

Heat health in general practice: An evidence-based approach to the prevention of heat-related illness



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Background

The year 2023 was the hottest on record, with heatwaves becoming more frequent and severe due to climate change. Extreme heat is the deadliest climate-related event, causing significant morbidity and mortality globally. Vulnerable groups include older people, young children and pregnant women.

Objective

This paper aims to equip general practitioners (GPs) with evidence-based strategies to prevent and mitigate heat-related illnesses. It identifies at-risk populations through life stage analysis and advocates for effective adaptation and mitigation strategies.

Discussion

This paper highlights essential practice points for GPs and discusses the expanding evidence on heat-related health impacts, including direct effects like heat stress and indirect effects such as exacerbation of chronic diseases. The importance of cooling strategies and heat action plans are emphasised while advocating for systemic changes to address the root causes of heat-related health risks.

EXTREME HEAT has historically been accepted as the biggest killer of all disasters in Australia.¹ Between January 2006 and October 2017, more than 36,000 Australians died from heat-related illnesses.² During the January 2019 heatwave in New South Wales, there was a 133% increase in the diagnosis of heatstroke-related conditions and a 63% rise in dehydration cases in emergency departments.³ Globally, extreme heat is increasingly understood as a major killer and is projected to cause increasing morbidity and mortality as global heating worsens.^{4,5}

The year 2023 was the hottest year since temperature records began.⁶ In the 12 months from June 2023 to May 2024, every month had record-high global temperatures.⁷ Our world is getting hotter and for the health of our community, this means an increased need to manage heat-related illnesses. General practitioners (GPs) can play a pivotal role in helping mitigate heat-related effects, reducing pressure on emergency departments and improving patient care.

Many groups have developed tools to support clinicians to implement heatwave plans, including state health departments, medical colleges, Primary Health Networks and non-government organisations like Doctors for the Environment Australia and Sweltering Cities.

We conducted a review of literature and resources, including journal articles and academic reports, to provide evidence-based strategies for GPs to prevent, mitigate and manage heat-related illness in their patients while also advocating for climate action to address the underlying cause — global heating.

Discussion

Direct and indirect effects on health

The Bureau of Meteorology of Australia defines a heatwave as a prolonged period, typically lasting three days, where maximum and minimum temperatures, both day and night, are unusually high.⁸ The specific threshold and duration can vary by region and climate, but it generally refers to temperatures significantly higher than the seasonal average. With climate change, as heatwaves become more extreme, frequent, prolonged and intense, they are increasingly referred to as extreme heat events (EHEs).⁹ Both terms describe periods of both direct and indirect effects on health, with direct effects, termed heat-related illness (HRI), including heat stress, heat exhaustion and heatstroke.

As seen in Figure 1, these should be considered a spectrum of heat effects on health, ranging from mild to severe to life-threatening.¹⁰ Patients suffering from

Why extreme heat is bad for the body?

In hot weather, we try to keep our internal body temperature to around 37°C by sweating. But our bodies can eventually overheat, especially if we do not drink enough fluid or move to a cooler place. Illness caused by overheating can be mild to severe.

Heat Exhaustion

- high internal body temperature (>38°C)
- reduced amount of sweating because of insufficient fluid in the body
- nausea
- vomiting
- headache
- fainting

Heat Stress

- feeling uncomfortable from heat
- weakness
- tiredness
- cramps
- dizziness



Heat Stroke

- very high internal body temperature (>40.5°C)
- confusion
- reduced alertness
- red, hot dry skin

Heat Stroke can quickly become life-threatening

Figure 1. Signs and symptoms of heat-related illness.

Reproduced from Doctors for the Environment Australia. Heat and health fact sheet. Doctors for the Environment Australia, 2023. Available at www.dea.org.au/heat_and_health_fact_sheet, with permission from Doctors for the Environment Australia.¹⁰

Who is most at risk?

