



Government of **Western Australia**
Department of **Health**

Climate Health WA Inquiry: submission from the Department of Health WA

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Introduction

The Department of Health (DoH) submits this document as a response to the call for written submissions by the WA Climate Health Inquiry. All Divisions, via their Assistant Director Generals, were asked to provide a response. These responses were reviewed and collated into a single document, which is presented as the DoH submission.

Background

The potential for effects of climate change on Health in Western Australia (WA) were described in a previous publication by the Environmental Health Directorate in the Department of Health (DoH)¹. This report highlighted the links and complex interactions between a changing climate, the natural and built environment, and human health. Quantifying, monitoring and managing changes in risks to human health will increasingly be a challenge for all levels of Government (Federal, State and Local), the private sector, communities and individuals, not only because of direct effects, but also because of the unintended consequences of climate mitigation and adaptation strategies. Public health practitioners will need to lead and coordinate much of this work.

Projections obtained from IPCC, CSIRO and IOCI reports indicate that, by 2030, WA will be hotter, particularly in inland regions, and drier, particularly in the South West.

There will be:

- more frequent, intense droughts, heatwaves and fires;
- more intense storms, floods, rainfall events and tropical cyclones; and
- increases in sea level in coastal regions.

The reports indicate that WA will experience:

- an average temperature increase of between 0.5°C to 2°C;
- an increase in the number of days over 35°C in the:
 - South West of +1 to +20 days (now 27 in Perth).
 - North West of +10 to +90 days (now 54 in Broome and 156 in Halls Creek);
- rainfall changes in:
 - South-West of 2 to 20% reduction in annual rainfall with a 17% reduction in winter rain days and catchment runoff decreases of 5 to 40%
 - North-West of annual rainfall decreases of 1.5 to 3.5%;
- an increase in extreme weather events, such as:
 - heatwaves
 - droughts
 - bushfires
 - floods
 - storms
 - dust storms
 - tropical cyclones; and
- sea-level increases of 3 to 17 cm by 2030 and 25 to 75 cm by 2100.

¹ Spickett, J., Brown, H. and Katscherian, D. *Health impacts of climate change: adaptation strategies for Western Australia*. Department of Health Report, 2008. https://ww2.health.wa.gov.au/Articles/A_E/Climate-change-and-health

Vulnerability

All Australians are vulnerable to the influence of climate change. However, there is increasing concern that the negative effects will disproportionately affect those who are economically and socially disadvantaged².

“...disruptive change compounds the experience of disadvantage”³

Vulnerability may be defined as needing special care, support or protection because of factors such as age, disability or risk of abuse or neglect. Vulnerability is subject to change. While some people remain vulnerable (e.g. the aged), others may only be vulnerable by circumstance: for example, a patient recently discharged from hospital may be vulnerable immediately following their hospital presentation and require special care, but their vulnerability will then decrease over time.

Homelessness is a subset of vulnerability. Homeless populations generally have higher rates of poorly controlled chronic disease, smoking, respiratory conditions, and mental illnesses, which creates vulnerability to new and resurgent diseases associated with climate change through four main pathways: increased heatwaves, increased air pollution, increased severity of floods and storms, and changing infectious disease vectors^{4, 5}.

Census data from 2016 estimated that there were more than 9000 people who are considered homeless in WA, which is a conservative estimate. Of the 9000 identified, just fewer than 30 percent indicated that they were Indigenous.

Engaging vulnerable or at-risk people is a challenge to a Hazard Management Agency (HMA) such as Health. A typical heatwave response aims to protect the public from the harmful health impacts of heatwave with strategies such as targeted messaging. The challenge faced is how to connect with the agencies that care for the vulnerable communities when many not-for-profit support agencies change as their funding opportunities alter. It is difficult to maintain a current register of the agencies best linked with these vulnerable groups. The better Health can connect with the vulnerable communities, via their providers, the better opportunities available for reducing morbidity and mortality.

The DoH can have an impact on three of the four pathways required to aid in improving health outcomes of the homeless population in WA. As HMA for heatwave, DoH can prepare the homeless population to reduce the impact of heatwaves on their health; reduce air pollution created by the operations of the health system; and assist in managing the infectious disease vectors. Some adaptation measures specific to the homeless are already in place within communities, but more adaptation and mitigation efforts are required to prevent further deterioration in the health of the homeless.

² Sevoyan, A, Hugo, G, Feist, H, Tan, G, McDougall, K, Tan, Y & Spoehr, J 2013, *Impact of climate change on disadvantaged groups: Issues and interventions*, National Climate Change Adaptation Research Facility, Gold Coast, 180 pp.

³ Leonard, S, Mackenzie, J, Kofod, F, Parsons, M, Langton, M, Russ, P, Ormond-Parker, L, Smith, K & Smith, M, 2013, *Indigenous climate change adaptation in the Kimberley region of North-western Australia. Learning from the past, adapting in the future: Identifying pathways to successful adaptation in Indigenous communities*, National Climate Change Adaptation Research Facility, Gold Coast, 131 pp.

⁴ B Ramin & T Svoboda, 2009 <https://link.springer.com/article/10.1007/s11524-009-9354-7>

⁵ M Fransham & D Dorling, 2018 <https://doi.org/10.1136/bmj.k214>

Impact of climate change on the Australian Aboriginal population⁶

Research highlights the unique impact of climate change on the health and wellbeing of Indigenous peoples around the world. While there is a strong history of adaptation by Indigenous people over thousands of years, “the magnitude, accelerated pace and compound effects of climate change today are unprecedented, thus presenting major challenges to indigenous peoples’ capacity to adapt”⁷.

