Science for Communities

Considerations for developing a Health National Adaptation Plan for New Zealand

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EXECUTIVE SUMMARY

Climate change is likely to have the greatest impact on the most vulnerable groups in society. This includes the old and the young, those with chronic illness, those socially excluded and deprived, Māori, and refugees and immigrants, as they may have insufficient means to adapt. Adapting to anthropogenic climate change is a major challenge faced by health sectors globally and one of the most serious threats to sustainable development efforts. Excluding the health sector in adaptation planning can miss critical actions to protect population health and can result in policies and programmes in other sectors inadvertently causing or contributing to adverse health impacts, thereby undermining efforts to protect the environment.

Due to the challenges ahead, many countries have prepared specific health national adaptation plans (HNAPs) as a strategy to help prepare and manage the health impacts associated with a changing global climate. These health specific plans often accompany national adaptation plans or national adaptation action plans (NAPs), which encompass all sectors.

This report outlines a number of considerations for the New Zealand Ministry of Health in scoping a process for climate related health adaptation planning. Issues and options for health adaptation planning are identified through a review of existing guidelines. Further considerations have been identified through a review of the health component of national adaptation plans (NAPs) and health national adaptation plans from (HNAPs) from a number of countries. It also includes, where relevant, are peer-reviewed and grey literature on health adaptation planning.

Some key questions and considerations for health adaptation planning in New Zealand identified through the preparation of this report are:

- whether a HNAP should consider both ‘health’ and ‘well-being’
- what comprises ‘health’ and ‘well-being’ in health adaptation planning eg, health care, health sector, and individual health
- what the goal and the outcomes of a HNAP should be
- whether HNAPs should target specific health risks or focus on national-level initiatives and policies to guide more targeted actions at the sub-national level
- how the HNAP is co-ordinated from national to regional or local level
- The co-ordination of health adaptation (or reduction of risk) related to natural hazards and climate sensitive health risks
- how Māori can be active participants in climate and health adaptation planning and development
- whether mitigation and adaptation for health are considered in the same plan
- what health values, legislation, policy and frameworks are likely to drive adaptation planning processes
- how other sectors are co-ordinated and included in health adaptation planning and vice versa
- how health actions or implementation of actions are financed and prioritised.

1. INTRODUCTION AND PURPOSE

1.1 Introduction

The health impacts of climate change are evident across the globe. New Zealand needs to be prepared for any future shocks and changes that will impact the health and well-being of its population. The climate related implications for environmental and public health have been explored in two prior reports (Bolton 2018; Royal Society of Zealand 2017). The reports show several future risks that are expected to be unequally distributed and potentially increase health inequity.

Building preparedness and resilience to the expected health impacts of climate change now will save costs in the short and long term.

The development of a health national adaptation plan is one way to prepare for, and develop, prioritised activities to build health resilience, thereby reducing future health risks and protecting lives.

1.2 Purpose

The main purpose of this document is to provide the New Zealand Ministry of Health with a consolidated report on considerations that need to be made when developing a health national adaptation plan (HNAP). This report does not provide a detailed cost benefit analysis of health interventions or adaptation in response to climate change.

This report provides information on key differences between national adaptation plans (NAPs) and HNAPs including a more detailed comparison from a selection of international plans, frameworks and guidelines, a general overview of how HNAPs are structured and where useful, includes peer reviewed and grey literature to support some of the discussion.

In addition, during the initial development of this report, ESR and MoH conducted a workshop attended by central Government in July 2019. The workshop gathered perspectives from key stakeholders in central Government on climate change health adaptation planning in New Zealand. We have therefore incorporated those insights into this report.

2. BACKGROUND

2.1 Climate Change and Health: Global Health Impacts

Climate change refers to changes in the mean climate and/or variability of the climate that persist over long periods (Intergovernmental Panel on Climate Change 2014). Anthropogenic climate change refers to the warming of the earth in response to human activities, which have increased the concentrations of heat-trapping gasses or greenhouse gases such as carbon dioxide (CO_2) in the atmosphere (Parliamentary Commissioner for the Environment 2014).

Climate change directly impacts human health by increasing air and sea temperature, or worsening existing risks such as storms and flooding, and over longer time scales by increasing sea level. Increased air temperature is almost certain (Reisinger et al 2014) and changes to our weather patterns will have impacts across many systems that humans rely upon (food, water, environment and ecosystems); social and economic changes such as migration stresses, well-being, health inequality and socioeconomic deprivation (Intergovernmental Panel on Climate Change 2014; Royal Society of New Zealand 2016; Weissbecker 2011). Evidence suggests a number of psychological responses and mental health impacts will accompany gradual environmental change and extreme weather events and intensify existing inequities (Smith et al 2014; Weissbecker 2011).

Globally, the impacts from a changing climate are projected to result in significant additional deaths and incidence of disease on top of existing health burdens. There are also significant opportunities to increase health capacity to manage and adapt to those future health risks (Kim et al 2015; McIver et al 2016).

2.2 Climate Change and Health: New Zealand Health Impacts

The overall extent to which climate change is affecting health in New Zealand has not yet been quantified. However, specific health impacts identified for New Zealand suggest changing climate is already impacting public health and will increase the risk of health impacts over the coming decades (Bolton 2018; Royal Society of New Zealand 2017; Tong et al 2016). The health risks include those that are direct, such as changes to the intensity or frequency of natural hazards such as flooding, drought and fire, and those related to climate-sensitive disease shifts such as the introduction of exotic vectors and the transmission of vector borne diseases (Figure 1). Indirect impacts include an increased risk of crop damage or disease, food spoilage or food and water contamination that could affect food and water security and safety, and diffuse impacts that include intergenerational inequity and migration or environmental displacement.

This extends to the realm countries of Cook Islands, Niue, and Tokelau where increases in immigration to New Zealand are already occurring (in the case of Niue, there are now more Niuean's in New Zealand compared to those living in Niue) (Statistics New Zealand 2019). Pacific islanders that move away from their island homes do so because they seek better service delivery, especially regarding health, education, and economic opportunity (House of Representatives New Zealand 2010). This movement is likely to increase with increasing extreme weather events, and over time with increases in sea-level rise that may as a last resort, require planning for moving people from low-lying islands (Tennent et al. 2015; Cameron et al. 2013). The changes in population demographics may lead to health disparities in relation to overcrowding, the incidence of infectious disease (eg, tuberculosis) and cascading effects on housing that impact on those already vulnerable (New Zealand College of Public Health Medicine 2013). There is also very little in terms of research on the impact of existing communities receiving migrating communities, whether they are internal or external.

This highlights need to develop more effective approaches that respond to the health needs of displaced populations, which includes substantial institutional innovation and capacity to foster adaptation both in and outside of at-risk communities (Peters 2018).

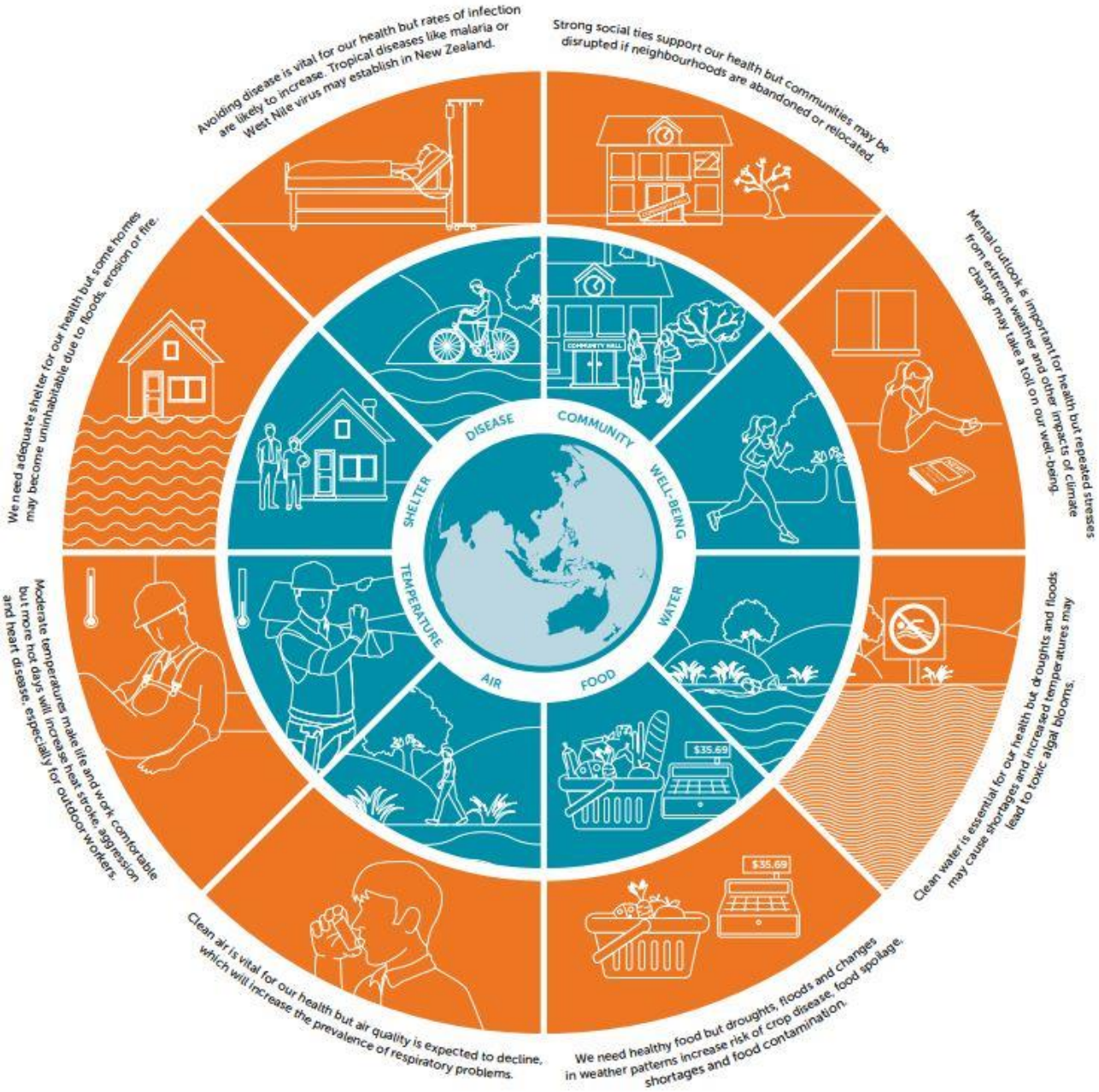


Figure 1: Examples of potential health impacts associated with a changing climate (from Royal Society of New Zealand, 2017).

2.3 Health System Impacts

Climate change is also likely to impact the health system. Health systems can be thought of as agencies that provide health services for the better health of New Zealanders. They include hospitals and health care services and organisations established through the New Zealand Public Health and Disability Act 2000, such as district health boards and other Crown entities (Minister of Health 2016).

International literature suggests adverse impacts on health systems or a worsening of the capability of health systems to cope with changes to climate (Carthey et al 2009; Curtis et al 2017; Guenther and Balbus 2014). They include but are not limited to the following health system risks:

- preparedness and resilience in the design and operation of hospitals, particularly in response to extreme weather events
- operation of health services through the effects on built, social and institutional infrastructures which support health and health care
- increased service demand, particularly during extreme weather events
- impacts on staff and patients access to medical facilities due to extreme weather events
- preparedness and emergency response strategies requiring action that extends beyond the emergency response services, such as health and social care providers
- not reducing health sector reliance on fossil fuels (mitigation) that could further exacerbate health system impacts
- vulnerability of energy supply including backup systems during extreme events
- capability issues related to climate sensitive health impacts (eg, general practitioners)
- access to safe and secure water supply as a result of extreme weather events and long-term changes in climate
- access to medicines eg, for emerging diseases.

The severity of health impacts will depend on a number of factors: the concentration of heat-trapping gas emissions in the future; how both heat-trapping gas emissions and current environmental risks are managed (mitigated); and how prepared the Government, public and the health sector are in terms of management of projected impacts (adaptation).

3. BRINGING HEALTH INTO NATIONAL ADAPTATION PLANNING

This section examines at a high-level, how health fits within national adaptation planning, and what a HNAP might look like, including some principles of a HNAP.

3.1 What is Adaptation and Mitigation in a Health Context?

Adaptation is referred to as 'the process of adjustment to actual or expected climate and its effects resulting from greenhouse gas emissions already released into the atmosphere and those that may be released in the future' (Climate Change Adaptation Technical Working Group 2017). The IPCC Fifth Assessment Report define adaptation as 'the process of adjustment to actual or expected climate and its effects. In human systems, adaptation seeks to moderate or avoid harm or exploit beneficial opportunities. In some natural systems, human intervention may facilitate adjustment to expected climate and its effects' (IPCC, 2014). Health adaptation can also be considered as equal with prevention (Ford et al 2014). Given recognition of the health risks posed by climate change, adaptation has emerged as a key component to reduce risk by means of climate policies in a health context (Watts et al 2015). Mitigation addresses the causes of climate change, which in a health planning context would focus on the reduction of greenhouse gas emissions from the health sector.