 People with a chronic medical condition like heart or lung disease, dementia, multiple sclerosis (MS) or poor mental health.	 Those who are unwell with a fever, vomiting or diarrhoea, as they become dehydrated easily.
 Older people, especially those who are frail or over 65 years	 People who are pregnant or breastfeeding — they may go into early labour, or can also get hotter and need more fluids.
 Young children, as they cannot manage their body temperature well or change their hot surroundings	 Those who take medications that affect the way the body reacts to heat
 Those who are unable to move around, including getting enough fluids for themselves	 People who are socially isolated or living alone, as no one may know if they are getting sick
 People who are homeless or have limited choices in housing, work, transport or cooling	 Those who work or exercise outdoors - even people who are fit and healthy

Figure 2. Groups identified most at risk of health impacts of extreme heat.

Reproduced from Doctors for the Environment Australia. Heat and health fact sheet. Doctors for the Environment Australia, 2023. Available at www.dea.org.au/heat_and_health_fact_sheet, with permission from Doctors for the Environment Australia.¹⁰

heat stress and heat exhaustion might need medical care to prevent progression to heatstroke, a medical emergency that can be rapidly fatal due to multiorgan failure.¹¹

The indirect effects include exacerbations of chronic diseases reflecting the increased physiological load placed upon the body by heat, coupled with underlying pathology.¹² For example, heatwaves increase the risk of myocardial infarction, stroke and arrhythmia in those with underlying cardiovascular disease¹³ and increase the incidence of emergency department presentations for kidney disease.¹⁴ An age greater than 65 years increases the risk of all these outcomes.

Pregnant women and their unborn children face risks from heat too. A recent cohort study analysing 53 million singleton births from 1993 to 2017 across the 50 most populous US metropolitan areas found a positive association between heatwaves and increased rates of preterm and early-term births by 2% and 1% respectively.¹⁵ The study observed stronger associations in socioeconomically disadvantaged groups and highlighted the significant public health implications of heatwaves on perinatal health.

Rising temperatures and temperature variability are also associated with exacerbations of mental health conditions, including increased suicidality and hospital attendance for mental health exacerbations,¹⁶ increased violence,¹⁷ including sex offences,¹⁸ as well as interpersonal and domestic violence.¹⁹

Vulnerability to heat health impacts

Although everyone is at risk of HRI, certain groups are more vulnerable, as highlighted in Figure 2.²⁰

This vulnerability not only leads to an increased risk of adverse outcomes, but also means that these groups are more susceptible to HRI at lower temperatures. To illustrate, a person with diabetes has an increased risk of hyperglycaemia from dehydration²¹ and a HBA1c level >8.5 is linked with a reduced capacity to dissipate heat through sweating and vasodilation.²² These patients could be counselled to be proactive with cooling measures and avoid heat when the forecast is in the high twenties (degrees Celsius) or above.

Heat exposure, influenced by factors like the urban heat island effect,²³ poses a significant risk, especially for urban dwellers,

increasing vulnerability to the 73% of our population living in a major city, and outdoor workers such as labourers, park and wildlife officers and the homeless.²⁴

Additionally, housing quality plays a crucial role in heat vulnerability, with lower socioeconomic status linked to residing in poorly insulated homes without adequate cooling options like air conditioning.²⁵ A report by Better Renting highlights that renters are four-fold more likely than homeowners to struggle with heat.²⁶

Rebecca, a mother of three children, shares her experience of extreme heat:

Having my first baby and navigating issues from the constant heat was very difficult. It was often over 30 degrees inside our house, and without air conditioning, we struggled to keep his room cool enough for safe sleeping. Knowing that SIDS can occur due to overheating was always front of mind. When the air was thick with smoke from the bushfires, it was impossible to open windows to cool the house, and we couldn't go outside for days. While pregnant with my third child, it was again incredibly hot, and I found it hard to get through the day. I was constantly sweating, had heat rash, and always felt dehydrated.

Rebecca's story exemplifies why GPs need to understand each patient's circumstances. This ensures they can have adequate and appropriate conversations about staying safe during EHE, especially for vulnerable groups like expectant mothers.

Table 1 considers heat risk, mitigation and management strategies using a human life stage analysis for vulnerable groups.

