

# CLIMATE CHANGE HEALTH CHECK 2020

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A report prepared for the Climate Institute of Australia in relation to World Health Day on April 7, 2008 for which the World Health Organisation's theme is 'Protecting Health from Climate Change'.

**Doctors for the Environment, Australia** (DEA) is a voluntary, doctor's organization, formed in 2001, with members in all States and Territories. The aim of the organisation is to inform and educate the public, the medical profession and policy makers about the relationships between health and the environment. Our priority issue at the present time is the health effects of climate change. DEA is a member of the International Society of Doctors for the Environment.

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**The Climate Institute** is a non-partisan, independent research organisation that works with community, business and government to drive innovative and effective climate change solutions. Our vision is for an Australia leading the world in clean energy use and innovation, with clean and low energy solutions a part of everyday life throughout the community, government and business  
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# Executive Summary

The World Health Organisation (WHO) has chosen “protecting health from climate change” as the theme for this year’s World Health Day on April 7. WHO selected this theme in recognition that climate change is posing ever growing threats to global public health security and that “wherever you live, climate change threatens your health”.

WHO notes that global warming induced by climate change dramatically disrupts some of life’s basic essential requirements for health: water, air and food. According to WHO, health damage from climate change is already happening. This report for the Climate Institute summarises recent research on health risks and effective responses with a focus on minimizing human health impacts of climate change in Australia in 2020 and beyond. In particular the report emphasises expected changes in medical practice and how patients will come to their doctors in future years with illness due to climate change:

**1** In 2020, it is likely that Australian doctors and other health professionals will be seeing patients with a diverse range of climate change-related illnesses. These include heat stress, other heat-related illness events (affecting the heart, blood vessels and lungs), trauma from extreme weather events, and more allergic diseases. In those areas affected by long-term drought and other natural disasters, it is likely that patients will experience distress and more mental illness such as depression and post traumatic stress disorders. It is anticipated that there will be a changes in airborne pollutants leading to increased respiratory problems. The incidence of some infectious diseases such as gastroenteritis (‘food poisoning’) is predicted to rise and there will be changes in the distribution of mosquito-transmitted diseases such as Dengue fever and Ross River virus.

**2** The more vulnerable members of our community will be most affected by climate related illnesses. These include the elderly who cope less well with changes in temperature, and young children whose developing lungs are susceptible to ambient air pollution. Rural, regional and some remote indigenous communities will face more climatic extremes and changes to food supplies and freshwater. Some coastal communities may face relocation due to inundation with storms and flooding. Food and water insecurity in other parts of the world as well as sea level rise may contribute to the need for us to care for increased numbers of environmental refugees.

**3** Climate change is of great relevance to the health care which will be provided by health professionals in coming years. Australians need to know how our changing climate will affect the health of our community and there is an important role for health professionals to raise awareness in this area.

**4** Health care for 2020 and beyond needs to be increasingly responsive to the health needs of our community which will arise as a result of climate change. Planning for climate change should be part of every future deliberation in health services and this should include preparation for potentially large numbers of environmental refugees in our region as the century progresses. Effective health strategies will require collaboration between health professionals and other sectors of the community.

**5** There are many opportunities for doctors and the rest of the health sector to implement solutions which promote the community's health whilst protecting the environment and reducing greenhouse gas emissions. Health professionals can and should play an increased role in advocating community responses to protect health from climate change, including by engaging in policy development with other professional groups and sectors of government.

## Introduction

Doctors along with the rest of the community now realise that the effects of climate change are upon us (1). There is increasing focus on the resulting human health impacts; indeed, the topic selected for World Health Day on April 7 by the World Health Organisation is “protecting health from climate change”. WHO estimates that climate change already accounts for more than 60,000 deaths, globally, from climate-related natural disasters every year (2), along with at least another 100,000 deaths from malaria, malnutrition and child diarrhoea (3).

