EVALUATION TO ASSESS WHO'S CONTRIBUTION TO IMPLEMENT HEALTH CARE WASTE MANAGEMENT PROJECT IN MALDIVES FROM 2016 – 2021

NOVEMBER 2023

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WORLD HEALTH ORGANIZATION, MALDIVES.

ESKEY MALDIVES

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OCTOBER -NOVEMBER 2023.

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ABBREVIATIONS:

ADB	Asian Development Bank
FGD	Focus Group Discussion
GRH	Gan Regional Hospital
HC	Health Centre
HCWM	Healthcare waste management
HF	Health Facility
HMP	Health Master Plan
HPA	Health Protection Agency
ICP	Infection Control Practices
KII	Key Informant Interviews
LECReD	Low Emission Climate Resilient Development
MHQS	Maldives Healthcare Quality Standards
MOH	Ministry of Health
NGO	Non-Governmental Organization
PIIR	Policy Implementation and International Relations Division
PPE	Personal Protective Equipment
QARD	Quality Assurance and Regulatory Division
RAHS	Regional and Atoll Health Services
TOT	Training of Trainers
UN	United Nations
UNDP	United Nations Development Program
UNEP	United Nations Environment Program
WAMCO	Waste Management Corporation
WHO	World Health Organization
WHO CO	World Health Organization Country Office
WHO SEAR	World Health Organization, South East Asia Region

EVALUATION TO ASSESS WHO'S CONTRIBUTION TO IMPLEMENT HEALTH CARE WASTE MANAGEMENT PROJECT IN MALDIVES FROM 2016 – 2021

1. Background:

Globally, around 1.47 billion tons of solid waste are produced each year[1], out of which1-2% is estimated to be healthcare waste[2]. According to the World Health Organization (WHO), 'medical waste' is all the waste generated from health-care activities[9]. Around 85% of healthcare waste is non-hazardous, while the remaining considered to be hazardous include infectious, toxic, hazardous or radioactive3. While the production of hazardous waste is estimated to be 11 kg per hospital bed per day in high-income countries, this rate is approximated to be 6 kg per hospital bed per day in low-income countries. Nevertheless, due to inadequate segregation of hazardous and non-hazardous waste in low-income countries, the final amount of hazardous waste generated is higher[5,6]. On the other hand, health systems across the globe are focusing on improving infection practices in preparation of unprecedented pandemics, such as that of COVID-19. As a result, this has added to the burden of healthcare waste and potentially more dangerous waste, raising the need for simultaneous and effective actions to enhance health systems' capacity to manage and handle healthcare waste[4].

Healthcare waste generated in Maldives is estimated as 119 tons per year[8] and according to the Maldives National Waste Accounts, 6,000 tons of healthcare waste was generated in 2019[7]. Hospitals in Maldives, were estimated to produce waste at 0.75 to 1.5 tons of stabilized autoclaved waste per day, depending on the level of healthcare provided to the public[7]. However, inappropriate waste management systems can render all the medical waste as infectious and toxic10, making it potentially harmful for health and environment[9]. It is estimated that globally, 5.2 million people worldwide die each year due to illnesses caused by unmanaged medical waste[12]. Additionally, more than 2 million of healthcare workers are exposed to pathogens during their daily work routines[13]. These include, doctors, nurses, patients, visitors and support services workers, such as laundry workers, waste management and transportation staff and waste-disposal facility employees[14].

Maldives was no exception to the experiences of other countries, where provision of healthcare exhausted the limited resources, leaving healthcare waste in the sidelines amongst healthcare priorities[11]. Despite its relevance, healthcare waste management had not received much attention in the Maldives. Nevertheless, the initiative and the technical guidance of WHO that addressed the needs of developing countries, drove actions towards building more comprehensive, environmentally sustainable and standardized healthcare waste management systems within the country. Moreover, the unprecedented events of COVID-19 and the subsequent increase in the volume of healthcare waste, brought into light the dire need to improve healthcare waste management practices in the country. Thus, protecting healthcare workers, public and the environment through appropriate practices in healthcare waste management gained importance in the last decade. The fundamental and pivotal role of WHO Country Office, as a partner of Ministry of Health, played a crucial role in initiating, advocacy, coordination between various stakeholders, including international organizations and leveraging resources and action towards improving healthcare waste management in the Maldives.

