



National Climate Change and Health Policy and Revised Action Plan

Government of the Republic of the Marshall Islands



GCCA +
THE GLOBAL CLIMATE CHANGE ALLIANCE PLUS INITIATIVE



Funded by
the European Union

SCALING UP PACIFIC ADAPTATION (SUPA)



National Climate Change and Health Policy and Revised Action Plan

Government of the Republic of the Marshall Islands



Noumea, New Caledonia, 2022

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Ministry of Health and Human Services
PO Box 16, Majuro MH 96960

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Contributors: Sotiris Vardoulakis, Christine McMurray, Lachlan McIver, Liz Hanna, Amelia Joshy, Aparna Lal, Robyn Lucas; National Centre for Epidemiology and Population Health, College of Health and Medicine, The Australian National University, Canberra ACT 2601, Australia

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Abbreviations

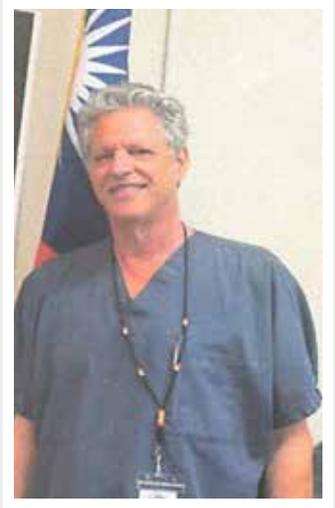
CMI	College of the Marshall Islands	NCDs	Non-communicable diseases
COPD	Chronic Obstructive Pulmonary Disease	NDMO	National Disaster Management Office
CSO	Central Statistics Office	NTA	National Telecommunication Authority
EPA	Environmental Protection Authority	PIDC	Pacific Island developing country
JNAP	Joint National Action Plan	RCP	Representative Concentration Pathway
MIMRA	Marshall Islands Marine Resources Authority	RECO	Research and Education Community Organization
MNRC	Ministry of Natural Resources and Commerce	RMI	Republic of the Marshall Islands
MOCIA	Ministry of Culture and Internal Affairs	SID	small island developing state
MOF	Ministry of Finance	SPC	Pacific Community (previously: Secretariat of the Pacific Community)
MOFA	Ministry of Foreign Affairs	TB	Tuberculosis
MOHHS	Ministry of Health and Human Services	USP	University of the South Pacific
MPW	Ministry of Public Works	WASH	Water, Sanitation and Hygiene
MWSC	Majuro Water and Sewer Company	WHO	World Health Organization
NCCHAP	National Climate Change and Health Action Plan		
NCCHP	National Climate Change and Health Policy		



Foreword



**REPUBLIC OF THE MARSHALL ISLANDS
MINISTRY OF HEALTH AND HUMAN
SERVICES**



This health policy and revised action plan addresses the impacts of climate change on people's health in the Marshall Islands. Importantly, it is the outcome of wide consultation with stakeholders and communities on how we can best protect the Marshallese population from the effects of climate change and improve the resilience of our health system.

Climate change is already having an impact on the environment and on the health and wellbeing of our people. We know that it causes sea-level rise, which results in coastal erosion, flooding, and seawater intrusion affecting freshwater resources. Water is precious to any country, and it is important to ensure it is available and safe for human consumption. Diarrheal diseases are common in RMI, especially among children, due to poor hygiene and unsafe drinking water, and this will only worsen with changing rainfall patterns associated with climate change.

Climate change is also affecting food production and consumption patterns in our country. Poor food quality and reduced availability of fresh produce lead to poor nutrition, which can lead to obesity, diabetes and poor growth and development in children. Climate change also affects the spread of vector-borne diseases, such as dengue, which can result in disease outbreaks like those we experienced recently. The population is already experiencing the impacts of climate change on their physical and mental health. Decisive action across all sectors is needed to protect the health of our people and improve the resilience of health services to these changing climatic conditions.

The ministry acknowledges the support received by the European Union-funded Global Climate Change Alliance Plus Scaling Up Pacific Adaptation project in the development of this health policy and action plan. We look forward to working with all stakeholders and communities to implement the action plan in the coming years.

Endorsed by: 
Hon. Minister Bruce Bilimon
Minister of Health & Human Services


Mr. Jack Niedenthal
Secretary of Health & Human Services

Executive summary

Given the vulnerability of the Republic of the Marshall Islands (RMI) to the impacts of climate change, the government has developed this comprehensive *National Climate Change and Health Policy and Revised Action Plan (NCCHP v2)*. The goal of the NCCHP v2 is to improve the coordination and effectiveness of measures that will lead the country into a climate-resilient and healthier future.

A range of stakeholder and community engagement and consultation methods were used in the development of the NCCHP v2, including stakeholder workshops, targeted interviews, and focus group discussions. These consultations directly involved around 200 local stakeholders, including government officials, local authority representatives, traditional leaders and landowners, business people, non-governmental organisations, community groups, and residents, representing a significant cross-section of the RMI population.

A number of key health issues – food and water safety and security, respiratory and vector-borne diseases, mental health, and extreme weather-related impacts – were identified as priorities. In addition, barriers to implementation of the plan, such as insufficient funding and human resources, apathy and stigma, were highlighted. Stakeholders suggested responsible RMI agencies, strategies to manage these risks and timeframes. The strategies include increased resource allocation, educational campaigns, and continuing communication and engagement, particularly with traditional leaders, landowners, and community and faith-based groups.

Key areas of action include sustainable agricultural practices, advanced weather forecasts, increased rainwater harvesting, water quality testing, promotion of healthy nutrition, elimination of mosquito breeding sites, improved waste disposal and recycling, better walking and cycling infrastructure, measures to promote sport and exercise, and flood and heat protection measures.

Successful implementation of the NCCHP v2 requires government and community commitment, as well as dedicated resources, technical expertise, and coordination across government agencies, local authorities, landowners and community groups. It is recommended that an influential champion, who will have oversight and responsibility for the action plan, and a coordinating officer who will take care of the day-to-day delivery of tasks, be appointed by the Ministry of Health and Human Services (MOHHS). Finally, it is recommended that this five-year action plan be reviewed annually against a set of indicators and updated if needed.

01

Vision statement



Focusing on interlinked climate, environmental, societal and health issues, the vision of this *National Climate Change and Health Policy and Revised Action Plan* is that everybody is protected – body and mind – from the direct and indirect consequences of climate change. This is aligned with Pacific Island leaders’ healthy island vision, “where children are nurtured in body and mind;

environments invite learning and leisure; people work and age with dignity; ecological balance is a source of pride; and the ocean is protected to sustain our needs.” It is also aligned with the vision of the World Health Organization that, by 2030, all health systems in small island developing states will be resilient to climate variability and change.

02

Development of the NCCHP v2



2.1 Policy context

At the 23rd Conference of the Parties (COP23) to the United Nations Framework Convention on Climate Change (UNFCCC) in Bonn in 2017, the World Health Organization (WHO) launched a Special Initiative on Climate Change and Health in small island developing states (SIDS) in collaboration with UNFCCC and the Fijian Presidency of COP23. The Initiative recognizes that SIDS are on the front line of climate change, given that they face a range of immediate and long-term

risks, including extreme floods, storms, drought and sea-level rise; increased risks of water-, vector- and food-borne diseases; and other health problems, such as trauma, heat-related illnesses, malnutrition, non-communicable diseases and psychosocial disorders. The vision of the SIDS Initiative is that, by 2030, all health systems in SIDS will be resilient to climate variability and change (WHO 2018).

The *2050 Climate Strategy: Lighting the Way* (RMI 2018) outlines a pathway for RMI to facilitate adaptation and climate resilience in a way that ensures the future protection and prosperity of the country and its people. Furthermore, it prioritizes an integrated approach that combines climate and disaster risk considerations in building resilience across the entire country and economy. Disaster risk management, as well as contingency and emergency response, are areas of focus for improving resilience, including improved communication with outer islands and establishment of a financial mechanism to allow for rapid response and emergency funding. The *RMI Climate Strategy* recommends the review and consolidation of policies and measures on climate change adaptation and resilience, as well as social and economic policies. For the health sector, it highlights the importance of taking steps to increase the adaptive capacity and resilience of RMI's health system, with the most effective health adaptation strategies considering contextual factors to meet often highly localized adaptation needs. As part of this process, RMI should identify and assess the greatest health risks and shortcomings in the current health system in order to develop effective strategies for minimizing the risks of climate change on the health of the population.

This integrated approach also aligns with MOHHS's Three-year Rolling Strategic Plan 2017–2019 *Kumiti Ejmour* (i.e. health is a shared responsibility). The ministry's vision is to facilitate the concept of the Pacific Island leaders' healthy islands vision, "where children are nurtured in body and mind; environments invite learning and leisure; people work and age with dignity; ecological balance is a source of pride; and the ocean is protected to sustain our needs."

The MOHHS developed an initial *National Climate Change and Health Action Plan* (NCCHAP) in 2012, in collaboration with WHO and with funding from the governments of South Korea and Japan. The NCCHAP was intended to be the key instrument through which the ministry contributed to the *RMI Joint National Action Plan on Climate Change Adaptation and Disaster Risk Reduction* (JNAP) 2014–2018. Specifically, the NCCHAP was created to address the health goals outlined in the JNAP. Although NCCHAP was a pioneering initiative, there was:

- i. no funding or staff at the ministry to implement it;
- ii. progress in certain areas but no overall coordination;
- iii. no monitoring or reporting.

This current document provides an update to the earlier NCCHAP and constitutes RMI's national adaptation plan for the health sector.

The development of this policy and action plan has been based on extensive consultation with key RMI stakeholders and other members of the public (Vardoulakis and McMurray 2020), a review of relevant scientific literature (Vardoulakis et al. 2020b), and an evaluation of the aforementioned NCCHAP (Vardoulakis et al. 2020a).

Focusing on overarching climate, environmental and health issues, and in line with both the healthy islands vision for the Pacific region (McIver et al. 2017) and WHO's SIDS initiative on climate change and health (WHO 2018), the needs listed below were identified to be considered as part of the revised NCCHAP v2 for RMI.

1. **Increase awareness of the direct and indirect health consequences of climate change** across the RMI population, including policymakers, the private sector, youth and the elderly, and those living on outer atolls.
2. **Strengthen the capacity of health systems** to provide protection from climate-related risks, including extreme weather events, sea-level rise, and vector-, water-, and food-borne diseases.
3. **Ensure that health concerns are addressed** in decisions to reduce risks from climate change in other sectors.
4. **Mobilize communities** to better adapt to the health consequences of climate change, as well as other impacts, applying the healthy settings approach embedded in the healthy islands vision.
5. **Strengthen national capacity** to develop and implement effective interventions to minimize climate-related health risks and enhance community resilience for adaptation, with special regard for the most vulnerable populations.
6. **Reinforce existing programs** and build the capacity of health and other related sectors in terms of infrastructure, human resources and financial resources.
7. **Assess the health implications** (including co-benefits and potential trade-offs) of decisions made on climate change by other key sectors, such as energy, agriculture, fisheries, industry, water supply and sanitation, transport, urban and rural planning, and advocate for decisions that would improve health.

To achieve measurable outcomes in the next five years, RMI NCCHP v2 builds on:

- existing RMI policies and frameworks;
- extensive internal (MOHHS) and external consultation and communication;
- strong leadership, a committed local champion (from MOHHS), endorsement by government, and ownership by local communities; and
- a realistic implementation plan and a mechanism for attracting and applying funds from donors.

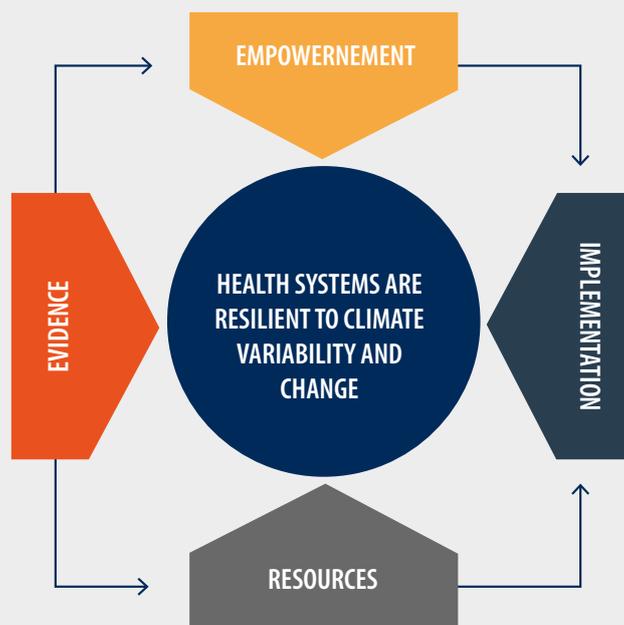
NCCHP v2 follows the four strategic lines of action of the SIDS Initiative.

- **Empowerment:** Supporting health leadership to engage locally, nationally and internationally
- **Evidence:** Identifying priorities and gaps and building the business case for investment
- **Implementation:** Preparedness for climate risks, and health-promoting mitigation policies
- **Resources:** Facilitating access to climate and health finance

These four components are interlinked, as shown in Figure 1. Evidence leads both to empowerment and access to resources. Both empowerment and access to resources lead to successful implementation of actions. The four components aim at making health systems in SIDS resilient to climate variability and change (WHO 2018).