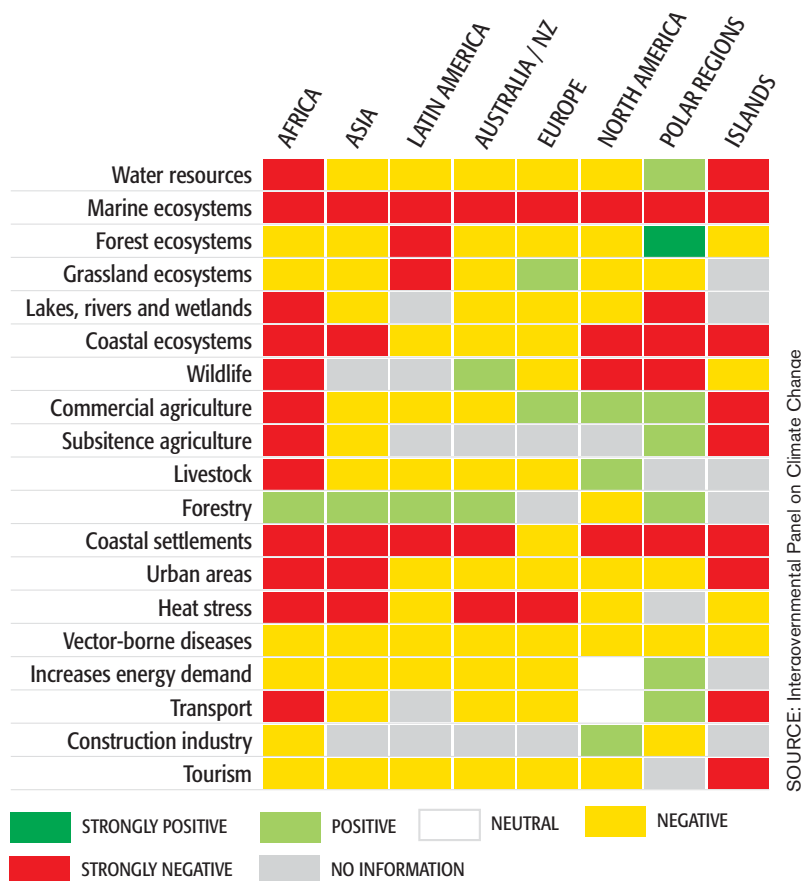
Australian doctors and the communities which we serve have the opportunity to work together to limit the severity of these effects. We can do this both by reducing the production of greenhouse gases and by ensuring that those who suffer with adverse health impacts of climate change receive the care they need. Temperatures are predicted to continue to rise during this century. In order to determine how doctors and other health professionals might best engage with what lies ahead, it is useful to consider how patients will come to their doctors in future years with illness due to climate change.



# Health Effects on Australian Communities in 2020 and Beyond

The effects of climate change will vary around the world depending on factors which include the response of the local climate and the vulnerability and adaptive capacity of communities. Figure 1 indicates the impacts which Australia may face as a result of climate change, alongside those expected to affect other countries in coming decades. It can be seen that heat stress and vector borne diseases are predicted to be adversely affected by climate change, as are other factors which influence health such as water resources and integrity of ecosystems (food yields, fish stocks, water cleansing, environmental stabilisation, etc.).

**FIGURE 1 – Dark effects of climate change (4)**



Climate change will lead to a wide range of adverse health impacts in Australia which are featured in Box 1 and discussed below.

## Heatwaves, Heat Stress and Bushfires

Australians will experience more heatwaves in coming years. The deadly nature of these events was shown during the European heatwaves of 2003 which claimed over 35,000 lives. Those who were most vulnerable were those with restricted mobility and the elderly, particularly those who lived alone (5). The effects of increased temperature in heatwaves is heightened by reduced fluid intake, alcohol or drug use, too much physical activity in the heat, especially if outdoors, as well as low income, cardiac disease and mental illness (6). Researchers have begun to predict by how much the mortality rate from heatwaves will increase by 2020. In the case of Lisbon, Portugal the death rate is expected to rise from between 5.4 and 6.0 (per 100,000) for 1980–1998 to between 5.8 and 15.1 for the 2020s. (7) Residents of urban areas are considered to be more at risk than those in rural areas (8). In cities the “heat island” effect means that in heavily built up areas with limited vegetation the temperatures tend to be higher. This is because buildings, asphalt and concrete absorb heat during the day and this is radiated back to the surroundings during the night.

Research has commenced in Australia to determine how vulnerable we are to heat-related illness and death. A study which has examined past heatwaves has predicted that the risk of death from heatwaves is likely to be higher in our southern cities than in our warmer northern ones (7). This is due to people who are not used to warm temperatures and who have not modified their surroundings accordingly being more vulnerable to large fluctuations of temperature as occurs with heatwaves.

