



Maldives Green Climate-Smart Hospitals

Hospital Vulnerability Analysis and Report

Co-Produced by the World Health Organization and Health Care Without Harm



World Health Organization and Health Care Without Harm

Maldives Green Climate-Smart Hospitals: Hospital Vulnerability Analysis and Report

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Forward

Climate change is happening in real time and is occurring swifter than the current response. It threatens to overwhelm the world's health systems and health of the people. As a small island nation, the Maldives are on the front line of these impacts. The country is particularly vulnerable to sea level rise, storm intensity, flooding and outbreak of vector borne diseases. As a first responder, the country's national health system needs to cope with the onslaught, be able to provide health care and contribute to reduce the carbon print of the health sector.

Maldives Green Climate-Smart Hospital Policies and Strategies Report and Maldives Green Climate-Smart Hospital Vulnerability Analysis and Report is a collaborative project between Government of Maldives, Health Care Without Harm, and World Health Organization, Maldives. These documents provide frameworks for healthcare facilities in the Maldives to provide low-carbon, environmentally sustainable health care services on an ongoing basis that are resilient to the impacts of climate change and related emergencies. We want to also mention that the strategies are one of the first of its kind and can support green health development of Maldives and can be adopted in other small island states.

These reports encapsulate the work of and input from many people in the Maldives, and global knowledge. The collective wisdom attempts to provide solutions to a diversity of issues driven or exacerbated by climate change.

As the next steps, we encourage that the concept is discussed with relevant stakeholders, and used as reference to plan future expansion of the health sector or during renovation. It can guide hospitals in the Maldives to become champions in protecting people's health from climate change and reduce carbon foot print of the health sector.



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Maldives Green Climate-Smart Hospitals: Hospital Vulnerability Analysis and Report describes ways in which the healthcare system and public health contribute to climate change, be affected by effects of climate change and become more resilient to the impacts of climate change. It includes site assessments of a range of facilities representing the tiers of the Maldivian health care system, The assessments focus climate-smart and environmentally friendly health care.

Maldives Green Climate-Smart Hospitals: Policies and Strategies describes ways in which healthcare facilities can mitigate their contribution to climate change, and provide environmentally sustainable healthcare services on an ongoing basis by being resilient to the impacts of climate change.

These reports are the result of a project commissioned by WHO for Health Care Without Harm to provide technical support to develop a Green, Climate Smart Hospital Policy and Strategy for the Maldives. The Maldives Health Protection Agency (HPA) requested this technical assistance to facilitate HPA's initiative to pilot a green, climate-smart health facilities program in the Maldives. Health Care Without Harm was selected to conduct this project based on HCWH's 22-years of experience in sustainable health care, including a long collaborative relationship with WHO. The project focused on a review of existing Maldives policies and related national and international documents and studies, on-site visits and initial assessments of seven typical Maldives health care facilities from 1 July 2018 through 6 July 2018. It also included meetings with WHO, Maldives Ministry of Health, Maldives Health Protection Agency, Maldives Ministry of Environment and Energy and key stakeholders.

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Executive Summary | Hospital Vulnerability Analysis Report

This report and the companion policy report are jointly produced by the World Health Organization (WHO) and Health Care Without Harm (HCWH).

Maldives Green Climate-Smart Hospitals: Hospital Vulnerability Analysis and Report describes ways in which the healthcare system and public health can contribute to climate change, and be affected by acute and chronic effects of climate change and become more resilient to the impacts of those changes. It includes site assessments of a range of facilities representing the tiers of the Maldivian health care system. The assessments focus on climate-smart and environmentally friendly health care. This report is a joint production of the World Health Organization (WHO) and Health Care Without Harm (HCWH).

Maldives Green Climate-Smart Hospitals: Policies and Strategies Report describes ways in which healthcare facilities can mitigate their contribution to climate change, and provide environmentally sustainable healthcare services on an ongoing basis by being resilient to the impacts of and in the face of climate change and related emergencies.

Climate Change is a Health Issue

With increased frequency and severity of extreme weather events like drought, flood and storms, heat stress, increasing vector-borne diseases and sea level rise,¹ climate change is a health issue now and into the future. As the World Health Organization (WHO) summarized: “Climate change is much more than an environmental issue. It poses a serious threat to our health and survival. It impacts all of us, no matter where we live.”²

The Maldives is Vulnerable to Climate Change Impacts

Small island nations are particularly vulnerable to the sea level rise and extreme weather events.³ The Maldives is particularly vulnerable to flooding and rising sea levels driven by climate change. Even a one-meter rise in sea-level could threaten the ability to inhabit most of the country’s islands.⁴ Extreme weather coupled with sea level rise can generate storm surges with flooding that could quickly overwhelm island infrastructure and significantly impact health care service delivery in emergencies. Like other health facilities around the world, hospitals and health centers in the Maldives are particularly vulnerable to the impacts of climate change, as they protect the health of their communities during and after these natural disasters.

Green Climate-Smart Health Facilities Solutions

Hospitals and health systems can both build resilience (adaptation) while reducing their own climate impact (mitigation) by implementing a “climate-smart” approach that focuses on both resilience and mitigation.⁵ By also

¹ IPCC, 2014: Climate Change 2014: Synthesis Report. Contribution of Working Groups I, II and III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change [Core Writing Team, R.K. Pachauri and L.A. Meyer (eds.)]. IPCC, Geneva, Switzerland,

² Bulletin of the World Health Organization 2018;96:78-78A. doi: <http://dx.doi.org/10.2471/BLT.17.206474>

³ Climate Change and Health in Small Island Developing States: WHO Special Initiative in collaboration with UNFCCC Secretariat and Fijian Presidency of COP-23 (<http://www.who.int/globalchange/sids-initiative/about/en/>)

⁴ MEE. (2017). State of the Environment 2016, Ministry of Environment and Energy (<http://www.environment.gov.mv/v2/wp-content/files/publications/20170202-pub-soe-2016.pdf>)

⁵ Bouley, Timothy; Roschnik, Sonia; Karliner, Josh; Wilburn, Susan; Slotterback, Scott; Guenther, Robin; Orris, Peter; Kasper, Toby; Platzer, Barbara Louise; Torgeson, Kris. 2017. Climate-smart healthcare : low-carbon and resilience strategies for the health sector (English). Investing in climate change and health series. Washington, D.C. : World Bank Group. (<http://documents.worldbank.org/curated/en/322251495434571418/Climate-smart-healthcare-low-carbon-and-resilience-strategies-for-the-health-sector>)

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incorporating “green” environmental sustainability elements, such as the 10 components of the Global Green and Healthy Hospitals Agenda⁶, Hospitals can be “Green climate-smart health facilities.”

Green, Climate-Smart Health Care

By adopting a green, climate-smart approach to providing health care, health care facilities can adapt to climate change, reduce carbon emissions, air and water pollution, promote sustainable use of resources, manage waste and reduce the use of toxic chemicals.

Green, climate-smart health care focuses on:

1. Implementing the **resilience** components of climate smart healthcare
2. Implementing the **low-carbon** (mitigation) component of climate smart health care
3. Implementing an overarching **green** health care framework that protects local health and the environment.

1. Climate Resilient Health Care Facilities are structurally and functionally able to withstand the impacts of all types of natural hazards and mitigate the impacts of climate change enabling them to operate without interruption to safely shelter patients in place; provide key ambulatory and community health services during and following extreme weather, or other natural disasters.

2. Low-Carbon Health Care Facilities reduce their carbon footprint through energy efficient building design, mechanical and electrical systems, building operations, clean renewable energy generation and implementation of low-carbon procurement, transportation, food, water and waste management activities.

3. Green and Healthy Hospitals protect the lives and health of patients, health workers and their communities by reducing their environmental footprint while maintaining clinical excellence.

⁶ Health Care Without Harm, Josh Karliner, Robin Guenther, Global Green and Healthy Hospitals Agenda, 2011 (<http://www.greenhospitals.net/sustainability-goals/>)

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Criteria for the vulnerability assessments are based on the WHO model for climate resilient health systems,⁷ the World Bank Climate-Smart Healthcare, Low-Carbon and Resilience Strategies for the Health Sector⁸ and HCWH's Global Green and Health Hospitals (GGHH) Agenda⁹ 10 sustainability goal areas:

- Leadership – prioritize environment health
- Chemicals – substitute harmful chemicals with safer alternative
- Waste – reduce, treat and safely dispose of health care waste
- Energy – implement energy efficiency and clean renewable energy generation
- Water – reduce health facility water consumption and supply potable water
- Transportation – improve transportation strategies for patients and staff
- Food – purchase and serve sustainably grown, health food
- Pharmaceuticals – safely manage and dispose of pharmaceuticals
- Buildings – support green and healthy hospital design and construction
- Purchasing – buy safer and more sustainable products, materials and services

⁷ WHO, 2015, Operational framework for building climate resilient health systems, Geneva: World Health Organization. (<http://www.who.int/globalchange/publications/building-climate-resilient-health-systems/en/>)

⁸ Bouley, Timothy; Roschnik, Sonia; Karliner, Josh; Wilburn, Susan; Slotterback, Scott; Guenther, Robin; Orris, Peter; Kasper, Toby; Platzer, Barbara Louise; Torgeson, Kris. 2017. Climate-smart healthcare : low-carbon and resilience strategies for the health sector (English). Investing in climate change and health series. Washington, D.C. : World Bank Group. (<http://documents.worldbank.org/curated/en/322251495434571418/Climate-smart-healthcare-low-carbon-and-resilience-strategies-for-the-health-sector>)

⁹ Health Care Without Harm, Josh Karliner, Robin Guenther, Global Green and Healthy Hospitals Agenda, 2011 (<http://www.greenhospitals.net/sustainability-goals/>)

Overview | Climate Change and Climate-Smart Health Care

Climate change impacts health around the world today and into the future. The Intergovernmental Panel on Climate Change (IPCC) identifies numerous climate change health risks associated with increased frequency and severity of extreme weather events like drought, flood and storms, heat stress and increasing vector-borne diseases¹⁰. As the World Health Organization (WHO) summarized: “Climate change is much more than an environmental issue. It poses a serious threat to our health and survival. It impacts all of us, no matter where we live. The health of humanity is directly related to the health of our environment. We depend on our environment for everything we are and everything we have – the air we breathe, the food we eat and the water we drink.”¹¹ The Maldives in its unique context is increasingly faced with new challenges such as the growing menace of noncommunicable diseases and vulnerability to climate change, among others.¹²

Being a low-lying island nation, the Maldives is particularly vulnerable to flooding and rising sea levels driven by climate change. Even a one-meter rise in sea-level could threaten the habitability of most of the country’s islands.¹³ In addition, increasing extreme weather coupled with sea level rise can generate storm surges with flooding that could quickly overwhelm island infrastructure and significantly impact health care service delivery in emergencies.

