Health and equity impacts of climate change in Aotearoa-New Zealand, and health gains from climate action

Hayley Bennett, Rhys Jones, Gay Keating, Alistair Woodward, Simon Hales, Scott Metcalfe

Abstract

Human-caused climate change poses an increasingly serious and urgent threat to health and health equity. Under all the climate projections reported in the recent Intergovernmental Panel on Climate Change assessment, New Zealand will experience direct impacts, biologically mediated impacts, and socially mediated impacts on health. These will disproportionately affect populations that already experience disadvantage and poorer health.

Without rapid global action to reduce greenhouse gas emissions (particularly from fossil fuels), the world will breach its carbon budget and may experience high levels of warming (land temperatures on average 4–7°C higher by 2100). This level of climate change would threaten the habitability of some parts of the world because of extreme weather, limits on working outdoors, and severely reduced food production.

However, well-planned action to reduce greenhouse gas emissions could bring about substantial benefits to health, and help New Zealand tackle its costly burden of health inequity and chronic disease.
Global health impact of climate change

Climate change is already contributing to global disease, disability and premature death—most seriously affecting people in poor countries, and the most disadvantaged and vulnerable within all countries.\(^2,6,7,20\)

By the 2050s, the projected health impacts are extensive (summarised in Box 1).\(^2\) Levels of risk will be influenced by population vulnerability (population health status, age, gender, health infrastructure) as well as the degree of social and economic development within populations during this timeframe.\(^2\)

**Box 1. Expected global health impacts with projected climate change to 2050\(^2\)**

<table>
<thead>
<tr>
<th>Health Impact</th>
<th>IPCC Level of Confidence*</th>
</tr>
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<tbody>
<tr>
<td>Higher risk of injury, disease and death from more intense heat waves and fires</td>
<td>Very high confidence</td>
</tr>
<tr>
<td>Higher risk of food- and water-borne diseases</td>
<td>Very high confidence</td>
</tr>
<tr>
<td>Higher risk of under-nutrition from lower food production in poor regions</td>
<td>High confidence</td>
</tr>
<tr>
<td>Health impacts related to lost work capacity/lower labour productivity in vulnerable populations</td>
<td>High confidence</td>
</tr>
<tr>
<td>Higher risk of vector-borne diseases in some areas</td>
<td>Medium confidence</td>
</tr>
<tr>
<td>Modest improvements in cold-related mortality and morbidity in some areas</td>
<td>Low confidence</td>
</tr>
<tr>
<td>Reduced capacity of disease-carrying vectors (from exceedance of thermal thresholds) in some areas</td>
<td>Medium confidence</td>
</tr>
</tbody>
</table>

* Confidence: IPCC qualitative assessment of evidence (type, amount, quality, consistency) and the agreement of evidence.

Box 1 includes some possible health gains from climate change (e.g. reduction in cold-related morbidity and mortality), but the IPCC has concluded that any positive effects from climate change will be outweighed globally by negative effects.\(^2,3\)

It is important to note that many climate-health risk assessments to date remain conservative (based on lower-range warming scenarios of around 2°C) and consider relatively near-future timeframes (e.g. by 2030 or 2050).\(^20\) However it is becoming increasingly likely that higher levels of warming may occur by 2100.\(^1,2,17,18\) This would lead to environmental conditions (e.g. periods of extreme high temperatures; inability to raise food crops) that threaten human health and wellbeing in large parts of the world.\(^2,21\) Under such scenarios, resources would become scarce and populations may be forced to migrate to other regions, creating risk factors for violence and conflict.\(^2,22\)

Health impacts of climate change in Aotearoa-New Zealand

New Zealand is already experiencing climate change, and more change is expected.\(^23\) According to the projections reported in the AR5, New Zealand will continue to warm over coming decades, and will be wetter in the west and drier in the east and north. Heavier and more frequent extreme rainfalls are expected (with increased flood risk), along with more drought, the duration of drought in the north and east is projected to at least double by 2040.\(^16,23,24\)
There is expected to be more extreme heat (up to 60 more days >25°C in the north by 2090), with increased wild-fire risk. Some of these trends (e.g. increases in heavy precipitation) have already been observed.¹⁶,²³,²⁴