This updated climate change and health policy has a realistic and specific five-year action plan, which will be fully integrated in the new joint national adaptation plan, which is currently under development. This NCCHP v2 includes specific actions, responsible agencies, resources required, indicative costs, implementation strategies (including timelines), and monitoring and evaluation (including measurable indicators). It is recommended that the action plan be reviewed and updated annually.

FIGURE 1. Interlinkages among the four components of the SIDS Initiative (WHO 2018)



2.2 Development process

The NCCHP v2 development process involved five components:

1. A desktop review of the scientific literature on climate change and health in the Pacific Island developing countries (PIDCs) and other SIDS.
2. A preliminary review of climate change and health research, initiatives, policies and plans relevant to RMI. This review included studies published in the scientific literature, as well as those made available through government and international organizations, such as WHO.
3. Mapping of and consultation with a wide range of institutional and community stakeholders in RMI.
4. A range of participatory research methods for consultations, including a rapid survey, in-depth interviews, focus group discussions, and stakeholder workshops.
5. Advice and input from national and international experts in public health, environmental health, environmental management, and climate change.

Advice was sought from experts in the RMI MOHHS, the Australian National University, WHO and other organisations through formal and informal contacts. This included a qualitative assessment of achievements of NCCHAP (RMI 2012).

2.3 Goals of NCCHP v2

Based on findings from the above process, NCCHP v2 sets out three main goals and related areas of work aligned with the JNAP.



GOAL 1:

Improved health protection against climate-related risks in RMI

- Identify and prioritize climate-related health risks in RMI.
- Strengthen health protection measures against climate-related infections (i.e. communicable and non-communicable diseases).
- Improve public health education and awareness of effective health protection measures.
- Identify gaps and resource needs, and monitor progress.



GOAL 2:

Enhanced community resilience and improved health and wellbeing

- Reduce vulnerability to vector-borne diseases.
- Reduce vulnerability to food- and water-related health risks.
- Reduce vulnerability to extreme weather events.
- Improve mental health resilience and social connectedness.



GOAL 3:

Integrated approach to health and climate change adaptation

- Health protection policies are integrated into the JNAP.
- Improved coordination among responsible government departments and agencies on health protection, health promotion, climate change adaptation, sustainable development, and planning.
- Key stakeholders and communities are active participants in the development and implementation of the NCCHP v2.

03

Action plan matrix for NCCHP v2, 2021–2025



TABLE 1. Action plan matrix for NCCHP v2, 2021–2025

Health issue	Priority	Action(s) needed	Lead agency and supporting agency	Indicative cost	Indicator (KPI)
Food safety and security	High	<p>Improve agricultural practices to increase local food production:</p> <ul style="list-style-type: none"> → Introduction of more drought-resistant crops → Better techniques for preservation and storage of crops → Adoption of more water-efficient techniques for growing crops → Replanting traditional foodstuff 	<p>MNRC</p> <p>MOHHS, Central Statistics Office (CSO), NDMO, MOCIA, CCD, MICNGOs</p>	<p>USD 200.00 per raised beds</p> <p>GCCA+SUPA project funded 93 raised beds from 2021–2022 in Jaluit and Majuro Atoll</p>	<p>Number of community/island development plans including sustainable agricultural practices</p> <p>Number of drought-resistant crops established</p> <p>Number of new irrigation systems installed</p>

Health issue	Priority	Action(s) needed	Lead agency and supporting agency	Indicative cost	Indicator (KPI)
Food safety and security <i>(cont.)</i>	High	Increase outreach and awareness raising in sustainable agricultural techniques, including irrigation (wicking) systems for crop growing, pest control, use of non-chemical fertilizers	MNRC MOHHS, Wellness Center, Local Resources Committee	USD 47,000 on Jaluit, USD 15,000 on Majuro for awareness and outreach funded by GCCA+ SUPA project 2021–2022	Awareness-raising campaign for sustainable agricultural practices
	Low	Investigate local production and benefits of traditional medicines	CMI Land Grant MOHHS, MNRC, local government, traditional leadership, faith-based organizations	USD 263,000 (estimated for two years) <i>(Funding to be sourced)</i>	Study of benefits of traditional medicines
	Medium	Improve advance weather forecasts and associated advice for agricultural practices	WSO EPA, CCD, MNRC (Agriculture Division)	USD 5,000 (per year) <i>(Funding to be sourced)</i>	Daily weather forecasts with related advice for farmers
	Medium	Reduce ciguatera occurrences: → Continue community education, for example via posters → Expand conservation areas to restrict fishing in ciguatera hotspots	MIMRA NGOs, local government, traditional leadership	USD 10,000 (per year) <i>(Funding to be sourced)</i>	Number of ciguatera poisoning cases per year
Water safety and security	High	Increase water quality testing and data collection on drinking water supplies, and community access to safe water on outer islands	EPA Majuro Water and Sewer Company (MWSC), local government, MOHHS	USD 20,000 for test kits annually USD 10,000 for travel annually <i>(Funding to be sourced)</i>	Number of water quality tests conducted per island per year
	High	Engage with communities to raise awareness about water-related health risks Prepare educational materials on clean drinking water, sanitation and hygiene	MOHHS Local government, MNRC, EPA, traditional leadership, faith-based organizations	USD 15,000 (per year) <i>(Funding to be sourced)</i>	Online and printed resources for public health education on water-related health risks
	High	Increase community rainwater harvesting systems	Local government MNRC, EPA, MWSC	Funded under the USD 22 million GCF project 2021–2027	Number of community rainwater harvesting systems installed
	High	Enforce existing water regulations and develop a national plan for water, coordinated by a national water office	EPA MNRC, MOHHS, Attorney General's Office	Human resource and workshops, USD 100,000 per year <i>(Funding to be sourced)</i>	National plan for water developed

Health issue	Priority	Action(s) needed	Lead agency and supporting agency	Indicative cost	Indicator (KPI)
Vector-borne diseases	High	Continue community education and awareness-raising about vector-borne diseases and the importance of eliminating mosquito breeding sites	MOHHS MICNGOs, traditional leadership, faith-based organizations, Public School Services MAWC	USD 3,000 per year <i>(Funding to be sourced)</i>	Online and printed resources for public health education on vector-borne diseases
	High	Promote behavioural changes in retailers and communities to reduce waste and promote recycling	Local government NRC, EPA, traditional leadership, Public School Services, MICNGOs, faith-based organizations MAWC NGO	USD 70,000 per year for mass media campaign and community awareness outreach <i>(Funding to be sourced)</i>	Number of accessible recycling and waste disposal facilities
	High	Increase access to these facilities for the community to reduce plastic waste, waste burning, domestic fuel use, and unnecessary car journeys	Local government NRC, EPA, traditional leadership, Public School Services, MICNGOs, faith-based organizations MAWC NGO	USD 30,000 per year <i>(Funding to be sourced)</i>	Number of accessible recycling and waste disposal facilities
	High	Improved municipal services to support refuse collection and disposal	Municipal waste services EPA, MOHHS MAWC	USD 168,236 per year (This is the portion of the annual budget for MAWC allocated to municipal services)	Quantity of waste that goes into dump/ burning
	High	Review and enforce regulations concerning litter, storage of waste, waste burning, and pollution control	EPA Local government Attorney General's Office	USD 10,000 (To review regulations) <i>(Funding to be sourced)</i>	Update and publish new regulations on waste management and pollution control
	High	Increase the capacity for vector control beyond Majuro Atoll. This involves providing staff, equipment and transport	MOHHS Local government	USD 100,000 per year <i>(Funding to be sourced)</i>	Number of environmental health staff working on vector eradication across RMI
	Medium	Engage with landowners and church leaders for coordinated community clean-up activities	Local government Traditional leadership, faith-based organizations, EPA, MOHHS	USD 50,000 per year <i>(Funding to be sourced)</i>	Community outreach and liaison officer employed

Health issue	Priority	Action(s) needed	Lead agency and supporting agency	Indicative cost	Indicator (KPI)
Non-communicable diseases	High	Raise awareness in schools and communities about healthy nutrition. This includes providing information on the importance of a balanced diet, avoidance of foods high in salt, fats and sugar, and restricting alcohol intake	MOHHS Public school services / CMI / USP, MICNGOs, faith-based organizations, traditional leadership	USD 15,000 per year <i>(Funding to be sourced)</i>	Awareness-raising campaign on healthy diet, targeting households and food outlets
	High	Promote and raise awareness of the importance of physical activity for men and women of all ages and abilities	MOHHS MICNGOs, faith-based organizations, traditional leadership, Public School Services	USD 15,000 per year <i>(Funding to be sourced)</i>	Number of community sports programs for people of all ages
	High	Increase the availability of facilities for sports and exercise for all, including air-conditioned spaces in offices and public buildings	MOHHS Local government, Public School Services, MICNGOS	USD 10,000 per building <i>(Funding to be sourced)</i>	Number of indoor facilities available for sports and exercise
	High	Provide safe and well-lit walkways and cycle lanes in Majuro to promote active travel (i.e. walking and cycling). Encourage the formation of bike-sharing schemes and clubs for various age groups	Local government MPW, MOHHS, traditional leadership, faith-based organizations, Public School Services, MICNGOS	USD 75,000 per year <i>(Funding to be sourced)</i>	Length of safe/well-lit walkways and cycle lanes. Number of communal bike-sharing schemes
	Medium	Creation of safe swimming areas and introduction of swimming lessons, lap training and water aerobics for men and women of all ages	MOHHS Local government, traditional leadership, MICNGOS	USD 20,000 per year <i>(Funding to be sourced)</i>	Number of safe swimming areas. Number of swimming learning programmes
Mental health and well-being	High	Review health system facilities and resources in relation to mental health in RMI, as well as traditional / community-led initiatives	MOHHS RMI Mental Health Advisory Council, Public School Services/ CMI / USP, MICNGOS	USD 40,000 per year <i>(Funding to be sourced)</i>	Review of existing facilities and resources for mental health services provision
	High	School education and community awareness-raising in the causes and nature of mental stress and associated mental health problems, including exacerbation by climate change	MOHHS RMI Mental Health Advisory Council, Public School Services / CMI / USP, MICNGOs, faith-based organisations	USD 100,000 per year <i>(Funding to be sourced)</i>	Number of awareness-raising campaigns and school programs on mental health and wellbeing
	High	Increased availability of trained mental health professionals and facilities (e.g. mental health helpline) to ensure sufficient and adequate mental health services	MOHHS MICNGOS	USD 10,000 per year <i>(Funding to be sourced)</i>	Number of psychiatric nurses, psychologists and psychiatrists employed. Establishment of a mental health helpline

Health issue	Priority	Action(s) needed	Lead agency and supporting agency	Indicative cost	Indicator (KPI)
Mental health and well-being <i>(cont.)</i>	High	In-service training for health professionals on outer islands and atolls to raise awareness of the likely impact of climate change on mental health	MOHHS	USD 20,000 (USD 2,000 per year) <i>(Funding to be sourced)</i>	Number of trained staff per outer island health center
Respiratory diseases	High	Up-to-date emergency plan for infectious disease outbreaks, including provision for border closures, mass screening, and mass vaccinations	Cabinet MOHSS, MOFA, MICNGOs, CSO	USD 10,000 per year <i>(Funding to be sourced)</i>	Up-to-date infectious disease outbreak emergency plan Screening programmes for TB and COVID-19 Measles/ Influenza vaccination coverage
	High	Community education and awareness-raising in schools, faith-based organizations and other community groups on how infectious respiratory diseases are transmitted within the home as well as within the community, and on related preventive measures and to discourage smoking, especially in rural areas	MOHHS Public School Services, MICNGOs	USD 15,000 per year to support promotion campaigns, printing services USD 2,000 per year to support evening gatherings in communities <i>(Funding to be sourced)</i>	Awareness-raising campaign on infectious respiratory illnesses and anti-smoking campaign covering rural areas and remote islands
Extreme weather events	High	Timely extreme weather alerts, including projected wave heights when relevant. Alerts should include risk for flooding potential and reach, risk of lens contamination, crop and structural damage	MOHHS NDMO, WSO, NTA	USD 30,000 <i>(Funding to be sourced)</i>	Combined action under Food Safety & Security: <i>"improved advance weather forecasts and associated advice for agricultural practices"</i>
	High	Community education and practical health protection advice to prevent injury and food and water contamination from floods Assessment of resources required to equip citizens to self-protect in place	MOHHS NDMO, MICNGOs, faith-based organizations	USD 20,000 <i>(Funding to be sourced)</i>	Educational campaign to raise awareness of extreme weather events and related health protection
	Medium	Heat-health plan, including community education that can be disseminated through health clinics to achieve broad reach across RMI	MOHHS WSO, CCD, NDMO NGOs	USD 20,000 <i>(Funding to be sourced)</i>	Heat-health plan and educational campaign

3.1 Description of the actions

This section describes specific actions for mitigating climate change-related health risks in RMI.