Cooling strategies

GPs play a crucial role in preparing patients for extreme heat. Key advice, as summarised in Table 1's 'General public' section, includes avoiding outdoor activities during the hottest part of the day, wearing light clothing and staying well-hydrated. Figure 3 outlines new evidence-based, cost-effective cooling strategies that can help keep a home or individual cooler. For example, fans can make a room feel about 4°C cooler by speeding up sweat evaporation. They use about 5% of the electricity of air conditioners, saving money and reducing

CO₂ emissions. Fans can also be combined with air conditioning, allowing a higher thermostat setting to reduce costs while maintaining overall cooling;²⁷ however, this effect is limited; above 40°C, sweat evaporation is insufficient for cooling the body.

Given the risk of power outages during EHEs, it is important to explore back-up options with patients, such as identifying nearby refuges. Affordable, sustainable and accessible cooling methods include using fans, self-dousing, wet clothing, ice towels and foot immersion.^{27,28}

The Heat Watch App (<https://heatwatch.sydney.edu.au>) provides personalised risk assessments and evidence-based advice based on postcode and can be suggested to patients and carers to improve management.

Heat action plans

Incorporating heat action plans into chronic disease management plans allows GPs and practice nurses to systematically target at-risk patients and tailor their advice to the individual. Box 1 outlines a heat action planning tool. This process could include audits for at-risk groups such as pregnant patients, those on multiple medications (especially heat-sensitive ones), the elderly and socially vulnerable individuals. It could also serve as a quality improvement project for practices ahead of summer.

GPs might consider familiarising themselves with heat-sensitising medications and their effects, outlined in Table 2, and conduct regular medication reviews.^{29,30}

Patients on multiple medications or fluid restrictions are particularly vulnerable. A home medication review with a pharmacist can provide a detailed assessment, especially considering the home environment. Health assessments (for those aged 45–49 years and >75 years) also offer opportunities to discuss heat-related issues and provide relevant state-based information handouts.^{31–36}

Treating the causes

As trusted community members, health professionals can advocate for safe environmental conditions that support health. Our efforts should focus on policies that enhance heat resilience, such as improved urban planning, increased green spaces and affordable cooling options

for all. Global heating will increasingly have an effect on heat-related illnesses on our healthcare system, communities and patients.³⁷ We have a responsibility to advocate for climate action, recognising that ongoing fossil fuel combustion is heating our planet and harming health. Coal, oil and gas are driving up temperatures and should be seen as a public health hazard.

Box 1. Heat action plan: Formulation tool

1. Monitor weather reports and understand personal heat risk

- Ensure regular access to weather forecasts to plan activities that avoid heat exposure.
- Educate patients on understanding their personal heat risk based on their health conditions, lifestyle and environment.

2. Identify heat exposure risks

- Evaluate heat exposure risks related to patients' occupations, hobbies, interests and health conditions.

3. Assess living conditions

- Gather information about patients' living conditions, including homelessness, home cooling availability, building type, insulation and shade.
- Discuss optimal sleeping arrangements, recognising that the coolest room in a home might not be the bedroom.

4. Evaluate cooling methods

- Identify and assess available cooling methods such as fans, air conditioning and water-based cooling.
- Acknowledge that not all individuals can afford air conditioning and some live in homes without adequate cooling or water.

5. Review medications and recreational drug risks

- Evaluate and manage medication risks, particularly with angiotensin-converting enzyme inhibitors, diuretics, anticholinergics, antipsychotics and beta-blockers.
- Identify and mitigate risks from alcohol and recreational drugs that can exacerbate heat-related illnesses.

6. Manage underlying illnesses

- Implement strategies to manage underlying illnesses to reduce overall health-related health risks.

