
AMA Position Statement on Climate Change and Human Health

2008

The world's climate – our life-support system – is being altered in ways that are likely to pose significant direct and indirect challenges to health. While 'climate change' can be due to natural forces or human activity, there is now substantial evidence to indicate that human activity – and specifically increased greenhouse gas (GHGs) emissions – is a key factor in the pace and extent of global temperature increases.¹ There is also evidence that GHG emissions are rising more rapidly than worst-case scenarios had predicted² and that the climate may be more sensitive to GHG emissions than previously thought.³

Global climate change

Scientific data indicate that the Earth is heating up faster than at any time in recorded history, and concentrations of CO₂ are said to be higher than at any time over at least the last 650 000 – 720 000 years.⁴ Between 1970 and 2004, GHG emissions increased by 70%, with CO₂ emissions growing by about 80%. Based on current climate change mitigation policies and related sustainable development practices, global GHG emissions are predicted to continue to grow over the next few decades.⁵

Global surface temperature is estimated to have increased by between 0.6°C and 0.66°C during the 20th century, and global temperatures are estimated to have risen by an average of about 0.17°C per decade since 1976.⁶ The 1990s were the warmest decade since records have been kept.⁷ There is an emerging consensus among scientists that a 2°C increase in global temperatures above pre-industrial levels is likely to give rise to “dangerous, irreversible and potentially catastrophic global impacts”,⁸ and concerns have been raised about much greater temperature increases by the end of the century.⁹ Significant warming of the oceans and accelerated melting of polar ice have already been recorded.¹⁰

Climate change in Australia

In Australia, average temperatures are estimated to have increased by between 0.7°C and 0.86°C since 1910,¹¹ and by 0.9°C since 1950.¹² Observed warming has accelerated over recent decades, with the late 20th century warming now considered to be largely attributable to GHG emissions.¹³ Substantial warming has occurred in the three oceans surrounding Australia, and sea levels have risen.¹⁴

There is uncertainty about precisely how the climate will continue to change throughout Australia, as this depends on a range of factors. However, predictions suggest that, relative to 1990 temperatures, annual average temperatures are likely to increase significantly (0.4°C - 2.0°C) by 2030, with further increases by 2070.¹⁵ Regional variations will also occur. For example, Western Australia is predicted to experience higher temperatures during the period 1990 - 2030, especially in inland regions; less rainfall, particularly in southwestern areas; more frequent and intense droughts, heatwaves and fires; more intense storms, floods, rainfall events and tropical cyclones; and increases in sea level in coastal regions.¹⁶ There are indications that, by 2030, Australia will have fewer frosts and more summer days warmer than 35°C.¹⁷ A number of Australia's ecosystems are particularly vulnerable to significant adverse consequences from even relatively small shifts in climate conditions.¹⁸

Climate change is expected to have direct and indirect impacts on Australia's rural communities, as changes in temperatures and rainfall patterns, and increased frequency and severity of extreme events, influence crop and pastoral production.¹⁹ There are indications that north-west Australia has become wetter since the 1950s, with most of eastern and south-western Australia experiencing drier conditions.²⁰ Projections suggest that there will be up to 20 % months with drought conditions over most of Australia by 2030, increasing to 40 % by 2070.²¹ Reduced precipitation and increased evaporation are expected to result in worsening water security problems in southern and eastern Australia. This will cause significant reductions in water available for irrigation in South Australia, New South Wales and Victoria. Within 20 years, farms and towns along the Murray and lower Darling Rivers will be expected to have to live with 41% less water.²² The number of days with very high and extreme fire danger is projected to increase, with a lengthening in the fire season.²³

Climate change has been associated with increases in the rate of extreme weather events. In Australia, there has been an increase in extreme events, particularly severe storms and floods.²⁴ Many of these effects can give rise to a number of other effects, such as harmful algal blooms triggered by major coastal storms and sanitation issues associated with flooding. In addition to the more immediate impacts of higher-intensity storms and more flooding, there are predictions of longer-term effects such as rises in sea level, increases in sea surface temperature, coastal erosion and contamination of estuaries.²⁵ With 85 % of the Australian population living near the coastline, these changes may have major consequences. For example, the combined effect of rising sea level and stronger tropical cyclones could result in coastal flooding over large areas in the tropics.²⁶

