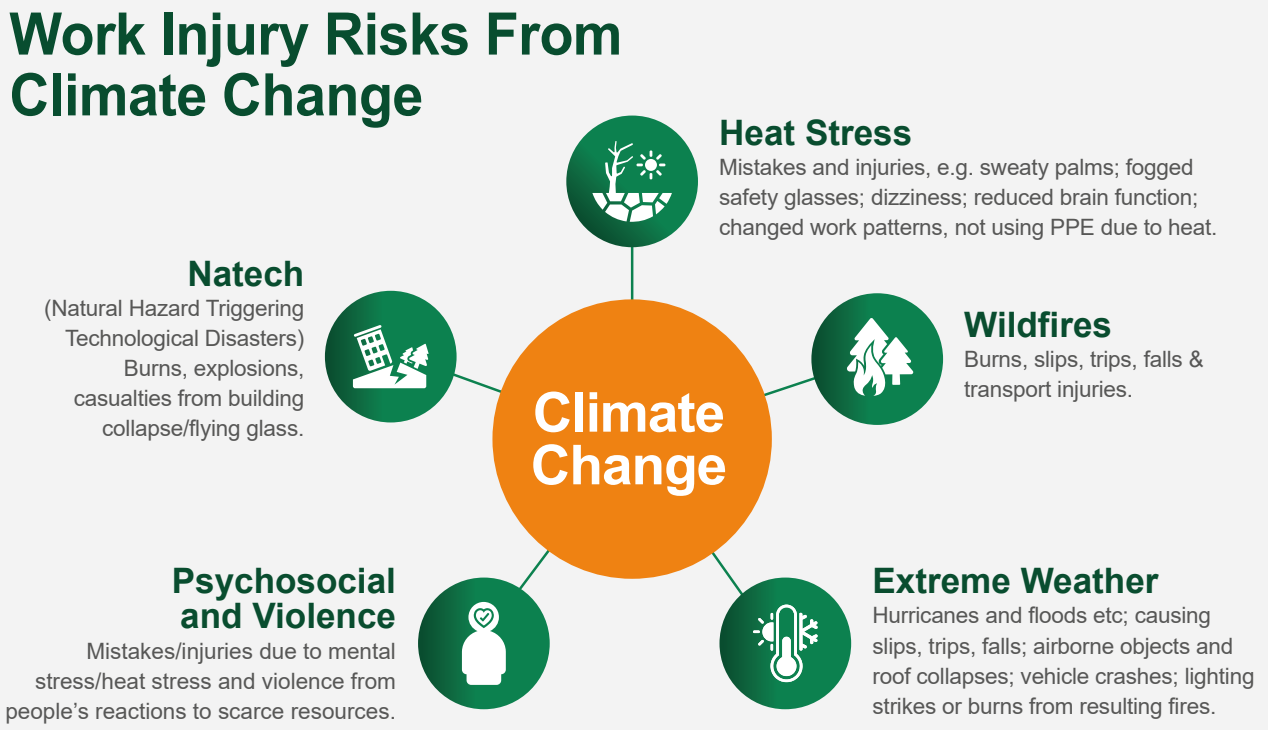
38. The 2024 Europe report of the Lancet Countdown on health and climate change: unprecedented warming demands unprecedented action https://www.thelancet.com/journals/lanpub/article/PIIS2468-2667(24)00055-0/fulltext
39. Lancet Heat and Health series, 19 August, 2021 https://www.thelancet.com/series/heat-and-health
40. World Health Organization Scale and nature of the health impacts of heat, 16 May 2024 https://www.who.int/multi-media/details/scale-and-nature-of-the-health-impacts-of-heat
41. Extreme weather events in Europe and their health consequences – A systematic review https://www.sciencedirect.com/science/article/pii/S1438463921000018
International Journal of Hygiene and Environmental Health Volume 233, April 2021, 113688
Department of Occupational and Environmental Health, Bavarian Health and Food Safety Authority, Germany
42. Lwin KS, Tobias A, Chua PL, Yuan L, Thawonmas R, Ith S, Htay ZW, Yu LS, Yamasaki L, Roqué M, Querol X, Fussell JC, Nadeau KC, Stafoggia M, Saliba NA, Sheng Ng CF, Hashizume M. Effects of Desert Dust and Sandstorms on Human Health: A Scoping Review. Geohealth. 2023 Mar 1;7(3):e2022GH000728 https://www.ncbi.nlm.nih.gov/pmc/articles/PMC9976568/
43. Goudie, A.S. (2020). Dust Storms and Human Health. In: Akhtar, R. (eds) Extreme Weather Events and Human Health. Springer, Cham. https://doi.org/10.1007/978-3-030-23773-8_2
44. Vergadi E, Rouva G, Angeli M, Galanakis E. Infectious Diseases Associated with Desert Dust Outbreaks: A Systematic Review. Int J Environ Res Public Health. 2022 Jun 5;19(11):6907 https://www. ncbi.nlm.nih.gov/pmc/articles/PMC9180817/
45. Dust Storms and Human Health https://link.springer.com/chapter/10.1007/978-3-030-23773-8_2

