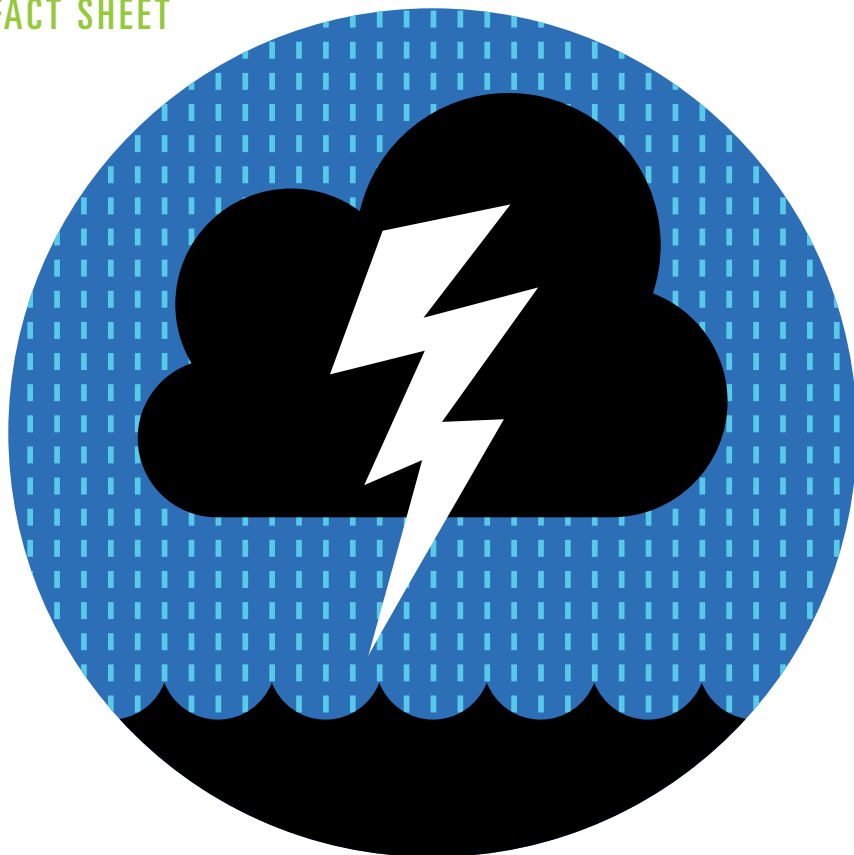


SEVERE STORMS, FLOODS AND YOUR HEALTH

FACT SHEET



Doctors for the Environment Australia has developed this fact sheet to detail the adverse effects of floods and storms on our health and simple measures for avoidance and treatment. Such extreme weather events are becoming more frequent with climate change and are demanding and costly to health services and communities.

BACKGROUND

Cyclones, typhoons, and hurricanes, officially known as “tropical cyclones”, are all the same weather phenomenon, differing only in location. Cyclones occur in the South Pacific and Indian Ocean, including Australia. In the Atlantic and Northeast Pacific, the term hurricane is used, while in the Northwest Pacific this weather disturbance is called a typhoon (National Ocean Service, NOAA 2014).

Cyclones and floods are amongst the most significant natural disasters in terms of global numbers of lives lost and numbers of persons affected (Doocy et al. 2013; ESCAP 2015; UN Office of DRR & CRED 2015; Jonkman 2005; Jonkman & Vrijling 2008).

Definition of cyclone

According to the Bureau of Meteorology, cyclones are low-pressure systems that form over warm tropical waters and have gale force winds (sustained winds of 63 km/h or greater and gusts in excess of 90 km/h) near the centre. Because they form over warm tropical seas, they carry a

lot of heat and moisture. When this precipitates they produce destructive winds, heavy rainfall leading to severe flooding, and storm surges - a temporary but extreme rise in sea level that inundates low-lying coastal areas (BOM 2017a).