Heatwaves, together with more hot dry conditions, are also expected to increase our risk of bushfires in coming years (10). Figure 2 depicts the increased risk for very high and extreme high fire danger days for areas of South Eastern Australia as reported by the Bushfire Collaborative Research Centre and the CSIRO. Estimated risk is shown for the years 2020 and 2050 for both “low” and “high” global warming scenarios. In Australia we are all too familiar with the devastation wrought by bushfires in both urban and rural areas and the human cost includes fatalities, injuries and burns. Poor air quality due to increased particle density is a major cause of respiratory disease due to bushfires.

**FIGURE 2: Percent changes in the number of days with very high and extreme fire-weather – 2020 and 2050, relative to 1990 (10)**

	2020		2050	
	Low global warming (0.4°C)	High global warming (1°C)	Low global warming (0.7°C)	High global warming (2.9°C)
Very high	+2-13%	+10-30%	+5-23%	+20-100%
Extreme	+5-25%	+15-65%	+10-50%	+100-300%

### Storms and Other Extreme Weather Events.

It is predicted that the frequency of extreme weather events such as storms and heavy rain will increase and this will lead to both direct and indirect health effects. Most of the deaths directly related to storms are known to occur as a result of flooding (6). Other direct health impacts would include traumatic injuries and post traumatic stress syndrome.

Indirect health impacts which occur in the aftermath of these events include outbreaks of illnesses such as Ross River virus due to breeding of mosquitos in flood water. Breakdown and overflow of sewerage systems can lead to infectious diarrhoea and other transmissible diseases as a result of contaminated food and water. Increased rates of children being admitted to hospital with diarrhoea have been observed following El Nino weather events (9).

### Infectious Diseases

Research has suggested that the risks of diarrhoeal disease may be augmented by the increased temperatures which result from climate change.

One study showed that for every degree of increase in temperature the rate of hospitalisation of children with diarrhoea increased by 8 per cent (9). It has also been predicted that gastrointestinal infections which are already common in our community such as salmonella, cryptosporidium and campylobacter are likely to increase with higher temperatures (11,12).

There will be changes in the distribution and intensity of infectious diseases which are spread by insects such as mosquitos. Those of most relevance to Australia include Dengue fever, an outbreak of which occurred in Townsville between March and August 2007 causing 46 cases (13). During this century, the distribution of this disease, which until recently has been restricted to areas north of Broome, Katherine and Cairns, has the potential to extend much further south as far as New South Wales depending on how quickly we act to limit greenhouse



gases (14). Melioidosis is a disease which causes severe pneumonia in the tropical region of the Northern Territory. Its transmission is also dependent on climate factors and increases with periods of more intense rainfall (15).

### **Increased Temperatures and Air Pollution**

There are many well recognized adverse health effects of air pollution including cardiac and respiratory disease. What is less well known is that increased temperatures may interact with air pollution to compound these illnesses. Ground level ozone, which is likely to increase with increasing temperatures, could lead to increasing prevalence of asthma (16). An American study found that by the 2050s, climate change could be responsible for a 4 per cent increase in the deaths related to ozone, one type of air pollution, in the New York area (12).

### **Allergy-related Illness**

Asthma has been increasing in prevalence in many parts of the world. Other allergic diseases include eczema and sinusitis. It has been observed that the production of pollens, moulds and fungi which give rise to allergic symptoms have increased due to temperature changes in some regions. Climate change may therefore cause people to present for medical care with these conditions in increasing numbers in the coming decades (9, 12).

### **Drought and Long-Term Drying**

Climate change will result in much of Australia becoming warmer and drier (17). This is predicted to cause increase in drought severity and reduced agricultural productivity in southern Australia (1). Drought leads to financial hardship for many rural Australian families and this could be expected to lead to psychological distress in coming years.

Drought and long-term drying conditions in parts of Australia will also increase the risks of exposures to extreme environmental conditions (dust, smoke, heat), shortages of water (hygiene consequences), reduced local food supplies (and increased prices for families with reduced farm incomes), and perhaps changes in health-risk behaviours (smoking, alcohol consumption, self-medication).