Potential health impacts of climate change

The health impacts of climate change are likely to vary from place to place and over time. Uncertainties about climatic variations, environmental changes and non-climate factors such as levels of education and health care in a country, its economic development and public health initiatives and infrastructure readiness mean that the precise effects of climate change on human health are difficult to discern and to quantify.²⁷ Most scientists, however, believe that the effects of climate change on health will be negative overall, and especially severe in developing countries.²⁸

Health impacts of climate change include the direct impacts of extreme events such as storms, floods, heatwaves and fires and the indirect effects of longer-term changes, such as drought, changes to the food and water supply, resource conflicts and population shifts. Increased vector-borne diseases may be associated with both direct and indirect effects. Some adverse impacts are already evident, while others are not expected to be felt until the middle of this century or even later. The World Health Organization has estimated that climate change is already responsible for measurable increases in malaria, diarrhoea and malnutrition.²⁹

Projected climate changes are likely to affect the health status of millions of people, particularly those with low adaptive capacity. Some believe that the largest challenge posed by global climate change is likely to be the response to displaced populations, or 'environmental refugees'.³⁰

Climate change is expected to continue to contribute to the global burden of disease and premature deaths, especially in developing countries.³¹ For example, subsistence

agriculture is expected to suffer, with Africa predicted to be severely affected as early as 2020, by which time water stress may affect 250 million people and crop yields in some countries are predicted to fall by 50 %.³²

Extreme weather events

The health impacts of extreme climate-related events can include:

- fatalities and injuries,
- diseases from water contamination and other effects related to the quantity and quality of water,
- vector-borne diseases,
- food-borne diseases,
- dietary changes due to cost and availability of food,
- effects of poor air quality,
- possible impact of chemical exposures (resulting from spills from damaged pipes, industrial storage, etc.).
- impact of changes to infrastructure and essential services,
- lapsed chronic disease management,
- psychological stresses of dislocation and the experiencing of the extreme event,
- reduction in sense of community, and
- stress from loss of income and assets.

Addressing the health impacts of extreme weather events requires adequate levels of physical and human resources to meet immediate needs as well as resources to meet longer-term needs.³³

Long term climatic change

Longer-term effects of climate change include increased temperatures, changes in sea level affecting coastal areas, changed precipitation patterns, changes in frequency of fires and droughts. These effects may have a number of health consequences, which can include:

- increases in malnutrition and consequent disorders, the result of impacts on food production (with implications for child growth and development),
- increased deaths and injury resulting from heatwaves, fires and droughts,
- increased risk of water-borne infectious diseases from poor water quality,
- increased frequency of cardiorespiratory diseases because of higher concentrations of ground-level ozone,
- increased risk of vector-borne diseases caused by altered spatial distribution of some infectious diseases;
- increase in food-borne infectious diseases, through exposure to higher temperatures,
- increases in asthma and allergic diseases from increased production of aero-allergens (spores, pollens) in some areas,
- significant population movements between climatic regions, with the possibility of displaced populations, and
- mental health problems and emotional stresses associated with social, economic and demographic dislocations (particularly with children).³⁴

Increases in average temperatures mean that alterations in the geographic range and seasonality of certain infections and diseases (including vector-borne diseases such as malaria, dengue fever, Ross River virus and food-borne infections such as *Salmonellosis*) may be among the first detectable impacts of climate change on human health.³⁵ It has been suggested that another early example of a direct medical consequence of global warming is an increase in kidney stones, with a 30 % rise in kidney stone disease predicted to occur in some of the driest areas of the United States if current temperature trends continue.³⁶