3.1.1 Food safety and security

Food security is a major concern in RMI, as highlighted by participants in the focus group discussions and stakeholder workshops. The actions recommended include practical improvements in agricultural practices, provision of more education and information on crop cultivation methods, and the need for preservation of fish stocks and control of ciguatera. Practical agricultural strategies may include introduction of more drought-resistant crops, better techniques for preservation and storage of crops, and adoption of more water-efficient techniques for growing crops.

A general recommendation is that there should be more outreach and awareness-raising in sustainable agricultural techniques, including better management of water resources for crop growing. While there is much knowledge of traditional cultivation methods in RMI, most information on modern agricultural science is obtained from consultants and regional agencies, such as the Pacific Community, and from educational posters. The increasing importance of local cultivation in conjunction with the harsher environmental conditions associated with climate change is increasing the demand for agricultural advice, especially in techniques such as pest control, use of fertilisers, and safe use of grey water. Advice on safe post-harvest handling and storage of food crops is also needed to prevent diarrheal and other diseases. While general information can be provided in poster and media broadcasts, there is also a need for a small team of local agricultural advisers to identify specific problems in the field and provide targeted advice on the best way to address them.

Other recommendations about the types of food-related education and information that should be provided in conjunction with the JNAP include:

- **assessment of the scope** for increased local food production and preservation (linked to the National Food Security and Sustainable Livelihoods Program);

- **identification and implementation** of key practical strategies for increasing and diversifying local food production, including climate-resilient crops and replanting traditional foodstuffs (e.g. pandanus, koin, konnat, lukwe) and reducing dependency on imported foods;
- **assessment of ways of ensuring** marine food security and protecting the coral reefs that support coastal fisheries; and
- **strengthening, implementing and enforcing** the RMI Food Security Policy (RMI 2013).

These activities will benefit from advice and interaction with the Centre of Excellence for Atoll Agriculture Research and Development in the Pacific, established in South Tarawa, Kiribati. Regional partnerships with the Australian Centre for International Agricultural Research will also help promote local food production.

Some stakeholders mentioned that cultivation of traditional medicines should be promoted as part of food security. As certain traditional medicinal plants may have both therapeutic and nutritional benefits, they should be considered in strategies to increase cultivation of local foods.

Ciguatera prevention is another perceived priority, especially as the decline in fish stocks is leading to consumption of types and parts of fish known to be more at risk of carrying ciguatera. Despite scientific research, no effective way of preventing outbreaks of the toxins that cause ciguatera in large reef fish has yet been found (Friedman 2008). The ciguatera problem is therefore best addressed by continuing community education, for example via posters explaining the risk and especially advising against consuming fish offal.

Actions to improve nutrition are addressed in the section on NCDs below.



3.1.2 Water safety and security

Water safety and security is a high priority for RMI in the context of climate change and public health. Data and characteristics on water access from outer islands are currently limited. Increased water quality testing and data on drinking water supplies, and community access to safe water in these areas should be prioritised. To do this efficiently, coordination with the Environmental Protection Authority (EPA) on water quality testing is needed. Indicators of this action could include an increase in the data available on outer islands and a national record of the number of water shortages and contamination events, coordinated by the EPA.

Increased engagement of the public health sector in raising awareness of water-related health risks is recommended. Communication and health promotion activities can be coordinated under the JNAP, where integrated awareness-raising campaigns to link water, pollution, public health, and food security are conducted. Educational materials on clean drinking water, sanitation and hygiene should be developed as part of this action. Given the widespread use of mobile technology, efforts should be made to strengthen public education on hygienic practices using available electronic media. Indicators of this action could include the development of online and printed resources for public health education.

Behavioural changes in waste disposal and recycling should be combined with an increase in the easy access to these facilities for the community. Indicators of this action could include the installation of accessible recycling and waste disposal facilities for the communities.

Overall, increased awareness of water-related health risks, together with improved protection of water catchments and drinking water sources and enhanced public health awareness campaigns, should lead to a decrease in water-borne diseases over the medium term. In the short term, the reporting of water-borne disease cases should be monitored, with the aim to progressively reduce the number of reported cases.

The added risk of salination of water supply sources though over-wash of the lens from wave surges, and drought-induced reduced lens filling rates, requires escalation of efforts to preserve drinking water resources and reduce salt intake of the RMI population. It is important that this work runs complementary to efforts to reduce other sources of salt, such as inadvertent dietary intake through dietary shifts to processed foods. Food labelling and dietary education campaigns could be considered, thus offering multiple co-benefits.

The establishment of a central coordinating body (e.g. a national water office) should be considered. This body will aim to increase protection of community water catchments across

urban and rural areas, with members comprising government officials from the environment and health sectors, as well as community leaders. The health sector, particularly public health, should be involved as a key stakeholder in this body. Indicators of this action could include the number of meetings across sectors on environment health and the development of a national plan for water.

3.1.3 Vector-borne diseases

Numerous outbreaks of vector-borne disease, such as dengue outbreaks in recent years, have created a high level of awareness of vector-borne diseases in the Marshallese community, including considerable awareness of modes of transmission. This is evidenced by frequent community clean-ups and increasing use of mosquito nets and insecticides. The main obstacles preventing better control of vector-borne diseases are financial and organisational. These limitations can be seen at government, community and household levels. While ongoing education and awareness-raising about vector borne diseases and the importance of eliminating mosquito breeding sites should continue, the focus of this NCCHP v2 is on addressing financial and organisational barriers and enforcing anti-litter and environmental regulations. Regulations concerning litter, storage of waste, and pollution control should be reviewed and if necessary updated to ensure they give sufficient power to authorities to enforce them.

The four-person Environmental Health Division of MOHHS should continue its good work and be augmented to increase its capacity for vector control beyond Majuro Atoll. At the same time, there needs to be strict enforcement of regulations requiring vector breeding sites to be removed or covered, so that water cannot accumulate. In some cases, fumigation of mosquito breeding sites may be needed. For example, the very large outdoor tyre dump in Majuro supports potentially thousands of vector breeding sites that cannot be eliminated by hand spraying alone. Elimination of such sites would greatly increase the effectiveness of the Environmental Health Division's vector control programme.

Coordination of community clean-ups is essential, especially in Majuro and Ebeye. Failure to coordinate undermines and discourages efforts, such as when one community cleans up all its trash and eliminates breeding sites, but trash and breeding sites remain on adjoining land. Logistic support, as well as coordination, is needed so that any obstacles, such as problems associated with tenancies and landownership, can be removed. This could be addressed by employing an officer to coordinate clean-ups and liaise with communities (or adding this responsibility to an existing post) to encourage clean-ups, engage with communities and landowners, and ensure coordination and cooperation.

Regular waste collection in urban communities and commercial areas is an essential part of vector control. Sufficient funds must be made available to ensure that collections occur regularly, e.g. weekly, and all urban areas are covered. Rural village communities should be encouraged and assisted to make their own arrangements for collection and safe disposal of trash. Financial limitations in waste management at the community level should be mitigated by local authorities, which should be able provide cleaning equipment, bags for collecting trash, and transport to remove the collected trash for safe disposal.

While remoteness, small population size, and high transport costs are ongoing limitations as regards recycling in small island states, increased advocacy for re-using and re-purposing would help to reduce the overall amount of trash. This strategy should include discouraging unnecessary packaging and use of plastic shopping bags through community awareness-raising and education.

3.1.4 Non-communicable diseases

Non-communicable diseases (NCDs) are an ongoing and major health concern in RMI that has been partially addressed in previous health plans, including the NCCHAP (RMI 2012). As NCDs are the leading cause of death in RMI, especially NCDs associated with diabetes and obesity, it is crucial that they continue to be a high priority in this 2021 NCCHP v2.

The NCCHAP (RMI 2012) identified the main pathways through which climate change is likely to affect NCDs as being: (i) altered dietary patterns (a shift from fresh to processed foods); (ii) population displacement; (iii) compromised food security; and (iv) altered human activity levels. Actions to promote and support increased cultivation of local crops (proposed above) will partially address the first and third of these pathways. In addition, ongoing education and awareness-raising about healthy nutrition should continue via school education, NGOs, and faith-based organizations. This includes providing information on the importance of a balanced diet, avoidance of foods high in salt, fats and sugar, and restricting alcohol intake. This needs to be supported by awareness-raising campaigns to promote healthier food options (i.e. more access to and use of whole grains, unprocessed and traditional foods) and healthier methods of cooking (i.e. less use of salt, sugar and frying in food preparation). These campaigns should target households and food outlets.

Strategies to address population displacement are complex and were not seen as a priority for the current NCCHP v2 by participants in stakeholder workshops and focus group discussions. The remaining actions proposed to address obesity and diabetes-related NCDs focus on increasing physical activity levels.

The MOHHS, in conjunctions with schools, NGOs, and faith-based organizations, needs to continue and intensify the ongoing promotion and awareness-raising of the importance of physical activity for men and women of all ages. This includes encouraging the formation of clubs and other incentives to increase participation. It is especially important to make ongoing efforts to change community perceptions that sport and exercise are only for young and/or fit people or only for boys/men. Promotion and awareness-raising need to be accompanied by efforts to increase the availability of facilities for sport and exercise for all.

High air temperatures in RMI have always been a major factor limiting outdoor activities such as walking, running, cycling and team sports, and many participants in the focus group discussions and stakeholder workshops perceived temperatures as increasing with climate change. Air-conditioned indoor sports facilities, such as gymnasiums, are costly to build, equip and maintain, so the focus of this set of actions needs to be on simple modifications to the built environment that will promote exercise in the cool of the early morning and evening.

There are already many air-conditioned spaces in offices and public buildings around Majuro and Ebeye that could be used after hours for exercise sessions. Aerobics, tai chi and dance workouts provide many benefits and require little or no equipment other than a music player and a cleared space. Yoga and step workouts provide similar benefits with only a little more equipment. Some of these activities are already taking place, but promotion and support are needed to increase participation of men and women of all ages. A maintenance program for existing sports facilities, such as basketball and volleyball courts, is needed to ensure that they are always safe and usable, with cracks repaired and weeds removed.

Safe and well-lit walkways and cycle lanes also provide opportunities for increased physical exertion through active travel. The stretch of footpath in the Lagoon Road to the east of the Majuro Bridge is a good example of a well-lit facility to encourage walking. Urban planners need to prioritise a long-term program of building footpaths in urban Majuro, smoothing the edges of urban roads, marking off separate cycle lanes and providing good lighting to encourage active travel and recreational walking and cycling when temperatures permit. This needs to be accompanied by a road safety awareness campaign to ensure that walkers and cyclists are anticipated and treated with respect by motorists. Encouraging the formation of communal bike-sharing schemes and clubs for various age groups would help to increase the uptake of walking and cycling for exercise. This may involve providing incentives for private companies to establish cycle hire businesses.

Swimming is an excellent form of exercise for men and women of all ages and is highly appropriate in hot climates, but opportunities for swimming tend to be limited by conservative attitudes inhibiting the wearing of practical swimwear, along with a scarcity of swimming

pools and safe public areas for sea swimming. Attitudes are gradually relaxing, however, and the public beaches at Laura and near the airport on Majuro atoll have become popular spots for water play, if not swimming for exercise. Until now, pollution around Majuro has limited the creation of safe swimming areas by fencing off small sections of lagoon. As clean-ups proceed and sea-water quality improves, however, a long-term objective should be the creation of safe swimming areas and the introduction of swimming lessons, lap training and water aerobics for men and women of all ages.

3.1.5 Mental health and psychosocial well-being

Mental health was a key theme that permeated throughout participant responses as a need to know, and a need to act. Awareness of climate change and mental health among community members and traditional leaders was reportedly patchy, and action was insufficient to address the pressing needs. It was recognized by stakeholders and participants in focus group discussions that poor mental health is sometimes stigmatized and fear of stigmatization can be a barrier preventing individuals from seeking help. Another identified barrier was the marked variation in responses amongst individuals, groups and leaders in enthusiasm or level of effort, as well as efficacy of actions being adopted. There was strong agreement that at all levels throughout RMI, positive, cogent and effective mitigation and adaptation responses were necessary, stressing that they needed to be “implemented and well-coordinated.”

Given the substantive evidence which indicates that climate change negatively affects mental health and psychological well-being, it is imperative that they are considered a priority within the NCCHP v2. As outlined in the evidence section, mental health and psychological well-being can be affected by short-term climate events (i.e. cyclones and floods) and long-term climate events (i.e. drought and sea-level rise) (Helland and Walkover 2018). The mental health needs of the population differ in accordance with the nature of the climate change-related event. Overall, it is important that initiatives aimed at promoting mental health and psychosocial well-being encompass both ongoing mental health services and emergency mental health response.

To improve overall mental health service delivery, health system facilities and resources should be reviewed in relation to mental health. Often PIDC's struggle with fragmented health care systems and lack of trained health professionals. Strengthening mental health care capacity requires increasing the number of mental health practitioners and improving mental health care skills. Mental health training that is relevant to the needs of the population and include in-service training (i.e. continuing education) is essential. Other health care practitioners, such as nurses, doctors and social workers, also play an important role. Depending on the training level, health care practitioners can detect mental health problems, ensure adherence to treatment, refer complex cases, and provide support for caregivers (Kakuma et al. 2011).