The closer relationship with the environment (and the greater dependence on its resources) suggests that Indigenous people are among the first to face the direct consequences of climate change⁸.

It is anticipated that climate change will exacerbate the many difficulties faced by vulnerable Indigenous communities, including loss of land and resources, greater marginalisation (both political and economic), human rights violations, discrimination and unemployment.

Climate change is likely to affect all aspects of life for Aboriginal people, involving natural, social and cultural domains. Detrimental consequences will be experienced in: (a) health, (b) access to and use of land (including displacement due to rising sea levels), (c) distribution and disruption to local species, bush food, and fisheries, (d) access to resources and sustainability of livelihoods, (e) community infrastructure, and (f) access to government services^{3,9}.

Within Australia, climate change is likely to disproportionately affect the Aboriginal population who are already economically and socially disadvantaged. The significant health discrepancies that exists between Aboriginal and non-Aboriginal Australians, coupled with the existing elevated rates of poverty and multiple sources of disadvantage (e.g. low incomes, low education levels), will compound the effect of climate change on the Australian Aboriginal population^{9, 10}.

The climate change risks posed to Aboriginal people are not uniform and will vary between locations and socio-economic status¹¹. The effects will be particularly felt by those living in remote communities, who will more directly experience the environmental changes of climate change (such as increased extreme cyclonic events, flooding and rising temperatures), affecting their way of life and exacerbating the social and economic difficulties that already exist^{3,9,12}.

These combined effects reduce the capacity of Aboriginal individuals, households, communities and institutions to adapt to climate change¹³. A snapshot of the unique challenges that Aboriginal populations will experience due to climate change are highlighted below.

⁶ The term ‘Aboriginal’ will be used in this submission to reflect Aboriginal and Torres Strait Islanders, the Indigenous populations of Australia

⁷ United Nations, 2008a, *Permanent Forum on Indigenous Issues. Report on the seventh session*. Economic Social Council Official records Supplement No. 23: [https://undocs.org/E/C.19/2008/13%20\(SUPP\)](https://undocs.org/E/C.19/2008/13%20(SUPP))

⁸ United Nations, 2008b, *Permanent Forum on Indigenous Issues. Indigenous Peoples Indigenous Voices Backgrounder*: https://www.un.org/en/events/indigenousday/pdf/Backgrounder_ClimateChange_FINAL.pdf

⁹ Green D, S Jackson and J Morrison, 2009, *Risks from Climate Change to Indigenous Communities in the Tropical North of Australia*. Department of Climate Change and Energy Efficiency: Canberra

¹⁰ National Climate Change Adaptation Research Facility, 2013, *Adaptation and First Australians: lessons and challenges. Policy Guidance Brief 6*:

https://www.nccarf.edu.au/sites/default/files/attached_files_publications/Indigenous_A4-Webview.pdf

¹¹ Langton, M, Parsons, M, Leonard, S, Auty, K, Bell, D, Burgess, P, Edwards, S, Howitt, R, Jackson, S, McGrath, V & Morrison, J, 2012, *National Climate Change Adaptation Research Plan for Indigenous Communities - Summary*, National Climate Change Adaptation Research Facility, Gold Coast, 4pp.

¹² Steering Committee for the Review of Government Service Provision, 2007, *Overcoming Indigenous Disadvantage: Key Indicators 2007*, Productivity Commission, Canberra.

¹³ National Climate Change Adaptation Research Facility 2011, *Implementation Plan for Climate Change Adaptation Research: Indigenous Communities 2011*, National Climate Change Adaptation Research Facility, Gold Coast, pp. 18.

Health:

- climate change is expected to elevate existing (and create new) health risks for Aboriginal people compared to the general population. These include: increasing incidence of respiratory illnesses; transferability of disease; water-, vector- and food-borne illnesses; and air pollution episodes^{7,9,13};
- climate change will add additional stressors to the already increased rate of chronic diseases experienced by the Aboriginal population⁹; and
- due to the holistic concept of health held by Aboriginal people, changes in the local environment of sacred sites or hunting grounds may add an additional vulnerability to the psychosocial health of Aboriginal people⁹.

Living conditions:

- the already existing poor nutrition, overcrowded housing, and lack of adequate water supplies frequently found in Aboriginal communities will increase vulnerability and reduce adaptive capacity to climate change⁹;
 - the additional impact of increased food and water insecurity due to the effects of climate change will have a significant impact on many Aboriginal communities¹⁰,
- the risks that events, such as cyclones and flooding, pose to major infrastructure (housing and electricity, telecommunications and water supply services) may compound existing stresses or increase the failure rates of already overloaded utilities and services for Aboriginal communities^{9,10};
- climate change threatens important cultural and heritage sites; disrupts the ancestral, spiritual, totemic and language connections; and limits access to country and traditional lands¹⁰; and
- migration from island and coastal communities, and those dependent on inland river systems, will affect a much larger population. As a result, stresses are likely to be felt in the migrant communities, as well as those in extended families in more urban areas, who are likely to need to accommodate more people¹⁴.