**BOX 1. CLIMATE CHANGE: Main categories of risks to health in Australia**

- health impacts of extreme weather events (floods, storms, cyclones, bushfires, etc.)
- health impacts of temperature extremes, including heatwaves
- vector-borne infectious diseases (e.g. mosquito-borne dengue fever, Ross River virus)
- food-borne infectious diseases (including from Salmonella, Campylobacter and many other microbes)
- water-borne infectious diseases and risks from poor water quality
- diminished food production: yields, costs/affordability, nutritional consequences
- increases in urban air pollution (e.g. ozone), and interaction of this environmental health hazard with meteorological conditions thereby increasing the risk to health
- increased production of aeroallergens (spores, pollens), thus exacerbating asthma and other allergic diseases
- mental health consequences of social, economic and demographic dislocations (e.g. in parts of rural Australia, and, via disruptions to traditional ways of living, in remote indigenous communities)
- emotional stresses and mental health problems in children, in response to perceptions/fears of climate change and to family stresses (e.g. impaired rural livelihoods)

## Who is Most at Risk in Australia?

There are a number of groups within our community who are at particular risk from the health impacts of climate change.

### Children

The behaviour patterns of children, such as outdoor play are considered to lead to an increased risk of heat stress during heat waves and also increases their exposure to diseases transmitted by mosquitos (18). Children are often reliant on others to watch out for their needs (12). Other factors contributing to their vulnerability include immaturity of their body systems and this would likely lead to greater risk of respiratory conditions associated with enhanced air pollution. Children's lungs are more susceptible to increased particle density, as occurs during bushfires.

Extreme weather events may cause many children to suffer with post-traumatic stress disorder and following such natural disasters children can suffer with high rates of sleep disturbance, aggressive behaviour, problems with mood and even substance abuse. Some studies have suggested that these psychological effects after disasters last longer in children than in adults (9).

### The Elderly

The elderly in our community are particularly vulnerable to increased temperatures (7), particularly those who have cardiovascular and respiratory diseases (8) This was found during the European heatwaves in 2003 as older citizens, particularly those with restricted mobility and chronic medical conditions were the group most affected (5). Climate modelling studies have shown that in temperate Australian cities, a 75 per cent increase in annual heat-related mortality among people 65 years and older may occur by 2050 (8).

### Rural, Regional and Remote Communities

Much of rural Australia (especially in the south, south-east and parts of eastern Australia) experienced a severe and prolonged drought during 2001-2007. Economic, social and mental health stresses have resulted. Wellbeing and ways of living continue to be under threat in some regions.

Meanwhile, a longer-term drying process may now be underway. Such a trend, especially in the world's mid-latitude regions (~ 25-40 deg latitude), is thought likely as the world warms and rainfall systems shift towards the poles. The combination of reduced rainfall, increased evaporation, and diminished stream/river flows mean that soil moisture and crop irrigation will both decline,

with inevitable impairment of agricultural yields. Further, weather patterns are likely to become more variable, and include more extreme events.

This situation casts a long shadow over the prospects for rural and regional Australia and for many indigenous and remote communities. In summary, adverse impacts are likely to occur in many domains, including on:

- agricultural productivity;
- exposures to extreme weather events (severe bushfires, floods, dust storms, etc.);
- community functioning and morale;
- mental stress, depression and risk of suicide;
- emotional and developmental effects on children;
- exposures to extremes of heat: impacts on mood, behaviour and work capacity;
- access to fresh water (irrigation, livestock, domestic and personal hygiene, drinking);
- local food production and availability (affordability) with nutritional consequences; and
- other health risks (eg, infectious disease patterns; changes in health-related behaviours).

Climate change will pose a number of complex and unique risks to the health and well being of rural, regional and remote communities.

### **Coastal Communities**

In the 2 per cent of the world's coastal areas which are less than 10 meters above sea level, reside ten percent of the population. Coastal communities in all countries including Australia are vulnerable to sea coastal surges which will occur from a combination of sea level rise and more severe storms (20)

## Australia and the Global Community

Having considered the wide range of health impacts which Australians face as a result of climate change, we must not forget that developing countries will be hit hardest by the effects of climate change in terms of water and food security, sea level rise and extreme weather events. It has been estimated that the reduction in food yields from agriculture in Africa will be as great as 50 per cent by 2020. According to the Intergovernmental Panel on Climate Change, 75–250 million people in Africa will suffer water shortages by this time, and residents of Asia's megacities will be “at great risk of river and coastal flooding.” (2)

Australia as a global citizen has the opportunity to help address health impacts which result from climate change in other countries, and the magnitude of this threat warrants us considering how Australians might best prepare to help in ways including assisting those people who are displaced. Already the citizens of the island state of Tuvalu have made plans to emigrate to New Zealand. When we fully take into account the problems facing developing countries, the risk of widespread political instability due to limited resources, and potentially millions of people displaced in our region, the need to reduce the degree of climate change assumes even greater urgency.