Additionally, in a general sense, the New Zealand climate change technical advisory committee has defined effective adaptation to mean:

'…..that New Zealand's current and future communities are able to reduce the risks from climate change impacts over the medium and long term by:

- reducing the exposure and vulnerability of our natural, built, economic, social and cultural systems
- maintaining or improving the capacity of our natural, built, economic and social and cultural systems to adapt' (Climate Change Adaptation Technical Working Group 2018).

3.2 Introduction to National Adaptation Planning

National adaptation plans pertain to overall adaptation (to climate change) ie, not specifically health. However, many overseas NAPs and/or policies recognise health as a key sector, and that the impacts from climate change will affect public and environmental health, the health sector and health policy. Including health within the NAP process also increases the likelihood of considering unintended health impacts introduced in other sector adaptation plans. Inclusion therefore ensures health sector synergies and promotes health co-benefits across health-determining sectors, such as energy, agriculture, housing, water and transport (World Health Organization, 2014). In the absence of a NAP for New Zealand (see Appendix 1), it is still advantageous to explore how health, and frameworks for developing a health adaptation plan, will work and ultimately align themselves to a NAP.

3.3 Climate Change and Health: Legislative and Policy Context

The legislative and policy context is composed of international commitments, legislation, national and regional plans and policies and district direction plans and policies.

International commitments include the Sustainable Development Goals (SDGs) and the United Nations Framework Convention on Climate Change (UNFCCC). The 2030 agenda for sustainable development (2016)[1] includes 17 SDGs and 169 targets, now supplemented by more than 230 indicators. Economic, social, and environmental dimensions of sustainable development are integrated within and across the goals and sectors therefore breaking down traditional silos. These are designed to encourage more cross-sectoral participation to foster joint decision-making and proposals for solutions. The goals are applicable to any country and many are interconnected. Additional areas such as climate change, economic inequality, innovation, sustainable consumption, peace and justice, among other priorities have also been included, but SDG 3 is health specific and achievement of this and many of other SDGs will also have positive health-related benefits (Nunes et al 2016). It is recognised that for New Zealand, achieving the SDGs will require cross-Government effort. It is expected that New Zealand will contribute to this achievement "through a combination of domestic action, international leadership on global policy issues, and supporting countries through the New Zealand Aid Programme"[2].

The UNFCCC was ratified in 1994 that has the objective of preventing dangerous anthropogenic (human) interference with the climate system. Parties to the convention are encouraged to formulate NAPs[3]. These are reduction plans that address the medium- and long-term risks[4] posed by climate variability and change. Note, at the time of writing, the Zero Carbon Bill (expected to be law by the end of 2019)[5] aims to reduce all GHG emissions (except biological methane) to 'net zero' by 2050 (hence aiming to limit the global temperature increase to 1.5°C above pre-industrial levels).

As emissions continue to rise UNFCCC has been superseded by the Paris Agreement (United Nations 2015a), which aims keep the global average temperature below 2°C above pre-industrial levels, while pursuing efforts to limit the temperature increase to 1.5°C. New Zealand has committed to reduce emissions to 30% below 2005 levels by 2030. The agreement also supports financial flows for the development of low carbon resilient economies and enhances national abilities to adapt. It defines effective adaptation as:

- assessing risks and identifying priorities through risk and vulnerability assessments
- developing plans that set out concrete policies and measures for addressing adaptation
- implementing policies and measures outlined in the plans
- assessing progress of implementation of adaptation measures using a series of indicators.

The Climate Change Response (Zero Carbon) Amendment Bill is legislation that is an amendment to the existing Climate Change Response Act 2002. The amendment sets the

1 https://sustainabledevelopment.un.org/?menu=1300
2 https://www.mfat.govt.nz/en/peace-rights-and-security/work-with-the-un-and-other-partners/new-zealand-and-the-sustainable-development-goals-sdgs/
3 https://unfccc.int/topics/adaptation-and-resilience/workstreams/national-adaptation-plans
4 The intergovernmental panel on climate change define medium and long-term risks as years 2050 and 2100.
5 https://www.mfe.govt.nz/climate-change/zero-carbon-amendment-bill

framework for New Zealand to transition to a low emissions and climate resilient economy (Ministry for the Environment 2019).

There are four key components:

1. Reducing all greenhouse gases (except biogenic methane) to net zero by 2050 and reduce emissions of biogenic methane within the range of 24-47% below 2017 levels by 2050 including to 10% below 2017 levels by 2030,
2. Set a series of emission budgets to act as stepping stones towards the long-term target,
3. Require the Government to develop and implement policies for climate change adaptation and mitigation.
4. Establish a new, independent Climate Change Commission to provide expert advice and monitoring, to help keep successive government on track to meeting long-term goals.

The Bill proposes a NAP for New Zealand providing the framework for mitigating and adapting to climate change (section 5ZQ). The NAP includes consideration of health, amongst the economic, social, environmental, ecological, and cultural effects of climate change, including effects on iwi and Māori (5ZQ, 4a).

The United Nations Declaration on the Rights of Indigenous Peoples is an international instrument adopted by the UN to enshrine the rights that "constitute the minimum standards for the survival, dignity and well-being of the indigenous peoples of the world." Indigenous people including Māori[6] have been involved in drafting this document. The document sets out the minimum standards for the survival, dignity, wellbeing, and rights of the world's indigenous peoples. Several articles cover areas of human rights as they apply to indigenous peoples with the following key themes[7]:

- self-determination
- equality and non-discrimination
- participation, underpinned by free, prior, informed consent
- culture
- land, territories, and resources.

National legislative commitments include the Resource Management Act (RMA) 1991[8] and many subsequent amendments. The Act sets out how New Zealand manages its environment. The Act requires all persons exercising duties and functions under the Act to have particular regard[9] to the effects of climate change. Unlike all other OECD countries, in New Zealand the effects of climate change on the application, rather than the effects of the application on climate change is the focus. Sections 70A and 104E buttress this by instructing a decision maker not have regard to the effects of a discharge into air of greenhouse gases on climate change (except to the extent that the use and development of renewable energy enables a reduction in the discharge into air of greenhouse gases). New Zealand has nationalised its

[6] https://www.tpk.govt.nz/en/whakamahia/un-declaration-on-the-rights-of-indigenous-peoples

[7] https://www.hrc.co.nz/files/5814/5618/4456/NZHR_Booklet_12_WEB.pdf

[8] http://www.mfe.govt.nz/rma

[9] http://www.environmentguide.org.nz/rma/principles/section-7-other-matters/

approach to the emission of greenhouse gases as part of wider natural hazards management. Policy direction to local government under The Act includes The New Zealand Coastal Policy Statement (Department of Conservation 2010) and the National Policy Statement for Freshwater Management (Ministry for the Environment 2017) as well as National Environmental Standards.

Managing the effects of climate change in New Zealand is undertaken as part of wider natural hazards management. Natural hazards management in New Zealand is a function of local authorities under the Act.

Natural hazards are defined in the RMA (Section 2) as 'any atmospheric or water related occurrence (including earthquake, tsunami, erosion, volcanic and geothermal activity, landslip, subsidence, sedimentation, wind, drought, fire, or flooding) the action of which adversely affects or may adversely affect human life, property, or other aspects of the environment'. Local government can reduce risks using the Act by controlling of the use of land for the purpose of the avoidance or mitigation of natural hazards (regional councils), or control of any actual or potential effects of the use, development, or protection of land for the purpose of the avoidance or mitigation of natural hazards (territorial authorities). Indeed, regional or territorial authorities are required to reduce risk across the scope of responsibility.

New Zealand takes an "all hazards – all risks" approach to national security since a Cabinet decision to this effect since 2001. National security considerations include state and armed conflict, transnational organised crime, cyber security incidents, natural hazards, biosecurity events and pandemics (National Security System Handbook 2016). The New Zealand system also puts emphasis on resilience, which is the ability of a system to respond and recover from an event (whether potential or actual). Resilience includes conditions that allow a system to absorb impacts and cope with an event meaning that systems, people, institutions, physical infrastructure, and communities are able to anticipate risk, limit impacts, cope with the effects and adapt or even thrive in the face of change.

There is **one international** and one NZ relevant **regional framework** relevant to this report: The Sendai Framework (United Nations 2015b) and the Western Pacific Regional Framework for Action on Health and Environment on a Changing Planet (World Health Organization 2017). The Sendai Framework is a 15-year, voluntary, non-binding agreement, which recognizes that the state has the primary role to reduce disaster risk but that responsibility, should be shared with other stakeholders including local government, the private sector and other stakeholders. It aims to substantially reduce disaster risk and loss of life, livelihoods, and health and in the economic, physical, social, cultural and environmental assets of persons, businesses, communities and countries.

In addition, the Western Pacific Regional Framework for Action on Health and Environment on a Changing Planet (New Zealand is considered part of the Western Pacific area) also advocates for cross-sectoral legislation, regulation and enforcement measures and includes protecting health from climate change (ie, adaptation, mitigation and resilience actions).

3.4 Why is a Health National Adaptation Plan Important?

To achieve the goals of healthy people in healthy communities, it is critical that the health sector is properly represented in the NAP process. Excluding the health sector in adaptation planning can miss critical actions to protect population health and can result in policies and

programmes in other sectors inadvertently causing or contributing to adverse health impacts, thereby undermining efforts to protect the environment (World Health Organization 2014). According to the UNFCCC, a health national adaptation plan (HNAP) should be a health component of the NAP. It is designed to achieve the national health adaptation goals within a specific period of time and given available resources.

The current interim climate change commission and national risk assessment panel (New Zealand Parliament 2019) has a strong focus on physical risk but it is unclear how this process might extend to emergency management and indirect health impacts. Additionally, in terms of health, the Zero Carbon Amendment Bill, focuses on lifelines that include water, wastewater, transport, energy and telecommunications but not specific climate-sensitive disease.

These lifelines are essential for health, however, the health system definition is much wider. It includes the health of individuals and communities, but may also include health service delivery, health workforce capacity and health information.

HNAPs recognise that the impacts from climate changes go beyond the physical impacts. They include indirect impacts and diffuse impacts. These are impacts that are likely to require action and implementation plans that span across different agencies. Using two examples as case studies, first, the indirect impacts of climate change may relate to food security, eg, availability of nutritious food. Food insecurity may lead to increased food prices or increase consumption of less healthy food. In the case of diffuse impacts, New Zealand has three Pacific realm islands, and there could be an increased amount of climate related migration because of impacts across the Pacific and beyond. This will increase pressure on the existing health system, may require more specialised health care adaptation capacity, and have indirect impacts on other areas of health such as crowding (communicable disease), housing affordability and mental health support for incoming and receiving communities.

3.5 What is a Health National Adaptation Plan?

The UNFCCC refers to HNAPs as the formal health component of a National Adaptation Plan (NAP). HNAPs are also referred to as climate change and health action plans, human health and well-being climate change adaptation plans, health climate action plans, and climate change health adaptation strategies.

A HNAP or equivalent, typically builds the resilience of the existing health system to achieve nationally set strategic health adaptation goals within a specific period of time and given available resources (Watts et al 2018). The development of a HNAP also allows prioritised activities to achieve these goals. In larger countries these activities or actions are usually undertaken at both national and lower level (eg, local authority) and involve working with counterparts from other health determining sectors, (eg, environment, water, agriculture). In some cases, but not often (eg, in action or implementation plans), countries define who should undertake responsibility for activities. HNAPs are designed to align with NAPs. An example of this co-ordination is shown in Figure 2, which demonstrates the World Health Organization (WHO) concept of HNAPs and interaction with NAP and other sector adaptation plans.