¹⁴ Australian Human Rights Commission, 2008, Native Title Report, 2008, Chapter 5: Indigenous People and Climate Change:
https://www.humanrights.gov.au/sites/default/files/content/social_justice/nt_report/ntreport08/pdf/chap5.pdf

Water

Public health risks associated with use of water in all forms in Western Australia can be summarised as follows:

| Impact Type | Health Impact | Potential Impact Pathway |
|--|--|---|
| Water borne disease | Gastro-intestinal diseases, diarrhoea, vomiting | Change in incidence of water-borne pathogens such as <i>Cryptosporidium</i> , <i>Campylobacter</i> , <i>Amoeba</i> , <i>Burkholderia pseudomallei</i> . |
| | Amoebic meningitis | Temperature increase in drinking and recreational waters will increase the challenge to existing disinfection/water treatment technologies. |
| | Direct contact | Increased use of recycled water – increase contact with pathogenic organisms. |
| | Inhalation | Increased exposure to water for cooling. Legionella spp. both in numbers and in distribution*. |
| | Neuro/hepatotoxin poisoning | Increase in toxic algal blooms in drinking, recreational and recycled waters. |
| Reduced fresh water supply | Water stress | Reduction in flows to reservoirs, groundwater aquifers. |
| | Water quality | Increased evaporation/water loss impacting surface drinking and agricultural water storage. |
| | | Increased flooding, storm and drought damage. |
| | | Reduced surface and aquifer volumes – increases nutrients and contaminant concentration. |
| | | Warmer temperature—reduced dissolved oxygen—reduced water quality, thermal stratification in surface water bodies, microbiological inactivation. |
| | | Increased toxic algal blooms |
| | | Increased cost of production, quality control, maintenance and management. |
| Higher cost /complexity of treatment | Increased stress on infrastructure. Reduced asset life; systems complexity and diversity | |
| Competition/conflict | Supply chain disruption/disconnection | |
| Reduced food production/increased cost | Sea-level rise—saltwater intrusion into coastal aquifers, estuaries, wetlands. | |
| Mental health/Community wellbeing | Urban heat island, water restrictions for gardening and public open space. | |

*Legionnaires' Disease: increased temperatures may increase reliance on climate-controlled buildings, using cooling towers, creating an environment conducive to the growth of legionella bacteria and subsequent increase in human disease cases. Mitigation measures that promote reduced consumption of energy through reducing operating temperatures of warm water systems may have the unintended consequence of enhancing survival and replication of pathogenic bacteria including *Legionella* sp.

Food

The Food and Agriculture Organisation of the United Nations defines food security as *when all people, at all times, have physical, social and economic access to sufficient, safe and nutritious food which meets their dietary needs and food preferences for an active and healthy life.*¹⁵

Taken together, the effects of climate change, as well as its drivers, are likely to contribute to food insecurity. Food insecurity is exacerbated by poverty, poor housing, increased costs of living, and lack of transport, geographical isolation, poor food literacy, and low educational attainment.¹⁶ WA data shows that, in remote communities, fresh produce is already scarce, is often of poor quality, and is significantly more expensive than in metropolitan areas due to transport costs.¹⁷ This is a contributing factor to poorer health outcomes in regional and remote communities.

Climate change has a negative impact on air and soil quality, as a result of changes in ambient temperatures, rainfall patterns and drought cycles, which reduce agricultural yields and the availability of fresh, nutritious foods.¹⁸ Increases in greenhouse gases have been directly linked with reductions in the protein and micronutrient concentration of plant crops. Degradation in the nutritional quality of the food supply may lead to population-wide increases in nutrient deficiencies and malnutrition (i.e. under-nutrition and obesity). Climate change is expected to severely affect Australia and to reduce its food production by 15%.¹⁹

- Disruption of rainfall patterns and drought cycles will contribute to water scarcity, affecting safe drinking water supplies and water available for agriculture.
- Global forecasted projections of extreme weather events (such as cyclones, storms, floods, prolonged drought) threaten livestock and crop yields²⁰ and disrupt safe drinking water and electricity generation, and, in turn, compromise the refrigeration of perishable food.
- Adverse weather events cause major disruptions to food transportation, supply chains and logistics. Remote and regional communities are especially vulnerable, owing to their distance from major food distribution centres and their reliance on road transport for the delivery of fresh and non-perishable produce.

A global decrease in the supply of fresh nutritious food will have serious implications for food security, nutrition, and chronic disease prevention, including overweight and obesity. Cheap, processed, energy-dense nutrient-poor foods are likely to dominate the food supply (which is already distorted toward processed foods), as fresh produce becomes scarcer and more unaffordable, and sourcing a healthy diet more difficult.

Current food systems, agricultural practices, and food consumption patterns are unsustainable and exacerbate the effects of climate change.^{21, 22} For example, the increasing global demand

¹⁵ Food and Agriculture Organisation of the United Nations (FAO). Trade reforms and food security. Chapter 2. Food security: concepts and measurement. FAO, Rome; 2003.

¹⁶ Lindberg R et al. Food insecurity in Australia: Implications for general practitioners. Australian Family Physician. 2015; 44:859-62.

¹⁷ Western Australian Department of Health. Food Access and Cost Survey. Department of Health, Perth; 2015.

¹⁸ Food and Agricultural Organisation of the United Nations. Climate change and food systems – Global assessments and implications for food security and trade. FAO, Rome; 2015

¹⁹ Public Health Association of Australia. A Future for Food 2. 2012. Available from: <https://www.phaa.net.au/documents/item/562>

²⁰ World Health Organisation: 10 facts on climate change and health. Available from https://www.who.int/features/factfiles/climate_change/facts/en/

²¹ Intergovernmental Panel on Climate Change: Climate Change and Land. Available from https://www.ipcc.ch/site/assets/uploads/2019/08/4.-SPM_Approved_Microsite_FINAL.pdf

for red meats, dairy products and cheap vegetable oils has led to large-scale deforestation and land clearing to support livestock and palm oil crops in Asia and South America, altering weather and ecosystems.