Table 1. Heat risk, mitigation and management strategies using a human life stage analysis








Group	Heat risk	Mitigation and management
General public 	HRI – heat stress, heat exhaustion, heat stroke	<ul style="list-style-type: none"> • Understand heat: recognise how it affects activities and identify symptoms of heat-related illnesses • Educate patients on heat risks and prevention • Stay informed by monitoring heat warnings and planning ahead • Drink water regularly; avoid caffeine and alcohol • Dress in light, breathable clothing and wear a wide-brimmed hat • Be SunSmart; seek shade and use sunscreen outdoors • Schedule outdoor activities during cooler parts of the day • Refrigerate perishable foods and store medicines as directed • Provide information on affordable cooling solutions (eg fans, air conditioning) and how to create a cool space at home using available resources • Identify nearby cool refuges if home cooling is insufficient • Advocate for heat safety policies in workplaces, schools and sports • Support policies for equitable access to cooling measures, financial aid for air conditioning and energy costs, and building heat-resilient homes, towns and cities
Pregnant/lactating women 	<ul style="list-style-type: none"> • Preterm and early term birth • Cardiovascular stress • Intrauterine growth restriction • Pre-eclampsia • Impact on milk production 	<ul style="list-style-type: none"> • Provide targeted education and resources to at-risk groups, emphasising the importance of staying cool during pregnancy • Monitor for signs of preterm or early term birth and know when to seek medical assistance • Maintain hydration for maternal health and milk production • Avoid exercising in hot weather, especially in high humidity • Schedule breaks in a cool environment to prevent overheating and reduce cardiovascular stress • If feeling unwell, lie down and rest in a cool place (if available) • Attend scheduled prenatal and postnatal check-ups
Babies and young children 	<ul style="list-style-type: none"> • Greater risk of HRI and dehydration due to under-developed sweat glands, larger surface area-to-body volume ratio • Unsettled behaviour and disrupted sleep 	<ul style="list-style-type: none"> • Provide targeted education for parents and caregivers on heat risks and prevention • Recognise symptoms of heat stress, such as lethargy or excessive crying, and know when to seek medical assistance • Offer frequent small feeds (every 30–60 min) • For babies aged >6 months, provide cooled boiled water • For babies aged <6 months, provide only breast milk or formula • For older babies, offer hydrating foods like watermelon or ice blocks made from breast milk, formula or diluted fruit juice • Use sunshades in cars and prams • Offer water play in shaded areas or give lukewarm baths • Cover prams with a light, damp cloth, refreshing it every 15–20 min • Use lightweight bedding and ensure proper ventilation

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Table 1. Heat risk, mitigation and management strategies using a human life stage analysis (cont'd)

Group	Heat risk	Mitigation and management
Children and young adults 	Increased risk of HRI especially during outdoor and/or sporting events, music events and drug use	<ul style="list-style-type: none"> • Provide targeted education on heat risks and prevention for parents, caregivers and educators • Adjust outdoor activities, sports and events to cooler parts of the day • Encourage regular hydration breaks in shade areas during outdoor activities • Teach effective cooling techniques, such as using cool, damp cloths or taking cool showers • Emphasise the importance of drinking water before feeling thirsty, especially during active play • Advise minimising or avoiding drug and alcohol use during extreme heat • Promote access to water, fans, air conditioning and shaded spaces, along with heat safety policies in schools and sports organisations
Adults 	<ul style="list-style-type: none"> • Increased violence, mental health exacerbations • Higher risk of HRI during outdoor work or physical activities • Increased alcohol and soft drink consumption 	<ul style="list-style-type: none"> • Provide tailored education based on occupation, hobbies and interests • Take regular hydration breaks in shaded areas • Stop work during extremely hot and humid days • Adjust sporting activities to avoid peak heat • Review the impact of regular medication, alcohol and drug use in extreme heat conditions
Elderly 	<ul style="list-style-type: none"> • Increased risk of HRI with age, use of medications and comorbidities, which affect thermoregulation, fluid balance • Increased mortality rate • Poor sleep • Fatigue 	<ul style="list-style-type: none"> • Assess need for additional support and encourage building a support network • Educate on heat risks, prevention and early signs of heat stress • Refer to community support programs (eg Red Cross) • Recommend food delivery and telehealth to avoid going out during extreme heat events • Maintain a contact list for cooling centres, support persons and community transport • Develop heat action plans within chronic disease management or health assessments, including medication guidance • Liaise with aged care providers on heatwave management • Consider keeping a register of high-risk individuals
People with disabilities, comorbid conditions, including mental illness 	<ul style="list-style-type: none"> • Higher vulnerability and increased mortality risk • Exacerbation of symptoms (eg multiple sclerosis, mental health) • Increased risk of heat-related symptoms due to medications 	<ul style="list-style-type: none"> • Assess if additional support or carers are needed and encourage building a support network • Educate patients and caregivers on heat risks, prevention and early signs of heat stress • Include heat action plans in chronic disease or mental health care plans, with specific medication guidance • Coordinate with carers, NDIS providers and health workers on heatwave management • Ensure cooling centres and resources are accessible for individuals with mobility challenges • Advise on adjusting medication schedules during extreme heat, in consultation with healthcare providers

