

Global warming and Australian public health: reasons to be concerned

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Abstract

Studies in global warming and climate change indicate that human populations will be deleteriously affected in the future. Studies forecast that Australia will experience increasing heat waves and droughts. Heat stress caused by frequent heat waves will have a marked effect on older Australians due to physiological and pharmacological factors. In this paper we present an overview of some of the foreseeable issues which older Australians will face from a public health perspective.

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RECENT STUDIES into global warming have forecasted an increase in heat wave patterns, droughts, and inclement weather cycles in many regions of the world. In relation to Australia, future climate change will mainly manifest in accelerated greenhouse effect.¹ Some reports also predict that Australia's climate will become hotter and drier by 2070, which may have adverse consequences on the Australian population.^{2,3} In this paper we provide an overview of the major public health concerns that will affect many Australians.

Infectious diseases

Incremental heat temperatures may give rise to vector-borne infections and increase the likeli-

What is known about the topic?

There are predictions of climate change resulting in accelerated greenhouse effect and an increase in temperature and decreased precipitation in Australia.

What does this paper add?

This paper provides comment on the public health implications of this change including infectious diseases and heat stress, and the requirement for adaptation strategies.

What are the implications for practitioners?

Australian public health is particularly vulnerable to climate change, and because of the variable nature of global warming and its impact on natural and social systems, policy makers need a variety of approaches in dealing with present and future climate change.

hood of food pathogens and water-borne diseases.⁴⁻⁷ The World Health Organization has estimated that about 160 000 deaths occur annually from extreme weather events, and several major climate-sensitive infectious diseases.⁸ Climate change may influence both dengue and malaria vectors which already occur in Australia. For instance, climate models indicate that the malaria vector zone may travel southwards to regional zones such as Bundaberg and Rockhampton.⁹ Similarly, the *Aedes aegypti* form of dengue fever may also expand as far south as Carnarvon, Gympie, and Maryborough.⁹ Risk of dengue infection may threaten between 300 000 to 500 000 Australians living in northern parts of Australia by 2020, and 750 000 to 1 600 000 Australians by 2050.⁹ In relation to food-borne disease, reports indicate that viruses (eg, calicivirus, rotavirus), bacteria (eg, *Campylobacter*, *Salmonella*, *Shigella* and *Escherichia coli*) and other pathogenic agents (eg, *Cryptosporidium*, *Giardia*), which cause gastrointestinal infections, may increase in warmer temperatures.⁹⁻¹¹ Increases in

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diarrhoea are also associated with warmer temperature patterns associated with El Niño, which was characterised by high rates of dehydration and diarrhoea in Lima, Peru.¹² In Australia, the upward trend in food-borne diseases is evident in the increasing rates of infection by these pathogenic agents. Between 2 to 4 million cases of food-borne diseases occur annually among Australians, with many cases going unreported.^{9,13,14}

Heat stress and thermal impacts

As one of the most important health consequences due to extreme weather, an excess of deaths has been observed both on extremely hot^{15–20} and cold days.^{21,22} There is a significant increase in mortality beyond threshold temperature points.^{23–26} This will cause increases in mortality from specific causes, in particular cardiovascular, cerebrovascular and respiratory diseases, and among specific population settings including aged people and those with lower socioeconomic status.^{23,27–29} The 2003 European heatwave caused 35 000 excess deaths, with 15 000 in France.^{30–34}

In Australia, it was found there was higher coronary heart disease mortality in winter in NSW over 1979–97.³⁵ A 1993 study in Adelaide indicated that heatwaves may affect the aged population and people with illness.³⁶ Guest et al analysed data from five Australian cities over the period 1979–90 and found excess deaths were attributable to temperatures over the threshold,³⁷ and a similar result was obtained from Christchurch, New Zealand,³⁸ and Brisbane.^{39,40} A recent study indicated that heat-attributable mortality in the elderly increases as daily maximum temperatures exceed 20°C in Sydney, 28°C in Brisbane and 34°C in Darwin and Cairns.⁵ A study in Adelaide⁴¹ suggested extreme weather (mainly heatwaves) significantly increased human mortality, especially for people with cardiovascular diseases. In addition to mortality, our study in Adelaide, funded by an ARC linkage project, suggested there was a 5%–6% increase in ambulance call-outs in summers compared with winters over the period 1993–2005, suggesting that

heatwaves challenge our already overloaded health care system.⁴¹

It has been estimated that over most of Australia, albeit with significant regional variation, annual average temperatures will increase by 0.4–2.0°C by 2030, and by 1–6°C by 2070.⁴² In Sydney, for example, this would cause an up-to-twofold rise in the average number of days over 35°C by 2030 (and up to sixfold by 2070). Even in Hobart, the days over 35°C could be doubled by 2030 and up to fourfold by 2070. With additional climate variability in future — which can now be modelled by the CSIRO and the Australian Bureau of Meteorology — fluctuations in temperature extremes will be greater. These will have significant impact on population health including daily mortality, ambulance call-outs, hospitalisations and emergency department visits, and bring about extra burden of diseases, especially in vulnerable groups, which will challenge our overloaded infrastructure, emergency response capacity, health resource allocation and social welfare system.

