

Climate change, health and general practice in Aotearoa New Zealand and the Pacific

Position statement

The current and projected effects of climate change on health and equity led The Royal New Zealand College of General Practitioners (the College) to believe that general practice has a key role to play in raising awareness of the impacts of climate change on health, in social leadership and the promotion of appropriate lifestyle choices, in advocating for health-protecting climate policy and in supporting health sector movement towards sustainable systems.

The College has identified actions it can take as a sector leader as well as recommendations for general practitioners (GPs) to consider in their own lives and practices. These recommendations are available on the College website: www.rnzcgp.org.nz

Introduction

The College unequivocally acknowledges anthropogenic (man-made) climate change as a threat to health and equity in Aotearoa New Zealand. Equally, the College recognises that many climate actions aimed at mitigating greenhouse gas emissions also promote healthier lifestyles.

This policy statement does not aim to detail the convincing body of evidence supporting projected changes to global temperature or its impacts on the environment. This research has been extensively covered by qualified, reputable institutions – most notably the International Panel on Climate Change (IPCC) – and it is beyond scientific doubt that our world is warming.¹ The College notes that climate science is often described in probabilities and likelihoods due to the complexity of the science involved. This issue is eloquently explained by the Office of the Chief Science Advisor in the 2013 report on New Zealand's changing climate and oceans.²

Rising temperatures, altered ecosystems and changes to human systems (for example, food production and the global economy) will increasingly affect the health of New Zealanders, particularly the most vulnerable groups. As noted in the College's position statement on health equity, GPs are encouraged to take a population health as well as an individual approach.³ The current and projected effects of climate change on health and equity led the College to believe that general practice has a key role to play in raising awareness of the impacts of climate change on health, in social leadership and the promotion of appropriate lifestyle choices and in supporting health sector movement towards sustainable systems.

The responsibility of health professionals in climate action is increasingly being acknowledged by the New Zealand sector (as well as internationally), and the College supports this stance. Some key health institutions that have engaged in climate action to date include:⁴⁻⁹

- The New Zealand Medical Association
- The Royal Australasian College of Physicians*
- The New Zealand College of Public Health Medicine
- The Australasian College for Emergency Medicine
- The New Zealand Nurses Organisation
- The Royal College of General Practitioners (UK)
- The Public Health Association of New Zealand.

Another notable organisation is **OraTaiao: New Zealand Climate and Health Council**, which was established in 2009 by doctors, other health professionals and students concerned about the health impacts of climate change. Its membership has been steadily growing in size and support as more health professionals become aware of the impending threat and health opportunities.^{1,10} Groundswell support for climate action and social leadership among respected society members (including doctors) are important factors in creating political momentum. Public support for climate action facilitates the necessary national policy decisions about emission reductions and sustainable development.

Finally, the precautionary principle has been repeatedly identified as a reason to prepare and act now. The cost of climate action is far less than the potential costs of inaction. Furthermore, there are many positive health outcomes associated with climate actions that can help reduce the burden of numerous chronic diseases prevalent in New Zealand and the Pacific.

* The Royal New Zealand College of General Practitioners signed the Doctors for Climate Action Consensus Statement **Act now to reduce the damaging health impacts of climate change** in October 2015.

† OraTaiao is part of a growing global movement of health professionals concerned about the health impacts of climate change and a founding member of the Global Climate and Health Alliance.

Health impacts of climate change

The College considers climate change to be a health issue separate to its environmental implications. The effects of climate change on global health¹¹ are commonly divided into three categories:

1. **Direct impacts:** The most dramatic effect of climate change is (and will likely continue to be) the altered weather patterns. As well as the direct physical impact of extreme weather events (heat, drought, storms), affected populations continue to suffer from health and social impacts long afterwards.^{12,13} Rising temperatures are increasing the severity and frequency of these dramatic weather patterns already, with further increases expected over the coming decades. Neither New Zealand nor the Pacific countries and territories are immune from these consequences.^{2,14} Rising sea levels, resultant flooding and coastal erosion are already impacting on housing (particularly in low-lying coastal areas), with further sea level rise and its consequences projected to escalate.¹⁵
2. **Ecologically and biologically mediated impacts:** Changing temperatures and precipitation patterns are expected to alter ecosystems and, consequently, disease patterns. New Zealand and the Pacific are already affected by a range of climate-sensitive diseases (such as vector-borne disease, enteric infections, allergic disease, skin cancer).^{16–19}