As first responders, health systems are particularly vulnerable to the impacts of climate change, as they protect the health of their communities during and after these natural disasters. As major consumers of energy, water and products, hospitals and health centers also contribute to climate change as well. Hospitals and health systems can both build resilience (adaptation) while reducing their own climate impact (mitigation) through a “climate-smart” approach. Improving the resilience of health care facilities enables them to continue to provide essential health services during floods and increased storms and droughts brought on by climate change. Health facilities can also play a significant role in reducing pollution, promoting sustainable use of resources, managing waste and reducing the use of toxic chemicals. By adopting a green, climate-smart approach to providing health care, the health sector can build resilience, mitigate its own climate impacts and provide a model for improving community health and wellbeing.

Building on the Global Green and Healthy Hospitals (GGHH) Agenda, the WHO model for climate resilient health systems and other climate-smart health care programs; Health Care Without Harm is assisting WHO and the Maldives Health Protection Agency to develop the Maldives Green, Climate-Smart Hospital Policy and Strategy. This document provides a foundation for the policy discussion by assessing specific vulnerabilities of the Maldives health system.

Vulnerabilities were assessed in relation to concepts of climate smart healthcare elaborated by WHO, the World Bank and HCWH. These are described in more detail in the Policy Document.

¹⁰ IPCC, 2014: Climate Change 2014: Synthesis Report. Contribution of Working Groups I, II and III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change [Core Writing Team, R.K. Pachauri and L.A. Meyer (eds.)]. IPCC, Geneva, Switzerland

¹¹ Bulletin of the World Health Organization 2018;96:78-78A. doi: <http://dx.doi.org/10.2471/BLT.17.206474>

¹² Maldives-WHO Country Cooperation Strategy 2018-2022, ISBN 3 670 9022 92 978, Forward, Dr. Arvind Mathur, WHO Representative to the Republic of Maldives

¹³ MEE. (2017). State of the Environment 2016, Ministry of Environment and Energy (<http://www.environment.gov.mv/v2/wp-content/files/publications/20170202-pub-soe-2016.pdf>)

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As illustrated in the diagram below, WHO identifies 10 components for building climate resilience in health systems. Starting from health sector building blocks, the operational framework elaborates on 10 components that together provide a comprehensive approach to integrating climate resilience into existing health systems.



Source: World Health Organization (WHO) Operational framework for building climate resilient health systems¹⁴

¹⁴ WHO, 2015, Operational framework for building climate resilient health systems, Geneva: World Health Organization. (<http://www.who.int/globalchange/publications/building-climate-resilient-health-systems/en/>)

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The Global Green and Health Hospitals (GGHH) Agenda framework consists of 10 interconnected goals to enable health facilities to achieve greater sustainability and contribute to improved public health.

The 10 Global Green and Healthy Hospitals Goal Areas¹⁵



Leadership

Prioritize environmental health



Transportation

Improve transportation strategies for patients and staff



Chemicals

Substitute harmful chemicals with safer alternatives



Food

Purchase and serve sustainably grown, healthy food



Waste

Reduce, treat and safely dispose of healthcare waste



Pharmaceuticals

Safely manage and dispose of pharmaceuticals



Energy

Implement energy efficiency and clean, renewable energy generation



Buildings

Support green and healthy hospital design and construction



Water

Reduce hospital water consumption and supply potable water



Purchasing

Buy safer and more sustainable products and materials

Source: *Global Green and Healthy Hospitals Agenda, A Comprehensive Environmental Health Agenda for Hospitals and Health Systems Around the World*¹⁶

¹⁵ Health Care Without Harm, Josh Karliner, Robin Guenther, Global Green and Healthy Hospitals Agenda, 2011 (<http://www.greenhospitals.net/sustainability-goals/>)

¹⁶ Health Care Without Harm, Josh Karliner, Robin Guenther, Global Green and Healthy Hospitals Agenda, 2011 (<http://www.greenhospitals.net/sustainability-goals/>)

Green Climate-Smart Health Care

A green climate-smart health care policy focuses on both environmental sustainability (green) and low-carbon, climate change resilient (climate-smart) health care. It provides a set of activities and interventions to achieve natural disaster resilience, climate change adaptation, carbon footprint reduction and improved environmental sustainability.

Resilient Health Care Facilities are structurally and functionally able to withstand the impacts of all types of natural hazards and mitigate the impacts of climate change. Hospitals must be able to operate without interruption to safely shelter patients in place; provide key ambulatory and community health services and must be able to quickly recover and reopen following extreme weather, or other natural disasters. The Maldives Health Master Plan encourages the development of resilient health care facilities in Strategic Focus Area 3.6, Establish capacity for health and medical response in national disasters and emergencies.¹⁷

Low-Carbon Health Care Facilities reduce their carbon footprint through energy efficient building design, mechanical and electrical systems, building operations and clean renewable energy generation. They also implement policies and procedures to reduce the carbon footprint of their procurement, transportation, food, water and waste management activities.

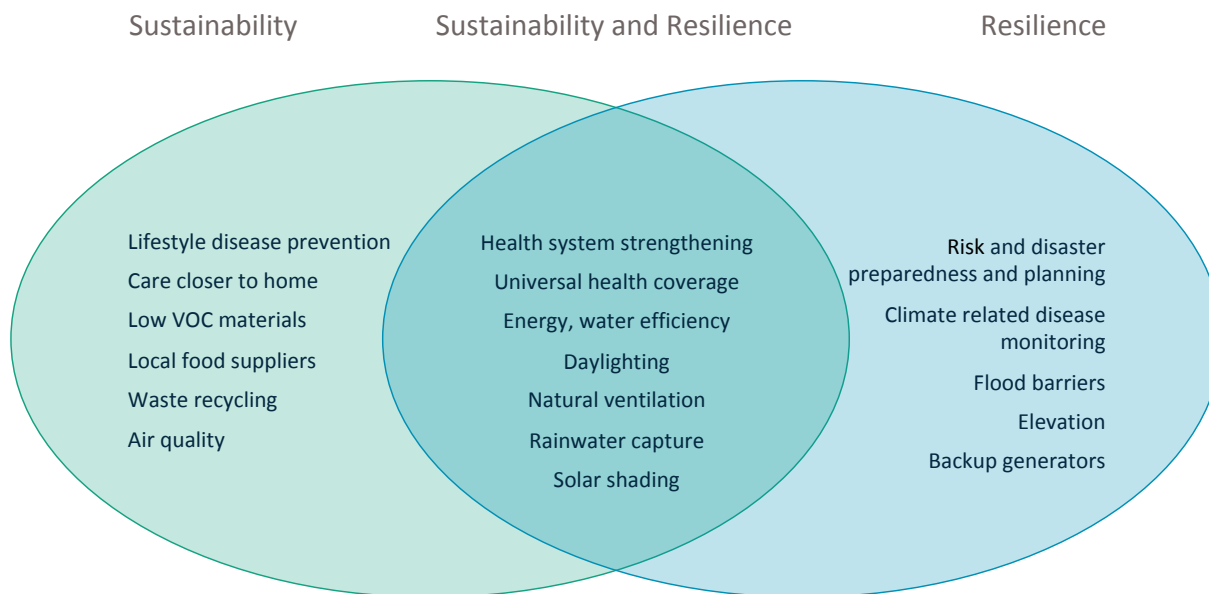
There is a strong connection between resilience to climate change and mitigation of Health Care's contribution to carbon emissions. As UNDP summarizes: "Adaptation to climate change remains the key priority for small island developing states (SIDS). At the same time, activities which reduce fossil fuel dependency and increase electricity services are vital for SIDS to meet their sustainable development objectives, especially on energy security."¹⁸

As illustrated in the diagram below, hospitals and health centers are finding that many of the environmental sustainability actions and climate change mitigation measures overlap with climate change adaptation and resilience actions, resulting in green, climate-smart low-carbon resilient health care.

¹⁷ Health Master Plan 2016-2025, Ministry of Health, Republic of Maldives, ISBN: 978-99915-66-50-4, p40

¹⁸ UNDP Responding to Climate Change in Small Island Developing States, UNDP, 2010 by: United Nations Development Programme (UNDP) (<https://sustainabledevelopment.un.org/index.php?page=view&type=400&nr=960&menu=1515>)

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There is an overlap with environmental sustainability actions and climate change mitigation and resilience measures, resulting in green, climate-smart low-carbon resilient health care.

Source: World Bank Climate-Smart Healthcare, Low-Carbon and Resilience Strategies for the Health Sector¹⁹

Green Health Care Facilities protect the lives and health of patients, health workers and their communities by reducing their environmental footprint in each of the Global Green and Health Hospitals (GGHH) 10 sustainability goal areas.

The need to obtain the best and most environmentally favorable products and services should be brought together in a national green procurement policy, in line with international efforts to save lives sustainably²⁰.

Health care can also protect public health by fostering more sustainable transportation systems. Efficient/low emission vehicles and boats should be purchased for patient and staff transportation and staff should be encouraged to work or cycle to work, to reduce fossil fuel use, reduce air pollution, and to increase health-promoting exercise.

¹⁹ Bouley, Timothy; Roschnik, Sonia; Karliner, Josh; Wilburn, Susan; Slotterback, Scott; Guenther, Robin; Orris, Peter; Kasper, Toby; Platzer, Barbara Louise; Torgeson, Kris. 2017. Climate-smart healthcare: low-carbon and resilience strategies for the health sector (English). Investing in climate change and health series. Washington, D.C. : World Bank Group. <http://documents.worldbank.org/curated/en/322251495434571418/Climate-smart-healthcare-low-carbon-and-resilience-strategies-for-the-health-sector>

²⁰ United Nations Informal Interagency Task Team on Sustainable Procurement in the Health Sector (SPHS) : <https://savinglivesustainably.org/>

Section I | Health Facilities Vulnerabilities

Vulnerability of Health Facilities to Natural Hazards and the impacts of Climate Change

The Lancet Commission characterized climate change as both the “biggest global health threat” and “the greatest global health opportunity” of the 21st century.²¹ Climate change is already damaging human health and will have a greater impact in the future, disproportionately impacting vulnerable populations. Health care is at the frontline of climate change, bearing the costs of increased diseases and vulnerability to frequent extreme weather events.