Aboriginal and Torres Strait Islander people, people with culturally and linguistically diverse backgrounds, single parent households, the unemployed, low-income earners, the homeless, rental households, young people, the elderly, frail, and socially isolated people, are at greatest risk of food insecurity.²³

Proper nutrition is one of the most effective ways to decrease the burden of many diseases and their associated risk factors. The access to proper nutrition in a community is heavily dependent on food security, which comprises two key factors: food availability and affordability. Climate changes such as reduced rainfall, temperature increases and increase in extreme weather events directly impact on the primary production of food which affects its availability and affordability.

A decrease in the availability and affordability of fresh food is also known to deter healthier food choices in a community. A study of the impact of geographic factors on food pricing and quality in WA²⁴ showed that fresh produce is significantly higher in cost and lower in quality in geographically isolated communities. The effects of climate change on primary production of food will further worsen the problem of food security in remote communities²⁵ and among socio-economically disadvantaged groups. This translates to poorer health outcomes in the vulnerable groups when healthy food choices are substituted with foods with high fat and sugar content that provide dietary energy at lower costs.

An independent study commissioned by Australia's Commonwealth, State and Territory Governments²⁶ found consistent evidence that gastrointestinal infection from bacterial pathogens is positively associated with ambient temperature. Foodborne illness, such as Salmonellosis, peaks in summer and the rate of notifications is positively and generally linearly associated with the average temperature of the previous month or week. An increase in the number of bacterial gastroenteritis cases will be expected with an increase in temperatures caused by climate change. Using 2005 data as a baseline, the estimated costs of healthcare and surveillance associated with cases of bacterial gastroenteritis due to climate change for WA is in excess of \$1 million by 2020 and \$4 million by 2050.

An indirect impact of shortfalls in the supply of local produce is the increase in imported foods. The current experience with imported foods highlights a concern with food safety in areas of cultivation and food processing. It is likely that risks of food contamination and associated health impacts will increase if resourcing for monitoring the safety of imported foods remains at current levels.

²² Swinburn B, et al. The Global Syndemic of Obesity, Undernutrition, and Climate Change: the Lancet Commission Report. The Lancet Commissions 2019; 393(10173): 791-846.

²³ Communities and Families Clearing House of Australia (CAFCA). CAFCA practice sheet: Food insecurity in Australia -What is it, who experiences it and how can child and family services support families experiencing it? Commonwealth of Australia, Canberra; 2011.

²⁴ Pollard et al, 2014 Geographic Factors as Determinants of Food Security: A Western Australian Food Pricing and Quality Study.

²⁵ Pollard et al, 2014 Understanding food security issues in remote Western Australian Indigenous communities.

²⁶ 2008 Garnaut Climate Change Review.

Heat

During hot weather and heatwave events the effects on health can include dehydration, heat stress, heat cramps, heat exhaustion, and heat stroke. Hot weather also has an impact on some medications that control chronic diseases and some mental health conditions.

It is difficult to measure the true human impact of Heatwave. During a heatwave, people suffering from chronic diseases who present to an Emergency Department may be coded in accordance with their presenting illness and the link with heat may be missed. This results in under reporting of heatwave related injuries and deaths.

As part of DoH's heatwave monitoring process, syndromic surveillance is undertaken on all presentations to the hospital emergency departments. This surveillance reviews the primary presenting symptom and records this against the International Classification of Disease (ICD-10) code.

It can be difficult to determine whether a death would have occurred at that time or whether the heatwave was a contributor. Retrospective analysis of morbidity and mortality in association with heatwave data enables the relationship to be better understood. The challenge for the HMA is to provide timely information on the magnitude of the heatwave. Making progress with this challenge could improve community awareness of the health effects of heat and promote behaviours to enhance resilience.

Nationally, every state and territory has experienced a Heatwave over the past seven years. These extreme weather events affect people, economy, environment, social setting and public administration.

Internationally, heatwaves are being experienced with increased frequency, such as the events in France²⁷ and India²⁸. The extent of heatwave-related mortality only becomes apparent months after incidents have occurred.

²⁷ <https://www.vox.com/2019/7/25/8930325/europe-heat-wave-france-uk-paris-germany-record>

²⁸ <https://www.bbc.com/news/world-asia-india-48495492>

Pollution

Climate change can alter meteorological factors that influence the development, chemical transformation, transport, dispersion and deposition of air pollutants. Ozone, and other photochemical oxidants, and particulate matter are pollutants with known adverse health effects that are projected to increase due to climate change.²⁹

Variances in temperature, precipitation, salinity, pH, groundwater infiltration, hydraulic conductivity, soil moisture and soil-water partitioning all affect contaminant fate, transport and exposure (for example, by altering the climate-sensitive variables in the order of 15 - 20%, the estimate of exposure increased by 27%). Therefore, contaminants in soils that are currently slightly below acceptable guideline values may, in the future, exceed these guidelines³⁰.

Weather extremes and variances will increase uncertainty in predictive contaminant fate and transport modelling, undermining confidence in risk-based management decisions. For example, as ground-gas/vapour emissions are heavily influenced by rapidly decreasing atmospheric pressure, risk mitigation measures installed within buildings to protect against gas and vapour intrusion under current "worst-case" atmospheric conditions may not be sufficient protection as atmospheric conditions change.

The projected increase in the frequency and intensity of both extreme weather events and bushfires has the potential to release chemical pollutants. For example, damage to asbestos products, which are abundant in Perth and WA regional and rural areas, from fires, storms and floods can release fibres and increase population exposure.

