

Climate change and health

Preparing for the next disaster

Stephen Duckett, Will Mackey, and Anika Stobart

December 2020



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Grattan Institute Report No. 2020-18, December 2020

This report was written by Stephen Duckett, Will Mackey, and Anika Stobart. John Walsh provided research assistance and made substantial contributions.

We would like to thank Fiona Armstrong, Kathryn Bowen, Kate Charlesworth, Lynne Madden, Martin Rice, Peter Sainsbury, Jill Sewell, Clare Walter, Tarun Weeramanthri, Ying Zhang, as well as numerous government and industry participants and officials for their input.

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This report may be cited as: Duckett, S., Mackey, W., and Stobart, A. (2020). *Climate change and health: Preparing for the next disaster*. Grattan Institute.

ISBN: 978-0-6488962-8-9

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Overview

Australia is about 1.5°C warmer than it was a hundred years ago. This warming is harming the health and well-being of Australians right now. It will only get worse. The health sector must adapt to the changing climate in Australia, and it must reduce its emissions to help minimise further damage.

The bushfires of last summer were devastating. Thirty-three people were killed directly by the 2019-20 bushfires, and thousands lost their homes or their livelihoods. Those who fought the fires, or who live in hard-hit areas, will suffer the mental health consequences for decades to come.

Millions of Australians were affected by bushfire smoke. The smoke alone caused more than 400 additional deaths and sent thousands of people to the emergency department for respiratory and heart problems. The long-term effects of this smoke exposure are not yet fully understood.

But climate change is not just increasing the severity and frequency of bushfires. It will cause harsher heatwaves and more severe storms. In the far north of Australia, cyclones will be more intense, causing floods that will destroy homes, businesses, and public buildings. Further south, droughts will be longer, creating still more hardship for farmers and regional towns and cities.

After decades of inaction on climate change, the health sector must rapidly adapt to the new climate realities facing Australia. It must develop plans and protocols to minimise the harm caused by climate disasters. It must ensure the supply of healthcare services can

continue in the face of disaster. It must communicate with the public about the increasing risks to their physical and mental health. And when climate disasters occur, it must provide mental health support not just during the crisis but for decades after.

The changing climate will hurt some Australians more than others. One-quarter of the Indigenous population of NSW and Victoria lived in areas affected by last summer's bushfires. Droughts create and exacerbate mental health problems in rural communities. Heatwaves harm children and the elderly more than others. Australia's health response to climate change must be tailored to, and driven by, the communities that will need the most help.

These are long-term health threats that require long-term planning. The Commonwealth Department of Health must incorporate the clear link between climate change and human health in its short-, medium-, and long-term strategies.

And although we are too late to prevent climate change from harming our health, we can act now to prevent greater damage. The health sector should provide an example for other sectors to follow. State and territory public health sectors should, by 2023, develop plans for net-zero public health sectors.

For the health sector, responding to climate change is not an optional extra, it is core business. In 2020, Australia listened to the science and acted on the health advice to prevent some of the catastrophic health costs caused by COVID-19. Now we must do it again.

Recommendations

Recommendation 1: Australia's governments should address in long-term planning the health risks posed by climate change

- The Commonwealth Department of Health must add the health risks posed by climate change to its priority list. Climate change should feature prominently in its *National Preventive Health Strategy*, the *Long-term National Health Plan*, the *Corporate Plan*, and the *Medical Research Future Fund* investment plan.
- All governments should ensure the health sector incorporates climate change into risk assessments and disaster planning. This could be achieved by mandating a new requirement in the National Safety and Quality Health Service Standards for health services assess climate change risks.

Recommendation 2: Establish a national climate change and health forum

- Governments should establish an explicit climate change and health subcommittee of the Australian Health Protection Principal Committee (AHPPC).
- Chief Health Officers at AHPPC should prioritise climate change in their forward work plan.

Recommendation 3: Monitor climate-related health risks

Australia's health systems should:

- Develop adequate systems and technologies for comprehensive data collection regarding climate change risks such as air pollution, including comprehensive coverage of air quality monitors across all jurisdictions.

- Maintain real-time monitoring and forecasting of health events – e.g. hourly reporting of air quality – and health service indicators – e.g. ambulance call-outs. These data streams should be integrated and monitored, with routine reports generated for Chief Health Officers and the public.
- Identify vulnerable regions or groups and deliver health system responses to those most at risk during climate-related phenomena.
- Track and report data on the immediate and direct health effects of climate-related phenomena – e.g. injury and death due to heatwaves – as well as the long-term and indirect effects – e.g. on mental health.
- Build climate-change scenarios into health system planning and budget forecasting to ensure future vulnerabilities and potential effects on the health system are taken into account.

Recommendation 4: Climate-change health risks should be clearly communicated to the public

- Governments at all levels should clearly communicate with Australians about the broad climate-related health risks facing Australia now and in the future.
- State governments should deliver targeted and tailored messages for at-risk groups about the health risks posed by expected climate-related events – e.g. imminent heatwaves – or current climate-related dangers – e.g. smoke harm from nearby hazard-reduction burns.

Recommendation 5: Improve mental health support systems

- Primary Health Networks across Australia should ensure their mental health plans address the current and future increased risks from climate change that are relevant to their local community.
- Mental health literacy training should be used to improve at-risk communities' resilience to natural disasters, particularly long-lasting disasters such as droughts.
- When disaster hits, governments should ensure community mental health services are equipped for the increased need for services in the short and long term.

Recommendation 6: Review health service resilience to climate disasters

- Governments should ensure there are enough health professionals on-call for expected natural disasters. Protocols should include ready-to-go contractual arrangements for general practitioners to work in local evacuation centres and hospitals with high demand.
- Disaster response systems should have contingency plans for disrupted access in the short term – e.g. to immediate medical attention – and the long term – e.g. to pharmaceuticals.

Recommendation 7: The health sector should plan to reduce its emissions

- The health sector should demonstrate leadership in emissions reduction.
- State and territory governments should develop plans by the end of 2023 for net-zero public health sectors.

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1 Climate change is harming Australians' health

A hundred years ago, climate-related natural disasters were rare in Australia. Today, they are more frequent and more devastating. Australia needs to prepare for more frequent climate catastrophes, while acting to make them less likely.

All emergency services are at the front line of these events, but the health sector has to deal not only with the immediate consequences of illness and injuries, but the long-term effects such as mental health problems and alcohol and drug abuse.

Our health is intrinsically linked to our environment. Climate change is causing our environment to change rapidly. The Commonwealth Government has not yet done enough to respond, although the states and territories have committed to net-zero emissions by 2050.

This report shows how the health sector can better prepare for the effects of climate change, and how it should lead by reducing its own carbon and environmental footprint.

1.1 Our health is intrinsically linked to our environment, and our environment is affected by our behaviour

Climate change is detrimental to our health in many ways. Longer heatwaves means more heat-stroke; bigger bushfires mean more pollution.¹ Climate-related natural disasters also damage the economy, which in turn degrades human health. For example, prolonged droughts that destroy farmland can lead to increased economic insecurity and increased drug or alcohol dependence. And human behaviour, of course, can affect the physical environment.

1. See Chapters 2 and 3 for a more detailed discussion of the health effects of climate change in Australia.

1.2 The climate is warming and its effects are being felt in Australia now

Human activity, particularly the burning of fossil fuels, is increasing the concentration of greenhouse gases in the atmosphere. These gases trap the heat and lead to warming.

In the past 130 years, the world has warmed by approximately 0.85°C.² Each of the past three decades has been successively warmer than any preceding decade since records began in about 1850.³

Climate change is increasing the frequency and intensity of extreme weather in Australia. The report of the Royal Commission into natural disasters, published in November 2020, found climate change will continue to cause more severe disasters.⁴ Among its 80 recommendations were calls for authoritative national action on climate change, and for greater adaptation to the increased risk of disasters in Australia.⁵ The Commonwealth Government has accepted some recommendations but rejected others.⁶

The Royal Commission was called after the summer bushfires of 2019-20. That so-called Black Summer was Australia's second warmest on record, just behind the record set the previous summer.⁷ Figure 1.1 shows that the national average temperature in 2019 was 1.52°C warmer than the long-term average.

2. IPCC (2014).

3. Ibid.

4. The Royal Commission into National Natural Disaster Arrangements (2020, pp. 59–61).

5. Ibid (pp. 34–46).

6. Livingston and Foley (2020).

7. Bureau of Meteorology (2020a).

Media and political debate may sometimes suggest such findings are controversial, but an overwhelming majority of Australians agree that the country is already suffering the effects of climate change.⁸

The warming climate is causing more bushfires.⁹ It is causing longer droughts and more frequent heatwaves.¹⁰ It is causing more severe in-land floods and coastal storms.¹¹ It is causing more damage to more Australians, and it is happening now.

1.3 Climate change is the world's greatest health risk

The World Health Organisation has declared climate change as a health emergency, and the 'greatest threat to global health in the 21st century'.¹² Understanding and witnessing the link, health practitioners in Australia have been sounding the alarm. The Climate and Health Alliance has produced a strategic framework for a national climate change response to protect and promote human health.¹³

The Australian Medical Association and Doctors for the Environment Australia have highlighted the health risk of climate change and called on the Commonwealth Government to act.¹⁴ In November 2020, more than 4,000 health professionals signed an open letter accusing the Commonwealth Government of failing to properly reduce emissions, and calling on it to acknowledge that 'climate damage is here now – and it is killing people'.¹⁵ The Medical Journal of Australia and The

8. Slezak (2020).

9. See Chapter 2.

10. See Section 3.1 and Section 3.2.

11. See Section 3.3.

12. Zhao et al (2019).

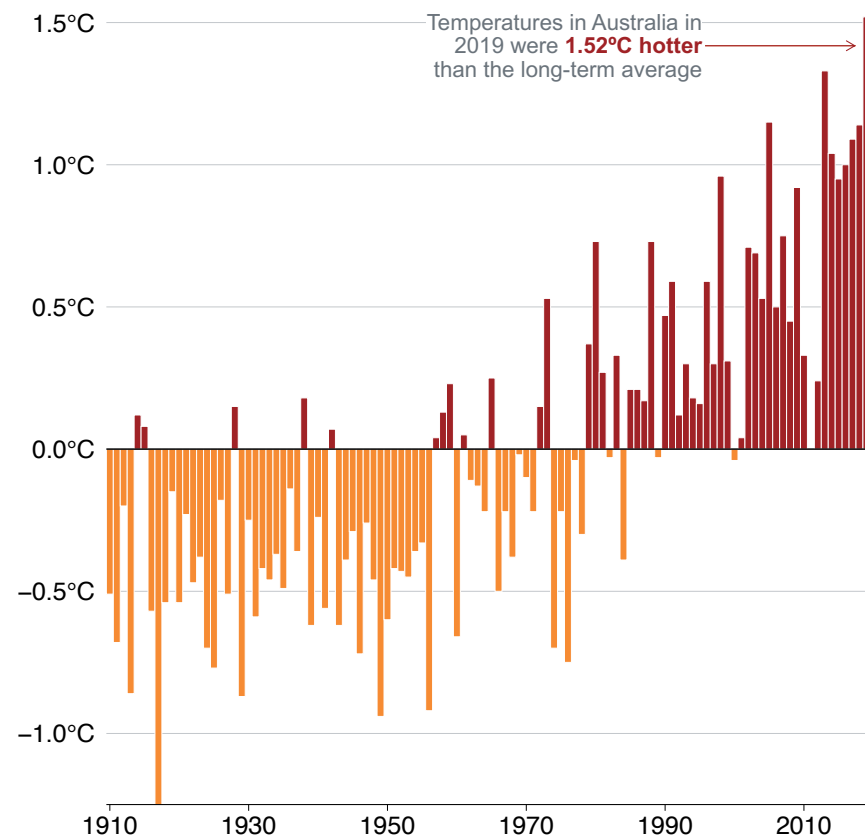
13. This framework 'should be considered applicable to national, state/territory, and local government departments and agencies, as well as across multiple portfolio areas, including health, transport, energy, environment, agriculture, planning and infrastructure': Horsburgh et al (2017, p. 24).

14. Australian Medical Association and Doctors for the Environment Australia (2020).

15. Australian Conservation Foundation (2020).

Figure 1.1: Australia is heating up

Mean annual temperatures compared to the 1961-1990 average



Source: Bureau of Meteorology (2020a).

Lancet have been for years generating a series of papers specifically focussed on climate change and health called *Countdown*.¹⁶

The Commonwealth Government has been slow to act. But the COVID-19 crisis has highlighted the delicate relationship between society, the economy, and human health.¹⁷ Australians and their governments took swift preventive action this year to save and improve lives. Australia's response to the pandemic, with strong leadership and national coordination, has been among the best in the world.¹⁸

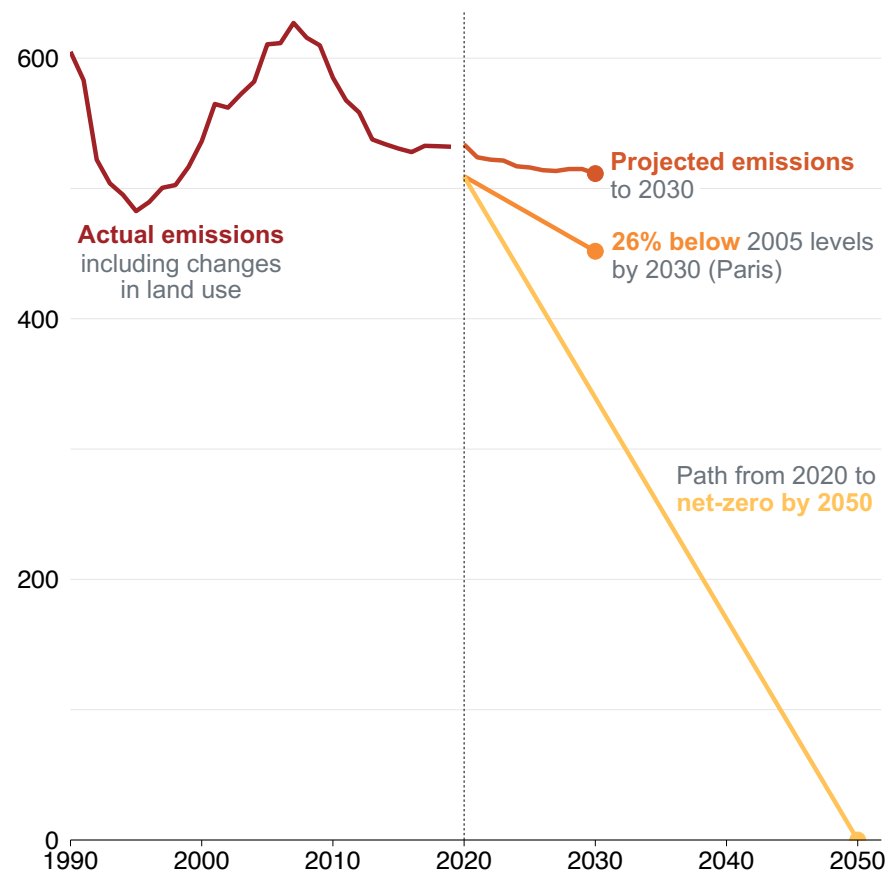
Australia's response to the pandemic was informed by evidence. Australians saw that the future health and economic toll would be enormous unless decisive action was taken quickly. The lessons for the response to climate change are clear.

1.4 Australian governments are not doing enough to reduce greenhouse gas emissions

Australia has ostensibly committed to the Paris Agreement targets: holding global warming well below 2°C, and achieving global net-zero emissions in the second half of the 21st century.¹⁹ But there is no national policy mechanism to ensure Australia meets these targets. In 2015, under the Paris Agreement, Australia promised to reduce its greenhouse gas emissions by 26-to-28 per cent from 2005 levels by 2030. Yet Figure 1.2 shows Australia is not on track to meet this target.²⁰

16. See Zhang et al (2018), Beggs et al (2019) and Zhang et al (2020).
 17. World Health Organisation (2020a).
 18. See Duckett et al (2020b, Chapter 1 and 2) and Duckett et al (2020a, Chapter 1).
 19. The commitments also include 'pursuing efforts to limit the temperature increase to 1.5°C above pre-industrial levels': *Article 2, Paris Agreement*; and 'achieving a balance between anthropogenic emissions by sources and removals by sinks of greenhouse gases in the second half of this century': *Article 4, Paris Agreement*.
 20. The Commonwealth Government has said that Australia will meet the target, if necessary by using controversial 'carry-over credits' from the Kyoto Protocol: Clennell and Taylor (2020).

Figure 1.2: Australia is not on track to reach net-zero emissions by 2050
 Net annual emissions, Mt of CO₂-equivalent



Note: A gentler transition between 2020 and 2050 is possible if Australia produces negative emissions in the future, by storing more carbon than it emits.

Source: Grattan analysis of Australia's emissions projections 2019: Department of Industry, Science, Energy and Resources (2019, Figure 5).

All Australian states have committed to net-zero emissions by 2050.²¹ Yet none of the states has comprehensive policy mechanisms to actually achieve that target.