The WHO reports that: “Although all populations are at risk, some are more vulnerable than others. Small Island Developing States (SIDS) are in the front line, encapsulating the range of acute to long-term risks, from more extreme floods and storms, to increased risks of water-, vector- and food-borne infectious diseases, and other communicable and non-communicable diseases, to sea-level rise threatening fragile healthcare facilities, mainly but not exclusively, situated in coastal areas.”²²

As a low lying island nation, the Maldives are particularly vulnerable sea level rise caused by climate change and the increases in the frequency and intensity of storms. The gaps in preparedness to manage the health risks of climate change will need to be addressed incorporating the contextual social vulnerabilities of the respective communities.²³ Healthcare facilities are critical infrastructure, with far-reaching consequences for public health should they be impacted.

Sea level rise associated with climate change and the increased possibility of land undulation that it brings poses a significant threat to Maldives. The small size and low elevation of the islands increase the vulnerability to coastal hazards and flooding.²⁴

The use of fossil fuel to generate electricity and power motor vehicles results in greenhouse gas emissions and air pollution which also generate health vulnerabilities.

Air quality in the Maldives is generally considered good, as the sea breeze flushes air masses over the small islands easily. However, the capital city of Male’ is facing increased air pollution due to growth of land and sea vessels, diesel power generation, construction and open-burning in the neighboring waste-island Thilafushi.^{25,26} Air pollution is also threatened by various forms of waste burning practiced or planned in different parts of the country. Small islands burn medical and municipal waste in the open. Resort islands have small batch incinerators without air pollution controls. Waste is routinely burned in an uncontrolled fashion at small uncontrolled landfills, and the large Male’ region landfill on Thilafushi Island. As well as creating pollution, waste burning accounts for

²¹ Watts, Nadger, WN, Agnolucci, P *et al.*, Health and climate change: policy responses to protect public health. Lancet. 2015; (published online June 23.) (published online June 23.) [http://dx.doi.org/10.1016/S0140-6736\(15\)60854-62](http://dx.doi.org/10.1016/S0140-6736(15)60854-62)

²² Climate Change and Health in Small Island Developing States: WHO Special Initiative in collaboration with UNFCCC Secretariat and Fijian Presidency of COP-23 (<http://www.who.int/globalchange/sids-initiative/about/en/>)

²³ Sen Banalata, Dhimal Meghnath, Latheef Aishath Thimna, Ghosh Uasona. Climate change: health effects and response in South Asia BMJ 2017; 359 :j5117

²⁴ MEE. (2017). State of the Environment 2016, Ministry of Environment and Energy (<http://www.environment.gov.mv/v2/wp-content/files/publications/20170202-pub-soe-2016.pdf>)

²⁵ MEE. (2017). State of the Environment 2016, Ministry of Environment and Energy (<http://www.environment.gov.mv/v2/wp-content/files/publications/20170202-pub-soe-2016.pdf>)

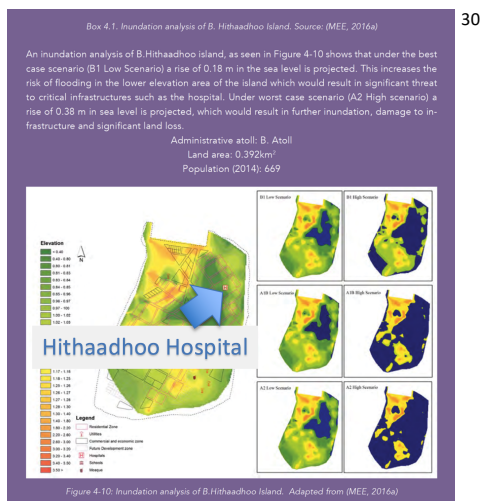
²⁶ Ibrahim, H.E.A.N. & Mathur, A. (2017) Climate change and health in the Maldives: protecting our common future. WHO South-East Asia Journal of Public Health 6(2): 1-2

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15% of the Maldives' carbon emissions. A plan for four incinerators has been proposed.²⁷ Controlling air pollution from incinerators requires installation, maintenance and close monitoring of air pollution control devices. The most efficient and least polluting mode of operation for incinerators is to operate around the clock, so construction of incinerators creates an ongoing demand for waste, thus creating a disincentive to reduce and recycle waste, strategies which create the least air pollution and greenhouse gas emissions. In theory, energy can be reclaimed from incineration of waste, but data from the US Energy Information Administration indicates that this is both more expensive and more polluting than any other form of energy generation.²⁸ Investment should instead be focused on waste reduction, sustainable waste disposal methods, and creating infrastructure for recycling materials such as paper for which there is a viable local use.

Sea Level Rise Vulnerabilities

Due to the small size of the islands, the whole land area is considered as a coastal zone. Over 80% of the total land area of the Maldives is less than one meter above mean sea level.²⁹



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Flood mapping from the Maldives Ministry of Environment and Energy State of the Environment 2016 Report with an overlay pointing to the location of the Hithaadhoo Hospital highlighting the low ground elevation and the proximity to the coast.

Source: Maldives Ministry of Environment and Energy State of the Environment 2016 Report

For example, Hithaadhoo Hospital is located, as many hospitals and health centers are throughout the Maldives, on low-lying land near the coast and is vulnerable to flooding from sea level rise, and the increased extreme weather events, such as tsunamis, cyclones/thunderstorms, and storm surges, as identified in the Disaster Risk Profile of Maldives done in 2006. (UNDP, 2006)³¹

²⁷ Lorson, H. and Kaserli, C. (2015) Decentralised waste incineration plant R. Vandhoo in the north of the Maldives – Project experience, energy use and first operating results. IRRCC Waste to Energy Conference, Vienna, October 2015, 12pp, http://www.vivis.de/phocadownload/Download/2015_wm/2015_WM_179-190_Lorson.pdf

<https://azdoc.site/queue/irrc-waste-to-energy-october-12-and-13-2015-vienna-marriott.html>

²⁸ U.S. Energy Information Administration 2013 Updated capital costs estimates for utility scale electricity generating plants. Pub: U.S. Department of Energy, 201pp, https://www.eia.gov/outlooks/capitalcost/pdf/updated_capcost.pdf

²⁹ MEE. (2017). State of the Environment 2016, Ministry of Environment and Energy (<http://www.environment.gov.mv/v2/wp-content/files/publications/20170202-pub-soe-2016.pdf>)

³⁰ MEE. (2017). State of the Environment 2016, Ministry of Environment and Energy (<http://www.environment.gov.mv/v2/wp-content/files/publications/20170202-pub-soe-2016.pdf>)

³¹ UNDP (2006) Disaster risk profile of the Maldives, United Nations Development Programme

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Hospitals and health centers are vulnerable to **risk of inundation and flooding** because they are frequently located near the coast on low lying land. Flooding from sea level rise, tsunamis and cyclones generate multiple vulnerabilities for health care facilities that can be characterized as:

- Facility Structural Vulnerabilities
- Facility Non-Structural Vulnerabilities
- Infrastructure Vulnerabilities, such as damage to energy and clean water supplies
- Organizational Vulnerabilities.

The impacts of these interrelated vulnerabilities are described in more detail below.

Climate Change Health Facility Vulnerabilities

Facility Structural Vulnerabilities

Structural vulnerabilities occur when the structural elements of the facility, such as foundations, walls, floors, columns, beams and vertical circulation elements such as stairs or elevators are damaged or destroyed. Structural damage can result from high storm winds and waves that apply lateral forces to the building that exceed the building's structural capacity. Structural damage can also occur from flooding and flood drainage that undermines the soil beneath the building. Often the design of these structural components is guided by building codes. However, building codes often address minimal safety requirements and don't guarantee that the facility will be able to withstand unanticipated extreme events, or they focus on life safety and not whether the building will be able to remain operational during and after extreme natural disaster events.

Facility Non-Structural Vulnerabilities

The ability of a health-care facility to remain operational during and after a natural disaster can be impacted by many non-structural vulnerabilities. Damage to non-structural building elements, such as walls, windows, roofs, which enable wind and water damage to occur from storms or flooding can severely compromise the facility's operations and the safety of staff and patients. Damage to building equipment and infrastructure also impact the operational capabilities of the facility. Ventilation systems can be particularly vulnerable, in health care facilities, such as large hospitals that have central ventilation and cooling systems, where one system supports the whole building. Roof-mounted ducts and air conditioning equipment is susceptible to damage from airborne debris and high winds. In addition, buildings that use central ventilation systems often have multiple interior rooms and sealed (non-operable) windows making them particularly vulnerable because they don't have backup systems for ventilation, such as opening windows and are dependent on the availability of electricity to be inhabitable.

Infrastructure Vulnerabilities

Health care facilities are also vulnerable to disruption or failure of infrastructure systems, such as electricity and water supplies and disposal of sewage and waste. As with facility structural and non-structural vulnerabilities, infrastructure vulnerabilities can also cripple or disable a health facility's ability to remain operational during, and after, a natural disaster.

Infrastructure Vulnerabilities - Energy

With year-round consistently warm weather, health facilities in the Maldives generally have little or no space heating requirements. This results in electricity providing most of the energy requirements of hospitals and health centers. Depending on the size of the island, many hospitals and health centers get their electricity from a central

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public provider of electricity. During a natural disaster the reliability of electricity being available is dependent on the quality and resilience of electricity generation and distribution systems during and after the event.

In preparation for natural disasters, most of the hospitals and health centers visited in the facility assessment have backup emergency generators that are powered by diesel fuel, the most common form of energy resilience currently used by hospitals. The quantities of fuel stored on site and the elevation of the generators are also components of the facility's vulnerability when losing electrical grid power during and after natural disasters, as ongoing supplies of diesel fuel can be disrupted by damaged ports or roads. Recent surveys of diesel backup systems in the U.S. documented high failure rates of on-site hospital diesel generators; generators must be rigorously maintained and tested to ensure that they will work for extended periods of time. Using diesel fuel for generating electricity also contributes to air pollution vulnerabilities. Diesel fuel is a known human carcinogen,³² short-acting climate pollutant and contributes to air pollution with particulates of 2.5 microns and smaller.³³ The amount of diesel available is also a factor in the resilience of facilities. Some had storage only for two days of reduced operation, leaving them vulnerable in the case of an extended emergency, or one that impacted the fuel delivery system.