2. Purpose and objectives:

The objective of this evaluation is to assess the contribution of World Health Organization in the implementation of healthcare waste management project in Maldives from 2016 – 2021. The specific objectives of the evaluation encompass the following.

1. To study the scope, extent of technical support provided and technical products of WHO used or referenced in developing the healthcare waste management policy, strategy, guidelines, standards and standard operation procedures.
2. To understand the usefulness of the initial assessments of Health Care Waste management situation in the country to inform the planning and strategic implementation of the project.
3. To assess the effectiveness of the pilot project for Health Care Waste Management in Laamu Atoll.
4. To study the extent of and effectiveness of the training support provided for Healthcare Waste Management specifically during the COVID pandemic response.
5. To describe the system in place for supportive supervision, monitoring and evaluation of Health Care Waste Management project in the country and the additional contributions largely attributed to WHO support.
6. To assess the contribution of WHO in scaling up and taking forward the Health Care Waste Management work forward in the Maldives and describe the key challenges faced by WHO in implementing the health care waste management project.

3. Evaluation framework:

The approach to study the objectives of this evaluation, the World Health Organization (WHO) Building Blocks framework[24] was used. This framework allows an approach to systems thinking[25] and sets clear categories to holistically appraise the effects of health initiatives within the overarching umbrella of health system. The framework describes health systems in terms of six components or Building Blocks, which are financing, health workforce, information systems, medical products and technologies, leadership/governance, and service delivery (Figure 1). Additionally, the framework was used to conceptualize the support given by WHO within the health system of the Maldives.

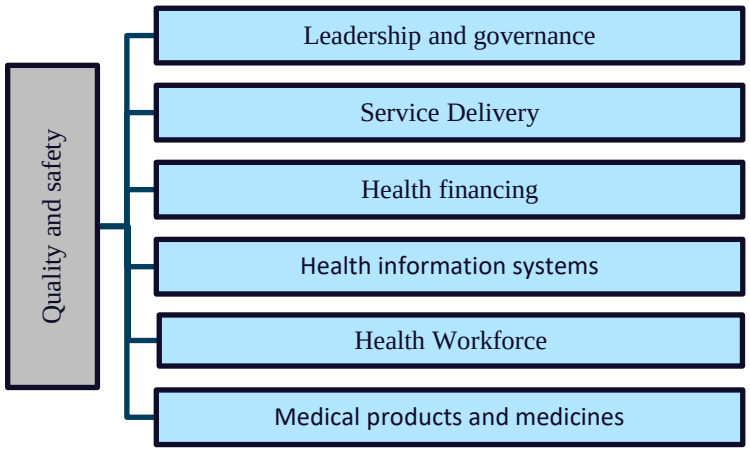

Figure 1*: WHO health system building blocks*

4. Methodology:

For the purpose of this evaluation, information was collected from WHO, Ministry of Health, and relevant stakeholders, and was carried out between October 1, 2023 to November 15, 2023. Data collection was carried out using the following approaches.

1. Desk review of exiting literature and documents.
2. Key informant interviews (KIIs) from relevant key individuals. (Annex 1)
3. Focus group discussion (FGD) involving health personal of Laamu Atoll. (Annex 1)
4. Data collection on numbers and locations of medical equipment.
5. Site visit to the LECREd site of Laamu Atoll.

Three questionnaires were developed for; KIIs, FGD and for health staff from Laamu Atoll. Key areas included in the study were applied within the evaluation framework of health system building blocks (Table 1). Health infrastructure has been included as health workforce and infrastructure following the WHO's Handbook on monitoring the building blocks of health systems[24].