Table 1. Expected health impacts of climate change in New Zealand

<p>Food security and nutrition: Increased global food prices, affecting a large number of locally produced and imported food staples in New Zealand, are likely to reduce the ability of some groups to afford a variety of nutritious foods, further compromising nutritional outcomes for those groups.^{11,20–22}</p>
<p>Mental health and suicide: Increased stress and mental health issues (for example, farmers with drought, victims of extreme weather). Young people may suffer anxieties about catastrophic climate change not unlike those experienced by children growing up with the fear of nuclear war.^{11,23–26}</p>
<p>Housing and health: Healthiness of some housing will be affected by extreme weather, for example, indoor moisture (with heavy rainfall, flooding), high indoor temperatures (during heatwaves in poorly insulated houses).²⁷ It is also likely that people will arrive in New Zealand from climate change-affected areas. This may put further pressure on availability of low income larger family homes, potentially impacting household overcrowding and the incidence of some infectious diseases.^{28–30}</p>
<p>Injury and illness from extreme weather events (for example, flooding, storms, landslides, storm surges, drought): Immediate trauma, and indirect health impacts in weeks to months after extreme events (for example, mental health problems, exacerbation of pre-existing medical conditions).^{11,31–33}</p>
<p>Heat-related deaths and illness: Increases in heat-related deaths and illness, particularly for those with chronic illness and those aged over 65 years. Heat stress for outdoor workers. Winter deaths may decline, but this is uncertain as winter deaths may be influenced by seasonal factors that are unrelated to climate.^{11,34–41}</p>
<p>Vector-borne and zoonotic (animal to human) disease: Increased likelihood that mosquito vectors could establish in New Zealand, which could lead to local transmission of mosquito-borne diseases (for example, dengue, Ross River virus). Also possible impacts on other vector-borne diseases (for example, tick-borne) and zoonotic diseases.^{11,42–47}</p>
<p>Food- and water-borne disease: Heavy rainfall can lead to contamination of drinking and recreational water/shellfish with faecal pathogens from animals and humans. Both high and low rainfall and higher temperatures may impact on bacterial and parasitic diseases causing gastroenteritis (for example, giardiasis, salmonellosis). Dry conditions could affect continuity of household water supplies, impacting diseases influenced by hygiene.^{11,47–50}</p>
<p>Ultraviolet (UV) radiation: Climate change may delay recovery of stratospheric ozone. Warmer temperatures could promote increased or decreased outdoor time, affecting exposure to solar ultraviolet (UV) radiation – with possible impacts on rates of skin cancer, eye disease, and vitamin D levels.^{11,51–54}</p>
<p>Physical activity: Warmer temperatures and either increases or decreases in outdoor time may impact on levels of recreational physical activity – an important determinant of health.⁵⁵</p>
<p>Cardiorespiratory disease from air pollution: High temperatures can exacerbate photochemical air pollution with impacts on respiratory disease. Hot, dry conditions increase potential for bush/forest fires, where smoke impacts on people with cardiorespiratory disease.^{11,56–59}</p>
<p>Allergic diseases, including asthma: Possible impacts on allergic conditions with changes in plant distribution, flowering and pollen production.^{11,60}</p>
<p>Indoor environment: Climate change may affect the healthiness of indoor environments (for example, overheating of buildings, changes in indoor air pollutants, flood damage and indoor moisture).^{26,61}</p>

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3. **Human system impacts:** As well as mounting political tensions caused by the global need for equitable emissions accountability, climate change is impacting countries' economies differently.⁶² Climate-sensitive industries (agricultural, horticultural, forestry, fishing) are a core component of New Zealand's economy – particularly in the export sector, Māori economy and for employment. Reduced exports could have impacts across the socioeconomic determinants of health, including health sector funding.

Whilst there are some positive regional projected effects from climate change on health (for example, increased agricultural productivity, modest reductions in cold-related mortality and morbidity in some areas due to fewer cold extremes, geographical shifts in food production and reduced capacity of disease-carrying vectors due to exceedance of thermal thresholds), the IPCC has concluded that these would be overwhelmed by the negative impacts.¹¹ This position statement will focus on predicted health impacts in New Zealand and the Pacific.

The direct, biologically mediated and socially mediated health impacts most likely to be experienced by New Zealanders as a result of climate change are listed in Table 1.⁶³ The College is particularly concerned that these health impacts are likely to disproportionately affect populations already experiencing inequitable health outcomes, including Māori, Pacific peoples living in New Zealand, and the Pacific Islands.^{3,64}

As the first point of contact and health care home for most New Zealanders, it can be surmised that general practice will see the changes to disease profiles first, especially in already vulnerable patients. This will have implications for required resources and is likely to particularly affect rural general practices where patients are more often agriculturalists, ie work outdoors and have climate-sensitive livelihoods.

The connection between the Pacific and New Zealand must also be factored in when considering the health impacts of climate change. The Realm of New Zealand includes Tokelau, the Ross Dependency and the self-governing states of the Cook Islands and Niue. Due to its historic, social and geographic proximity to Pacific Island nations, New Zealand is likely to see an increase in migrants from the Pacific as the atolls and islands succumb to rising sea levels and the difficulties created by climate impacts. This has implications for housing and social supports. Pacific Island nations need greater capacity to deal with climate impacts through increased human resources, medical equipment and medicines and general system structure support. As a developed nation within the Pacific region, New Zealand and its health sector have a role to play in growing this capacity. The top priority, however, must be to actively support the global aim of limiting warming to 1.5°C, which means our Pacific neighbours can retain their homelands.⁶⁵

Impact on Māori health

The health impacts for New Zealand, as expected in other countries, will vary between different subpopulations based

on socioeconomic factors, age, ethnicity, geographic location and health status.¹¹ Māori already experience gross inequities in disease burden, housing quality and socioeconomic status,^{66,67} and these disparities are expected to be exacerbated by climate change impacts. For example:

- Inequitable rates of mental illness and suicidal behaviour among Māori are likely to increase.
- Māori are disproportionately affected by poorer quality housing, overcrowding and crowding-related illness and will consequently be more affected by increased housing pressure from migrant populations, sea level rise, flooding and coastal erosion.
- Māori have inequitably higher burdens of climate-sensitive disease, such as cardiovascular and respiratory illness, asthma and allergic diseases.

There are also features of Māoridom that increase vulnerability to climate impacts, such as the concentration of the Māori population in the North Island, with many communities, marae and historical sites situated near the coast in areas that are at higher risk for the establishment of emerging mosquito-borne illness, sea level rise and coastal erosion.¹⁵ Additionally, there are implications for the Māori economy, which is predominantly invested in climate-sensitive primary industries.