King tide in Kiribati in February 2005. The salt water washes through the crop gardens and contaminates fresh water reserves. Photograph © Greenpeace.

## Health Care in a Changing Climate

Australians will need health care which addresses the health impacts of climate change. When we consider the wide range of health effects, it becomes evident that health care will need to be:

- Responsive to a broad range of emerging threats to health;
- Collaborative with other sectors of the community; and
- Informed by the strategic imperative of reducing greenhouse gas emissions and limiting the impacts of climate change.

### Responsive Health Care 2020

In the coming decades, patients and doctors alike will need to be on the lookout for the serious health consequences of climate change such as heat stress. Doctors may be called upon to recognise the early signs of heat related illness. Community and family physicians will be particularly well placed to counsel those at higher risk such as the elderly who live alone, about what to do in the event of extreme temperatures. Such recommendations might include dressing coolly, drinking enough fluids, limiting physical activity during the hottest part of the day, and keeping in the cooler part of the house.

The response of doctors and other health workers will need to be flexible and adaptive in order to meet the wide range and evolving nature of health impacts of climate change, whether allergies, respiratory illness, or the traumatic injuries relating to storms and floods and bushfires. The adaptive strategies in which the health sector can engage in order to minimise health risks associated with climate change are outlined in Box 2.

### Collaborative Health Care 2020

In dealing with the health impacts of climate change doctors and other health workers will need to collaborate with communities and organisations in areas such as disaster preparedness, disease surveillance as well as advocacy for sustainable community design which would include ensuring access to public transport.

### Infectious disease transmission

It is important that sectors of the community collaborate so that outbreaks of climate related infectious illnesses are detected at the earliest possible stage. General practitioners may be required to assist with public health strategies for monitoring the spread of diseases which are transmitted by vectors such as insects.

**BOX 2. Some major categories of adaptive strategies to lessen health risks from climate change****Activities in which the health sector should lead or participate:**

1. Public education, including in health-care settings (doctors' waiting rooms and hospital clinics)
2. Preventive programs  
e.g. vaccines, mosquito control, food hygiene and inspection, nutritional supplementation
3. Provision of health care (especially mental health promotion and primary care) for communities affected by environmental adversity (e.g. drying conditions in rural communities)
4. Surveillance of disease (especially infectious disease) and its key environmental, social and biological risk factors for those diseases
5. Forecasting future health risks from projected climate change
6. Health sector workforce training (primary and in-career) to attune to climate-related health risks

**Strategies that extend beyond the formal health sector:**

- Community education and mass media campaigns to reduce and prevent weather-related health risks
- Early-warning systems for impending weather extremes (e.g. heat-waves, storms)
- Neighbourhood support/watch schemes, to protect those who are most vulnerable
- Enhanced urban planning: green spaces, shade – reduction of 'heat island' effect
- Climate-proofed housing design (shade, insulation, ventilation)
- Improved water catchment in water-deprived regions
- Disaster preparedness across sectors (and including the 'surge' capacity of the health-system)

Based on McMichael et al. (2008) (1)

**Sustainable Communities**

Doctors and their patients must advocate for sustainable community design and work with local authorities to ensure that we can all live and work without expending large amounts of energy from fossil fuels. Such measures could include building design which reduces heat accumulation around buildings and which allows for good insulation, ventilation and sun-shading.

We must be cautious of adopting interventions which are not sustainable for the environment in the long term. Air conditioning may be one way of avoiding heat stress, but if our community heavily relies on such measures which require the burning of fossil fuels, not only would this increase greenhouse gas production but also would increase air pollution. Reduction in energy consumption must be a key part of the strategy and part of the solution includes increasing public awareness relating to our changing environment.

**Communities affected by drought**

Strategies which have been suggested as ways to assist communities to deal with prolonged drought include education about the financial and psychological effects of drought, cooperation and coordination between agencies and professionals, including doctors, who are involved in delivering health and other care to these communities, and developing mental health resources which are robust and skilled in this area (21)

Much of the research about natural disasters relates to supporting victims after an event has passed, however there are many opportunities to help the sufferers of ongoing problems like drought and more attention needs to be drawn to this area (21).