EXTREME WEATHER TYPES AND

SPECIFIC HEALTH IMPACTS

Occupational Health Considerations

More frequent and more severe weather events increase the risk to workers wherever they are in the world, particularly to assignees and business travellers who may not be acclimated and do not have the same understanding of weather systems and emergency response procedures as the local workforce. A 2024 literature review found “areas of concern encompass heat stress, vector-borne disease outbreaks, food and water insecurity, air pollution, UV radiation, psychological distress among workers; injuries and death from extreme weather events and climate change mitigation activities, as well as worker displacement. Reduced access to healthcare further compounds these issues.”[46]



Olivier LO and Richard Jones, Negative occupational health and safety impact of climate changes on organisations. International Congress on Occupational Health 2024, ICOH. Special Session SS03 – Climate changes and occupational safety and health.

46. Olivier Lo and Richard Jones, Negative occupational health and safety impact of climate changes on organizations 2024, ICOH; Special Session SS03 - Climate changes and occupational safety and health

EXTREME WEATHER TYPES AND SPECIFIC HEALTH IMPACTS

Occupational Health Considerations

The occupational implications of extreme heat are probably the best-known and most studied of the extreme weather events on the workforce. Extreme heat is thought to cause the highest morbidity and mortality globally compared to other extreme weather events. Annually, over 2.4 billion workers are estimated to be exposed to excessive heat through their occupation, leading to over 22 million occupational injuries and almost 19,000 work-related fatalities[47]. While outdoor workers, including construction and agricultural workers, are at high risk, indoor workers are also impacted. Heat illness can affect young, healthy workers, although those who are pregnant, older people and those with underlying health issues are more vulnerable. An increasing number of jurisdictions require employers to address the risks of heat health impacts beyond the "general duties" requirements. The United States is working towards a federal heat standard for heat at work, applicable to all employers conducting outdoor and indoor work in all general industry[48]. Many countries have implemented regulations that include maximum temperature limits, and guidelines for workplace adaptations, however, the European Union does not have a maximum acceptable temperature at work[49]. Some countries guide or regulate the upper and lower limits at which work can continue; for example Canada[50], China[51] and Norway[52].