Under the Treaty of Waitangi, the health, cultural concepts, values and practices of Māori must be protected and the inequities between Māori and non-Māori eliminated. Māori communities – iwi, hapū, and whānau – must be comprehensively involved in decision making, planning, development and the delivery of climate actions and policy.⁶⁸

With careful government policy planning, including health and equity impact assessment, it is possible for future inequities to be avoided and for the health co-benefits of climate action to be realised. For this to occur, health must be at the centre of climate policy.

Impact on Pacific health

Land underpins kinship and community identity and is critical to defining the identity, heritage and spirituality of Pacific peoples. Pacific peoples residing in New Zealand maintain historical, familial, cultural, language and economic connections with those living in the Pacific. Climate change is a severe threat to the survival of Pacific populations, with the loss of land disconnecting this relationship and placing enormous social, economic and cultural stressors on Pacific families and populations. Through the Paris Agreement 2015, the global community is committed to protecting human rights, the right to health, the rights of indigenous peoples, local communities, climate migrants, children, people with disabilities and other vulnerable populations.⁶⁵

Pacific Island nations have undertaken a significant amount of collaborative advocacy and adaption planning in mitigating the severe health impacts of climate change.^{69–73}

Many of the health impacts that will affect New Zealand are relevant to the Pacific but to an even greater extent, due to

geographical, resource and infrastructure vulnerabilities. While impacts vary across different Pacific Islands, some significant impacts of climate change on Pacific health include the following:

- **Loss of land and livelihoods** caused by rising sea levels, erosion and crop failure. For some islands, particularly Kiribati, the Marshall Islands, Tuvalu and Tokelau,^{74–76} rising seas may mean relocation, which has its own associated health concerns. Climate-induced migration has implications for recipient countries (such as New Zealand) and their populations. Additionally, loss of land is expected to lead to overcrowding and, consequently, greater risk for infectious disease transmission. Ocean acidification (affecting coral reef ecosystems) is also likely to have flow-on effects for local population economies, with indirect negative effects on peoples' health.
- **Negative impact on Pacific cultures, identity and mental wellbeing** following loss of land and increased dispersion and displacement of Pacific populations. This includes the risks of losing cultural norms and traditions, religious practices and other societal structures and relationships associated with the land. Loss of legal sovereignty will also have profound global legal implications.
- **Traumatic injuries and deaths** caused by unpredictable and/or more extreme weather events such as tropical cyclones, extreme high winds, droughts, floods, extreme heat.⁷⁷ Extreme weather is also often followed by disease outbreaks.^{78–81}
- **Increasing incidence of vector-borne and zoonotic disease** due to altered rainfall patterns and increasing air temperatures. Known diseases that are likely to increase include mosquito-borne malaria, dengue fever, Zika, chikungunya, parasite-borne lymphatic filariasis (elephantiasis), and mammal-borne leptospirosis.^{45,46,75,81–84}
- **Worsening water safety and increased waterborne disease** (diarrhoeal disease, cholera and typhoid fever) due to deterioration in the quality and/or supply of fresh drinking water.^{77,78} This deterioration is caused by extreme rainfall, saline intrusion of water supplies and warmer temperatures.
- **Worsening food safety and increased foodborne disease** due to contamination of food by climate-sensitive bacteria (ie bacteria sensitive to changes in temperature and high humidity), viruses and toxins. This is exacerbated in some islands by limited facilities for refrigeration and secure food storage, for example, Kiribati.^{74–75}
- **Mental health issues** (such as stress, anxiety, and depression) due to social impacts and changes to community lifestyle, relocation, property damage, loss of livelihood, economic instability and uncertainty about the community's future.
- **Higher malnutrition rates** due to increasing difficulties with securing local food production and supply and increased dependency on imported, processed foods that tend to be energy-dense and less nutritious.
- **Increased respiratory disease**, including those with infectious causes. This is particularly relevant in islands where smoking and overcrowding rates are high, as these are additional risk factors for transmission.
- **Widening inequities in health** due to unequal distribution of health impacts and limited resilience among already

vulnerable populations (for example, elderly, young children, those with a disability and/or pre-existing medical condition).

- **Poorer access to health services** due to overwhelmed or disrupted health systems.

Climate impacts on health in the Pacific are further exacerbated by mobile populations, poor infrastructure and already stretched health resources. The medical workforce density in the Pacific Islands varies between 0.1 and 0.5 doctors per 1000 population, compared to 2.7 per 1000 in New Zealand.⁸⁵ The additional strain of climate impacts are likely to overwhelm available resources.

Climate change and general practice

There will be some further increase in global temperature even if global greenhouse gas emissions stopped today, due to the inevitable impact of previous emissions.⁸⁶ Primary care and the health sector as a whole need to identify adaption strategies for these changes.

Currently, there is limited literature on how primary care specifically will be impacted by climate change, but generally it is expected that health care providers will be put under strain.⁸⁷ Health impacts will vary across regions, communities and demographic subgroups, reflecting differences in location (geographic), socioeconomic status, preparedness, infrastructure, institutional resources and local adaptive strategies. For example, migration-related health impacts are more likely to be concentrated in Auckland but not as much in Dunedin. Consequently, adaptive planning for the impacts of climate change on primary care will need to be undertaken in a context-specific way at a regional level. The severity of the impact of catastrophic events such as storms and floods can be minimised by good disaster planning, including the establishment or strengthening of relationships between GPs, health providers, and community services and councils – especially those that will be activated in an emergency.