Potential health impacts of climate change in Australia

In Australia, consequences of climatic extremes and changes to food and water supplies are predicted to have particular impacts on rural, regional and some remote Indigenous communities, with some coastal communities facing relocation due to storms and flooding.³⁷ Significant numbers of Australians are vulnerable to severe storms and to increases in sea level.³⁸

There is a consensus that the more vulnerable members of the community – the elderly, the young and those whose health is already compromised – will be most affected by climate-related illnesses.³⁹ Children's exposure to climate change-related exposures and social stresses has been highlighted as a particular concern.⁴⁰ By 2056, there will also be a much higher proportion of Australians over the age of 65, as well as a rapid increase in the number of people aged 85 and over.⁴¹ By 2020, it is expected that Australian doctors and other health professionals will be seeing patients with illnesses and conditions related to both short-term and longer-term effects of climate change.⁴²

Higher temperatures

Heatwaves, especially in cities, can increase the rates of death and illness, primarily from heart and respiratory illnesses. Australia's ageing population, increasing occurrence of chronic disease and co-morbidities and high levels of urbanisation all serve to increase susceptibility to the impact of heat waves. If New South Wales were to experience a heatwave similar to one that occurred in Europe in 2003, calculations suggest that an extra 647 deaths would occur over a 2-week period.⁴³

Studies suggest that over time, levels and patterns of airborne pollens and pollutants which have significant effects, on respiratory health can be affected by higher temperatures and humidity resulting from climate change.⁴⁴ While the links between ozone and atmospheric warming are complex, elevated levels of ambient ozone have been found to lead to more frequent asthma attacks and hospitalisations and greater morbidity and mortality in patients with pre-existing pulmonary or cardiovascular disease. Investigations of the potential impact of climate change on ambient ozone concentrations suggest that a continuation of current trends over the next 10 years could result in asthma-related deaths rising by almost 20 %.⁴⁵

Vector borne diseases

The potential for the resurgence of old diseases, the redistribution of others and the emergence of new diseases have all been linked to altered climate and changing ecological balances.⁴⁶ Changes in climate can significantly alter the ecology and epidemiology of viruses and their potential to cause outbreaks of human disease. The transmission of certain arboviruses (transmitted to humans through mosquito bites) is particularly susceptible to environmental conditions that enable breeding and survival; rainfall, tides, sea level,

temperature, humidity and wind all play a part. Climate change is expected to particularly affect the spread of diseases such as malaria and dengue fever.

The arboviruses of greatest concern in Australia are Ross River, Barmah Forest, Murray Valley Encephalitis, Kunjin virus, Dengue and Japanese encephalitis.⁴⁷ The spread of other mosquito-borne diseases such as Chikungunya virus may also be affected, as there is evidence that the virus, previously thought to be limited to particular species of mosquitoes, is capable of being transmitted by species distributed more widely in Queensland and in other areas throughout Australia.⁴⁸ It is believed that global warming will result in tropical conditions in Australia spreading south, as will disease vectors such as mosquitoes.

Food and water-borne diseases

Heavy rain, flooding and increased temperatures are factors that influence water-borne infections.⁴⁹ As the temperature of the environment increases, the quality and the quantity of drinking water could decrease through drought. In Australia, there are already water restrictions in many States for the first time in 20 years. It is expected that health disorders related to environmental and water contamination by bacteria, viruses, protozoa and parasites will increase as the quality of water decreases. This contamination also occurs at the other extreme as heavy rainfall and runoff influence the transport of microbial and toxic agents from agricultural fields, human septic systems and toxic dumps.⁵⁰

Warmer temperatures also encourage food-borne infections. The incidence of bacterial food-borne diseases (and amoebic diseases) increases during the summer months and is worse in the northern regions of Australia, due primarily to the increased bacterial replication where ambient temperatures are higher. If average temperatures continue to rise, rates of food-borne diseases are also predicted to rise. However, actual health impacts will depend on factors such as food hygiene practices and contributions of different pathogens.⁵¹

The combination of water shortages and lack of fresh food suggests the potential for significant harm to both the environment and human health in isolated Australian communities. Changes in the amount and distribution of wildlife, fish and vegetation could also have health consequences for people in remote Indigenous communities who follow a traditional diet.