Mental health service capacity-building and awareness-raising are both essential to improve mental health outcomes (Skuse 2018). Particularly in rural contexts, concerns have been raised regarding the lack of educational programs and infrequent follow-up sessions (Ibell et al. 2015). Local community networks are often in a better position to carry out such campaigns, as they are not constrained by logistical issues that non-local organizations face. Consequently, community networks can play an important role in reducing mental health stigma and raising awareness of mental health and related services, which increase help-seeking behaviour. Traditional community-led initiatives and healthcare initiatives can provide complementary pathways to promote good mental health.

Responding to short-term climate events often requires rapid response and large-scale response. The RMI WHO Country Cooperation Strategy 2018–2020 recommended the establishment of a dedicated team to prepare for and respond to emergencies and disasters (WHO 2017). Ensuring that mental health specialists are included in this team will help the delivery of mental health services during emergencies and disasters. However, mobilizing large teams of trained local mental health professional can be difficult and cultural differences can reduce the effectiveness of international aid. It is important to acknowledge the role of traditional and community networks in improving emergency mental health care capacity and resources.

Train-the-trainer programs are an intervention strategy that utilises traditional/community networks and has been successfully adopted in several LMICs. It enables local and

international mental health professionals to train local non-specialists to provide mental health services. Local non-specialists, who may be survivors of disaster or displacement themselves, are well-positioned to adapt to the cultural and environmental context. Local non-specialists often become an important first source of support for individuals who do not want to or cannot access other services (Zahlawi et al. 2019).

Ongoing education and awareness-raising in the causes and nature of mental stress and associated mental health problems, including exacerbation by climate change, is a key strategy to reduce stigma and increase and normalize the use of mental health support services. Education and awareness-raising must be prioritized in any mental health strategy. At the same time, the number and availability of trained mental health professionals must be increased to ensure that sufficient and adequate mental health services are available. This includes sufficient psychiatric nurses, psychologists and psychiatrists.

Mental health is a sensitive area, so it is particularly important that service providers understand and establish rapport with their clients. Service providers also need to understand and respect Marshallese culture. If additional trained staff are recruited overseas, customised orientation training will be needed to ensure that they can deliver appropriate assistance to Marshallese clients. MOHHS should prepare a suitable orientation programme. Orientation should include forming links with local youth, sport, faith-based and other community groups that work in conjunction with mental health services to improve mental health.

The promotion of exercise and participation in sport are important in any strategy to improve mental health and well-being in the community. The promotion strategies for RMI discussed above in the actions section in relation to NCDs also apply to the mental health strategy. What needs to be emphasised here is the importance of engaging all sections of the community in physical activity, including elderly men and women. Even very low intensity physical activity has been shown to help prevent mental deterioration and to enhance the well-being of the elderly. Strategies to promote sport and exercise should therefore include specific promotion of appropriate exercise for elderly men and women.

A strategy is also needed to address mental health problems in outer islands. This should include in-service training for health professionals on outer islands and atolls to raise awareness of the likely effect of climate change on mental health.

3.1.6 Respiratory diseases

Infectious respiratory diseases

Plans to contain infectious respiratory diseases need to be strengthened, given the potentially high impact of any outbreaks. Plans need to be supported by a community education program to raise awareness of how infectious respiratory diseases are transmitted and how they can be contained.

RMI has implemented sound strategies to limit the introduction of these diseases by international travellers arriving by air, but other strategies are needed to limit spread within the community, if and when an infectious disease arrives. All responsible agencies and relevant parties need to be clearly identified, well informed and coordinated. The experience of other countries during the COVID-19 epidemic is that this tends to be a major weakness. The MOHHS alone cannot prevent the spread of infectious respiratory diseases. Port authorities, educational institutions, retailers, employers and faith-based organizations must also promote and adopt safe practices to limit transmission. Good preventive practices include social distancing; good personal, occupational and environmental hygiene (e.g. handwashing, surface cleaning and disinfection); good ventilation of indoor spaces; face covering in high risk settings (e.g. airports); and ensuring sick leave is taken when required (Vardoulakis et al. 2020c). This is all in addition to the usual MOHHS measures of mass screening and immunization for TB, influenza and pneumonia.

Community education and awareness-raising in schools, faith-based organizations and other community groups and facilities is needed on how infectious respiratory diseases are transmitted within the home, as well as within the community. This includes education on the importance of social distancing,

proper ventilation and hygiene practices, as well as the need for testing and vaccination. Awareness-raising needs to include distinguishing the characteristics of the most common respiratory diseases – TB, COVID-19, measles and influenza – with regard to the risk of transmission and the best methods of containment.

Non-communicable respiratory diseases

Control of non-communicable (i.e. non-infectious) respiratory diseases, such as chronic obstructive pulmonary disease (COPD) and asthma, requires preventive strategies, including education, awareness-raising and targeted campaigns on tobacco smoking as well as on air pollution.

Despite ongoing education and awareness-raising, tobacco smoking is still common in RMI. A major challenge for any anti-smoking strategy is that the tobacco industry is profitable, so the interests of retailers and advertisers conflict with those of health authorities. Imposition of high taxes to increase the price of cigarettes is unlikely to be acceptable to the RMI community and could have the unintended effect of further burdening already low household incomes. A range of strategies is therefore needed to discourage smoking, especially in rural areas, where the impact of anti-smoking campaigns and restrictions on smoking in public buildings tends to be weaker.

Air pollution from waste burning, household fuel use, and vehicle emissions can be an underestimated problem. Burning of refuse is a long-established practice in Pacific communities, but the pollution generated has become more severe in recent decades because the refuse burned now includes plastics, rubber and other modern materials that yield toxic fumes. Increased crowding in urban areas has also exacerbated the impact of air pollution from domestic burning of household fuels and vehicle exhausts. The chemicals generated from the combustion of fuel and waste can have a major impact on respiratory health, especially in conjunction with underlying respiratory conditions such as asthma and COPD.

Focus group discussions indicated that there is widespread objection to the practice of generating toxic fumes from burning domestic refuse, and this is perceived as both an anti-social activity and a health hazard. At the same time, it was recognized that burning is sometimes the only way of disposing of household refuse. Therefore, regular household waste collection and safe disposal of modern materials by municipal authorities is essential, as well as continuing education on the harmful effects of air pollution.

These actions require coordination of MOHHS, EPA, and municipal services, as well as adequate funding to support refuse collection and disposal. This action should be supported by continuing to educate retailers and communities in urban and rural areas on the need to reduce plastic waste, fuel use, and unnecessary car journeys.

As noted above, if necessary, local regulations concerning litter, waste disposal and pollution should be reviewed and updated to ensure that they give sufficient power to local authorities when enforcement is required.

3.1.7 Extreme weather events

Preparation to manage health risks associated with advancing climate change and extreme weather events requires an information base and up-to-date and comprehensive data analysis. This is essential to fully understand the risk profile of natural disasters, heat, floods and droughts (Gheuens et al. 2019). Preparedness for extreme weather events is essential in a changing climate. In a climate-vulnerable nation such as RMI, this needs priority attention.

Sea-level rise and flooding

Sea-level rise, with associated coastal erosion, salination and flooding, is the most pressing climate-related issue for RMI. Protection against high seas and flooding by physical infrastructure, such as improved sea walls, is a high priority. However, authorities need to be mindful of unintended consequences of potentially accelerated erosion where sea walls have been constructed, and of badly built sea walls using rubble. JNAP supports activities under the Food Security and Sustainable Livelihoods Program (FAO) dealing with coastal erosion and enhancing buffer zones.

Timely extreme weather alerts, including projected wave heights when relevant, are recommended. These alerts should include a measure of risk of flooding potential and reach, risk of lens contamination, crop and structural damage, as well as relevant health advice. The Weather Service Office (WSO) system to disseminate weather alerts and related health messages to the entire RMI population must be reliably maintained and tested. Similarly, to assist in preparation and planning at the local level, communities and their leaders need advance notice of long-term forecasts, such as El Niño, and the associated health risks of storms, flooding and droughts.

Consideration should be given to the creation of a position in a government ministry that could straddle meteorological information, disaster planning and health education to ensure seamless knowledge transfer and feedback to the government, MOHHS and WSO regarding preparedness, resilience, and risks communication.

In this context, it is important to initiate, implement and evaluate mechanisms to ensure community-wide education of self-protection strategies against extreme weather events. These mechanisms should involve community groups, schools and faith-based organizations, in addition to WSO and MOHHS.

Heat strategies

Climate change is increasing heat-related health risks globally. Although heat extremes do not occur in RMI, the projected increase in average ambient temperature is a cause for concern and it is prudent for the RMI health sector to prepare. Higher temperatures, coupled with high humidity and other heat risk amplifiers, such as high obesity rates, high population densities and socio-economic disadvantage, place RMI firmly in the bracket of high heat exposure risk. Relatively simple strategies can be employed to reduce risks of heat related morbidity.

An RMI-specific heat-health plan should be developed, modelled on that of other areas with a tropical climate. A key feature of this would comprise a community education strategy that can be disseminated through health clinics to achieve broad reach across RMI. For example, community members need to be informed of the signs and symptoms of heat stress, so they can recognize it and provide assistance to reduce the risk of it escalating.

Heat stress follows a pattern of cascading seriousness, from mild to serious, potentially leading to long-term organ damage or death. Long-term residents of tropical climates are likely to be very familiar with heat coping strategies. Simple first aid strategies can be readily employed at the community level, such as rest, hydration and placing the affected person in the shade or in cool water. Continued warming is, however, likely to cause increased heat exposure. Preparedness for this can assist in preventing related health problems.

Physical exercise increases internal heat generation up to 12-fold. Shedding this additional heat to the external environment is impeded in hot and humid climates, which increases heat gain and the risk of harm. It is important for people to self-assess their own heat, and rest when hot. Perhaps more importantly, others must not encourage that person to keep moving. A strategy of work-rest periods can reduce heat gain when physical activity, such as outdoor work, is necessary. Another heat protective strategy is shifting the timing of activities to cooler parts of the day.

Heat education campaigns should also include information on population groups at greater risk, such as the aged and people with cardiovascular impairment, the obese, and those who work outside. Providing a summary of early symptoms can assist people to recognize the onset in themselves and others, which can prevent heat risks progressing to dangerous levels. Dehydration dramatically elevates heat risk, so drinking fluids (not alcohol) is part of the primary first aid treatment and prevention strategy. Heat education campaigns should also include practical advice for reducing the risk of overheating in homes, including improved shading and ventilation.

3.2 Empowerment

Strong ongoing engagement with stakeholders and making people more aware of climate change, weather phenomena and associated short- and long-term health risks will help support a proactive, evidence-based response system. This engagement will empower communities to take action and support the health leadership of RMI in raising resources and implementing the NCCHP v2 in the next five years.

3.2.1 Key stakeholder and community engagement

A range of stakeholder and community engagement and consultation methods were employed as part of the development of this NCCHP v2. In addition to the engagement with MOHSS and other RMI government services, the importance of engaging strongly with traditional leaders (Council of Iroij) and landowners, as well as faith-based groups and other community groups, was highlighted early on in the policy development process. To address this need, the following engagement methods were used:

- a Climate Change and Health Symposium took place on 30–31 January 2020;
- two stakeholder mapping workshops were conducted in July 2020; and
- a rapid survey, focus group discussions, and targeted interviews were carried out between January and March 2020.

These consultations directly involved around 200 local stakeholders, including government officials, local authority representatives, traditional leaders and landowners, businesspeople, NGOs, community and faith-based groups, and residents, representing a significant cross-section of the RMI population.

Overall, the findings were consistent, focusing attention on a number of key health issues, including food and water security, vector-borne diseases, mental health, and barriers

for implementation, such as insufficient funding and human resources, apathy and stigma. The consultations suggested responsible RMI agencies and strategies to manage these risks. The strategies included increased resource allocation and education, as well as communication and engagement with traditional leaders, landowners, communities and faith-based groups.

3.2.2 Communication

The success of the NCCHP v2 relies heavily on the ownership and support it receives from the MOHHS, other government ministries and agencies and, importantly, all sectors and levels of the community. This ownership and support will be made possible through a mechanism that provides ongoing and targeted communication and raising awareness of the actions and their interconnectedness with broader health issues (NCD and infectious disease prevention), climate change adaptation, and sustainable development in RMI.

An effective communication strategy is, therefore, required to ensure that the goals and actions within the NCCHP v2 are understood and supported by stakeholders from local to national levels, and from Majuro and Ebeye to the outer islands.

Effective communication needs to be culturally appropriate, linked to traditional knowledge, tailored to diverse audiences and be delivered by trusted messengers through established pathways. This includes training for health practitioners on the use of climate, environmental and weather information, as well as climate change and health educational programs for students and community groups.

3.3 Barriers and enablers for implementation

The NCCHAP (2012) was intended to be the key instrument through which the MOHHS contributed to the RMI JNAP 2014–2018. Specifically, the NCCHAP 2012 was created to address the health goals outlined in the JNAP. Despite its scientific merits, the NCCHAP (2012) did not achieve the intended goals due to internal and external factors. Importantly, there was no dedicated funding or staff at the MOHHS to implement it, and although there was progress in certain areas, there was no overall coordination, monitoring or reporting.