Some potential impacts on GPs may include the following:

- In some regions, a need to develop new knowledge and skills to respond to the introduction of illnesses such as dengue fever and Ross River virus.
- Greater care required for increasingly vulnerable patient groups (Māori, Pacific, children, elderly).
- The need to improve knowledge and skills to address sociocultural and mental health issues resulting from the loss of traditional land, culture and livelihood.
- Changes and increases in disease surveillance requirements (for example, dengue reporting, waterborne disease reporting).
- Patient list demographic changes (for example, from climate refugees).
- Greater need for disaster preparedness.
- Issues of disruption and resilience for general practice clinics, especially to buildings and other infrastructure.
- A more mobile population as storms and coastal effects trigger relocation within New Zealand.

As noted by Australian researcher Rae Walker in 2009, “Local health responses to climate change need to take into account population characteristics, local resources and the history of action on social and environmental health issues.”⁸⁸

For rural GPs, there is evidence to suggest they will see increasing numbers of patients with mental health problems and suicides in their community.⁸⁹ The increased droughts and/or flooding expected in north/eastern and western areas respectively are likely to lead to financial strain and stress for those whose livelihoods are climate dependent (for example, farmers) and the related community.³⁵ Considering the current rural workforce shortages, there will need to be considerable planning and effort to ensure access to support services for this vulnerable population.³⁶ Relevant services, telehealth innovations and community programmes will need to work closely alongside health services, with a focus on building community resilience, prevention and early intervention.

Recommendations

There are many actions that GPs as individual doctors, as part of the health sector and as part of the community can take to raise awareness of the impacts of climate change on health, to promote healthy, climate-friendly lifestyle choices and to improve the sustainability of health care in New Zealand and the Pacific. A list of recommendations for GPs to consider has been developed by the College and is available on the [College website](#) alongside *Greening general practice: a toolkit for sustainable practice*.

Importantly, many health issues that GPs face on a daily basis, such as obesity, physical inactivity, housing-related illness and cancers, could be prevented or reduced through climate action. The health co-benefits of actions to decrease greenhouse gas emissions are considered by many to be sufficient motivation to act, and many ‘climate’ actions would be recommended solely on a health basis.

Finally the College has also identified actions it can take as a sector leader and to demonstrate its commitment to climate action. These are available on the [College website](#).

Due for Review: August 2019

References and resources

1. International Panel on Climate Change (IPCC) website: <http://www.ipcc.ch/>
2. Office of the Prime Minister’s Chief Science Advisor. New Zealand’s changing climate and oceans: the impacts of human activity and implications for the future. Wellington: Office of the Prime Minister’s Chief Science Advisor; July 2013. Available from: <http://www.pmcsa.org.nz/wp-content/uploads/New-Zealands-Changing-Climate-and-Oceans-report.pdf>
3. RNZCGP. Achieving health equity by eliminating health inequities. Wellington: The Royal New Zealand College of General Practitioners; 2012. Available from: http://www.rnzcgp.org.nz/RNZCGP/Advocacy/Position_statements/RNZCGP/Advocacy/Position_statements.aspx?hkey=26539289-7e92-4616-b5d9-dfbcc7e39bb9
4. The New Zealand Medical Association. New Zealand Medical Association position statement: Health and climate change. Wellington: NZMA; 2015. Available from: <https://www.nzma.org.nz/advocacy/position-statements>
5. The Royal Australasian College of Physicians. Consensus statement: Act now to reduce the damaging health impacts of climate change (Doctors for Climate Action). Wellington: RACP; 2015. Available from: <https://www.racp.edu.au/advocacy/consensus-statement-health-impacts-of-climate-change/health-impacts-of-climate-change-consensus-statement>
6. The New Zealand College of Public Health Medicine. Policy statement on climate change. Wellington: New Zealand College of Public Health Medicine; 2013. Available from: <http://www.nzcphm.org.nz/policy-publications>
7. Australasian College for Emergency Medicine. Statement on climate change. Melbourne: ACEM; 2012. Available from: <http://www.acem.org.au/getattachment/7bd0af68-1762-4d19-9946-6b209bb76691/Statement-on-Climate-Change.aspx>
8. The New Zealand Nurses Organisation. Climate change and health (webpage). Accessed Jan 2016: http://www.nzno.org.nz/get_involved/campaigns/climate_change_and_health
9. Royal College of General Practitioners. Climate change, sustainable development and health. (RCGP Policy area webpage) Accessed Jan 2016: <http://www.rcgp.org.uk/policy/rcgp-policy-areas/climate-change-sustainable-development-and-health.aspx>
10. OraTaiaio: The New Zealand Climate and Health Council website: www.orataiao.org.nz
11. Smith KR, Woodward A, Campbell-Lendrum D, Chadee D, Honda Y, et al. Human health: impacts, adaptation, and co-benefits. In: Climate Change 2014: Impacts, Adaptation and Vulnerability. Contribution of Working Group II to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change [Field CB, Barros VR, Mastrandrea MD, Mach KJ, et al. (eds.)]. Cambridge University Press, Cambridge, UK and New York, NY, USA, 2014. http://ipccwg2.gov/AR5/images/uploads/WGIIAR5-Chap11_FGDall.pdf
12. Berggren RE, Curiel TJ. After the storm – health care infrastructure in post-Katrina New Orleans. *N Engl J Med*. 2006;354:1549–52: <http://www.nejm.org/doi/full/10.1056/NEJMp068039>
13. Briere J, Elliot D. Prevalence, characteristics and long-term sequelae of natural disaster exposure in the general population. *J Trauma Stress*. 2000;13(4):661–79
14. Hollis M. Climate change: IPCC fifth assessment report New Zealand findings. Wellington: New Zealand Climate Change Centre; 2014. Available from: <http://www.nzclimatechange.org/research/ipcc-fifthassessment-report-new-zealand-findings>
15. Wright J. Preparing New Zealand for rising seas: certainty and uncertainty. Wellington: Parliamentary Commissioner for the Environment; 2015. Available from: <http://www.pce.parliament.nz/media/1380/preparing-nz-for-rising-seas-web-small.pdf>
16. Crump JA, Murdoch DR, Baker MG. Emerging infectious diseases in an island ecosystem: the New Zealand perspective. *Emerg Infect Dis*. 2001;7(5):767–72. Available from: http://wwwnc.cdc.gov/eid/article/7/5/01-7501_article.html
17. Baker M, Barnard L, Kvalsvig A et al. Increasing incidence of serious infectious diseases and inequalities in New Zealand: a national epidemiological study. *Lancet*. 2012;379(9821):1112–9.
18. O’Dea D. The costs of skin cancer to New Zealand. A report to the Cancer Society of New Zealand; 2009. Available from: http://www.cancernz.org.nz/assets/files/info/SunSmart/CostsofSkinCancer_NZ_22October2009.pdf
19. Asher MI, Barry D, Clayton T, Crane J, D’Souza W, et al. International Study of Asthma and Allergies in Childhood (ISAAC) Phase One. The burden of symptoms of asthma, allergic rhinoconjunctivitis and atopic eczema in children and adolescents in six New Zealand centres: ISAAC Phase One. *N Z Med J*. 2001;114(1128):114–20. Available from: <http://journal.nzma.org.nz/journal/114-1128/2206/content.pdf>
20. Parnell WR, Reid J, Wilson NC, McKenzie J, Russell DG. Food security: is New Zealand a land of plenty? *N Z Med J*. 2001;114(1128):141–5. Available from: http://www.nzma.org.nz/data/assets/pdf_file/0014/18014/Vol-114-No-1128-23-March-2001.pdf
21. Quiggin J. Drought, climate change and food prices in Australia. University of Queensland; 2008. Available from: http://www.acfonline.org.au/sites/default/files/resources/Climate_change_and_food_prices_in_Australia.pdf
22. Husband A. Climate change and the role of food price in determining obesity risk. *Am J Public Health*. 2013;103:e2. Available from: <http://ajph.aphapublications.org/doi/abs/10.2105/AJPH.2012.301084>