1.5 The health sector contributes a decent chunk to Australia's emissions and has the most to gain from cutting them

The health care sector contributes about 7 per cent of Australia's carbon emissions.²² Globally, health care is responsible for 4.6 per cent of total greenhouse gas emissions.²³

Actions that reduce greenhouse gas emissions can improve Australians' health. For example, reducing the number of coal-fired power stations and switching from petrol-fuelled cars to electric vehicles will improve air quality and therefore health.

Australia – and its health sector – cannot unilaterally arrest global warming by cutting emissions. This action needs to be taken in concert with the rest of the world, and the other sectors of the economy. But given the direct damage that climate change will cause to Australians' health, it is incumbent on the health sector to lead.

Ideally, Australia would have a national policy to comprehensively reduce Australia's emissions – such as a price on carbon.²⁴ But political reality suggests Australia will not have a price on carbon in the immediate future. Therefore the country has little choice but to make sector-specific interventions to bring down emissions.²⁵ Yet there is

no national or state government policy to reduce the health sector's climate footprint (see Chapter 5). The burden of health sector adaptation and mitigation of the health effects of climate change have fallen to others – such as the Climate and Health Alliance and Doctors for the Environment – and on voluntary initiatives such as the Global Green and Healthy Hospital network.²⁶

1.6 The remainder of this report

This report focuses on one important aspect of climate change: its direct effect on the health of Australians.

Chapter 2 details the health consequences of the 2019-2020 summer bushfires.

Chapter 3 shows how climate change is increasing the likelihood and severity of natural disasters, and how these disasters directly and indirectly harm Australians' health.

Chapter 4 outlines ways Australia's health sector can better prepare for climate change.

Chapter 5 identifies how the health sector can reduce emissions to mitigate further damage.

21. Wood and Dundas (2020, p. 8).

22. Malik et al (2018).

23. Watts et al (2019). This is for 2016 and excludes land-use change.

24. Previous Grattan Institute recommendations to reduce emissions nationally are detailed in Appendix A.

25. The Gillard government introduced a Carbon Pricing Mechanism in 2012, but it was repealed by the Abbott government in 2014: *Clean Energy Legislation (Carbon Tax Repeal) Act 2014*.

26. See (Section 5.1).

2 The health effects of the 2019-20 summer bushfires

Hundreds of bushfires ravaged south-eastern Australia over the 2019-20 summer, burning millions of hectares and billowing large plumes of smoke into the atmosphere. The fires and the smoke claimed many lives, and caused mental health problems that will last.

The 2019-20 bushfire season won't be a one-off. Climate change is increasing the likelihood of ever more severe, intense, and longer-lasting bushfires into the future.

2.1 The fire risk was extreme leading up to the 2019-20 bushfires

Hot weather and drought leading up to the summer of 2019-20 primed much of south-eastern Australia for bushfires.

2019 was Australia's hottest year on record.²⁷ Temperatures across the country were 1.5 degrees warmer than the long-term trend.²⁸ 2019 was also Australia's driest year on record.²⁹ Areas of south-eastern Australia that subsequently burned had their lowest rainfall on record.³⁰

There had been extensive hazard reduction burns in the decade leading up to the 2019-20 summer, but dry and hot conditions limited the scope of hazard reduction burns in the winter before.³¹ As the climate heats up in Australia, the effectiveness of control measures such as hazard reduction burns is diminishing.³²

27. Bureau of Meteorology (2020a).

28. Long-term trend is the average between 1961 and 1990.

29. Bureau of Meteorology (2020a).

30. Ibid.

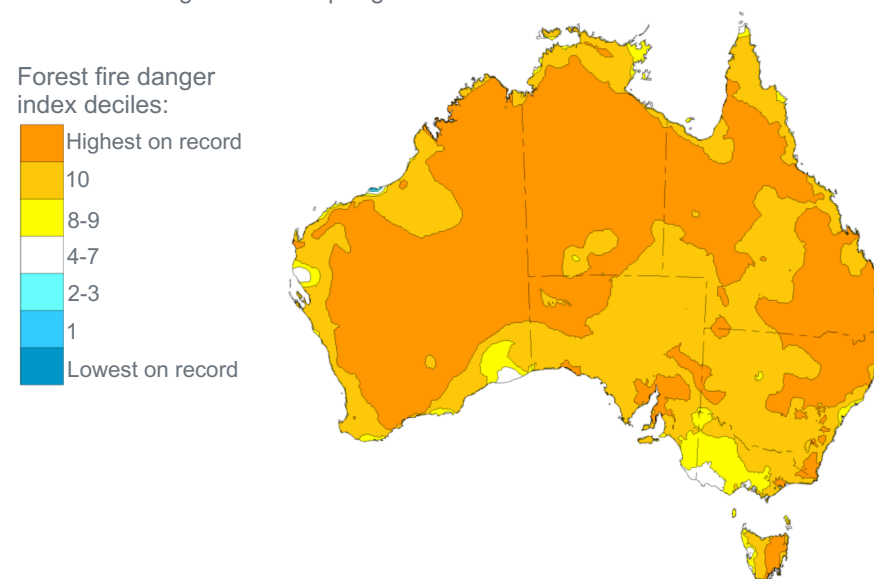
31. RMIT ABC Fact Check (2020); and Hannam and Mannix (2020).

32. The Royal Commission into National Natural Disaster Arrangements (2020, p. 373).

By the spring of 2019, the Bureau of Meteorology reported that most of Australia had the highest fire danger weather on record (Figure 2.1).³³ In early September, the fire season had kicked in, just five months after the previous season ended.³⁴ By 9 September, more than 50 fires were burning in NSW, and 80 in Queensland.³⁵

The dangerous fire weather continued through the summer. In December, the fire danger index was the highest on record across most

Figure 2.1: Fire danger was high in the lead-up to the 2019-20 summer
Forest fire danger index in spring 2019



Source: Bureau of Meteorology (2019a, p. 11).

33. Bureau of Meteorology (2019a).

34. Bureau of Meteorology (2019b).

35. Ibid (p. 25).

of the country.³⁶ By the end of January 2020, about 21 per cent of all Australia’s forests had burnt.³⁷

2.2 The bushfires directly affected many people

Across south-eastern Australia, the fires directly killed at least 33 people and destroyed more than 3,000 homes.³⁸

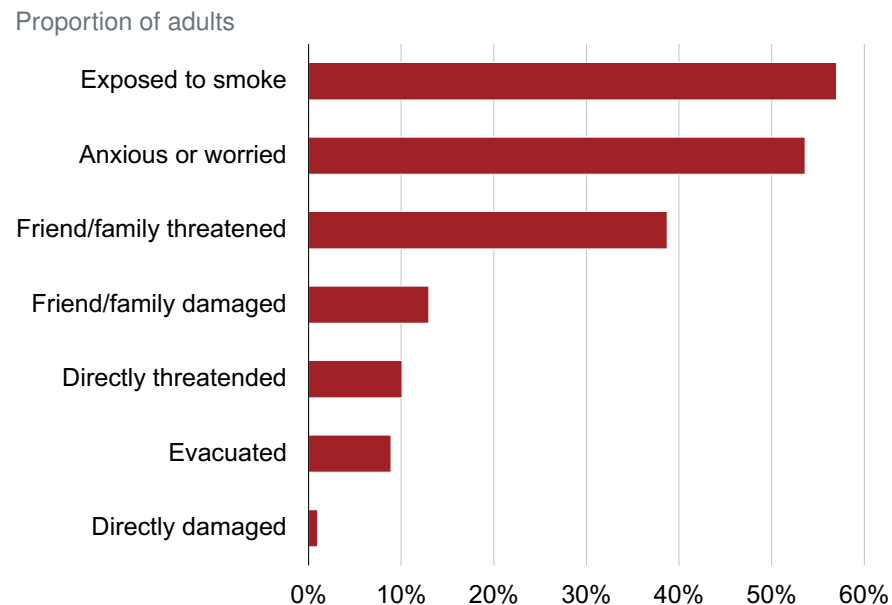
A survey of 3,000 Australians in January 2020 found that one-in-seven were directly affected by the bushfires through their property being damaged or threatened, or by being told to evacuate.³⁹ Figure 2.2 shows 10 per cent of Australians reported being directly threatened by the fires. About 1.8 million people were forced to evacuate their homes.⁴⁰

2.3 The bushfires caused dangerously poor air quality for prolonged periods

As fires burned across NSW, the ACT, South Australia, and Victoria, many people were exposed to the smoke that rose, drifted, and blanketed towns and cities. The smoke caused air pollution to be many times the ‘hazardous’ levels (see Figure 2.4, Figure 2.5, and Figure 2.6). About 11 million Australians reported some exposure to smoke caused by the 2019-20 fires (Figure 2.2).⁴¹

Bushfire smoke is made up of a complex mix of particles and gases. This mix includes particles less than 2.5 micrometres in diameter

Figure 2.2: Almost three-in-five Australians were affected by bushfire smoke over the 2019-20 summer



Source: Biddle et al (2020, p. 5).

36. Bureau of Meteorology (2020b, p. 9).

37. Boer et al (2020). This figure excludes the fires in Tasmania.

38. The Royal Commission into National Natural Disaster Arrangements (2020, p. 5); and Australian Institute of Health and Welfare (2020, p. 2).

39. Biddle et al (2020, p. 5).

40. Ibid (p. 5).

41. Ibid (p. 5).

(‘particulate matter’, known as PM_{2.5}) – about 30 times thinner than a human hair.⁴²

The micrograms of these small particles per cubic metre of air – PM_{2.5}µg/m³ – is the key measurement to monitor air quality related to bushfires.⁴³

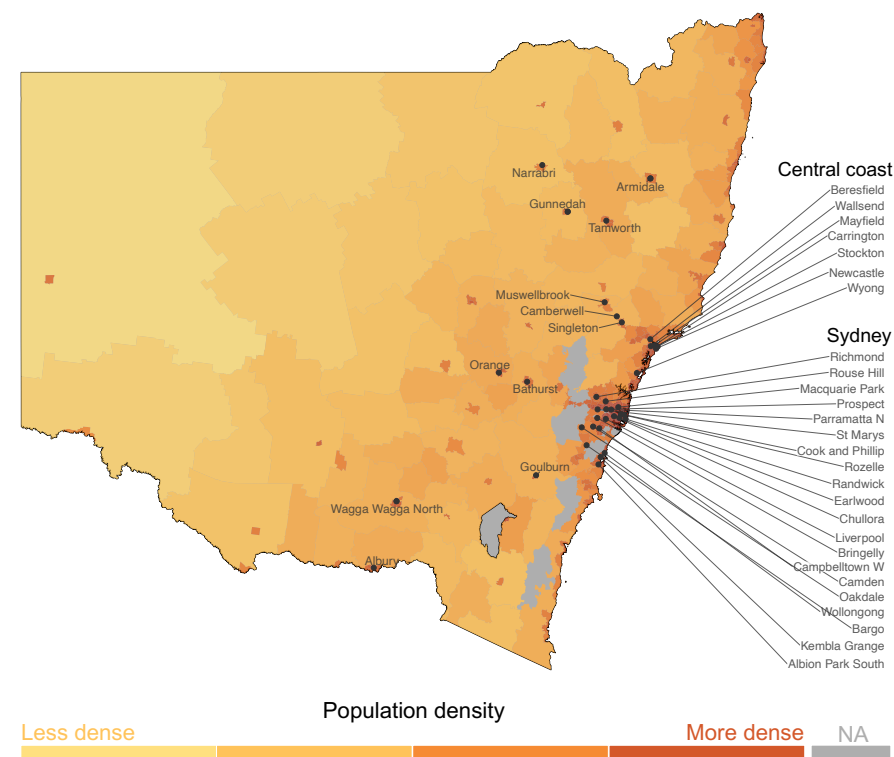
While there is no safe level of PM_{2.5} exposure, the World Health Organisation⁴⁴ and Australian National Air Quality Standards⁴⁵ set the ‘safe’ threshold at 25 PM_{2.5}µg/m³ on average over 24 hours.

The distribution of air quality monitors to measure PM_{2.5} varies between states. The Victorian Environment Protection Agency (EPA) locates most of its air quality monitors in Melbourne, its surrounds, and in the Latrobe Valley.⁴⁶

The NSW Department of Planning, Industry and Environment monitors air quality through 17 monitors in Sydney and surrounds, and others in major towns such as Bathurst, Goulburn, Singleton, Tamworth, and Wagga Wagga (as Figure 2.3 shows). There is no PM_{2.5} monitoring in the state’s west, where population density is low.

Across south-eastern Australia, air quality monitors recorded very high levels of PM_{2.5} during the 2019-20 coast

Figure 2.3: Air quality stations monitoring PM_{2.5} in NSW
Air quality monitors and population density



Sources: Grattan analysis of Department of Planning, Industry & Environment (NSW) (2020a), Australian Bureau of Statistics (2020) and Mackey (2020).

42. United States Environmental Agency (2018).
 43. Particulate matter is predominately made up of mineral dust, water, black carbon, sodium chloride, sulphate, ammonia, and nitrates: World Health Organisation (2018). The toxicity of PM_{2.5} from bushfire smoke can vary dramatically and will depend on what materials are being burnt: Johnston et al (2019).
 44. World Health Organisation (2018).
 45. *National Environment Protection (Ambient Air Quality) Measure* (2016, Schedule 2, Table 1).
 46. EPA Victoria (2020).
 47. Remeikis (2020).

PM_{2.5} levels reached over 300. In the bushfire-affected region of Gippsland, PM_{2.5} levels reached over 500.

Many regions in NSW were badly affected for prolonged periods. Figure 2.5 and Figure 2.6 show that there were high levels of PM_{2.5} in Sydney and regional NSW from October 2019 to February 2020. The PM_{2.5} levels in Sydney during the 2019-20 bushfire season spiked to extremely high levels, with the hourly readings reaching up to 800 for parts of the city. And parts of regional NSW had significantly worse readings. For example, Goulburn's hourly reading at one point in early 2020 went over PM_{2.5} levels of 2,000.

Figure 2.5 and Figure 2.6 on the following page also show the NSW air quality categories for different PM_{2.5} levels.⁴⁸ The 'hazardous' level of PM_{2.5} in NSW is 50 µg/m³. Numerous days last summer were above the 'hazardous' level. Some days peaked at 10-to-14 times the hazardous level.

2.4 The bushfire smoke damaged people's physical health

A NSW survey found that most people experienced at least one minor health symptom from bushfire smoke in December 2019 to January 2020.⁴⁹ People most commonly said they had suffered eye and throat irritation, coughing, headaches, and anxiety.

But inhaling particulate matter from bushfire smoke can also cause many serious health problems.⁵⁰ The link between respiratory issues

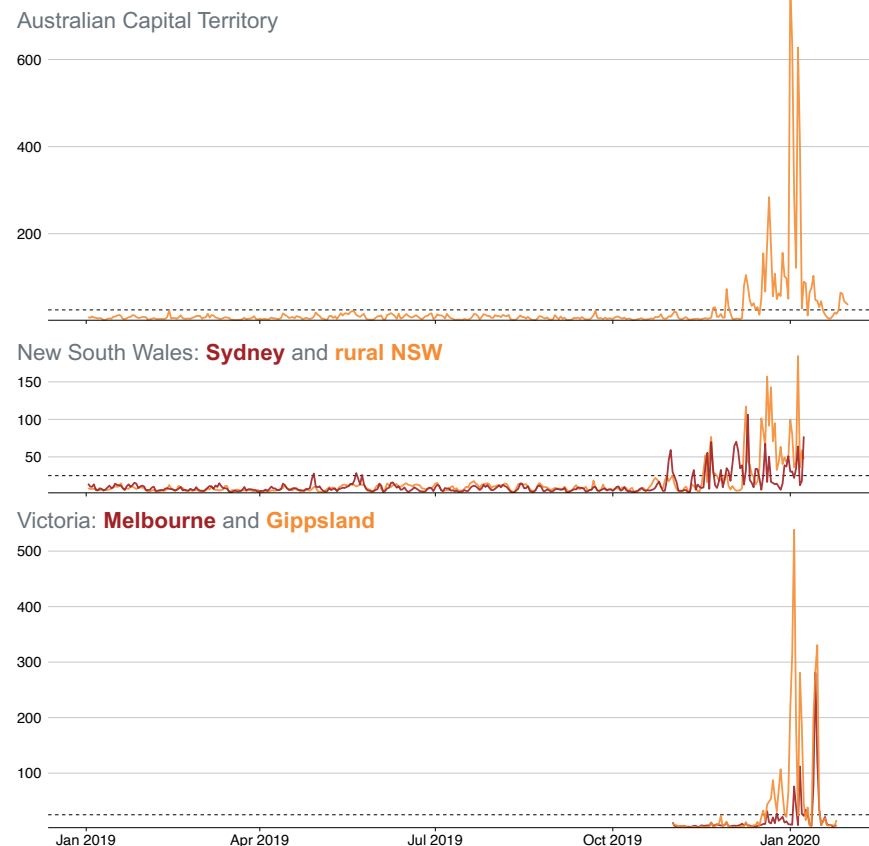
48. See Figure 4.1 on page 33 for an explanation of NSW air quality categories.