Predictions of heat waves in Australia in the 21st century will be critical due to Australia's ageing population. By 2051, one in four Australians will be 65 years of age and over.⁴³ In addition, population increase of older Australians will be between 7 and 9 million by 2050, a 300% rise from the current population.⁴³ Older people tend to be more reliant on various medications such as diuretics, tranquillisers and sedatives, and heart and blood pressure drugs which may impede diaphoresis. Studies conducted by Clark and Lipton,⁴⁴ Beggs,⁴⁵ Klein-Schwartz and Oderda,⁴⁶ Epstein et al,⁴⁷ and Vanakovski and Seppala⁴⁸ have examined the relationship between pharmacokinetics, physiological changes, and heat exposure in the elderly. Klein-Schwartz and Oderda note that various “physiological changes in the elderly may influence” absorption, excretion, metabolism, and distribution.^{43,49} Similarly, Beggs states that “certain medications predispose individuals to excessive heat strain by altering physiologically and behaviourally thermoregulatory functions.”⁴⁵ The elderly are “particularly vulnerable to climate induced

pharmacokinetic changes" which are exacerbated in warmer periods.⁴⁵ (p. 631) Moreover, some drugs could be compromised due to heat exposure.⁴⁸

Depletion of the ozone layer also needs to be addressed in the context of public health in Australia. Greenhouse gases caught in the outer stratosphere result in increasing ozone reduction.^{49,50} According to Selvey and Sheridan, ozone depletion has influenced morbidity and mortality rates of Australians living in eastern coastal cities such as Melbourne and Brisbane.⁴⁹ This is particularly concerning for the elderly due to their vulnerability to increasing respiratory ailments. Moreover, reduction of the ozone layer increases harmful ultraviolet rays which can lead to eye disease and skin cancer in older Australians due to accumulative exposure to the sun.⁵¹

Adaptation strategies

The likely burden of temperature-related mortality and morbidity due to climate change needs to be systematically examined. Such studies will provide evidence for health resources allocation, infrastructure establishment, the improvement of social and welfare systems and aged-cared services, and other government policies.

The impending climate changes pose a wide range of risks to the Australian population. Therefore, adaptive strategies, to lessen the health risk, should be identified and evaluated. Long-term adaptations that are efficient, equitable and sustainable are preferable. However, no research has yet been conducted in Australia on health-specific adaptation strategies. Therefore, as the Australian Greenhouse Office indicated: "Further research is necessary to identify the most cost-effective adaptation and mitigation options and strategies, which in most cases need to be location- and sector-specific."⁵²

Such research will provide government agencies with information on the risks to health from extreme weather. The study results will form the basis for the implementation of appropriate response mechanisms to deal with heatwaves as part of government's Disaster Response Plan.

Furthermore, historic data analysis and projections need to be applied to identify appropriate societal and health responses for reducing vulnerabilities to climate change in Australia. This is extremely important to the process of government policy making, sustainable development planning, environmental risk assessment, impact assessment (including quantification of economic implications and management), and local community education campaigns to mitigate the consequence of climate change. Such responses might include changes in resource management systems and their operation, a range of socioeconomic actions (such as institutional initiatives, community education, and regulatory responses), infrastructure establishment and relocation, health resource management, disaster prevention mechanisms, response to emergency events, the improvement of public services, service promotion in relevant industries such as aged-care services, health education, and health promotion campaigns.

Here, the implementation of focus groups by Australians from various age and ethnic groups may be instrumental in the transmission of public health information concerning global warming and in facilitating needed health services.⁵³ Such groups will also be accessible to researchers, health care professionals and policy makers and act as monitoring health agencies for Australians. It must not be assumed that ordinary Australians have an informed understanding of global warming and its forecasted health implications. Additionally, public health professionals should not assume that ordinary "Australians will not take an active part in changing their health habits and attitudes in the future."⁵⁴

Another concern is the need for public health professionals to develop better communicative strategies with older Australians from non-English-speaking backgrounds in relation to taking medications. Research has shown that this group has frequent communication problems when dealing with health professionals.⁵⁵⁻⁵⁷ Careful planning is necessary in order to identify elements for more "meaningful interaction" with older Australians from non-English-speaking

backgrounds. This will entail a sustained cultural change in the way in which medications will be prescribed in the future.