Mental health

Both extreme events and gradual climate-related changes, such as drought, may give rise to mental health problems, and these may continue for a significant period, and even be delayed.

Populations exposed to climate-related extreme weather events or disasters experience social, physical and material conditions that adversely affect mental health. Post-traumatic stress disorder, depression and anxiety may all result.⁵² Because of increasing numbers of extreme weather events, the impact of natural disasters on mental health is a growing concern.

Studies have found that mental health issues remain for a considerable time after the event and that, while post-disaster morbidity is likely to decline over time, the effects of exposure to the initial disaster and losses are likely to persist.⁵³ A number of Australian studies have shown that bushfires increase psychological morbidity among individuals and communities

experiencing loss.⁵⁴ These effects can be chronic and delayed and may require ongoing intervention, although relatively few individuals develop serious long-term problems.⁵⁵ Diagnosis of post-traumatic stress disorder requires a clinical evaluation of symptoms.⁵⁶

Other mental health problems occurring in a post-disaster environment include depression, bereavement complications, anxiety disorders, substance abuse and adjustment disorders.⁵⁷ Three years after Hurricane Katrina in the USA, psychiatrists and other clinicians, hospitals, government and non-government agencies, schools and community groups were still working to help adults and children overcome persistent mental health problems.⁵⁸

Studies have found that people recover from extreme events in different ways and that a range of support services across the whole of the community are required. People who had accessed the services of the ACT Bushfire Recovery Centre reported that, after the Recovery Centre, doctors were the next most common source of help that they consulted.⁵⁹

In addition to the impact of disaster events, coping with and moving away from longer-term effects of climate change may create mental health problems for some people. In Australia, drought has had a major impact on farm families and communities reliant on agricultural production. Levels of depression and suicide in rural Australia have been correlated with prolonged drought, and there are concerns about the likelihood of mental health problems continuing to increase, particularly among rural men.⁶⁰ Many communities, including those familiar with drought, are likely to face the challenges of longer term climate change.⁶¹

The AMA Position

Human health is ultimately dependent on the health of the planet and its ecosystem. The AMA believes that measures which mitigate climate change will also benefit public health. Reducing GHGs should therefore be seen as a public health priority.⁶² At the same time, health systems need to be responsive to a range of health effects associated with both short-term and longer-term impacts of climate change.

In relation to climate change and human health, the AMA believes that:

- because climate change involves potentially serious or irreversible harm to the environment and to human health, it is essential to adopt mitigation strategies that reflect a precautionary approach even where uncertainties may exist in relation to scientific evidence,
- failure to achieve significant reductions in greenhouse gas emissions on a global basis is likely to cause significant public health problems,
- effective measures for improved energy efficiency, clean energy production and other emission reduction measures are likely to contribute to reducing the health impacts of climate change,
- economic assessments of the costs and benefits of mitigating climate change must incorporate the predicted public health costs of unmitigated climate change,
- there should be greater awareness, at all levels of government, of the direct and indirect impacts of policies, regulations and programs on energy use and greenhouse gas emissions,