Drought exacerbates the generation, movement and distribution of both natural and contaminated soils and increases human exposure to respirable asbestos fibre, fine silica particulates and synthetic micro and nanoparticles. Reduced groundwater levels will expose natural acid sulfate soils to oxidation, acidification and resultant remobilisation of bound arsenic and heavy metals causing contamination, which will denude valuable and increasingly scarce groundwater resources.

Warmer temperatures will increase the volatilisation, solubility and mobility of a range of hazardous and persistent organic pollutants from soils and groundwater previously considered semi or non-volatile, immiscible or bound within the soil matrix.

Warmer, drier soils may inhibit microbial growth and activity, inhibiting timely and effective remediation strategies reliant on bioremediation and/or natural attenuation (e.g. petroleum hydrocarbon residues).

Rising sea levels may erode or inundate coastlines historically used for uncontrolled waste disposal (e.g. Swan River foreshore), inhibit the ability to contain and manage soil contamination in-situ (e.g. Cocos Islands), and alter groundwater flow patterns interfering with established groundwater monitoring, management and remediation schemes. Any contaminated sites that are close to the coast may be affected by increasing sea levels.

Whilst temperatures may increase, this may not necessarily be associated with an increase in UV levels and the effects are likely to be different depending on latitude. Indeed, a reduction in UV levels is expected in some places if any repair of the Ozone layer occurs. The increasing number of aerosols in the atmosphere may also be related to a decrease in UV levels.

²⁹ *Climate Change, Air Pollution and Health in Australia*, 2017. A. Dean, D. Green. UNSW Sydney, Grand Challenges, Sydney Australia.

³⁰ *Climate change — An uncertainty factor in risk analysis of contaminated land*, (22 July 2011) A. Augustsson. <https://www.sciencedirect.com/science/article/pii/S0048969711008084>

Other

Mosquitoes

Changes to one or more of temperature, rainfall, humidity and tides can influence mosquito distribution and abundance, larval development rate, adult survival and dispersal, virus transmission rate (incubation period), and animal host/reservoir populations. However, changes will not be uniform across WA. Complex interactive systems influence the potential for disease outbreaks and arbovirus transmission may be either enhanced or inhibited under various local conditions.

Extended drought over the past decade has left Australian capital cities and rural towns considering the need to increase water storage capacity. Water storage tanks or other forms of water storage is now promoted for new domestic dwellings in most cities and has been mandated in some. Inadequate maintenance of water tanks has implications for mosquito control. Other responses to climate change and decreasing biodiversity, such as the conservation and remediation of natural wetlands or increased requirements for water management or treatment, are also likely to change the pattern of mosquito-borne disease activity.

Detection of exotic mosquitoes at first ports of entry has increased in WA over the last decade driven by a range of factors. While climate change models propose southerly movement of receptive zones for malaria and dengue (i.e. presence of suitable habitat for vector mosquitoes), past occurrences of the dengue vector *Ae. aegypti* in southwest WA did not lead to outbreaks. The potential for disease outbreaks will not only be mediated by the potential for establishment of exotic mosquitoes but also other public health measures and lifestyle controls.

Mould

Complaints to the DoH about mould have been increasing in the past few years. While the exact cause is unclear, increased severe weather events may result in increased water infiltration into homes. Energy efficiency initiatives with building design that decrease ventilation and increase potential for condensation are also likely to have unintended consequences for mould.

Injury

More frequent and intense weather events (such as flooding, heatwaves and bush fires) as a result of climate change can also be anticipated to increase the risk of injury. For example, increasing temperatures leading to increased aquatic activity could increase risk of water-related injury.

Public events and mass gatherings

Any increased potential for severe weather events may result in the need to plan for evacuation, delays, cancellation, structure damage, injuries and increased first aid presentations due to weather-induced health effects, including:

- Heat and heatwave impacts
- Hyperthermia and dehydration
- Sun stroke
- Compounded effects of heat on drug and alcohol consumption
- Asthma and allergies exacerbated
- Gastro / waterborne illnesses due to water / food contamination / spoilage

Adaptation

Climate change adaptation and water

Good health infrastructure and surveillance programs currently exist within WA Health to monitor and manage environmental health issues, in conjunction with local government and other stakeholders. However, it is important that programs continue to evolve and keep pace with required responses and available resources and technology.

- Increased competition for water resources is encouraging the development of novel approaches to utilise alternative water sources for industrial, commercial, local government and domestic applications. However, to date, very few presented to the DoH have given due regard to the increased operational and ongoing management, maintenance and energy input requirements for their ongoing safe operation.
- Small scale water reuse systems will introduce levels of complexity and management that are beyond current governance frameworks.
- Both existing and future novel alternate water treatment systems will require increased levels of competency and compliance monitoring, neither of which exist at this stage.
- Increased variability of water quality in all water bodies exposed to the environment will require the development of improved monitoring and reporting systems incorporating a greater public awareness.
- Increased reliance on complex interrelated systems, developed in response to climate change, will have to incorporate redundancies and be resilient to operate within a wider range of operational conditions.
- Communities in rural and remote areas that currently rely on small-scale local water supplies may need to relocate or consider alternative (and likely more costly) water supplies in the event of diminishing water or water quality. Resources will need to be allocated to monitoring of such water supplies and ensuring alternative solutions comply with drinking water standards.

There are likely to be both short- and long-term impacts on workforce capacity. A comprehensive disaster response capability is essential to ensure surge capacity is available for emergency responses. Longer-term planning is also required to increase workforce capacity to manage emerging environmental health issues as risk profiles change over time. This does not necessarily mean an increase in the size of the workforce, but rather using existing personnel and equipment more efficiently, with better collaboration and engagement with intra- and interstate stakeholders and effective communication strategies to ensure good public understanding of personal responsibility for reducing exposure to environmental health hazards.