Due to the variable nature of global warming and its impact on natural and social systems, policy makers need a variety of approaches in dealing with present and future climate change. Australian public health is particularly vulnerable to climate change. This has been contributed to by a culture of denial at the highest levels and promotion of population increase.⁵⁸

The need to create public health adaptation models is complex since one must account for various determinants such as distribution of health and public health infrastructure.⁵⁹ This must be combined with relevant policies and measures as well as mitigation policies.⁵⁹ Moreover, the implementation of viable public health adaptation models is inherently uncertain since many variables may change over time, and different responses from populations may diminish the effectiveness of prescribed adaptation models.^{59,60} Climate change uncertainty is also due to the long-term time scale. In this scenario governments will be expected to learn adaptation processes in relation to prevention activities and allocation of resources as well as appropriate responses.⁶¹⁻⁶³

An important public health adaptation strategy will be the use of safe community housing as a crucial haven for the less privileged in the community such as the homeless and people from lower socioeconomic backgrounds who may not be able to afford air conditioning. I envisage the creation of one or more large community houses in every suburb to cater for several hundred individuals. Community members will be able to visit such centres during heat waves. At present many people use shopping centres as havens in order to find respite during very hot days.

More information on weather patterns could be given during weekly community meetings. This will improve people's ability to prepare for warmer conditions, particularly those people who have inadequate home air conditioning.

As the price of fuel rises, poorer Australians may limit the use of air conditioning. This will set

a dangerous precedent, as it will increase heat-induced exhaustion, heat stroke and other related ailments. Along with improved air conditioning practices is the need to install air conditioning in all dwelling types and in public places.⁶⁴ Furthermore, an upgrade of Australian building materials and standards for housing to make them "less vulnerable to high temperatures and provide air conditioning at low costs" is needed.⁶⁴

Organisations are "primary socio-economic units" in which public health adaptation will take place.⁶⁵ Business routines can be modified or adapted to novel situations such as ongoing climate change, however feedback mechanisms which demonstrate adaptation to climate change may be weak.⁶⁵ Thus, organisational adaptation will be based on the inter-relationships between numerous actors over a long time scale, with the hope that organisations will be able to integrate feedback mechanisms for improving their adaptive capacity in "less stable environments".⁶⁵

In addition, mobility patterns will need to adapt to climate change. This may eventuate in increasing nocturnal living patterns such as more night-time shopping. The recent heat wave in March 2008 in Adelaide demonstrated that people tend to stay indoors during very hot days, suggesting Australians may change their living patterns to include more night-time activities.

By 2050 there will be an array of biotechnologies available to many Australians which will not only prolong life but will greatly improve the quality of life, with improved mobility and enhanced cognitive and sensory abilities. Such enhancements will ultimately mean greater capacity to adapt to extreme climate change. The advent of nanotechnology in combination with genetic engineering will change the way we view our bodies in a generation from now. New drugs may improve homeostatic functions in the human body and adaptation to climate extremes. As Stock proposes, "In the decades ahead, we will develop the power to safely manipulate our internal chemistry to regulate our bodies as we wish."⁶⁶ While this is still in the realm of science fiction it would be unwise to discount its possibility. There is little doubt that new biotechnologies

will also markedly improve the heat carrying or cooling capacities of future clothes.

Another important strategy is the advocacy of anticipatory public health adaptations, as these have been shown to be effective.⁶⁷ Since infrastructural systems are interrelated, adaptations addressed in one system will affect other systems. For instance, improvements in water quality have the potential to improve water supply and health management rates.⁶⁷ Better risk assessment regimes could be created in the form of impact analyses to identify and assess key public health issues arising from climate change.^{68,69} Future impact analyses would also examine the level of effectiveness between infrastructural systems in relation to their adaptational capacities.⁷⁰ Interestingly, Baron points out that due to the unknown but imaginable risks of climate change,⁷¹ public health policies will need to cater for less-than-effective political processes and “positive illusions” which augment our inattention to public health problems.⁷² This will assist in increasing the availability of potential technologies for mitigating global warming while enhancing public health capacities.^{73,74}

Competing interests

The authors declare that they have no competing interests.

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