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

<table>
<thead>
<tr>
<th>Category</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Food security and nutrition</strong></td>
<td>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.²⁸⁰–²⁸²</td>
</tr>
<tr>
<td><strong>Mental health and suicide</strong></td>
<td>Increased stress and mental health issues (e.g. 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.²³⁳–²³⁶</td>
</tr>
<tr>
<td><strong>Housing and health</strong></td>
<td>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).³⁷ 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.¹⁴,³⁸,³⁹</td>
</tr>
<tr>
<td><strong>Injury and illness from extreme weather events (e.g. flooding, storms, landslides, storm surges, drought)</strong></td>
<td>Immediate trauma, and indirect health impacts in weeks to months after extreme events (e.g. mental health problems, exacerbation of pre-existing medical conditions).²⁴⁰–²⁴²</td>
</tr>
<tr>
<td><strong>Heat-related deaths and illness</strong></td>
<td>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.²⁴³–²⁵⁰</td>
</tr>
<tr>
<td><strong>Vector-borne and zoonotic (animal to human) disease</strong></td>
<td>Increased likelihood that mosquito vectors could establish in New Zealand, which could lead to local transmission of mosquito-borne diseases (e.g. dengue, Ross River virus). Also possible impacts on other vector-borne diseases (e.g. tick-borne) and zoonotic diseases.²⁵¹–²⁵⁶</td>
</tr>
<tr>
<td><strong>Food- and water-borne disease</strong></td>
<td>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 (e.g. giardiasis, salmonellosis). Dry conditions could affect continuity of household water supplies, impacting diseases influenced by hygiene.²⁵⁶–²⁵⁹</td>
</tr>
<tr>
<td><strong>Ultraviolet (UV) radiation</strong></td>
<td>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.²⁶⁰–²⁶³</td>
</tr>
<tr>
<td><strong>Physical activity</strong></td>
<td>Warmer temperatures, and either increases or decreases in outdoor time, may impact on levels of recreational physical activity—an important determinant of health.²⁶⁴</td>
</tr>
<tr>
<td><strong>Cardio-respiratory disease from air pollution</strong></td>
<td>High temperatures can exacerbate photo-chemical air pollution with impacts on respiratory disease. Hot, dry conditions increase potential for bush/forest fires, where smoke impacts on people with cardiorespiratory disease.²⁶⁵–²⁶⁸</td>
</tr>
<tr>
<td><strong>Allergic diseases, including asthma</strong></td>
<td>Possible impacts on allergic conditions with changes in plant distribution, flowering, and pollen production.²⁶⁹</td>
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<tr>
<td><strong>Indoor environment</strong></td>
<td>Climate change may affect the healthiness of indoor environments (e.g. overheating of buildings, changes in indoor air pollutants, flood damage and indoor moisture).³⁷,³⁷⁰</td>
</tr>
</tbody>
</table>

Sea-level rise is expected to continue, with an increase in the frequency of extreme high tides and their associated risks, including coastal flooding, inundation, and erosion.¹⁶,²³,²⁴

These climate and related environmental changes have multiple implications for health and wellbeing in New Zealand (Table 1). The magnitude of health impacts will depend on the existing burden of climate-sensitive diseases, the extent and rate of climate change in New Zealand, the capacity of individuals and society to adapt, and the policies chosen to reduce and adapt to climate change.²⁵
New Zealand is already affected by a range of diseases that are sensitive to climatic factors, and climate trends may well be affecting New Zealanders’ health and wellbeing, although such effects are not yet well quantified.

Furthermore, given that global greenhouse gas emissions are continuing to track near the upper end of projections, it will be important to gain a better understanding of the health impacts in New Zealand under high-end scenarios of climate change.

Effects on the determinants of health in Aotearoa-New Zealand

In addition to the health issues listed in table 1, climate change will impact on the broader socioeconomic determinants of health in New Zealand.

The economy will be influenced by global climate change. Reduced export income due to, for example, effects on agricultural production (or overseas markets) could lead to higher unemployment, less household money to secure the basics for good health, and a reduced tax-base for health and social spending. An analysis prepared for the Ministry of Primary Industries in 2013 showed that under a high end warming scenario (4.4°C average temperature increase by 2100) there would be a significant decline in dairy pasture production, along with increased dairy cow heat stress in many dairying areas of New Zealand.

However, some positive effects on agriculture/horticulture in New Zealand are also possible. Thus forward planning and adaptability within the sector will be required to safeguard the economic output of climate sensitive primary industries, which many New Zealanders rely on for good health and wellbeing.

Furthermore, responses to mitigate climate change also have the potential to adversely impact on health. For example, mitigation policies that raise costs for fuel and energy (and therefore increase costs of goods and services) without compensatory measures, could place extra financial burden on people, particularly for low income families, thus affecting ability to afford the basics for good health.

Risks of climate change to health equity and Māori health in Aotearoa-New Zealand

Climate change will cause different impacts for different population groups depending on geographic location, age, ethnicity, health status, and socioeconomic circumstances. Māori, Pacific, and low-income groups in New Zealand are at risk of greater adverse health impacts from climate change.

