

Climate Risk :

Implications for South Eastern Sydney Local Health District



Acknowledgments

Acknowledgement of Country

South Eastern Sydney Local Health District would like to acknowledge the Traditional Custodians on whose land we stand, and the lands our facilities are located on: the lands of the Dharawal, Gadigal, Wangal, Gweagal and Bidjigal peoples. We would like to pay our respects to Elders past, present, and emerging.

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Community members of South Coogee
Rodrigo Escobar, Day Centre Manager, War Memorial Hospital
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Foreword



The United Nations Sustainable Development Goals (SDGs) set out a path to achieving a fairer, healthier and more sustainable future for all. The Australian Government, along with all UN Member States have adopted the SDGs as part of the 2030 Agenda for Sustainable Development. The next decade will be critical for protecting human health and developing health systems' resilience in the face of the climate emergency.

SESLHD's core business is human health and our values and objectives are consistent with the SDGs. We are therefore committed to using the SDGs as a framework for our District. We recognise that the health of our patients and communities is fundamentally dependent on a safe climate and functioning ecosystems for clean air, food and water security and protection from extreme weather. The climate crisis threatens these life-support systems and we are now seeing the impacts: prolonged drought, heatwaves, extreme weather and last summer the unprecedented bushfire crisis which exposed nearly half of the Australian population to hazardous levels of air pollution for weeks and months. The photograph on the front cover of this report shows the city of Sydney, covered by the smoke haze.

The SDGs set out a response to the interconnected health, environmental and social risks and the particular challenge for health systems to build resilience to the climate challenge. However, we also recognise that the required solutions represent a raft of opportunities to improve health: cleaner air, healthier diets, safer and cooler neighbourhoods, more connected communities, and so on.

Whilst there are a range of climate-health threats, this report focuses on the most urgent risks for the people in our District: extreme heat, air pollution and at-risk communities. The report's author consulted widely with staff, consumers and community members, and received widespread support for this work. Along with my fellow SESLHD Executive, I am personally very committed to the sustainable future of our community. We therefore welcome this report as an initial step towards identifying the climate risks for our District and using the SDGs to shape our responses based on protecting health, fairness and resilience.

Mr Tobi Wilson
Chief Executive

Executive Summary

The Lancet Commission on Health and Climate Change found that the health impacts of climate change risk undoing the last 50 years in public health gains. Climate-health impacts are wide-ranging and increasing, and include extreme weather (heatwaves, droughts, bushfires, storms and floods), air pollution, food and water insecurity, under-nutrition, changing distributions of vector borne disease and mental ill health, as well as the health impacts of socio-economic disruption, displacement and security risks. Since the most vulnerable in our community will be most and earliest affected, it is also an issue of health equity and social justice.

There are, then, a number of interconnected challenges: health, environmental, equity and social. The United Nations Sustainable Development Goals (SDGs) recognises this and going forward will guide the District's responses to these risks. There are particular challenges for health organisations which have duty of care to protect and promote health. In the future all activities and services will need to address these challenges to ensure a health service that is fit-for-purpose in a low-carbon and climate-impacted future. This report, *'Climate Risk: Implications for South Eastern Sydney Local Health District'* examines the main physical climate risks for SESLHD: air pollution and extreme heat. It considers the impacts for our patients and communities, and how our priority populations and others at greater risk will be affected.

Extreme heat and air pollution are two major issues. The 2019-2020 NSW bushfires resulted in a significant increase in presentations to SESLHD emergency departments for respiratory issues: up to 25% higher than usual for two weeks in December. More than 2000 children in SESLHD have asthma attributable to air pollution from vehicle emissions. Heatwaves have killed more Australians than any other extreme weather event and in Sydney have been associated with significant increases in emergency presentations, ambulance callouts, and deaths.

The SESLHD population groups most at risk from extreme heat and air pollution include children, the elderly, pregnant women, people experiencing homelessness, people living with disability, people who are socially isolated, Aboriginal and Torres Strait Islanders, and people from culturally and linguistically diverse backgrounds. Many of SESLHD's priority populations have multiple reasons for being at higher risk. Effective responses need to recognise that the climate crisis is an issue of health inequity.

For SESLHD, climate risks threaten to delay progress in reaching our strategic priorities. Going forward, we will need a range of responses to climate risk including: reducing our own environmental impact, building capacity to respond to the additional health burdens, developing climate risk management frameworks and educating our staff and communities about managing these risks. The recommendations in this report serve as a starting point for our response to the health risks of a changing climate.

Introduction

Climate change: a health emergency

For decades, climate experts have warned us that human-driven greenhouse gas emissions are causing unprecedented warming of the planet, and that the climate is on a trajectory to irreversible change. The climate crisis is widely regarded as the biggest threat to global health in the 21st century¹.

Climate change threatens to undermine the last 50 years of progress in public health²

Despite these warnings, an appropriate, evidence-based response has not been taken, and we are now faced with a climate crisis and a health emergency. More than 1216 jurisdictions in 26 countries have declared a climate emergency, including 75 Australian jurisdictions representing roughly one quarter of our population³. Increasingly, professional health bodies are declaring a health emergency due to the climate crisis. The Royal Australian College of Physicians, Australian Medical Association, and Australasian College for Emergency Medicine have all released position statements calling for urgent action to ensure the sustainability of our health systems^{4,5,6}.

South Eastern Sydney Local Health District (SESLHD) has made a strong commitment to addressing its climate risk. Our Environmental Sustainability Plan 2019 – 2021 provides a framework for identifying and addressing unsustainable practices and adapting our health services to the changing climate. This aligns with the NSW Government Climate Change Policy Framework, which commits NSW to achieving net zero carbon emissions by 2050 and adapting to the impacts of the climate crisis⁷.

How the climate crisis affects health

The climate crisis poses a range of threats to human health through multiple, interacting pathways⁸ (Figure 1). After only 0.9°C warming of the planet, many of these threats are already a reality for individuals and communities across the globe. Continued warming of the planet will see these impacts becoming more severe and affecting greater numbers of people.

¹ World Health Organization (2015). Climate change and human health. Retrieved 7 Dec 2019 from www.who.int/globalchange/en/

² Watts N, Amann M, Ayeb-Karlsson S et al (2018). The 2018 report of the *Lancet* Countdown on health and climate change: shaping the health of nations for centuries to come. *Lancet* 392(10163): 2479 – 2514.

³ Climate Emergency Declaration. Retrieved 8 Dec 2019 from <https://climateemergencydeclaration.org/climate-emergency-declarations-cover-15-million-citizens/>

⁴ Australasian College for Emergency Medicine. Position statement: climate change and health 2019. Retrieved 8 Dec 2019 from: https://acem.org.au/getmedia/d37965ca-42ee-4a65-a979-ae1a13bcbf31/S68-Position-Statement-on-Climate-Change_R2

⁵ Royal Australasian College of Physicians. 2016. Climate change and health position statement. Retrieved 4 Dec 2019 from: https://www.racp.edu.au/docs/default-source/advocacy-library/climate-change-and-health-position-statement.pdf?sfvrsn=5235361a_5

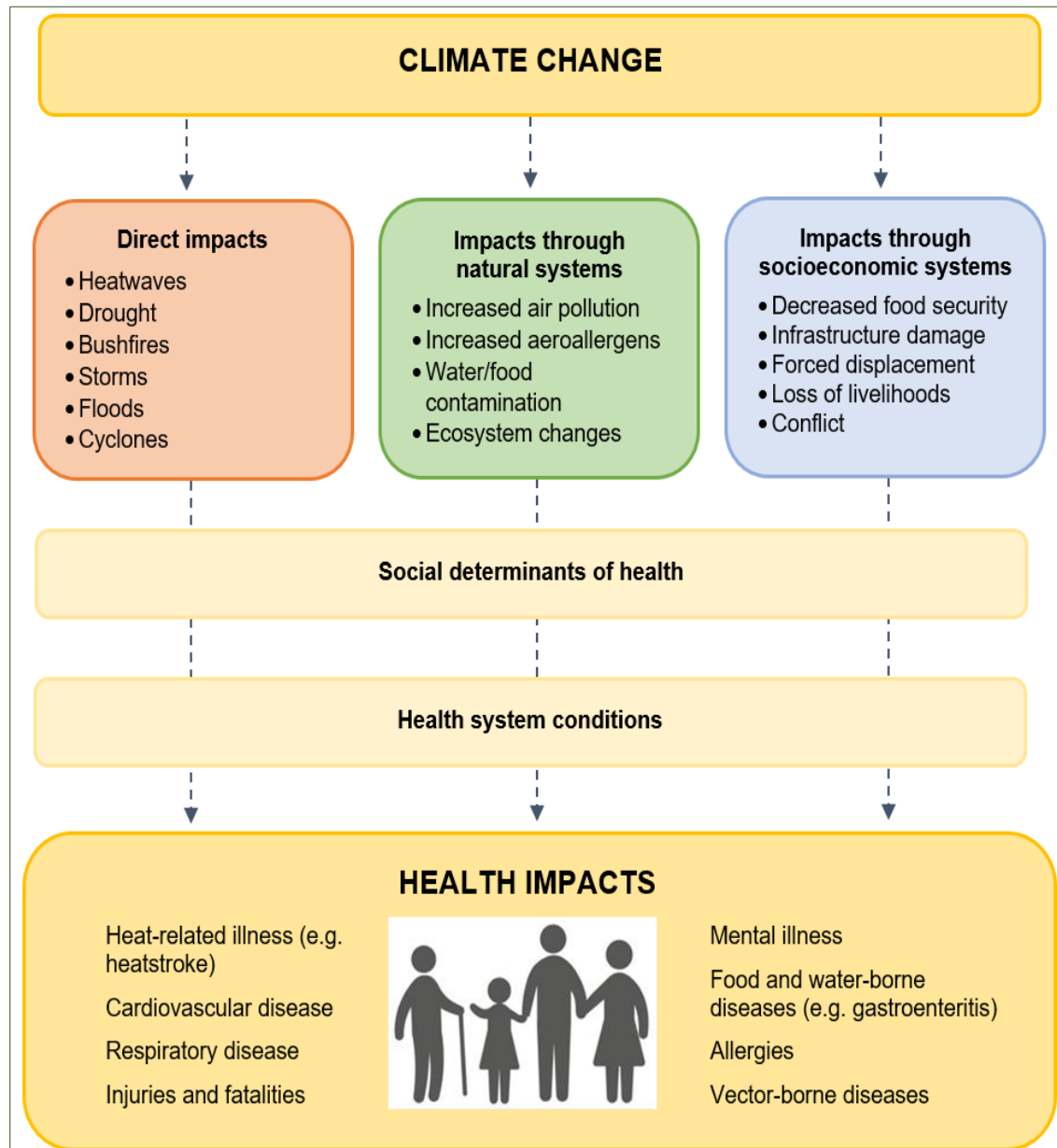
⁶ Australian Medical Association. Sep 2019. Climate change is a health emergency. Retrieved 2 Dec 2019 from: <https://ama.com.au/media/climate-change-health-emergency>