23. Nicholls N, Butler C, Hanigan I. Inter-annual rainfall variations and suicide in New South Wales, Australia, 1964–2001. *Int J Biometeorol.* 2006;50:139–43. Available from: <http://link.springer.com/article/10.1007%2Fs00484-005-0002-y>

24. Berry HL, Bowen K, Kjellstrom T. Climate change and mental health: a causal pathways framework. *Int J Public Health.* 2010;55:123-32: <http://link.springer.com/article/10.1007%2Fs00038-009-0112-0>

25. Polain J, Berry H, Hoskin J. Rapid change, climate adversity and the next 'big dry': older farmers' mental health. *Aust J Rural Health.* 2011;19:239–43.

26. Fritze J, Blashki G, Burke S, Wiseman J. Hope, despair and transformation: climate change and the promotion of mental health and wellbeing. *Int J Ment Health Syst.* 2008;2:13. Available from: <http://www.ijmhs.com/content/2/1/13>

27. Vardoulakis S, Thornes J, Ka-Man L. Health effects of climate change in the indoor environment. In: Vardoulakis S, Heaviside C, editors. *Health effects of climate change in the UK: current evidence, recommendations and research gaps.* London: Health Protection Agency; 2012. Available from: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/371103/Health_Effects_of_Climate_Change_in_the_UK_2012_V13_with_cover_accessible.pdf

28. Howden-Chapman P, Chapman R, Hales S, Britton E, Wilson N. Climate change and human health: impact and adaptation issues for New Zealand. In: Nottage RAC, Wratt DS, Bornman JF, Jones K, editors. *Climate change adaptation in New Zealand: future scenarios and some sectoral perspectives.* Wellington: New Zealand Climate Change Centre; 2010. Available from: [https://www.nzclimatechange.org/sites/nzclimatechange.org/files/images/research/Climate%20Change%20Adaptation%20in%20New%20Zealand%20\(NZCCC\)%20high%20.pdf](https://www.nzclimatechange.org/sites/nzclimatechange.org/files/images/research/Climate%20Change%20Adaptation%20in%20New%20Zealand%20(NZCCC)%20high%20.pdf)

29. McMichael C, Barnett J, McMichael AJ. An ill wind? Climate change, migration, and health. *Environ Health Perspect.* 2012;120:646–54. Available from: <http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3346786/>

30. Britton E. Preparing for change. Wellington: Regional Public Health; 2009.

31. McMichael A, Woodruff R, Whetton P, Hennessy K, Nicholls N, Hales S, Woodward A, Kjellstrom T. Health and climate change in Oceania: a risk assessment 2002. Canberra: Commonwealth Department of Health and Ageing; 2003. p.33–34,57 (Table 17). Available from: <http://webarchive.nla.gov.au/gov/20080727052932/> http://health.gov.au/internet/main/publishing.nsf/Content/health-publth-publicat-document-metadata-env_climate.html

32. McKinney N, Houser C, Meyer-Arendt K. Direct and indirect mortality in Florida during the 2004 hurricane season. *Int J Biometeorol.* 2011;55:533–46. doi: 10.1007/s00484-010-0370-9.