It is, therefore, important for the NCCHP v2 to be realistic and achievable, with clear actions, responsible agencies, and timescales and costs for delivery. Where possible, the NCCHP v2 indicates plans to generate the necessary funding for the implementation of actions. Costing of the actions is important for facilitating access to climate and health finance, for example through the Green Climate Fund. Furthermore, the NCCHP v2 includes a list of indicators that provides a framework for its regular monitoring and evaluation. It is recommended that yearly progress reports be produced over the five-year implementation period.

The main risks to implementation identified during the consultations with stakeholders include financial, practical, cultural and bureaucratic constraints:

- a. insufficient expertise and resources, including lack of dedicated staff, equipment, training and information;
- b. complicated transportation logistics for reaching outer islands and unreliable internet and electronic communications;
- c. perceived lack of political will and competing priorities;

- d. limited engagement of traditional leaders and landowners; and
- e. cultural taboos, apathy and stigma in some cases (e.g. mental health issues).

To overcome these risks, it is recommended that an influential and committed champion (e.g. MOHHS Deputy Secretary), who will have oversight and responsibility for the action plan, be appointed. Successful implementation also requires dedicated resources and expertise, so a coordinating officer needs to be appointed to take care of the day-to-day tasks, coordinate actions, organize regular meetings, collect data, and produce progress reports. Other new and existing resources need to be allocated or re-allocated, as indicated in the description of the actions.

Ministerial endorsement of this policy and action plan is also important for securing funding and buy-in from other government departments and agencies and overseas donors. Strong engagement with traditional leaders and landowners, local government, NGOs, and faith-based groups from an early stage is essential for successful implementation. Finally, the NCCHP v2 needs to be embedded in the revised JNAP, as well as in other relevant RMI policies and plans across all sectors.



04

Conclusions and recommendations



In a nation vulnerable to climate change and with high prevalence of infectious and non-communicable diseases, actions to protect the population's health from the adverse effects of climate change requires priority attention. Preparedness must be proactive, rather than reactive, and involve multiple agencies, communities and other stakeholders, such as traditional leaders, landowners, NGOs and faith-based organizations. It should also adopt a process of implementation, continuous practice, monitoring, evaluation and updating.

Importantly, the NCCHP v2 needs to be well-coordinated and holistic because of the synergies between actions. For example, food and water safety and security affect

susceptibility to infectious disease and NCDs, and physical and mental health affect the ability to adapt to and tolerate extreme weather events.

A critical factor for the successful implementation of the action plan is the allocation of new and/or existing resources, and the appointment of a senior champion in the MOHHS and a coordinator with overall responsibility for the action plan and its delivery.

Finally, the health considerations reflected in the NCCHP v2 should be integrated into RMI's upcoming Joint National Adaptation Plan.

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APPENDIX 1

Circulation list

RMI Government and agencies

- Ministry of Health and Human Services
- Office of the Chief Secretary
- Office of the Chief Secretary) – Ebeye
- Office of Environment Planning and Policy Coordination
- RMI Climate Change Directorate
- Marshall Islands Marine Resources Authority
- Ministry of Culture and Internal Affairs
- Ministry of Natural Resources and Commerce – Agriculture Division
- National Telecommunication Authority
- Kio Club/National Energy Office
- RMI Youth Services Bureau
- Environmental Protection Authority
- Office of Commerce, Investment & Tourism
- Weather Service Office
- Economic Policy, Planning and Statistics Office
- Marshall Islands National Disaster Management Office
- *Tile Til Eo* Committee

Local authorities

- Majuro Atoll Local Government
- Delap Council
- Laura Lolap Council
- Laura Lomar Council
- Lobat Council
- Rita Council
- Rairok Council

- Woja Council
- MIMA / Namo Mayor
- KBE Mayor
- Likiep Council
- Wotho Mayor
- Ebon Mayor
- Jaluit Mayor

Traditional leaders and landowners

- Council of Iroj

Business sector

- Chamber of Commerce
- Majuro Atoll Waste Company
- Majuro Water and Sewer Company
- Tobolar Copra Processing Plant
- Marshall Islands (MI) Handicraft Group
- Taiwan Farm / Taiwan Technical Mission

Non-profit organizations

- College of the Marshall Islands
- Enemanit-Latuma Extended Family Association – Bikini Conservation Group
- Marshall Islands Conservation Society
- Marshall Islands Epidemiology & Prevention Initiatives
- Marshall Islands Council of Non-governmental Organizations
- Red Cross
- Waan Aelon in Majel – Canoes of the Marshall Islands Program

- Youth to Youth in Health
- Women United Together Marshall Islands
- *Jo-Jikum* (Marshall Islands Youth and Climate Organisation)
- Canvasback Wellness Center
- MI Organic Farmers Association
- Reach-MI – NGO for addressing unresolved nuclear issues in Marshall Islands
- *Kora in Jiban Lolorjake Ejmour* – NGO promoting weight loss and improved health
- *Jined* (“our mothers”) Club – NGO promoting lives & livelihoods of women and families
- Womens Athletic Co.
- Taiwan Health Center
- Chinese Association
- Billfish/Urok Club

- Kunit Bobrae Coalition (alcohol, tobacco and drugs-free coalition)
- Law Association
- Research and Education Community Organization RMI
- Assembly of God Church
- Marshall Islands Organic Farmers Association
- Land Grant Program
- Salvation Army

International / Academic Organizations

- World Health Organization (WHO, North Pacific Office)
- International Office of Migration
- University of South Pacific
- Australian National University

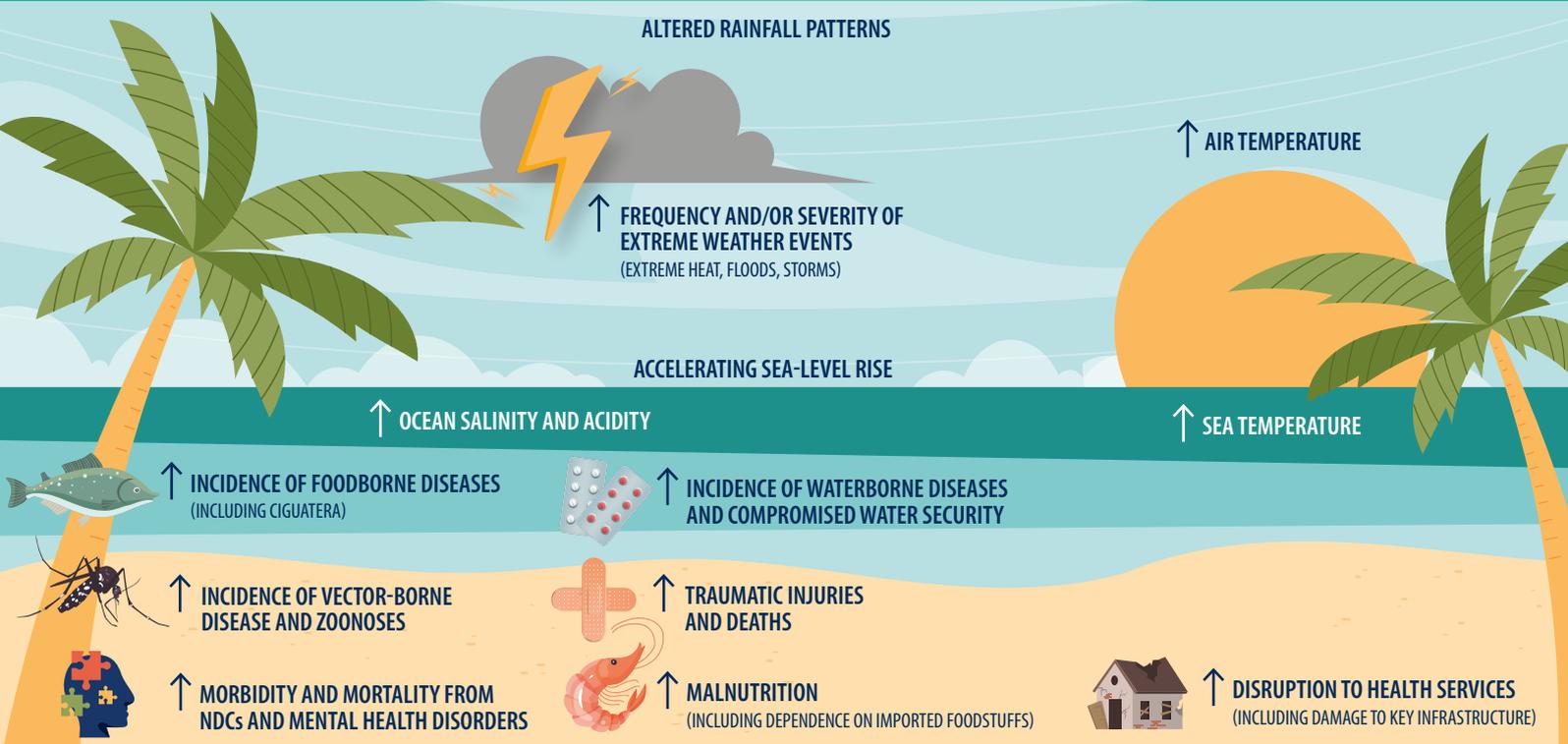
APPENDIX 2

Evidence

The following sections provide an overview of the contemporary climate-sensitive health risks considered most relevant to RMI. These risks have been identified, based on the vulnerability assessment conducted as part of the country's NCCCHAP development in 2011–2012, the findings of WHO's

regional climate change and health vulnerability assessment and adaptation planning project (published in a 2015 report and summarized in Figure 2) and the updated literature review, key informant interviews and stakeholder consultations conducted as part of this project.

FIGURE 2. Pathways by which climate change may affect health in PIDCs (WHO 2015a)



Pathways for health impacts

- direct and indirect exposures
- social disruption
- detrimental impacts on economic and human developments

Mediators of health impacts

- sociopolitical strategies
- environmental measures
- health systems resilience
- economic development

The topics summarized below include:

1. food security, malnutrition and non-communicable diseases;
2. food safety and food-borne illnesses (including ciguatera);
3. water security, water safety and water-borne illnesses;
4. vector-borne diseases and zoonoses;
5. mental health and psychosocial well-being;
6. respiratory diseases; and
7. extreme weather events.

A. Climate-sensitive health risks and priorities

A.1 Food security, malnutrition and non-communicable diseases

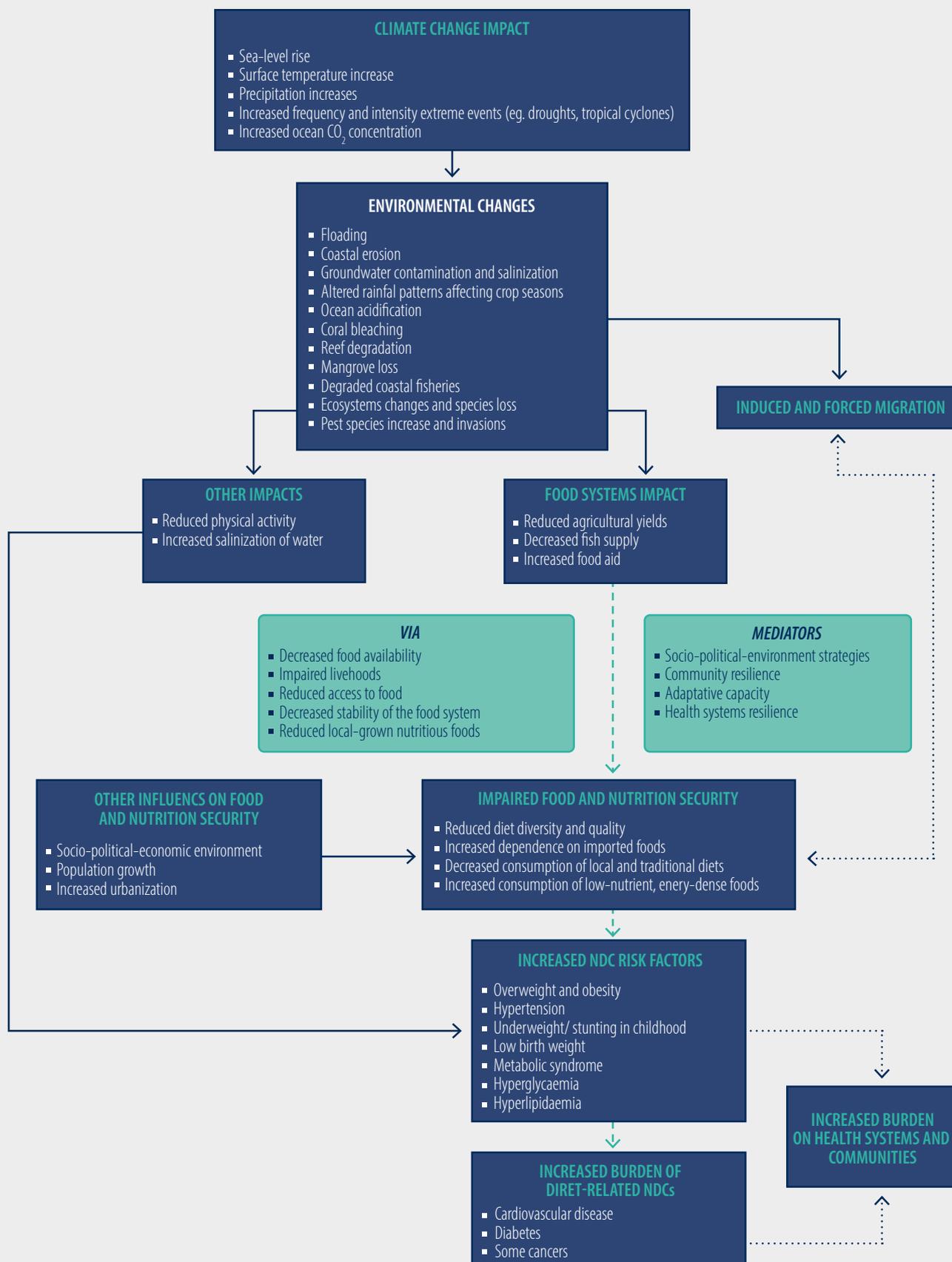
There is a growing body of evidence linking climate change, food insecurity, malnutrition and non-communicable diseases (NCDs) (Barnett 2011; Savage et al. 2020a). This is especially problematic in PIDs such as RMI, where the burden of NCDs such as diabetes, cardiovascular disease and certain types of cancer, and their associated risk factors, particularly obesity, are among the highest in the world, as are the exposure and vulnerability of communities to the impacts of climate change (Sarfati et al. 2019; Smith 2019). The links between climate change, food security, malnutrition and NCDs are summarized in Figure 3.