49. FluTracking (2020).

50. See Reid et al (2016, table 1) for a critical review of the health effects of exposure to bushfire smoke. The wide-ranging health problems exacerbated by particulate matter include respiratory, cardiovascular, Parkinson's disease, diabetes, phlebitis, thrombophlebitis, and thromboembolism: Wei et al (2019).

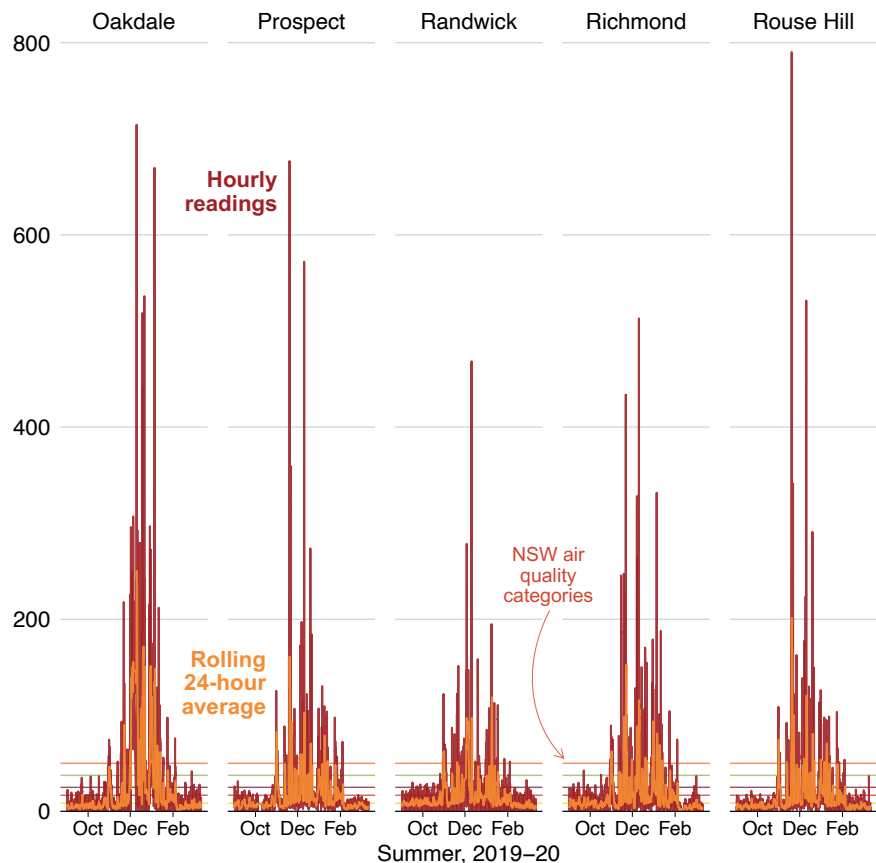
Figure 2.4: Air pollution from the bushfires was many times the 'safe' level

PM_{2.5} levels, 2019-20; 'safe' threshold shown as dotted line



Source: Grattan analysis of ACT and Victorian air quality data.

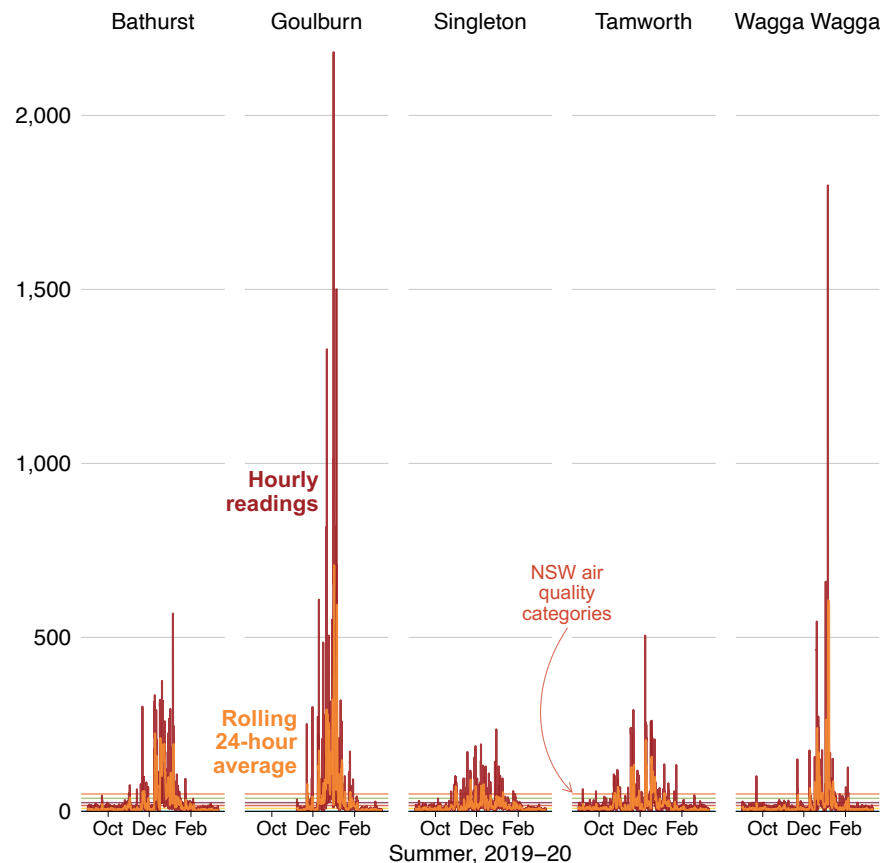
Figure 2.5: Air pollution was many times the ‘hazardous’ level in Sydney
PM_{2.5} levels by hour and rolling 24-hour average



Note: The NSW air quality categories range from ‘very good’ up to ‘hazardous’. The air quality categories are also shown in Figure 4.1.

Source: Grattan analysis of Department of Planning, Industry & Environment (NSW) (2020a).

Figure 2.6: Air pollution was even worse in some parts of regional NSW
PM_{2.5} levels by hour and rolling 24-hour average



Note: The NSW air quality categories range from ‘very good’ up to ‘hazardous’. The air quality categories are also shown in Figure 4.1.

Source: Grattan analysis of Department of Planning, Industry & Environment (NSW) (ibid).

and particulate matter is well established.⁵¹ small particles can be inhaled deep into the lungs, causing difficulty breathing.

Our analysis of Victorian and ACT emergency department data show that the number of people going to hospital with respiratory problems increased significantly on days with poor air quality – by 27 per cent on days with PM_{2.5} levels between 50 and 100, and by 70 per cent on days with PM_{2.5} levels above 200 (compared to days with PM_{2.5} levels below 25, shown in Figure 2.7). While emergency data from NSW was not available for this analysis, the effects are likely to have been similar.⁵²

Another study, shown in Figure 2.8 on the following page, found that pollution from the bushfires caused an estimated 2,000 people to be admitted to hospital with respiratory problems, and about 1,300 people to go to emergency departments with asthma-related conditions.⁵³ About 1,100 people were admitted to hospital with cardiovascular problems caused by the fires. And the bushfire smoke was responsible for 417 deaths.⁵⁴ The health costs of smoke exposure was estimated at almost \$2 billion.⁵⁵

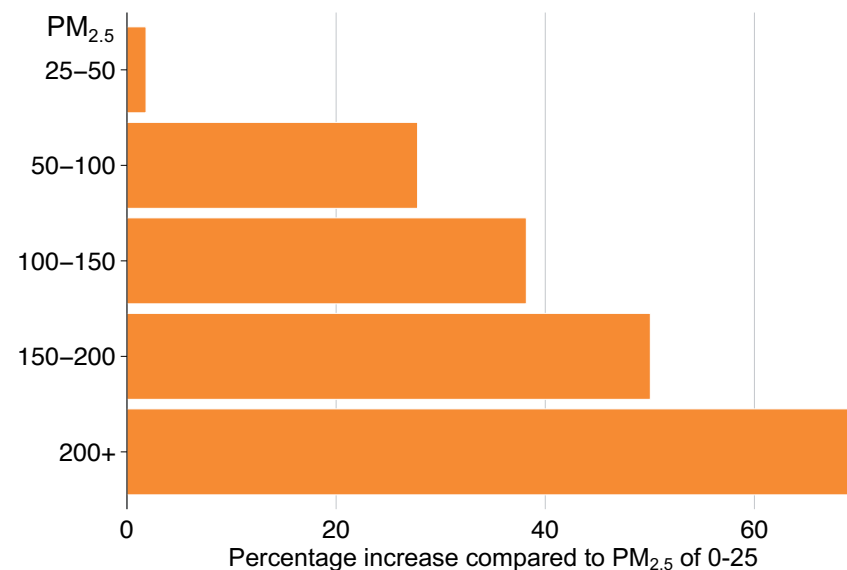
But only time will reveal the full impact of the health consequences of the 2019-20 bushfires and the smoke it caused. For example, some studies are suggesting that pregnant women and small children who were subjected to prolonged periods of smoke may suffer higher rates

of respiratory problems in the coming decades from this single event alone.⁵⁶ But more research is needed (see Section 4.8).

2.5 Bushfires damage people’s mental health over both the short and long term

Bushfires destroy homes, livelihoods, and lives. People from affected communities suffer emotional distress, anxiety, and depression.⁵⁷

Figure 2.7: More people go to hospital with respiratory illness when PM_{2.5} levels are high



Source: Grattan analysis of emergency department data from ACT Health and Victorian Department of Health and Human Services. The model controls for seasonal, day, temperature, and population effects.

51. See, for example, Borchers Arriagada et al (2019), Rappold et al (2017), Broome et al (2016), Reid et al (2016), Dennekamp and Abramson (2011), Rappold et al (2011) and Tham et al (2009).

52. Demand for health services due to poor air quality was also reported in NSW over the 2019-20 bushfire season: Nguyen and Bullen (2019) and Noyes (2020).

53. Arriagada et al (2020). This analysis covered the regions of NSW, Queensland, the ACT, and Victoria for which publicly available air quality monitoring data were available.

54. Ibid.

55. Australian Institute of Health and Welfare (2020, p. 3).

56. Mackee (2020).

57. Bryant et al (2018).

After the 2019–20 bushfires, more than half of Australian adults felt anxious or worried about the bushfires.⁵⁸ MBS-subsidised mental health items by people impacted by the bushfires increased sharply between January and March 2020.⁵⁹

About one-fifth of the people affected by the 2003 Canberra bushfires reported high to very-high levels of psychological distress three years later.⁶⁰

The 2009 Black Saturday bushfires in Victoria, which killed 173 people and destroyed more than 2,000 homes,⁶¹ also caused devastating and long-term mental health problems.⁶² Three years after the fires, people in ‘highly affected’ communities – those in which people had died or properties had been damaged – were more than twice as likely to suffer from post-traumatic stress disorder (PTSD), depression, or severe distress than people in less-affected communities.⁶³ Although many people recovered, these communities still had higher rates of mental health problems than the general population five years later.⁶⁴ These mental health problems are worse for people who confront difficulties with insurance or rebuilding their properties.⁶⁵

A 10-year follow-up of people in highly-affected communities during the Black Saturday bushfires found that about 20 per cent have a probable psychological disorder.⁶⁶ And, a decade after the fires, most of these people were not receiving mental health care.

58. Australian Institute of Health and Welfare (2020, p. 19).

59. Ibid (p. 18).

60. Camilleri et al (2010).

61. Victorian Bushfires Royal Commission (2009, p. 13).

62. Bryant et al (2018).

63. Bryant et al (2014).

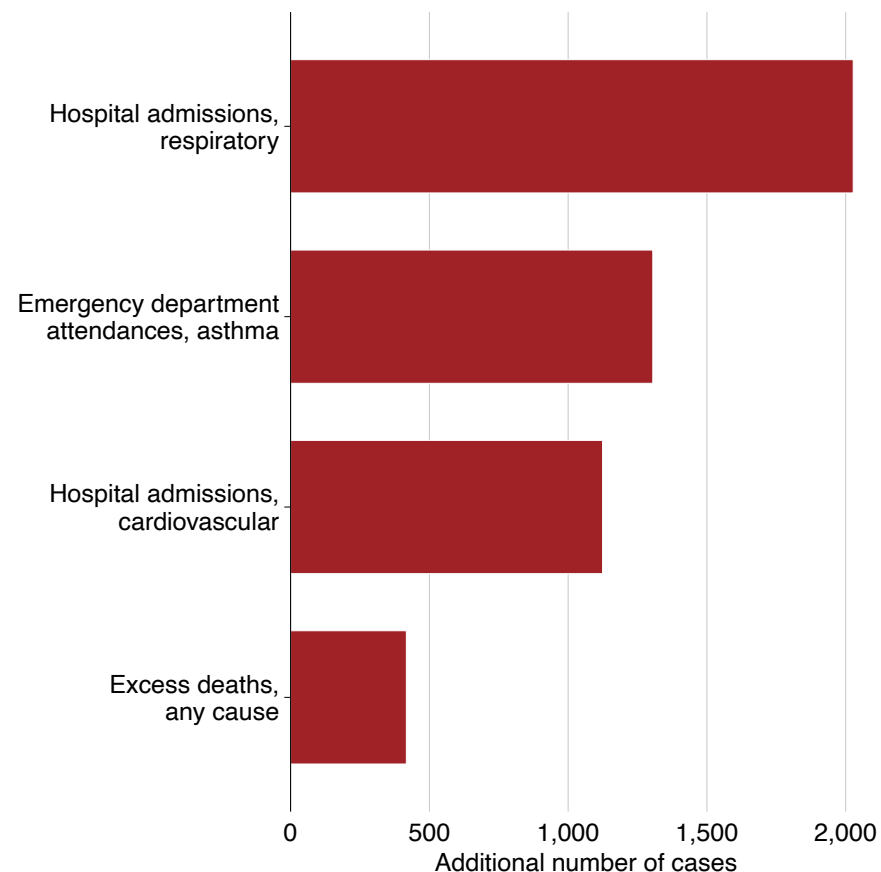
64. Bryant et al (2018).

65. Ibid (pp. 547–549).

66. Bryant et al (2020).

Figure 2.8: Bushfire smoke caused more deaths than the fires during the 2019-20 summer

Additional number of cases caused by bushfire smoke in east-coast states, October 2019-February 2020



Source: Arriagada et al (2020, Box 2).

Firefighters on the front-line are even more likely to suffer mental health problems.⁶⁷ About 15 per cent of firefighters suffer PTSD after fighting a bushfire.⁶⁸ And, like other communities affected by bushfires, alcohol abuse and domestic violence rates also increase.⁶⁹

It's too early to know the full extent of the mental health consequences of the bushfires of 2019-20. But a January 2020 survey of 3,000 Australians found that more than half (54 per cent) felt anxious or worried about the safety of themselves and others during the fires (see Figure 2.2).⁷⁰ This equates to many millions of people feeling an impact on their mental well-being – people living in both regional areas and cities.

2.6 Indigenous Australians are disproportionately affected

A quarter of Indigenous Australians in Victoria and NSW live in areas that were affected by the 2019-20 bushfires.⁷¹ This resulted in 96,000 Indigenous Australians – 12 per cent of Australia's entire Indigenous population – being directly affected by the bushfires.⁷²

Although Indigenous Australians are resilient, and should not be 'viewed solely as vulnerable populations, [or] victims', they may feel the effects of bushfires differently to non-Indigenous Australians.⁷³ For example, connection to country may mean destructive bushfires have a different mental health impact. The Yuin people from the south-coast of NSW said they feared that many sacred sites were damaged or destroyed in the 2019-20 bushfires.⁷⁴

67. Beyond Blue (2018); and Aisbett and Nichols (2007).

68. Fullerton et al (2004, p. 1374).

69. Bryant et al (2018).

70. Biddle et al (2020, p. 5).

71. Williamson et al (2020).

72. Royal Commission into National Natural Disaster Arrangements (2020, p. 799).

73. Williamson et al (2020, p. 15).

74. Pickrell (2020); and Perry and Hayman-Reber (2020).

Bundjalung and Wonnarua academic Vanessa Cavanagh, reported in January 2020 the sense of loss she felt from the bushfires:

The sight of this old tree with her crown removed brought warm, stinging tears to my eyes. It was a deep hurt of losing someone far older and wiser than me. Losing someone who was respected and adored. Someone with knowledge I cannot fathom or comprehend. When I told my mum that evening she reacted similarly, a personal and family loss. To others she might just be a big tree.⁷⁵

Trauma felt by Indigenous Australians could be further exacerbated if they are not included in the recovery processes.⁷⁶

Indigenous Australians have often been excluded as part of fire risk management.⁷⁷ This issue has been highlighted in the recent Royal Commission into National Natural Disaster Arrangements, which recommended that governments engage with Traditional Owners on Indigenous land and fire management.⁷⁸

2.7 Climate change means more frequent, more intense, and longer-lasting bushfires

Bushfires have long been a part of Australian life. But a warming climate means longer heatwaves and less rainfall. These conditions mean there are more days of extreme fire risk (Figure 2.9), and larger and longer-lasting bushfires.