Definition of flood

Geoscience Australia defines a flood as “a general and temporary condition of partial or complete inundation of normally dry land areas from overflow of inland or tidal waters from the unusual and rapid accumulation or runoff of surface waters from any source” (Geoscience Australia 2011).

CURRENT AND FUTURE TRENDS

Long-term observations show that extreme weather events (floods, cyclones, droughts, heatwaves and bushfires) are now more severe and generally more common than in the recent past (CSIRO 2015c), with climate change being a major driver of this change due to the ongoing combustion of fossil fuels and its associated carbon dioxide and other greenhouse gas emissions (US EPA 2016).

In Australia

- Australian annual average daily mean temperatures have increased by almost 1°C since 1910, and are projected to rise by 1.0 to 5.0°C by 2070 (CSIRO & BOM 2016).
- The years 2013 to 2014 were the warmest two-year period in Australia’s recorded history, with 2015 and 2016 being the fifth and fourth, respectively, warmest years on record (BOM 2017b).
- The number of cyclones is projected to be similar or decrease in frequency in the Australian region by 2050, but severity of cyclones (in Categories 3-5) is expected to increase markedly (CSIRO 2015b; BOM 2017c; Reisinger et al. 2014; CSIRO & BOM 2014).
- Heavy rainfall days and extreme rainfall events are projected to become more intense over most areas of Australia, resulting in more severe flooding (CSIRO 2015b; CSIRO 2015a; CSIRO & BOM 2014).



Healthy planet, healthy people

CURRENT AND FUTURE TRENDS

Continued

Globally

- The number of reported weather-related natural disasters has more than tripled since the 1960s, resulting in over 60,000 deaths every year (WHO 2016).
- More than half of the world's population lives within 60 km of the sea (WHO 2016).
- Global average mean sea level for 2011 was 210 mm above the level in 1880 (CSIRO & BOM 2012).
- Sea surface temperatures have increased by 0.8°C since 1910 (CSIRO & BOM 2012).
- 2016 was the hottest year on record (NASA/NOAA 2017), with 16 of the world's hottest years occurring in the last 17 years (NASA/NOAA 2017).

HEALTH EFFECTS OF CYCLONES AND FLOODS

Many studies have documented the health effects of cyclones and floods. (Doocy et al. 2013; ESCAP 2015; UN Office of DRR & CRED 2015; Jonkman 2005; Jonkman & Vrijling 2008; WHO 2016; Lowe D et al. 2013; Alderman et al. 2012; Salazar et al. 2016; Aitken et al. 2015; WHO 2010).

During tropical storms/cyclones:

- Storm surges (rather than wind) are responsible for most deaths/injuries for those living in coastal areas.
- Inland flooding from intense rainfall is responsible for most deaths/injuries for those living inland.

The direct health effects include:

- Injury and death due to, for example, drowning, falls, exposure to fallen electrical wires, being struck by falling debris or objects moving quickly, and mudslides/landslides.
- Carbon monoxide poisoning from using petrol-powered generators and pumps in confined spaces during power failures caused by flood and cyclone events (QLD DOH 2014; Becker et al. 2005; Vilain et al. 2015).
- Bites and injuries caused by displaced wild animals, for example, snakes, spiders, reptiles and rodents.

The indirect and/or after-effects include:

- Mosquito-borne illnesses such as Ross River Virus, Barmah Forest Virus, and Dengue.
- Gastrointestinal illness (diarrhoea and vomiting) from eating contaminated or poorly refrigerated foods or

liquids, leading to dehydration.

- Other communicable diseases, including hepatitis A and E, leptospirosis and parasitic diseases.
- Skin/wound infections and rashes.
- Increased prevalence of asthma and other respiratory illnesses from mould inhalation.
- Release of toxins, for example, chemicals, pesticides, and heavy metals such as lead and arsenic.
- Liberated asbestos fibres being released into the air (Ryan et al. 2014; Ravikrishna et al. 2010).
- Psychological distress from loss of home and/or livelihood.
- Difficulty accessing usual medications/health care such as dialysis, home oxygen supplies and inability of home nursing services to visit.
- Breakdown of routine health care services such as immunisation programs and other preventive care.
- Malnutrition and food insecurity.
- Poorer birth outcomes due to disrupted access to obstetric services.