Examples of current responses by industry and Government to climate change include:

- Integrated Water Cycle Management and Water Sensitive Urban Design through use of Town Planning schemes and other planning approaches for both urban infill developments and new Greenfield developments.
- Using and/or mandating fit for purpose water use for both public open space and domestic irrigation via shallow aquifer recharge of stormwater and/or treated sewage.
- Improved groundwater management designed to reduce the impact of saltwater intrusion and/or groundwater depletion is placing restrictions on domestic, agricultural (food production), local government (public open space) and drinking water allocations.

- Use of treated sewage and non-potable water supplies for toilet flushing, industrial and irrigation uses.

Several environmental health risk management tools, initiatives and policies will be required, including:

- benchmarking and surveillance of relevant health indicators to provide an evidence base of changes (particularly increases) in risks to health;
- risk and vulnerability assessments and tools for Local Governments to assist with identifying and prioritising climate-related impacts to health;
- programs to build resilience to potential health impacts;
- addressing the issue of increasing reluctance to provide insurance for public events and housing in coastal communities linked to climate-related physical and environmental risks;
- regular reviews of management plans and decision support tools (including protect in place or evacuate) linked to monitoring of changes to risks from environmental and physical hazards;
- monitoring impacts of adaptation health services and whether these interventions are having intended effects;
- improving the sharing of information, data and resources across Government and Australian jurisdictions; and
- incorporating health impact assessments into mitigation and adaptation strategies to identify and plan for unintended consequences for health.

Environmental health must be given more weight and consideration by Government agencies and a range of environmental health indicators developed to allow for consistent monitoring and evaluation of adaptation strategies. Only by properly resourcing and acknowledging the role of prevention activities (for food security, air and water quality, vector borne disease control, etc.) will DoH be able to understand and mitigate impact on health and health service providers from the effects of climate change.

Climate change adaptation and food

The interactions between climate change and food supply are complex and encompass politics, economics, international trade, environment, science, and society. Addressing climate change and its effects on nutrition, food security and other risks to public health will require a multi-sectoral, comprehensive response across all jurisdictions, and at both macro- and micro-economic levels. Several recent major reports on the sustainability of the world's food supply and the effects of climate change on health could inform a program of work in WA. These include:

- A recent Lancet Commission Report identifying the combination of climate change, undernutrition and obesity as a global syndemic due to their common underlying drivers.³¹ The global obesity epidemic is partly a result of market economies driven by consumption-driven growth in the food supply, which significantly contributes to greenhouse gas emissions. Low- and middle-income countries undergoing nutrition transition, whereby

³¹ Swinburn B, et al. The Global Syndemic of Obesity, Undernutrition, and Climate Change: the Lancet Commission Report. *The Lancet Commissions* 2019; 393(10173): 791-846.

traditional, healthy diets (and food production) are replaced with cheap energy-dense, nutrient-poor processed foods are particularly susceptible.

- The Intergovernmental Panel on Climate Change's *Climate Change and Land Report* has recommended changes to food systems to mitigate the effects of greenhouse gas emissions on land use, desertification, land degradation, and food security.³²
- A Lancet Commission on *Food in the Anthropocene: the EAT–Lancet Commission on Healthy Diets from Sustainable Food Systems* has made recommendations for more sustainable and health-promoting diets that rely more on plant foods and less on animal proteins.³³
- The Public Health Association of Australia has called for a national food policy spanning agriculture and fisheries, health, education, social inclusion, welfare, treasury, innovation and the environment to mitigate the effects of climate change on the food system and food security.³⁴

As it is uncertain if the current climate change mitigation measures will be enough to arrest the effects of climate change on agriculture and food production, it is important that primary production industry puts in place adaptation strategies to ensure food security will not be compromised. The National Climate Change Adaptation Research Facility (NCCARF)³⁵ has made key recommendations in their Policy Guidance Brief 4 that are worth considering.

Existing foodborne illness control and reduction strategies will need to be properly resourced and further developed to ensure that risk mitigation strategies can be effectively implemented. Some of the key risk mitigation strategies include:

- Educating primary producers, food businesses and consumers on food safety.
- Ensuring primary producers and food businesses are meeting the necessary food safety standards by implementing effective surveillance and compliance programs.
- Ensuring effective response to foodborne illness outbreaks are in place.

Aboriginal health

It is imperative that government responses to climate change incorporate an Aboriginal perspective both about the impact of climate change, and how to maximise adaptive capacity.

*“Adaptive capacity is a multi-scalar, nested concept in which the capacity of the Indigenous community itself both affects and is affected by the capacity of individual households within the community and the wider regional, state and national level policy context outside the community”*⁹.

There is an urgent need to better appreciate current Aboriginal perspectives on climate change and to develop collaborative responses to it⁹. Essential components of any evaluation framework must:

- incorporate Aboriginal worldviews and traditional ecological knowledge;

³² Intergovernmental Panel on Climate Change: *Climate Change and Land*. Available from: https://www.ipcc.ch/site/assets/uploads/2019/08/4.-SPM_Approved_Microsite_FINAL.pdf

³³ Willett W, et al. *Food in the Anthropocene: the EAT–Lancet Commission on healthy diets from sustainable food systems*. The Lancet Commissions 2019; 393(10170):447–92.