75. Cavanagh (2020).

76. Williamson et al (2020).

77. Analysis by Williamson et al (ibid) of two past bushfire inquiries only briefly mention Indigenous people. The authors note that 'Aboriginal peoples are primarily relegated to an historical footnote, rather than featuring as contemporary residents, as First Peoples, as land and rights holders, or as part of contemporary fire management.'

78. The Royal Commission into National Natural Disaster Arrangements (2020, pp. 386–397).

An ‘attribution’ study published in March 2020 found that human-caused climate change had made the 2019-20 bushfires 80 per cent more likely to happen.⁷⁹ It found that if global temperatures continue to rise to 2°C above pre-industrial levels, bushfires in Australia like those of 2019-20 will be about eight times more likely.⁸⁰

Higher bushfire risk is already being incorporated into financial markets. In California, the average annual insurance payouts from bushfires has risen almost 40-fold over the past half-century, from US\$100 million between 1964-1990 to \$3.7 billion in 2011-2018.⁸¹ This has led insurers to significantly raise their rates or stop providing insurance altogether – which many have already done for floods.⁸²

As bushfires become more frequent and intense, they will affect more Australians more often.⁸³ People repeatedly exposed to bushfire smoke will be more likely to suffer serious health problems including stroke.⁸⁴ Similarly, droughts and heatwaves are also likely to be more frequent and intense as a result of climate change.⁸⁵

79. Oldenborgh et al (2020, p. 26). The lower-bound estimate was 30 per cent. Both estimates are likely to ‘severely underestimate’ the attribution (p. 26) due to underestimations of the main heatwave inputs (p. 1).

80. Oldenborgh et al (ibid, p. 27). Lower bound is four times more likely.

81. Kaufman and Roston (2020).

82. Ibid.

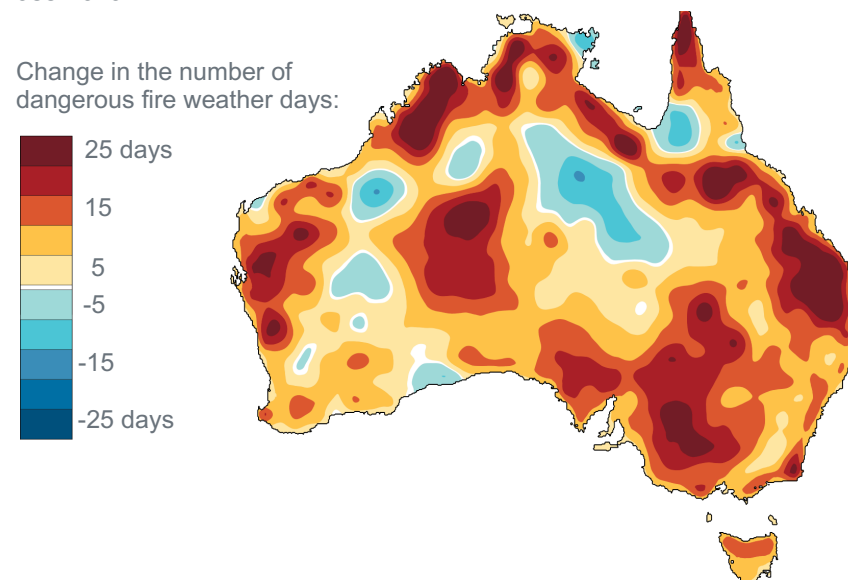
83. As discussed after the 2003 fires in Canberra: Hennessy et al (2005); after the 2009 fires in Victoria: Booth (2009) and Garnaut (2011); and after the 2013 fires in NSW: Hennessy (2013).

84. Huang et al (2019); and Yuan et al (2019).

85. Bureau of Meteorology and CSIRO (2018).

Figure 2.9: Across most of Australia, the number of extreme fire-risk days is rising

Change in number of annual dangerous fire weather days, 1950-1985 to 1985-2020



Note: Change in the annual (July to June) number of days between the two periods on which the Forest Fire Danger Index exceeded its 90th percentile, which is an indicator of dangerous fire weather conditions for a given location.

Source: Bureau of Meteorology and CSIRO (2020, p. 5).

3 Climate change-related natural disasters are increasingly harming Australians' health

Australia is experiencing ever more frequent and severe bushfires, heatwaves, droughts, and floods as a result of climate change. More Australians will feel the impact of these natural disasters on their health.

As the climate gets hotter, the health effects will get bigger. An increasing number of Australians will suffer physical health problems, such as heat stress on yet another sweltering hot day. Children, older people, and people with chronic illnesses are particularly vulnerable.

Many Australians will also have their livelihoods put at risk as worsening droughts, bushfires, and floods destroy homes and businesses. The stress will increase mental health problems, particularly for Australians living in regional and rural communities.

During or after these crises, many Australians will turn to their local GPs or hospitals for medical assistance. Some will recover, others will suffer long-term health effects. This will place a substantial burden, often in peak surges, on health services.

3.1 More frequent and extreme heatwaves

More frequent, intense and longer-lasting heatwaves will increasingly affect the health of Australians.

The Australian Bureau of Meteorology defines a heat wave as 'three days or more of maximum and minimum temperatures that are unusual for the location'.⁸⁶ For example, in Adelaide, a heatwave is three consecutive days at or above 40°C, or five consecutive days at or above 35°C.

86. Heatwave definitions vary between regions, because people have adapted to different environmental conditions.

3.1.1 It is getting extremely hot, more often, for longer

Global temperatures are getting warmer because of climate change.⁸⁷ As greenhouse gases increase in the atmosphere, more heat is being trapped. This leads to warmer temperatures and more days of extreme heat.⁸⁸

Although there are numerous climatic factors that cause heatwaves, climate change is a key contributor to worsening heatwaves.⁸⁹ The Intergovernmental Panel on Climate Change (IPCC) has found that it is 'very likely' that human influence has more than doubled the likelihood of heatwaves in parts of the world, including Australia.⁹⁰

In Australia, the climate has warmed by 1.44°C since 1910, leading to an increase in the frequency of extremely hot days and heatwaves (Figure 3.1).⁹¹ Since the 1950s, the number of heatwaves has increased fivefold.⁹²

87. IPCC (2014).

88. Ibid.

89. Note that heatwaves vary between regions across Australia due to local climatic factors. There is also year-to-year variation in heatwaves due to broader climate phenomena, such as El Niño and La Niña. During El Niño years, Australia generally has below average rainfall and above average temperatures. Conversely, during La Niña years, Australia generally has higher than average rainfall and lower than average temperatures. Heatwaves are also influenced by other weather conditions, as described in Steffen et al (2014, p. 10).

90. IPCC (2014, p. 53); and Reisinger et al (2014).

91. Australia has warmed on average by 1.44°C since national records began in 1910, and most of this warming has occurred since 1950: Bureau of Meteorology and CSIRO (2020, p. 4). This is leading to more heatwaves: Bureau of Meteorology and CSIRO (2018, p. 4) and Bureau of Meteorology and CSIRO (2020, pp. 22–23).

92. Bureau of Meteorology and CSIRO (2018, p. 4).

Heatwaves are getting hotter in Australia. The 2019-20 summer was not only Australia’s second hottest summer on record (behind the previous summer), but it also broke hottest-day records.⁹³ On Tuesday 16 December 2019, BOM recorded Australia’s hottest average day at 40.9°C. The record was broken the following day,⁹⁴ Wednesday 17 December, with an average maximum temperature of 41.9°C.⁹⁵

Heatwaves are also becoming longer and occurring earlier.⁹⁶ Between 2000 and 2017, the average length of a heatwave increased by more than two days.⁹⁷

Recent examples of heatwaves in Australia include the January 2009 Victorian heatwave (see Box 1 below), which was followed by a devastating bushfire season (‘Black Saturday’).⁹⁸ A heatwave in January 2013 was unprecedented in duration and scale, affecting most of the country.⁹⁹

Heatwaves will continue to worsen.¹⁰⁰ The IPCC has projected that heatwaves are ‘very likely’ to occur more often and last longer.¹⁰¹ The largest increases in frequency and duration of heatwaves are expected to occur in northern tropical regions of Australia.¹⁰² Under a high-emissions scenario, central, northern, and north-western Australia are likely to have more than 130 days per year over 40°C by 2100.¹⁰³ Southern Australia will also have hotter heatwaves, with maximum

93. Bureau of Meteorology (2020c).

94. Ibid.

95. Ibid.

96. Perkins and Alexander (2013); and Steffen et al (2014, pp. 5-6, 9).

97. Zhang et al (2018, 474.e2). This was for Brisbane, Melbourne, and Sydney.

98. Bureau of Meteorology (2009).

99. Bureau of Meteorology (2013).

100. Bureau of Meteorology and CSIRO (2018, p. 4).

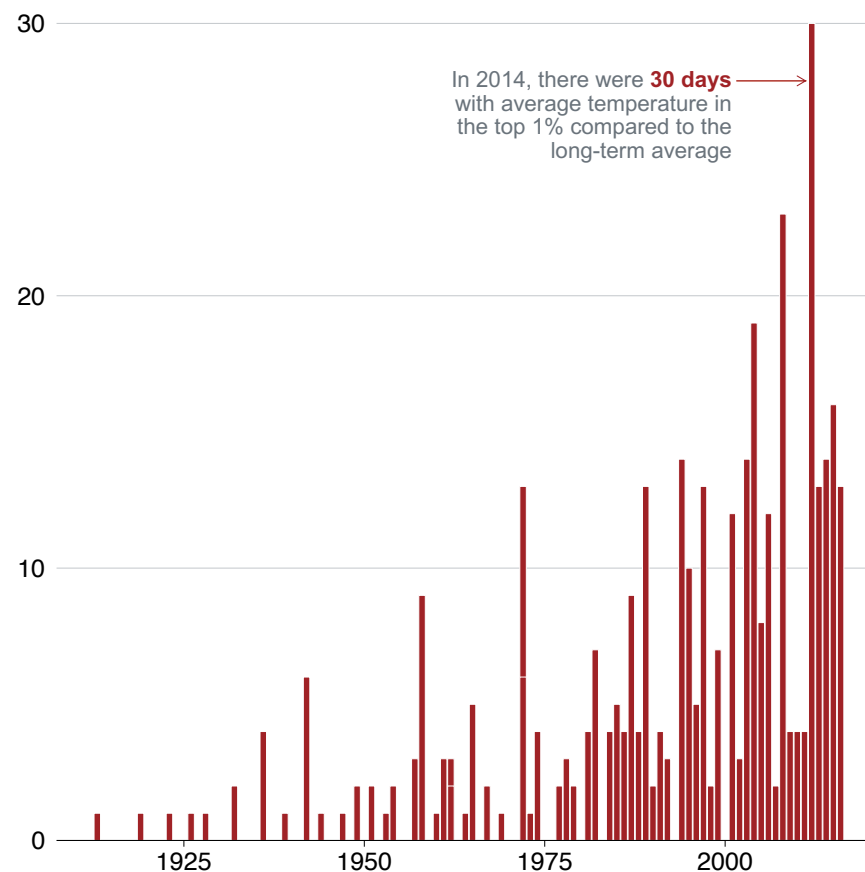
101. IPCC (2014, p. 10); and Perkins-Kirkpatrick et al (2016).

102. Cowan et al (2014).

103. Reisinger et al (2014, p. 1402).

Figure 3.1: Extremely hot days are becoming more frequent

Number of days in the top 1 per cent of Australian temperatures between 1910-2017



Source: Bureau of Meteorology and CSIRO (2018, p. 4).

temperatures projected to increase by about 3°C by the end of the Century.¹⁰⁴

Australians living in cities are likely to feel the effects of heatwaves more intensely, because urban environments absorb and trap heat, making the city warmer than the surrounding regional area.¹⁰⁵

3.1.2 Heatwaves are a health risk

On days of extreme heat, people can suffer dehydration, heat stress, and exhaustion.¹⁰⁶ In severe cases, hot temperatures can increase the risk of circulatory and respiratory problems.¹⁰⁷

More people require hospital care on hot days,¹⁰⁸ and more again during heatwaves. A study in NSW looked at hospital admissions between 1998 and 2006. It found that during heatwaves there was a six-fold increase in people going to hospital for heat-related concerns (such as heat stroke) and a significant increase in the number of people with dehydration and other disorders of fluid balance.¹⁰⁹

The extent of the health impacts depends on the severity and duration of the heatwave. A 13-day heatwave in 2009 in Adelaide that reached a maximum temperature of 45.7°C resulted in a 14-fold increase in heat-related hospital admissions.¹¹⁰ This hospitalisation rate was much higher than a similarly long but less intense heatwave the year before.¹¹¹

104. Cowan et al (2014).

105. Hoegh-Guldberg et al (2018, p. 180) and Guo et al (2016). This is known as the 'urban heat island' effect.

106. World Health Organisation (2020b).

107. World Health Organisation (2020b); and De Blois et al (2015).

108. Patel et al (2019); Campbell et al (2019); and Schaffer et al (2012).

109. Khalaj et al (2010, p. 837).

110. Nitschke et al (2011).

111. Ibid.

Given the number of extremely hot days is projected to increase, the number of Australians with heat-related health concerns will continue to increase.

3.1.3 Heatwaves can kill

Extreme heat can lead to heatstroke, which often kills.¹¹² Over the past 200 years, heatwaves have caused more deaths than all other extreme weather events combined.¹¹³

But many deaths caused by heat in Australia aren't officially recorded as such. Researchers estimate that heat-related deaths are at least 50 times higher than official records.¹¹⁴

During a 2011 heatwave in NSW, when maximum temperatures in the Hunter Valley were over 39°C for six consecutive days, hospitals recorded a 13 per cent increase in the number of deaths.¹¹⁵

A small proportion of these heat-related deaths could be offset by a warming climate. As temperatures get warmer there will be fewer deaths in winter (see Figure 3.3). A 2015 study comparing likely deaths from temperature extremes in the three biggest Australian cities found that Brisbane and Sydney are likely to have many more deaths overall each year under all future climate scenarios (Figure 3.4).¹¹⁶ But in Melbourne there could be fewer deaths overall, because there are likely to be fewer deaths in winter.

112. Deaths are more likely to occur on days with exceptionally high temperatures than when there are consecutive days of high temperatures: Xu et al (2016).

113. Coates et al (2014).

114. Longden (2019) and Longden et al (2020).

115. Schaffer et al (2012).

116. Guo et al (2016). Climate scenarios have been projected by the IPCC: IPCC (2014).

Box 1: The 2008-09 summer heatwave in southern Australia

During the 2008-09 summer, southern Australia endured a seven-day heatwave between 26 January and 1 February. For five days, the maximum temperature in Melbourne averaged 15°C above the average temperature for that period. The hottest of these days was 45.1°C.

This heatwave caused health problems.^a Many people suffered mild health issues such as dehydration and heat stress that required hospitalisation, but others also suffered severe problems such as heat stroke (Figure 3.2).

Ambulance Victoria was in huge demand, with call-outs over the three hottest days increasing by 46 per cent compared to the same period the previous year. Most of the call-outs were for heat-related conditions such as dehydration, heat stress, and heat stroke.

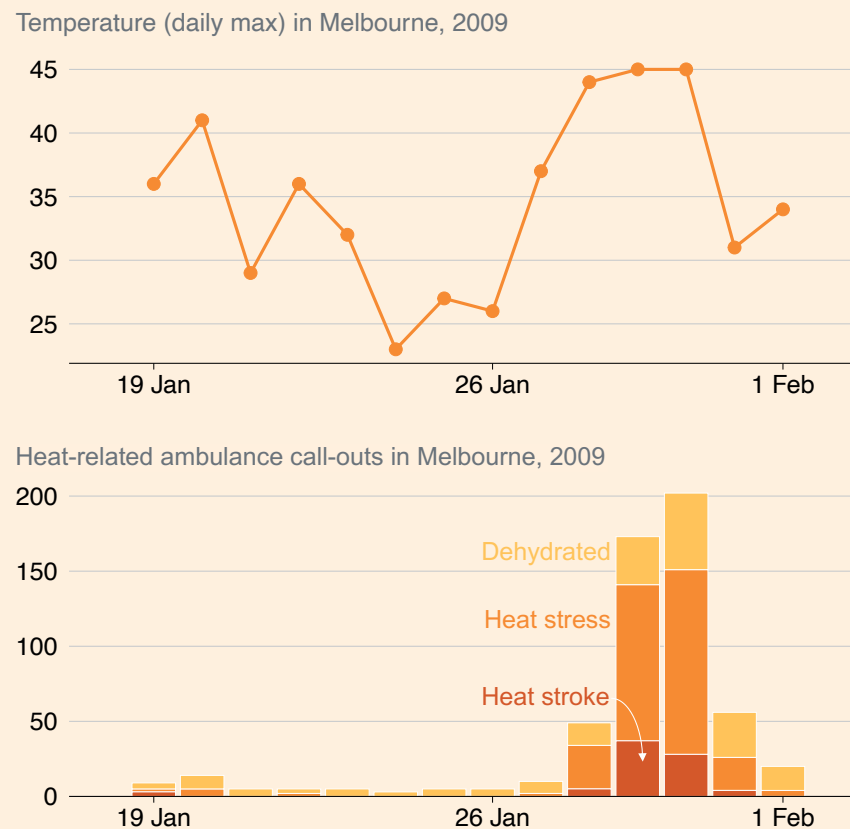
Victorian hospitals were also under pressure. There was a 12 per cent increase in people going to emergency departments over the week of the heatwave – 2,820 more cases than for the same period in 2008.