**Preventative Health Care for Patients and the Environment**

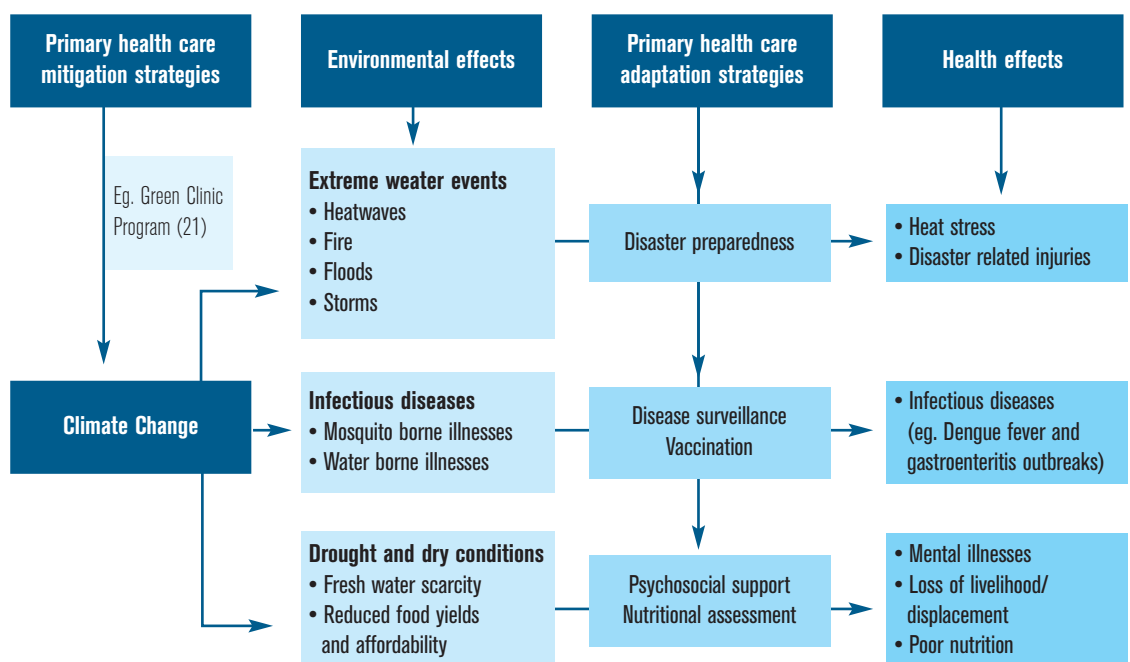
There is much to be gained from doing what we can to reduce greenhouse gas emissions and to attempt to limit the increase of global temperatures. The benefits would include preservation of species and protection of endangered natural environments. These are part of the ecosystems that are our life support services and are therefore essential to the health and well being of our own communities. It has also been shown that this could improve the health and well being of our own community. A report published by the Australian Conservation Foundation and the Australian Medical Association estimated that implementation of strong policy action on climate change compared to no climate change policy could save between 900 and 1300 lives annually by 2100 (14).

It is therefore particularly important that every citizen and especially every doctor, who frequently has a leadership role in the community, do all they can to find opportunities to decrease greenhouse gas emissions. In the course of patient care, doctors and other health professionals can recommend and implement



interventions which are good for health as well as being good for the environment (22). Figure 3 shows schematically how the primary health care sector can intervene to promote the reduction in greenhouse emissions as well as providing health care for those who are affected by health impacts of climate change.