⁷ State of NSW and Office of Environment and Heritage. 2016. NSW Climate change policy framework. Available at: www.environment.nsw.gov.au/-/media/OEH/Corporate-Site/Documents/Climate-change/nsw-climate-change-policy-framework-160618.pdf

⁸ Smith K, Woodward A, Campbell-Lendrum D, et al (2014). Human health: impacts, adaptation, and co-benefits. In: Climate change 2014: Impacts, Adaptation, and Vulnerability. Part A: Global and Sectoral Aspects. Contribution of Working Group II to the Fifth Assessment Report of the IPCC [Field C et al (eds.)]. Cambridge University Press, UK and NY, pp. 709-754.

The climate crisis can lead to a broad range of health impacts. These can be direct, or indirectly mediated through effects on ecosystems and socioeconomic structures⁹, as shown in Figure 1.

Figure 1: Health impacts of the climate crisis



Adapted from the Intergovernmental Panel on Climate Change⁸ and Watts et al⁹

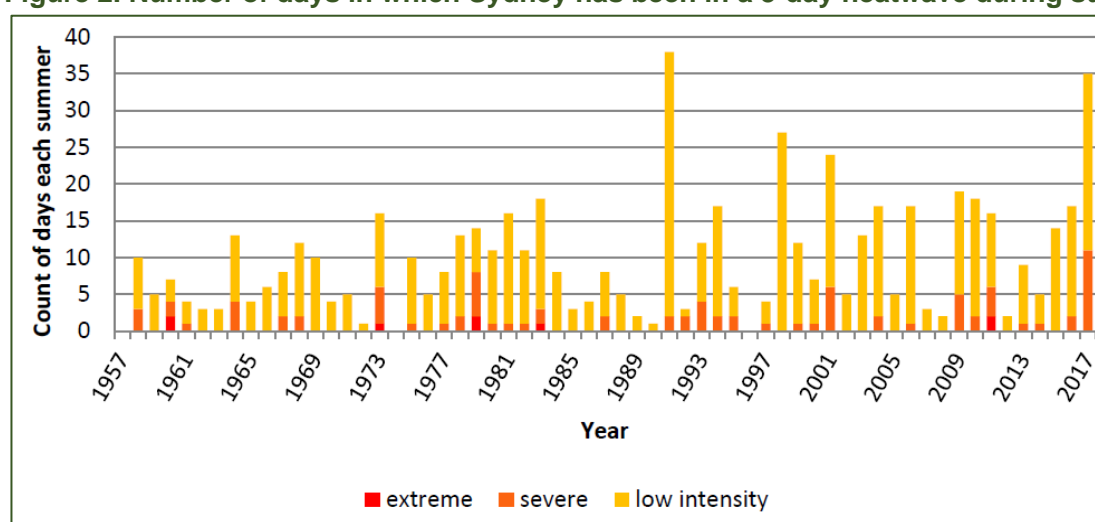
⁹ Watts N, Adger W, Agnolucci P et al 2015. Health and climate change: policy responses to protect public health. Lancet 386:1861-1914

What does a changing climate look like for SESLHD?

Climate observations

Australia's climate has warmed by just over 1°C since the earliest available climate records from 1910¹⁰. This has resulted in more frequent extreme weather events including heatwaves, droughts, floods and bushfires³. In the Greater Sydney region, heatwaves have become longer and more severe (Figure 2). The Intergovernmental Panel on Climate Change (IPCC) has warned that heating above 1.5°C will have devastating consequences for human health, livelihoods, food security, water supply, security, and economic growth¹¹. As the climate continues to heat, we are approaching a tipping point beyond which further change is inevitable and may be irreversible.

Figure 2. Number of days in which Sydney has been in a 3-day heatwave during summer



Bureau of Meteorology¹²

Climate projections

Robust climate modelling data for Australia as well as for the Greater Sydney region are available^{13,14}. While different models produce slightly different projections, the overall findings are largely consistent (summarised in Figure 3). It is widely accepted that in the near future, Sydney will experience a hotter climate in all seasons and an increase in the frequency, intensity and duration of heatwaves. Rainfall variability will increase, while bushfire and drought conditions will intensify in the regions surrounding Sydney. Sea levels will continue to rise and there may be further coastal inundation. It is also likely that Sydney will experience worsening air pollution.

¹⁰ Bureau of Meteorology & CSIRO. State of the Climate 2018. Retrieved 9 Nov 2019 from <http://www.bom.gov.au/state-of-the-climate/>

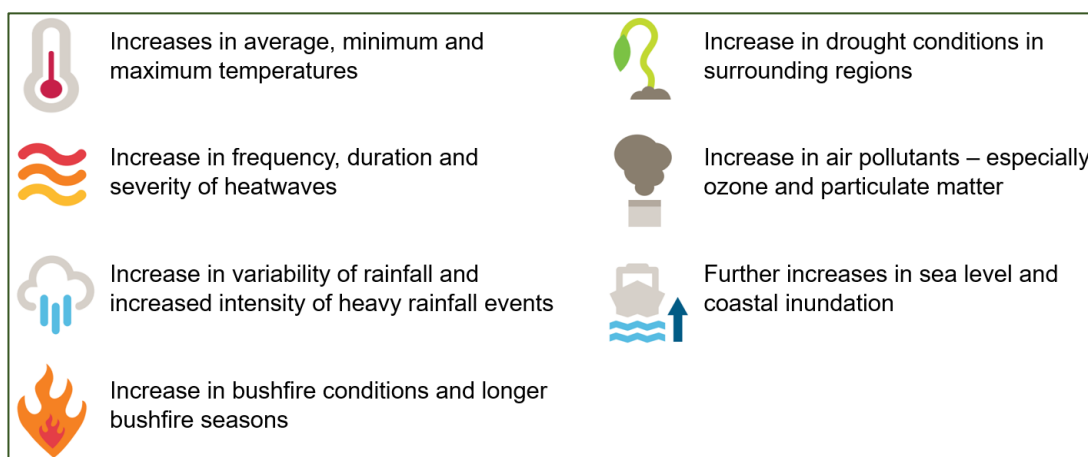
¹¹ Masson-Delmotte P, Zhai H, Pörtne H, et al (eds) (2018). IPCC, 2018: Global Warming of 1.5°C. An IPCC Special Report on the impacts of global warming of 1.5°C above pre-industrial levels and related global greenhouse gas emission pathways, in the context of strengthening the global response to the threat of climate change, sustainable development, and efforts to eradicate poverty.

¹² Bureau of Meteorology. Special Climate Statement 61 – exceptional heat in southeast Australia in early 2017. 2017. Available at: <http://www.bom.gov.au/climate/current/statements/scs61.pdf> [verified 11 November 2019]

¹³ Dowdy A, Abbs D, Bhend J, et al. (2015). East Coast Cluster Report, Climate change in Australia; projections for Australia's NRM regions. In: Ekström M, Whetton P, Gerbing C, Grose M, Webb L, Risbey J, editors. Australia: CSIRO and Bureau of Meteorology; 2015

¹⁴ Argüeso D, Di Luca A, Evans J, Parry M, Gross M, Alexander L, et al. (2015). Heatwaves affecting NSW and the ACT: recent trends, future projections and associated impacts on human health. NARCLiM Technical Note 5. Sydney, Australia: Report to the NSW Office of Environment and Heritage, 2015

Figure 3. Climate projections for the Greater Sydney region

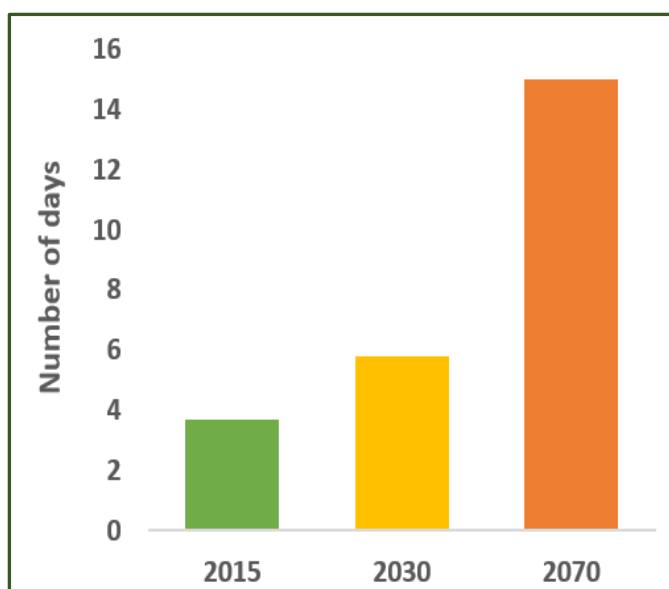


Sources: Dowdy¹³, Argüeso¹⁴

SESLHD covers 468 square kilometres that includes Sydney's central business district as well as the Royal National Park, and encompasses a geographically diverse region with densely urban, coastal, and dry bushland environments. SESLHD is therefore susceptible to all of these climate projections.

Heat is a particular concern for the Sydney region: the number of days above 35°C in Sydney are projected to increase more than four-fold over the next 50 years, from an average of 3.7 days a year in 2015 to 15 days by 2070¹⁵ (Figure 4).