WHO IS VULNERABLE?

Extreme weather events affect everyone, but some people are more vulnerable than others (Doocy et al. 2013; Lowe D et al. 2013; Alderman et al. 2012).

Vulnerable groups:

- Children are highly dependent on caregivers and lack the physical and behavioural maturity necessary to escape dangerous situations. Their behavioural patterns, such as outdoor play, also lead to an increased risk of exposure to contaminated water and asbestos fibres, as well as increased risk of injury, and bites from insects and animals.
- Women, especially in developing countries, are more vulnerable as they are more likely to be housebound with children, and will often wait for relatives to return home to accompany them to safety despite warnings. Also, women often wear more restrictive clothing (example, saris) and hence may be less physically able to escape (WHO 2010).
- The elderly, who have lower cardiovascular fitness, impaired mobility, visual impairment, varying degrees of cognitive decline and waning social connectedness and support, have reduced capacity to adequately care for themselves during extreme weather events.
- People with disabilities or pre-existing medical conditions, such as cardiovascular or chronic respiratory disease.

- People living alone, and those who are otherwise socially isolated and/or more exposed to extremes of weather, such as the homeless.
- People belonging to lower socio-economic groups, who for example are more likely to live in older accommodation built pre-cyclone building codes; they are also typically less able to change their circumstances or behaviour during extreme weather.
- Outdoor workers, particularly emergency service workers and volunteers, such as those with the SES and firefighters associations.

Studies of past cyclone and flooding events indicate that:

- Men, the elderly, and poorer communities are at greater risk of mortality in developed countries while women, the elderly, and children experience higher mortality in less developed countries (Doocy et al. 2013; Alderman et al. 2012; WHO 2010).
- Women and the elderly appear to be at greater risk of psychological health effects (Lowe D et al. 2013; Alderman et al. 2012) but this can be modified by other risk factors, including previous flood experiences, greater flood depth or flood trauma, existing illnesses, medication interruption, and low education or socio-economic status (Lowe D et al. 2013; Alderman et al. 2012).

ECONOMIC AND HEALTH CARE COSTS

In Australia, the economic cost of natural disasters exceeded \$9 billion in 2015 alone (Australian Business Roundtable 2016).

Globally it is estimated that the cost of climate-related disasters has led to economic losses of over US\$2 trillion in the past 20 years (UN Office of DRR & CRED 2015; Kreft et al. 2013).

The economic cost associated with cyclones and floods is escalating due to increasing population, changes to settlement spread, and vulnerability of modern societies and technologies to natural hazards (Schuster 2011).

Healthcare costs will rise significantly due to the increased physical and mental health impacts of cyclone/flooding events.

Healthcare systems and infrastructure are also vulnerable to extreme weather

events. For example, cyclones and floods may cause damage to buildings, interruption of supply chains, and power failures, all of which compromise health care delivery.

Examples of recent events in Australia and their health/economic impacts

Queensland floods 2011:

- 78% of the state declared a disaster zone.
- 35 dead, 2.5 million people affected.
- \$10 billion reconstruction costs.
- Cancellation of approximately 1,400 elective surgeries.
- 500 clinical staff in Queensland Health deployed to deliver services.
- 17,000 tetanus/diphtheria vaccines distributed.
- Queensland health hotline received 54,881 calls.
- \$18 million to repair health infrastructure.
- \$37.8 million for mental health support.