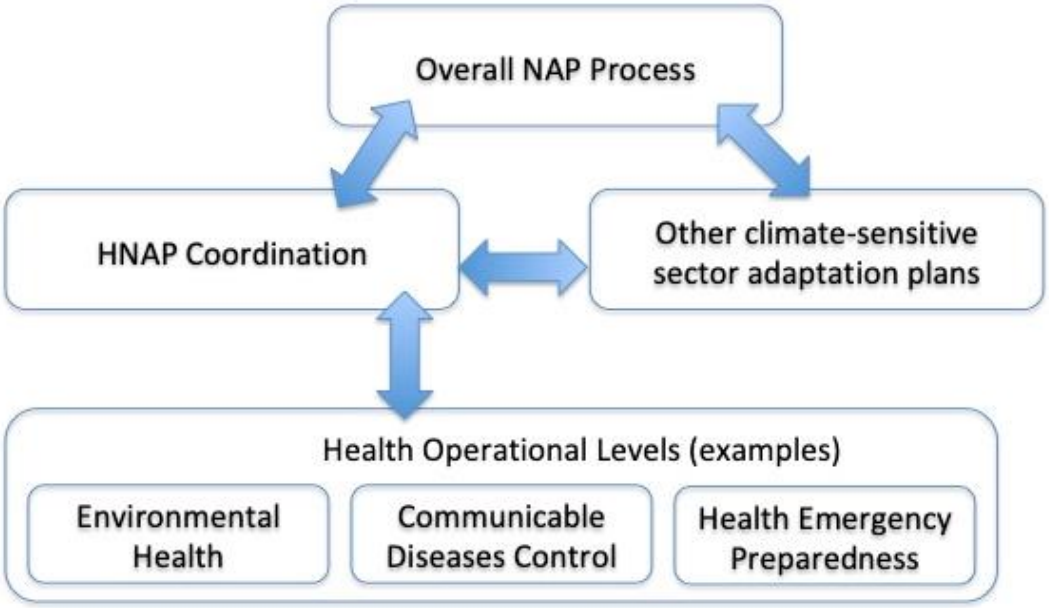


Figure 2: Example of how HNAPs are integrated into the NAP process (WHO 2014)

International literature that compares and describes adaptation plans can provide insights into the challenges of adaptation. A literature review of health adaptation plans revealed a wide range of topics covered, including challenges with administrative systems (Cotton et al 2019; Orru et al 2018); adaptation activities in health adaptation planning (Austin et al 2016; Paz et al 2016); components of resilient health systems (Hanefield et al 2018); what successful adaptation (generic) planning looks like (Olazabal et al 2017); and building adaptive capacity and/or resilience through adaptive management (Austin et al 2019; Hess et al 2012; Marinucci et al 2014).

In terms of administration, Cotton et al (2019) discussed the requirement for prioritising mitigation over adaptation to avoid shifting the focus away from emission reduction. They also explore a general lack of responsibility and leadership in adaptation (eg, government, vs collective action, vs individuals), which they label as the 'responsibility gap'. Similarly, Orru et al (2018) considered a number of reasons for the lack of health adaptation to climate change or management (in Estonia). The reasons they identified were: "that people are able to cope with long-term effects"; a lack of mainstreaming health impacts into policy; a lack of experience and understanding of managing extreme weather events; short-term thinking; no clear responsibilities for governance, lack of evidence and the limited economic capacity of the country.

In terms of adaptation definitions, Marinucci et al (2014) define climate adaptation as 'adjustments in ecological, social, or economic systems in response to actual or expected climatic stimuli and their effects or impacts. It refers to changes in processes, practices, and structures to moderate potential damages or to exploit beneficial opportunities associated with climate change'. In terms of public health adaptation, this could be defined as 'any short or long-term strategies that can reduce adverse health impacts or enhance resilience in response to observed or expected changes in climate and associated extremes'.

Internationally, the health care system is the primary focus of HNAPs. Within New Zealand, a consideration for adaptation planning is the degree to which the health sector (eg, health care

services, disability services, public and environmental health services) is the focus compared to adaptations to support health and wellbeing outcomes, including equity outcomes.

Successful adaptation planning can also be categorised by adaptation typology: capacity building; management, planning and policy; practise and behaviours; information and warning or observation systems (Marinucci et al 2014). Rather than using adaptation planning, Hanefield et al (2018) explore what constitutes a resilient health system by examining the response to recent 'shocks'. They found the WHO building blocks a useful way to describe health system functions, with health management, health funding and health workforce as the key dimensions, crosscut by governance and values. Austin et al (2019) use two case studies from Canada and Germany to illustrate public health agencies that support mechanisms to adapt and discuss the barriers to adaptation. The detailed supporting mechanisms include building financial capacity; developing, sharing and using knowledge; collaboration and coordination and leadership. The barriers included a lack of mandate for public health, when it is organisationally separate from local government (as it is in New Zealand). For example, several public health adaptation opportunities fall outside of the health sector, such as the built environment. Changes in other sectors are more challenging and existing more immediate/pressing public health issues tend to dominate adaptation efforts due to a lack of dedicated funding and workforce expertise.

Adaptive management, as opposed to planning, describes an iterative, learning-based approach to the design, implementation, and evaluation of interventions in complex, changing systems (Marinucci et al 2014). This concept is explored further by the application of the 'Building Resilience Against Climate Events' (BRACE) framework (Appendix 3) developed by the Centre for Disease Control (USA). The BRACE framework includes incorporation of short and long-term climate projections into public health planning. The advantage of this approach allows health officials, in conjunction with epidemiologic analysis to effectively anticipate and prepare for a wide range of climate sensitive health impacts.

Austin et al (2016) reviewed several public health adaptation initiatives in selected OECD countries. They found that 'nearly half of the health adaptation initiatives planned or implemented by national governments do not target specific health risks, likely due to the nature of national-level initiatives and policies intended to guide more targeted actions at the sub-national level'. In terms of adaptation planning for specific health risks, Hess et al (2012) suggest initially focussing on distinctly climate sensitive health risks. These could include extreme weather events, ecosystem shifts, and emergence of new disease. Paz et al (2016) included temperature extremes, wind, storms, floods; fresh water supply and quality; air quality and vector-borne disease; urban biodiversity; risks to vulnerable populations; in addition to education and raising awareness. However, infectious disease and heat-related risks were the most commonly addressed in OECD countries (Austin et al 2016). The distinction between climate sensitive health risks and those that could be considered natural hazards is explored in more detailed in section 4.2.

3.6 Principles of the HNAP Process

The WHO provides guidance for the overall HNAP process. Although this is geared towards lesser-developed countries, many of the principles may be relevant to New Zealand (World Health Organization 2014, Appendix 3). These include:

- ensuring that health adaptation planning is based on the best available evidence and, as appropriate, traditional and indigenous knowledge, and employ gender-sensitive, socially inclusive approaches with a view to

integrating adaptation into relevant social, economic, and environmental policies and actions, where appropriate
- building on existing national efforts towards health adaptation to climate change, including assessments, and development and implementation of policies and programmes in local to national systems
- integrating health adaptation to climate change into national health planning strategies, processes, and monitoring systems
- providing for a flexible and context-specific approach to health adaptation to climate change
- maximising synergies across sectors, mainly across those that determine health, such as the food, water, energy, transport and housing sectors
- ensuring that the health adaptation plan feeds into and coordinates with the overall NAP
- piloting approaches that promote an iterative process for health adaptation to climate change, producing time-bound plans
- promoting collaboration within the country and harmonising adaptation approaches at sub-regional levels
- taking consideration of vulnerable and excluded groups, communities, and ecosystems
- not be prescriptive, nor result in the duplication of effort undertaken in a country, but rather facilitate country-owned, country-driven action.

The New Zealand Climate Change Adaptation Technical Working Group 2017 recommended a set of principles to guide adaptation action in New Zealand, including but not limited to health. These include:

- anticipate change and focus on preventing future risks from climate change rather than responding as the changes occur
- take a long-term perspective when acting
- take actions which maximise co-benefits, and minimise actions which hinder adaptation
- act together in partnership, ara whakamua, and do this in a way that is based on principles contained in the Treaty of Waitangi
- prioritise action to the most vulnerable communities and sectors
- integrate climate change adaptation into decision-making
- make decisions based on the best available evidence, including science, data, knowledge, and mātauranga Māori
- approach adaptation action with flexibility and enable local circumstances to be reflected.

Common between the two sets of principles are: the use of indigenous knowledge; use of the best available evidence; taking actions that have co-benefits (maximising synergies across sectors); consideration of groups and communities (includes indigenous peoples) that are vulnerable or excluded; integrating adaptation into decision making (relevant social, economic, and environmental policies and actions, where appropriate) and using a flexible approach to adaptation action.

The principles not common to both sets include piloting approaches that promote an iterative process for health adaptation to climate change; producing time-bound plans and taking a long-term perspective when acting.

Considerations for adaptation planning in New Zealand should include whether the shared principles are essential for a HNAP, and whether any of the differences are applicable in a health context.

4. COMPARISON OF SELECTED HEALTH NATIONAL ADAPTATION PLANS

One way to inform discussion of climate related adaptation planning for health in New Zealand is to consider how other countries and jurisdictions have approached planning. This section describes the process and findings from a review of 12 NAPs and 8 HNAPs, deemed to be useful by the report's authors for comparison (Table 1). The countries reviewed include the UK, USA, and Australia, which are large and prominent members of the OECD with HNAPs well established. Samoa & Fiji were selected for their island and Pacific perspective, The Netherlands for their progressive climate change adaptation and mitigation strategies and high renewables energy sector, and Singapore for its developed population with similar population size to New Zealand.

A review framework was developed to consider the scope of plans and types of actions included. The review framework is summarised in Table 2.

Table 1: Summary of National Adaptation and Health National Adaptation Plans reviewed by country

Country/Organisation	NAP or equivalent	HNAP or equivalent
United Kingdom	The National Adaptation Programme and the Third Strategy for Climate Change Reporting (Department of Environment, Food and Rural Affairs 2018) UK Climate Change Risk Assessment 2017 (HM Government 2017) The National Adaptation Programme (HM Government 2013)	Adaptation to Climate Change – Planning Guidance for Health and Social Care Organisations; NHS (Public Health England 2014)
United States of America	Fourth National Climate Assessment, Volume II: Impacts, Risks, and Adaptation in the United States (U.S. Global Change Research Program 2018)	HHS Climate Adaptation Plan (Department of Health and Human Services 2014) Assessing health vulnerability to Climate Change – A Guide for Health Departments (Manangan et al 2014) New York State Department of Health: Building Resilience Against Climate Effects (BRACE) in New York State (Department of Health New York 2015)

Country/Organisation	NAP or equivalent	HNAP or equivalent
Australia	National Climate Resilience and Adaptation Strategy (Australian Government 2015) National Climate Change Adaptation Framework (The National Climate Change Adaptation Research Facility 2007)	Queensland Climate Adaptation Strategy – Human Health and Wellbeing Climate Change Adaptation Plan for Queensland (Armstrong et al 2018) Framework for National Strategy on Climate, Health and Wellbeing for Australia (Horsburgh et al 2017) Action on Climate Change and Health: Governance and Strategy (Doctors for the Environment 2018)
Samoa	National Adaptation programme of Action – Samoa (National Adaptation Programme of Action Task Team 2005) Samoa – Pilot Programme on Climate Resilience (PPCR) (World Bank Group and Asian Development Bank 2010)	Samoa's Climate Adaptation Strategy for Health (Ministry of Health 2014)
Fiji	Republic of Fiji National Adaptation Plan – A pathway towards climate resilience (Republic of Fiji Government 2018)	Fiji Climate change and health strategic action plan 2016-2020 (Ministry of Health & Medical Services 2018) (see Table 3)
The Netherlands	Adapting with Ambition – National Climate Adaptation Strategy (Ministry of Infrastructure and the Environment 2016)	The effects of climate change on health: Update for the National Adaptation Strategy (Wuijts et al 2016)
Singapore	A Climate Resilient Singapore for a Sustainable Future – Climate Action Plan (Ministry of the Environment and Water Resources and Ministry of National Development 2016)	Appendix 3

Table 2: Categories selected and descriptions of each category analysed in this report

Category	Description
NAP/HNAP vs. JNAP[10]	Whether the document considers both natural hazard and climate change related impacts into one document
Health definition	How the document defines 'Health'; whether it distinguishes between environmental health, public health, health system, etc.
Mitigation vs. Adaptation	Whether the document covers mitigation and/or adaptation

[10] A joint national action plan for climate change adaptation and disaster risk management (JNAP) is a plan to reduce the impacts of disasters and climate change by integrating both these approaches.

Category	Description
Influence of health on non-health sectors	Whether the document includes information on cross-sectoral collaboration and decision-making.
Indigenous peoples	Health adaptation indigenous-focused content
Other population groups relevant to HNAPs	Eg, Migrants, people with disabilities
Interface between disaster risk and climate change	How climate change and disaster risk are aligned within relevant organisations and how they are managed
WHO Building Blocks[11]	Building Blocks: 1=Service delivery 2=Health workforce 3=Information 4=Medical products/vaccines/technology 5=Financing 6=Leadership/governance

4.1 Review Framework and Results

The following subsections refer to the categories selected for review (Table 2) and general findings. Findings from the review are discussed in relation to other literature on the topic area. The review includes specific topics of relevance for New Zealand (indigenous populations and vulnerable populations, definitions, and disaster risk resilience), as well as other considerations for scoping a New Zealand health climate adaptation approach (adaptation versus mitigation, WHO building blocks, cross sectoral influence).