- individuals, businesses and organisations - including in the health and medical field - should be informed about, and take measures to reduce, their greenhouse gas emissions ('carbon footprint') by making appropriate changes to consumption patterns,
- National Strategy for Health and Climate Change should be developed and implemented to ensure that Australia can respond effectively to the health impacts of gradual climate change, extreme events, and to people's medium - to long-term recovery needs. That strategy should incorporate the following:
 - localised disaster management plans for specific geographical regions that model potential adverse health outcomes in those areas and incorporate appropriate localised health and medical response measures, including for people who have been evacuated or relocated, temporarily or permanently,
 - strong and active communication linkages between hospitals, major medical centres and local weather forecasters and emergency response agencies (in at - risk locations) to maximise timely responses and efficient use of health resources in extreme weather events,
 - measures targeted to the needs of certain vulnerable population groups (older Australians, children, Indigenous communities, members of remote communities),
 - measures to address health and medical workforce needs in rural and remote communities, particularly in mental health services,
 - enhanced awareness among doctors and health professionals of the potential consequences on mental health of extreme weather events and disasters,
 - development of effective interventions to address mental health issues arising from extreme events, including those involving mass casualties and from longer-term changes, including drought,
 - programs to improve the education and awareness of health professionals about the links between health and climate change, and their understanding of the risks of new vector-borne diseases and their health impacts,
 - measures to prevent exotic disease vectors from becoming established in Australia and nationally coordinated surveillance for dangerous arboviruses, with public education programs promoting mosquito avoidance and measures to prevent mosquito/arthropod breeding, and
 - preparedness to deal with the temporary and permanent dislocation of people due to climate-related physical events and economic conditions.

The AMA believes that doctors and other health professionals should:

- support policies and practices compatible with a healthy and sustainable future,
- promote the community's awareness of the impacts of climate change on health,
- encourage the sustainable reduction of carbon emissions from health care facilities and organisations, and act as role models for others in reducing emissions in their own practices,
- draw attention to health issues associated with climate change in their roles as educators in health and medical faculties, residency programs and continuing education programs,
- undertake and participate in research to ascertain the effects on physical and mental health of both extreme and gradual climate change, and to quantify more rigorously the potential health effects that can be achieved by appropriate policies and practices.

NOTES

¹ IPCC 2007a, Summary for Policymakers, in: *Climate Change 2007: Impacts, Adaptation and Vulnerability. Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change*, M.L. Parry, O.F. Canziani, J.P. Palutikof, P.J. van der Linden and C.E. Hanson, Eds., Cambridge University Press, Cambridge, UK, 7-22. <http://www.ipcc.ch/pdf/assessment-report/ar4/wg2/ar4-wg2-spm.pdf>

² R Garnaut., S Howes , F Jotzo F and P Sheehan 2008, Emissions in the Platinum Age: The implications of rapid development for climate change mitigation at [http://www.garnautreview.org.au/CA25734E0016A131/WebObj/OXREP_paper_2-05-08/\\$File/OXREP_paper_2-05-08.pdf](http://www.garnautreview.org.au/CA25734E0016A131/WebObj/OXREP_paper_2-05-08/$File/OXREP_paper_2-05-08.pdf)

³ J Hansen, M Sato, P Kharecha, D Beerling, V Masson-Delmotte, M Pagani, M Raymo, DL Royer, JC Zachos 2008, Target Atmospheric CO₂: Where Should Humanity Aim? Columbia University Earth Institute, New York, USA at http://www.columbia.edu/~jeh1/2008/TargetCO2_20080407.pdf

⁴ Climate Institute 2006, *Top Ten Tipping Points on Climate Change*, the Climate Institute (Australia) Ltd, Sydney, p.4, www.climateinstitute.org.au; DA Jones, AB Watkins and K Hennessy (2005) Humans do contribute to global warming, *Engineers Australia*, Sept., pp.44-47.

⁵ IPCC 2007b, Summary for Policymakers, *Climate Change 2007: Mitigation – Contribution of Working Group III to the 4th Assessment Report of the Intergovernmental Panel on Climate Change*, p.3, 4 (B. Metz, O. Davidson, PR Bosch, R. Dave, LA Meyer (eds), Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA. at <http://www.ipcc.ch/pdf/assessment-report/ar4/wg3/ar4-wg3-spm.pdf>); BL Preston and RN Jones 2006, *Climate Change Impacts on Australia and the Benefits of Early Action to Reduce Global Greenhouse Gas Emissions: a consultancy report for the Australian Business Roundtable on Climate Change*, CSIRO, Melbourne, p.7.