Climate change is predicted to have a significant detrimental impact on food security in many PIDs (Savage et al. 2020a). In general, the lack of access to nutritional food sources is a greater challenge in PIDs than food availability *per se* (McCubbin et al. 2017), but the converging problems of declining fisheries and agricultural yields, increasing consumption of energy-dense imported foods, and a loss of desire and/or ability to perform physical work and exercise in hotter conditions, are considered

to be contributing, inexorably, to the rise in NCDs. Access to fish – a key element of the diet of Pacific Islands people – will likely decrease due to the adverse effects of climate change (sea-water warming and acidification, in particular) on coastal fisheries and coastal aquaculture (Cvitanovic et al. 2016; Jenkins et al. 2018). Recent years have seen an increase in the shift away from traditional foods towards imported, processed foods in many PIDs (Connell 2014). At the same time, some effects of climate change, such as droughts and further intrusion of saltwater, adversely affect agriculture and increase dependence on easily accessible imported foods, which are typically much higher in caloric, sugar and trans-fat content (Ahlgren et al. 2014).

The absence of traditional food sources affects lifestyle choices more broadly. Traditional farming and fishing practices are being slowly eroded as traditional food sources diminish. This change in lifestyle ultimately shifts towards a more sedentary way of life, contributing to obesity in adults, while at the same time it contributes to the under-nutrition and micronutrient deficiencies observed in Marshallese children (Blankenship et al. 2020). Physical inactivity is also linked with NCDs (Smith 2019). Initiatives that aim to change food or lifestyle choices should ideally be owned and driven by local communities, to ensure that changes are sustainable (Hoy et al. 2014). Policies in this area should adopt a multidisciplinary approach that takes into account both environmental and public health priorities (Kingsley et al. 2015).

FIGURE 3. Links between climate change, food security, malnutrition and NCDs (Savage et al. 2020b)



A.2 Food safety and food-borne illnesses

Diarrheal illness is a major cause of morbidity in RMI, with gastroenteritis one of the most common diagnoses, both in the emergency rooms of the two main hospitals (Majuro and Ebeye) and in outpatient clinics across the country. Diarrheal illness is most commonly spread via person-to-person contact or through contaminated food or water. Incidence of diarrheal illness tends to increase with increasing temperature, including in PIDs (Singh et al. 2001).

There is also a link between diarrheal illness and traditional, cultural practices in the Pacific Islands, such as community feasting. An outbreak of acute gastroenteritis on Ebeye in March 2009 led to over 80 admissions at Ebeye Hospital. This was the worst gastroenteritis outbreak in Ebeye's history, and in terms of the number of hospitalised patients was one of the worst of any published outbreak anywhere in the world. An epidemiological investigation of the outbreak suggested that the source was sandwiches (ham, egg, mayonnaise) and the likely offending organism was either *Staphylococcus aureus* or *Bacillus cereus*, both of which produce a toxin when allowed to replicate in warm, unrefrigerated conditions. The obvious implication of this finding is that warmer conditions in the future may lead to more frequent outbreaks of this nature in the absence of appropriate regulations, environmental health practices, and individual and cultural behaviour change.

Ciguatera poisoning, due to accumulation of a toxic organism in the marine food chain, has long been considered a significant public health issue related to food safety in the Pacific region (McIver et al. 2016; Rongo and van Woesik 2013). The link between ciguatera and climate change is less clear, although some evidence suggests that disturbances in coral reef ecology, such as those that occur with changing ocean temperatures and following tropical storms, may lead to an accumulation of herbivorous fish, which in turn increases the risk of toxicity when consumed by humans (Rongo and van Woesik 2013; Skinner et al. 2011).

A.3 Water security, water safety and water-borne illnesses

Ongoing and intensifying drought conditions driven by climate change can result in diarrhoeal disease outbreaks in PIDs. In Tuvalu, in 2011, a diarrhoeal disease outbreak was reported following a prolonged drought leading to water scarcity (Kool et al. 2012). Water scarcity can lead to long-term storage of water for consumption and if facilities are inadequate, this may increase microbial contamination.

As well as drought, heavy rainfall events are positively associated with an increase in diarrheal disease presentations (Singh et al. 2001). Threats to water security because of

extreme climate events, such as prolonged drought or flooding, can result in diffuse health impacts, exacerbating social issues and mental health in PIDs. For example, flooding has been linked to outbreaks of water-borne leptospirosis in Fiji (Togami et al. 2018).

Access to water and good hygiene is an important priority. Considerable gaps in access have been documented in 21 Pacific Island nations (excluding Australia and New Zealand) using the most recent data from the WHO/UNICEF Joint Monitoring Programme for Water Supply, Sanitation and Hygiene (www.washdata.org) to assess potential access to water, sanitation and hygiene (WASH) services. Only four nations (RMI, Solomon Islands, Vanuatu, and Federated States of Micronesia [estimates from 2005]) had data on household handwashing and hygiene facilities. Rural areas in RMI, Solomon Islands and Vanuatu had a higher percentage of households with no facilities for water and soap, and a lower percentage of households with basic facilities for water and soap, compared to urban areas (Lal et al. 2020).

Inadequate drinking water and sanitation infrastructure is an issue for RMI, with similar issues appearing in many other PIDs (Ebi et al. 2006). For example, urban communities in Kiribati have limited access to clean water for drinking and washing, brackish water, and inadequate storage facilities. Communities have cited limited toilet facilities and concerns about contamination due to the lack of maintenance and improvement of existing toilets in Kiribati (Cauchi et al. 2020). The *Palau climate change policy and action plan for climate and disaster resilient low emission development* (2015) identifies increases in water-borne diseases and damage to water and sewage infrastructure because of extreme weather events.

In PIDs, there already exist policy vehicles, which can be modified using the proposed five-year action plan to target water safety and security issues.

A.4 Vector-borne diseases and zoonoses

The main vector-borne diseases (VBDs) of contemporary concern in RMI are viruses transmitted by mosquitoes of the *Aedes* genus. These include Zika virus, dengue fever virus and chikungunya (Canyon et al. 2016; Descloux et al. 2012; Filho et al. 2019). All of these VBDs have been recorded in RMI in recent years, including an outbreak of thousands of dengue cases in 2011–2012 (Sharp et al. 2014) – a disease to which many Marshallese mistakenly believed they were immune. While the illnesses caused by these viruses are usually mild, severe forms can occur – particularly with dengue, where infection can lead to fatal haemorrhagic disease. Furthermore, countries in the Micronesian region were among the first to note the in-utero long-term neurological complications of the Zika virus (Filho et al. 2019), which was subsequently declared a Public Health Emergency of International Concern by WHO in 2016.

Mosquito-borne viruses have strong links with climatic conditions, in particular higher temperatures (leading to faster mosquito breeding and viral replication) and altered rainfall patterns (increased rainfall leads to wider availability of mosquito breeding habitats, up to the point where flooding flushes these away). Extreme weather events such as droughts and high temperatures caused by climate change are projected to exacerbate the transmission of vector borne diseases (Ebi et al. 2006).

In addition to VBDs, RMI is also at risk of climate change-related increases in the burdens of disease from zoonoses, i.e. diseases spread from animals to humans. In the Pacific region, the zoonosis of most concern is leptospirosis, typically transmitted from rodents and domestic livestock such as pigs. To date, the evidence for the burden of leptospirosis in RMI is scant (Guernier et al. 2018). As leptospirosis is most commonly transmitted to humans via water or soil contaminated with animal urine, the potential for altered rainfall patterns – particularly severe storms and flooding – to cause increases in exposure to and cases of leptospirosis in RMI may be extrapolated from the evidence of these effects in other PIDCs such as Fiji (Lau et al. 2016).

Preventive strategies for VBDs and zoonotic diseases rely on a combination of community-level initiatives – particularly in eliminating mosquito-breeding habitats to break the cycle of transmission – and personal protective behaviors. Increasing personal protective behaviors requires behavioural modification and increased awareness (Canyon et al. 2016; Filho et al. 2019). Enhanced disease surveillance, improved laboratory diagnostic capacity, and strengthening the health workforce, particularly in primary care and environmental health, are all critically important in ensuring that future outbreaks are detected early and contained (McIver et al. 2014).

A.5 Mental health and psychosocial well-being

Research into climate change-related mental health in RMI and surrounding PIDCs has mainly focused on distress experienced while preparing for a disaster, during an ongoing disaster situation, and/or post-disaster (Asugeni et al. 2015; Dawes et al. 2019; Zahlawi et al. 2019). A study conducted in Solomon Islands examined participants' thinking and behavior relating to sea-level rise. Participants expressed worry and reported that their worry affected individual and community behavior (Asugeni et al. 2015). This is consistent with other studies conducted in SIDS, which reported a strongly negative correlation between drought and life satisfaction. A weak negative correlation between floods and life satisfaction has also been observed (Lohmann et al. 2019). A study based in Tuvalu found that distress was linked to both ongoing and predicted climate change impacts (Gibson et al. 2019).

The prospect of forced migration to other islands and countries due to climate change and sea-level rise may raise fears of having to abandon culture and customs, and loss of cultural knowledge among the children. Culture is deeply embedded in a nation's identity, and intricately aligned with a sense of place, such that forced migration to culturally distinct foreign lands heralds a permanent loss of place and a loss of the symbiotic relationship between place and self. Marshallese who have migrated to USA report a sense of eternal homelessness or 'placelessness', even when home-building and construction are based on homeland designs (Miller 2019). In RMI, out-migration rates are high, with one recent study reporting over 90% of respondents had at least one brother, sister, son or daughter who had migrated (van der Geest et al. 2020).

Decisions to migrate are multifactorial and heavily weighted on seeking better opportunities for education, income and lifestyles. However, RMI households affected by heatwave and storm surge impacts and who perceived that these climatic events are worsening have higher migration propensities (van der Geest et al. 2020). Climate change-related issues of food and water insecurity, disease risk and inundation are existential, and perceived inadequate or inequitable responses add to mental stress.

Collectivism has been described as a core cultural value among the Marshallese. Focus group participants raised concern that climate change-driven reduction in core resources resulted in "less helping and sharing in the community because people have less to share". Climate change thus threatens to also erode cultural identity.

Taken collectively, the fundamental necessities of life – a home, food, water, diminished livelihoods and being free of disease – coupled with potential decay in the mutual sharing and caring collectiveness that underpins cultural harmony and love of place, potentially pose a source of deep grief. Grief can turn to despair when possible alternative options, such as migration, receive negative reports.

Well-being falters without sound mental health, and this knowledge has gained increasing global awareness over recent years (Obradovich et al. 2018). Positive actions are therefore critical to protect the mental health of citizens and must be central to climate change adaptation strategies. Community connectedness and social capital have been long understood as protective of mental health.

The best chances for resilience to climate disasters are found when three types of social capital are combined across the social gradient. The first involves connections with a network of people who are similar. The second involves building relationships with people who are dissimilar (bridging social capital), providing access to new ideas and connecting across geographic, social,

cultural, and economic lines. The third is building relationships with people and organizations who have authority (linking social capital), which is critical to solving systemic problems faced by residents (Helland and Walkover 2018).

In the work for the NCCHP v2, respondents highlighted the need for strong mitigation actions and urging other nations to lower their emissions. Actions are also required at a local level to engender a personal sense of positivity and bolster community cohesiveness. Of the strategies already trialled in RMI, community clean-ups were rated very highly in achieving these goals for connectedness, whilst improving the health and amenity of the local region. Co-benefits include opportunities for physical exercise. Strategies involving shared vision, shared effort and delivering shared benefits can be designed to incorporate these three types of social cohesion and provide adaptation benefits.

This area requires more research, as there are few empirical papers on the mental health and psychosocial effects of climate change in RMI and PIDCs (Asugeni et al. 2015). The capacity of health systems to cope with disaster situations and adapt to the effects of climate change has been consistently identified as a barrier to well-being in PIDCs (Ibell et al. 2015). A review examining post disaster mental health support in low- and middle-income countries (LMICs) found that, while 57% of participants sought support from a health care professional, 45% of participants used community networks as a source of support (Zahlawi et al. 2019).