Infrastructure Vulnerabilities - Water Resources

The Maldives rely on groundwater from fresh water lenses, harvested rainwater stored in tanks and desalinated water. Groundwater depletion, contamination through poor sewage disposal, and saltwater intrusion threaten the Maldives' water resources. Future regional climate change scenarios show that the Maldives will experience high intensity monsoonal rainfall events, while the number of rainy days are likely to decrease, increasing the risk of drought. This impacts the availability of rainwater for communities as a source of water. While availability is a primary issue of concern, another important consideration is the quality of rainwater collected. It is reported that rainwater collected in community tanks were contaminated with *Escherichia coli* bacteria and air pollutants, and toxoplasmosis is also associated with harvested rainwater,³⁴ raising concern for the spread of diseases, especially during emergency situations and floods.³⁵

"Key drivers that impact groundwater in the Maldives are climate and hydrology, sea level movement, island stratification and permeability, as well as human activities. Inundation of land and associated saltwater intrusion would reduce the available fresh groundwater in islands. The porous soil structure of the island further adds to this vulnerability making groundwater vulnerable to pollution by solid waste and other pollutants."³⁶

As sea level rises it could compress the already narrow, freshwater lenses that float on the seawater within the porous soil, further reducing the quantity of fresh water available and increasing the risk of salt water intrusion.

³² IARC (2012) Diesel and gasoline engine exhausts and some nitroarenes. IARC Monographs on the Evaluation of Carcinogenic Risks to Humans Vol 105, publ. International Agency for Research on Cancer, Lyon, 714pp. <http://publications.iarc.fr/Book-And-Report-Series/Iarc-Monographs-On-The-Evaluation-Of-Carcinogenic-Risks-To-Humans/Diesel-And-Gasoline-Engine-Exhausts-And-Some-Nitroarenes-2013>

³³ World Health Organization <http://www.who.int/sustainable-development/cities/health-risks/climate-risks/en/> ;

WHO Air Pollution (undated), Climate and Health Factsheet. 6pp. Accessed 19 August 2018 http://www.who.int/sustainable-development/AirPollution_Climate_Health_Factsheet.pdf

³⁴ Maldives Water and Sanitation Authority (2005) Rainwater harvesting and its safety in Maldives; a pilot study conducted in laamu Atoll Gan, Maldives - 2005, 6pp, <http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.738.4471&rep=rep1&type=pdf>

³⁵ MEE. (2017). State of the Environment 2016, Ministry of Environment and Energy (<http://www.environment.gov.mv/v2/wp-content/files/publications/20170202-pub-soe-2016.pdf>)

³⁶ MEE, (2016). Second National Communication of Maldives to the United Nations Framework Convention on Climate Change: Ministry of Environment and Energy (http://www.environment.gov.mv/v1/wp-content/blogs.dir/1/files/downloads/20161030-Pub-Second_National_Communication_of_Maldives.pdf)

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Decreases in clean groundwater and rainwater capture will likely increase requirements for desalinated water, which consumes diesel fuel in its production, resulting in additional greenhouse gas emissions and air pollution, and vulnerability of fuel availability during an emergency. Taken together, these vulnerabilities suggest that potable water conservation is a key priority.

Hospitals are generally both large consumers of potable water and, in many instances, are discharging pollutants, such as pharmaceutical waste, into wastewater. To reduce potable water consumption, hospitals can utilize non-potable water or implement water recycling for many process water uses, from sewage conveyance to laundry and irrigation. Ensuring domestic and facility-level rainwater harvesting continues in a safe manner will protect public health while also reducing fuel use and increasing resilience.

Organizational Vulnerabilities

In addition to facility and facility infrastructure vulnerabilities, operational vulnerabilities can also cripple a hospital or health center's ability to function during and after natural disasters. Organizational vulnerabilities include the ability of staff and patients to access the facility, as well as access to critical patient records, equipment and materials that may be stored in flood prone areas of the facility. Organizational vulnerabilities may include inadequate provisions for patient surges during or after an event, or the displacement of elderly or medically vulnerable populations who cannot return home. Hospitals and health centers' emergency or disaster plans should include plans for addressing these organizational vulnerabilities.

Duration of Emergency Vulnerabilities

A key component to disaster management planning is the duration of the disaster and the disruption of services it causes. In order to remain operational after a disaster, health facilities need to anticipate how long their back-up provisions, such as emergency food, water, fuel and other necessary materials will need to last before reliable resupply. In some instances, critical facilities will need to identify a second level of off-site backup to handle prolonged disruption to transportation infrastructure.

Human Health Vulnerabilities

Climate change impacts on public health. Dengue epidemics are influenced by variation in climate and even mental health is at risk from the impacts of climate change.³⁷

The Maldives produces an estimated 313,900 tonnes of general waste per annum, plus around 510 tonnes of healthcare waste.³⁸ Improperly treated healthcare waste is a potential source of infection, physical harm such as needle stick injuries, and pollution from chemicals and waste burning, with impacts on the health of staff, patients and the wider community.³⁹

Site assessments (see Section 4) confirmed numerous weaknesses previously identified in the healthcare waste management system⁴⁰ still remain and several healthcare professionals identified waste management as the most pressing environmental problem that they faced. Weakness identified by the 2016 healthcare waste management policy document and observed in the site visits include: lack of segregation and proper treatment; disposal without

³⁷ Ibrahim and Mathur (2016)

³⁸ Ibrahim and Mathur (2016)

³⁹ Harhay et al (2007) Health care waste management: a neglected and growing public health problem worldwide. *Tropical Medicine and International Health* 14(11): 1414-1417

⁴⁰ Ministry of Health (2016) National Healthcare Waste Management Policy. Publ: Maldives Ministry of Health, 15pp, [www.health.gov.mv/Uploads/Downloads//Informations/Informations\(68\).pdf](http://www.health.gov.mv/Uploads/Downloads//Informations/Informations(68).pdf)

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disinfection; drain disposal of liquid chemical waste; lack of adequate treatment for pharmaceutical waste; low temperature combustion of waste; lack of designated healthcare waste manager at facilities; and lack of well defined roles and responsibilities; lack of funding for healthcare waste management; poor availability of spare parts for healthcare waste management and lack of monitoring and evaluation of waste management.

Only the privately operated healthcare facilities visited during the research for this report had autoclaves for treating infectious waste. Instead, government healthcare facilities either burned it locally or sent it, untreated, for disposal via the municipal system. Unsafe treatment of healthcare waste leaves populations vulnerable to occupational, environmental and public health threats.⁴¹ The Healthcare Waste Management Policy also points to health and environment vulnerabilities from improper treatment and disposal and low temperature combustion.⁴²

The majority of municipal waste is burned, most notably at Thilafushi island close to Male'.⁴³ Burning both municipal and healthcare waste are significant sources of persistent organic pollutants, including the highly toxic dioxins and furans, into the environment.⁴⁴ The Stockholm Convention on Persistent Organic Pollutants (www.pops.int), to which the Maldives is a party, advises that infectious healthcare waste should be segregated, to minimise its quantity, and disinfected with technologies such as autoclaving which do not produce dioxins and furans.⁴⁵ Drain disposal of cleaning products, unwanted/expired pharmaceuticals and laboratory chemicals will contaminate the marine environment and scarce groundwater resources.

Policies to substitute products and services- mercury containing medical devices and dental amalgam, digital imaging- have reduced the amount of hazardous chemicals, particularly mercury and silver- which need to be treated and disposed of, and should be pursued as the strategy of choice wherever possible. Chemical waste management strategies need to be implemented, including safe storage of hazardous chemicals such as mercury, for which there are no national disposal exists, eliminating drain disposal, and establishing proper chemical waste treatment.

Ibrahim and Mathur identified in *Climate change and health in the Maldives: Protecting Our Common Future* (2006) that "in both urban and rural areas, particulate air pollution is modeled to be above WHO guidelines."⁴⁶ Hospitals indirectly contribute to air pollution, through the **energy** they use, the **transportation** choices of their staff, patients and patient families and their generation of **waste** along with the waste disposal methods used. While air pollution is increasing, the health impacts of air pollution, such as respiratory diseases, are also increasing.

⁴¹ Harhay, M.O., Halpern, S.D., Harhay, J.S. & Olliaro, P.L. (2009) Health care waste management: a neglected and growing public health problem worldwide. *Tropical Medicine and International Health* 14(11): 1414-1417 <http://onlinelibrary.wiley.com/doi/10.1111/j.1365-3156.2009.02386.x/pdf>

⁴² Ministry of Health (2016) National Healthcare Waste Management Policy. Publ: Maldives Ministry of Health, 15pp, [www.health.gov.mv/Uploads/Downloads//Informations/Informations\(68\).pdf](http://www.health.gov.mv/Uploads/Downloads//Informations/Informations(68).pdf)

⁴³ Ibrahim & Mathur (2017)

⁴⁴ UNEP (2013) Toolkit for Identification and Quantification of Releases of Dioxins, Furans and Other Unintentional POPs under Article 5 of the Stockholm Convention. Publ: United Nations Environment Program, 445pp. <http://www.pops.int/Implementation/UnintentionalPOPs/ToolkitforUPOPs/Overview/tabid/372/Default.aspx>

⁴⁵ SSC (2008) Guidelines on best available techniques and provisional guidance on best environmental practices relevant to Article 5 and Annex C of the Stockholm Convention on Persistent Organic Pollutants: Waste incinerators. Publ: Secretariat of the Stockholm Convention on Persistent Organic Pollutants, 69pp. <http://chm.pops.int/Programmes/BAT/BEP/Guidelines/tabid/187/language/en-GB/Default.aspx>

⁴⁶ Ibrahim, H.E.A.N. and Mathur, A. (2016) Climate change and health in the Maldives: protecting our common future. *WHO South-East Asia Journal of Public Health* 6(2): 1-2 <http://www.searo.who.int/publications/journals/seajph/issues/seajph2017v6n2p1.pdf?ua=1>

Section 2 | Assessment of Typical Existing Health Care Facilities

During a 1-week period HCWH, accompanied by WHO and HPA staff, conducted on-site assessments of typical Maldives health facilities, ranging from a small island level health center to atoll specialty care level hospitals, private hospitals and the 300-bed national tertiary care center, Indira Gandhi Memorial Hospital (IGMH).