Note: General public advice is broadly applicable to all groups.

HRI, heat-related illness; NDIS, National Disability Insurance Scheme.

Sustainable and accessible ways to keep cool

Mitigating climate change is vital, but inevitable rising temperatures means that identifying sustainable cooling strategies is also important. Strategies at the individual scale that focus on cooling the person instead of the surrounding air can be effectively adopted, even in low-resource settings.

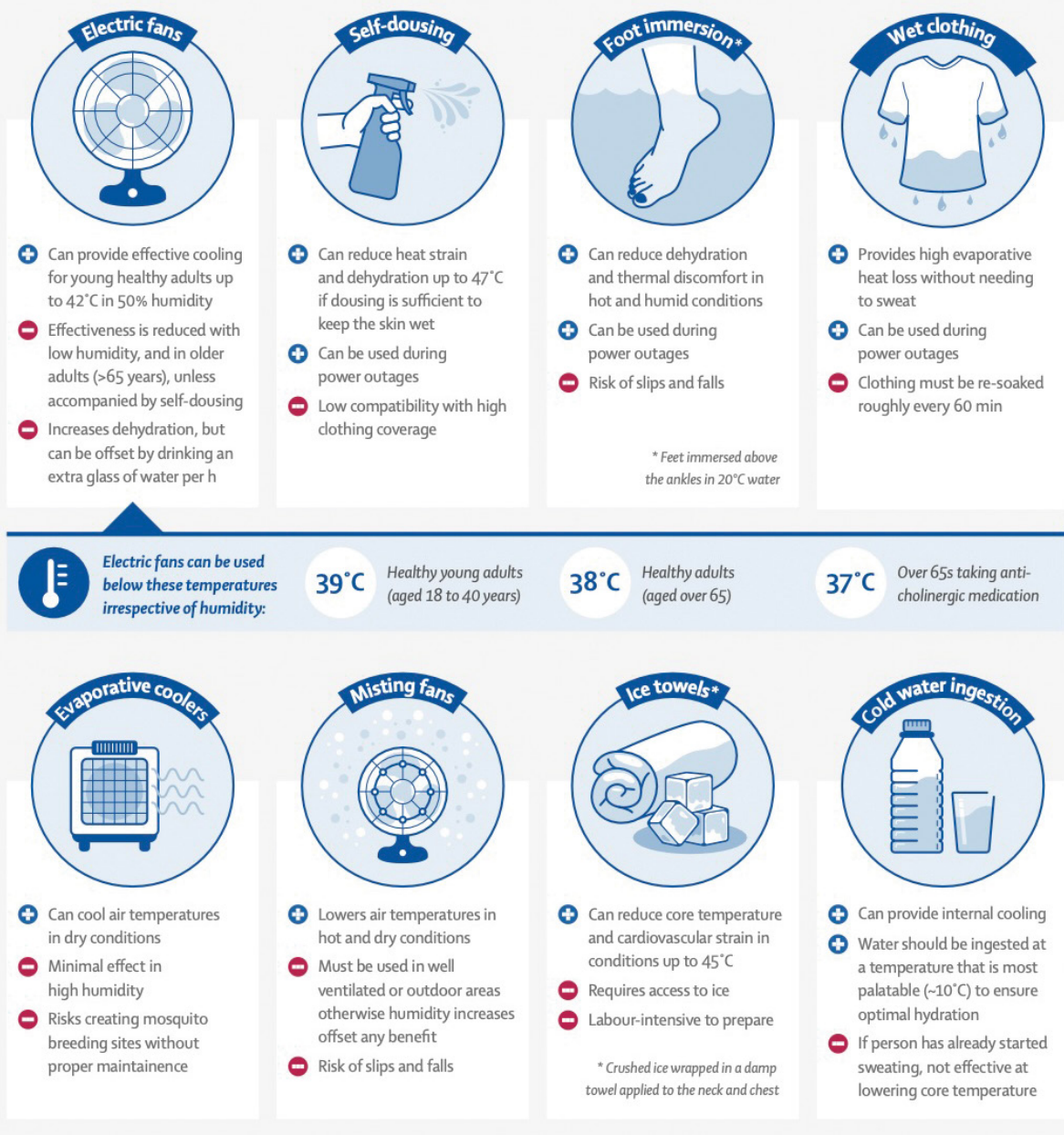


Figure 3. Sustainable and accessible ways to keep cool.

Reproduced from Jay O, Capon A, Berry P, et al. Reducing the health effects of hot weather and heat extremes: From personal cooling strategies to green cities. *Lancet* 2021;398(10301):709-24. doi: 10.1016/S0140-6736(21)01209-5, with permission from Elsevier Ltd.

Table 2. Heat-sensitising mechanism of common medications^{29,30}

Mechanism	Drug class or subclass	Examples of drugs
Reduced vasodilation	Beta-blockers	atenolol, metoprolol, propranolol
	Triptans	sumatriptan, zolmitriptan
Decreased sweating	Anticholinergics – Tricyclic antidepressants	amitriptyline, clomipramine, dothiepin
	Anticholinergics – Sedating antihistamines	promethazine, doxylamine, diphenhydramine
	Anticholinergics – Phenothiazines	chlorpromazine, thioridazine, prochlorperazine
	Other anticholinergics	benztropine, hyoscine, clozapine, olanzapine, quetiapine, oxybutynin, solifenacin
	Beta-blockers	atenolol, metoprolol, propranolol
	Vasoconstrictors	ephedrine, phenylephrine
Interference with thermoregulation	Antipsychotics or neuroleptics	risperidone, clozapine, olanzapine
	Serotonergic agonists	sumatriptan, zolmitriptan
	Stimulants	amphetamine, cocaine, levothyroxine
Decreased thirst	Butyrophenone	haloperidol, droperidol
	Angiotensin-converting enzyme inhibitors	enalapril, perindopril, ramipril