The International Labour Organization April 2024 report, "Ensuring Safety and Health at Work in a Changing Climate"[43], again finds there is limited data on the global burden of occupational exposures to extreme weather events. Other than extreme temperature, as discussed earlier, there is limited specific legislation protecting workers from the health impacts of extreme weather. Rather, general Occupational Safety and Health rules speak to emergency response plans for natural disasters such as wildfires. One example of specific regulation is Germany's Workplace Ordinance, which states "Workstations in workplaces that are not enclosed on all sides and outdoor workstations must be designed and operated in such a way that they can be reached, used, and left again safely by the workers in all weather conditions and without any hazard to their health. This also means that workstations must be protected against inclement weather conditions or that the workers must be provided with suitable personal protective equipment."[53]

47. International Labour Organization Ensuring safety and health at work in a changing climate 22 April 2024 https://www.ilo.org/publications/ensuring-safety-and-health-work-changing-climate
48. US Department of Labor, Occupational Safety and Health Administration, 2 July, 2024 https://www.osha.gov/news/newsreleases/national/07022024
49. Eurogip July 2023 Working in extreme heat and heatwaves: what legislation and preventive measures at international level? https://eurogip.fr/en/what-are-the-rules-in-the-different-countries-for-working-in-hot-weather/
50. Canadian Centre for Occupational Health and Safety, Temperature Conditions – Legislation https://www.ccohs.ca/oshanswers/phys_agents/temp_legislation.html
51. Chinese Centre for Disease Control and Prevention 22 July 2022 Work in high temperatures and protective measures https://en.chinacdc.cn/health_topics/occupational_health_poisons/202207/t20220722_260518.html
52. Norwegian Labor Inspection Authority, Temperature – heat and cold at work https://www.arbeidstilsynet.no/tema/temperatur/
53. German Federal Office of Justice, Workplace Ordinance – ArbStättV https://www.gesetze-im-internet.de/englisch_arbst_ttv/englisch_arbst_ttv.html

RECOMMENDATIONS

FOR ORGANISATIONS

Organisations must act now to assess potential impacts and mitigate their risks. International SOS Foundation recommends organisations adopt the following practices:

01 RISK ASSESSMENT

Undertake a current state, baseline assessment of extreme weather events and potential impacts, including health consequences. Ensure a risk assessment is performed regularly for each location of operations, and updated accordingly. Consider the transition risks as the world moves towards renewable energy.

02 ADOPT POLICIES

Keep abreast of employer requirements to protect the workforce against extreme weather events, which are increasingly being introduced globally. Consider implementing best practice even if not required.

03 REMAIN INFORMED

Understand the local and national warning systems and monitor them. Health warning systems are critical. Many locations provide air quality, storm, wind, flood, and extreme temperature hazard alerts. Ensure plans include these warning systems as triggers for escalating / de-escalating response actions.

04 UNDERSTAND CAPABILITIES

Be aware of local, national, and critical supplier capabilities to prepare and respond to extreme weather events. Assess the impact of these gaps on operations and the organisation's ability to fill these gaps by utilising its own resources or engaging additional third-party providers.

05 PLAN AHEAD

Create a plan encompassing preparedness, response and recovery, including the travelling workforce. Consider a stockpile of critical supplies, including food, water, and power. Ensure mental health impacts and support are addressed.

06 PRIORITISE TRAINING

Conduct regular awareness and education for managers and the workforce for all relevant aspects. Consider including first responder training.

Dr Irene Lai MBBS (Sydney) FFTM RCPS (Glasg)

Global Medical Director, Medical Information & Analysis, International SOS

Irene has over 20 years' experience in health intelligence, risk assessment, communications, and clinical medicine. Her focus areas are emerging and pandemic health threats, heat and climate impacts, travel, public health, and emergency preparedness and response. She trained primarily in internal medicine, working in Sydney, Chicago, and New York. She has experienced different roles within the group, in Singapore, Jakarta, and Sydney.

Dr Katherine O'Reilly

Regional Medical Director, Medical Information & Analysis UK, Europe and Americas, and Training Services, International SOS

Kate is an experienced doctor with over 10 years of expertise in medical assistance, health intelligence, and risk assessment. She has a diverse background across multiple specialties, including general practice, anaesthesia, public health, and clinical medicine. Kate is particularly passionate about risk management, the effects on health of heat and other climate conditions.

COMPILED AND PRODUCED BY

INTERNATIONAL SOS FOUNDATION