Figure 4. Projected number of days of extreme heat in Sydney, 2015 – 2070



Source: City of Sydney 2015¹⁵

¹⁵ RPS 2015. City of Sydney Climate risk and adaptation: Project Report. Retrieved 4 Sep 2019 from https://www.cityofsydney.nsw.gov.au/_data/assets/pdf_file/0020/250625/2015-342655-ATTACHMENT-D-Project-Report-by-RPS-and-KPMG2.pdf

How we're preparing

Why SESLHD needs to adapt

SESLHD's Environmental Sustainability Plan 2019 – 2021 demonstrates the District's commitment to providing high quality healthcare that does not harm our environment.

Mitigation as well as **adaptation** strategies will be needed to achieve this. Mitigation aims to avoid catastrophic climate change by reducing greenhouse gas (GHG) emissions. Examples include clean energy, energy efficiency, and sustainable transportation. Although mitigation is an important component of addressing our climate risk, it is well recognised that our GHG emissions to date have already locked in climate changes for decades to come. This means that adaptation is also required.

To maintain a sustainable health care system that supports healthy lives and delivers exceptional care, SESLHD will need to adapt to current and future climate-related health impacts

Adaptation strategies prepare health services for expected climate impacts by anticipating changes to health service demand, and increasing resilience among health staff and the community¹⁶. This report has been developed to improve our understanding of key impacts for SESLHD so that we can manage our climate risk and take actions to adapt.

How this report was developed

This report was undertaken to identify climate-related health impacts with the greatest priority and urgency for SESLHD, and the populations within SESLHD that are most likely to be affected. Close consultation with SESLHD staff and consumers informed all three of the following stages of this assessment:

- ❖ Climate observations and current conditions for the Sydney region were sourced from the Bureau of Meteorology and the Commonwealth Scientific and Industrial Research Organisation (CSIRO). Climate projections were identified through climate models for Australia, as well as climate models for the Sydney region produced by the NSW and ACT Regional Climate Modelling Project. These projections were then considered in the context of SESLHD's natural and built environment.
- ❖ Peer-reviewed literature and reports were examined to evaluate the wide range of possible climate-related health impacts, and to understand which groups are at greater risk. Given the large number of potential health impacts, priority impacts for inclusion in this report were chosen based on a consideration of previous local impacts and SESLHD's vulnerable populations. These were **extreme heat** and **air pollution**.
- ❖ Consultation with stakeholders was undertaken to identify how staff and consumers are already being impacted, and likely future impacts. SESLHD-specific health data was analysed to determine possible health and financial impacts for the District.

¹⁶ IPCC, 2014: Climate Change 2014: Synthesis Report. Contribution of Working Groups I, II and III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change [Core Writing Team, R.K. Pachauri and L.A. Meyer (eds.)]. IPCC, Geneva, Switzerland

Populations at greater risk

Why are some people more likely to be affected?

Climate-related risks and harms will not be evenly distributed across society; certain populations will experience a disproportionate burden of the impacts.

People may be more likely to experience climate-related health impacts due to:

- ❖ Greater **exposure** to climate hazards due to geographical location, employment type, or housing¹⁷
- ❖ Increased **sensitivity** to the effects of climate due to factors such as age (especially older people and babies), pregnancy, pre-existing burden of disease, and different levels of access to health information and services¹⁸
- ❖ Lower **adaptive capacity** to withstand the climate impacts due to socioeconomic status, support systems, quality of health infrastructure, and social protection policies.¹⁹

The climate crisis is an issue of health inequity



Many of SESLHD's Priority Populations are at greater risk of being affected by the climate crisis (Figure 5).

¹⁷ Button J (Ed). (2019). Global Health Alliance Australia. Health and climate change in Australia and the Asia Pacific region: From Townsville to Tuvalu

¹⁸ Barnett A, Williams G, Schwartz J, Neller A, Best T et al. (2005). Air pollution and child respiratory health: A case-crossover study in Australia and New Zealand. *Am J Respir Crit Care Med* Vol 171:1272–1278.

¹⁹ Hanson S, Richardson J, Every D, Krackowizer A, Tehan B. (2016). Climate change, housing and homelessness: Report on the homelessness and climate change forum. Red Cross Victoria.

Figure 5. SESLHD populations at greater risk of harm from the climate crisis

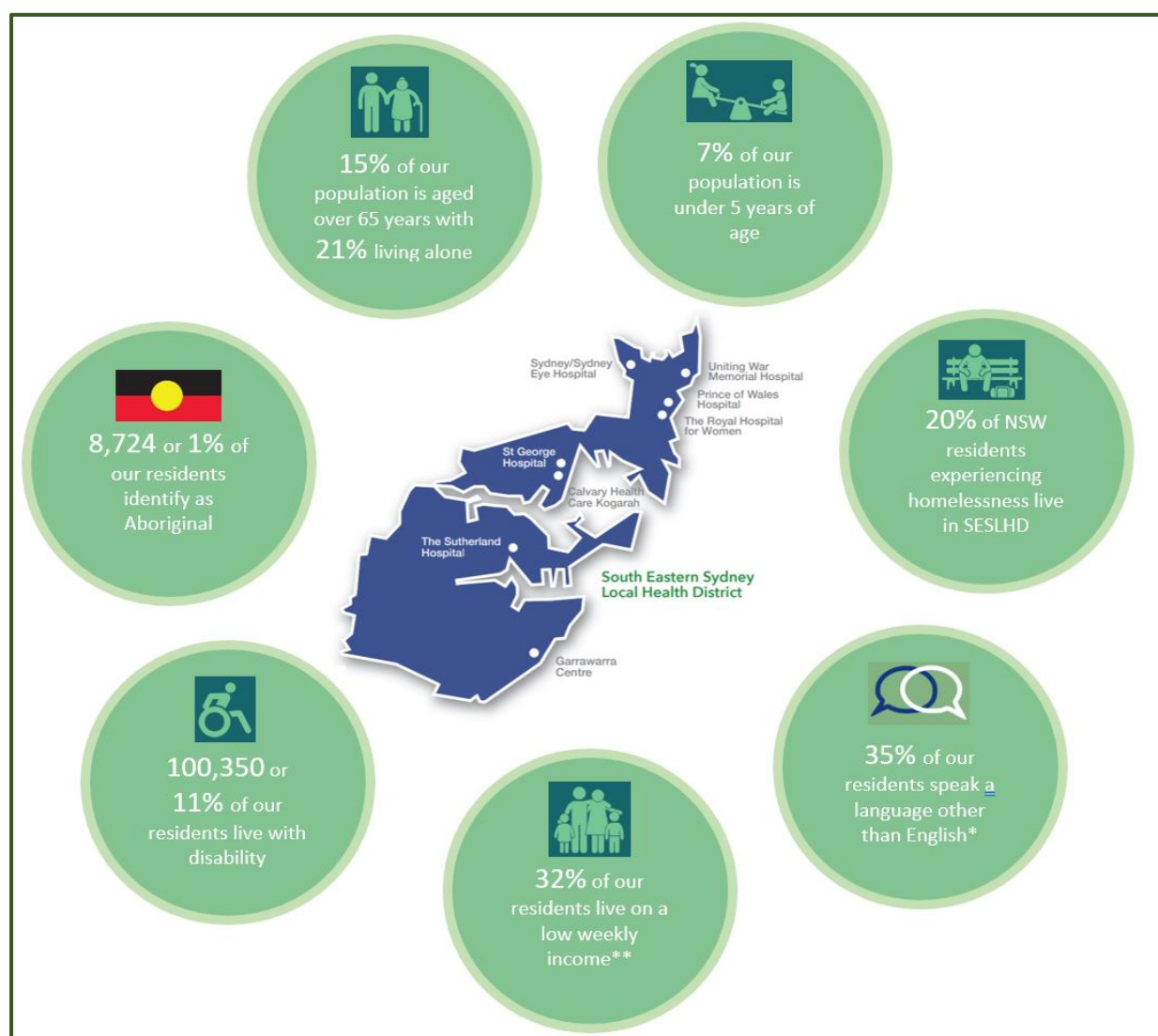


Figure adapted from SESLHD Vulnerable Populations Profile 2018

*Top 3 languages spoken are Mandarin, Cantonese, Greek

**Low weekly income is an individual weekly income below \$499

Population	Risk factors for climate-related health impacts
 Older people	<ul style="list-style-type: none"> ❖ Higher prevalence of chronic disease ❖ Longer period of exposure to climate-related toxins e.g. air pollutants ❖ Impaired ability to regulate body temperature due to physiological reasons (e.g. reduced thirst sensation) and/or use of certain medications²⁰ ❖ Decreased mobility/independence and/or social isolation ❖ Financial constraints may impact on protective factors e.g. help-seeking, use of fans
 The very young	<ul style="list-style-type: none"> ❖ More susceptible to heat-related illness due to greater body surface to volume ratio ❖ More susceptible to effects of air pollution due to higher breathing rate ❖ Exposure to air pollutants at critical stages of development may impact on respiratory and neuroendocrine systems¹⁸ ❖ Infants unable to express needs (e.g. related to thirst, overheating)
 People experiencing homelessness	<ul style="list-style-type: none"> ❖ Increased exposure to extreme weather – especially for people sleeping rough ❖ Extreme weather events may affect ability to meet basic needs e.g. food, shelter ❖ Decreased access to health services – e.g. due to financial barriers and/or stigma ❖ Care coordination services may be disrupted during extreme weather events ❖ Higher prevalence and severity of chronic disease including cardiovascular and respiratory disease, mental health illness, substance use, and cognitive impairment²¹
 Aboriginal people	<ul style="list-style-type: none"> ❖ High burden of pre-existing and chronic disease: for example, dementia prevalence up to 3 times higher among older Aboriginals compared with the age-matched total Australian population²² ❖ Reduced access to health services ❖ Lack of Aboriginal representation in climate change adaptation policy and initiatives ❖ Dislocation due to the climate crisis may result in loss of cultural attachment to place
 People living with a disability	<ul style="list-style-type: none"> ❖ Reduced access to health services ❖ May require assistance for activities of daily living, including for accessing healthcare ❖ During extreme weather events, infrastructure that enables access to health services may be disrupted e.g. wheelchair-accessible transportation, staff trained in disability needs¹⁷
 Culturally and linguistically diverse people	<ul style="list-style-type: none"> ❖ More likely to face greater socioeconomic disadvantage, and to work in hazardous jobs with increased exposure to climate extremes²³ ❖ Lack of acclimatisation to local climate for recently-arrived communities²⁴ ❖ Low risk perception of extreme weather events due to linguistic and social isolation ❖ Decreased access to health services, especially for newly arrived communities and people on temporary visas
 People living on low incomes	<ul style="list-style-type: none"> ❖ People living in community housing, boarding accommodation, and other temporary lodgings may lack the money or capacity to control the temperature of their dwelling¹⁹ ❖ Housing infrastructure is frequently sub-standard in these types of accommodation, with poor insulation and ventilation⁸

²⁰ Haq G, Whitelegg J, & Kohler M. (2008). Growing old in a changing climate: Meeting the challenges of an ageing population and climate change. Stockholm Environment Institute.