³⁴ Public Health Association of Australia. *A Future for Food 2*. 2012. Available from: <https://www.phaa.net.au/documents/item/562>

³⁵ NCCARF <https://www.nccarf.edu.au/>

- such knowledge, skill and agency can be used to build resilience and reduce community vulnerability, as well as enhance future adaptive capacity (Leonard et al., 2013; NCCARF, 2013).
- avoid viewing Aboriginal communities 'as timeless and static'; and disadvantaged groups as 'passive victims' of the negative effects of climate change²;
 - many worldwide Indigenous societies have continuously confronted and engaged with changing environments for generations⁷
- maximise Aboriginal engagement and create meaningful partnerships:
 - direct participation in climate change studies and adaptation planning enables Aboriginal people to define and articulate their interests and needs in climate change matters^{3,9};
 - effective participation is likely to include a complementary and structured program of capacity building, such that traditional owners and Aboriginal communities develop their understanding, skills, knowledge and confidence to actively participate in planning decisions³;
 - partnerships maximise knowledge transfer and enrich local understanding of climate change risks. They will assist Aboriginal people to critically evaluate scientific predictions in their own languages and cultural terms, and test adaptive capacity at a community level³, and
 - partnerships and collaborations with institutions contribute to capacity building, which provides opportunities for equitable roles in climate change planning and assists in developing adaptation tools to contribute to the sustainability of Aboriginal communities over future generations^{3,Error! Bookmark not defined.}
- utilise education appropriately to prepare communities for climate change. The role of Aboriginal knowledge in strengthening cultural resilience must also be specifically recognised in any education program⁹;
 - a comprehensive communication strategy about climate impacts for Aboriginal people is critical to the success of Australia's adaptation response⁹;
 - climate change research findings and education must be incorporated into community-level and regional planning initiatives to ensure local understanding of concepts, to project future change, and to develop adaptation planning frameworks³; and
 - adequate resources are required to design comprehensive community engagement strategies for adaptation planning. Ethnographic methods informed by Indigenous philosophies, and social and cultural values must be employed⁹.
- appreciate that 'one size will not fit all' with regards to developing resilience and adaptation strategies;
 - it is important to acknowledge the great diversity of Aboriginal communities, which range from urban centres to very remote outstations, and to ensure that adaptation research encompasses this diversity; and
 - it is recommended that by adopting a regionally-specific approach, the varying needs of remote communities would be captured⁹.

- ensure adaptation strategies emphasises local and regional scales, employs participatory and adaptive learning research methods, and builds on national and international research³⁶;
 - the need for planned adaptation is more crucial for certain regions and sectors (such as remote Aboriginal communities in northern Australia), which have diminished access to the resources that can facilitate spontaneous adjustment³; and
 - for many areas, adaptation is likely to focus on activities that enhance local capacity to address current social and economic issues. By building general adaptive capacity, the capacity of communities to respond to climate change impacts will improve³.
- enhance the resilience and adaptive capacity of vulnerable groups. This will be a key ingredient for effective adaptation, and must cover areas such as:
 - housing (e.g., subsidising household energy efficiency and low carbon measures),
 - transportation (e.g., subsidising low income families for affordable fuel prices and transportation to workplace or school), and
 - livelihoods (e.g., providing training in 'green skills' to enhance employability of people)².
- implement health strategies and policies to reduce the range of risk factors that are frequently found in Aboriginal communities, such as poor nutrition, overcrowded housing, lack of adequate water supplies – all of which serve to reduce adaptive capacity⁹; and
- ensure that strategies and initiatives aimed at adaptation are able to be modified, so that they are accessible to, and eventually benefit, all groups in the community including those who are most disadvantaged².

³⁶ Parsons, M, 2012, *Climate Change Adaptation. For Indigenous Communities: An Overview*.
https://www.nccarf.edu.au/sites/default/files/attached_files_publications/CCA%20Indigenous%20Communities%20Overview.pdf

Mitigation

Consideration of climate change mitigation should be a checklist item in the development of system-wide policies and broader planning issues (e.g. the built environment, access to public transport (reduce use of cars), use of grey water etc.). All decision making must be supported by comprehensive and protective risk-based public health policy around emission and pollution controls to mitigate the impacts from climate change.

The Sustainable Health Review

The Sustainable Health Review (SHR) Final Report³⁷ was released on 10 April 2019 and has eight Enduring Strategies and 30 Recommendations, which seek to drive a cultural and behavioural shift across the health system.

In *Strategy 1 – Commit and collaborate to address major public health issues*, Recommendation 5 in the Final Report highlights the need to reduce the health system's environmental footprint; ensure mitigation and adaptation strategies are in place to respond to the health impacts and risks of climate change; and to set ongoing targets and measures aligned with established national and international goals.

Implementation planning has commenced within the health system and the Sustainable Health Implementation Support Unit (SHISU) has been established to support planning and assurance of this process.

The health system is currently considering the alignment of existing work to the priorities in implementation highlighted by the SHR Panel within each recommendation.

The priorities in implementation for Recommendation 5 include:

- Reduction in the environmental footprint, including energy use, water use, emissions and consumables; driven by local staff, supported by system executives, and coordinated by dedicated resources on a system wide basis guided by the successful National Health Service (NHS UK) model.
- Transparent public reporting on the WA health system's environmental footprint by July 2020.
- Establishment of an inquiry under the *Public Health Act 2016* to review current planning and response to the health impacts of climate change and make recommendations for improvement in terms of climate change mitigation and public health adaptation strategies, including principles or smart cities.