⁶ DA Jones, AB Watkins and K Hennessy 2005, Humans do contribute to global warming, *Engineers Australia*, Sept., pp.44-47

⁷ BL Preston and RN Jones 2006, p. 6; DA Jones, AB Watkins and K Hennessy 2005, Humans do contribute to global warming, *Engineers Australia*, Sept., pp.44-47.

⁸ BL Preston and RN Jones 2006,; Bali Climate Declaration by Scientists (2007), Climate Change Research Centre, University of New South Wales, Sydney, Australia. (<http://www.climate.unsw.edu.au/bali/>)

⁹ BL Preston and RN Jones 2006.

¹⁰ PR Epstein and E Mills (eds) 2005, *Climate Change Futures: Health, Ecological and Economic Dimensions*, Center for Health and the Global Environment, Harvard Medical School, p.4

¹¹ B Pittock (ed) 2003, *Climate Change: An Australian Guide to the Science and Potential Impacts*, Australian Greenhouse Office, Canberra <http://www.greenhouse.gov.au/science/guide/pubs/science-guide.pdf>; DA Jones, AB Watkins and K Hennessy 2005, pp.44-47

¹² CSIRO and the Australian Bureau of Meteorology 2007, *Climate Change in Australia: observed changes and projections*, report for the Australian Climate Change Science Program, at www.climatechangeinaustralia.gov.au/resources.php

¹³ DA Jones, AB Watkins and K Hennessy 2005, p.44; A Haines , RS Kovats , D Campbell-Lendrum, C Corvalan 2006, Climate change and human health: impacts, vulnerability, and mitigation, *The Lancet* 367: 9528 , pp. 210 –2109.

-
- ¹⁴ CSIRO and the Australian Bureau of Meteorology 2007, p.3.
- ¹⁵ B Pittock (ed) 2003, p.4
- ¹⁶ Environmental Health Directorate 2008, *Health Impacts of Climate Change: adaptation strategies for Western Australia*, 2008, WA Department of Health, p.7
- ¹⁷ Australian Greenhouse Gas Office 2005, Trends in Extreme Weather Events: Australia and Globally, Past and Future, Department of Environment & Heritage, April, at <http://www.climatechange.gov.au/science/hottopics/pubs/topic8.pdf>.
- ¹⁸ BL Preston and RN Jones 2006, pp.5, 22.
- ¹⁹ P Bi and KA Parton 2008, Effect of climate change on Australian rural and remote regions: what do we know and what do we need to know? (review article), *Aust J Rural Health* 16, 2-4.
- ²⁰ CSIRO and the Australian Bureau of Meteorology 2007, p.2.
- ²¹ CSIRO and the Australian Bureau of Meteorology 2007, p.7.
- ²² K. Hennessy, R. Fawcett, D. Kirono, F. Mpelasoka, D. Jones, J. Bathols, P. Whetton, M. Stafford Smith, M. Howden, C. Mitchell, and N. Plummer, July 2008, 'An assessment of the impact of climate change on the nature and frequency of exceptional climatic events', CSIRO and the Bureau of Meteorology for the Australian Government's National Review of Drought Policy, http://www.daff.gov.au/__data/assets/pdf_file/0007/721285/csiro-bom-report-future-droughts.pdf.
- ²³ CSIRO and the Australian Bureau of Meteorology 2007, p..
- ²⁴ Australian Greenhouse Gas Office 2005.
- ²⁵ Australian Greenhouse Office 2006, *Assessing and mapping Australia's coastal vulnerability to climate change: Expert Technical Workshop*, Department of Environment & Heritage, 13-14 December 2005, <http://www.climatechange.gov.au/impacts/publications/coastal-workshop.html>; W Steffan 2008, 'The Science of Climate Change: Implications for the Coastal Zone', paper presented to the Coast to Coast Collaboration: Crossing Boundaries conference, 18-22 August, Darwin <https://www.coast2coast.org.au/plenary-abstracts.html#steffen>.
- ²⁶ Australian Greenhouse Gas Office 2005.
- ²⁷ IPCC 2007a, p.9; Environmental Health Directorate 2008.
- ²⁸ IPCC 2007a, p.12.
- ²⁹ AJ McMichaelJ, D Campbell-Lendrum , S Kovats , et al. 2004, Climate Change, In: Ezzati M, Lopez AD, Rodgers A, Mathers C (eds.) *Comparative Quantification of Health Risks: Global and Regional Burden of Disease due to Selected Major Risk Factors*. Geneva: World Health Organization; 2004. pp. 1543-1650. <http://www.who.int/publications/cra/chapters/volume2/1543-1650.pdf>; World Health Organization 2002, *World Health Report 2002: Reducing risks, promoting healthy life*, Chapter 4, WHO, Geneva, <http://www.who.int/whr/2002/chapter4/en/index7.html>.
- ³⁰ JA Patz and M Khaliq, 2002, Global climate change and health: challenges for future practitioners, *JAMA* 287:17, 1 May, p.2284; W Steffan 2008.
- ³¹ British Medical Association 2008, *Health Professionals – Taking Action on Climate Change - 'What are the health implications?'*, April, <http://www.bma.org.uk/ap.nsf/content/climatechange>.
- ³² M Chan 2007, 'Climate change and health: preparing for unprecedented challenges', David E. Barmes Global Health Lecture, Bethesda, Maryland 10 Dec. at www.dea.org.au.