²¹ Ramin B, Svoboda T. (2009). Health of the homeless and climate change. J Urban Health 86(4): 654-64.

²² Radford K, Mack H, Draper B, Chalkley S, Daylight G, et al. 2015. Prevalence of dementia in urban and regional Aboriginal Australians. Alzheimer's & Dementia 11 (271-79).

²³ Betancourt J, Green A, Carrillo J & Ananeh-Firempompong O. (2003). Defining cultural competence: a practical framework for addressing racial/ethnic disparities in health and health care. Public Health Rep 118(4): 293-302.

²⁴ Hansen A, Bi P, Saniotis A, Nitschke M, Benson J et al. (2013). Extreme heat and climate change: Adaptation in culturally and linguistically diverse (CALD) communities. National Climate Change Adaptation Research Facility, Gold Coast, pp. 101

Heat & Health

How does heat affect health?

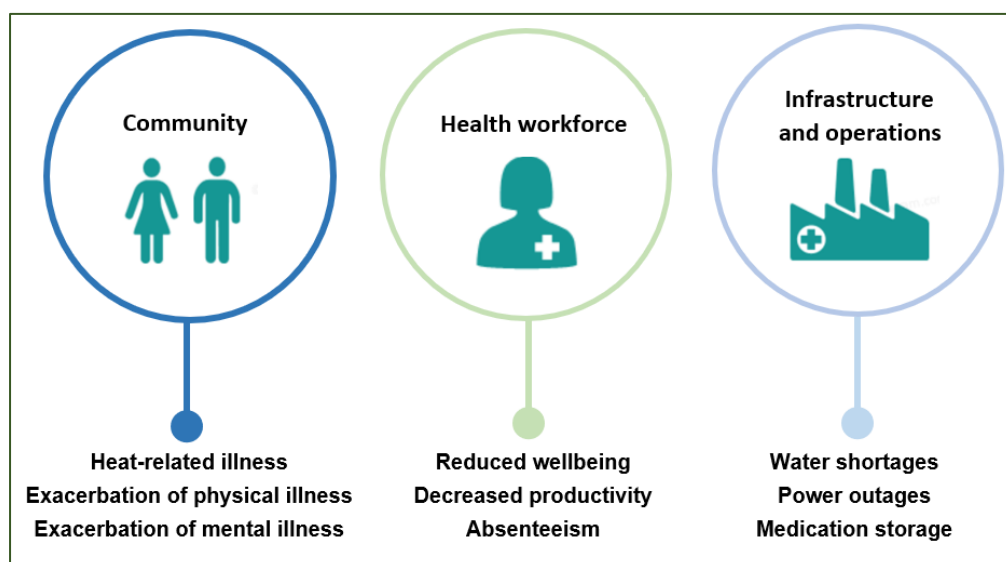
When ambient temperatures increase, humans can regulate their body temperature through behavioural responses (e.g. moving to a cooler area) and physiological mechanisms (e.g. sweating). When these mechanisms are unable to compensate for temperature increases, heat-related illnesses can occur.

Direct heat-related illnesses include heat cramps, heat exhaustion, and heat stroke. Although these are important and potentially serious conditions, exacerbation of pre-existing disease generally causes more severe illness during extreme heat events²⁵. This includes conditions where heat contributes but may not be the primary diagnosis, for example:

- ❖ Exacerbation of cardiovascular, respiratory, and renal disease
- ❖ Exacerbation of mental health conditions
- ❖ Dehydration resulting in confusion, muscle weakness, and falls.

Severe heat can also impact health indirectly. For example, food and water quality can be affected, resulting in gastrointestinal illness. Disease vectors can change, leading to increased transmission of Dengue and Ross River viruses²⁶. Prolonged heat events can disrupt vital health infrastructure such as power and water, and pose serious health risks to the workforce, particularly those working outdoors or with inadequate ventilation²⁷. Workforce productivity can also be affected: work absenteeism and under-performance as a result of heat has been estimated to cost the Australian economy \$8.7 billion each year²⁸.

Figure 6. Health impacts of extreme heat



²⁵ Victorian Chief Health Officer (2009). Heatwave in Victoria: An assessment of health impacts. Melbourne, Australia. State Government of Victoria, Department of Human Services.

²⁶ NSW Health Environmental Health Branch. How climate change can affect your health. Retrieved 4 Oct 2019 from: <https://www.health.nsw.gov.au/environment/climate/Pages/how-climate-can-affect-health.aspx>

²⁷ The Silent Killer: Climate Change and the Health Impacts of Extreme Heat by Lesley Hughes, Elizabeth Hanna and Jacqui Fenwick (Climate Council of Australia).

²⁸ Button J (Ed). (2019). Global Health Alliance Australia. Health and climate change in Australia and the Asia Pacific region: From Townsville to Tuvalu

How hot is too hot?

'Extreme heat' describes very hot days as well as prolonged periods of very high temperatures (also called 'heatwaves'.) The risk for heat-related health impacts increases when temperatures rise quickly, remain elevated for longer, and when night temperatures remain high²⁹. Heat thresholds above which mortality and morbidity increase significantly have been reported for some areas of Australia. Sydney's average daily mortality rate has been shown to increase by 7.3% when maximum temperatures exceed 32°C.³⁰

What is a heatwave?

In Australia, a heatwave is defined as three or more days where temperatures and excess heat are unusually high for the local climate. This means milder cities may experience heatwaves at lower temperatures compared to cities with warmer climates. In New South Wales, the State Heatwave Plan is activated when temperatures are in the top 10% of maximum temperatures for the same time period within the year.



Some people are more likely to be affected by heat because of additional risk factors for heat stress, including individual, social and environmental factors. Vulnerability to heat stress has been calculated for 15 Local Government Areas (LGAs) within coastal Sydney, based on population demographics and environmental factors. The three coastal LGAs with the highest heat stress vulnerability score are all within SESLHD – Randwick, Botany Bay, and Rockdale³¹. This reflects that many of SESLHD's residents have multiple risk factors for being affected by heat.

Factors increasing vulnerability to extreme heat

Physiological

- Age 0-4, 65+
- Pre-existing illness
- Medications, polypharmacy
- Delayed acclimatisation

Socioeconomic

- Social isolation
- Financial concerns (e.g. utility costs)
- Outdoor/manual occupations
- Residing in poorly insulated housing

Other

- Reliant on external assistance
- Heat not perceived as a risk
- Reduced access to health services
- Residing in Urban Heat Island areas

Dense urban areas can be up to 10°C hotter than surrounding pre-urban or rural regions, due to the Urban Heat Island effect³²

The Urban Heat Island effect occurs because of heat-absorbing materials used to construct buildings and roads. It is a particular concern for people sleeping rough in the Sydney Central Business District, and will likely affect increasing numbers of people with continued population growth and urbanisation within the south-eastern Sydney area.

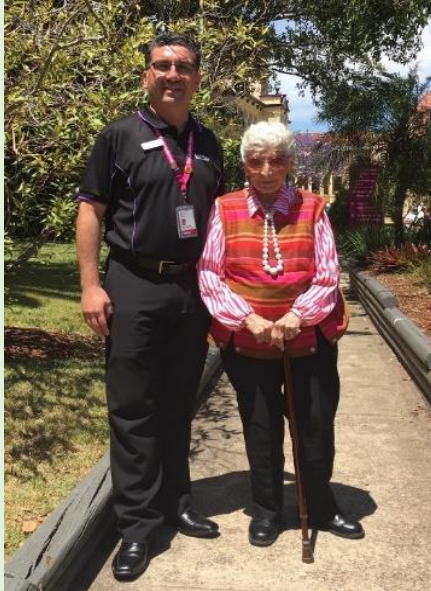
²⁹ Steffen W, Hughes L, Perkins S. (2014). Heatwaves: Hotter, Longer, More Often. Climate Council of Australia.

³⁰ Hu W, Mengersen K, McMichael A, Tong, S. (2008). Temperature, air pollution and total mortality during summers in Sydney, 1994–2004. Int J Biometeorology, 52(7): 689-696.

³¹ El-Zein A, Tonmoy F. (2015). Assessment of vulnerability to climate change using a multi-criteria outranking approach with application to heat stress in Sydney. Ecological Indicators 48: 2017-17.

³² Sharifi, E, Lehmann, S. (2014). Comparative Analysis of Surface Urban Heat Island Effect in Central Sydney. J Sust Dev, 7(3): 23-35.

Snapshot: How heat affects SESLHD's priority populations



Katie is 96 years old and lives independently in a social housing unit. Katie's unit gets very hot and she uses a fan to keep cool, but this isn't always effective. *"Sometimes I sit on the floor of the lobby because it's cool there"*. Katie has a number of chronic health conditions and on hot days she sometimes gets palpitations. Even when she feels unwell in the heat, Katie isn't always certain when to call for help. ***"I can't rely on my neighbours...I could call the ambulance but I feel silly"***.