Māori are at risk of greater impacts (compared with NZ European people) because of a disproportionate burden of disease across many of the health conditions affected by climate change: infectious diseases (e.g. gastrointestinal infection), chronic conditions (e.g. cardio-respiratory disease), and mental ill-health.

The disproportionately high number of Māori living in deprived circumstances means that climate change effects on food security and vulnerable infrastructure and housing will be more difficult to prepare for and recover from—meaning that important determinants of health (such as healthy nutrition, safe drinking water, healthy homes) are undermined.

Any additional pressure on the availability of low income and/or larger family homes resulting from arrival of climate migrants in areas with existing housing pressures (e.g. Auckland region) would also disproportionally affect Māori who have higher levels of household overcrowding and crowding-related infectious diseases. Previous experience in New Zealand has shown that factors that affect the ability of low income families to buy or rent adequately sized houses can lead to families co-habiting, with resultant household overcrowding.
Additional factors which increase climate-health risks for Māori include indigenous relationships with the environment, greater exposure to food-borne disease risk through customary practices such as collection of kaimoana (seafood),\textsuperscript{90} greater exposure to outdoor heat whilst undertaking outdoor labour (Māori are overrepresented in semi-skilled/unskilled workforces),\textsuperscript{91,92} and poorer access to and through health and social services.\textsuperscript{93–100}

Perhaps even more significant are the implications for the economic determinants of health for Māori. The Māori economy is heavily invested in climate-sensitive primary industries;\textsuperscript{23,84} and policy responses that place extra financial burden on low income families (disproportionately Māori), without counter-balancing measures, would exacerbate Māori experience of poverty and poverty-related diseases.\textsuperscript{73,76}

It is important to note that while this section has focussed on the equity impacts for Māori, many of these issues are also relevant to Pacific peoples in New Zealand and to low income New Zealanders.\textsuperscript{10,14}

**Health benefits of climate action**

The other important link between climate change and health is the substantial opportunity to improve current population health and wellbeing through well-designed policies to reduce greenhouse gas (GHG) emissions.\textsuperscript{2–4,19} Knowledge in this area has increased substantially in the last five years, and the health chapter in the recent Fifth Assessment Report of the IPCC included, for the first time, a dedicated section about the health co-benefits of climate action.\textsuperscript{2}

Health and health equity gains are possible for heart disease, cancer, obesity, musculoskeletal disease, Type 2 diabetes, respiratory disease, motor vehicle injuries, and mental health, with resultant cost savings for the health system.\textsuperscript{2–4,19}

These co-benefits arise because some emission reductions measures impact on important determinants of health, especially energy intake (nutrition) and expenditure (physical exercise). For example:

- **Active transport** (walking, cycling, public transport) in addition to reducing CO\(_2\) emissions, improves physical activity and can reduce air pollution and road traffic injuries.\textsuperscript{2,101–107} Walking and cycling are inexpensive, and public transport is used proportionately more by people with lower incomes. Thus improved active and public transport infrastructure has the potential to benefit health, climate and equity.\textsuperscript{101}

- **In New Zealand healthy eating**, including increased plant and less red meat and animal fat consumption, would reduce agricultural GHG emissions, and likely lead to reduced rates of bowel cancer and heart disease.\textsuperscript{2,108–111}

- **Improving indoor environments** (e.g. energy efficiency measures such as home insulation) can reduce illnesses associated with cold, damp housing (e.g. childhood asthma and chest infections which are leading causes of hospital admissions, particularly for Māori and Pacific children).\textsuperscript{112–114}

- **Increasing energy efficiency** and/or moving away from fossil fuels would reduce health-damaging air pollution (e.g. particulates) from fuel combustion, in both indoor and outdoor environments, with health gains.\textsuperscript{2}

Thus well planned climate action could contribute to significant reductions in the large burden of chronic disease and health inequity in New Zealand, leading to large cost savings for the health sector and society as a whole. This could offset a great deal of the early costs associated with climate change mitigation measures.\textsuperscript{2,3}

The New Zealand research community continues to make a strong contribution to the body of knowledge on the health co-benefits of climate action. The housing and health programme (University
of Otago, Wellington) has led the way in quantifying the costs and benefits (including health) of insulation and clean heating.112,113

Research at the University of Auckland, using novel modelling techniques, has indicated that transport policy that enables safe commuter bicycling in Auckland has the potential to yield benefits (with respect to injury, physical activity, fuel costs, air pollution, and carbon emissions) that are 10–25 times greater than costs.107