**FIG 3: Adaptive strategies: Intervention opportunities for primary healthcare system (11)**



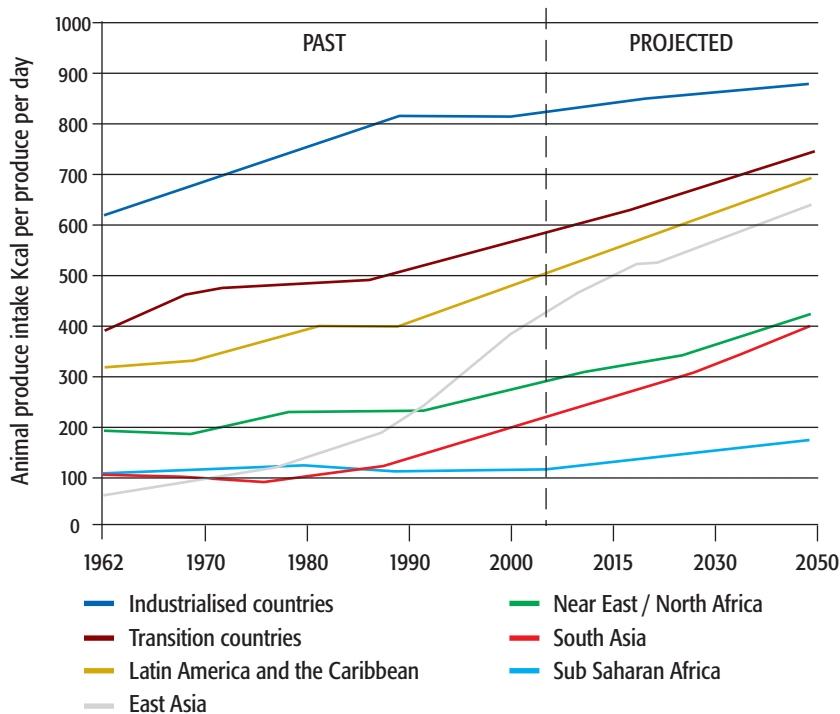
### Diets with low environmental impact

We are now aware that intensive agriculture, particularly the farming of livestock for red meat production, requires large amounts of resources and produces large quantities of greenhouse gases. When factors such as deforestation for grazing land and feed production, energy use in growing feed-grains, processing and transporting grains and meat as well as gases (especially methane) from animal belching and from manure have been taken into account, the contribution of livestock production to global greenhouse gas emissions has been estimated to be in the order of 18% (24). Globally, the consumption of animal products is rising rapidly which is shown in Figure 4.

The way in which livestock is farmed may be difficult to change on a large enough scale in a short time. There are therefore growing calls in the scientific literature

for those in developed countries to reduce red meat consumption and there are personal health benefits in so doing. Some groups in the community (e.g. women when they menstruate or are nursing, and elite athletes (24)) that require iron in an easily absorbed state, such as that offered by eating red meat, would still derive health benefits from the moderate consumption of lean red meat.

**FIGURE 4.** Trends in consumption of livestock products per person (including milk, eggs, and dairy products, excluding butter) The projected trends assume no policy- induced change from present consumption. (25)



### Physical exercise

There are many ways of increasing activity levels which have low environmental impact and which produce minimal greenhouse gases. Active transport refers to people getting from place to place by expending their own metabolic energy rather than sitting in a car. Active transport can involve walking, cycling and catching public transport.

Physical exercise is good for health in many ways, from reducing obesity to preventing many types of cancer. It reduces rates of heart disease and is associated with positive changes in mental health. With respect to climate change it is now claimed that those who are fitter will be less susceptible to heat stress (7).

We must be on the look out for other ways to keep fit and healthy without travelling large distances by car. Reduction of motor vehicle use results in cleaner air in our cities and towns, which in turn will lead to better respiratory health and fewer premature deaths especially from heart and lung disease. It has been estimated that reduction of 50 per cent in greenhouse gas emissions from road transport could save between 150 and 250 lives per year from air pollution by 2100 (14).

### **Raising awareness of the health risks of climate change**

Doctors and health professionals have opportunities to demonstrate our commitment to mitigating the causes of climate change to patients. Community education programs have previously resulted in significant improvements in environmental impact and it is important that we share any successful strategies which engage others in our profession in the quest for sustainability. Some doctors' groups have already sought to educate patients using educational materials in waiting rooms and by health promotion (1). The magnitude and urgency of the problem of climate change requires that all who understand the threats to health and who are in a position of influence must act to shape and strengthen the community's attempts to reduce greenhouse gas emissions.

## **Conclusion**

Climate change is already a threat to community well-being. It is not only an economic issue; it is a threat to our life support systems. In the coming decades doctors who are interested in the long term health of their patients and communities will have a central role in the mitigation of climate change and in preparing for and managing its adverse health impacts. The human health impacts of climate change for Australia in 2020 will partly depend on how our community addresses these challenges.