Rodrigo Escobar is the manager of the Day Centre at the War Memorial Hospital. The Day Centre operates seven days a week and provides elderly community members with a supervised, airconditioned space. During hot weather, Rodrigo and his team have concerns for clients who remain at home alone. *"It's more dangerous for people at home by themselves, especially if they don't have air conditioning."* Rodrigo notes that many of their clients don't understand the health risks from heat. ***"They're a very tough generation, they have been through a lot, but of course they are"***

Diane Gellatly is a Nurse Practitioner for the Geriatric Flying Squad, a sub-acute rapid response team located at the War Memorial Hospital. Diane's team responds to clinicians' concerns in hot weather with welfare checks and Diane has observed that many elderly people are not taking appropriate actions. ***"I went on one home visit to see a lady who had agoraphobia...the temperature gauge inside read 32 degrees...she had two jumpers on and no windows opened"***. Diane reports that many older people are unable to manage during heatwaves. *"Hot weather impacts their functioning at home. They won't go up to the shops and they won't be able to buy their food."*



Kaye lives with a number of chronic health conditions, including arthritis and chronic pain. She lives on the top floor of a social housing unit which becomes very hot in summer. Kaye explains ***"I don't use the aircon because I can't afford the electricity bill."*** Her chronic pain becomes more severe on hot days and she finds it difficult to get out of the unit.

Other community members living in social housing in South Coogee report similar experiences. Many cannot afford to run fans, and some do not have a fridge, making it difficult to keep food and medications cool. A number of people in this community have suffered from falls on hot days resulting in hospitalisation. Community members identified that 'how to keep cool' messaging would be valuable, as well as an accessible airconditioned space.

The health burden from heat

There is strong and consistent evidence that mortality increases in hot weather in Australia^{33,30}. A recent study estimated that 2% of all deaths in Sydney between 2006 and 2017 were associated with heat³⁴. Compared with all other extreme weather events, heatwaves stand out as the major contributor to mortality in Australia.

Heatwaves have killed more Australians than any other extreme weather event³⁵

Heatwaves in Australia have resulted in significant increases in ambulance call-outs, emergency department presentations, and hospitalisations (Table 1). During the 2011 Sydney heatwave there was a 13% increase in all-cause mortality and an 8% increase in emergency department presentations for people aged 75 years and over³⁶. The 2009 Victorian heatwave, which was longer and more severe than the Sydney heatwave, saw a 62% increase in mortality²⁵.

Table 1. Health outcomes and service demand during heatwaves in Australia

Heatwave	Ambulance callouts	Emergency department presentations (all-cause)	Excess mortality* (all-cause)
Sydney February 2011	14% increase (all ages) 17% increase among people aged >75 years	2% increase (all ages) 8% increase among people aged >75 years	13% increase
Melbourne January 2009	46% increase	12% increase (all ages) 37% increase for people aged >75 years	62% increase
Adelaide January 2009	16% increase	13% increase	37% increase

Sources: Schaffer et al³⁶, Victoria Health²⁵, Nitschke et al³⁷

*'Excess mortality' refers to deaths that were additional to expected deaths without an extreme heat event

During extreme heat events in Australia, emergency presentations and hospitalisations have increased above expected numbers for renal disease, ischaemic heart disease, and mental illness^{38,39,40}. Extreme heat has also led to behavioural impacts: for example, during heatwave periods in Adelaide, there was a 13% increase in assault-related injuries³⁷.

³³ Reisinger A, Kitching R, Chiew F et al. (2014). Australasia. In: 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 [Barros V et al (eds.)]. Cambridge University Press, United Kingdom and New York, NY, USA, pp. 1371-1438.

³⁴ Longden T (2019). The impact of temperature on mortality across different climate zones. Climatic change 1-2.

³⁵ Coates L, Haynes K, O'Brien J, McAneney J, de Oliveira FD. Exploring 167 years of vulnerability: an examination of extreme heat events in Australia 1844–2010. *Environ Sci Policy* 2014; 42: 33–44

³⁶ Schaffer A, Muscatello D, Broome R, Corbett S, Smith W. 2013. Emergency department visits, ambulance calls, and mortality associated with an exceptional heat wave in Sydney, Australia, 2011: a time-series analysis. *Env Health* 11(3)

³⁷ Nitschke M, Tucker G, Hansen A, Williams S, Zhang Y, et al. (2011) Impact of two recent extreme heat episodes on morbidity and mortality in Adelaide, South Australia: a case-series analysis. *Environmental Health* 10: 42.

³⁸ Hansen, A, Bi, P, Ryan, P, et al. 2008. The effect of heat waves on hospital admissions for renal disease in a temperate city of Australia. *Int J Epid* 37(6):1359-1365.

³⁹ Nitschke M, Tucker G, Bi P. (2007). Morbidity and mortality during heatwaves in metropolitan Adelaide. *MJA* 187(11): 662-65.

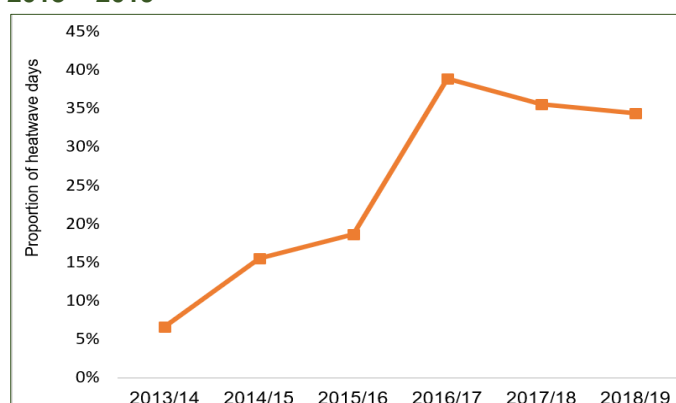
⁴⁰ Khalaj B, Lloyd G, Sheppard V, Dear K. (2010). The health impacts of heat waves in five regions of New South Wales, Australia: a case-only analysis. *Int Arch Occup Environ Health* 83(7): 833-42.

Extreme heat burden for SESLHD

Quantifying the health burden of heat-related illness is challenging, because it can be difficult to identify heat as a contributing factor to certain illnesses. For example, a patient presenting with atrial fibrillation that was triggered by hyperthermia is unlikely to be recorded as having a 'heat-related illness'. Nevertheless, studies have shown that all-cause emergency department presentations increase significantly on hot days⁴¹, and we have used this approach to evaluate the impact of extreme heat for SESLHD's emergency services.

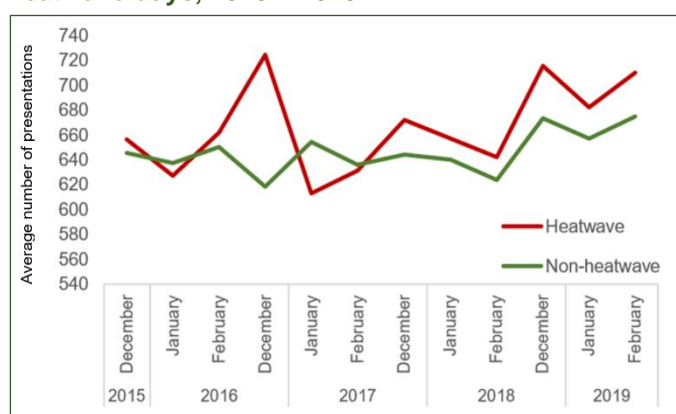
Figure 7 shows that the number of heatwave days in Sydney from 2013 to 2018 increased seven-fold over the past five years, from 5% of days in 2013 to 35% in 2018⁴². A comparison of SESLHD emergency department visits on heatwave versus non-heatwave days over this period shows that there were generally more presentations during heatwaves, with 238 additional presentations on heatwave days compared with non-heatwave days (Figure 8). The average difference was 5%, with the greatest observed difference in December 2016 of 17%. The financial cost to SESLHD of these additional presentations on heatwave days depends on the triage category, but is estimated to be between \$114,876 and \$197,152*.

Figure 7. Proportion of heatwave days in Greater Metropolitan Sydney, December-February, 2013 – 2019



Source: National Heatwave Project, Bureau of Meteorology⁴²

Figure 8. Average number of SESLHD emergency visits (all-cause) on heatwave and non-heatwave days, 2015 – 2019



⁴¹ Bi P, Williams S, Loughnan M, et al. (2011). The effects of extreme heat on human mortality and morbidity in Australia: Implications for public health. *Asia Pac J Public Health*. <https://doi.org/10.1177/1010539510391644>

⁴² National heatwave project. Australian Government, Bureau of Meteorology 2019. Number of heatwave days (n) defined by Excess Heat Factor (EHF), Greater Sydney region, for warmer months (October to April), 2013-2019.

*Lower range estimate based on conservative estimate which assumed all presentations were category 5; upper range estimate based on assumption that all presentations were category 3

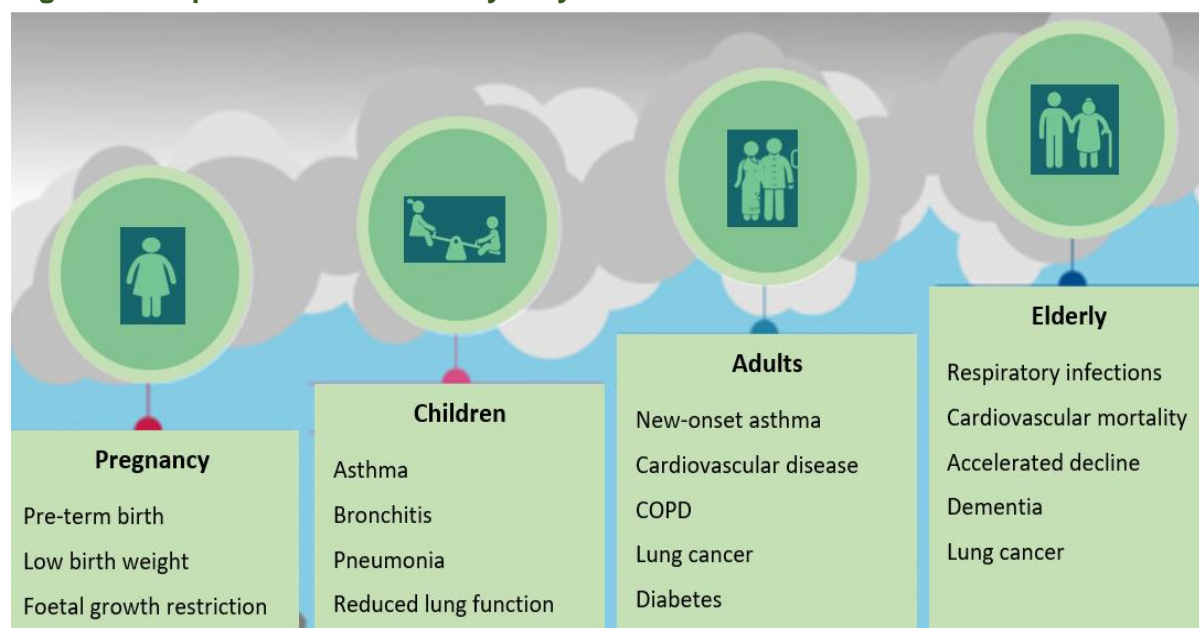
Air pollution & health

How does air pollution affect health?