33. Kessler RC, Galea S, Gruber MJ, Sampson NA, Ursano RJ, Wessely S. Trends in mental illness and suicidality after Hurricane Katrina. *Mol Psychiatry.* 2008;13:374–84. doi: 10.1038/sj.mp.4002119.

34. Basu R. High ambient temperature and mortality: a review of epidemiologic studies from 2001 to 2008. *Environ Health.* 2009;8:40. Available from: <http://www.ehjournal.net/content/8/1/40>

35. Kjellstrom T. Climate change, direct heat exposure, health and wellbeing in low and middle income countries. *Global Health Action;* 2009. doi: 10.3402/gha.v2i10.1958. Available from: <http://www.globalhealthaction.net/index.php/gha/article/view/1958/2183>

36. Hales S, Woodward A. Potential health impacts and policy responses. In: Chapman R, Boston J, Schwass M, editors. *Confronting climate change: critical issues for New Zealand.* Wellington: Victoria University Press; 2006.

37. Dunne JP, Ronald J, Stouffer J, Jasmin JG. Reductions in labour capacity from heat stress under climate change. *Nature Climate Change.* 2013;3:1827. Available from: <http://www.nature.com/nclimate/journal/v3/n6/full/nclimate1827.html>

38. Hales S, Salmond C, Town GI, Kjellstrom T, Woodward A. Daily mortality in relation to weather and air pollution in Christchurch, New Zealand. *Aust NZ J Public Health.* 2000;24:89–91.

39. Cockburn S. Does climate affect mortality in Auckland. Thesis. Dunedin: University of Otago; 2001.

40. McMichael A, Woodruff R, Whetton P, Hennessy K, Nicholls N, Hales S, Woodward A, Kjellstrom T. Health and Climate Change in Oceania: A Risk Assessment 2002. Canberra: Commonwealth Department of Health and Ageing; 2003. p. 28,33 (Tables 5,6). Available from: <http://webarchive.nla.gov.au/gov/20080727052932/> http://health.gov.au/internet/main/publishing.nsf/Content/health-publth-publicat-document-metadata-env_climate.htm

41. Ebi K, Mills D. Winter mortality in a warming world: a reassessment. *WIREs Climate Change.* 2013;4:203–212. Available from: <http://wires.wiley.com/WileyCDA/WiresArticle/wisld-WCC211.html>

42. de Wet N, Slaney D, Ye W, Hales S, Warrick R. Hotspots: exotic mosquito risk profiles for New Zealand. IGCI Report. Hamilton: International Global Change Institute (IGCI), University of Waikato/Ecology and Health Research Centre, Wellington School of Medicine and Health Sciences; 2005. Available from: <http://researchcommons.waikato.ac.nz/handle/10289/916>

43. de Wet N, Slaney D, Ye W, Hales S, Warrick R. Hotspots: modelling capacity for vector-borne disease risk analysis in New Zealand: a case study of Ochlerotatus camptorhynchus incursions in New Zealand. IGCI Report. Hamilton: International Global Change Institute (IGCI), University of Waikato/Ecology and Health Research Centre, Wellington School of Medicine and Health Sciences; 2005. Available from: <http://researchcommons.waikato.ac.nz/handle/10289/917>

44. Mills JN, Gage KL, Khan AS. Potential influence of climate change on vector-borne and zoonotic diseases: a review and proposed research plan. *Environ Health Perspect.* 2010;118:1507–14. Available from: <http://www.ncbi.nlm.nih.gov/pmc/articles/PMC2974686/>

45. Derraik JG, Slaney D, Nye ER, Weinstein P. Vector-borne disease prevention: the need for a joint South Pacific approach. *N Z Med J.* 2009;122(1299):7–12. Available from: http://www.nzma.org.nz/_data/assets/pdf_file/0006/17790/Vol-122-No-1299-24-July-2009.pdf

46. Derraik JG, Slaney D, Nye ER, Weinstein P. Chikungunya virus: a novel and potentially serious threat to New Zealand and the South Pacific islands. *Am J Trop Med Hygiene.* 2010;83:755–9. Available from: <http://www.ajtmh.org/content/83/4/755.long>

47. Wilson N, Slaney D, Baker MG, Hales S, Britton E. Climate change and infectious disease in New Zealand: a brief review and tentative research agenda. *Rev Environ Health.* 2011;26:93–99. Available from: <http://www.degruyter.com/view/j/reveh.2011.26.issue-2/reveh.2011.013/reveh.2011.013.xml>

48. Hambling T, Bandaranayake D. Climate change and waterborne diseases in New Zealand and the role of primary care in the early detection of common source waterborne disease outbreaks. *Public Health Surveillance Report.* 2012;10(4). Available from: http://www.surv.esr.cri.nz/PDF_surveillance/NZPHSR/2012/NZPHSR2012Dec.pdf

49. Britton E, Hales S, Venugopal K, Baker MG. Positive association between ambient temperature and salmonellosis notifications in New Zealand, 1965–2006. *Aust NZ J Public Health.* 2010;34:126–9. doi: 10.1111/j.1753-6405.2010.00495.x.