A.6 Respiratory diseases

Climate change is expected to cause an increase in the incidence of a range of respiratory illnesses. These include allergic conditions, obstructive airways diseases (including asthma) and respiratory infections (Mirsaeidi et al. 2016). The latter include; (i) those caused by bacteria (e.g. bacterial pneumonia, a common cause of illness and death in children and the elderly); (ii) viruses (e.g. those that cause upper respiratory tract infections, the single most common presentation to outpatient clinics in RMI, as well as rarer but serious viral illnesses such as measles); (iii) and mycobacteria causing tuberculosis (TB).

TB, in particular, has a high prevalence in RMI, affecting approximately 1 in 200 people (WHO 2015a; Yamada et al. 2016). Overcrowding, smoking, NCDs and poor sanitation have all been identified as risk factors for TB. Of particular concern in RMI is the issue of overcrowding, which, given the existing high rates of diabetes and smoking, has the potential to be exacerbated by sea-level rise and population displacement, creating a perfect storm for TB transmission. RMI, along with other Pacific atoll nations, such as Kiribati and Tuvalu, is likely unique in the world in experiencing climate change as a driver of TB transmission (WHO 2015a).



The effects of the novel coronavirus 2019 infection (better known as COVID-19) on health systems, and individual behaviors that may lead to or protect against the transmission of respiratory diseases, are areas that will require additional research. While several Pacific Island countries and territories, including Fiji, Papua New Guinea, Guam, French Polynesia and New Caledonia, are reporting local transmission of COVID-19 at the time of writing, the extent of the epidemic in each country, and its impact in RMI, remain to be seen (Craig et al. 2020; Mei and Hu 2020).

Of note, while the restrictions on international travel currently in effect may hinder the progress of initiatives to combat climate change, they have at least resulted in a small, temporary reduction in carbon emissions from air travel.

The COVID-19 pandemic may affect perceptions of food security, food safety, hygiene issues (such as handwashing, water quality, air quality) and place additional pressure on the health infrastructure of RMI. In addition to personal protective measures, the single most important endeavour to protect against climate change-related respiratory diseases in the foreseeable future will continue to be vaccination, both of children (for measles and pneumonia) and adults (for influenza and pneumonia).

A.7 Extreme weather events

Extreme weather events can be catastrophic for small nations. Two thirds of the countries with the highest disaster losses relative to gross domestic product (GDP) are SIDS, with average annual losses between 1% and 9% of GDP (GFDRR 2017). These average figures hide impacts of individual extreme events, since a single disaster can sometimes cripple an island's entire economy. RMI is no exception to this risk, as climate change is projected to increase the frequency and intensity of climatic disasters across the globe.

The *RMI Disaster Management Reference Handbook* notes that annual flooding could make the country's drinking water undrinkable by 2030 and is likely to inundate the islands entirely by 2050 (Republic of the Marshall Islands 2019). In recognition, the RMI Parliament, the *Nitijela*, declared a Climate Crisis Emergency in 2019, calling on the international community to consider additional support to low-lying atoll nations in their fight against climate change (RMI 2019b).

Tropical cyclones are the most extreme weather events, yet projection of future exposure to their effects in any specified area is complicated by their relative infrequency and short span of accurate historical data. Available projections suggest tropical cyclone frequency is likely to decrease as a global average between 6%-35% by the end of the 21st century, and a decrease between 20% and 50% is possible for RMI (BoM and CSIRO 2014). However, an increase in the mean maximum wind speed of cyclones by

between 2% and 11% globally, and an increase in rainfall rates of approximately 20% within 100 km of the cyclone centre, will increase their destructive capacity on RMI (Knutson et al. 2010).

The frequency and intensity of tropical cyclones (hurricanes, typhoons) can be major factors degrading the ecological condition of reefs. The positioning of RMI (at a latitude of about 7° N) offers some protection from tropical cyclones, which tend to avoid the equatorial regions and track beyond latitudes of 8° North or South (Puotinen et al. 2020). However, due to wind speed and wave formation the worst cyclone wave damage occurs within around 100 km of the storm track, and major coral loss can occur up to 800 km from a strong and widespread cyclone.

Sea-level rise

The driving forces for sea-level rise (SLR) are continuing. Global average atmospheric CO₂ levels continue to rise. As more than 90% of the excess energy accumulating in the climate system arising from this increased concentration of greenhouse gases goes into the ocean, the oceans are warming (Cheng et al. 2019) setting a new record in 2019 (WMO 2020). Over 30% of SLR is attributed to the resultant thermal expansion of warmer water.

In 2012, SLR projected in the Marshall Islands was approximately 7–19 cm by 2030, increasing to 41–92 cm by 2090 under the RCP8.5 (BoM and CSIRO 2014). The accelerated ice melt from Greenland, Antarctica, and glaciers is also contributing to faster than projected SLR. These recent measurements, coupled with advancements in monitoring and modelling, have resulted in an upwards revision in global SLR projections. Notably, these projections indicate sea level will be higher in the tropics than the global average.

Updated SLR projections specifically for RMI are not yet available but inundation reach has been calculated for Majuro Atoll for varying levels of SLR and tide levels (Gesch et al. 2020). High sea-water levels can result in extensive inundation in agricultural regions, and airport runways surrounded by water may prevent aeroplanes taxiing or landing, thus preventing arrival of urgent supplies by air.

Land elevation is the primary geophysical variable that determines exposure to inundation in coastal settings. With an average elevation of approximately two meters above mean sea level, RMI is one of the lowest-lying island nation states in the world, making it highly vulnerable to the effects of SLR. Current rates of inundation are expected to increase as the rate of vertical coral accretion (growth) is slower than the rate of SLR (Storlazzi et al. 2018a).

Coral reefs are living bio-geomorphic systems whose structure and function highly depend on their health. Globally, reef health is under threat from local stressors, ocean acidification, and global warming; reefs are likely to degrade rapidly over

the next 20 years (Hoegh-Guldberg et al. 2017). Healthy atoll structure is essential for foundational stability as a homeland, in providing resistance to wave pressures and as a provider of food supplies. Human use of coral reefs also has profound effects on reef community structure (Crane et al. 2017). The dynamic relationship between reefs and the people who utilize them is complex and remains poorly understood. Estimating the relative and interactive effects of climate change and local anthropogenic stressors is difficult in most locations, due to a lack of physical monitoring data (Bruno and Valdivia 2016).

King tides, floods, and salination

In addition to the chronic slow onset of SLR, incoming swell from distant storms and cyclones can trigger storm surges and wave run-ups that lead to inundation (flood) events, especially when coinciding with high spring tides (King tides) and/or other sea-level anomalies. Also, the El Niño Southern Oscillation and the Pacific Decadal Oscillation systems can raise or lower sea level by ± 30 cm beyond normal astronomical tide levels (Smith and Juria 2019).

In RMI, the two highest sea-level measurements on record both occurred during La Niña events, with both leading to inundation. Approximately half of these inundation events were caused by tropical storms and cyclones / typhoons that passed near the region (Smith and Juria 2019).

Wave-induced overwash and the resulting island flooding can cause injury and death, and readily contaminate an island's underlying thin freshwater lens with saltwater. This is particularly problematic when the freshwater lens is the sole or primary source of water supply for islanders. Sea-water flood mixing with the aquifer groundwater can render the lens water non-potable. Partial recovery from saltwater intrusion into the lens can be swift, whereas full recovery to drinking water standards is very slow (Gingerich et al. 2017). Rainwater stored in tanks during the previous wet season may provide one month's supply, which is not sufficient for the island's needs during the subsequent five months of the dry season.

The World Health Organization does not have a health-based standard for salt content of drinking water. Low levels of salt in drinking water are considered a negligible contribution to daily salt intake. Several studies have, however, identified an association between excessive salinity in drinking water and increased risk of heart diseases, hypertension, stroke, preeclampsia and gestational hypertension, infant mortality, cholera, and skin and diarrheal diseases (Chakraborty et al. 2019). High water salinity is associated with significantly higher health burden and hospital visits.

Wave-induced overwash and the resulting island flooding also threaten terrestrial infrastructure. RMI's isolation and scattered nature of hundreds of islands bring substantial logistic challenges associated with mustering and transporting resources vital to restoring safety and functionality of critical services. The *RMI Disaster Management Reference Handbook* details the comprehensive management system in place with regard to delivery of humanitarian cargo and utilities (RMI 2019a). The key lies in early warning systems that can accurately estimate likely disruption and restoration needs and have emergency assistance primed to arrive promptly.

Droughts

Drought presents another risk of climate change for RMI, as rainfall contributes to over 90% of its water supply (RMI 2019a). Diminished groundwater supplies render water quality unsafe for human consumption due to high salinity levels and damage food crops, such as banana, taro, and breadfruit.

A trend of decreasing annual rainfall has been evident in RMI since 1954, although this trend is projected to reverse, with an increase in average rainfall, along with more frequent extreme rainfall events with higher rainfall totals (BoM and CSIRO 2014). A powerful El Niño event in 2015–2016 left RMI in drought conditions throughout 2015–2017, which followed a severe drought in 2013. Thousands of Marshallese suffered from food and water shortages and practically the entire nation faced chronic water scarcity. The State of Emergency declared on 4th February 2016 was elevated to a National Disaster on 10th March, whilst a State of Emergency was also declared in April 2017. These calls serve as the trigger to allow for international assistance to provide resources to cope with the crisis.

Health and social ramifications felt by RMI people during past droughts are diverse. Water is necessary for life. Hydration, the ability to cook and to secure sanitation are fundamental to health and indeed to survival. Surveys in RMI of drought-affected residents reported a sense of shame in having to beg friends and neighbours for water when their own reserves were down or they lacked the funds to purchase water. They also reported that people needed to walk further to access potable water amid concerns about the dust on the health of children and walking in the heat (van der Geest et al. 2020). The effects of drought on food safety and the increased exposure to heat reduce people's access to fresh, nutritious and affordable food, as well as potentially generating a sense of solastalgia (i.e. emotional or existential distress caused by environmental change) as the local amenity degrades. These events can incrementally erode the sense of pride and security of place.

Communities in RMI have reported that 86% of households have experienced drought and 88% reported resilience measures using multiple water sources to meet normal household needs (MacDonald et al. 2020). Reverse osmosis desalination units have provided relief during drought emergencies, but concerns have been raised around dependency, maintenance challenges, and loss of traditional water practices.

Heat effects

Moderated by surrounding oceans and trade winds, temperatures in RMI vary little throughout the year. The average daily maximum temperature at the Kwajalein Weather Station is 86.5°F (30.3°C), the average minimum is 77.6°F (25.3°C), and the average relative humidity ranges from 78% at local noon to 83% at midnight. Although extreme heat risks are unlikely, the high tropical humidity elevates the heat discomfort levels.

Warming trends have been observed in annual and half-year mean temperatures at Majuro since 1955 and Kwajalein since 1949 (BoM and CSIRO 2014). The temperature of the 1-in-20-year hot day is projected to increase by approximately 0.7°C by 2030 under the RCP2.6 (very low) scenario and by 0.8°C under the RCP8.5 (very high) scenario, and annual average daily maximum temperatures are projected to rise approximately 0.8°C and 1.5°C by 2030 and 2050 respectively under the higher emission scenarios (BoM and CSIRO 2014).

Global warming has already led to observed significant diverse changes in human health, productivity and well-being, sufficient to provide increasing confidence that continued warming will lead to mass migration, decreased economic output, increased morbidity and mortality, and lower human capital (Masuda et al. 2019). Whilst not immediately threatened with extreme heat events, exacerbation of the persistent heat and high humidity levels in RMI may elevate the exposure to heat above human tolerance levels (Hanna and Tait 2015). One manifestation is fatigue, which reduces capacity to work and willingness to engage in physical exertion.



B. Vulnerable populations

Climate change vulnerability for RMI spans the topographic, climatic and geophysical domains, all of which are amplified by the nation's demographic and socio-economic characteristics. Notwithstanding, the Marshallese are staunchly resilient. The successful inhabitation of these islands for several thousand years has conferred a deep multi-generational knowledge and cultural understanding of the local environment, and how to best survive and flourish amidst its challenges.

Vulnerability to climate change exists for all residents of RMI, from impacts on key resources to chronic climate-related shifts and extreme weather events. At the most fundamental level, the reef structure itself is under threat due to sea-level rise, storm and wave damage, acidification and local degradation arising from human occupation. Reef health is vital to provide a safe home, a source of marine-based food and a source of water to the lens. Limited land availability and population pressures lead to increased population densities, most notably on Majuro and Ebeye, which in turn increases the pressure on reef health through the ecological effects of industrial, commercial, agricultural and human waste run-off and the demand for fish and freshwater.