We all rely on clean air for good health. Air pollutants are inhaled in the air we breathe and can cause irritation and damage to the entire respiratory tract, resulting in allergies and a range of respiratory and cardiovascular diseases such as asthma, bronchitis, and chronic obstructive pulmonary disease. Particulate Matter (PM) of less than 10 microns in diameter (PM₁₀ and PM_{2.5}) can enter the bloodstream and result in systemic inflammation⁴³.

The severity of health impacts from air pollution depend on the type of pollutant, its concentration, and how long the person is exposed for. Damage can occur with both short- and long-term exposure. People with chronic comorbidities, as well as children and older people, are more susceptible to the health impacts⁴⁴. Children inhale and retain larger amounts of air pollution per unit of body weight than adults, and their developing body systems are particularly sensitive to the toxic effects of pollutants⁴⁵. Occupational exposure can also increase people's risk – people who live or work in close proximity to busy roads and coal-fired power stations are more exposed⁴⁶. Air pollution exposure can affect people at all stages of life (Figure 9).

Figure 9. Air pollution affects everybody



Adapted from Public Health England⁴⁷

⁴³ Broome R, Fann N, Cristina T, et al. 2015 The health benefits of reducing air pollution in Sydney, Australia Environ. Res. 143 19–25

⁴⁴ Himes N, Cowie C, Marks G. Review of the health impacts of emission sources, types and levels of particulate matter air pollution in ambient air in NSW. 2015.

⁴⁵ Barnett, A., Williams, G., Schwartz, J., Neller, A., Best, T., Petroeschovsky, A., Simpson R. 2005. Air Pollution and Child Respiratory Health A Case-Crossover Study in Australia and New Zealand. Am J Respir Crit Care Med Vol 171. pp 1272–1278.

⁴⁶ Chakraborty & Green. 2014. Australia's first national level quantitative environmental justice assessment of industrial air pollution, Environmental Research Letters 9(4)

⁴⁷ Public Health England. 2019. Review of interventions to improve outdoor air quality and public health. Accessed 3 Sep 2019 from <https://www.gov.uk/government/publications/improving-outdoor-air-quality-and-health-review-of-interventions>

What determines air quality?

The quality of the air we breathe is affected by a range of air pollutants, which are primarily produced by the burning of fossil fuels. In Sydney, the major sources of ambient (outdoor) air pollution are vehicle emissions, coal-fired power plants, and domestic solid fuel burning (Table 2). Pollutants with the strongest evidence for public health concern include particulate matter (PM), ozone (O₃), nitrogen dioxide (NO₂) and sulphur dioxide (SO₂)⁴⁸.

Table 2. Major air pollutants in Sydney

Air pollutant	Key sources
Ozone (O ₃)	Ozone is a secondary pollutant and is formed when precursors (e.g. from vehicle emissions, power stations, and solvents) react with heat and light
Sulphur Dioxide (SO ₂)	Fossil fuel combustion (e.g. coal-fired power plants, crude oils used by ships)
Nitrous oxide (NO ₂)	Vehicle emissions (especially diesel), coal-fired power stations, industrial processes
Particulate matter (PM _{2.5} and PM ₁₀)	Domestic solid fuel burning, bushfires, diesel exhaust

Source: Australian State of the Environment 2016⁴⁹, Himes et al 2016⁴⁴

The climate crisis affects air pollution by altering temperature, precipitation, and wind. These play a role in how air pollutants are developed, transported, and dispersed⁵⁰. In addition, severe weather events can increase pollutant levels. For example, hotter and drier weather increases the severity of bushfires and dust storms, which lead to increases in PM levels.

Although ambient air pollutant levels in Sydney are generally low by international standards, levels have previously exceeded advisory standards⁵⁰. Furthermore, adverse health outcomes have been shown to occur even when air pollutants are below these standards, demonstrating that there is no safe level of air pollution. Air pollutant levels in Sydney are likely to increase in the future because of continued warming of the climate, longer bushfire seasons, and increases in population density⁵⁰.

The health burden from air pollution

Ambient air pollution is a major contributor to morbidity and mortality. Globally, it is the second leading cause of noncommunicable diseases such as stroke, cancer and heart disease, and in 2016 was responsible for an estimated 4.2 million premature deaths and 103.1 million disability-adjusted life-years⁴⁸. The health burden from ambient air pollution in Australia is already significant, and will worsen if current trends continue. A major study⁵¹ concluded that air pollution in Australia was responsible for 3,056 premature deaths each year, representing 2.3% of total deaths – more than the number of deaths from car accidents. The main causes of death due to air pollution in Australia are ischaemic heart disease, stroke, lung cancer, and chronic obstructive pulmonary disease⁴⁹.

⁴⁸ World Health Organization 2018. Burden of disease from ambient air pollution for 2016.

⁴⁹ Keywood M, Emmerson K, Hibberd M. (2016). Ambient air quality: Introduction. In: Australia state of the environment 2016, Aust Gov Dept Environ and Energy, Canberra, <https://soe.environment.gov.au/theme/ambient-air-quality/framework/introduction>

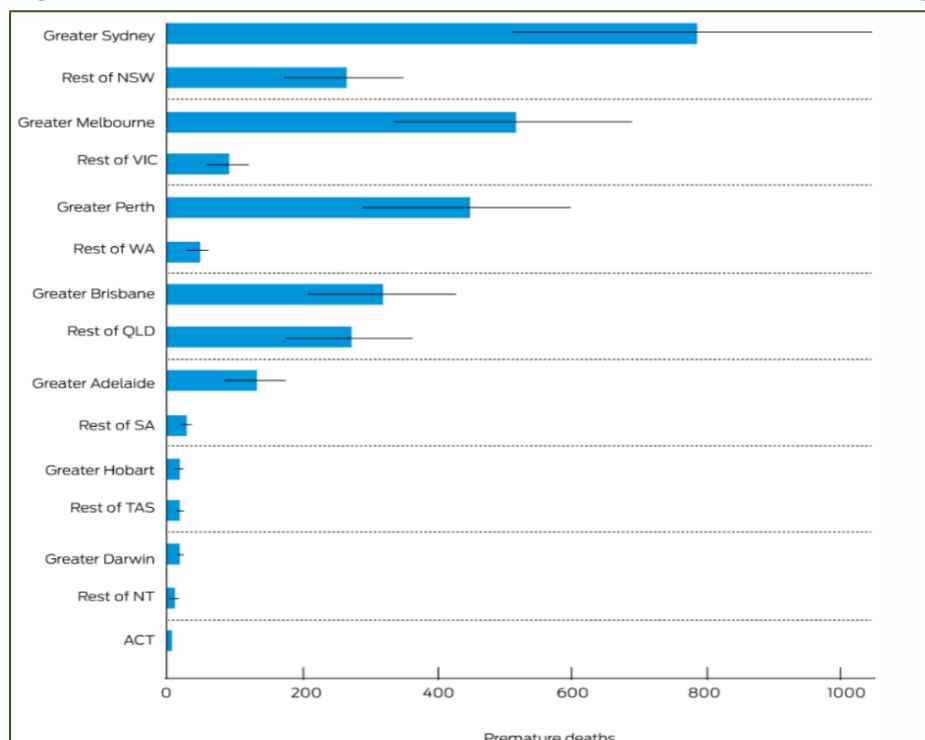
⁵⁰ Dean A, Green D. 2018. Climate change, air pollution and human health in Sydney, Australia: a review of the literature. *Env Res Let* 3(5)

⁵¹ Begg S, Vos T, Barker B, et al. (2007). The burden of disease and injury in Australia 2003. Cat. no. PHE 82. Canberra: Australia Institute of Health and Welfare. Available: <http://www.aihw.gov.au/publication-detail/?id=6442467990> [Accessed 5 Oct 2019].

In Australia, ambient air pollution contributes to over 3000 premature deaths each year⁵², with an estimated financial cost of between \$11 billion and \$24 billion annually^{49, 53}

Particulate Matter (PM) pollution is of significant concern, as there is a strong link between PM levels and premature deaths. In 2015, PM_{2.5} levels in Australia were responsible for an estimated 2900 premature deaths, with one quarter of these – 785 deaths – occurring in Sydney (Figure 10)⁵⁴.

Figure 10. Premature deaths from PM_{2.5} in Australian cities and regions, 2015



Reproduced with permission from Zhang et al⁵⁴

Australian studies have demonstrated links between exposure to air pollution and adverse paediatric respiratory health, even in settings where air pollution levels are considered low. Paediatric emergency presentations for asthma, acute bronchitis, influenza and pneumonia have increased with short-term increases in levels of PM_{2.5}, NO₂, O₃, and SO₂.^{55,56,57} Maternal exposure to air pollutants may also increase the risk for adverse neonatal outcomes including preterm birth, low birth weight and foetal growth restriction^{58,59,60}.

⁵² Institute for Health Metrics and Evaluation (IHME). Global Burden of Disease Compare Data Visualization. Seattle, WA: IHME, University of Washington, 2016. Available from: <http://vizhub.healthdata.org/gbd-compare>

⁵³ Health Effects Institute (HEI). 2017. State of Global Air 2017 (online database) www.stateofglobalair.org

⁵⁴ Zhang Y, Beggs P, Bambrick H et al. (2018). The MJA-Lancet Countdown on health and climate change: Australian policy inaction threatens lives. *Med J Aust* 2019(11): 474.

⁵⁵ Jalaludin B, Khalaj B, Sheppard V, & Morgan G. (2008). Air pollution and ED visits for asthma in Australian children: A case-crossover analysis. *International Archives of Occupational and Environmental Health*, 81(8), 967-974.