50. Lal A, Baker MG, Hales S, French NP. Potential effects of global environmental changes on cryptosporidiosis and giardiasis transmission. *Trends Parasitol.* 2013;29:83–90. Available from: <http://www.sciencedirect.com/science/article/pii/S1471492212001833>

51. McMichael AJ, Campbell-Lendrum DH, Corvalan CF, Ebi KL, Githelo A, Scheraga JD, Woodward A, editors. *Climate change and human health. Risks and responses.* Geneva: World Health Organization; 2003. Available from: <http://www.who.int/globalchange/publications/cchhbook/en/>, <http://www.who.int/globalchange/publications/climchange.pdf>

52. Waugh DW, Oman L, Kawa SR. Impacts of climate change on stratospheric ozone recovery. *Geophysical Res Letters.* 2009;36:L03805 doi:10.1029/2008GL036223. Available from: http://acdbext.gsfc.nasa.gov/People/Oman/papers/Waugh_etal_2009aGRL.pdf

53. Lucas R, McMichael T, Smith R, Armstrong B. Solar Ultraviolet Radiation: Global Burden of Disease from Solar Ultraviolet Radiation. *Environmental Burden of Disease Series, No.13.* Geneva: World Health Organization; 2006. Available from: <http://www.who.int/uv/health/solaruvrad.pdf>

54. Thomas P, Swaminathan A, Lucas RM. Climate change and health with an emphasis on interaction with ultraviolet radiation: a review. *Global Change Biology.* 2012;18:2392–2406.

55. Stamatakis E, Nnoaham K, Foster C, Scarborough P. The influence of global heating on discretionary physical activity: an important and overlooked consequence of climate change. *J Phys Act Health.* 2013;10(6):765–8. Available from: <http://www.naspspa>