Dehydration or electrolyte imbalance	Diuretics	furosemide, hydrochlorothiazide, acetazolamide, aldosterone
	Drugs causing diarrhoea or vomiting	colchicines, antibiotics, codeine
	Alcohol	–
Reduced renal function	Non-steroidal anti-inflammatory drugs	ibuprofen, naproxen
	Sulphonamides	sulfamethoxazole
Aggravation of heat illness by worsening hypotension in at-risk patients	All antihypertensives, particularly vasodilators such as nitrates and calcium channel blockers	Nitrates: glyceryl trinitrate, isosorbide mononitrate Calcium channel blockers: amlodipine, felodipine, nifedipine
Levels of drug affected by dehydration (possible toxicity for drugs with a narrow therapeutic index)	Various	digoxin, immunosuppressants, lithium, metformin, warfarin
Altered state of alertness	Drugs altering state of alertness	alcohol, benzodiazepines

Conclusion

GPs play a crucial role in managing heat-related health risks, especially for vulnerable populations. By integrating heat action plans into chronic disease management, reviewing medications and offering practical cooling strategies, GPs can significantly mitigate the health impacts of extreme heat. Additionally, health practitioners should advocate for systemic changes to address the root causes of heat-related vulnerability.

This comprehensive approach will protect and support patients and communities from the growing health effects of global heating.

Key points

- Heat-related illnesses are rising as global temperatures increase.
- GPs have a vital role in advocating for health measures to counteract the effects of climate change.

- This article offers practical strategies for identifying, supporting and managing patients at risk from heat, including educating patients and caregivers on evidence-based cooling techniques.

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