4.2 Joining Disaster and Climate Action Plans

Many extreme weather events can be considered national or civil emergencies eg, hazards classified as climate-sensitive, which may include hydrological (eg, flood and rainfall-triggered landslide), climatological (eg, drought and wildfire), biological (eg, relevant climate-sensitive diseases such as dengue, cholera, etc.) and meteorological hazards (eg, temperature extremes, severe storms) (Banwell et al 2018). As the frequency of meteorological events and extremes are projected to increase, minimising or reducing[12] risk from natural hazards will become increasingly more necessary. Adaptation to climate related health impacts and reduction of risk from natural hazards share similar, if not the same goals. In the civil defence emergency management vision of a resilient New Zealand, responsibility for risk reduction is devolved to local levels (ie, communities and individuals) (National Civil Defence Emergency Management Strategy 2008).

Some of the NAPs/HNAPs reviewed consider extreme events interchangeably with emergencies and disasters. For example, the UK national adaptation programme report (Department for Environment Food and Rural Affairs 2018) considers the impact of extreme

[11] A full description of each building block is included as Appendix 2.

[12] Risk reduction (ie, pre-event action) is a potentially broad field of activity but includes measures taken under the Resource Management Act (land use control) and Building Act (building design) as well as infrastructure investment (to decrease vulnerability and improve resilience) under the Local Government Act and Soil Conservation and Rivers Control Acts (Climate Change Adaptation Technical Working Group 2017).

weather events on emergency services and includes actions such as ensuring that emergency and local services are best prepared for extreme weather events. In terms of heat waves, a cross sectoral approach is adopted across housing, infrastructure, productivity and health and social care services. The Queensland Human Health and Well-being Climate Change Adaptation Plan (Armstrong et al 2018) uses a similar approach, although it very much considers the impacts of the effects of climate change on the health sector. For example, planning was suggested as a tool to tackle extreme meteorological events but also to ensure the sustainability of the health sector in terms of infrastructure, building, and accessibility for the community, as well as staff retention.

Adaptation approaches, or integration of actions to the health risks from disaster-related events, include enabling resilience through the application of the Sendai Framework (United Nations 2015). For example, aligning/mainstreaming disaster risks, disaster risk reduction, reducing disaster damage to critical infrastructure and 'building back better', including the creation of policies and mechanisms to implement these actions or approaches.

Applying the Sendai Framework is also an opportunity to include sustainable development and environmental initiatives into HNAPs such as:

- increasing the availability of, and access to, multi-hazard early warning systems and disaster risk information and assessments
- using toolkits for vulnerability and adaptation assessments eg, human health and well-being climate change adaptation plan for Queensland 2018, (Armstrong et al 2018)
- adopting an all-agencies approach to disaster and emergency management across the prevention, preparedness, response and recovery phases
- scaling up adaptation in the disaster risk sector in the form of forward-looking processes to respond to the increasing intensity and complexity of climate risks, eg, ensuring that climate sensitive health risks are adequately addressed in emergency and disaster protocols, policies and plans
- pre-emptive disaster planning
- comprehensive disaster management.

Many of these actions acknowledge that the first of the 4 R's[13] in disaster risk resilience should focus on **reduction**, which has typically not taken place to date (Climate Change Adaptation Technical Working Group 2018).

To illustrate, some developing nations have combined climate change and disaster risk management through a joint national action plan (JNAP) at a national level. JNAPs are plans designed to reduce the impacts of disasters and climate change by integrating and adapting to both by designing cross-sectorial activities across all stakeholders and society. They have typically been developed for Pacific island countries and some South Asian countries. As New Zealand is susceptible to both natural hazards and changes related to climate, this approach from a health perspective might be beneficial at a national level.

4.3 Definitions of Health, Health Systems and Health Services

None of the HNAPs reviewed defined health, health systems or health services. A number of reports (UK, Australia, Singapore) combine human health and well-being. For New Zealand, how health, health systems and health services are defined will be an important component

[13] The four R's include Reduction; Readiness, Response and Recovery, https://www.civildefence.govt.nz/cdem-sector/the-4rs/

of a health adaptation plan, and whether wider health systems (eg, social care and health care services) are included in the strategy will need to be carefully considered.

WHO define health systems as follows:

"A health system consists of all organizations, people and actions whose primary intent is to promote, restore or maintain health. This includes efforts to influence determinants of health as well as more direct health-improving activities. A health system is therefore more than the pyramid of publicly owned facilities that deliver personal health services. It includes, for example, a mother caring for a sick child at home; private providers; behaviour change programmes; vector-control campaigns; health insurance organizations; occupational health and safety legislation. It includes inter-sectoral action by health staff, for example, encouraging the ministry of education to promote female education, a well-known determinant of better health" (WHO 2007).

Using the information gathered from a workshop attended by central Government agencies (Walton et al 2019), and using two future climate scenarios, the scope of health within climate change adaptation planning revealed:

- Health can be impacted by a wide variety of scenarios, therefore there is a role for health agencies to be involved in numerous climate change adaptation activities. However, health impacts will often be indirect and the adaptation response will most appropriately be led by non-health agencies.
- Health co-ordination responses to *some* events are already in place and understood eg, MCDEM.
- Effective adaptive actions will require coordination between sectors. Effective adaptation planning will need to recognise and establish this coordination.
- These actions will also require a discussion regarding the resourcing of adaptation options.

Therefore, there are clear roles for health agencies but also, it is important that co-ordination occurs across health-determining sectors and determinants of health.

4.4 Vulnerable Populations

Vulnerable populations or communities are noted in each country's plan but are defined differently ie, *what* makes communities vulnerable versus *what types* of communities are identified as vulnerable. Vulnerability can also depend on whether the adaptation plan is at a national or local level. The New Zealand stocktake report (Climate Change Adaptation Technical Working Group 2017) identified vulnerable populations (from a health perspective) as Māori; communities in low-lying areas or rural communities' dependent of non-reticulated water resources (eg, rain water tanks). More specific vulnerable populations are likely to be identified through local health impact assessments.

4.5 Indigenous Populations including Māori

Two countries selected in the review framework specifically mention indigenous populations: the USA and Australia. To complement this section (4.5), a number of papers, reports and adaptation plans were identified and analysed. They were selected from developed countries with indigenous populations (Australia, Canada and the USA) that the research team considered were similar to New Zealand's. The literature related to USA indigenous

populations only considered American Indians/Alaska Natives/Native Hawaiian's as one of many potentially ethnic and vulnerable populations (Department of Health and Human Services, 2014). Both Australia (Horsburgh et al, 2017) and Canada (Austin et al 2015; Government of Canada 2016; Ford et al 2010; Ford et al 2016; Ford et al 2018) specifically recognise their indigenous populations as being central to policy development on climate mitigation and adaptation. It is also worth noting that Canada has federal support and a First Nations and Inuit programme to build capacity for these communities to adapt to climate change health impacts (McClymont and Erin 2012).

For Māori, climate change is expected to exacerbate existing health disparities (Bennett and King 2018; Jones et al 2014; Nottage et al 2010). These health disparities along with having lower socio-economic resources and poorer access to quality to health care (eg, cost, lack of transport, appointment availability) will increase vulnerability to the health effects of climate change for Māori (Jones et al 2014; Nottage et al 2010). Not only will Māori face more physical health disparities in the face of climate change but due to their relationship to the natural environment, Māori will also experience adverse mental and spiritual outcomes (Jones et al 2014). There is a real risk of a loss of identity and mental distress due to displacement and dispossession of lands, marae and urupā, along with adverse effects on resources such as mahinga kai and valued flora and fauna (Nottage et al 2010; Jones et al 2014). This is also reflected in the international indigenous literature that cite as key challenges: environmental justice; the importance of traditional knowledge systems and practices; views and capacity issues associated with land, indigenous rights, poverty challenges and intergenerational disadvantage.

However, there was little detail in the adaptation plans reviewed on how the impacts on indigenous peoples' health would be addressed either at the local or at a national level. Instead, many adaptation plans recognised the limited capacity of indigenous communities to adapt (The National Climate Change Adaptation Research Facility 2007) and the vulnerability of indigenous populations (Horsburgh et al 2017; The National Climate Change Adaptation Research Facility 2007; U.S. Global Change Research Program 2018). Actions that did consider indigenous populations were limited but included redesigning healthcare, inclusion in policy development, relocation, self-determination (see also Jones 2019 for Māori view), and application of traditional knowledge systems and practises (eg, fire and skilful burning in Australia).

4.6 Adaptation vs. Mitigation

Whilst adaptation is the main focus of HNAPs, some countries also include or align adaptation with mitigation. Mitigation is essential because it can restrict climate change and its impacts, and in doing so can also reduce the level of adaptation required. Mitigation was included in a number of NAPs and HNAPs reviewed at both the national and local level. For example, the UK NHS guidance (Public Health England 2014) states that 'adaptation should therefore be addressed alongside mitigation actions to reduce carbon emissions in a twin-track approach to addressing climate change'. Similarly, the Human Health and Services (HHS) Climate Adaptation Plan (Department of Health and Human Services 2014) states that 'HHS has a critical role to play in reducing our own emissions, while also providing tools and technical assistance to prepare for and adapt to climate change to ensure our ability to sustain HHS operation'.

4.7 WHO building blocks

The WHO Building Blocks are 'a framework that describes health systems in terms of six core components or 'building blocks' which contribute to the strengthening of health systems in different ways (World Health Organization 2010). The six building blocks are (1) service delivery; (2) health workforce; (3) information; (4) medical products/vaccines/technology; (5) financing; (6) leadership/governance.

Although the use of the WHO building blocks framework (World Health Organization 2015a) is not mandatory for HNAP development, it does provide useful guidance, in particular for adaptation to climate related health system risks. Fiji specifically used the WHO framework to develop their Climate Adaptation Strategy for Health and other countries reviewed include all or some of the WHO building blocks or elements of a climate resilient health system (Appendix 3). The most common of those elements were 'service delivery', 'information' and 'leadership'. The least common was 'medical products'.

4.8 Cross-sector Influences

Cross-sectoral influence, which expresses the interconnectedness of different sectors on health, is recognised in all countries reviewed. Cross-sectoral collaborators can include, but are not limited to infrastructure providers, energy and environment sector, transport, housing, water and food services, agriculture, local and central Government, the finance and insurance sector, the primary sector, the business sector and iwi/hapū and civil society/non-government organisations (NGOs). Co-ordinated adaptation or action planning across sectors can ensure that health co-benefits are not only recognised and acknowledged but are also integrated into individual sector strategies, plans and policies that align across health eg, adapting to drought would remove stress in agricultural families and communities, (Figure 2). This ensures that other sector adaptation plans do not worsen health impacts eg, switching to biofuels could impact on food security.

Cross-cutting and cross-sectoral barriers in some cases were seen as a challenge to health adaptation, eg, poor urban and infrastructure planning, which fails to account for climate impacts (Armstrong et al 2018), thereby locking in ongoing adaptation difficulties, policies and financial frameworks. Some examples of opportunities across sectors are improving the natural environment and thus ecological foundations of health, collaboration across sectors and creating a framework for cross-sectoral planning and response. A comprehensive chapter on sector interactions is included in the USA's 4th national climate assessment with some useful case studies (U.S. Global Change Research Program 2018).

4.9 Key considerations

Considerations for section 4 include:

- what institutional mechanisms, capacities, structures, and allocation of responsibilities are required to address climate, disaster and health risk management
- whether combining climate adaptation planning with disaster risk management planning is a useful pathway for a HNAP
- how health, health systems and health services are defined in the context of the scope of a HNAP
- how to identify vulnerable populations

- whether HNAPs should also include mitigation efforts across the health sector
- how to ensure that Māori have an active role in adaptation planning; whether mitigation should be considered in parallel with adaptation (ie, in the same planning document) and
- how the WHO health system building blocks can help identify functions, capability, capacity or resources to support climate related health adaptation planning.

5. STRUCTURE OF HNAPS

This section examines the main differences between NAPs (in a health context) and HNAPs. These are important considerations once the purpose and function of a HNAP have been defined. The function, operation and information required to develop a HNAP have been summarised based on the literature review. To complement the review framework (chapter 4) a wider literature review was undertaken, including peer-reviewed literature and grey literature (eg, Government reports). Where relevant, they are included in this section. The chapter ends with a consideration of the key elements and limitations of HNAPs and an overall conclusion.