A sustainable health care system

To ensure an environmentally sustainable health system³⁸ that continues to provide high-quality healthcare (monitored through existing and future indicators/systems), consideration needs to be given to the carbon emissions from procurement activities (noting 57% of emissions in the UK were from procurement, including manufacturing of pharmaceuticals and medical equipment; and that pharmaceuticals are the second largest contributor to carbon emissions in the US). Sustainability measures should be included in procurement decisions (the Medicines

³⁷ Sustainable Health Review Final Report 2019 <https://ww2.health.wa.gov.au/Improving-WA-Health/Sustainable-health-review>

³⁸ RACP position statement at https://www.racp.edu.au/docs/default-source/advocacy-library/environmentally-sustainable-healthcare-position-statement.pdf?sfvrsn=2834361a_4

and Technology Unit in DoH has links with procurement and through the SMF/WA DEP and Western Australian Policy Advisory Committee on Health Technology (WAPACT) process may be able to influence this process)

Wasteful and unnecessary medical interventions should be avoided (Choosing Wisely Working Group is about to convene and provides an existing governance mechanism and the ability to share learnings/scale-up activity, but funding is required for scale-up). The use of new technology (links with WAPACT process; the 'health technology governance policy' could include sustainability measures) should be optimised.

The DOH should establish a Healthcare Sustainability Unit that can influence system-wide policy, measure the carbon footprint of HSPs, and support health services (Patient Safety and Clinical Quality Directorate could engage with this unit).

Consideration will be needed as to who within the DoH will be responsible for preparing any financial information and if there is likely to be a requirement for involvement by officers at the DoH to support this work.

Waste

In March 2018, the Clinical Senate of WA³⁹ debated the issue of Waste in four areas; one of the focus areas was environmental waste.

Clinicians determined that, in order to reduce environmental impacts, there is the need to:

- focus on reducing single use items to reduce the environmental impact;
- share practical examples around reuse, recycle or repurpose across health services;
- rotate or redistribute stock in accordance with the use by dates; and
- measure environmental waste through waste reporting.

Policy, legislation and regulation

The DoH's *Western Australian Health Promotion Strategic Framework 2017–2020*⁴⁰ includes several strategies for chronic disease prevention relevant to climate change and health; for example:

- Healthy policies – promoting the adoption of policies that support healthy food choices and reductions in food waste in the WA health system.
- Legislation and regulation – the *WA Public Health Act 2016* requires local governments to develop a detailed public health plan, which could include actions to help mitigate greenhouse gas emissions (e.g. by supporting active transport, local food production).
- Supportive environments – a range of policy options to reduce the impact of obesity in WA were identified in the 2018 WA Preventive Health Summit; for example, the WA Government could implement a ban on the advertising and promotion of junk food on state assets.

³⁹ Clinical Senate

https://ww2.health.wa.gov.au/~/_/media/Files/Corporate/general%20documents/Clinical%20Senate/PDF/2018/March/Waste-not-executive-summary.pdf

⁴⁰ Chronic Disease Prevention Directorate. *Western Australian Health Promotion Strategic Framework 2017-2021*. Department of Health, Perth; 2017.

- Public awareness and engagement – the DoH funds a suite of population-wide obesity prevention programs, including the LiveLighter® healthy lifestyle promotion and education program.
- Targeted interventions – the DoH funds food literacy programs in primary and secondary schools and for adults on low to middle incomes.
- Community development – the DoH supports health service providers and local governments in their public health policy and planning, which includes community development and participation.
- Strategic coordination and building partnerships for prevention – obesity prevention requires a whole of government response, as identified by the Sustainable Health Review. The Chronic Disease Prevention Directorate within the DoH is already working across government agencies to identify shared policy interests that could contribute to obesity prevention.

The DoH can provide support to the Minister for Health in recommending and endorsing nationally coordinated action on obesity prevention; food and nutrition policy; and climate change and broader impacts to public health via the Council of Australian Governments.

Disaster preparedness

Disaster management planning is critical for sustaining food and water supplies in the event of adverse weather events, particularly for communities outside major centres that depend on road transport for food access. DoH has been charged by the Sustainable Health Review to reduce inequity in health outcomes and access to care, specifically identifying Aboriginal people and families; Culturally and Linguistically Diverse people; and people living in low socioeconomic conditions. Notably, the State Hazard Plan: Heatwave⁴¹ emphasises the vulnerability of *culturally and linguistically diverse people, who may have limited understanding of the impacts of a heatwave*. It is vital to introduce information early and in accessible forms to strengthen resilience of all WA communities prior to heatwaves and other extreme events and impacts related to climate change.

As the Hazard Management Agency (HMA) for heatwave, the DoH needs to identify emerging and existing vulnerable populations within WA and recognise that vulnerable populations may differ depending on locality. Effective messaging depends on understanding the target group. Messaging for vulnerable communities should be tailored and use appropriate communication technology. Traditional mediums such as televisions, phones, and radios may not have enough reach. One idea that has been proposed is peer-to-peer messaging between those who distribute *The Big Issue* publication.

The DoH should provide greater support to local governments, emphasising the importance of the development of plans to build resilience of the homeless in both preparation and response (e.g. Melbourne's Heatwaves and Homelessness Action Plan)⁴². Actions such as these will strengthen, prepare and create community resilience to impacts of climate change and lead to better health outcomes for the WA population.

⁴¹ State Emergency Management Committee. State Hazard Plan: Heatwave. Department of Health, Perth; 2019. Available from: <https://semc.wa.gov.au/Documents/Resources/LegislationPolicyPlansProcedureandGuidelines/Plans/StateHazardPlans/StateHazardPlanHeatwave.pdf>

⁴² <https://www.melbourne.vic.gov.au/SiteCollectionDocuments/heatwaves-homelessness.pdf>

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