- ³³ M Traub, D A Bradt and A P Joseph 2007, The Surge Capacity for People in Emergencies (SCOPE) study in Australasian hospitals, *MJA* 186: 394–398; E Salinsky 2008, Strong as the weakest link: medical response to a catastrophic event, Background Paper No. 65, National Health Policy Forum, George Washington University, Washington DC, 8 August, www.nhpf.org.
- ³⁴ G Horton and T McMichael 2008, *Climate Change Health Check 2020: a report prepared for the Climate Institute of Australia*, Doctors for the Environment, www.dea.org.au, p.10.
- ³⁵ WHO 2003, Climate change and human health – risks and responses – Summary, Geneva, at www.who.int/globalchange/climate/summary; B Pittock (ed) 2003, Ch 4, Potential Impact of Climate Change: Australia, at <http://www.climatechange.gov.au/science/guide/pubs/chapter4.pdf>; G Horton and T McMichael 2008.
- ³⁶ T Brikowski, Y Lotan and MS Pearle 2008, Climate-related increase in the prevalence of urolithiasis in the United States, *Proceedings of the National Academy of Sciences*, published online before print July 14, doi: 10.1073/pnas.0709652105.
- ³⁷ G Horton and T McMichael 2008.
- ³⁸ G Horton and T McMichael 2008, p.12.
- ³⁹ P Sly, E Hanna, B Giles-Corti, J Immig, T McMichael 2008, Environmental Threats to the Health of Children in Australia: The need for a National Research Agenda, supported by the ARACY ARC/NHMRC Research Network, World Health Organization Collaborating Centre for Research on Children's Environmental Health, Perth, March.
- ⁴⁰ P Sly, E Hanna, B Giles-Corti, J Immig, T McMichael 2008.
- ⁴¹ Australian Bureau of Statistics 2008, Population Projections, Australia, 2006 to 2101, Cat. No. 3222.0, 4 Sept.
- ⁴² G Horton and T McMichael 2008.
- ⁴³ Epstein PR and E Mills (eds) 2005, p.55 – 59; Faculty of Public Health 2008, *Sustaining a Healthy Future: Taking action on climate change*, London, p.6.
- ⁴⁴ British Medical Association 2008; ML Bell, R Goldberg, C Hogrefe et al 2007, Climate change, ambient ozone and health in 50 US cities, *Climatic Change* 82 (1-2), May, pp. 61-76, at <http://www.springerlink.com/content/7380101v7q674581/>; Union of Concerned Scientists 2008, Explaining Global Warming – What's Ozone Got to Do with It?, at: www.ucsusa.org/ssi/archive/ozone-climate-connection.html
- ⁴⁵ KJ Bransford 2002, Global climate change and air pollution: common origins with common solutions, *JAMA* 287:17, p.2285
- ⁴⁶ PR Epstein and E Mills (eds) 2005 p.33; M Chan 2007.
- ⁴⁷ RA Dunstan, CR Seed and A J Keller, 2008, Emerging viral threats to the Australian blood supply, *ANZJPH* 32:4, p.354-360
- ⁴⁸ Australian Biosecurity Cooperative Research Centre 2008, Aussie mozzies a Chikungunya risk, media release, 11 February, at http://www1.aberc.org.au/uploads/89f0c50a-9c28-4707-b25b-bdd5a7848440/docs/Media_Release_-_Chikungunya.pdf; : D F Johnson et al 2008, Chikungunya virus infection in travellers to Australia, *Medical Journal of Australia* 188:1, p.41-3.
- ⁴⁹ British Medical Association 2008.