Hospitals and Health Centers that participated in the assessment include:

(listed in order of when they were visited)

- **ADK Hospital** – Private Hospital in Male, 58 beds
- **IGM Hospital** – Maldives National tertiary care facility in Male, 350-beds
- **25-Floor IGM Replacement Hospital** – Maldives National tertiary care facility in Male
- **Alif Dhaal Atoll Hospital (ADh) Atoll Hospital** – Atoll specialty care level Hospital
- **ADh Omadhoo Health Center** – Island level Health Center
- **Hulhumale Hospital** – Atoll specialty care level Hospital
- **Tree Top Hospital** – New private hospital in Hulhumale
- **Villimale Hospital** – Atoll specialty care level Hospital

The assessments focused on climate change vulnerability, mitigation and resilience as well as other green, environmental sustainability features. The environmental sustainability attributes that were assessed were based on the Global Green and Healthy Hospitals (GGHH) agenda goals which include:

- **Leadership** – prioritize environment health
- **Chemicals** – substitute harmful chemicals with safer alternative
- **Waste** – reduce, treat and safely dispose of health care waste
- **Energy** – implement energy efficiency and clean renewable energy generation
- **Water** – reduce health facility water consumption and supply potable water
- **Transportation** – improve transportation strategies for patients and staff
- **Food** – purchase and serve sustainably grown, health food
- **Pharmaceuticals** – safely manage and dispose of pharmaceuticals
- **Buildings** – support green and healthy hospital design and construction
- **Purchasing** – buy safer and more sustainable products, materials and services



ADK Hospital Assessment

ADK is a tertiary private hospital in Male City.

BUILDINGS

Exterior Building Envelope

Like most hospitals in the Maldives, the ADK hospital is primarily steel and masonry construction, which provides thermal mass that slows heat gain during the day and provides structural resistance to high winds during storms. The multi-story buildings reduce roof area solar exposure and maximize the facilities tight urban site, centrally located in Male. Operable windows support natural ventilation when air conditioning is not needed and allow passive ventilation if mechanical systems fail to operate and provide access to daylight in most spaces. Access to daylight and natural ventilation reduce energy consumption. Tile floors also provide thermal mass and a floor surface that can be cleaned without chemical treatment. Rubber flooring provides a sustainable alternative to sheet vinyl flooring found in other hospitals. Mature trees in the hospital entry courtyard reduce the heat island impact of the dense urban site.



ENERGY

Daylighting from windows reduces the need for electrical lighting. LED lighting fixtures reduce energy consumption, reduce replacements and don't contain the mercury, found in fluorescent lighting. Roof-top solar power is being planned.



WATER

The hospital primarily uses desalinated water from its own borewell. Since the desalination process is energy intensive and powered by diesel generators, water conservation would both save water and reduce carbon emissions through the reduced use of the diesel desalination system. Although the desalinated tap water is potable, staff and patients prefer bottled water and the management are investigating the use of glass bottles of water to eliminate plastic bottles. We were unable to evaluate during the site assessment if low-flow sink and toilet fixtures are being used throughout the hospital, or if backflow prevention measures have been take to prevent backflow of fixtures on the ground floor. Water and sewage disposal uses an on-site septic system. Digital x-ray is being used throughout the hospital, eliminating the large quantities of process water and silver contaminated waste water associated with the x-ray film developing.

WASTE MANAGEMENT

ADK has recently switched from incineration of waste to an autoclave with internal shredding which also reduces the volume of waste requiring final disposal. Onsite incineration had prompted many complaints from nearby residents. Treated waste and general waste is disposed of with via the municipal system. The facility is part of a project which recycles PET from water bottles into clothes and shoes. Bed-pan washing and disinfection machines avoid the waste that is associated with disposable bedpans.

FOOD

Like most hospitals in the Maldives, patient food is prepared and provided by family members. This reduces hospital food waste and food service infrastructure, such as dishwashing, etc.

CHEMICALS

Mercury containing thermometers and sphygmomanometers have been phased out.

PHARMACEUTICALS

Pharmaceuticals are provided by ADK Pharmacies, which is a separate company to that operating the hospital. The pharmacy manages inventory carefully to minimize wastage. Good stock management reduces waste. Waste that is generated is disposed of with other wastes via the municipal system, which has no special system for treating pharmaceuticals.

PROCUREMENT

German partners have required that environmentally friendly products (eg rubber flooring, non-mercury medical devices) have been purchased, but there is no overall sustainable purchasing policy.

TRANSPORTATION

Located in central Male, with minimal parking, most staff and patients are able to walk to the hospital.

LEADERSHIP

The hospital has a sustainability program and green team. ADK applied for membership in the Global Green and Health Hospitals (GGHH) network. They are developing an emergency preparedness plan based on the Safe Hospitals index.



IGM Hospital (existing hospital) Assessment

The 350 bed Indra Gandhi Memorial Hospital is the main public hospital in the Maldives and is typically at 100% occupancy.

BUILDINGS

Exterior Building Envelope

The IGM hospital is primarily steel and masonry construction, which provides thermal mass that slows heat gain during the day and provides structural resistance to high winds during storms. The large roof area provides opportunities for solar water heating and mechanical equipment. Being located on the perimeter of Male facilitates access to ocean breezes enhancing natural ventilation. Natural ventilation assisted by ceiling fans is used in public corridors, waiting areas and patient wards, reducing the need for air conditioning. Operable windows support natural ventilation when air conditioning is not needed and allow passive ventilation if mechanical systems fail to operate. Natural ventilation can provide more air exchanges per hour than mechanical ventilation. The numerous windows also provide access to daylight in many spaces.

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Access to daylight and natural ventilation reduce energy consumption by reducing the need for air conditioning and electric lighting. Mature trees in the hospital courtyards and several outdoor waiting areas reduce the heat island impact of the dense urban site. Tetrapod sea walls and drainage within the perimeter roadway separate IGM hospital from the ocean coast and provide protection against flooding.



BUILDING INTERIORS

Tile floors also provide thermal mass and a floor surface that can be cleaned without chemical treatment. Sheet vinyl flooring is found in some areas and is showing signs of wear. The ground floor is elevated, reducing the risk of flooding. Mechanical equipment is located above the basement level also reducing its vulnerability to natural disasters. Mature trees in the hospital entry courtyard reduce the heat island impact of the dense urban site.

ENERGY

Daylighting from windows reduces the need for electrical lighting. LED lighting fixtures reduce energy consumption, reduce replacements and don't contain the mercury, found in fluorescent lighting. Backup electricity is provided by diesel powered generators located within the building above the island ground level. Solar water heating on the roof eliminates the need for electrical water heating, reducing electricity consumption in both day to day operation and during emergencies, when diesel generators are employed.

WATER

The hospital primarily uses desalinated water from its own borewell. Since the desalination process is energy intensive and powered by diesel generators, water conservation would both save water and reduce emissions of carbon dioxide and black carbon, which is a short-acting climate pollutant⁴⁷ through the reduced use of the diesel

⁴⁷ World Health Organization <http://www.who.int/sustainable-development/cities/health-risks/climate-risks/en/>; WHO Air Pollution (undated), Climate and Health Factsheet. 6pp. Accessed 19 August 2018 http://www.who.int/sustainable-development/AirPollution_Climate_Health_Factsheet.pdf

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desalination system. We were unable to evaluate during the site assessment if low-flow sink and toilet fixtures are being used throughout the hospital, or if backflow prevention measures have been taken to prevent backflow of fixtures on the ground floor. Water and sewage disposal uses an on-site septic system. Rain water is harvested and stored in a tank within the hospital building. The rain water is used for emergency backup should the city water system fail. Digital x-ray is being used throughout the hospital, eliminating the large quantities of process water and silver contaminated waste water associated with the x-ray film developing.

WASTE MANAGEMENT

A waste segregation system including red bag (infectious), black bag (general) and sharps boxes (sharps) is in place but not rigorously implemented. Waste is disposed of to the municipal system, though the new building currently under construction anticipates having an on-site waste management system. Interim storage does not meet WHO standards⁴⁸. There is potential for waste minimization through reduction of the use of disposable foodware.

FOOD

Like most hospitals in the Maldives, patient food is prepared and provided by family members. This reduces hospital food waste.

CHEMICALS

Mercury containing medical devices are still being used in some areas of the hospital. Switching to LED lighting (which is in progress) will replace mercury containing fluorescent light bulbs. Floor cleaning uses unnecessary chemicals (sodium hypochlorite) for disinfecting floors where only ordinary cleaning is required.

PHARMACEUTICALS

Good stock management reduces waste. Waste that is generated is disposed of with other wastes via the municipal system, which has no special system for treating pharmaceutical waste.

PROCUREMENT

Sustainable procurement policies were not identified during the assessment.

TRANSPORTATION

Located in central Male, with minimal parking, most staff and patients are able to walk to the hospital.

LEADERSHIP

The hospital promotes the green aspects of its facilities.

⁴⁸ WHO (2014) Safe management of wastes from health-care activities, second edition. Publ: World Health Organization, Geneva, 329pp., http://apps.who.int/iris/bitstream/10665/85349/1/9789241548564_eng.pdf



New 25-Floor IGM replacement Hospital Assessment

The 25-floor replacement hospital will replace the existing Indira Gandhi Memorial Hospital as the main public hospital in the Maldives. It includes tertiary treatment facilities, patient rooms and housing for medical students.

BUILDINGS

Exterior Building Envelope

The new hospital is primarily steel and concrete construction, clad in glass on all four sides. The roof area provides space for mechanical equipment. Located on the perimeter of Male facilitates access to ocean breezes enhancing opportunities for natural ventilation. The building is primarily mechanically ventilated with some operable windows. Operable windows allow some passive ventilation if mechanical systems fail to operate. The numerous windows also provide access to daylight in many spaces. Access to daylight can reduce energy consumption by electric lighting. Trees that will be planted in some outdoor areas will help reduce the heat island impact of the dense urban site. Tetrapod sea walls and drainage within the perimeter roadway separate the new hospital, as they do the existing IGM hospital, from the ocean coast and provide protection against flooding.