Table 1: Evaluation framework components

WHO's technical support	Key areas
1. Leadership and governance	Policy, strategy, laws and regulations for healthcare waste management.
	Priority of healthcare waste management
	Policy decisions on current and future actions for improving healthcare waste management within the country.
	WHO's role and stewardship in carrying forward HCWM within the health system.
2. Service Delivery	Standards, SOPs and process utilized for health care waste management in health facilities.
	Compliance with standards and application of knowledge received from training in service delivery
	Use of WHO's products within the health system
3. Health financing	Technical assistance from WHO and other international partners.
	Government spending for HCWM
4. Health Information system	Information systems used in the supply and consumables management.
	Monitoring systems in place within MOH and from islands and health facilities.
5. Health workforce and infrastructure	Training on HCWM, usefulness and components covered.
	WHO's approach to support lack of human resources within the health sector.

	Status and development of infrastructure for HCWM
	WHO's support in infrastructural development.
6. Medical Products	Autoclaves and utilization in health facilities.
	Numbers, locations and coverage among health facilities.
	Availability and procurement of autoclaves and consumables

Data gathered from KIIs and FGD were analyzed and categorized into themes to derive important findings and tables obtained from MOH, were synthesized and analyzed to understand the situation in relation to the objectives of the evaluation. Additionally, the LECReD project of Laamu Atoll was studied and presented as a case study.

5. Results and findings

The pioneering role of WHO in the healthcare waste management area of the Maldives, commenced with the development and implementation of strategies and technologies, involving environmentally sustainable approaches within the health system's framework. Despite various challenges in the implementation of planned actions and sustainability, the evaluation demonstrated the critical and imperative role of WHO's technical assistance in commencing and driving forward a holistic approach to healthcare waste management, encompassing all components of the health system in the Maldives (Figure 2).