⁵⁶ Pereira G, Cook A, De Vos A et al. (2010). A case-crossover analysis of traffic-related air pollution and emergency department presentations for asthma in Perth, Western Australia. *The Medical Journal of Australia*, 193(9), 511-514.

⁵⁷ Barnett A, Williams G, Schwartz J, et al. (2005). Air Pollution and Child Respiratory Health: A Case-Crossover Study in Australia and New Zealand. *Am J Respir Crit Care Med* Vol 171. pp 1272–1278.

⁵⁸ Chen G, Abramson Williams, & Li. (2018). Exposure to low concentrations of air pollutants and adverse birth outcomes in Brisbane, Australia, 2003–2013. *Science of the Total Environment*, 622-623, 721-726.

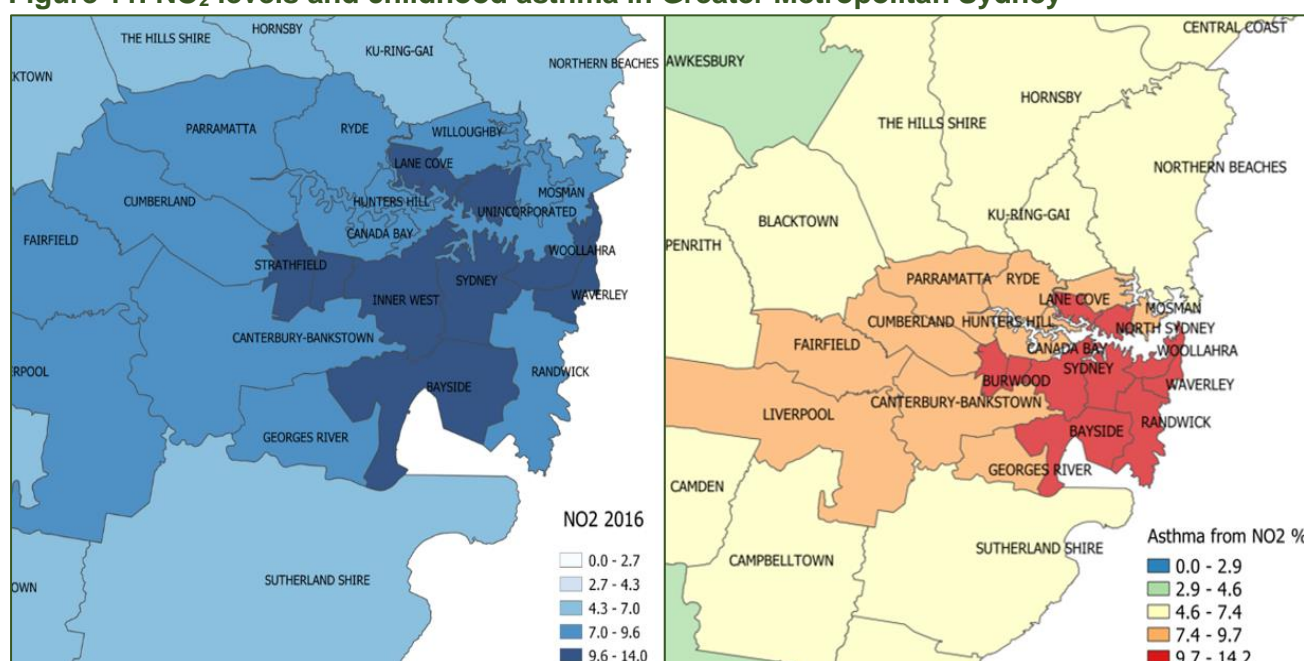
⁵⁹ Li S, Guo Y, Williams G. (2016). Acute Impact of Hourly Ambient Air Pollution on Preterm Birth. *Environmental Health Perspectives*, 124(10), 1623-1629.

⁶⁰ Pereira G, Cook A, Haggard F, et al. (2012). Locally derived traffic-related air pollution and fetal growth restriction: A retrospective cohort study. *Occupational and Environmental Medicine*, 69(11), 815-822.

Long-term exposure to NO₂ has been shown to increase the risk for developing childhood asthma and having reduced lung function⁶¹. Modelling of NO₂ concentrations in Sydney demonstrates that levels are higher in more urban areas (due to vehicle emissions.) Based on these levels and the relationship between NO₂ exposure and asthma, the proportion of childhood asthma that can be attributed to NO₂ exposure has been estimated for different parts of Sydney (Figure 11).

An estimated 2010 children in SESLHD have asthma attributable to NO₂ exposure – which is mostly from vehicle emissions⁶²

Figure 11. NO₂ levels and childhood asthma in Greater Metropolitan Sydney



Source: Dr Ben Ewald, General Practitioner and Epidemiologist⁶²

Air pollutants affect the health of Australian adults

Among Australian adults, living near major roads (which results in high exposure to NO₂) has been shown to be a risk factor for adult-onset asthma⁶³, and for the development of wheeze and reduced lung function⁶⁴. Higher NO₂ exposure increases the risk for biomarkers of systemic inflammation⁶⁵, which can lead to a wide range of health conditions including cardiovascular and respiratory disease. Long- and short-term exposure to NO₂, PM and SO₂ can result in cardiovascular morbidity and mortality.^{66,67}

⁶¹ Knibbs C, Toelle D, Guo D et al (2018). The Australian Child Health and Air Pollution Study (ACHAPS): A national population-based cross-sectional study of long-term exposure to outdoor air pollution, asthma, and lung function. *Environment International*, 120, 394-403.

⁶² Dr. Ben Ewald, personal communication, August 2019.

⁶³ Bowatte G, Lodge C, Knibbs L, et al (2018). Traffic related air pollution and development and persistence of asthma and low lung function. *Environment International*, 113, 170-176.

⁶⁴ Bowatte G, Lodge C, Knibbs L, et al (2017). Traffic-related air pollution exposure is associated with allergic sensitization, asthma, and poor lung function in middle age. *The Journal of Allergy and Clinical Immunology*, 139(1), 122-129.e1.

⁶⁵ Perret J, Bowatte G, Lodge C et al (2017). The dose-response association between nitrogen dioxide exposure and serum interleukin-6 concentrations. *Int J Mol Sci* 18(5), 08 May 2017.

⁶⁶ Barnett A, Williams G, Schwartz J, et al. (2006). The Effects of Air Pollution on Hospitalizations for Cardiovascular Disease in Elderly People in Australian and New Zealand Cities. *Environmental Health Perspectives* Vol. 114, No. 7

⁶⁷ Wang X, Hu W, Tong S. (2009). Long-term exposure to gaseous air pollutants and cardio-respiratory mortality in Brisbane, Australia. *Geospatial Health*, 3(2), 257-263.

Air quality burden for SESLHD

The prolonged bushfires and smoke haze across eastern Australia during the 2019-2020 summer had unprecedented health impacts, with leading health and medical organisations describing them as public health emergency⁶⁸. Sydney experienced first-hand the effect of exposure to PM_{2.5} from bushfires, with air quality reaching hazardous levels⁶⁹ and increases in ambulance call-outs and emergency presentations⁷⁰.

Some parts of Sydney experienced hazardous air quality from the 2019 – 2020 bushfire smoke haze, equivalent to smoking up to 40 cigarettes a day⁷¹

Respiratory presentations at SESLHD emergency departments were significantly higher than expected during this time, with 241 additional presentations between 25 November and 5 January, costing an estimated excess \$206,423. The highest number of respiratory presentations at SESLHD hospitals occurred between 3 December and 15 December, which was 26% higher than normal.

Snapshot: How air quality affects people living with asthma



Edan is 19 years old and has lived with asthma for most of his life.

“I was rushed to the hospital on my 3rd birthday...and was diagnosed with asthma”.

Edan’s asthma is severe: during his childhood he was often admitted to hospital because of asthma attacks. Edan’s mother, Alex, recalls: *“There were times he was hospitalised every 5 to 6 weeks...about a quarter of those admissions were to ICU.”*

Like many people, air pollution can trigger Edan’s asthma attacks. Alex describes how being near wood-burning fires can cause problems: ***“In wintertime there’s a lot of open fire places in our area...if there’s a lot of smoke he’ll become wheezy”.*** When Edan was younger, Alex noticed that being around dense traffic could also lead to breathing difficulties.

The 2019-20 NSW bushfires have impacted many people, but especially those living with chronic respiratory conditions like asthma. Edan explains: ***“My asthma has been pretty bad with the recent bushfires...I’ve started to wake up during the night to take my Ventolin, and I’ve had to stay indoors, it’s inhibited a lot of my daily activities.”*** Edan was unable to join us for this interview in person because of the risks to his asthma from being outside.

“Just walking around outside he starts to wheeze...”

Air quality in Sydney was at hazardous levels on many days over the 2019-2020 summer. Edan reflects: ***“I think it’s a wake-up call for Australia...there are measurements we need to put in place to achieve better air quality.”***

⁶⁸ Climate and Health Alliance. December 16 2019. Joint Statement: Air Pollution in NSW is a Public Health Emergency. Retrieved 20 December from <https://www.caha.org.au/air-pollution>

⁶⁹ Sydney Morning Herald Dec 6 2019. Sydney registers record number of ‘hazardous’ air pollution days. Retrieved 7 Dec 2019 from <https://www.smh.com.au/environment/weather/sydney-registers-record-number-of-hazardous-air-pollution-days-20191206-p53hok.html>

⁷⁰ Sydney Morning Herald 19 Nov 2019. Sydney’s bushfire smoke haze leaves 60 people needing treatment from paramedics. Retrieved 20 Nov from <https://www.abc.net.au/news/2019-11-19/sydney-haze-sets-as-bushfire-smoke-blows-across-nsw/11716450>

⁷¹ ABC News 5 December 2019. How does poor air quality from bushfire smoke affect our health? Retrieved 6 Dec from <https://woolcock.org.au/new-2/abc-news-how-does-poor-air-quality-from-bushfire-smoke-affect-our-health>

Taking Action

SESLHD has already made important progress in improving its environmental sustainability. Across the District, staff and community members have demonstrated a strong commitment and an enthusiasm for doing more. This section summarises the key climate risks for SESLHD together with suggestions for how we can respond.