Many people suffering in the heat died. The Victorian Government estimated that during the heatwave, there were about 374 more deaths than usual, including 126 people who were dead on arrival at hospital.

Older people were affected particularly severely. Over the week, 61 per cent of the heat-related ambulance call-outs were for people aged 75 or older, and about 69 per cent of the deaths recorded on arrival at hospitals were of people aged 75 or older.

a. Department of Health and Human Services (Victoria) (2012).

Figure 3.2: Ambulance Victoria call-outs for heat-related conditions increased dramatically during the week of the heatwave



Source: Department of Health and Human Services (Victoria) (2012, Figure 3).

3.1.4 Heatwaves exacerbate mental health problems

During heatwaves in Adelaide between 1993 and 2006, 7.3 per cent more people than usual went to hospital with a mental health problem.¹¹⁷ Heatwaves particularly affect the mental health of older people and people with existing problems such as dementia.¹¹⁸ These effects tend to be take longer to emerge than physical health effects.

3.2 Longer and more severe droughts

As droughts become longer and more severe in Australia, mental health rates will worsen.

Droughts have long been part of Australian regional and rural life, but recent Australian droughts have been the longest and most intense.¹¹⁹ Fossil records from across Australia show that the 1996-2009 Millennium drought was larger and longer than any other drought in southern Australia in the previous 400 years.¹²⁰

The current drought in south-eastern Australia is stacking up to be even worse. For many areas across the Murray-Darling Basin, it is the most severe drought in 120 years of Bureau of Meteorology records.¹²¹ The drought comes after almost three decades of record-low rainfall across the south-west and south-east of the country (Figure 3.5).¹²² Climate scientists predict that in the coming decades, droughts will be longer still in southern parts of Australia.¹²³

117. Hansen et al (2008).

118. Ibid.

119. Freund et al (2017).

120. Ibid.

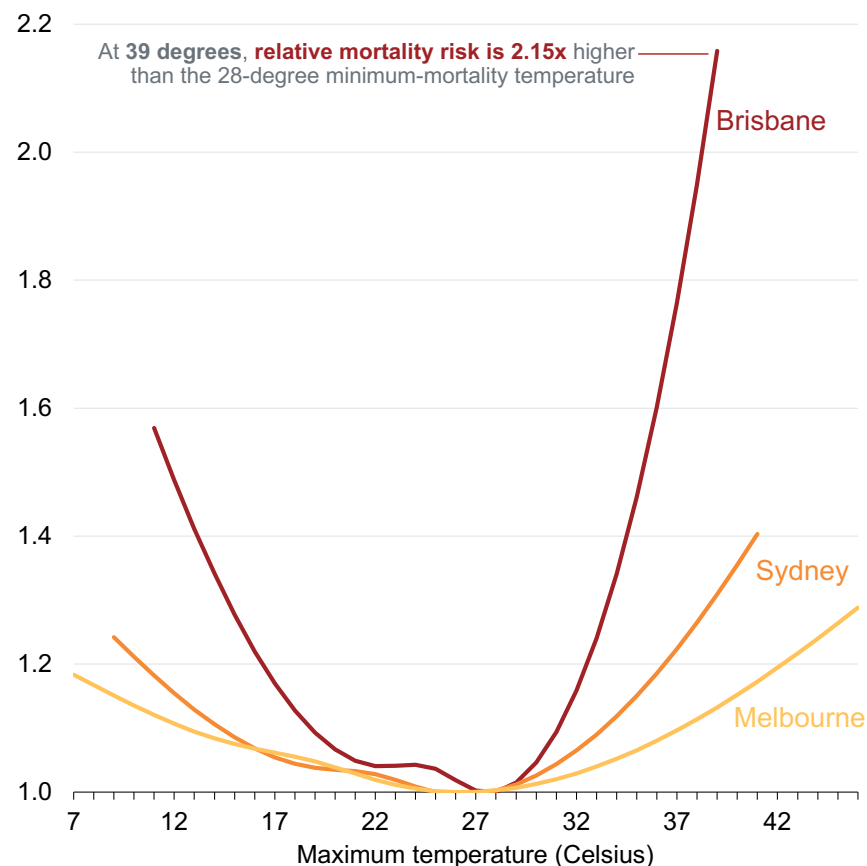
121. Doyle (2019).

122. Bureau of Meteorology and CSIRO (2018).

123. Reisinger et al (2014, p. 1380); and CSIRO (2019).

Figure 3.3: Temperature-related deaths occur in both colder and warmer weather

Relative risk, per cent, compared to the minimum-mortality temperature for each city during 1990-2009



Source: Guo et al (2016).

3.2.1 As droughts get worse, so will mental health problems

Financial hardship caused by drought can lead to emotional distress, depression, and suicide.¹²⁴ A study in NSW showed that over the period 1964 to 2011, for every 300mm reduction in rainfall there was about an 8 per cent increase in the suicide rate.¹²⁵

Farmers are particularly more likely to suffer mental health problems during drought,¹²⁶ especially those that find it difficult to innovate and adapt their farming businesses to changing environmental conditions.¹²⁷

The federal Department of Agriculture estimates that changes in climate since 2000 have reduced broadacre farm profits by 22 per cent.¹²⁸ This included a 35 per cent decline in crop profits and an 8 per cent decline in livestock profits.¹²⁹ The flow-on effects of drought can put strain on other members of the community.¹³⁰

Prolonged drought can also damage adolescents' mental health. One study showed that after three years of drought, emotional distress among young people increased significantly.¹³¹

3.3 Floods, storms and cyclones

In northern parts of Australia, floods, storms, and cyclones have long been a part of life. The health consequences are substantial and will worsen with climate change.

124. Austin et al (2018); Feller and Vaseva (2014); Stanke et al (2013); Guiney (2012); Polain et al (2011); and Carnie et al (2011).

125. Colin and Hanigan (2006).

126. Austin et al (2018).

127. Hogan et al (2011).

128. N. Hughes et al (2019).

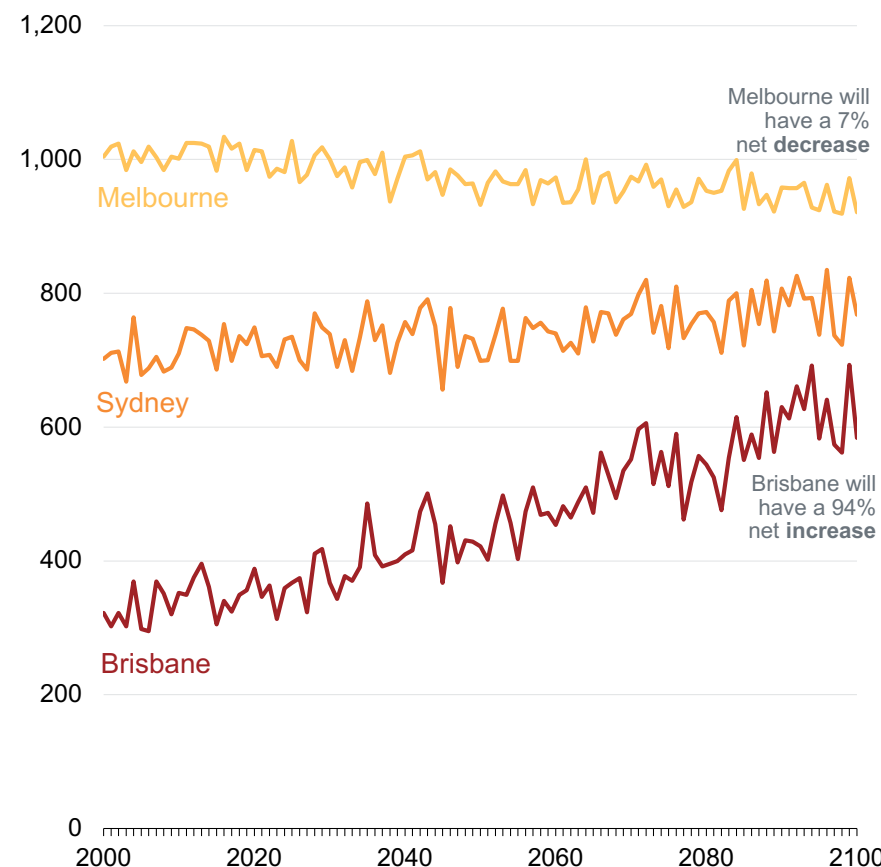
129. Ibid.

130. Vins et al (2015).

131. Dean and Stain (2010).

Figure 3.4: Climate change will increase temperature-related deaths in Brisbane and Sydney

Projected number of temperature-related deaths per year under a 'medium' climate scenario



Note: This is under the 'A1B' scenario, which includes very rapid economic growth, low population growth, and the rapid introduction of new and more efficient technologies, with a balanced emphasis on all energy sources.

Source: Guo et al (2016).

3.3.1 Floods are becoming more frequent and intense

Floods are becoming more frequent and intense in northern and eastern Australia, in part because of climate change.¹³²

As global temperatures increase, heavy rainfall is expected to become more intense.¹³³ This is because the warmer the temperature, the more water can be held in the atmosphere. The Bureau of Meteorology and CSIRO have estimated that for every degree in warming, the amount of rain falling on heavy rain days is expected to increase by about 7 per cent, and even more during flash floods.¹³⁴

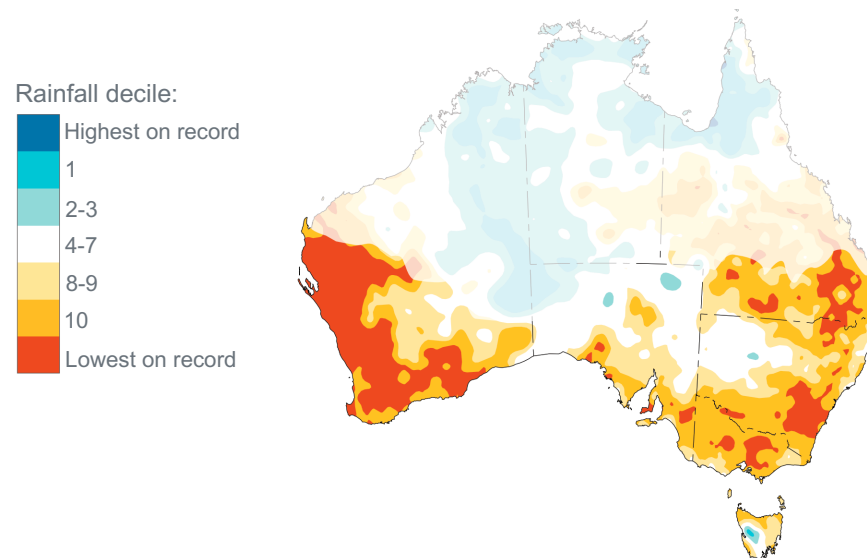
In Australia, rainfall is highly variable and influenced by naturally occurring climate patterns such as El Nino, La Nina, and the Indian Ocean Dipole. Figure 3.6 shows that in the wet seasons in the 20 years to 2018, much of north and west Australia had its highest ever recorded rainfall.¹³⁵

Climate scientists predict that Australia will have more intense storms in future, with stronger winds and more rainfall.¹³⁶ Heavy rainfall can result in flooding, particularly around river catchments.¹³⁷ Coastal flooding is caused by storm surges and high tides.¹³⁸

Under a high emissions scenario, there is expected to be more floods across northern and eastern Australia, as well as in the Murray-Darling basin.¹³⁹ As the frequency of devastating floods rises, parts of Australia

Figure 3.5: Big parts of Australia are suffering a big dry

April to October rainfall deciles for the 20 years to 2018, compared to all years since 1900



Source: Bureau of Meteorology and CSIRO (2018, p. 6).

132. Bureau of Meteorology and CSIRO (2018).

133. Ibid (p. 8).

134. Ibid (p. 8).

135. Ibid (pp. 6–7).

136. Bureau of Meteorology and CSIRO (2018, p. 22); and CSIRO and Bureau of Meteorology (2015, p. 8).

137. Longman et al (2019).

138. Bureau of Meteorology and CSIRO (2018); and CSIRO and Bureau of Meteorology (2015).

139. Hirabayashi et al (2013, Figure 1 and 2).

will see '100-year floods' every 5 to 25 years.¹⁴⁰ Partly lost among the smoke and the virus, NSW experienced major flooding during 2020.¹⁴¹

The risk of flooding from cyclones is getting lower. Tropical cyclones have become less frequent over the past 40 years, and climate scientists expect the number will continue to decline.¹⁴² Climate change may nevertheless increase the intensity of cyclones when they do hit,¹⁴³ and extend their range further down into southern parts of the country.¹⁴⁴

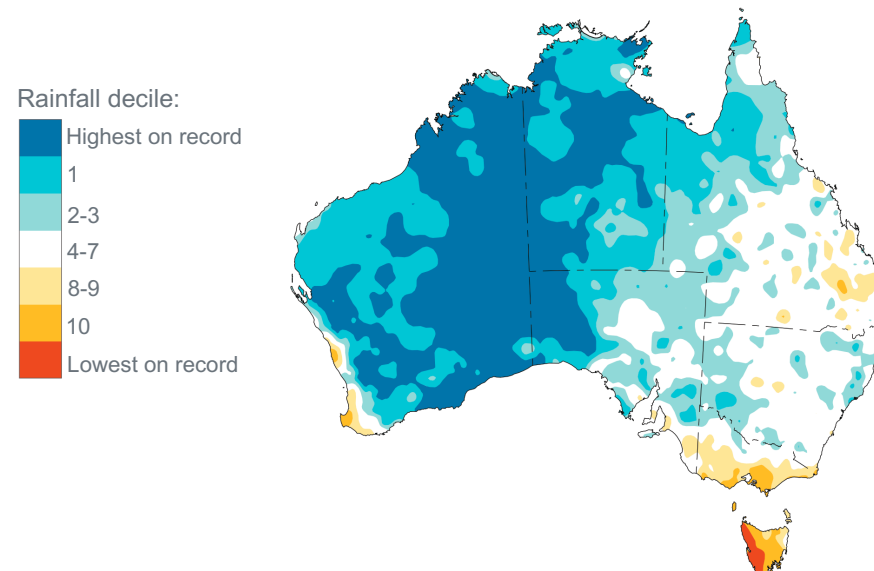
3.3.2 Floods and cyclones cause injury and death

Over the past 40 years in Australia, increasingly more people have been injured or killed by floods,¹⁴⁵ through drowning, exposure to fallen electrical wires, or by being struck by falling debris or flying objects.¹⁴⁶

In an investigation after the 2017 flooding across the Northern Rivers, more than one-fifth reported still being distressed six months after the flood.¹⁴⁷ About 15 per cent had probable PTSD, and 7 per cent had suicidal ideation.¹⁴⁸

During the Townsville flood in February 2019, an additional 780 people attended the hospital emergency department compared to the same month in the previous year.¹⁴⁹

Figure 3.6: Rainfall during the northern wet season has been extreme



Note: Northern wet season (October-April) rainfall deciles for the 20 years from 1998-99 to 2017-18, compared with the entire national rainfall record from 1900.

Source: Bureau of Meteorology and CSIRO (2018, p. 7).

140. Ibid (Figure 1).

141. Wahlquist (2020).

142. Bureau of Meteorology and CSIRO (2018, p. 9).

143. Reisinger et al (2014, p. 1374).

144. CSIRO and Bureau of Meteorology (2015, p. 8).

145. Hu et al (2018).

146. Doctors for the Environment Australia (2017).

147. University Centre for Rural Health (2019).

148. Ibid.

149. Townsville Hospital and Health Service (2019).

After a flood, people are at risk of infectious disease and gastrointestinal illness from contaminated food or dehydration.¹⁵⁰ Mould inhalation increases the risk of asthma and respiratory problems.¹⁵¹

Tropical cyclones similarly cause illness and injury. During Cyclone Yasi in January 2011, there was a 40 per cent increase in the number of people going to the Townsville hospital emergency department.¹⁵²

3.3.3 Mental health is a substantial health risk from floods

Injury and death are immediate consequences of major floods, but mental health issues are more long-term and widespread.

The emotional and financial strain can lead to or exacerbate mental health problems, most commonly post-traumatic stress disorder.¹⁵³ Mental health effects can be long-lasting, with many people reporting an issue one year after a flood.¹⁵⁴ Prescription rates for anti-depressants also increase in the year after a flood.¹⁵⁵

During the 2010-11 Queensland floods, mental health costs were the biggest health cost (see Box 2).¹⁵⁶

A survey of people aged 60 or older, conducted before and after a flood, found that those personally affected by the flood (i.e. those who suffered financial loss or damage) reported significantly higher PTSD symptoms.¹⁵⁷ About 15 per cent of those personally affected had serious mental health issues that would require clinical treatment.