BUILDING INTERIORS

Concrete sub-floors provide some thermal mass. The final floor covering had not yet been installed during the site assessment visit. The ground floor appears to be elevated, reducing the risk of flooding. Mechanical equipment on lower floors appeared to be located above the basement level also reducing its vulnerability to natural disasters.

ICU and ORs have “Bioclad” flooring⁴⁹ which is PVC incorporating silver ions as an antimicrobial. However, *Salmonella typhimurium*, *E. coli*, and other bacteria have demonstrated the ability to develop resistance to silver ions,⁵⁰ and PVC is associated with harm throughout its life cycle.⁵¹

ENERGY

Daylighting from windows reduces the need for electrical lighting. LED lighting fixtures reduce energy consumption, reduce replacements and don’t contain the mercury, found in fluorescent lighting. The desalination system has a dedicated generator. Backup electricity is provided by diesel powered generators located within the building above the island ground level, and UPS systems cover the time lag of 7-10 seconds for the generators to respond to a power outage. Fuel storage capacity will allow partial operation of the facility for 48 hours in emergencies.

WATER

The hospital primarily uses desalinated water. Since the desalination process is energy intensive and powered by diesel generators, water conservation would both save water and reduce emissions of carbon dioxide and black carbon, which is a short-acting climate pollutant⁵² through the reduced use of the diesel desalination system. Dual flush toilets will be fitted to reduce water consumption but we were unable to evaluate during the site assessment if low-flow sink fixtures are being used throughout the hospital, or if backflow prevention measures have been taken to prevent backflow of fixtures on the ground floor. We were also not able to identify the water and sewage disposal septic system. Rain water is harvested and stored in a tank within the hospital building but we were unable to establish how long it would supply the facility. It is likely that digital x-ray will be used throughout the hospital, eliminating the large quantities of process water and silver contaminated waste water associated with the x-ray film developing.

WASTE MANAGEMENT

With the building still under construction during the assessment, the waste management facilities were not available to be included in the assessment. Waste chutes are included in the building structure, but it was not possible to assess what part this will play in overall waste segregation and treatment strategy. Planned waste reduction strategies include employing reusable bedpans and urinals, and catheters.

⁴⁹ Cladding (2018) BioFloor technical brochure and Specifications https://www.cladding.co.uk/wp-content/uploads/Flooring_Spec.pdf
<https://www.cladding.co.uk/wp-content/uploads/2310-Biofloor-Display-Leaflet-Digital.pdf>

Accessed 28 September 2018

⁵⁰ Healthy Building Network and Perkins+Will (2017) Healthy Environments: Understanding Antimicrobial Ingredients in Building Materials. 42pp. https://perkinswill.com/sites/default/files/Antimicrobial_WhitePaper_PerkinsWill.pdf

⁵¹ Stringer, R.L. & Johnston, P. (2001) Chapter 4: PVC. In: Chlorine and the Environment: an overview of the chlorine industry. Publ: Kluwer Academic Publishers, London, 429pp, ISBN 0-7923 6797-9

⁵² World Health Organization <http://www.who.int/sustainable-development/cities/health-risks/climate-risks/en/>; WHO Air Pollution (undated), Climate and Health Factsheet. 6pp. Accessed 19 August 2018 http://www.who.int/sustainable-development/AirPollution_Climate_Health_Factsheet.pdf

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FOOD

With the building still under construction during the assessment, the food management systems were not available to be included in the assessment. Betel nut and carbonated beverages are not allowed within IGMH.

CHEMICALS

Using LED lighting eliminates the mercury found in fluorescent light bulbs.

With the building still under construction during the assessment, the floor cleaning protocols were not able to be viewed and were not included in the assessment.

PHARMACEUTICALS

With the building still under construction during the assessment, the pharmaceutical stock management protocols were not able to be viewed and were not included in the assessment.

PROCUREMENT

Sustainable procurement policies were not identified during the assessment.

TRANSPORTATION

Located in central Male, with minimal parking, most staff and patients are able to walk to the hospital. Plans for small battery operated vehicles are under discussion.

LEADERSHIP

The hospital promotes the green aspects of its facilities.



Alif Dhaal Atoll Hospital Assessment

Alif Dhaal Atoll Hospital serves a population of approximately 10,000 consisting of the 2,000 on the island and 8,000 in the rest of the atoll. It has 8 beds and provides 24 hour care, but patients requiring surgery will be transferred to a larger facility. Medical staff include four general practitioners, a gynaecologist and a pediatrician. The staff at this level of facility usually also includes an anaesthetist, to assist at childbirths.

BUILDINGS

Exterior Building Envelope

The ADh Atoll hospital is primarily masonry construction, which provides thermal mass that slows heat gain during the day and provides structural resistance to high winds during storms. While most of the building is one level, it also has a second story with a large meeting room that could provide for patient surge or operate as a place of refuge for some of the community during a natural disaster. The hospital is located close to the island coast and the ground floor is not built above the island ground, making it vulnerable to flooding during storm surge and future sea level rise. However, the building's location also affords the hospital access to sea breezes that facilitate natural ventilation. The hospital also installed solar photovoltaic panels on the roof of a hospital support building to supplement utility power. Special switching equipment is needed to connect the solar panels to the hospital electrical system and they are in the process of being obtained.



Natural ventilation assisted by ceiling fans is used in public corridors, waiting areas and multiple spaces, significantly reducing the need for air conditioning. Operable windows support natural ventilation when air conditioning is not needed and allow passive ventilation if mechanical systems fail to operate. The numerous windows and open layout of the hospital provide access to daylight in many spaces. Access to daylight and natural ventilation reduce energy consumption by reducing the need for air conditioning and electric lighting.



BUILDING INTERIORS

Tile floors also provide thermal mass and a floor surface that can be cleaned without chemical treatment.

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ENERGY

Daylighting from windows reduces the need for electrical lighting. LED lighting fixtures are being used to reduce energy consumption, reduce maintenance and eliminate the mercury, found in fluorescent lighting. The hospital is in the process of installing solar photovoltaic panels on the roof of a hospital support building. The hospital has some naturally ventilated corridors and waiting areas that reduce the need for mechanical cooling and conserve energy.



WATER

The hospital primarily uses water from the city water supply. We were unable to evaluate during the site assessment if low-flow sink and toilet fixtures are being used throughout the hospital, or if backflow prevention measures have been taken to prevent backflow of fixtures on the ground floor. Water and sewage disposal uses an on-site septic system. Digital x-ray is being used in the hospital, eliminating the large quantities of process water and silver contaminated waste water associated with the x-ray film developing. To reduce the quantity of disposable plastic water bottles being used, the hospital provides a water bottle filling station for staff and patient use.

WASTE MANAGEMENT

Non-sharps infectious and general waste are not segregated. A needle cutter is deployed in the laboratory and lab waste is autoclaved before disposal. Sharps waste is open burned and the remainder goes to the municipal system. Placentas are returned to family members who bury them at least 30cm deep on a designated part of the beach.

FOOD

Like most hospitals in the Maldives, patient food is prepared and provided by family members. This reduces hospital food waste.

CHEMICALS

Mercury containing medical devices are still being used in some areas of the hospital. Switching to LED lighting replaced mercury containing fluorescent light bulbs. Floor cleaning uses unnecessary hazardous chemicals (sodium hypochlorite) for to disinfect floors where only ordinary cleaning is required

PHARMACEUTICALS

Good inventory management minimizes waste generation. Waste that is generated management is disposed of with other wastes via the municipal system, which has no special system for treating pharmaceuticals.

PROCUREMENT

Sustainable procurement policies were not identified during the assessment.

TRANSPORTATION

Located on a relatively small island, most staff and patients are able to walk to the hospital.

LEADERSHIP

The hospital participated in a greening program with the support of Volunteer for Environment, Social Harmony and Improvement (VESHI). The program is supported by the GEF Small Grant Program, implemented by UNDP. The hospital acted on recommendations to not use electrical lighting during the day in spaces where adequate lighting is provided by daylight, use natural ventilation where appropriate, and use energy efficient air conditioning units in the limited spaces that require air conditioning. The hospital is adding solar photovoltaic panels on the roof of the hospital to provide power for some of the electrical needs.



ADh Omadhoo Health Center Assessment

The health center has four beds, a staff of six including one doctor, and provides an 8 hour service to a population of approximately 1,000. Patients requiring overnight observation or treatment that is not offered at the Health Center are transferred to the Atoll Hospital or a referral hospital.

BUILDINGS

Exterior Building Envelope

The ADh Omadhoo Health Center is primarily masonry construction, which provides thermal mass that slows heat gain during the day and provides structural resistance to high winds during storms. The building is located close to the island coast and the ground floor is not built above the island ground level, with entrances at grade, making it vulnerable to flooding during storm surge and future sea level rise. However, the building's location also affords the health center access to sea breezes that facilitate natural ventilation. Roof overhangs provide shade and rain protection to primary entrances. The light-colored soil (without paving) and mature trees reduce the heat-island effect on the health center site.



BUILDING INTERIORS/ ENERGY

Power is provided by the government company, using diesel generators. Without backup generators, the building's function would be limited during a loss of grid electricity. However, the access to daylight in most spaces and the availability of natural ventilation significantly reduce the need for electrical power to remain partially operational during the daytime. Natural ventilation assisted by ceiling fans is used in public corridors, waiting areas and other spaces, significantly reducing the need for air conditioning. Operable windows between internal rooms and the corridors provide cross ventilation and access to daylight. Exterior operable windows support natural ventilation when air conditioning is not needed and allow passive ventilation if mechanical systems fail to operate. The numerous windows and open layout of the health center provide access to daylight in many spaces. Access to daylight and natural ventilation reduce energy consumption by reducing the need for air conditioning and electric lighting. Tile floors provide thermal mass and a floor surface that can be cleaned without chemical treatment. Some air conditioners have been replaced with more energy efficient split systems.

Daylighting from windows reduces the need for electrical lighting. LED lighting fixtures are being used to reduce energy consumption, reduce maintenance and eliminate the mercury, found in fluorescent lighting.