- org/AcuCustom/Sitename/Documents/DocumentItem/00b_Stamatakis_JPAH_201_30000_ej.pdf
56. The Royal Society. Ground-Level Ozone in the 21st century: future trends, impacts and policy implications. Science Policy Report 15/08. London: The Royal Society; 2008. Available from: <http://royalsociety.org/policy/publications/2008/ground-level-ozone/>
 57. Ebi KL, McGregor G. Climate change, tropospheric ozone and particulate matter, and health impacts. *Environ Health Perspect*. 2008 Nov;116:1449–55. Available from: <http://www.ncbi.nlm.nih.gov/pmc/articles/PMC2592262/>
 58. Pearce HG, Mullan AB, Salinger MJ, et al. Impact of Climate Change on Long-Term Fire Danger. New Zealand Fire Service Commission Research Report 50. Wellington: NIWA/Forest Research, for New Zealand Fire Service Commission, 2005. Available from: <http://www.fire.org.nz/Research/PublishedReports/Documents/bfcbd58e48631b9442304dc76797bad2.pdf>
 59. Finlay SE, Moffat A, Gazzard R, et al. Health impacts of wildfires. *PLoS Curr*. 2012;4:e4f959951cce2c. Available from: <http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3492003/>
 60. D'Amato G, Cecchi L. Effects of climate change on environmental factors in respiratory allergic diseases. *Clin Exp Allergy*. 2008;38:1264–74. Available from: <http://onlinelibrary.wiley.com/doi/10.1111/j.1365-2222.2008.03033.x/full>
 61. Committee on the Effect of Climate Change on Indoor Air Quality and Public Health, Institute of Medicine (IOM). Climate change, the indoor environment and health. Washington DC: Institute of Medicine; 2011. Available from: http://www.nap.edu/catalog.php?record_id=13115
 62. Woodward A, Smith KR, Campbell-Lendrum D, Chadee DD, Honda Y, et al. Climate change and health: on the latest IPCC report. *Lancet*. 2014;383(9924):1185–9. Available from: [http://www.thelancet.com/journals/lancet/article/PIIS0140-6736\(14\)60576-6/fulltext](http://www.thelancet.com/journals/lancet/article/PIIS0140-6736(14)60576-6/fulltext)
 63. Bennett H, Jones R, Keating G, Woodward A, Hales S, and Metcalfe S. Health and equity impacts of climate change in Aotearoa-New Zealand, and health gains from climate action [special article]. *N Z Med J*. 2014;127(1406). Available from: <http://www.nzma.org.nz/journal/read-the-journal/all-issues/2010-2019/2014/vol-127-no-1406/6366>
 64. RNZCGP. Pacific Peoples' health. Wellington: Royal New Zealand College of General Practitioners; 2012. Available from: http://www.rnzcgp.org.nz/RNZCGP/Advocacy/Position_statements/RNZCGP/Advocacy/Position_statements.aspx?hkey=26539289-7e92-4616-b5d9-dfbcc7e39bb9
 65. Paris Agreement under the United Nations Framework Convention on Climate Change; 2015. Available from: <https://unfccc.int/resource/docs/2015/cop21/eng/l09r01.pdf>
 66. Ministry of Health. Health loss in New Zealand: a report from the New Zealand Burden of Diseases, Injuries and Risk Factors Study, 2006–2016. Wellington: Ministry of Health; 2013. Available from: <http://www.health.govt.nz/publication/health-loss-new-zealand-report-new-zealand-burden-diseases-injuries-and-risk-factors-study-2006-2016>
 67. Flynn M, Carne S, Soa-Lafoa'i M. Māori Housing Trends report. Housing New Zealand; 2010. Available from: <http://www.hnzc.co.nz/our-publications/maori-housing-trends/2010-maori-housing-trends-report/2010-maori-housing-trends-report.pdf>
 68. Jones R, Bennett H, Keating G, Blaiklock A. Climate Change and the Right to Health for Māori in Aotearoa/New Zealand. *Health Hum Rights*. 2014;16(1):54–68. Available from: <http://www.hhrjournal.org/2014/07/climate-change-and-the-right-to-health-for-maori-in-aotearoa-new-zealand/>
 69. WHO. Climate change and health in the Western Pacific. World Health Organization; 2015. Available from: http://iris.wpro.who.int/bitstream/handle/10665.1/12401/9789290617372_eng.pdf
 70. Pacific-Australia Climate Change Science and Adaptation Planning Programme. Australian Government Department of the Environment. Available from: <https://www.environment.gov.au/climate-change/adaptation/international-climate-change-adaptation-initiative/paccsap>
 71. Secretariat of the Pacific Community – Global Climate Change Alliance: Pacific Small Island States. Available from: <http://www.gcca.eu/regional-programmes/gcca-pacific-small-island-states>
 72. SPREP. Pacific Islands framework for action on climate change 2006–2015. Available from: http://www.sprep.org/climate_change/pycc/documents/PIFACC.pdf
 73. Talo F. Solomon Islands National Adaptation Programme of Action (NAPA) Official Document. Honiara: Ministry of Environment, Conservation and Meteorology; 2008. Available from: <http://adaptation-undp.org/resources/assessments-and-background-documents/solomon-islands-national-adaptation-programme-action>
 74. Woodward A, Hales S, Weinstein P. Climate change and human health in the Asia Pacific Region: who will be most vulnerable? *Climate Research*. 1998;11:31–38. Available from: http://climatehealthconnect.huang.radicaldesigns.org/sites/climatehealthconnect.huang.radicaldesigns.org/files/resources/AWoodward_0.pdf
 75. McIver L, Woodward A, Davies S, Tibwe T, Iddings S. Assessment of the health impacts of climate change in Kiribati. *Int J Environ Res Public Health*. 2014;11(5):5224–5240.
 76. McIver L, Kim R, Woodward A, et al. Health impacts of climate change in Pacific Island countries: a regional assessment of vulnerabilities and adaption priorities. *Environ Health Perspect*. 2015. Available from: <http://ehp.niehs.nih.gov/wp-content/uploads/advpub/2015/12/ehp.1509756.acco.pdf>
 77. Kovats R. El Niño and human health. *Bull World Health Organ*. 2000;78(9):1127–35. Available from: <http://www.ncbi.nlm.nih.gov/pmc/articles/PMC2560836/>
 78. Stanke C, Kerac M, Prudhomme C, Medlock J, Murray V. Health effects of drought: a systematic review of the evidence. *PLoS Currents*. 2013;5. Available from: <http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3682759/>
 79. Ahern M, Kovats RS, Wilkinson P, Few R, Matthies F. Global health impacts of floods: epidemiologic evidence. *Epidemiolo Rev*. 2005;27(1):36–46. Available from: <http://epirev.oxfordjournals.org/content/27/1/36.long>
 80. WHO Regional Office for Europe. Public health advice on preventing health effects of heat: new and updated information for different audiences; 2011. Available from: http://www.euro.who.int/__data/assets/pdf_file/0007/147265/Heat_information_sheet.pdf
 81. Singh RBK, Hales S, de Wet N, Raj R, Hearnden M, Weinstein P. The influence of climate variation and change on diarrheal disease in the Pacific Islands. *Environ Health Perspect*. 2001;109:155–9. Available from: <http://www.ncbi.nlm.nih.gov/pmc/articles/PMC1240636/>
 82. Spickett J, Katscherian D. Health impacts of climate change in the Solomon Islands: an assessment and adaptation plan. *Glob J Health Sci*. 2014;6(5):261–73.
 83. Spickett J, Katscherian D, McIver L. Health impacts of climate change in Vanuatu: an assessment and adaptation plan. *Glob J Health Sci*. 2013;5(2).
 84. Comrie A. Climate change and human health. *Geography Compass*. 2007;1(3):325–339.
 85. Physicians (per 1,000 people) 2010–2014 data: The World Bank; [cited 2015 August 10]. Available from: <http://data.worldbank.org/indicator/SH.MED.PHYS.ZS>.
 86. National Institute of Water and Atmospheric Research (NIWA). Climate change: scenarios for New Zealand (webpage). Wellington, NIWA [cited 2016 Jan]. Available from: <https://www.niwa.co.nz/our-science/climate/information-and-resources/clivar/scenarios>
 87. Blashki G, McMichael T, Karoly D. Climate change and primary care. *Aust Fam Physician*. 2007;36(12):986–9. Available from: <http://www.racgp.org.au/afpbackissues/2007/200712/200712Blashki.pdf>
 88. Walker R. Climate change and primary health care intervention framework. *Aust J Prim Health*. 2009;15:276–284. Available from: <http://www.enliven.org.au/sites/default/files/Climate%20Change%20%26%20Primary%20Care.pdf>
 89. Berry H, Kelly B, Hanigan I, Coates J, McMichael A, Welsh J, Kjellstrom T. Rural mental health impacts of climate change. *Garnaut Climate Change Review*; 2008. Available from: <http://www.mentalhealth.org.nz/assets/ResourceFinder/Rural-mental-health-impacts-of-climate-change.pdf>

If you have any questions about this issue, or would like to express a view on this topic, please email policy@rnzcgp.org.nz