150. Department of Health and Human Services (Victoria) (2020a).

151. Ibid.

152. Aitken et al (2015).

153. Stanke et al (2012).

154. Munro et al (2017).

155. Milojevic et al (2017).

156. Deloitte Access Economics (2016).

157. Bei et al (2013).

People with greater flood exposure and lack of social support were more likely to have physical and mental health problems after the flood.

A study of the 2010-11 floods in Brisbane found that people whose houses were damaged were five times more likely to have poorer health, and two times more likely to have probable PTSD.¹⁵⁸ Another study found that mental health rates are higher among people displaced from their homes during floods.¹⁵⁹

3.4 Some Australians are more at risk

People with existing health problems, older Australians, children, people who work outdoors, and people from lower socio-economic groups are more vulnerable to the health impacts of natural disasters.

People's existing health problems are likely to get worse during heatwaves. This is especially the case for people with diseases of the circulatory system, the respiratory system, and the nervous system.¹⁶⁰

Older Australians are more likely to have existing health problems, such as cardiac disease, which make them more vulnerable. For example, during a 2011 heatwave in NSW, there was an 8 per cent increase in people aged 75 and older going to emergency departments.¹⁶¹ A study of heatwaves in Adelaide in 2008 and 2009 found that older people were more likely to go to hospital with renal problems.¹⁶² And a European study found that for every 1°C increase in temperature above a threshold, people aged 75 and older attending hospital for respiratory conditions increased by 14 per cent.¹⁶³

158. Alderman et al (2013).

159. Munro et al (2017) found a 95 per cent increase in the likelihood of depression when displaced compared to when not displaced.

160. Khalaj et al (2010).

161. Schaffer et al (2012).

162. Nitschke et al (2011).

163. Michelozzi et al (2009).

Box 2: The Queensland floods of 2010-2011

The summer of 2010-11 was devastating for many Queenslanders. Heavy rain began in early November and barely stopped. Most of the flooding was in and around the Brisbane River catchment, but by January, flooding had hit more than 75 per cent of the state. Thousands of homes and businesses were destroyed. More than 2.5 million people were affected in some way.^a The Queensland Government declared a disaster zone.

Thirty-six people died in the floods. About 100 people suffered severe injuries and 200 minor injuries.

Deloitte Access Economics calculated the economic cost of the disaster to be \$14.1 billion.^b About half of this was health costs, and the biggest health cost was mental health, at \$5.1 billion (Figure 3.7).

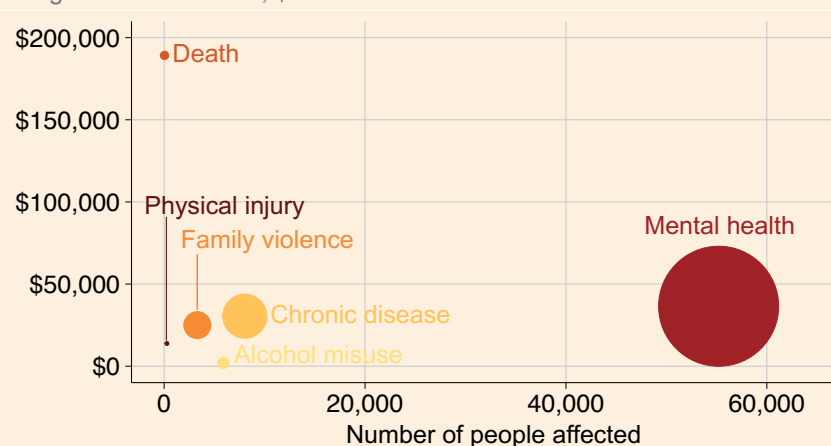
After the floods, family violence and alcohol abuse increased. Many people had long-lasting health problems. One study found that six months after the flood, those directly affected were five times more likely to report worse health problems.^c Many of these people cited mental health problems, including psychological distress, poor sleep, and PTSD symptoms. Respiratory problems were also commonly cited.

- a. Deloitte Access Economics (2016, pp. 33–37).
- b. Ibid (pp. 33–37).
- c. Alderman et al (2013).
- d. L. Hughes and McMichael (2011, p. 16).

The Queensland Government invested \$37.8 million on mental health support after the flood.^d

Figure 3.7: Mental health costs after the 2010-11 floods were higher than any other health cost

Average annual unit cost, \$2015



Source: Deloitte Access Economics (2016, p. 37).

Extreme temperatures can also lead to older people dying earlier than would be expected. A study of heatwaves across major Australian cities between 1988 and 2011 found that people aged 75 or older were 28 per cent more likely to die.¹⁶⁴

Children are particularly vulnerable to extreme heat. Young children can suffer renal disease, respiratory disease, electrolyte imbalance, and fever.¹⁶⁵ During heatwaves, the number of children being taken to emergency departments increases by about 15 per cent, and more for children aged 5 or younger.¹⁶⁶

People who do heavy physical labour outdoors are also more likely to suffer during extreme heat,¹⁶⁷ especially tradespeople and agriculture workers.¹⁶⁸

After the 2010-11 Queensland floods, women were more likely than men to suffer psychological distress.¹⁶⁹ This is partly because domestic violence increases after a disaster.¹⁷⁰

People already struggling with mental health or other health problems tend to suffer more if they are hit by disaster.¹⁷¹ And people on lower incomes are less able to deal with the financial toll.

Indigenous Australians may also suffer the health effects of natural disasters at higher rates than, or differently to, non-Indigenous Australians (see also Section 2.6). They are 2.3 times more likely to have pre-existing health conditions such as cardiovascular disease,

diabetes, mental disorders, and chronic respiratory diseases.¹⁷² This could make Indigenous Australians more vulnerable to the health affects of heatwaves, floods, and so on, although there is limited research on the specific effects of environmental risk factors on Indigenous people's health.¹⁷³

164. Cheng et al (2018).

165. Xu et al (2014).

166. Campbell et al (2019).

167. De Blois et al (2015).

168. Xiang et al (2014).

169. Alderman et al (2013).

170. Alderman et al (2013); and Clemens et al (1999).

171. Alderman et al (2013).

172. Australian Institute of Health and Welfare (2011).

173. Knibbs and Sly D. (2014).

4 The health sector must better prepare for a changing climate

The previous chapters have shown the current impact of climate change on health. Governments need to act now to minimise potentially even worse health affects from natural disasters in the future.

Authorities should improve their communication to the public of health risks from exposure to bushfire smoke. Health departments should build more resilience in the healthcare system, so that bushfires and other natural disasters do not compromise healthcare. Governments also need to do more to address the mental health problems people suffer as a result of natural disasters.

The actions of all states and territories need to be aligned through a national forum, and be integrated under a broader climate change response strategy.

4.1 Governments are not doing enough to address the health impacts from climate change

Health policy in Australia does not adequately consider the increasing health risks associated with climate change. At a national level, there are no policy initiatives to address the health risks from climate change. While the Department of Health states that its vision is ‘better health and wellbeing for all Australians, now and for future generations’,¹⁷⁴ climate change is not once mentioned in *Australia’s Long-term National Health Plan*, nor is it listed as a national health priority.¹⁷⁵

Australia is not keeping up with the rest of the world. In 2018, the MJA-Lancet Countdown¹⁷⁶ surveyed 101 countries and found that most had a climate and health strategy, including the United States, France, and Germany.¹⁷⁷ Australia did not.

In 2020, the updated MJA-Lancet Countdown provided a set of indicators with which the Australian Government could monitor its progress on health and climate change.¹⁷⁸ These indicators were in five categories: exposure to temperature change; adaptation, planning and resilience for health; mitigation actions and health co-benefits; economics and finance; and public and political engagement.

Overall, the 2020 report found that Australia lacked adaptive capacity and was not making progress in reducing emissions.¹⁷⁹ But, at the state level, where primary responsibility for healthcare lies, the picture looks a bit better. Some state governments have begun planning for the increased risk to health from climate change. Victoria¹⁸⁰ and Queensland¹⁸¹ have climate change and health plans, and Western Australia has launched an independent inquiry on the issue.¹⁸²

174. Department of Health (2019a).

175. Department of Health (2019b).

176. The Lancet in 2015 began a countdown to 2030 against 40 indicators to measure countries’ progress towards addressing climate change health risks. See Zhang et al (2018), Beggs et al (2019) and Zhang et al (2020).

177. Watts et al (2019). Although these plans are not perfect. Fewer than 20 per cent of the countries that had a plan had put it into action. Even fewer (only 16 per cent) had provided funding to help implement the plan. Another problem was that many of the plans were not comprehensive and were more than five years old.

178. Zhang et al (2020).

179. Ibid (p. 7).

180. See Victorian Government (2019) and Department of Health and Human Services (Victoria) (2020b).

181. See Queensland Government (2018).

182. See Department of Health (Western Australia) (2020).

But there needs to be a much stronger focus on practical actions, particularly in strengthening the healthcare system response.

State governments must develop targeted health interventions to protect Australians' health from climate change risks, including measures that reduce exposure to health risks such as air pollution.

4.2 Monitor climate-related health risks

Governments should collect data on and monitor climate-related health risks. Information about health risks enables public health departments to design targeted policies that protect vulnerable people.

Effective climate change health surveillance should have the following features:

- Adequate systems and technologies for comprehensive data collection (e.g. comprehensive coverage of air quality monitors across the jurisdiction).¹⁸³
- Real-time monitoring (e.g. hourly reporting of air quality).¹⁸⁴
- Coverage of multiple indicators, including environmental (e.g. temperature) and health service indicators (e.g. ambulance callouts, emergency department presentations).¹⁸⁵
- Integrated data on environmental and health risks.¹⁸⁶ A good example is the model proposed for Victoria's Environmental Health Tracking System.¹⁸⁷

183. Some jurisdictions have air quality monitors in cities only, meaning regional areas that are generally more affected by bushfire smoke may not be able to get accurate readings.

184. Vardoulakis et al (2020).

185. Some state governments currently receive health data from hospitals only after a lag of a couple of weeks.

186. Fitzgerald et al (2019).

187. Edokpolo et al (2019).

- The ability to pin-point vulnerable regions or groups, to target messaging and health system responses to those most at risk.¹⁸⁸
- Data on both immediate and direct health effects (e.g. injury and death), but also long-term and indirect effects (e.g. mental health).¹⁸⁹
- Forecasting of future risks (e.g. building climate change scenarios into the system to understand future vulnerabilities and their potential impact on the health system).

Currently, Australia's health surveillance systems are slow,¹⁹⁰ and largely focus on infectious diseases. Environmental monitoring (e.g. of air quality or temperature) is often a function separated from health departments.¹⁹¹ This can lead to lack of action, and confusion about accountability. Monitoring of the health system's capacity is sometimes unsophisticated, relying on individuals reporting a problem.¹⁹²

4.3 Make people more aware of the health risks from bushfire smoke

Governments must provide clearer, more detailed information that is easily available to the public when bushfire smoke causes high pollution. This should be consistent across jurisdictions, to avoid confusion.

At the moment there are inconsistencies. For example, Figure 4.1 shows that current classifications of air quality in NSW (right panel)

188. Benjamin (2016).

189. Fitzgerald et al (2019); Bryant et al (2018); and Bryant et al (2020).

190. Fitzgerald et al (2019).

191. e.g. EPA monitors air quality, BOM monitors temperature, and Department of Health monitors disease. Although these agencies often work well together, institutional barriers can make real-time, integrated monitoring difficult.

192. Fitzgerald et al (2019).

do not distinguish between very high levels of PM_{2.5}. This means that the same advice is given to the public on days with PM_{2.5} of 60 (as in Sydney at the start of last summer) and 200 (at the peak of the bushfire smoke haze).

The newly released categories from ACT Health (on the left panel of Figure 4.1) give people better information about the risks to health when pollution levels are high.

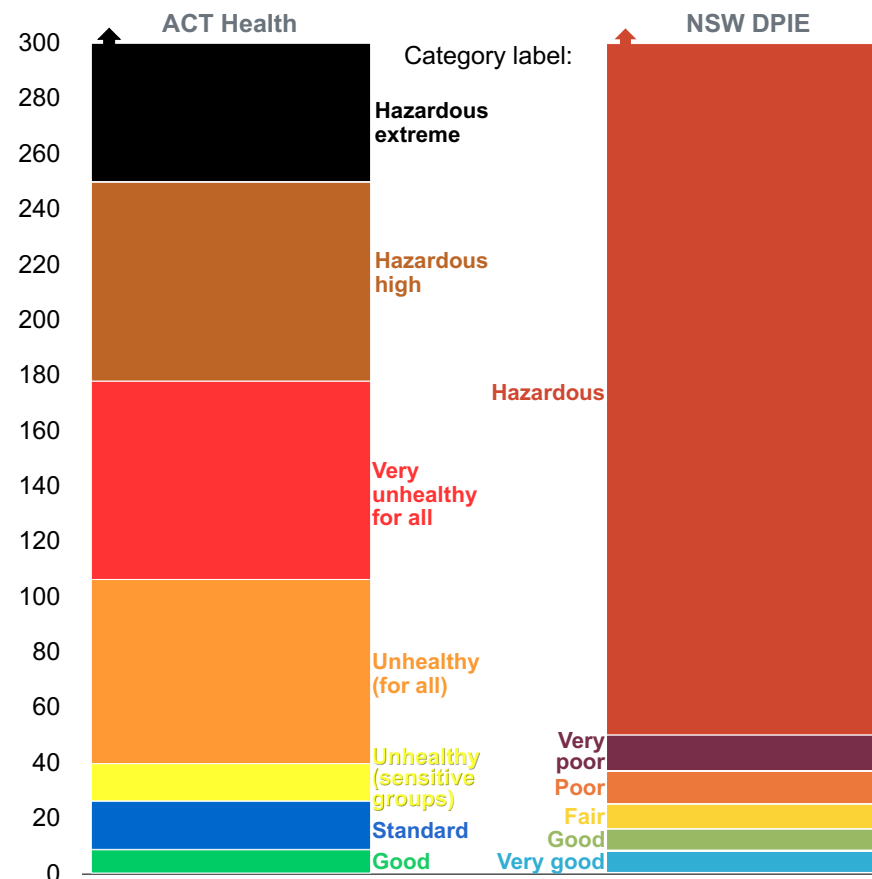
ACT Health's advice for each air quality category (see Figure 4.2) is also more detailed than other governments.

For example, current advice for 'hazardous' days in NSW, provided on the Department of Planning, Industry and Environment (DPIE) website alongside air quality ratings, is: 'Sensitive groups should avoid all outdoor activities. Other adults should avoid strenuous outdoor activities.'¹⁹³ By contrast, ACT Health's advice for days of 'hazardous high' air quality is: 'Everyone should avoid all physical activity outdoors. Sensitive groups should temporarily relocate to a friend or relative living outside the affected area. If this is not possible, remain indoors and keep activity levels as low as possible.'¹⁹⁴

Called to action by the bushfires, the Australian Health Protection Principal Committee (AHPPC) has endorsed a national air quality messaging framework for hourly reporting of PM_{2.5}. State and territory environment agencies are attempting to implement the framework for the 2020-21 bushfire season.

Governments should also develop health alert systems for bushfire smoke.¹⁹⁵ Health warning systems can reduce the number of people

Figure 4.1: Air quality categories in the ACT and NSW are different
PM_{2.5}µg/m³



Note: DPIE = Department of Planning, Industry and Environment.

Sources: ACT Health (2020); Department of Planning, Industry & Environment (NSW) (2020b).

193. Department of Planning, Industry & Environment (NSW) (2020b).

194. ACT Health (2020). Note that these instructions were updated in February, after the worst cases of bushfire smoke.

195. For example, NSW's air pollution health alerts: Department of Planning, Industry & Environment (NSW) (2020b).

who get sick, by advising communities of imminent risks to their health and steps they can take to protect themselves.

Air quality alert systems should target at-risk people and provide practical information about how they can minimise health risks.¹⁹⁶

Air quality alert systems should also give people guidance on:

- How to minimise air pollution in the home during short- and long-exposure periods.¹⁹⁷
- How to minimise exposure to air pollution if staying at home is not possible.¹⁹⁸
- Appropriate actions for employers, schools, and other organisations to reduce people’s exposure, including whether outdoor activity should be prohibited.