5.1 Function of HNAPs

The function of a HNAP is to achieve a goal that relates climate change, health and well-being. For example, the goal of a New Zealand HNAP could be that *health and well-being in New Zealand is resilient against the impacts of climate change*. It may include both mitigation and adaptation, where mitigation is linked to the Government's international obligations to meet the Paris Agreement. Mitigation could also be aligned to other sector policies or programmes. Other functions of HNAPs that are relevant to New Zealand are listed below:

- implementation, monitoring and reporting processes
- aligning or mainstreaming the Sendai Framework with the climate change and health adaptation plan process
- mainstreaming of climate and health into existing strategies, policies and programmes (eg, New Zealand Health Strategy) and creating new ones that are able to address future climate sensitive health risks based on sound evidence, and taking into account actions that are most urgent, low regret and that focus on the most vulnerable communities to avoid health inequality
- a policy direction to support the HNAP goals and actions, for example, new policies that recognise cross-sector interactions and promote climate-resilient health such as reducing deaths associated with poor air quality and inadequate building standards.

5.2 Operation – How do HNAPs work and how are actions co-ordinated?

Operationally, a HNAP needs to be a flexible framework that allows health adaptation planning and consistency regionally, or locally. It also needs to co-ordinate with the NAP process. Given information on climate health risks are likely to change over time, at a local or regional level, a HNAP will need to assist with planning to account for health risks in the future by:

- creating climate and health action plans that include all sectors as responsible parties
- create action plans that are tailored to suit geographical, social, climatic variables and consider current and future capacity for adaptation.

Considerations to improve cross-sectoral engagement in health include:

- establishing health sector partnerships
- creating opportunities or formalising cross-sectoral prevention and risk management such as health impact assessments that ideally include social vulnerability
- recognising that human health and well-being are connected to the health of the environment, and therefore environmental protection should form a part of action planning for climate related health impacts.

A ‘health in all policies’ approach, including the use of health impact assessments and whanau ora health, should be promoted as the standard procedure when considering industrial and infrastructure projects eg, (Health in All Policies Team 2018; Ministry of Health 2007; Public Health Advisory Committee 2005). Consideration should also be given to other risk factors including environmental, social, economic and technological trends that impact on the risk associated with climate change and other co-related sectors. These considerations include:

- demographic changes (population growth, urbanisation, age) and future health system demand
- global economic growth and migration
- wealth inequity which affects individual and community resilience and adaptive capacity
- changes to digital connectivity and technology
- occupational impacts on health in conjunction with well-being and productivity.

5.3 Information required for HNAP development: Health and Wellbeing

The information required for HNAP development and prioritisation of adaptation actions includes:

- mapping existing management plans for natural hazard and climate sensitive diseases in terms of responsibilities, information, management, monitoring, adaptation plans
- monitoring climate sensitive diseases and linking them to meteorological data to enable attribution of impacts or disease[14,15].
- establishing a health adaptation portal including case studies to curate knowledge and information (local, national and international) eg, building upon existing resources such as the Health Analysis and Information for Action (HAIFA) (Tompkins et al 2015); reviews and stakeholder interviews; water supply vulnerability assessment; environmental health indicators[16] and actions across DHBs
- creation of indicators to monitor and measure progress, including cross-sectoral monitoring eg, The Lancet Countdown on Health (Appendix 3, Olazabal et al 2017; Watts et al 2018)
- survey health and well-being stakeholders for feedback on a national health adaptation strategy, eg, Climate Change and Health Policy Assessment Project Associations (Environmental Health Working Group of the World Federation of Public Health Associations 2015), specifically regarding the impact of climate change on services and the population and including challenges that relate to adaptation, opportunities for climate action and developing effective responses
- consider an economic cost-benefit analysis of the future burden of climate-related health risks to the health care system versus the economic savings, including those from additional health benefits from implementing adaptation actions to climate change

[14] The UK National Health Service are assessing hospital admissions over 10 years and matching to local daily weather data to analyse any correlation between weather and hospital admissions. By looking at all types of admissions, and weather types, and splitting analysis by different socio-economic groups to identify the vulnerable sub-populations, they are able to translate the impact of weather in terms of cost, which has never been done in the past to their knowledge. In the future, they plan to expand analysis to emergency care and outpatients. https://www.imperial.ac.uk/business-school/knowledge/health/how-does-climate-change-affect-the-provision-of-healthcare/

[15] A review by Austin et al (2016) found the most frequently addressed health risks are infectious diseases and heat-related risks.

[16] http://www.ehinz.ac.nz

eg, impacts to delivery of health, social care services and emergency services; local responders and community resilience.

5.4 Key Elements of HNAPs

Some country HNAPs employ existing frameworks whereas others do not. There was no consistency or preference in the use of the frameworks in countries reviewed (see Table 3 and Appendix 3). There are, however, several common elements across the HNAPs that intersect with existing frameworks. The common elements include the UNFCCC framework (Appendix 3) and the WHO climate resilient health systems framework (World Health Organization 2015a) that builds upon the six building blocks of resilient health systems. Collectively they include:

- governance, policy and management (ownership and leadership)
- research, monitoring and management of data and information (evidence and risk assessment)
- climate resilience, building response capabilities and adaptation to health risks (government, private sector and civil society)
- health sector finance (implementing actions and programs)
- communication and knowledge sharing (across sectors and overseas).

5.5 NAP versus HNAP: Key differences

The key difference observed between NAPs and HNAPs is the level of detail. NAPs focus on a nation-wide overview of multiple sectors, in which health could be included, and is typically assigned a chapter at a high level (eg, UK and Australia) or several sub-level chapters that relate to health eg, water, air quality. NAPs may also include more health detail at a regional level (USA).

NAPs appear to focus on direct health and health sector consequences (eg, heat stress resulting from increased temperature), or those that are considered national impacts. For example, the UK NAP includes subsections covering flood and coastal erosion risk management; water supplies and resources; overheating in buildings; delivery of health and social care services and emergency services; local responders and community resilience. These sub-sections fit within a chapter ‘People and the Built Environment’. However, the UK NAP does not include a specific chapter on human or public health despite ‘health’ being referred to throughout the document.

A number of NAPs include a detailed appendix of key actions, progress milestones and responsibilities (eg, UK, Samoa, Fiji). The actions are considered at both the national and local level. Other countries provide actions at a higher level (eg, Singapore). Other NAPs provide guidance or frameworks from which to develop adaptation actions for health (USA, Australia, The Netherlands). The Netherlands NAP also includes a matrix on climate effects by impact and urgency to assist in prioritisation.

A review by Austin et al (2016) found that almost half of the planned or implemented health adaptation initiatives by national governments do not target specific health risks. This is likely due to the nature of national-level initiatives and policies intended to guide more targeted actions at the sub-national level. An on-line survey of actions by national governments found more than 40% of the respondent countries had failed to involve the health sector in mitigation planning or invest in research on the health effects of climate change (Environmental Health

Working Group of the World Federation of Public Health Associations 2015). Only two countries responded to the survey with comprehensive climate change action plans containing both mitigation and adaptation strategies, climate-health risk surveillance, and early warning systems for health risks from extreme weather (Taiwan and Lithuania).

Therefore, there appears to be no clear approach to the structure of NAPs or HNAPs, or their development, despite numerous frameworks existing (Appendix 3). One country reviewed (Samoa), specifically used the UNFCCC framework as the basis for a HNAP development (WHO, 2014), Fiji utilised the WHO operational framework, and the New York State Department of Health (Department of Health New York 2015) used the BRACE framework. In the HNAPs reviewed, only the Queensland climate adaptation strategy (Armstrong et al, 2018) included the process used to develop their HNAP (Appendix 3). Compared to NAPs, most of the reviewed HNAPs outline the majority of health concerns related to climate change, including impacts on health systems and human health, both direct and indirect, as well as the effects often overlooked, such as cold-related mortality rates or psychological and/or mental stress and illness. Larger countries such as the USA and the UK utilise both national (ie, NAPs that include some aspect of health) and regional or local (HNAPs) that are more detailed. In the UK, at a local level planning guidance is available for health and social care organisations, including an adaptation report for the healthcare system, but only a number of local adaptation plans were found. Pacific island countries appear to include HNAPs only at a national level, likely due to their smaller population and geographic size. The US NAP specifically includes health at a national and regional level, although more specific and detailed adaptation actions exist at the local level, on a state-by-state basis.

Table 3: Summary of health adaptation frameworks reviewed in this report

Document	Adaptation Planning Framework/Process	Additional information
Public Health England, Adaptation to Climate Change. Planning Guidance for Health and Social Care organisations (Public Health England 2014)	Stage 1 - RISK: Assessing risks, identifying threats and opportunities Stage 2 - ACTION: Developing adaptation plans Stage 3 - IMPACT: Implementing the adaptation plan, embedding adaptation into existing structures and monitoring the effects	See Appendix 3
New York State Department of Health: Building Resilience Against Climate Effects (BRACE) (Department of Health New York 2015)	1. Forecasting climate impacts and assessing vulnerabilities 2. Projecting the disease burden 3. Assessing public health interventions 4. Developing and implementing a climate and health adaptation plan 5. Evaluating impact and improving quality of activities	Uses the BRACE framework
Queensland climate adaptation strategy (2018) (Armstrong et al 2018)	Theme 1: Impacts of climate change on health and wellbeing Theme 2: Gaps and barriers to adaptation Theme 3: Opportunities and co-benefits Theme 4: Pathways to respond	Priority Adaptation Measures: 1. Leadership and governance 2. Building capacity in the sector and the community 3. Specific public health measures 4. Risk management and legal liability 5. Research, data and evaluation 6. Economics and financing 7. Collaboration across agencies, sectors and stakeholder groups 8. Education and communication 9. Policy, regulation and legislation 10. Infrastructure, technology and service delivery
Framework for a national strategy on climate, health and well-being for Australia (Horsburgh 2017)	The Seven Areas of Policy Action 1. Health-Promoting and Emissions-Reducing Policies 2. Emergency and Disaster-Preparedness 3. Supporting Healthy and Resilient Communities 4. Education and Capacity Building 5. Leadership and Governance 6. A Sustainable and Climate-resilient Health Sector 7. Research and Data	

Document	Adaptation Planning Framework	Additional information
Samoa's Climate Adaptation Strategy for Health (Ministry of Health 2014)	Key strategic area 1: Health Governance, Policy and Management Key strategic area 2: Cross-sectoral collaboration and partnership Key strategic area 3: Capacity Development Key strategic area 4: Vulnerability and adaptation assessment Key strategic area 5: Cross sectoral prevention and risk management	
The Netherlands The effects of climate change on health: Update for the National Adaptation Strategy (2016) (Wuijts et al 2016)	Note: There is no specific framework listed, but the following are relevant recommendations: • Apply the system approach when developing knowledge and policy. • Apply a phased approach to resolve gaps in current knowledge • Monitor climate change and design new measures accordingly. • Inform the public about the measures they are able to take for themselves • Seek combinations of measures • Improvement of air quality remains important, also with a view to reducing heat stress and alleviating allergic reactions.	
Fiji Climate change and health strategic action plan 2016-2020 (Ministry of Health & Medical Services 2018)	Component 1: Leadership and governance Component 2: Health workforce Component 3: Vulnerability, capacity and adaptation assessment Component 4: Integrated risk monitoring and early warning Component 5: Health and climate research Component 6: Climate resilient and sustainable technologies and infrastructure Component 7: Management of environmental determinants of health Component 8: Climate-informed health programs Component 9: Emergency preparedness and management Component 10: Climate and health financing	These are the components of the WHO operational framework for climate resilient health systems (World Health Organization 2015)

5.6 Limitations, Knowledge and Research Gaps

The HNAPS themselves seldom include the process for development of adaptation planning, nor do they detail ongoing processes of adaptation plan evaluation and revision outside of monitoring health and climate indicators. Adaptation planning for New Zealand needs to consider the functions that will be required to carry out adaptation planning and action, coordination between parts of the adaptation system, as well as links with on-going policy settings.

The following limitations, including research and knowledge gaps, for HNAP development were identified:

- decision-making and prioritisation can be difficult due to incomplete information on existing and future health risks eg, inputs from other health determinant sectors may be required
- capacity to implement plans and actions - financial and operational support, upskilling, available advice, awareness, regional and inter-departmental support
- lack of mandate for public health adaptation to climate change
- dedicated funding and capacity for adaptation to prevent more immediate/pressing public health issues that can hinder adaptation efforts
- information related to feasibility, cost and equity implications of potential actions
- information is required on how climate sensitive health risks are currently managed eg, public health surveillance, vector control, and early warning systems.