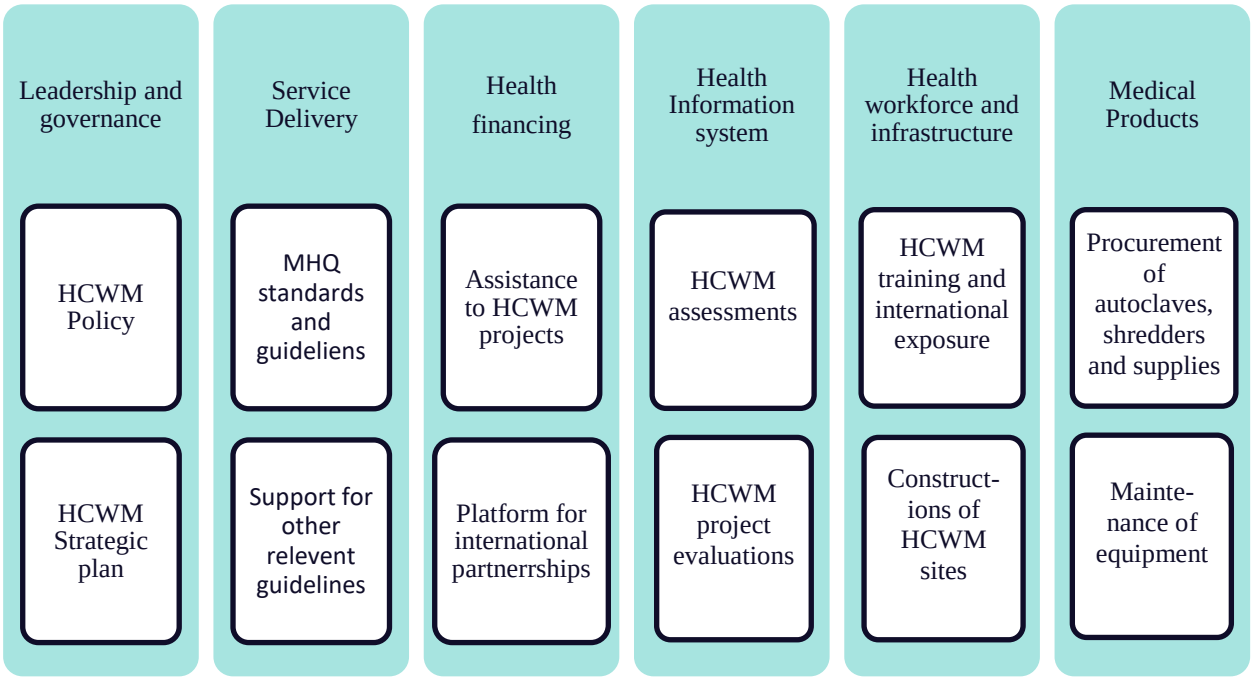

Figure 2: Summary findings of WHO's technical support to HCWM in the Maldives.

5.1.Scope and extent of WHO's Technical Support to Government:

WHO was the first United Nations (UN) agency to partner with the Maldives and since the 1950s it has continued to collaborate with the government of Maldives[19]. WHO's support to the Maldives was initially provided in disease control and later with the establishment of more partnerships with other UN agencies, Bilateral Organizations, NGOs, different government Ministries and the community helped further a health agenda for the population of Maldives[19].

In 2005, a World Health Organization (WHO) health care waste expert, as well as an expert from the Ministry of Health, participated in UNEP's expert field mission to conduct a comprehensive assessment of health care waste in several health care facilities in the Maldives[20]. Findings from the assessment were consistent with general waste management situation in the Maldives which include the absence of law, policy, regulations, guidelines and monitoring and the lack of awareness among the authorities and the public of the hazards associated with health care waste and the options for proper health care waste management[20].

The Health Master Plan (HMP) 2016 – 2025 was developed by the Ministry of Health with technical support from WHO to provide strategic direction and guidance to further develop policies, plans and programs to improve the health of the population (Health Master Plan 2016-2025). WHO is also committed to providing support in implementing and monitoring of the plan (HMP 2016-2025). The HMP 2016-2025 identified enforcing regulation and standards on reduction and management of communal, health care and hazardous waste as one of the critical strategic inputs for public health protection. The Ministry of Health (MOH) also developed a National Healthcare Waste Management Policy (2016) and a Healthcare Waste Management Strategy (2016-2021) with technical assistance from WHO[21]. A health care waste management training was also conducted during this time.

Subsequently, a pilot Healthcare Waste Management Project was implemented in all inhabited islands of Laamu Atoll through the UN Low Emission Climate Resilient Development Program (LECReD)[21]. As part of the project, autoclaves were installed, infrastructure development was supported, consumables for three months were provided and training was provided on healthcare waste management for all the healthcare workers in Laamu Atoll[21]. Additional autoclaves and consumables were provided to the MOH and some of those were being used for waste management in COVID 19 facilities. WHO also supported the MOH to install autoclaves in 40 islands under the Canada Grant[21].

From 1 July to 6 July 2018, WHO commissioned a project for Health Care Without Harm (HCWH) upon the request of Health Protection Agency (HPA) to provide technical support to develop a Green, Climate Smart Hospital Policy, and Strategy for the Maldives[22]. The project focused a review of existing government policies and related national and international documents and studies, site visits and initial assessments of seven typical Maldives health care facilities[22].

The Maldives developed its Health National Adaptation Plan (HNAP) in 2020 with technical and financial support from WHO[21]. The aim of the plan is to create climate resilience of health facilities, mainstream climate change induced risk management, protect human health through multisectoral engagement, capacity building and raising public awareness of the impact on health from climate change and ensuring sustainable financing[21].

5.2.Leadership and governance:

The role of WHO CO in providing guidance and technical support to the relevant national parties and driving forward the healthcare waste management in the Maldives, was highlighted to be imperative, critical and very useful. The overall sentiment for WHO's support was very positive across all interviewed. As a partner to the Ministry of Health, WHO led and supported various activities to develop the healthcare waste management practices in the country.