Health messages should be tailored for different at-risk groups. For example, messages for people with asthma should be different to messages for pregnant women, and different again for people working outdoors.¹⁹⁹

Alerts should also be issued before planned hazard reduction burns to warn people of air quality risks.²⁰⁰

4.4 Warn people about broader climate-related health risks

Climate change is not only increasing the severity of bushfires (see Section 2.7), it is increasing the likelihood and intensity of other natural disasters such as heatwaves, droughts, and floods.²⁰¹

196. Ibid.

197. Vardoulakis et al (2020).

198. Ibid.

199. Borchers Arriagada et al (2019); and Abdo et al (2019).

200. Broome et al (2016).

201. Bureau of Meteorology and CSIRO (2018).

Figure 4.2: From February 2020, ACT Health provided more detailed guidance for high air pollution days

Screenshot of the ACT Health: Health advice for smoky air (PM_{2.5}) website

| Health advisory categories | PM _{2.5} (24 hour) µg/m ³ | Potential health effects without following advice or actions | Cautionary health advice/actions** |
|--------------------------------|---|--|---|
| Good | 0-8.9 | N/A – Below the relevant air quality standard | None |
| Meets air quality standard | 9-25.9 | N/A – Meets the relevant air quality standard | No tailored advice necessary |
| Unhealthy for sensitive groups | 26-39.9 | Symptoms may occur in sensitive groups | Sensitive groups^a should reduce prolonged or heavy physical activity. Where possible, these people in the community should also limit the time spent outdoors Anyone with a heart or lung condition should take their medication as prescribed by their doctor. People with asthma should follow their asthma action plan. Anyone experiencing wheezing, chest tightness or difficulty breathing should seek urgent medical attention |
| Unhealthy for all | 40-106.9 | Increased likelihood of effects for sensitive groups Symptoms may occur in the general population | Everyone should reduce prolonged or heavy physical activity Sensitive groups^a should avoid prolonged or heavy physical activity altogether Anyone with a heart or lung condition should take their medication as prescribed by their doctor. People with asthma should follow their asthma action plan. Anyone with concerns about their health should seek medical advice from their doctor. Anyone experiencing wheezing, chest tightness or difficulty breathing should seek urgent medical attention |
| Very unhealthy for all | 107-177.9 | Significant likelihood of effects for sensitive groups Symptoms among general population common | Everyone should avoid prolonged or heavy physical activity Sensitive groups^a should avoid all physical activity outdoors Anyone with a heart or lung condition should take their medication as prescribed by their doctor. People with asthma should follow their asthma action plan. Anyone with concerns about their health should seek medical advice from their doctor. Anyone experiencing wheezing, chest tightness or difficulty breathing should seek medical attention |
| Hazardous high | >177.9 | Serious likelihood of effects for sensitive groups Symptoms among general population very common | Everyone should avoid all physical activity outdoors Sensitive groups^a should temporarily relocate to a friend or relative living outside the affected area. If this is not possible, remain indoors and keep activity levels as low as possible Anyone with a heart or lung condition should take their medication as prescribed by their doctor. People with asthma should follow their asthma action plan. Anyone with concerns about their health should seek medical advice from their doctor. Anyone experiencing wheezing, chest tightness or difficulty breathing should seek medical attention Anyone experiencing symptoms which may be due to smoke exposure should consider taking a break away from the smoky conditions |
| Hazardous extreme | > 250 | Serious likelihood of effects for sensitive groups Symptoms among general population very common | Cautionary health advice and actions are the same as for Hazardous high above |

Source: ACT Health (2020).

The 2019-20 summer bushfires should prompt Australian governments and health authorities to better prepare for the increasing health risks from climate change. Governments should look to Victoria²⁰² and Queensland,²⁰³ which have begun to consider the health risks from natural disasters under a broader climate change and health agenda.

Governments should actively communicate with their communities about the broad climate-related health risks facing Australians. Health risks need to be communicated to encourage behaviour that reduce people's exposure and protects them.

Public health authorities should develop action plans for health risks exacerbated by climate change, including for heatwaves, droughts, air pollution, and floods. The action plans should be triggered when a health risk is identified through the surveillance system. The plan should guide public health officials in warning vulnerable communities about imminent risks to their health and steps they can take to protect themselves. For example, Victoria's heatwave action plan²⁰⁴ and NSW's air pollution health alert include an email alert to subscribers advising of basic precautions.²⁰⁵

Victoria's heatwave alert system was introduced after the severe heatwave in 2009 and was a step in the right direction.²⁰⁶ But

202. Victorian Government (2019). In 2019, the Victorian Department of Health and Human Services published new climate change and health information and resources for the community, which are available from the department's 'Better Health Channel': Department of Health and Human Services (Victoria) (2019).

203. Queensland Government (2018).

204. See Victorian Government (2009).

205. See NSW Health (2020).

206. The heatwave alert system notifies local governments, program areas, hospitals and state-wide and major metropolitan health and community service providers, and the general community of forecast extreme heat and heatwave conditions. The Department of Health and Human Services monitors the Bureau of Meteorology's 7-day forecast maximum and minimum temperatures. When the heat health temperature threshold is reached in a specific weather forecast

after another severe heatwave in 2014 that killed 134 people, its effectiveness was questioned.²⁰⁷ An audit found that the health alert was not always clear or timely, there was insufficient public messaging about the risks to health, and that the information was not always integrated into broader government planning.²⁰⁸

Effective climate change-related health warning systems should:

- Encourage at-risk communities to change their behaviour.²⁰⁹ Warning systems do not prompt the desired behaviour change if people think the advice does not apply to them.²¹⁰
- Report health hazards in real time, e.g. hourly reporting of air pollution in PM_{2.5} concentrations.²¹¹
- Be communicated through the media, social media, apps, etc., to ensure as many people as possible get the message.²¹² Information posted only on a website can be hard to find in an emergency.
- Target the specific needs of at-risk groups (e.g. pregnant women, people with chronic health problems, people older than 75).²¹³

district, a heat health alert is issued by the Chief Health Officer. See further information here: Victorian Government (2020a).

207. Medew (2014).

208. Victorian Auditor-General's Office (2014).

209. Vardoulakis et al (2020).

210. Bouzid et al (2013), citing Bassil and Cole (2010).

211. Some jurisdictions present air quality indexes and others present PM_{2.5} concentrations. Experts have strongly recommended that PM_{2.5} be reported rather than an index, because real time, hourly averaged PM_{2.5} concentrations are considered to be the most appropriate metric to guide personal behaviour that minimises exposure to bushfire smoke: Vardoulakis et al (2020).

212. See Victorian Auditor-General's Office (2014).

213. Bouzid et al (2013); Nitschke et al (2016). Vardoulakis et al (2020) developed a factsheet about health protection against bushfire smoke which included detailed information for at-risk groups.

- Be proactive. In high-risk situations and for high-risk individuals, alerts should be pushed as text messages. Alert systems can now be tailored to specific groups and areas as required.²¹⁴
- Provide practical information (e.g. where people can buy air filters for the house, the location of nearby safe havens).
- Provide advice directly to relevant health services, schools, workplaces, aged care facilities, community organisations, to enable them to respond.
- Involve a phased and coordinated government response.²¹⁵
- Be integrated into the state's broader emergency management plans.

Health warning systems don't require significant resources, and they can significantly reduce injuries and illness.²¹⁶ For example, after South Australia's heatwave warning system was introduced, there was a measurable drop in cardiac, renal, and heat-related diagnoses during heatwaves.²¹⁷

Warning systems can also reduce mental health problems. A UK study found that people who did not receive a warning more than 12 hours before a flood were more likely to have depression and post-traumatic stress disorder than those who did receive an early warning.²¹⁸

214. See Tocci (2020).

215. The Victorian Auditor-General's Office found that a weakness in the Victorian heatwave alert system was that it did not use a phased approach: Victorian Auditor-General's Office (2014).

216. Zuo et al (2015). See here for international examples of effective heatwave warning systems.

217. Nitschke et al (2016). Although note that the mortality rate did not change from the previous heatwave.

218. Munro et al (2017).

4.5 Targeted mental health interventions

Government mental health support systems must address the increased risks from climate change. They should include early intervention measures and a scaled response when a disaster does occur. Governments need to act early to address the long-term risks to mental health from natural disasters.²¹⁹

Primary Health Networks (PHNs) across Australia should review their mental health plans to ensure they address the increased risks from climate change that are relevant to their local community.²²⁰ They should focus on building at-risk communities' resilience to natural disasters, particularly for long-term disasters such as drought.²²¹ The support of friends, family, social networks, and community groups is crucial during and after disasters.²²²

When a disaster strikes, government should ensure that community mental health services are equipped to meet the increased need for services. This is particularly important for regional and rural communities that have fewer mental health services than the larger towns or cities.²²³

PHN's mental health plans should include processes to boost local mental health services when a disaster strikes, and encourage coordination between GPs and mental health support services.²²⁴ Community support workers and volunteers should be trained in mental health first aid.²²⁵

219. See Section 2.5; Section 3.1.4; Section 3.2.1; and Section 3.3.3.

220. The Commonwealth Department of Health established PHNs to help ensure patients get the right care in the right place at the right time. See Department of Health (2020a).

221. Hart et al (2011).

222. See Gibbs et al (2016).

223. National Rural Health Alliance (2017).

224. Sartore (2007).

225. Sartore et al (2008).

The mental health of communities hit by natural disasters can be harmed for decades.²²⁶ The plans developed by PHNs should account for sustained mental health care over the long term, including through virtual services.

4.6 Climate change emergency preparedness

Australian governments must ensure the health sector incorporates climate change into its risk assessments and disaster planning.²²⁷ This could be achieved by mandating a new requirement in the National Safety and Quality Health Service Standards (NSQHS) for health services to assess climate change risks. The health system must have both the capacity and capability to respond to health problems caused or exacerbated by climate change.²²⁸

The impacts from climate change vary across the country, so health services need to consider the local risks relevant to their region and community.²²⁹ Health services need to plan for the potential increased call on resources, workforce, infrastructure, and medical supply.²³⁰

4.6.1 Health system resilience to increased demand

States should review public health funding and accountability policies to ensure they are sensitive to surges and the costs of short periods of high demand.

As heatwaves, bushfires, and floods become more frequent and extreme, more and more Australians will seek medical help. This will

place an increased burden on the health sector, which will have to deal with more demand surges.

Government disaster response systems should include protocols for quickly mobilising additional healthcare workers from outside an affected region. These protocols should include ready-to-go contractual arrangements for GPs to work in local evacuation centres and hospitals with high demand.²³¹

Disaster response systems should also have contingency plans to ensure people have access to immediate medical attention after a disaster, and to pharmaceuticals in the long term.

4.6.2 Health system resilience against disruption to services

Australian governments need to review healthcare services' resilience to climate change threats to ensure disruptions to services are minimised. Disasters such as cyclones and floods can damage health care infrastructure, interrupt supply chains and cause power failures, compromising health care services.²³²

During the 2019-20 summer, bushfire smoke polluted the air inside Canberra Hospital. Many elective procedures were cancelled, and the MRI machines were affected.²³³

The February 2019 Queensland flood resulted in the cancellation of about 1,400 elective procedures, and about 500 additional Queensland

226. A study 10 years after the 2009 Black Saturday bushfires in Victoria found that one-in-five people had a probable psychological disorder, and most were not receiving care: Bryant et al (2020).

227. Rychetnik et al (2019).

228. Fitzgerald et al (2019).

229. Rychetnik et al (2019).

230. Ibid.

231. These contractual arrangements would authorise GPs to be paid as sessional Visiting Medical Officers during and after extreme weather, potentially covered under Health Program Grants made under Part IV of the Commonwealth's *Health Insurance Act 1973* and paid in lieu of fee-for-service payments. During the 2019-20 bushfires, there were concerns that local GPs were not able to assist at emergency evacuation centres: Woodley (2020).

232. Doctors for the Environment Australia (2017).

233. SBS News (2020).

Health clinical staff were deployed to help deliver services.²³⁴ The cost to repair damaged health infrastructure was \$18 million.²³⁵

During the January 2009 heatwave in southern Australia, hot weather contributed to power outages, which caused a Sydney hospital to lose power.²³⁶ There were similar problems throughout the Australian east coast during the 2018-19 summer,²³⁷ and the 2019-20 summer.²³⁸

State emergency protocols should include provisions for people to be able to get their prescribed medicines without requiring a new prescription, if local GP clinics and hospitals have been forced to close.²³⁹ The Federal Government should ensure the Pharmaceutical Benefits Scheme (PBS) is sufficiently flexible to allow for such protocols.

4.7 Align government response systems to ensure a national approach

Governments and health authorities across Australia should better align their disaster planning and response systems.²⁴⁰

Australia's current national health response to natural disasters is fragmented. For example, during the 2019-20 fires, there appeared to be limited collaboration between jurisdictions to manage the health effects.²⁴¹

234. L. Hughes and McMichael (2011, p. 16); and Townsville Hospital and Health Service (2019).

235. L. Hughes and McMichael (2011, p. 16).

236. VOA (2019).

237. Ibid.

238. Toscano and Foley (2020).

239. For example, see South Australia's policy: SA Health (2020).

240. See Horsburgh et al (2017, p. 24).

241. The 2020 Royal Commission into Natural Disaster Arrangements emphasised the need for a national emergency response capability: The Royal Commission into National Natural Disaster Arrangements (2020, Chapter 6).

A national approach would help avoid inconsistent public messaging that may cause confusion.²⁴² *The Australian Warning System* – a new disaster warning system that is consistent across jurisdictions – was launched in December 2020 to reduce confusion.²⁴³ But inconsistencies remain. For example, mixed messaging on the health risk ratings about bushfire smoke may have undermined the health advice last summer (see Section 4.3 and Figure 4.1).

To implement a national approach, governments should establish a 'Climate Change and Health' standing committee of the Australian Health Protection Principal Committee (AHPPC). This committee would be tasked with climate change adaptation and mitigation, and would incorporate research by existing committees – for example the Communicable Diseases Network Australia, the Environmental Health Standing Committee, and the National Health Emergency Standing Committee – as well as providing its own advice. Officials should meet regularly, share strategies, and encourage coordinated and consistent national action where appropriate. This forum should include officials from the Commonwealth and all states and territories.

Informed by the new Climate Change and Health standing committee, Chief Health Officers (CHOs) should give priority to climate change in their forward work plan. The CHOs should lead their jurisdictions in an education campaign about the health risks posed by Australia's changing climate.

242. The inconsistent public messaging between states and the Commonwealth in response to COVID-19 has caused confusion. The Australian Medical Association said the mixed messaging may have increased the public health risk: Keane (2020).

243. Gooch (2020).

4.8 Universities must get more support to pursue research specific to climate change and health

With the world's sixth-largest landmass spanning a wide variety of climates, the climate-health challenges faced by Australia will be unique. Our research institutions must get more support to pursue climate-health knowledge.

Between 2013 and 2020, the National Health and Medical Research Council (NHMRC) awarded less than \$2 million out of \$6.3 billion to climate-and-health research topics. This is less than 0.05 per cent of total NHMRC funding.²⁴⁴

A separate analysis of NHMRC data found that the overwhelming majority of grant applications with a focus on health and climate change were unsuccessful between 2000 and 2018.²⁴⁵

However, the NHMRC has since nominated 'resilience to environmental change, emerging health threats and emergencies' as one of its strategic priorities for action for 2018-2022, and has committed \$10m in funding over five years for such research.²⁴⁶ This is a step in the right direction, but it's not enough.

The federal Department of Health's \$5 billion investment plan for the Medical Research Future Fund (MRFF) describes 20 funding initiatives over the next 10 years, and identifies 'areas of national priority', but doesn't mention climate change once.²⁴⁷ Climate change and health research must become a priority.

While Australia's size and diverse climate demands Australian-based research, this research could also help drive down emissions and improve health outcomes for the rest of the world (see Chapter 5).

This research must be translated into action by governments. Australia's ability to utilise research will be limited by its number of climate change and human health professionals.

244. Grattan analysis of NHMRC grant applications data between 2013-2020. A 'climate-and-health' research topic was any topic that had any of its five keywords containing: 'climate change', 'heatwave', 'flood', 'bushfire', 'fire', 'cyclone', 'natural disaster'. See Health and Council (n.d.[a]).

245. Zhang et al (2020, Figure 8).

246. Health and Council (n.d.[b]).

247. Department of Health (2020b).

5 Building a carbon-neutral healthcare system

After the summer of 2019-20, when millions of Australians were exposed to harmful bushfire smoke and severe heatwaves, it is time to consider how Australia can better respond to the health effects of climate change. Action needs to be taken now, before we experience ever worsening extreme weather in the coming years due to climate change. Australian governments must ensure the health system can respond to these growing challenges.²⁴⁸

The world is currently on track for 3-to-5°C warming by the end of the 21st century.²⁴⁹ Even if countries are successful at meeting the Paris Agreement target of well-below 2°C, that still means increasing risks to health are unavoidable.

Adapting to the effects of climate change is a form of risk management.²⁵⁰ This involves assessing the climate change-related risks, developing and implementing risk mitigation strategies, and appropriately responding if the risks come to fruition. The increased health risks from climate change require targeted health interventions and preparedness.

As well as responding to immediate risks, future risk should be reduced. Australia's healthcare system must deal with the fundamental causes of climate change by reducing its carbon footprint. It must take responsibility for its contribution to climate change.

248. Fitzgerald et al (2019).

249. World Meteorological Organisation (2020).

250. Rychetnik et al (2019).

5.1 Reducing health sector carbon emissions

The most obvious way to prevent the health effects of climate change is for the world to reduce carbon emissions.²⁵¹

The health sector, which experiences first-hand the direct effects of climate change, should take a lead role in reducing greenhouse gas emissions (see Box 3 on the next page). Reducing the health sector's carbon footprint should be seen as another aspect of providing Australians with good healthcare.²⁵²

Investing in climate change resilience is an important aspect of ensuring the safety and quality of healthcare in Australia into the future.²⁵³

Given that climate change negatively affects the health of Australians, the health care sector should demonstrate leadership in reducing greenhouse gas emissions.