**The way forward**

Rapid and sustained global action to reduce GHG emissions is required to avoid the worst health effects of climate change.2,115 It is possible to limit the degree of future climate change and to improve health, if the world rapidly upcales carbon-neutral energy production to replace energy production from fossil fuels, along with reducing energy usage, increasing carbon dioxide sinks (e.g. forests) and curbing rising levels of methane and nitrous oxide by modifying our waste management and agricultural/food systems.4,115

All individuals, groups, businesses and organisations have a role in reducing emissions, reducing investment in fossil fuels, and demanding that local and central governments act to reduce climate risks in ways that improve health and equity.4

Some New Zealand health organisations are beginning to take a lead in addressing their climate-health responsibilities, with action to measure and reduce organisational carbon footprint (Counties-Manukau District Health Board, Canterbury District Health Board), and employment of Sustainability Officers (Counties-Manukau, Waitemata, Auckland and Canterbury District Health Boards). A national network of health professionals interested in collaborating to improve the environmental sustainability of the New Zealand health sector was established in early 2014.116

There is much untapped willingness amongst health professionals to improve environmental sustainability within their workplaces (with large potential for operational cost savings),117,118 but as yet no national framework or mandate to support this, despite a growing international movement and ample international expertise.119

There is also a need for the health sector to plan for the inevitable health impacts of climate change in coming decades. Health services should plan for more climate-sensitive diseases, extreme weather events and their casualties, and climate migrants with new and challenging health issues.10,14,120

Public Health Services should be strengthened to enable planning and response capability for impacts on drinking water, sewage systems, and civil defence emergencies. Public health surveillance systems need to be in place to detect new and emerging illnesses.10,120

It is essential that planning prioritises those population groups most in need of health support in the face of climate change—Māori, Pacific, people on low incomes, migrants, rural people, children, and the elderly.10 Other events (e.g. Christchurch earthquakes, Hurricane Katrina) have shown that planning is required to avoid an inverse equity pattern in post-disaster responses and outcomes.121–123

Outside the health sector, effective public policies are required that both lessen climate risk, and improve population health and health equity. These policies should include an effective carbon pricing system (to replace the largely ineffective Emissions Trading Scheme),124 while ensuring that financial costs do not adversely affect those on low incomes.4,73

Greater investment is required in programmes that both decrease GHG emissions and improve health, such as healthy housing modifications (insulation and clean/efficient heating), active transport infrastructure, and interventions that encourage increased plant and less red meat and animal fat consumption.

One way to encourage this is to ensure that public policy decisions include a health impact analysis, so that potential adverse health impacts can be avoided and positive effects maximised.125 It is also
critical that any such decisions incorporate an equity analysis, to ensure that the resulting interventions contribute to reducing social and health inequities.

New Zealand must also consider its role in international climate change negotiations and responses. As a high (and growing) per-capita greenhouse gas emitter, New Zealand has a responsibility to both increase its own ambitions with respect to greenhouse gas emission reductions, and to promote fair and equitable approaches to emissions reductions globally that take into account historical responsibility and capacity to mitigate.

New Zealand, as part of the Pacific, will also need to play a role in supporting the health, wellbeing and adaptation of Pacific Island and other developing nation populations who will face many of the worst health effects of climate change.

**Conclusion**

Climate change poses an urgent threat to human health, wellbeing, and health equity globally, and in Aotearoa-New Zealand.

On the other hand, well-planned action to reduce greenhouse gas emissions offers opportunities to improve population health, equity, and reduce chronic disease burden. This could result in large cost savings for the health sector and society as a whole, which would offset a great deal of the early costs associated with climate change mitigation measures.

As health professionals, we have a responsibility to raise awareness of the health implications of climate change, and to press for urgent action. If we act quickly, we have an opportunity to turn one of our greatest health threats into positive action to significantly improve the health, equity, and resilience of our patients and population.

**Competing interests:** Scott Metcalfe is a member of the NZMA Services Board.

**Author information:** Hayley Bennett, Public Health Physician, Rotorua; Rhys Jones, Senior Lecturer, Te Kupenga Hauora Māori, Faculty of Medical and Health Sciences, University of Auckland; Gay Keating, Public Health Physician, Eru Pōmare Māori Health Research Centre, Department of Public Health, University of Otago, Wellington; Alistair Woodward, Professor of Epidemiology and Biostatistics, School of Population Health, Faculty of Medical Sciences, University of Auckland; Simon Hales, Research Associate Professor, Department of Public Health, University of Otago, Wellington; Scott Metcalfe, Public Health Physician, Wellington

**Correspondence:** Dr Rhys Jones, Te Kupenga Hauora Māori, Faculty of Medical and Health Sciences, University of Auckland, Private Bag 92019, Auckland 1142, New Zealand. rg.jones@auckland.ac.nz

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