## References

1. McMichael AJ, Friel S, Nyong T, Corvalan C. Global environmental change and health: impacts, inequalities, and the health sector. *BMJ* 2008; 336:191-4
2. World Health Organisation. Protecting health from climate change – a toolkit for event organisers. [http://www.who.int/world-health-day/toolkit/toolkit\\_en.pdf](http://www.who.int/world-health-day/toolkit/toolkit_en.pdf) [Accessed 22/2/08]
3. McMichael AJ, Campbell-Lendrum D, Kovats S, 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>
4. Tibbetts J. Driven to extremes health effects of climate change. *Environmental Health Perspectives* 2007;115:A196-203
5. Vandenortren S, Bretin P, Zeghnoun A, Mandereau-Bruno L, Croisier A, Cochet C, Ribe´ J, Siberan I, Declercq B, Ledrans M. August 2003 Heat Wave in France: Risk Factors for Death of Elderly People Living at Home *European Journal of Public Health* 2006; 16: 583–591
6. Sellman J, Hamilton JD. Global climate change and human health. *Minnesota Medicine* 2007;90:47-50
7. Gosling SN, McGregor GR, Paldy A. Climate change and heat-related mortality in six cities part 1: model construction and validation. *International Journal of Biometeorology* 2007; 51:525-40.
8. Knowlton K, Lynn B, Goldberg RA, Rosenzweig C, Hogrefe C, Rosenthal JK, Kinney PL. Projecting heat-related mortality impacts under a changing climate in the New York City region. *American Journal of Public Health* 2007; 97:2028-34
9. Shea KM. Global climate change and children's health. *Pediatrics* 2007; 120: e1359-1367.
10. Lucas C, Hennessy K, Mills G, Bathols J. Bushfire weather in southeast Australia: recent trends and projected climate change impacts. Bushfire CRC and Australian Bureau of Meteorology, CSIRO Marine and Atmospheric Research. Consultancy report prepared for the Climate Institute September 2007. [Available at <http://www.climateinstitute.org.au/images/stories/bushfire/fullreport.pdf> 15 March 2008]
11. Blashki G, McMichael T, Karoly DJ. Climate change and primary health care. *Australian Family Physician* 2007; 36: 986-989.
12. Ebi KL, Paulson JA. Climate change and children. *Pediatric Clinics of North America* 2007; 54:213-26
13. [Available at [www.health.qld.gov.au/dengue/outbreak\\_update/current.asp](http://www.health.qld.gov.au/dengue/outbreak_update/current.asp) [accessed 3 October 2007]
14. Woodruff R, Hales S, Butler C, McMichael AJ. Climate change health impacts in Australia: effects of dramatic CO<sub>2</sub> emission reductions Report for the Australian Conservation Foundation and the Australian Medical Association, 2005.
15. Currie BJ, Jacups SP. Intensity of rainfall and severity of melioidosis, Australia. *Emerging Infectious Diseases* 2003; 9:1538-42
16. Bunyavanich, S., Landrigan, C., McMichael, A., & Epstein, P. (2003). The impact of climate change on child health. *Ambulatory Pediatrics*, 3, 44–52
17. Available at [www.csiro.au/resources/ps3bv.html#3](http://www.csiro.au/resources/ps3bv.html#3) [Accessed 5 September 2007]
18. Arnold RG, Carpenter DO, Kirk D, Koh D, Armour MA, Cebrian M, Cifuentes L, Khwaja M. Meeting report: threats to human health and environmental sustainability in the Pacific basin. *Environmental Health Perspectives* 2007; 115:1770-5
19. Sachs JD. Climate change refugees. *Scientific American* 2007; 296:43
20. IPCC: summary for policymakers. In: *Climate change 2007: the physical science basis*. Contribution of Working Group 1 to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change. Solomon S, Qin D, Manning M, et al, editors. Cambridge: Cambridge University Press.
21. Morrissey SA, Reser JP. Natural disasters, climate change and mental health considerations for rural Australia. *Australian Journal of Rural Health* 2007;15:120-5.
22. Horton G, Magin P. Health patients, healthy planet. Green recommendations for GP health promotion. *Australian Family Physician* 2007; 36: 1006-1008.
23. American Academy of Pediatrics Committee on Environmental Health. Global climate change and children's health. *Pediatrics* 2007; 120 :1149- 1152
24. McMichael AJ, Powles JW, Butler CD, Uauy R. Food, livestock production, energy, climate change, and health. *Lancet* 2007; 370:1253-63
25. FAO. *Livestock's long shadow*. Environmental issues and options. Rome: Food and Agriculture Organisation, 2006: 15.