Ex-tropical Cyclone Oswald (Queensland and New South Wales) January 2013:

- 5 mini-tornadoes and record-breaking rainfalls across Wide Bay and Burnett health districts in Queensland (30 *Wide Bay Public Health Unit* 2013).
- 4,000-plus homes affected, 500 sustained severe or irreparable damage.
- 600-plus businesses affected by partial or total inundation.
- Major damage to road and rail networks, electricity and telecommunications assets, sewage plants and water treatment plants.
- At the peak, 6,000 people displaced with 1,500-plus accommodated at evacuation centres (*Wide Bay Public Health Unit* 2013).
- \$2.5 billion worth of damage in Queensland alone.
- 39% who attended a tetanus vaccination clinic reported a potentially tetanus-prone injury during clean-up.
- One small food-borne outbreak, two reported cases of leptospirosis and sporadic cases of viral gastroenteritis.

PROTECTING YOURSELF DURING CYCLONES AND FLOODS

The Queensland Department of Health has several useful web-based resources to help those affected by flood, cyclones and other extreme weather events (*QLD Government* 2017b).

Preparation:

- Ensure adequate supplies of essential medications and foods, a clean and

non-contaminable water supply, a battery-operated radio for updates, and a source of power for lighting.

- Infants and the elderly, along with anyone requiring a constant supply of electricity for medical reasons, should be evacuated well in advance to a government-run evacuation centre if no safe alternative place is available.
- Local councils and State Emergency Service centres have details of what is available in each locality.

During the event:

- Keep yourself updated so that you are aware if, for instance, unexpected flash flooding starts to occur as this may require a specific evacuation route.
- Beware of injury, for example falls, skin lacerations, exposure to fallen electricity wires.
- Clean and dress wounds in a timely manner to avoid infection.
- Be aware of the risk of carbon monoxide poisoning from using petrol powered generators and pumps in confined spaces.
- Beware of potential bites from snakes, spiders, reptiles, rats and other displaced wild animals.
- Watch for sunburn and dehydration in the preparation and clean-up phases.

Following the event:

- Mosquito-borne illnesses such as Ross River Virus, Barmah Forest Virus and Dengue become more prevalent. Take appropriate mosquito exposure precautions by using mosquito nets and personal insect repellents, and clean up any sources of surface water as soon as possible.
- Gastrointestinal upset such as diarrhoea and vomiting from eating contaminated or poorly refrigerated foods or liquids can cause dehydration.
- Mould inhalation can cause or exacerbate asthma and other respiratory illnesses.
- Asbestos and other toxins such as lead and arsenic are often liberated by these events and require precautions.
- Local general practices and pharmacies can assist with supply of essential medications through community or hospital pharmacies (*QLD Government* 2017a).

WHAT CAN BE DONE?

Climate change will bring more frequent and severe cyclones and floods in Australia, with profound implications for health and significant associated costs.

Doctors for the Environment

Australia calls for:

- Urgent action to mitigate climate change. In particular, supporting the phasing out of coal mining and use of coal-fired power stations, reduced coal exports and the more rapid development and implementation of renewable energy and energy storage technology.
- The increasing risk of extreme weather events necessitates more action on adaptation measures. We call for national action to lead and coordinate community and health service adaptation to climate change, including the development of a national strategy to both prevent and manage health impacts. This requires leadership at the federal level, and close collaboration with communities, local, state and territory governments, researchers, health care providers, emergency services, and relevant non-government organisations.

MORE INFORMATION

- Bureau of Meteorology – preparation for cyclones <http://www.bom.gov.au/cyclone/about/tc-checklist.shtml>
- Queensland Government – storms, cyclones and flood (several useful resources and information) <https://www.qld.gov.au/emergency/dealing-disasters/>
- Queensland Government – accessing medications and PBS during natural disasters <https://www.qld.gov.au/emergency/dealing-disasters/accessing-medication.html>
- No Time For Games: Children's Health and Climate Change https://www.dea.org.au/wp-content/uploads/DEA9934_No_Time_for_Games_web_final.pdf
- Preparedness is key to extreme weather events <https://www.dea.org.au/preparedness-is-key-to-extreme-weather-events-healthy-planet-healthy-people-dea/>
- Why climate change should be a key health issue this election <https://www.dea.org.au/why-climate-change-should-be-a-key-health-issue-this-election-healthy-planet-healthy-people-dea/>
- Submission to Senate inquiry for recent trends in and preparedness for extreme weather events https://www.dea.org.au/wp-content/uploads/Extreme_Weather_Events_Submission_01-13.pdf