Knowledge and Research Gaps:

- climate change and health adaptation for persons with disabilities, inequities associated with gender, minorities, Pacific people, and vulnerable communities
- the impacts of climate change on Hauora Māori and adaptation options that include traditional knowledge
- engagement with Māori for developing climate change policy - initial climate change plans have been developed by iwi and marae around the country although it is unclear how many of these plans include health and well-being impacts on Māori due to climate change
- the use of health research systems ie, research systems designed to fill health data gaps or work on developing implementation programmes (Ekeroma et al 2016; World Health Organization 2009)
- understanding at District Health Board level whether climate change adaptation is incorporated into plans, why and how
- understanding social vulnerability in New Zealand and how to assess it
- impacts on human health and health services including human tolerance limits
- the impacts of climate change on existing and future health inequities, by ethnicity and socioeconomic status
- the extent of psychosocial impacts caused by climate change in New Zealand
- other influences on health - attitude, behaviour, changes in the economy and public awareness need to be considered
- climate change attribution to climate sensitive diseases are required to understand the future risk and develop appropriate adaptation and action plans.

6. CONCLUSION

In this report, a comparison of 12 NAPs and 8 HNAPs was conducted. Each HNAP reviewed appears to be unique to the country and therefore no common framework or process was found. However, existing health adaptation and general adaptation frameworks do contain consistent elements:

- governance, policy and management (ownership and leadership) that integrates adaptation into decision making (relevant social, economic, and environmental policies and actions)
- research, monitoring and management of data and information (evidence and risk assessment), including the use of indigenous knowledge and application of the best available evidence
- climate resilience, building response capabilities and adaptation to health risks (government, private sector and civil society). This includes taking actions that have co-benefits (maximising synergies across sectors); flexible actions; consideration of vulnerable groups and communities
- health sector finance
- communication and knowledge sharing (across sectors and overseas).

Overall, there were a number of key considerations revealed that are applicable to HNAP development for New Zealand. They include:

- whether a HNAP should consider both ‘health’ and ‘well-being’
- what comprises ‘health’ and ‘well-being’ in health adaptation planning eg, health care, health sector, and individual health
- what the goal and the outcomes of a HNAP should be
- whether HNAPs should target specific health risks or focus on national-level initiatives and policies to guide more targeted actions at the sub-national level
- how the HNAP is co-ordinated from national to regional or local level
- the co-ordination of health adaptation (or reduction of risk) related to natural hazards and climate sensitive health risks
- how Māori can be active participants in climate and health adaptation planning and development
- whether mitigation and adaptation for health are considered in the same plan
- what health values, legislation, policy and frameworks are likely to drive planning processes
- how other sectors are co-ordinated and included in health adaptation planning and vice versa
- how health actions or implementation of actions are financed and prioritised

APPENDICES

Appendix 1: Background to National Adaptation Planning for New Zealand

A scoping report[17] for a NAP was conducted in 2017 to determine whether it would benefit New Zealand. It recommended that:

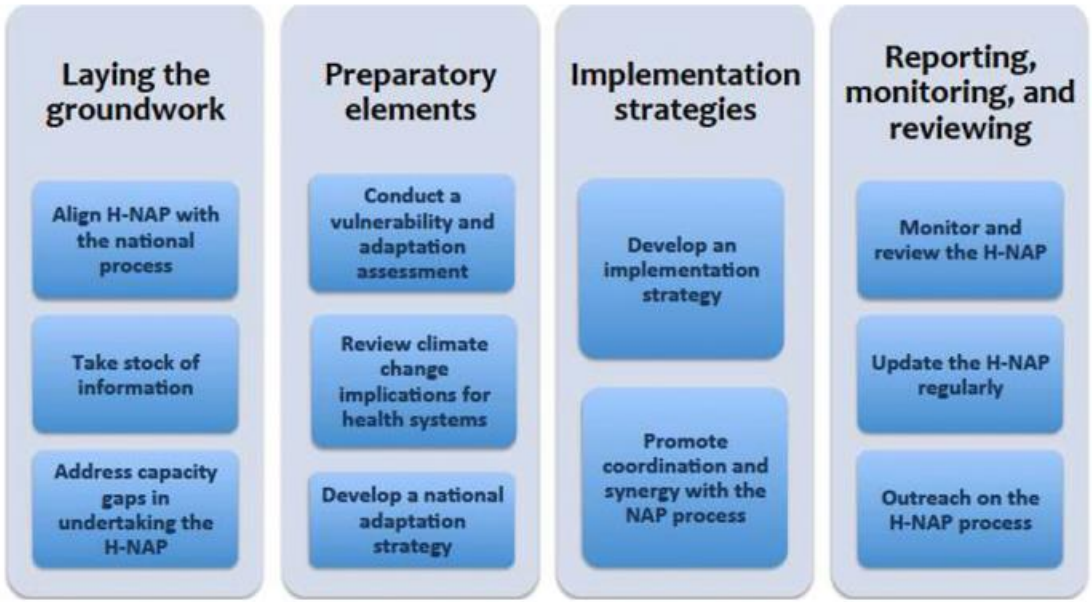
- ministries and local governments **develop their own separate implementation plans** – following a defined framework or template, linked to the same overall goals and principles, but allowing for flexibility as necessary
- both an **Adaptation Strategy (high-level)** and an **Action Plan (detailed level)** are developed, either as separate documents or combined into one document
- both **urban and rural situations** are included as well as considerations through climate change case studies and legislation
- **key sectors and policy areas list both existing and potential adaptation actions**. Regional priorities may also be included in the same document
- the focus is on **short-term implementable actions**, which are based on **longer term climate** projections
- list **key prioritised actions, with responsible parties, timeframes, resources available, and evaluation indicators described in detail**
- have a **mandate** to evaluate and update the NAP on a regular basis, thus making it into a flexible, living document
- any adaptation strategy or plan developed is **statutory**
- a NAP is based on a comprehensive **national risk assessment and prioritisation process**
- climate change adaptation is **mainstreamed** into regular activities of government so as to increase efficiency and avoid conflicting goals
- **separate municipal adaptation plans are developed** for large cities
- a **national research strategy for climate change adaptation is developed** in order to ensure climate change research fills the gaps in knowledge required for adaptation planning
- a coordinating body is established to oversee implementation and evaluation of strategies and plans
- a national web-based information **portal** is developed for climate change information
- pathways are established for **integrating climate change data** and information from the science sector into a NAP and corresponding policies and actions
- **international responsibilities** are considered when developing a NAP

[17] See https://www.niwa.co.nz/sites/niwa.co.nz/files/NAP-scoping-report-NIWA-Mar2017.pdf

Appendix 2: WHO Building Blocks (World Health Organization 2015b)

1=Service delivery	2=Health workforce	3=Information	4=Medical products/vaccines/technology	5=Financing	6=leadership/governance
An immediate output of the health system; whilst also a fundamental input to population health status. Key characteristics: comprehensiveness; accessibility; coverage; continuity; quality; person-centred; coordination; accountability & efficiency.	A key input component. 'The ability of a country to meet its health goals depends largely on the knowledge, skills, motivation and deployment of the people responsible for organizing and delivering health services'. The health workforce can be defined as 'all people engaged in actions whose primary intent is to enhance health'.	Health Information Services: provides the basis for the overall policy and regulation of all the other health system blocks; underpins decision-making, has four key functions: data generation; compilation; analysis and synthesis, and communication & use. Different kinds of information needed for health-planners & decisions-makers.	Access to essential medicines: one of the immediate outputs of the health system. Essential medicines: those that satisfy the priority healthcare needs of the pop. Access is measured in terms of availability and affordability.	Health Systems Financing: key input component to the health system; 'fundamental to the ability of health systems to maintain and improve human welfare.' Concerned with the mobilization, accumulation, and allocation of money to cover the health needs of the population.	Provides the basis for the overall policy and regulation of all the other health system blocks; 'ensuring that strategic policy frameworks exist and are combined with effective oversight, coalition-building, regulation, attention to system design, and accountability.'

Appendix 3: Existing HNAP Processes, Frameworks and Indicators

Name	Description	Reference
WHO guidance to protect health from climate change through health adaptation planning (World Health Organization. 2014)		Integration of the HNAP within the overall NAP process (Ebi and Prats 2015; World Health Organization 2014)

Building Resilience Against Climate Effects (BRACE) framework

2.1. The Five Steps of BRACE

Table 1. There are five sequential steps in BRACE.

Step No.	BRACE Step Title	Description of Functions	Corresponding Adaptive Management Element
Step 1	**Anticipating Climate Impacts and Assessing Vulnerabilities**	Identify the scope of climate impacts, associated potential health outcomes, and populations and locations vulnerable to these health impacts.	1, 2, 4, 5, 6
Step 2	**Projecting the Disease Burden**	Estimate or quantify the additional burden of health outcomes due to climate change.	1, 2, 4, 5
Step 3	**Assessing Public Health Interventions**	Identify the most suitable health interventions for the health impacts of greatest concern.	1, 3, 4, 5, 6
Step 4	**Developing and Implementing a Climate and Health Adaptation Plan**	Develop a written plan that is regularly updated. Disseminate and oversee the implementation of the plan.	1, 4, 6
Step 5	**Evaluating Impact and Improving Quality of Activities**	Evaluate the process. Determine the value of information attained and activities undertaken.	1, 3, 4, 5, 6

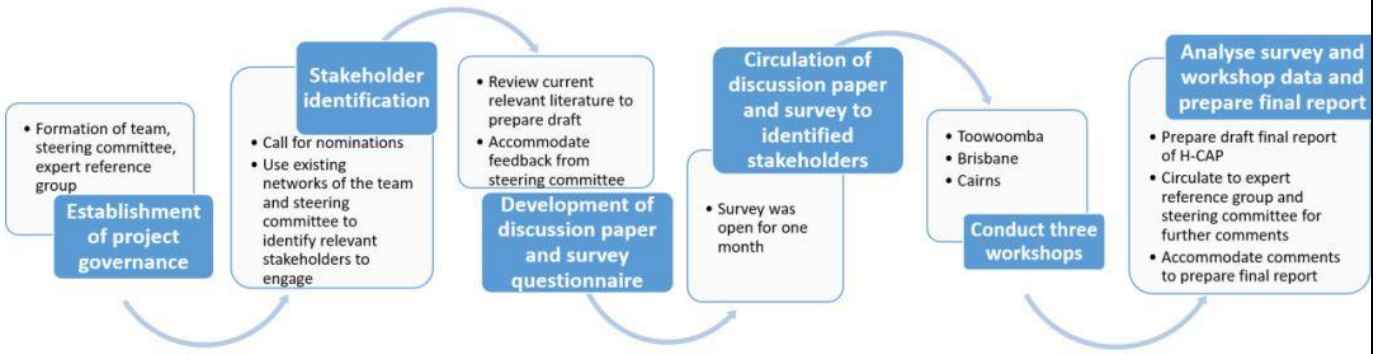
A typical Climate Change Adaptation Plan has the following elements: (in Marinucci et al 2014 p. 6447-6448)