Certain population subgroups are more at risk than others to specific climate-related threats to health and well-being and, as in all populations, poverty reduces the capacity to adapt and chronic health conditions and age reduce resilience to health challenges. The Asian Development Bank suggested that up to 20% of the RMI population were unable to afford their basic needs (RMI 2019a). Furthermore, the 2017 Borgen Project reported only 39.3% of the RMI population aged 15 years and above was employed (Tang 2017), and that was with strong gender imbalance. Other aspects of women's lives perpetuate their disadvantage, which transfers to children's disadvantage. Teen pregnancy rates in RMI are the highest in the Pacific region at 127 per 1000 teenagers, five-fold that of Tonga, and RMI has the fourth highest infant mortality rate in the Pacific region with 30/1000 babies dying before their first birthday (RMI 2019a). Poverty and lack of opportunity to access essential resources and employment brings a cascading series of disadvantages that hamper options for healthy flourishing and amplify vulnerability to additional threats associated with climate change.

Environmental and economic issues are intricately linked with population health concerns. Due to a shortage of fresh fruits and vegetables, and reliance on imported processed and packaged foods, more than half the women in RMI have

obesity or risk factors for related diseases. Diet choices are shared with children, who comprise 46% of the RMI population. Of particular concern is reliance on processed foods, which are characteristically low in nutritional value and high in calories, fats and salts. Whereas these are harmful for adults, they are especially risky in children's diets (Pries et al. 2019).

Low nutrient, high salt diets and consumption of water with high salt content contribute to a range of health conditions that escalate vulnerability to heat exposure. The human body tolerates only a small range in core temperatures and maintaining this places considerable strain on the heart and cardiovascular system (Hanna and Tait 2015). Hence obesity, hypertension, dehydration, and lack of physical fitness all independently and synergistically increase the risk of heat stress.

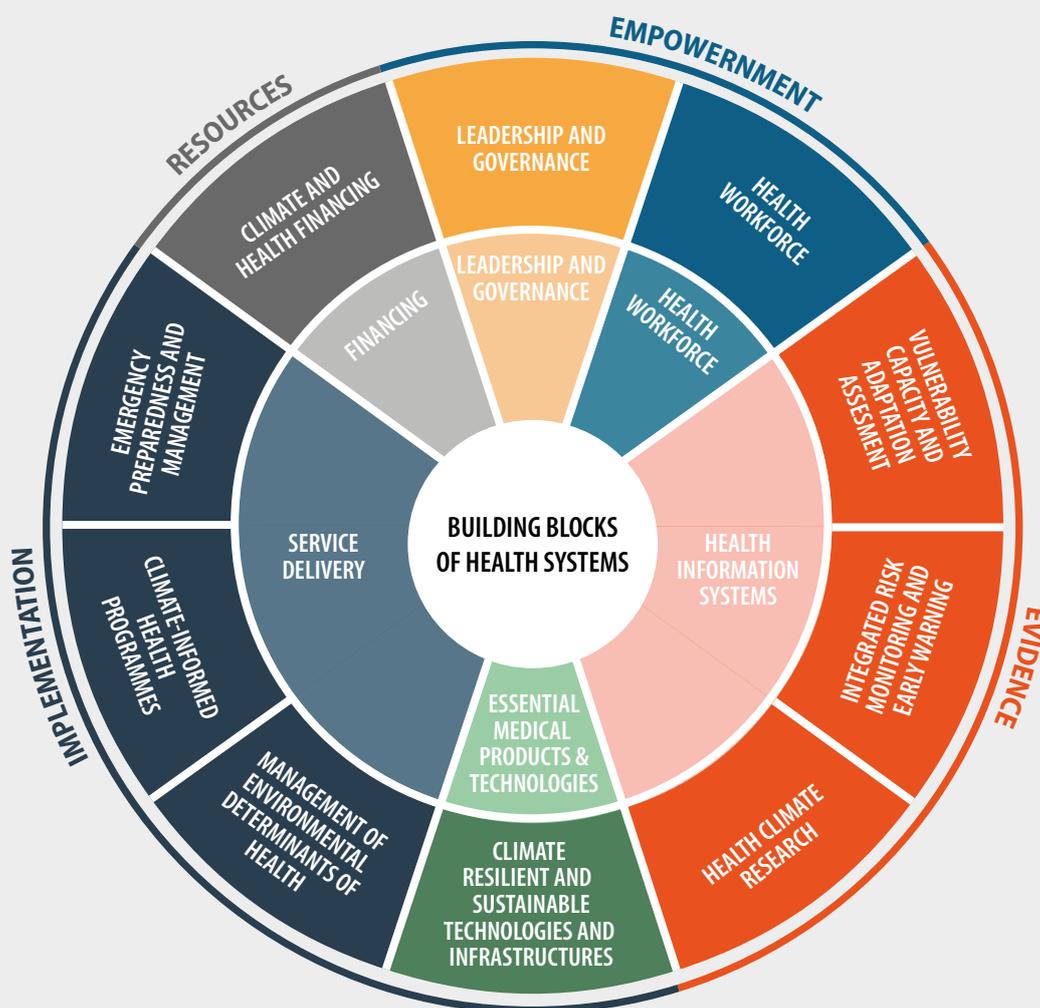
C. Health systems and infrastructure

The recommended approach to strengthening health systems in the face of climate change is the building of climate-resilient health systems (CRHS). In its 2019 'Special Initiative' report on climate change and health in SIDS, WHO reinforces the importance of the CRHS approach, which is itself an extension of WHO's overall guidance on health systems strengthening (Figure 4).

When examining the adaptation priorities for RMI, therefore, a concerted effort should be made to identify how those actions may align with the CRHS paradigm, as that is likely to be the best understood and most likely to be supported by donors and other health actors. Adaptation priorities should align closely with the highest-risk issues and also support health systems strengthening more broadly. The climate-sensitive health risks of greatest concern in RMI include, as described above: water-, food- and vector-borne diseases; heat stress; malnutrition and NCDs; mental ill-health and psycho-social problems; and injuries and deaths from extreme weather events.

The COVID-19 pandemic is an example of evolving challenges facing RMI's health system. The threat of COVID-19, combined with risk of dengue outbreaks, floods and droughts, puts a significant stress on the health sector and the communities it serves. A climate-resilient health system is now needed more than ever. This will protect RMI from the health effects of climate change, and also provide multiple co-benefits for public health, including control of disease outbreak prevention and prevention of NCDs.

FIGURE 4. Building blocks of climate-resilient health systems (WHO 2015b)



D. Evidence gaps

It appears that the only additional scientific investigation of climate change-related health threats in RMI that has been conducted since the publication of WHO’s regional report in 2015 (WHO 2015a) and the corresponding research paper in 2016 (McIver et al. 2016) is a qualitative study of the links between climate change, migration and health in the context of RMI and its free association with the United States (van der Geest et al. 2020).

New research is needed, therefore, on climate change and related health effects and preventive measures in RMI. The most obvious priorities for such research include the main burden of ill-health in RMI, namely NCDs. A possible topic for research would be an in-depth exploration of the relationships between NCDs, food security, increased temperature and more severe

extreme weather events. A focus on community knowledge, attitudes and practices and an evaluation of adaptive capacity and resilience factors in RMI would also be valuable additions to the evidence base. Such evidence is emerging from other PIDCs, such as Vanuatu (Savage et al. 2020b), but those findings are not necessarily generalizable to the context and culture of RMI.

An additional area of much-needed research in the region is the relationship between climate change and mental health and well-being. A recent study in Tuvalu demonstrated significant levels of anxiety and stress related to climate change – findings that are likely applicable to RMI (Gibson et al. 2020).

Table 2 provides a summary of the health issues/risks, evidence gaps, and short and long-term adaptation needs in RMI, based on the rapid literature review carried out as part of the development of NCCHP v2.

TABLE 2. Climate change and health risks, and related adaptation needs and priorities in RMI

Health Issue	Risk (i.e. likelihood x impact) posed by climate-sensitive disease in RMI	Needs / Gaps	Adaptation strategies
Vector-borne diseases (VBDs)	High	<ul style="list-style-type: none"> → Longstanding misconceptions and lack of preparedness regarding threats posed by VBDs 	<ul style="list-style-type: none"> → Significant strengthening is required in this area, given the impact of previous outbreaks → Mosquito surveillance and control as well as community education and environmental health training will all be part of these essential processes.
Diarrhoeal diseases (including water- and food-borne illnesses)	High	<ul style="list-style-type: none"> → Inadequate hospital preparedness for responding to an outbreak of water-borne illnesses → Limited public understanding/ awareness re: risks of water-borne disease transmission → Lack of strong coordination/ communication between MOHHS and EPA → Lack of access to clean drinking water and/or water catchments → Inadequate sewage treatment facilities (worse in Ebeye) → Lack of high-quality food-handling standards/regulations → Lack of understanding on the part of the public regarding safe food preparation and handling 	<ul style="list-style-type: none"> → Rotavirus vaccination to infants → Health promotion and community education regarding clean drinking water, sanitation and hygiene → Train and improve the skills of health assistants in the treatment of patients with water-borne diseases → Improve water quality testing, food safety inspections and sewage treatment practices
NCDs, obesity, malnutrition and stunting	High	<ul style="list-style-type: none"> → Lack of adequate consumption of healthy, nutritious, local foods → Lack of food choices (due to imported foods, processed foods and cost considerations) → Low levels of physical activity 	<ul style="list-style-type: none"> → Strengthen weight loss and physical activity programs, including community-based healthy lifestyle and physical activities → Build partnerships with other public, private and non-governmental organizations → Provide educational materials and information on local foods that are healthy and nutritious → Improve control of tobacco, alcohol and betel nut → Promote better nutrition, including subsidising sales of healthy foodstuffs

Health Issue	Risk (i.e. likelihood x impact) posed by climate-sensitive disease in RMI	Needs / Gaps	Adaptation strategies
Mental ill-health	High	<ul style="list-style-type: none"> → MOHHS not sufficiently resourced to deal adequately or appropriately with patients with mental health issues → Lack of trained counsellors and other mental health professionals → Lack of community awareness regarding manifestations, prevention and management of mental health problems → Anxiety is an overlooked factor. It came up in the initial survey and discussions in RMI in January 2020 	<ul style="list-style-type: none"> → Hire mental health professional staff → Create mental health policies and treatment guidelines → Conduct crisis assessment and treatment → Provide outpatient consultations and counseling → Conduct outreach visits in Majuro, outer atolls, schools, and various communities → Develop information, education and communication materials on the services available → Coordinate with other medical departments and/or countries to strengthen psychiatric evaluation and treatment services
Respiratory diseases (TB and COVID-19)	High	<ul style="list-style-type: none"> → Lack of sufficient funds/ resources for adequate management of TB in the community → Lack of public understanding re: symptoms/signs of TB and risks of transmission, with associated stigma → Lack of strong, well-coordinated primary health program for TB → High rates of household overcrowding and poor ventilation → Respiratory disease is related to health infrastructure and malnutrition and is also linked to diabetes → One of top 10 diagnoses in RMI; immunization levels still low → COVID-19 may affect perceptions of food security, food safety, hygiene issues → Maybe less relevant to climate change, but complementary to other plans and health priorities 	<ul style="list-style-type: none"> → Strengthen vaccination programs (i.e. for TB, influenza and pneumonia). → Strengthen health promotion and prevention, early detection and adequate management of TB → Reduce outdoor and indoor air pollutants (including cigarette smoke) → Improve environmental, occupational and personal hygiene (handwashing, surface disinfection, water quality)

Health Issue	Risk (i.e. likelihood x impact) posed by climate-sensitive disease in RMI	Needs / Gaps	Adaptation strategies
Measles	High	<ul style="list-style-type: none"> → Measles outbreaks can be deadly in countries experiencing or recovering from a natural disaster → Damage to health infrastructure and health services interrupts routine immunization → Overcrowding greatly increases the risk of infection → One of top 10 diagnoses in RMI; immunization levels still low → Maybe less relevant to climate change, but complementary to other plans and health priorities. 	<ul style="list-style-type: none"> → Have routine measles vaccination for children, combined with mass immunization campaigns – key public health strategies to prevent measles outbreaks → Maintain high vaccination coverage rates of the complete range of childhood vaccinations offered routinely in RMI
Traumatic injuries and deaths from extreme weather events	High/Medium	<ul style="list-style-type: none"> → This is potentially a high impact risk. MOHHS has limited capacity in terms of necessary medical supplies, pharmaceuticals, procedures, human and financial resources to react to injuries or deaths caused by extreme weather events (including stockpiled supplies, etc.) → MOHHS has a disaster plan, but not enough of the key people are aware of this plan (e.g. medical/nursing staff) 	<ul style="list-style-type: none"> → MOHHS to review and update plans regarding safe storage of medical supplies and equipment (i.e. surge capacity planning) → Disaster training for health and other staff
Ciguatera	Medium	<ul style="list-style-type: none"> → Lack of public understanding re: risks of transmission, recognition of symptoms, etc. → Anecdotal reports suggest that most cases of ciguatera are reported from Ailinglaplap and Jaluit → It could become more of a problem in the future 	<ul style="list-style-type: none"> → Health promotion and community education
Other effects, including temperature related effects and sun exposure	Medium/Low	<ul style="list-style-type: none"> → Lack of estimates of heat-related mortality and morbidity → Lack of evidence of productivity loss due to extreme heat → Lack of public understanding of risks of excessive sun exposure 	<ul style="list-style-type: none"> → Health promotion and community education → Adaptation in the built environment to avoid overheating through shading and other passive cooling methods

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