REFERENCES

- Aitken P, Franklin RC, Lawlor J, et al. Emergency department presentations following Tropical Cyclone Yasi. *PLoS One*. 2015;10(6): e0131196. doi:10.1371/journal.pone.0131196.
- Alderman K, Turner LR, Tong S. Floods and human health: a systematic review. *Environ Int*. 2012;47:37-47. <http://www.ncbi.nlm.nih.gov/pubmed/22750033>.
- Australian Business Roundtable for Disaster Resilience & Safer Communities, 2016. The economic cost of the social impact of natural disasters. Available at <http://australianbusinessroundtable.com.au/assets/documents/Report%20-%20Social%20costs/Report%20-%20The%20economic%20cost%20of%20the%20social%20impact%20of%20natural%20disasters.pdf>.
- Becker A, Dark T, Mason T, et al. 2005 hurricane surveillance: measures to reduce carbon monoxide poisoning in all Floridians. *J Environ Health*. 2012;74(9):16-21.
- Bureau of Meteorology (BOM), 2017a. About tropical cyclones. Available at <http://www.bom.gov.au/cyclone/about/>.
- Bureau of Meteorology (BOM), 2017b. Annual climate statement 2016. Available at <http://www.bom.gov.au/climate/current/annual/aus/>.
- Bureau of Meteorology (BOM), 2017c. Tropical cyclone FAQs. Available at <http://www.bom.gov.au/cyclone/faq/index.shtml#climatology>.
- CSIRO, 2015a. FAQs on floods. Available at <http://www.csiro.au/en/Research/Environment/Extreme-Events/Floods/FAQs-on-floods>.
- CSIRO, 2015b. FAQs on tropical cyclones. Available at <http://www.csiro.au/en/Research/Environment/Extreme-Events/Tropical-cyclones/FAQs-on-tropical-cyclones>.
- CSIRO, 2015c. How is extreme weather changing? Available at <http://www.csiro.au/en/Research/OandA/Areas/Assessing-our-climate/Climate-change-QA/Extreme-weather>.
- CSIRO and Bureau of Meteorology (BOM), 2012. State of the Climate 2012. Available at www.bom.gov.au/state-of-the-climate/documents/Climate-Snapshot-2012-Brochure.pdf.
- CSIRO and Bureau of Meteorology (BOM), 2014. State of the Climate. Available at <http://www.bom.gov.au/state-of-the-climate/2014/>.
- CSIRO and Bureau of Meteorology (BOM), 2016. State of the Climate 2016. Available at <http://www.bom.gov.au/state-of-the-climate/>.
- Doocy S, Dick A, Daniels A, et al. The human impact of tropical cyclones: a historical review of events 1980-2009 and systematic literature review. *PLoS Currents*. 2013; 5 doi: 10.1371/currents.dis.2664354a5571512063ed29d25ffbce74.
- Geoscience Australia, 2011. What is a flood? Available at <http://www.ga.gov.au/scientific-topics/hazards/flood/basics/what>.
- Jonkman SN. Global perspectives on loss of human life caused by floods. *Natural Hazards*. 2005;34:151-175. doi: 10.1007/s11069-004-8891-3.
- Jonkman SN and Vrijling JK. Loss of life due to floods. *J Flood Risk Manag*. 2008;1: 43-56.
- Kreft S, Eckstein D. Global Climate Risk Index 2014: Who Suffers Most From Extreme Weather Events? Weather-Related Loss Events in 2012 and 1993 to 2012. Bonn, Germany: Germanwatch; 2013.
- Lowe D, Ebi KL, and Forsberg B. Factors increasing vulnerability to health effects before, during and after floods. *Int J Environ Res Public Health*. 2013;10:7015-67. <http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3881153/pdf/ijerph-10-07015.pdf>.