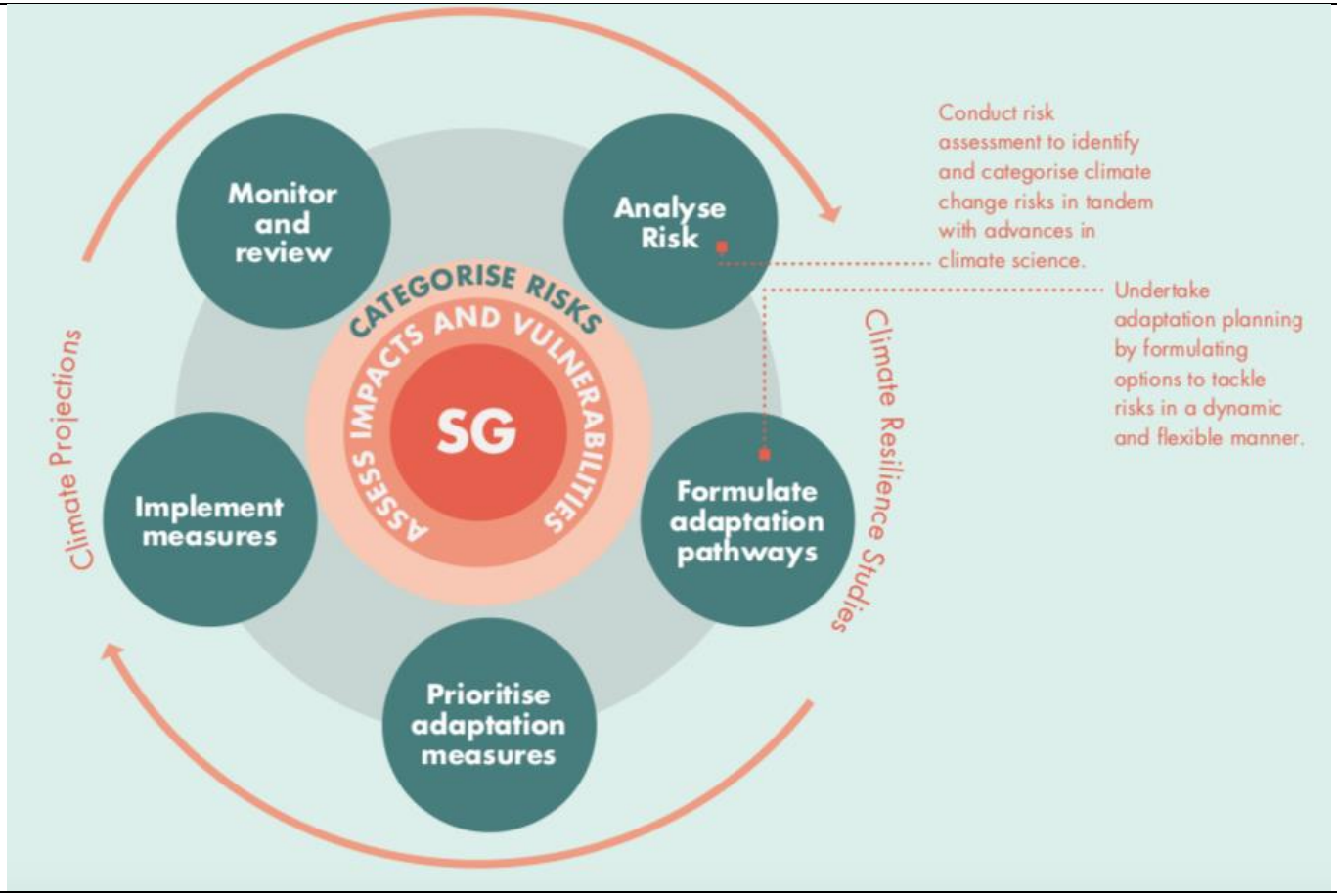
- Community profile which includes background information
- 'Most appropriate' regional/municipal climate change scenario
- Scoped local climate change impacts
- Prioritized consequences/prospects of risks and opportunities
- Maps showing priorities
- Adaptation planning principles
- Table of recommended adaptation policies and actions indicating priority, lead responsibility
- and fit with existing program (if applicable)
- Action plan for tasks to be accomplished in the community
- Community engagement process
- List of key stakeholders
- Inventory of risks and opportunities

(Department of Health New York 2015; Marinucci et al 2014)

Toolkit available at https://toolkit.climate.gov/tool/building-resilience-against-climate-effects-brace-framework

	• Inventory of consequences and prospects • Gap analysis of programs useful for adaptation actions	
Adaptation to Climate Change Planning Guidance for Health and Social Care organisations (2014)	Checklist of a good organisational adaptation plan: • is embedded in a Board approved Sustainable Development Management Plan • is approved annually by the board • links to and cross refers to Emergency Preparedness Plans, Business Continuity Plans and vice versa • is developed in partnership with Local Authority and other stakeholders, for example members of the Health and Wellbeing Boards, the third sector, service users • includes a mechanism for review and updating is part of/aligned with local community plans eg, Health and Wellbeing Board • is scrutinised, or part of a mutual accountability process, eg, by local resilience fora/HWBs. **Have you assessed the RISKS you face re: adaptation to climate change in relation to?** • People/population risks: (eg, changes to disease patterns, changes to the health needs of population, social and community impacts including vulnerable communities, migration and mental health etc.) • System risks: (eg, resilience to normal ways of protecting health and delivering care, business continuity, workforce and service delivery including training requirements etc.) • Infrastructure risks: (eg, buildings, transport, supply chain, getting to essential services as user or staff, resource use, scarcity and continuity including energy, food and water etc.) • The risks posed by specific events: (eg, Heat, Cold, Floods, Air quality) **Have you got ACTIONS and plans in place to assess and address these risks?** • Climate change risks are part of the organisational risk register • Actions plans are in place to mitigate significant risks identified • Each action in the plan includes timeframes and milestones • Each action in the plan includes responsibilities/accountabilities for development, implementation and monitoring **Are you assessing the IMPACTS of your actions?** • Quantitative measures are used to assess effectiveness of adaptation actions (eg, What are the observed vs. expected death rates with vulnerable groups following a recent event or crisis eg, heat wave?) • Plans are reviewed and progress monitored at least annually • A tool is used to assess resilience and preparedness (eg, use the 'Adaptation section' in the Good Corporate Citizen assessment tool designed specifically for the health and care system to monitor and 9 benchmark progress)	(Public Health England 2014)

	• A summary of progress is published in the annual report	
Queensland climate adaptation strategy: Human health and wellbeing climate change adaptation plan for Queensland (2018)	Process:  	(Armstrong et al 2018)
Towards successful adaptation: a checklist for the development of climate change adaptation plans.	Provides a series of definitions of adaptation and successful adaptation that are useful. Outlines 57 indicators of adaptation plan quality, which are useful for thinking of what should be in a plan, the process for developing a plan, and explicit commitment to delivering on a plan. The high-level indicators are listed below. 1. Funding and consistency 2. Prioritisation and timing 3. Assigned responsibilities 4. Legislation and regulatory nature 5. Networks membership 6. Leadership and support 7. Impacts and vulnerability assessment 8. Adaptation options assessment 9. Monitoring, Evaluation and Reporting processes 10. Learning mechanisms 11. Uncertainty 12. Transparency and dialogue 13. Engagement of stakeholders and civic society' 14. Equity and justice	(Olazabal et al 2017)

Singapore's Climate Action Plan: A Climate-Resilient Singapore, For a Sustainable Future (2016)		Ministry of the Environment and Water Resources and Ministry of National Development (2016)

GLOSSARY

Anthropogenic Climate Change

Changes to climate as a result of human (anthropogenic) activities on Earth.

Environmental Health

Is the field of science that studies how the environment influences human health and disease.

Greenhouse Gas (see Heat-trapping Gas)

A gas that contributes to the greenhouse effect by absorbing infrared radiation. Examples are carbon dioxide and methane.

Heat-trapping Gas as per Greenhouse Gas

An alternative term that acknowledges that not all countries will be familiar with a 'greenhouse'.

Hazard

An intrinsic capacity to cause harm. A hazard can be an event, entity, phenomenon or human activity, and can be single, sequential or combined with other hazards in its origin and effects. Each hazard is characterised by its timing, location, intensity and probability. The origin of hazards can be natural (geological, hydro-meteorological and biological) or induced by human activity (environmental degradation and technological hazards) and include latent conditions or trends that may represent future threats.

Health Adaptation

Strengthening public health care to increase adaptive capacity for climate change

Health Inequity

Health inequities refer to differences in health status or in the distribution of health resources between different population groups.

Health Sector

In general terms this includes the health system with many types and providers of health services and a range of funding and regulatory mechanisms. Those who provide services include medical practitioners, other health professionals, hospitals, and other government and non-government agencies.

Indigenous peoples

Are ethnic groups who are the original settlers of a given region, in contrast to groups that have settled, occupied or colonised more recently.

Mitigation

The action of reducing or preventing the severity or seriousness of an issue eg, the emission of heat-trapping gases.

Public Health

The health of the population as a whole.

Risk

Risk is defined as the likelihood and consequences of a hazard. Risk can also be described as the effect of uncertainty on objectives (Risk Management Standard ISO31000).

Socioeconomic deprivation

The lack of social and economic benefits which are considered to be basic necessities of a society or community or in a broader sense of a region.

Shock

The term ‘shock’ is used to denote a sudden, disruptive event with an important and often negative impact on a system/s and its assets.

Surveillance systems

Continuous, systematic collection, analysis and interpretation of health-related data needed for the planning, implementation, and evaluation of public health practice.

Sustainable Development

Development that meets the needs of the present without impacting the needs of the future eg, depleting of natural resources

System

A system is defined as a set of things working together as parts of an interconnecting network; a complex whole eg, society (individual, community, nation), the environment and physical entities (eg, infrastructure).

Vulnerability

The characteristics and circumstances of an asset (populations, systems, communities, the built domain, the natural domain, economic activities and services, trust and reputation) that make it susceptible to, or protected from, the impacts of a hazard.

Well-being

There are many definitions. Well-being can refer to both physical and mental health and can be described as the state of being comfortable, healthy, or happy. Measures of well-being include life satisfaction, finances, health, housing, human rights, and relationships.

LIST OF ABBREVIATIONS

BRACE	Building Resilience Against Climate Effects
CO_2	Carbon dioxide
DALY	Disability-adjusted life year
DHB	District Health Board
GHG	Greenhouse Gas(es)
HAIFA	The Health Analysis and Information for Action
HIA	Health Impact Assessments
HNAP	Health National Adaptation Plan
IPCC	Intergovernmental Panel on Climate Change
JNAP	Joint National Action Plan for Climate Change Adaptation and Disaster Risk Management
NAP	National Adaptation (and Action) Plan
NHS	National Health Service (UK)
NZ	New Zealand
PCE	Parliamentary Commissioner for the Environment
UNFCCC	United Nations Framework Convention on Climate Change
WHO	World Health Organization

REFERENCES

Armstrong F, Cooke S, Rissik D et al. 2018. *Pathways to a climate resilient Queensland*. Queensland Climate Adaptation Strategy. Department of Environment and Heritage Protection, Australia.

Australian Government. 2015. *National Climate Resilience and Adaptation Strategy*. Commonwealth of Australia.

Austin SE, Ford JD, Berrang-Ford L et al. 2015. Public health adaptation to climate change in Canadian jurisdictions. *International Journal of Environmental Research and Public Health* 12 (1): 623-651.

Austin SE, Biesbroek R, Berrang-Ford L et al. 2016. Public Health Adaptation to Climate Change in OECD Countries. *International Journal of Environmental Research and Public Health* 13 (9): 889.

Banwell N, Rutherford S, Mackey B et al. 2018. Towards Improved Linkage of Disaster Risk Reduction and Climate Change Adaptation in Health: A Review. *International Journal of Environmental Research and Public Health* 15 (4): 793.

Bennett H, King P. 2018. Pro-equity climate change and environmental sustainability action by district health boards in Aotearoa/New Zealand. The *New Zealand Medical Journal*, 131 (1481): 56-63.

Bolton A. 2018. *Climate Change and Environmental Health*. A report prepared for the Ministry of Health, Environmental Science and Research Limited. New Zealand. CLIENT REPORT No: FW17059, URL: https://www.esr.cri.nz/assets/Uploads/Climate-Change-and-Env-Health-FINAL-20180517.pdf

Cameron M. 2013. *The demographic implications of climate change for Aotearoa New Zealand: a review*. New Zealand Population Review, v.39:p. 121–142. http://researchcommons.waikato.ac.nz/handle/10289/7979

Carthey J, Chandra V, Loosemore M. 2009. Adapting Australian health facilities to cope with climate-related extreme weather events. *Journal of Facilities Management* 7 (1): 36-51.

Climate Change Adaptation Technical Working Group. 2017. *Adapting to Climate Change in New Zealand*. Ministry for the Environment, New Zealand

Climate Change Adaptation Technical Working Group. 2018. *Adapting to Climate Change in New Zealand*. Ministry for the Environment, New Zealand.

Council for Economic Planning and Development. 2012. *Adaptation Strategy to Climate Change in Taiwan*.

Curtis S, Fair A, Wistow J et al. 2017. Impact of extreme weather events and climate change for health and social care systems. *Environmental health: a global access science source*, 16 (Suppl 1): 128-128.

Department for Environment Food and Rural Affairs. 2018. *The National Adaptation Programme and the Third Strategy for Climate Adaptation Reporting*. United Kingdom.

Department of Conservation. 2010. *New Zealand Coastal Policy Statement 2010*. Wellington, New Zealand.

Department of Health and Human Services. 2014. *HHS Climate Adaptation Plan*. United States of America.

Department of Health NY. 2015. *Building Resilience against Climate Effects (BRACE) in New York State*. New York State Department of Health United States of America.

Department of the Prime Minister and Cabinet. 2016. *National Security System Handbook*. August, 2016. New Zealand.

Doctors for the Environment Australia. 2018. *Action on Climate Change and Health; Governance and Strategy*. Australia.

Ebi KL, Prats EV. 2015. Health in National Climate Change Adaptation Planning. *Annals of Global Health* 81 (3): 418-426.

Ekeroma AJ, Biribo S, Herman J et al. 2016. Health Research Systems in Six Pacific Island Countries and Territories. *Journal of Research and Development* 4 (1): 1-9.

Environmental Health Working Group of the World Federation of Public Health Associations. 2015. Climate Change and Health Policy Assessment Project Report.

Ford J, Maillet M, Pouliot V et al. 2016. Adaptation and indigenous peoples in the United Nations framework convention on climate change. *Climatic change* 139 (3-4): 429-443.