-
- ⁵⁰J Patz and R Kovats 2002, Hotspots in climate change and human health. *BMJ* ;325:1094-1098.
- ⁵¹ British Medical Association 2008.
- ⁵² D Satcher, S Friel and R Bell 2007, Natural and Manmade Disasters and Mental Health, *JAMA* 298:21, 5 Dec., p.2540
- ⁵³ P Camilleri, C Healy, E Macdonald, S Nicholls, J Sykes, G Winkworth, and M Woodward 2007, Recovering from the 2003 Canberra bushfire: a work in progress, report for Emergency Management Australia (grant 04/2005) at [http://www.ema.gov.au/agd/ema/rwpattach.nsf/VAP/\(63F21BC6A4528BAE4CED2F9930C45677\)~Recovery2003_May3007.pdf/\\$file/Recovery2003_May3007.pdf](http://www.ema.gov.au/agd/ema/rwpattach.nsf/VAP/(63F21BC6A4528BAE4CED2F9930C45677)~Recovery2003_May3007.pdf/$file/Recovery2003_May3007.pdf); L Lamberg 2008, Katrina's Mental Health Impact Lingers: Patients Face Shortages of Facilities, Clinicians, *JAMA* 300:9, p.1011-1013
- ⁵⁴ In a 2006 survey, of 500 people who had had direct experience of the 2003 bushfires in the Australian Capital Territory (ACT), 40 percent indicated that they had experienced one or more symptom of post-traumatic stress (PTS), with 13% reporting a level of PTS that could meet diagnostic criteria for post-traumatic stress disorder. Injury, perceived threat to life, and disaster-related losses were the strongest predictors of post-traumatic stress symptoms. Survey respondents highlighted a number of negative effects on their health and well-being and some reported lasting effects on children.
- ⁵⁵ P Camilleri et al 2007, p.69.
- ⁵⁶ P Camilleri et al 2007, p.70.
- ⁵⁷ P Camilleri et al 2007, p. 73.
- ⁵⁸ L Lamberg 2008, p.1011-1013.
- ⁵⁹ P Camilleri et al 2007, p.100
- ⁶⁰ Environmental Health Directorate 2008, p.27; M Alston and J Kent, 'The Big Dry: the link between rural masculinities and poor health outcomes for farming men', *J of Soc* 2008 44(2):133-147, p.136.
- ⁶¹ HL Berry, BJ Kelly, IC Hanigan, JH Coates, AJ McMichael, JA Welsh, T Kjellstrom 2008, *Garnaut Climate Change Review: Rural mental health impacts of climate change*, National Centre for Epidemiology and Population Health, ANU College of Medicine and Health Sciences, June ([http://www.garnautreview.org.au/CA25734E0016A131/WebObj/03-DMentalhealth/\\$File/03-D%20Mental%20health.pdf](http://www.garnautreview.org.au/CA25734E0016A131/WebObj/03-DMentalhealth/$File/03-D%20Mental%20health.pdf))
- ⁶² A Haines 2007, Comment: Energy and health series, *The Lancet*, 2007; 370:922.