Summary of risks

Extreme heat is a major risk for SESLHD

Hotter summers with more frequent and intense heatwaves will place a substantial burden on our health services. In the absence of adaptive measures, it is highly likely that there will be an increase in morbidity and mortality related to severe heat, as well as implications for health infrastructure, service operations, and workforce wellbeing.






Air pollutants are already impacting the health of people living in SESLHD, and these impacts are likely to become more severe

Air pollutants are causing harmful health effects at existing levels and contribute to the burden of disease at all stages of life. Air pollutant levels may increase further with continued urbanisation, heavy vehicle use, and longer bushfire seasons. This will likely exacerbate adverse health impacts and lead to an increased demand for emergency health services.

The health impacts of the climate crisis will be more severe for people already facing socioeconomic disadvantage, a higher burden of chronic illness, and marginalization

Climate-related health impacts threaten to slow our progress towards the five key priorities outlined in SESLHD's Journey to Excellence Strategy 2018 – 2021, as summarised in Figure 12.

Figure 12. Climate impacts for SESLHD's Journey to Excellence strategic priorities

Strategic Priority	Outcome measure	Challenges / opportunities
 Safe, person-centred and integrated care	Reduce emergency department presentations by 5% each year Decrease the percentage of patients admitted to the emergency department by 5% each year	Emergency department presentations have been on average 5% higher on heatwave days compared with non-heatwave days in SESLHD, and the number of hot days in Sydney is projected to increase
 Workforce wellbeing	Decrease absenteeism by 5% each year	Extreme heat events contribute to absenteeism and impact negatively on workforce wellbeing
 Better value	Reduce emergency department waiting times and number of visits Shift care into the community or outpatient settings	The increased demand for health services during extreme heat events or periods of poor air quality may increase wait times and increase demand for tertiary services
 Community wellbeing and health equity	Increase community reporting of good health by 5%	Extreme heat events and poor air quality contribute to people's experience of poor health
 Foster research and innovation	Increase the number of translational research projects	An opportunity exists for an enhanced research focus on climate-related health impacts and adaptation strategies for SESLHD

Recommendations

Address local air pollution and heat

Air pollution and extreme heat are key risks for SESLHD. Local mitigation as well as adaptation actions are needed. Strategies for addressing air pollution and extreme heat within SESLHD could include:

- ❖ Prioritise energy efficiency and renewable energy projects for new buildings, and when retrofitting existing buildings. Increasingly, facilities will require local, more secure sources of energy to ensure reliable cooling and lighting;
- ❖ Promote and support active transport (walking, cycling) and public transport for staff, patients and visitors. In comparison to vehicle use, active transport has numerous health benefits including increased physical activity, reduced air pollution, reduced vehicle accidents and improved mental health. The Randwick Hospitals' Campus Green Travel Plan is an important initiative and could be extended across the whole District;
- ❖ Provide amenities to encourage active transport (e.g. bicycle racks, showers and changeroom facilities, and cycling pollution masks);

- ❖ Provide amenities to support low emissions vehicles, such as electronic vehicle charging infrastructure⁷²;
- ❖ Introduce anti-idling enforcements for cars and ambulances in hospital and health facility zones, which can lead to reductions in air pollution levels in health hotspots, and reduce exposure for at-risk people⁷³;
- ❖ Plant more trees and plants, and protect and extend green space wherever possible at SESLHD facilities. NHS Forest in England is a useful precedent for this⁷⁴. Trees sequester CO₂, improve air quality, provide shade, and reduce local temperatures. Trees and green spaces are aesthetically pleasing and support mental wellbeing and healing: patients in hospitals with access to green spaces improve more quickly compared with hospitals without⁷⁵. Exposure to urban green spaces has multiple health benefits and reduces the risk of developing diabetes, hypertension, and cardiovascular disease⁷⁶.

Incorporate climate risk into risk management

Far from being a fringe environmental issue, climate risk directly affects healthcare providers and patients through its impacts on wellbeing and health service demand. A comprehensive climate risk assessment is needed to better understand and address these risks for SESLHD. The following actions could assist with managing climate risk in SESLHD:

- ❖ Develop a comprehensive climate risk management framework based on consultation across all levels of service provision, clients, and the community – ensuring inclusion of at-risk priority populations. Risks assessed should include risks to infrastructure, workforce, community, finances, reputation, and service continuity;
- ❖ Identify and mitigate specific climate risks for SESLHD services as a core risk management strategy;
- ❖ Incorporate climate-related risks into SESLHD's risk register and annual reporting.

Build capacity to respond to the additional health burden

SESLHD must build capacity to respond to the increased burden of chronic disease (from physical as well as mental illness), and emergency events requiring a rapid and coordinated response, such as bushfires and heatwaves. This requires planning for sustainable infrastructure and service delivery. The following strategies could be employed to increase capacity of SESLHD's health services, workforce and community:

- ❖ Continue to strengthen existing services so they are able to respond to the additional burden of chronic disease and are accessible for marginalised, at-risk groups⁷²;
- ❖ Promote workforce development by providing education and training around the health impacts of the climate crisis^{77,78};
- ❖ Include SESLHD Environmental Sustainability priority strategies in workforce orientation to enhance staff awareness of the climate risks to health and appropriate responses;

⁷² State of Queensland. 2018. Human health and wellbeing: Climate change adaptation plan for Queensland. Retrieved 2 September 2019 from: https://www.qld.gov.au/__data/assets/pdf_file/0022/64237/h-cap-qld.pdf

⁷³ Public Health England. 2019. Review of interventions to improve outdoor air quality and public health. PHE Publications, London. Retrieved 7 Jan 2020 from https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/795185/Review_of_interventions_to_improve_air_quality.pdf

⁷⁴ National Health Service. NHS Forest. Retrieved 29 Jan 2020 from <http://nhsforest.org/>

⁷⁵ Young L. 2019. Green Spaces. *Psychiatric Times* 36(9).

⁷⁶ Urban green space, tree canopy and prevention of cardiometabolic diseases: a multilevel longitudinal study of 46 786 Australians. *Int J Epidemiology*, 1-8.

⁷⁷ Bell E (2011). Ready health services for climate change: A policy framework for regional development. *Am J Public Health* 101(5): 804-13.

⁷⁸ Blashki G, Armstrong G, Berry H, Weaver HJ, Bi P, Harley D, Spickett J, Hanna L. (2011). Preparing health services for climate change in Australia. *Asia Pac J Public Health*. 23(2): 133S-43.

- ❖ Develop a comprehensive climate adaptation plan to help future-proof SESLHD's infrastructure and services from extreme weather events;
- ❖ Incorporate emergency preparedness for extreme weather events into existing disaster management planning⁷⁹;
- ❖ Develop a comprehensive heatwave health response plan as well as response plans for other climate emergencies including hazardous air quality; bushfires; and floods;
- ❖ Prepare and distribute heatwave preparation checklists and heatwave alerts to at-risk populations. This has been shown to increase community resilience and reduce emergency health service demand⁸⁰;
- ❖ Consider alternative models of care to build community and sector resilience to the climate crisis, such as localised service provision and hospital in the home approaches.

Communication and education

SESLHD's community needs to be well-informed about the short- and long-term health risks from the climate crisis. Information and education about these risks, and how they can be managed, increases resilience among communities and can reduce health service demand.

Key information that should be communicated includes:

- ❖ Health risks from heat exposure (and how to avoid these impacts);
- ❖ How to prepare for a heatwave and what to do during a heatwave;
- ❖ Health risks from air pollutant exposure (along with air quality alerts and information on how to minimise exposure);

Information needs to be targeted to at-risk groups including the elderly, caregivers for the very young, people experiencing economic hardship and/or homelessness, Aboriginal and Torres Strait Islander peoples, and people from culturally and linguistically diverse backgrounds. While social media platforms can be effective for engaging large audiences, many of SESLHD's at-risk groups are less likely to access information through conventional channels such as internet or television.

Strategies for effectively communicating with at-risk groups could involve:

- ❖ Engaging consumers and community members in the development and delivery of culturally acceptable education/information;
- ❖ Providing information in multiple relevant community languages, with distribution via relevant information channels, for example via ethnic media or peak community organisations;
- ❖ Engaging Aboriginal Community Controlled Health Organisations (ACCHOs), Aboriginal community leaders and Aboriginal health workers to develop and disseminate culturally appropriate information about risks to their communities, and how to manage during extreme weather events;
- ❖ Delivering community education programs to raise awareness about climate-related risks to health and wellbeing and promote behaviour change;
- ❖ Partnering with communities and community organisations to identify information gaps and develop community-led localised solutions

⁷⁹ Rychetnik L., Sainsbury T., Stewart G. 2019. How Local Health Districts can prepare for the effects of climate change: an adaptation model applied to metropolitan Sydney. *Australian Health Review* 43:601-610.

⁸⁰ Nitschke M, Tucker G, Hansen A, et al. Evaluation of a heat warning system in Adelaide, South Australia, using case-series analysis. *BMJ Open* 2016;6: e012125. doi:10.1136/bmjopen-2016-012125

Research, data and evaluation

Research about the health impacts of the climate crisis in NSW must be significantly scaled up, and SESLHD can contribute quantitative and qualitative data for such research. This will in turn inform service planning and enable SESLHD to monitor progress towards adapting to the climate crisis. SESLHD's contribution to such projects must be properly resourced.

In particular, research should focus on how best to build the capacity of at-risk communities and the workforces that serve them. Other research priorities include improving our understanding of ways to increase community cohesion to plan, prepare for and respond to climate-related impacts, and how best to protect mental health and wellbeing.

Some suggested areas for research include:

- ❖ Enhanced monitoring of emergency department presentations and hospitalisations during extreme weather events (including heatwaves and periods of worsening air quality);
- ❖ Evaluation of community attitudes and knowledge in relation to the climate crisis;
- ❖ Assessing SESLHD's contribution to greenhouse gas emissions, and trends over time
- ❖ Evaluation of the impact of the climate crisis on our workforce;
- ❖ Evaluation of the impacts of extreme weather events in relation to service accessibility for at-risk populations.