Ford JD, Berrang-Ford L, King M et al. 2010. Vulnerability of Aboriginal health systems in Canada to climate change. *Global Environmental Change* 20 (4): 668-680.

Ford JD, Sherman M, Berrang-Ford L et al. 2018. Preparing for the health impacts of climate change in Indigenous communities: The role of community-based adaptation. *Global Environmental Change* 49: 129-139.

Government of Canada. 2016. *Pan-Canadian Framework on Clean Growth and Climate Change: Canada's Plan to Address Climate Change and Grow the Economy*. Environment and Climate Change Canada.

Guenther R, Balbus J. 2014. Primary Protection: *Enhancing Health Care Resilience for a Changing Climate*. U.S. Department of Health and Human Services, United States of America

Hanefeld J, Mayhew S, Legido-Quigley H et al. 2018. Towards an understanding of resilience: responding to health systems shocks. *Health Policy Plan* 33 (3): 355-367.

Health in All Policies Team, Community and Public Health. 2018. *Tools to Support a Health in All Policies Approach: A guide for moving from theory to practice*. Christchurch, New Zealand: Canterbury District Health Board.

HM Government. 2013. The National Adaptation Programme. *Making the country resilient to a changing climate*. United Kingdom

HM Government. 2017. *UK Climate Change Risk Assessment 2017*. Presented to Parliament pursuant to Section 56 of the Climate Change Act 2008, United Kingdom.

Hosburgh N, Armstrong F, Mulvenna V. 2017. *Framework for a national strategy on climate, health and well-being for Australia*.

House of Representatives NZ. 2010. Inquiry into New Zealand's relationships with South Pacific countries. Report of the Foreign Affairs, Defence and Trade Committee. Forty-ninth Parliament (John Hayes, Chairperson). Accessed 23/5/2019. URL: https://www.parliament.nz/resource/enNZ/49DBSCH_SCR4945_1/a1e8715f6c270cf5ff075f2d42f4e19f92aef10d

Intergovernmental Panel on Climate Change. 2014. *Climate Change 2014: Synthesis Report*. Contribution of Working Groups I, II and III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change. Geneva, Switzerland.

Jones, R. 2019. Climate change and Indigenous Health Promotion. *Global Health Promotion*, 26(3_suppl), 73–81. https://doi.org/10.1177/1757975919829713

Jones R, Bennett H, Keating G et al. 2014. Climate change and the right to health for Māori in Aotearoa/New Zealand. *Health and Human Rights Journal* 16 (1): 54-68.

Kim R, Costello A, Campbell-Lendrum D. 2015. *Climate change and health in Pacific island states*. Bulletin of the World Health Organization 93 (12): 817-892

Manangan AP, Uejio CK, Saha S, Schramm PJ, Marinucci GD, Brown CL, Hess JJ, George Luber G, 2014. *Climate and Health Technical Report Series Climate and Health Program, Center for Disease Control and Prevention*. National Center for Environmental Health, Division of Environmental Hazards and Health Effects, United States of America

Marinucci GD, Luber G, Uejio CK et al. 2014. Building Resilience Against Climate Effects-a novel framework to facilitate climate readiness in public health agencies. *International Journal of Environmental Research on Public Health* 11 (6): 6433-58

McClymont PD, Erin M. 2012. Community-based participatory process–climate change and health adaptation program for Northern First Nations and Inuit in Canada. *International Journal of Circumpolar Health* 71 (1): 18412.

McIver L, Kim R, Woodward A et al. 2016. Health Impacts of Climate Change in Pacific Island Countries: A Regional Assessment of Vulnerabilities and Adaptation Priorities. *Environmental Health Perspectives* 124 (11): 1707-1714.

Ministry for the Environment. 2017. *National Policy Statement for Freshwater Management 2014*. Updated August 2017 to incorporate amendments from the National Policy Statement for Freshwater Amendment Order 2017. Ministry for the Environment. Wellington, New Zealand.

Ministry for the Environment. 2019. *Climate Change Response (Zero Carbon) Amendment Bill: Summary*. Wellington: Ministry for the Environment.

Ministry of Infrastructure and the Environment. 2016. *Adapting with Ambition. National Climate Adaptation Strategy (2016)*. The Netherlands.

Ministry of Health. 2007. *Whānau Ora Health Impact Assessment*. Wellington: Ministry of Health.

Minister of Health. 2016. *New Zealand Health Strategy: Future Direction*. Wellington: Ministry of Health.
Ministry of the Environment and Water Resources and Ministry of National Development. 2016. *Singapore's Climate Action Plan: A Climate-Resilient Singapore*. For a Sustainable Future. Singapore

Ministry of Health. 2014. *Samoa's Climate Adaptation Strategy for Health*. Apia, Samoa: Design TG. Samoa.

Ministry of Health. 2016a. *New Zealand Health Strategy: Future direction*. Wellington, New Zealand.

Ministry of Health. 2016b. *Health in the wider context of people's lives. Accessed: 11/10/2018*. URL: https://www.health.govt.nz/new-zealand-health-system/new-zealand-health-strategy-future-direction/health-wider-context-peoples-lives

Ministry of Health & Medical Services. 2018. *Climate change and health strategic action plan 2016-2020*. Ministry of Health & Medical Services, Fiji.

National Civil Defence Emergency Management Strategy 2007. 2008. *National Civil Defence Emergency Management Strategy 2007*. Department of Internal Affairs, New Zealand.

National Adaptation Programme of Action Task Team. 2005. *National adaptation programme of action Samoa*. Samoa.

New Zealand College of Public Health Medicine. 2013. *Policy statement on Climate Change*. Wellington: New Zealand College of Public Health Medicine.
URL: http://www.nzcphm.org.nz/policy-publications

New Zealand Parliament. 2019. National Climate Change Risk Assessment panel appointed, Press Release, Accessed 14/5/2019. URL: https://www.beehive.govt.nz/release/national-climate-change-risk-assessment-panel-appointed

Nottage RA, Wratt DS, Bornman JF et al. 2010. *Climate change adaptation in New Zealand. Future scenarios and some sectoral perspectives*. New Zealand Climate Change Centre, New Zealand.

Nunes AR, Lee K, O'Riordan T. 2016. The importance of an integrating framework for achieving the Sustainable Development Goals: the example of health and well-being. *BMJ Global Health*; 1:e000068. doi:10.1136/bmjgh-2016- 000068

Olazabal M, Galarraga I, Ford J et al. 2017. *Towards successful adaptation: a checklist for the development of climate change adaptation plans*. Working Paper. BC3 Working Paper Series, 2017-0. Basque Centre for Climate Change.

Orru, K. Tillmann, M. Ebi, K.L. Orru, H. 2018. Making Administrative Systems Adaptive to Emerging Climate Change-Related Health Effects: Case of Estonia. *Atmosphere*, 9:221.

Parliamentary Commissioner for the Environment. 2014. *Changing climate and rising seas: Understanding the science*. Parliamentary Commissioner for the Environment, Wellington, New Zealand.

Peters, D.H. 2018. Health policy and systems research: the future of the field. *Health Research Policy and Systems*,16:84. https://doi.org/10.1186/s12961-018-0359-0

Public Health Advisory Committee. 2005. *A Guide to Health Impact Assessment: A Policy Tool for New Zealand*. Public Health Advisory Committee Te Röpü Tohutohu i te Hauora Tümatanui. A sub-committee of the National Health Committee. Wellington, New Zealand.

Public Health England. 2014. *Adaptation to Climate Change*. Planning Guidance for Health and Social Care organisations. Sustainable Development Unit., NHS, UK.

Reisinger A, Kitching RL, Chiew F et al. 2014. *Climate Change 2014: Impacts, Adaptation, and Vulnerability*. Part B: Regional Aspects. Contribution of Working Group II to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change Cambridge, United Kingdom and New York, NY, USA: Cambridge University Press

Republic of Fiji Government. 2018. *Republic of Fiji National Adaptation Plan - A pathway towards climate resilience*. Government of the Republic of Fiji.

Royal Society of New Zealand. 2016. *Climate change implications for New Zealand*. URL: https://royalsociety.org.nz/what-we-do/our-expert-advice/all-expert-advice-papers/climate-change-implications-for-new-zealand/

Royal Society of New Zealand. 2017. *Human Health Change for New Impacts of Climate Zealand Change for New Zealand*. Evidence summary URL: https://royalsociety.org.nz/what-we-do/our-expert-advice/all-expert-advice-papers/climate-change-implications-for-new-zealand/

Smith KR, Woodward A, Campbell-Lendrum D et al. 2014. Human health impacts, adaptation, and co-benefits. In: *Climate Change 2014: Impacts Adaptation, and Vulnerability. Part A: Global and Sectoral Aspects*. Contribution of Working Group II to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change United Kingdom and New York, NY, USA: Cambridge University Press.

Statistics New Zealand. 2019. *Demographics of New Zealand's Pacific Population*. Statistics New Zealand. Accessed 23/5/2019.
URL:http://archive.stats.govt.nz/browse_for_stats/people_and_communities/pacific_peoples/pacific-progress-demography/population-growth.aspx

Tennent D. 2015. The adverse effects of climate change. *New Zealand Law Journal*, p. 23–26. Accessed 28/5/2019.
URL: http://primo-directapac.hosted.exlibrisgroup.com/primo_library/

The National Climate Change Adaptation Research Facility. 2007. *National Climate Change Adaptation Framework*. Government of Australia.

Tompkins D, Brock A, Jones G et al. 2015. *Modelling the Impacts of Climate Change on Infectious Diseases in New Zealand*. Environmental Science and Research Limited, Wellington, New Zealand.

Tong S, Confalonieri U, Ebi K, Olsen J. 2016. Managing and Mitigating the Health Risks of Climate Change: Calling for Evidence-Informed Policy and *Action. Environmental Health Perspectives* 124(10):A176-A179. doi: 10.1289/EHP555. Epub 2016 Oct 1. PubMed PMID: 27689449; PubMed Central PMCID: PMC5047783.

United Nations. 2015a. *Paris Agreement*. http://unfccc.int/paris_agreement/items/9485.php

United Nations. 2015b. *Sendai Framework for Disaster Risk Reduction 2015–2030*. Accessed 11/10/2018. URL: https://www.preventionweb.net/files/resolutions/N1516716.pdf

U.S. Global Change Research Program. 2018. *Fourth National Climate Assessment*. Accessed 11/10/2018. URL: https://www.globalchange.gov/nca4

Watts N. Adger W.N. Agnolucci P. Blackstock J. Byass P. Cai W. Chaytor S. Colbourn T. Collins M. Cooper A. et al. 2015. Health and climate change: Policy responses to protect public health. *The Lancet* 386:1861–1914. doi: 10.1016/S0140-6736(15)60854-6.

Watts N, Amann M, Arnell N et al. 2018. The 2018 report of the Lancet Countdown on health and climate change: shaping the health of nations for centuries to come. *The Lancet* 392 (10163): 2479-2514.

Weissbecker, I. (Ed.). 2011. *Climate change and human well-being: Global challenges and opportunities*. International and Cultural Psychology. New York, NY, US: Springer Science and Business Media. URL: http://dx.doi.org/10.1007/978-1-4419-9742-5

World Bank Group and the Asian Development Bank. 2010. *Pilot Program on Climate Resilience (PPCR)*. Samoa.
World Health Organization. 2007.Everybody's business. Strengthening health systems to improve health outcomes: WHO's framework for action, World Health Organization, Geneva, Switzerland.

World Health Organization. 2009. *National health research systems in Pacific island countries*. Manila, The Philippines.

World Health Organization. 2010. *Monitoring the building blocks of health systems: A handbook of indicators and their measurement strategies*. World Health Organization, Geneva, Switzerland.

World Health Organization. 2013. *Protecting health from climate change: vulnerability and adaptation assessment*. World Health Organization.
URL: http://www.who.int/iris/handle/10665/104200

World Health Organization. 2014. *WHO guidance to protect health from climate change through health adaptation planning*. World Health Organization, Geneva, Switzerland.

World Health Organization. 2015a. *Operational framework for building climate resilient health systems*. World Health Organization, Geneva, Switzerland.

World Health Organization. 2015b. *Hospital Safety Index: Guide for Evaluators*. Safe hospitals initiative. World Health Organization and Pan American Health Organization, 2015.

World Health Organization. 2017. *Western Pacific Regional Framework for Action on Health and Environment on a Changing Planet*. Manila, Philippines. World Health Organization Regional Office for the Western Pacific; 2017.

Wuijts S, Vros C, Schets FM et al. 2016. *The effects of climate change on health: Update for the National Adaptation Strategy (2016)*. National Institute for Public Health and the Environment, Ministry of Health, Welfare and Sport. The Netherlands.

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