- National Aeronautics and Space Administration (NASA) and National Oceanic and Atmospheric Administration (NOAA), 2017. NASA, NOAA data show 2016 warmest year on record globally. Available at <https://www.nasa.gov/press-release/nasa-noaa-data-show-2016-warmest-year-on-record-globally>.
- National Ocean Service, National Oceanic and Atmospheric Administration (NOAA), 2014. What is the difference between a hurricane, a cyclone, and a typhoon? Available at <http://oceanservice.noaa.gov/facts/cyclone.html>.
- Queensland Government, 2017a. Accessing medicine during a disaster. Available at <https://www.qld.gov.au/emergency/dealing-disasters/accessing-medication.html>.
- Queensland Government, 2017b. Disasters. Available at <https://www.qld.gov.au/emergency/dealing-disasters/> refers to a number of useful web based resources about storms, cyclones and flood.
- Queensland Government Department of Health, 2014. Keeping safe after a cyclone. Available at <https://www.health.qld.gov.au/news-alerts/doh-media-releases/releases/140412-cyclone-safety>.
- Ravikrishna R, Lee HW, Mbuligwe S, et al. Air quality during demolition and recovery activities in post-Katrina New Orleans. *Environ Toxicol Chem*. 2010;29(7):1438-44.
- Reisinger, A. et al., 2014. Chapter 25. Australasia. In V. Barros et al., eds. *Climate Change 2014: Impacts, Adaptation, and Vulnerability. Part B: Regional Aspects. Contribution of Working Group II to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change*. Cambridge, United Kingdom and New York, NY, USA: Cambridge University Press, pp. 1371-1438.
- Ryan B, Kuhl I, Ware R. Framework for handling asbestos after a tidal surge. *J Environ Health*. 2014;76(6):170-6.
- Salazar MA, Pesigan A, Law R, et al. Post-disaster health impact of natural hazards in the Philippines in 2013. *Glob Health Action*. 2016;9:31320 <http://dx.doi.org/10.3402/gha.v9.31320>.
- Schuster S. 2011. Natural catastrophes – data, trends, analysis. RE Munich. http://www.greenhouse2011.com/UserFiles/Presentation/presentationUrl_23.pdf.
- United Nations Economic and Social Commission for Asia and the Pacific (ESCAP). Overview of Natural Disasters and their Impacts in Asia and the Pacific 1970-2014. ESCAP Technical Paper, 2015. http://www.unescap.org/sites/default/files/Technical%20paper-Overview%20of%20natural%20hazards%20and%20their%20impacts_final.pdf.
- United Nations Office for Disaster Risk Reduction and CRED (Centre for Research on the Epidemiology of Disasters). The Human Cost of Natural Disasters 2015 – a global perspective. http://emdat.be/human_cost_natdis.
- US Environmental Protection Agency, 2016. Causes of climate change. <https://www.epa.gov/climate-change-science/causes-climate-change>.
- Vilain P, Pages F, Combes X, et al. Health impact assessment of cyclone Bejisa in Reunion Island (France) using syndromic surveillance. *Prehosp Disaster Med*. 2015;30(2):137-44.
- Wide Bay Public Health Unit Communicable Disease Report 2013, p. 6-7.
- World Health Organization (WHO), 2016. Climate Change and Health, Fact Sheet No 266. Available at <http://www.who.int/mediacentre/factsheets/fs266/en/> (Reviewed June 2016).
- World Health Organization (WHO), 2010. Gender, Climate Change, and Health. <http://www.who.int/globalchange/GenderClimateChangeHealthfinal.pdf>.