Each state and territory government in Australia has committed to an economy-wide target of net-zero emissions by 2050.²⁵⁴ Australia's public health sectors should lead the way in figuring out how their substantial systems can efficiently make the change. State and territory governments should develop plans by the end of 2023 for net-zero

251. See Appendix A. It is outside the scope of this report to recommend changes to models of care and preventative health care approaches. This report also does not cover issues relating to waste management in hospitals. Although this is relevant to reducing emissions, our recommendations focus on the immediate sources of carbon dioxide emissions, rather than improving broader environmental outcomes.

252. Pencheon (2018).

253. Paterson et al (2014).

254. Wood and Dundas (2020, p. 8).

Box 3: The UK National Health Service is leading the world towards sustainable health care

The UK National Health Service (NHS) is significantly reducing its greenhouse gas emissions,^a and has committed to net-zero emissions by 2040.^b

The NHS's Sustainable Development Unit has introduced measures such as health services reporting on carbon emissions and improving waste management, particularly for pharmaceuticals.^c Between 2007 and 2017, the NHS public health and social sector in England reduced emissions by about 18.5 per cent, despite growth in the sector over this period.^d The NHS is also seeking to reduce its water use, plastic waste, and air pollution.^e

The Australian health sector contributes a larger share of Australia's carbon emissions than the UK health sector contributes to the UK's emissions.^f

- a. Department for Business, Energy & Industrial Strategy (UK) (2019).
- b. Lee (2020).
- c. Pencheon (2018).
- d. NHS Sustainable Development Unit (2018, p. 3).
- e. *Ibid* (p. 3).
- f. Lee (2020).

public health sectors.²⁵⁵ For example, healthcare services could reduce

255. This should include 'scope 1' and 'scope 2' greenhouse gas emissions, which include the direct emissions from public health services and the emissions from those services' electricity supply respectively.

the emissions from their electricity supply by buying energy from renewable sources, such as wind and solar.²⁵⁶

These services should be required to report annually on their progress to meeting the targets, with each state health department issuing a summary statewide report.²⁵⁷ Larger health services should review their investment policies for their endowment funds to ensure they are also carbon-neutral.

Figure 5.1 shows that hospitals contribute almost half of the health sector's emissions. Hospitals should continue to take steps to reduce their energy emissions.²⁵⁸ Hospital accreditation standards should be updated to include a requirement for hospitals – public and private – to develop carbon footprint plans.²⁵⁹ The plans should include an assessment of the hospital's current emissions and identify the most efficient opportunities to reduce carbon emissions over time.²⁶⁰

256. The health services will also need to consider how to reduce or offset any direct emissions from, for example, their use of back-up generators, their ambulance and courier fleets, and gas use that cannot be electrified.

257. Victoria's public hospitals, for example, are already required to report on their carbon emissions in their annual reports: Department of Health and Human Services (Victoria) (2020c); and the Department of Health and Human Services reports on the emissions of Victoria's public hospitals in its annual report: Department of Health and Human Services (Victoria) (2020d, p. 180).

258. As of February 2020, 85 hospitals in the Pacific region (including Australia) were members of the Global Green and Healthy Hospitals network. See <https://www.greenhospitals.net/>. 270 hospitals now have their energy efficiency rated under the National Australian Built Environment Rating System (NABERS). See NABERS (2018).

259. This could be achieved under the Clinical Governance Standard (standard 1) of the National Safety and Quality Health Service Standards (NSQHS). An up-to-date carbon footprint plan should be provided to the relevant jurisdiction annually, and then be published.

260. This approach is similar to the Commonwealth Government's Energy Efficiency Opportunities program, which required large energy users to assess their carbon emissions and identify opportunities to reduce energy consumption. This program resulted in significant reductions in greenhouse gas emissions. A 2013

Like in the UK's NHS, these plans for emissions reductions could be coordinated by a national 'Healthcare Sustainability Unit', proposed by Doctors for the Environment Australia.²⁶¹

Carbon footprint plans could map the greenhouse gas emissions of different parts of a hospital. For example, the Victorian Government has previously assessed public hospital greenhouse gas emissions by 'functional group', such as by ward, surgery, etc..²⁶² This approach could be adopted to make it easier for hospitals to track their greenhouse gas emissions, as well as identify the most efficient carbon-saving opportunities.

Some hospitals are already switching to renewable power sources, but an emissions reduction target would help drive a health sector shift. The \$13.5 million Regional Health Solar Program, for example, has installed solar arrays on 37 health facilities in regional Victoria.²⁶³ Other hospitals with a large roof surface area should install solar panels where feasible and efficient. The Victorian Government is currently examining options for their renewable energy target of 40 per cent by 2025, which will include hospitals.²⁶⁴

independent review found that about 40 per cent of companies' energy savings occurred due to their involvement in this program. See Department of Industry (2014). But note that the challenges of implementing sustainability plans in healthcare services should be considered in the design of the plan: Charlesworth et al (2018).

261. Doctors for the Environment Australia (2019).

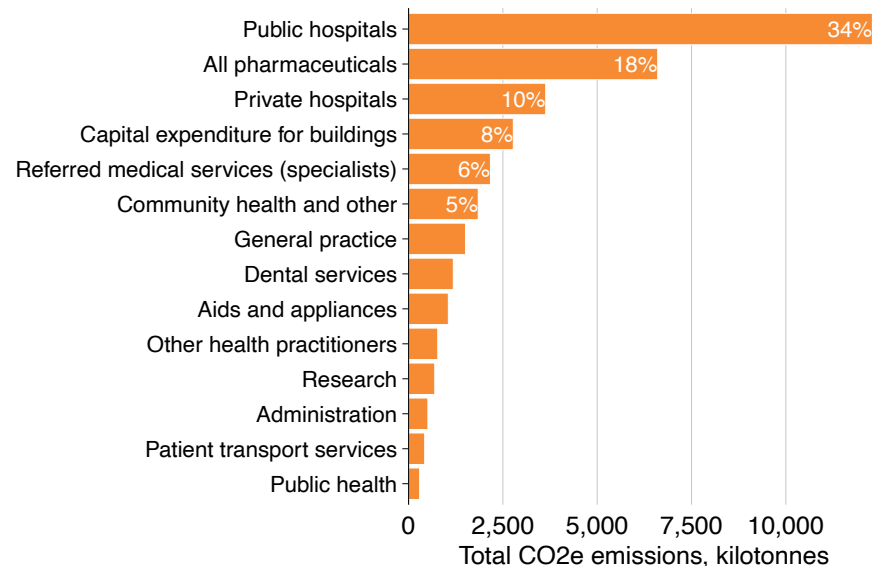
262. Victorian Government (2020b).

263. Victorian Department of Health and Human Services Building Authority (2020a).

264. Department of Environment, Land, Water and Planning (Victoria) (2020). This follows the work done by Health Purchasing Victoria in 2018 into the feasibility of state-wide agreements for renewable energy: Department of Health and Human Services (Victoria) (2018).

Figure 5.1: Hospitals and pharmaceuticals are the biggest contributors to health sector carbon emissions in Australia

Emission contribution for healthcare categories, 2014-15



Notes: These figures account for both direct emissions (emanating directly from energy used within the economic sector, e.g. burning of fuel or gas at a hospital) and indirect emissions (e.g. a hospital's electricity use that is generated elsewhere, plastics and drug manufacture). Public and private hospitals include pathology, radiology, and physiotherapy occurring within hospitals. Capital expenditure for buildings includes expenditure on the building of new hospitals and retrofitting or upgrading of established hospitals. Community health includes clinics for maternal and child health, mental health, and screening programs. Public health includes disease control, immunisation, etc.

Source: Malik et al (2018, Table 3).

5.2 Sustainable procurement policies

Governments should review their health procurement policies and practices to drive a reduction in health sector supply-chain emissions. This includes emissions from goods and services such as medical equipment, pharmaceuticals, and protective equipment.

Government leadership is critical to improving the sustainability of the healthcare supply-chain.²⁶⁵ Reducing supply-chain emissions should be a priority, because the manufacture and supply of goods to hospitals and healthcare services make up a large part of the health sector's greenhouse emissions. For example, emissions from pharmaceutical production alone make up 18 per cent of the sector's emissions (the second highest emitter in healthcare after public hospitals).²⁶⁶

Public sector purchasing bodies for health²⁶⁷ should add sustainability criteria to their procurement policies, and those criteria should become more stringent over time. This would encourage suppliers of goods and services to reduce their carbon footprint where possible. Health Purchasing Victoria already includes sustainability criteria in some of its purchasing processes.²⁶⁸ And in 2020, the Victorian Health and Human Services Building Authority released updated sustainability guidelines

265. Ahsan and Rahman (2017) found that one of the most important barriers to achieving green procurement practices in Australia's public healthcare sector is the lack of government incentives.

266. In 2014-15: Malik et al (2018).

267. Health sector purchasing bodies include HealthShare NSW, WA Health Procurement Directorate, Health Purchasing Victoria, SA Health Procurement and Supply Chain Management, and Queensland Health Strategic Procurement and Supply.

268. See Victoria's Environmental Sustainability Strategy 2018-19 to 2022-23 (Department of Health and Human Services (Victoria) (2018, p. 8)), Health Purchasing Victoria's 2017-18 annual report (Health Purchasing Victoria (2018, p. 21)), and state-wide government purchases of renewable energy, including for hospitals (Department of Environment, Land, Water and Planning (Victoria) (2020)).

for capital works, to ensure the design, construction and refurbishment of healthcare facilities have low environmental impacts.²⁶⁹

5.3 Consider emissions when building healthcare infrastructure

Governments should review their healthcare infrastructure policies to ensure that any new facility is designed to the highest environmental standards.²⁷⁰

Emissions from capital investment in buildings account for about 8 per cent of Australia's healthcare emissions.²⁷¹ Policies should both seek to improve sustainability in the construction phase and ensure long-term energy efficiency through sustainable building design.

Few governments have encouraged sustainable construction and design of healthcare infrastructure. Leading the way are the ACT, which includes it as a focus area in the territory's healthcare sustainability plan,²⁷² and Victoria, whose Health and Human Services Building Authority has developed sustainability guidelines for healthcare capital works.²⁷³ The Sydney Local Health District's sustainability plan aims for a four-star green rating in building design.²⁷⁴

269. Victorian Department of Health and Human Services Building Authority (2020b).

270. See the United Nations 2030 Sustainable Development Goal (SDG) 9, which includes the goal to build sustainable infrastructure. This goal should be interpreted in light of the other SDG goals, including goal 3, which is good health and well-being, and goal 13, which is climate action.

271. Malik et al (2018). This is for 2014-15 and includes both renovations and the building of new facilities.

272. ACT Health (2016).

273. Department of Health and Human Services (Victoria) (2018). See page 7 which refers to the *Guidelines for sustainability in healthcare capital works*. These Guidelines set 80 standard practice sustainability items, mandate 2.5 per cent of the total construction cost be allocated to sustainability items, and require a sustainability consultant to be engaged on all projects costing more than \$10 million.

274. See Sydney Local Health District (2013).

5.4 Upskilling the health sector workforce to drive change

Many people in the health sector already understand the urgency of action on climate change.²⁷⁵ Yet, to implement changes needed to shift the health sector towards zero emissions will require increasing the skills of the workforce.

As part of its strategy to deliver a ‘net zero’ health service, the NHS sought to ensure all healthcare workers understood the link between climate change and health, and the changes they could make to reduce emissions.²⁷⁶ A similar approach could be applied in Australia. State-level plans could include training modules for current and incoming healthcare workers.²⁷⁷ Training will be particularly important for senior managers who make decisions about how healthcare facilities run. Effective internal policies are needed to foster a culture that promotes environmental sustainability.

5.5 Conclusion

Climate change is a reality. The health sector needs to address this reality, and do more to reduce carbon emissions which are leading to climate change.

We urge action on five fronts:

1. Improve monitoring, surveillance, and alerts.
2. Improve mental health planning and support.
3. Revise emergency preparedness plans to ensure stronger focus on risks related to climate change.

4. State and territory governments should develop plans by the end of 2023 for net-zero public health sectors.
5. Facilitate national learning about and coordination of health-related climate change strategies.

275. See for example the open letter on climate change to the Prime Minister signed by more than 4,000 health practitioners: Australian Conservation Foundation (2020).

276. NHS (2020, Section 4.2.1).

277. Madden et al (2018).

Appendix A: Previous Grattan Institute recommendations to reduce emissions

Previous Grattan Institute reports have shown that an economy-wide carbon price through a market mechanism is the best way to meet Australia's emissions-reduction targets without excessive cost to the economy.²⁷⁸ Yet a decade of political warring – including the introduction and repeal of a carbon price, and the demise of multiple prime ministers over the issue – has left both major parties reluctant to re-adopt such a policy.²⁷⁹

The set of politically-feasible options has changed since the 2014 repeal of a carbon price, and continues to evolve. If governments are unwilling or unable to commit to an economy-wide, market-based mechanism today, then they will need 'second-best' policies to drive down emissions.

Wood et al (2015) outlines the goals that an emissions reduction policy should be designed to achieve. A policy (or suite of policies) should be:

- able to **credibly** meet the volume of emissions reductions required by current and future targets;
- **politically viable**, i.e. capable of evolving from current policy settings and achieving bipartisan support;
- **flexible**, i.e. able to adjust to changes in targets, political developments, and technologies;
- **adaptable**, with the potential to move towards an economy-wide, market-based scheme over time;²⁸⁰

278. Daley and Edis (2010) and Daley and Edis (2011). There are several models for the mechanism, including cap-and-trade, baseline-and-credit, and emissions intensity schemes: Wood (2020).

279. Daley et al (2019, Chapter 6).

280. This is useful because an economy-wide, market-based scheme is the 'first best' policy option, should a future government be willing and able to implement one.

- able to be understood and **accepted by the community**; and
- **low cost**.²⁸¹

A policy that covers emissions across the economy is typically more efficient than creating policies for each sector separately.²⁸² Australia could move towards an economy-wide emissions reduction policy by expanding the existing Safeguard Mechanism to cover more emitters, while reducing baselines to zero over time.²⁸³ As more emitters are included in the scheme, the total share of Australia's emissions covered by the mechanism would grow, gradually approaching an economy-wide policy. A market-based mechanism could also be introduced, by auctioning tradable permits that allow businesses to emit above the baselines, but within the target trajectory.²⁸⁴ This would help to ensure tougher emissions reduction targets could be met at low cost.

If governments prefer to proceed with ad hoc, sector-based policies, these policies should be:

- **consistent** with the sector's proportionate share of the target without being constrained by it;
- **able to be expanded** to meet future targets;
- **capable of being integrated** across the economy;²⁸⁵ and

281. Low cost in the economic sense, i.e. causing as little damage to the functioning of the economy as possible.

282. Wood et al (2015, p. 11).

283. Wood et al (2016); and Daley et al (2019, Chapter 6).

284. Wood et al (2016); and Daley et al (2019, Chapter 6).

285. Preferably with a national carbon price, but at the very least by allowing common permits such as Australian Carbon Credit Units (ACCUs).

- consistent with the longer-term **net-zero target** (i.e. the policy should not lock-in emissions-intensive activities for decades to come).

Consider the electricity sector. The Renewable Energy Target has delivered substantial emissions reductions since it was introduced in 2001. But because it focuses on renewable energy rather than on emissions-intensity, it cannot be used to accurately meet an emissions target for the sector. By contrast, the abandoned emissions component of the National Energy Guarantee would have been directly linked to Commonwealth-set emissions reduction targets.²⁸⁶

In all sectors, policies should be consistent with achieving net-zero emissions in the long term at as low a cost as possible. For example, for the residential sector Wood and Dundas (2020) recommended a moratorium on new gas connections to homes in states where it is clearly cheaper and cleaner for new houses to use only efficient electric appliances. While low-emissions gas substitutes could prove to be cheaper than electricity in future, this outcome is far from certain. If electricity proves to be the cheaper option, continuing to connect households to gas would mean paying more in the short term (because new households are generally better-off with efficient electric appliances), as well as higher switch-over costs in the longer-term (because more households would need to switch to electric appliances and disconnect from the gas network).

Similarly in the manufacturing sector Wood et al (2020) identified the potential to reduce emissions from steel-making using gas and hydrogen instead of coal. The prospects of this approach are better than other low-emissions steel technologies, and government funding for a low-emissions steel flagship project would help Australia to both reduce domestic emissions and position itself for a potentially large export opportunity. A gas-based 'direct reduction' plant would

already produce fewer emissions than a coal-based plant, and has the advantage that renewable hydrogen can be blended in over time as it becomes cheaper (so emissions are not locked-in for the life of the facility). As with a targeted moratorium on new household gas connections, this policy is narrowly focused but offers long-term economic and environmental benefits for Australia.

286. ESB (2017).

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