WATER

The health center primarily uses water from a borehole. In the rain season, rainwater (untreated) is used for drinking. We were unable to evaluate during the site assessment if low-flow sink and toilet fixtures are being used throughout the building. Rain water is collected from the roof and used for backup water. The health center has a roof cleaning protocol that is used to maintain the quality of the stored rainwater. Sewage disposal uses an on-site septic system.

WASTE MANAGEMENT

The facility only generates small amounts of waste; patients requiring advanced treatment and women about to give birth generally travel to the Atoll hospital or a referral hospital, depending on their treatment needs. Waste that is generated is burned weekly and plastic sharps boxes are reused after washing.

FOOD

Given the limited time for holding patients and the health center, patients generally do not need to eat at the health center. Like most health centers in the Maldives, patient food is prepared and provided by family members. This reduces hospital food waste.

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CHEMICALS

Mercury containing medical devices are still being used in some areas of the hospital. LED lighting has replaced mercury containing fluorescent light bulbs.

Vinyl flooring is being used in some areas, however the hospital appears not to be using a wax and buff cleaning protocol. Floor cleaning uses unnecessary toxic chemicals (sodium hypochlorite) for to disinfect floors where only ordinary cleaning is required

PHARMACEUTICALS

Only a restricted range of pharmaceuticals are prescribed at this facility. Good inventory management prevents significant wastage. Any waste that is generated will be open burned.

PROCUREMENT

Sustainable procurement policies were not identified during the assessment.

TRANSPORTATION

Located on a relatively small island, most staff and patients are able to walk to the hospital.

LEADERSHIP

The extent of the green team at the health center was not identified during the assessment.



HulhuMale Hospital Assessment

This government hospital is in the process of expanding from the current 50 beds to 180 as new buildings become fully operational within the year. It is also increasing specialities to become a tertiary facility.

BUILDINGS

Exterior Building Envelope

The HulhuMale hospital is primarily masonry construction, which provides thermal mass that slows heat gain during the day and provides structural resistance to high winds during storms. With an island elevation of two meters, HulhuMale is higher than most islands in the Maldives. However, the hospital could be vulnerable to flooding from storm surge coupled with sea level rise since its ground floor is not elevated above the surrounding ground. The building is located near the island coast and the ground floor is not built above the island ground level, with entrances at grade.

The original hospital was an adaptive reuse of a children's facility. Natural ventilation assisted by ceiling fans is used in some public corridors, stairs and waiting areas, reducing the need for air conditioning. Operable windows support natural ventilation when air conditioning is not needed and allow passive ventilation if mechanical systems fail to operate. The numerous windows and open layout of the hospital provide access to daylight in many spaces. Access to daylight and natural ventilation reduce energy consumption by reducing the need for air conditioning and electric lighting. Roof overhangs and mature trees provide shade, reducing the cooling load for the building.

A multi-story new hospital building is under construction next to the existing hospital. This building was not included in the facility assessment.



ENERGY

Daylighting from windows reduces the need for electrical lighting. LED lighting fixtures are being used to reduce energy consumption, reduce maintenance and eliminate the mercury, found in fluorescent lighting. Solar panels, connected to the grid, reduce fuel consumption. Two new 500kW generators provide backup in the case of grid failure but are dependent on continued diesel fuel delivery. The generators are at ground level and may be vulnerable to flooding.

BUILDING INTERIORS

Vinyl flooring may require hazardous chemicals for cleaning and cause pollution on disposal.

WATER

The hospital primarily uses water from the city water supply. We were unable to evaluate during the site assessment if low-flow sink and toilet fixtures are being used throughout the hospital, or if backflow prevention measures have been taken to prevent backflow of fixtures on the ground floor. Water and sewage disposal uses an on-site septic system. Digital x-ray is being used in the hospital, eliminating the large quantities of process water and silver contaminated waste water associated with the x-ray film developing.

WASTE MANAGEMENT

Waste management facilities are lacking, in part due to lack of space. They do not meet WHO standards.⁵³ Staff expressed a desire to improve the situation. Laboratory waste is autoclaved before disposal. Waste is not segregated, apart from sharps, which are collected in used gallon containers, and is disposed of via the municipal system. Chemotherapy wastes are stored because of concerns about the lack of capacity to treat it within the municipal system, again, not in accordance with WHO standards.⁵⁴

⁵³ WHO (2014) Safe management of wastes from health-care activities, second edition. Publ: World Health Organization, Geneva, 329pp., http://apps.who.int/iris/bitstream/10665/85349/1/9789241548564_eng.pdf

⁵⁴ WHO (2014) Safe management of wastes from health-care activities, second edition. Publ: World Health Organization, Geneva, 329pp., http://apps.who.int/iris/bitstream/10665/85349/1/9789241548564_eng.pdf

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FOOD

The facility plans to provide healthy food in a new hospital canteen. Biodigestion or composting should be considered for food waste to reduce disposal costs, methane emissions, and the potential of food waste to attract pests and disease vectors.

CHEMICALS

Mercury containing medical devices have been replaced throughout the hospital and mercury containing dental amalgam is no longer used.

Switching to LED lighting replaced mercury containing fluorescent light bulbs.

Floor cleaning uses unnecessary chemicals (glutaraldehyde) for to disinfect floors where only ordinary cleaning is required

PHARMACEUTICALS

Good inventory management means minimal pharmaceutical waste but the manufacturer policy of providing chemotherapeutic agents in oversized single dose vials can increase wastage⁵⁵ and this was acknowledged as a problem by staff. Most general pharmaceutical waste that is generated will be disposed of with other wastes via the municipal system, which has no special system for treating pharmaceuticals. Because of concern about submitting highly toxic oncology drugs to this system, the hospital is storing oncology waste in a storeroom adjacent to the oncology unit. This store room is not ventilated and wastes are not in leakproof containers. These wastes should be stored in line with WHO guidelines for hazardous chemicals.⁵⁶

PROCUREMENT

Sustainable procurement policies were not identified during the assessment.

TRANSPORTATION

Located in HulhuMale, with a significant road network some staff and patients drive to the hospital, but many are able to walk (active transport) to the hospital. Upgrading of services, particularly oncology, is projected to save air miles and costs associated with sending patients and family members overseas for treatment.

LEADERSHIP

The extent of the green team at the health center did not have green design specialists but consulted with some contacts at [Amrita Hospitals](#) in India.

⁵⁵ Bach, P.B., Conti, R.M., Muller, R.J., Schnorr, G.C. & Saltz, L.B. (2016) Overspending driven by oversized single dose vials of cancer drugs. *BMJ online* 352:i788.

⁵⁶ WHO (2014) *Safe management of wastes from health-care activities*, second edition. Publ: World Health Organization, Geneva, 329pp., http://apps.who.int/iris/bitstream/10665/85349/1/9789241548564_eng.pdf



Tree Top Hospital Assessment

BUILDINGS

Exterior Building Envelope

The 210 bed Tree Top hospital is steel and masonry construction, which provides structural resistance to high winds during storms. Located on HulhuMale island, with an elevation of two meters, is higher than most islands in the Maldives; the hospital is centrally located and is less vulnerable to flooding than most hospitals in the Maldives. The hospital is built with non-operable windows requiring air conditioning in all spaces. Compared to other hospitals in the study, Tree Top hospital has a large proportion of windows, which provide access to daylight in many perimeter spaces. The windows are tinted, which reduces solar heat gain. Garden areas and trees along the building and the street, along with a light colored roof, reduce the heat island effect.



ENERGY

Daylighting from windows reduces the need for electrical lighting. While a new hospital, fluorescent lighting is used throughout the hospital, with minimal use of LED lighting fixtures.

The hospital uses a central cooling system with a return air system to minimize heat loss from exhaust air. Solar hot water heating is located on the roof of the hospital. Open stairways are located adjacent to the elevator core, encouraging their use over elevators. Diesel powered emergency backup generators require twice daily fuel deliveries. The generators are located at ground level and could be vulnerable to flooding. We were not able to identify during the assessment whether waste heat from the generators is being used for heating water, taking advantage of combined heat and power (CHP).



WATER

The hospital primarily uses water from the city water supply, with storage for two days' supply in case of emergency. We were unable to evaluate during the site assessment if low-flow sink and toilet fixtures are being used throughout the hospital, or if backflow prevention measures have been taken to prevent backflow of fixtures on the ground floor. Digital x-ray is being used in the hospital, eliminating the large quantities of process water and silver contaminated waste water associated with the x-ray film developing. Drinking water is readily available, reducing the use of plastic water bottles.

The landscaping along the street is designed to channel street runoff into planted areas, reducing flooding while increasing groundwater recharge.

WASTE MANAGEMENT

The facility does not have a healthcare waste management policy. It is aiming for paper-free operation. Infectious waste is treated with steam and shredded to reduce volume before disposing to the municipal system. The system is capable of treating pathological waste. Liquid chemical waste is treated with ozone.

FOOD

Patient food is prepared at the adjacent hospital support building. As in most of the Maldives, much of the food is imported. However, the hospital has some garden areas that are planned for growing herbs and some food to be included in the hospital food service.

CHEMICALS

Mercury containing medical devices have been replaced throughout the hospital. Mercury containing fluorescent light bulbs are used throughout the hospital.

Floors appear to use PVC flooring. Floor cleaning protocols were not identified during the assessment.

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PHARMACEUTICALS

Efficacy of pharmaceutical inventory management could not be established as the hospital is recently opened and has few patients at present.

PROCUREMENT

Sustainable procurement policies were not identified during the assessment.

TRANSPORTATION

Located in Hulhumale, with a significant road network some staff and patients drive to the hospital, but many are able to walk to the hospital. The hospital intends to reduce the need for Maldivian citizens to be sent overseas for advanced treatments.

LEADERSHIP

No sustainability policy was identified during the assessment.



Villimale Hospital Assessment

This facility is managed via IGMH, close by in Male City; consultant physicians from IGMH conduct surgeries once or twice a week. Patients requiring overnight or advanced treatment typically travel to IGMH, so Villimale Hospital primarily provides OPD and dialysis.

BUILDINGS

Exterior Building Envelope

The Villimale hospital is primarily masonry construction, which provides thermal mass that slows heat gain during the day and provides structural resistance to high winds during storms. The hospital is located very close to the island coast and could be vulnerable to flooding, but also affords the hospital access to sea breezes that facilitate natural ventilation. The hospital and support buildings are raised about 30 centimeters above the surrounding grade, which reduces the flooding risk from rain storms, but may not protect them from natural disasters and sea level rise. Operable windows support natural ventilation when air conditioning is not needed and allow passive ventilation if mechanical systems fail to operate. The numerous windows and open layout of the hospital provide access to daylight in many spaces. Access to daylight and natural ventilation reduce energy consumption by reducing the need for air conditioning and electric lighting. Overhangs and mature trees shade windows, reducing the heat load for cooling.



BUILDING INTERIORS

Tile floors provide thermal mass and a floor surface that can be cleaned without chemical treatment.

ENERGY

Power comes from the island grid and there is no backup generator. Daylighting from windows reduces the need for electrical lighting. Fluorescent lighting fixtures are being used in many spaces. These could be replaced with LED lights to reduce energy consumption, reduce maintenance and eliminate the mercury, found in fluorescent lighting. Laundry is dried naturally.

WATER

The hospital primarily uses water from the city water supply and does not have a backup system should that fail. Distilled water is supplied by IGMH; a small RO plant provides high purity water in the dialysis unit. It was not established whether dialysis water is reused, but this is done in some dialysis units in other countries^{57,58} and should be replicated in Maldivian dialysis units to save water and energy resources. We were unable to evaluate during the site assessment if low-flow sink and toilet fixtures are being used throughout the hospital, or if backflow prevention measures have been taken to prevent backflow of fixtures on the ground floor. Water and sewage disposal uses an on-site septic system. Digital imaging is being used in the hospital, eliminating the large quantities of process water and silver contaminated waste water associated with the x-ray film developing.

WASTE MANAGEMENT

Waste is segregated at the source, including infectious, non-infectious and sharps. However all wastes are collected by the same company and segregation is not maintained.

⁵⁷ GGHH (2015) Recycle of Soft Water Discharged from Dialysis Room Capital Medical University Beijing Ditan Hospital, China. Publ: Global Green and Healthy Hospitals Network, 4pp. <https://www.hospitalesporlasaludambiental.net/wp-content/uploads/2017/12/Recycle-of-Soft-Water-Discharged-from-Dialysis-Room-China.pdf>

⁵⁸ GGHH (2016) Water – A Precious Commodity: Conserving and Reducing Water Consumption Using Recycled Reject Water Processed from Water Treatment System Buddhist Tzu-Chi Dialysis Centre (Penang Branch), Malaysia. Publ: Global Green and Healthy Hospitals Network, 4pp. <https://www.hospitalesporlasaludambiental.net/wp-content/uploads/2017/12/Water-A-Precious-Commodity-Buddhist-Tzu-Chi-Dialysis-Centre-Malaysia.pdf>

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Women tend to travel to nearby IGMH for childbirth, so there is rarely a need to dispose of pathological waste. Good inventory management and low patient numbers mean minimal pharmaceutical waste. There is no laboratory waste autoclave, but no microbial culturing is conducted in the laboratory, so highly infectious cultures are not produced.

FOOD

Like most hospitals in the Maldives, patient food is prepared and provided by family members. This reduces hospital food waste.

CHEMICALS

Mercury containing medical devices have been replaced throughout the hospital, but some old instruments remain in storage.

Switching to LED lighting would replace mercury containing fluorescent light bulbs.

Floor cleaning uses unnecessary chemicals (sodium hypochlorite) for to disinfect floors where only ordinary cleaning is required

PHARMACEUTICALS

Only a restricted range of pharmaceuticals are prescribed at this facility. Good inventory management prevents significant wastage.

PROCUREMENT

Sustainable procurement policies were not identified during the assessment.

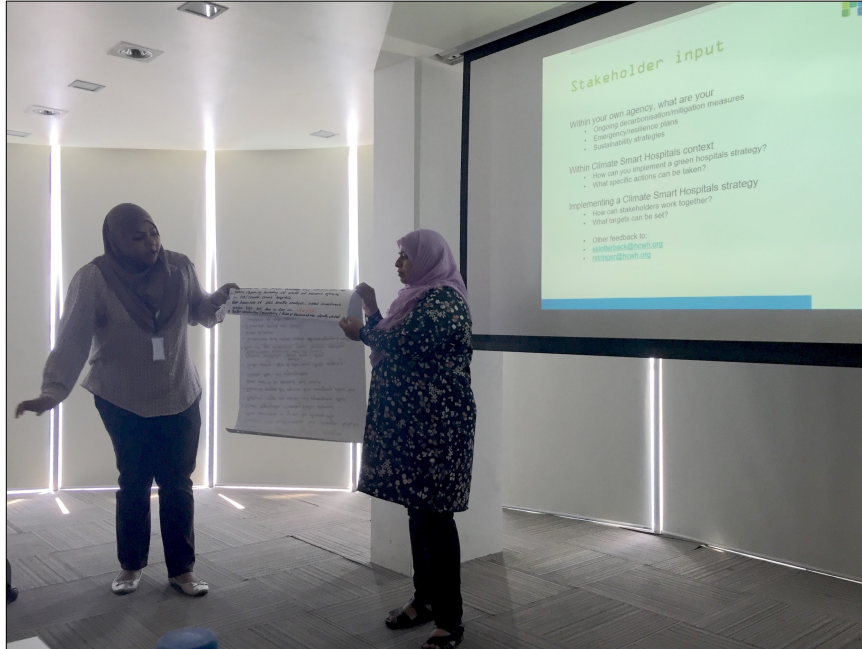
TRANSPORTATION

Located on the small island of Villimale, some staff and patients drive to the hospital, but many are able to walk to the hospital.

LEADERSHIP

The extent of the green team at the health center was not identified during the assessment.

Section 3 | Green, Climate-Smart Health Care Facilities Policy and Strategy Stakeholder Input



Stakeholder priorities were established during a consultation meeting on Thursday 5th July 2018, which was followed by a debrief with senior figures including the Permanent Secretary.

Findings from the site assessments (Section 2) were presented at the stakeholders meeting.

Breakout groups focused on specific topics:

- Ongoing decarbonization/mitigation measures
- Emergency/resilience plans
- Sustainability strategies
- How to implement a green hospitals strategy
- Specific actions to be taken
- How stakeholders work together
- What targets can be set?

Stakeholders identified ongoing actions and priorities for the future as follows:

BUILDINGS AND ENERGY

- Implement natural ventilation
- Provide trees and green areas, to reduce the heat island effect
- Install solar panels
- Maximize use of natural light

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WASTE

- Create a sustainable healthcare waste management plan, policy and implementation mechanisms
- Minimize waste generation
- Conduct regular waste audits to understand the waste stream and identify toxic or wasteful products that can be eliminated
- Eliminate single use plastics
- Explore zero waste hospitals
- Improve waste segregation
- Ensure hazardous healthcare waste is treated before being sent for disposal
- Phase out incineration of health care waste and implement a policy of sustainable healthcare waste treatment technologies
- Make autoclaving waste the national policy
- Recognize waste reduction as saving energy
- Establish chemical waste management and disposal policy

WATER

- Install drinking water dispensers to eliminate waste from single use plastic bottles
- Implement rainwater harvesting and safe storage to reduce energy consumption of desalination and for emergency use

CHEMICALS

- Substitute mercury-containing medical devices
- Ensure all x-ray systems are digital and chemical-free

TRANSPORTATION

- Encourage staff to use bicycles (and install bicycle parking)
- Use buggies for staff transport
- Choose energy efficient/low emission vehicles for ambulances

PHARMACEUTICALS/PROCUREMENT

- Reduce waste pharmaceuticals through recycling and procurement

BUILDINGS

- Include green technologies in building codes
- Housing ministry, Health ministry, Environment ministry should make joint hospital building code/standards, with a single source approval process
- Ensure compliance with building codes, minimise variation after approval

LEADERSHIP

- Build awareness and capacity in stakeholders
- Build public awareness

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- Include environmental focal points in hospital teams
- Improve communication/monitoring/roles and make responsibilities clearly known.
- Implement and enforce existing green policies
- Standardise the green hospital concept
- Plan strategically for Green Hospitals, including budgets and timelines
- Provide funding for green and climate-smart hospitals
- Provide arguments for green and climate-smart hospitals funding
- Raise awareness of cost benefit analysis of green initiatives: initial investments may be high but low in the long run
- Conduct environmental impact assessments of projects
- Review and integrate resilience and emergency resilience plans to create integrated interagency plans and funding and update policies in all relevant agencies, including National Emergency Operations Plan (NEOP), [Health Emergency Operations Plan](#) (HEOP),⁵⁹ Hospital Emergency Response Plan (HERP), National Emergency Operation Center NEOC and equipment, Cat DDO (Catastrophe Draw Down Option), Pandemic Emergency Financing (PEF).⁶⁰
- Include vectors and the diseases they carry in the green hospital concept
- Create and sustain training programs
- Make hospitals smoke free

Final debriefing meeting and priorities for action:

The site assessments and stakeholder consultation identified multiple initiatives under way to improve the climate mitigation, resilience and sustainability of the healthcare sector in the Maldives. However, there remain significant gaps and some fragmentation in efforts. Moreover, despite widespread interest in improving sustainability, and mitigating and improving resilience to climate change, few staff in healthcare facilities are designated responsible for these issues and there is little dedicated funding for it.

Consequently, measures to improve coordination, staffing and funding of green, climate-smart health care are needed.

The following Key Actions were presented at the final debriefing meeting:

- Health Minister to Convene a Climate-Smart Health Care Task Force
- Designation of MOH staff to lead Climate-Smart Health Care Agenda
- Financing mechanism for Climate-Smart Health Care

In addition to these actions, the Maldives Ministry of Health joined the Global Green and Healthy Hospitals (GGHH) Network. Members of the GGHH network have access to tools and guidance documents, case studies and to [GGHH Connect](#). An innovative, online platform, GGHH Connect enables members from Maldives hospitals and health centers to connect with each other and with hospitals, health systems, and experts from around the world. It also provides them with climate change and sustainability resources, and tools in the [Hippocrates Data Center](#) to calculate their greenhouse emissions and track progress reducing them.

⁵⁹ [http://www.health.gov.mv/Uploads/Downloads//Informations/Informations\(124\).pdf](http://www.health.gov.mv/Uploads/Downloads//Informations/Informations(124).pdf)

⁶⁰ <http://documents.worldbank.org/curated/en/764681513923499047/pdf/Concept-Program-Information-Document-PID.pdf>