5.2.1 The National Health Care Waste Management Policy:

With support from WHO CO, the National Health Care Waste Management Policy (Policy/23-MOH/2016/01) was developed and endorsed in April 2016, as a leading document that provides a framework for strategies, legal regulations, guidelines and operational procedures. Even though it is not the first initiative of WHO in the healthcare waste management arena of the Maldives, the document's importance is noted as a basis of legal obligations to decision-makers to implement safe and environment friendly healthcare waste systems in the Maldives[18]. Prior to the 2016 policy, WHO supported the development of a proposed policy in 2007, "Current Status of Healthcare Waste Management and Proposed Policy & Guidelines for Maldives"[29]. The document extensively assessed the healthcare waste management practices in the health facilities across Maldives, proposed policies and guidelines to create a healthcare waste management system in the country[29]. Posteriorly an assessment was done in 2016, information from which was derived to develop the National Health Care Waste Management Policy (2016).

The National Health Care Waste Management Policy (2016) addresses important aspects as objectives for healthcare waste management. These include, managing health care waste through healthcare waste management policies and strategies, integrating health care waste with the national waste policy and strategy, minimizing the quantities and risks associated with health care waste, protecting health of patients, health workers, and public from hazards related to health care waste, protecting the environment from the hazardous materials of health care waste, promoting economically sustainable practices for healthcare waste management, promoting the proper management of healthcare waste by institute training programs and raising awareness of health workers, patients and public, ensuring the proper management of healthcare waste through availability and accessibility of required tools and equipment and adopting healthcare waste management practices which support the international treaties such as Stockholm Convention on Persistent Organic Pollutants and the Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their disposal[18]. It is planned to review and revise the HCWM policy in 2024.

It is noted that international and national technical products of WHO were taken into consideration for the policy development; Safe management of wastes from healthcare waste policies[26], Minimum standards on HCW Management at Health Facilities (2008)[27] and Health Master Plan 2016-2025 (Draft)[28].

5.2.2 The National Health Care Waste Management Strategic Plan 2016-2021:

In line with the National Health Care Waste Management Policy, The National Health Care Waste Management Strategic Plan 2016-2021 (Plan/23/-MOH/2017/08) was formulated and endorsed in 2017. The aim of the strategic plan was to achieve 5 strategic priorities. The strategies encompassed; strengthening policy and regulatory structures for health care waste management, developing national training packages on health care waste management, implementing training programs, increasing advocacy awareness for behavioral change, promoting research and new technologies for sound management of Health Care Waste, setting up of an integrated system in a pilot atoll, strengthening the reporting, monitoring, and evaluation mechanism and establishing sustainable sources of funding[23]. This strategic plan was developed in agreement with the National Waste Management Policy endorsed by the Ministry of Environment, Climate Change and Technology, which proposed the development of waste centers on islands and waste management facilities within regions[30].

The strategic plan was developed with support from WHO involving extensive consultations from various stakeholders. The plan was a multi-sectoral costed action plan. The Health Protection Agency (HPA) was the responsible agency for the implementation of the plan and overseen by the National Environmental Health (EH) Program. The dissemination of the strategic plan was conducted through development of materials of communication and printing, which was also supported by the WHO CO. The revision of the National Health Care Waste Management Strategic Plan is planned to be carried out in 2024.

The high level of technical knowledge of the consultancy provided by the WHO CO, was noted to be advantageous for the EH program. It was reported that during the process of developing the strategic plan, the consultancy helped in decisions taken to determine the standards of equipment and procurement of the same. The consultancy was also reported to have helped other sectors as well during this consultancy.

5.2.3 Contributions of WHO as a partner to national and international stakeholders.

The proactive role of WHO in engaging with national and international partners were highlighted in this evaluation. Currently, the project for healthcare waste management as a partnership with Asian Development Bank (ADB) and UNDP as an implementing partner, includes provision of autoclaves, other medical devices and building infrastructural sites for autoclaves in selected islands of the Maldives. Similarly, the Healthcare Waste Management Project under Canada grant to WHO was another positive project that is taking shape in contributing to the development of healthcare waste management in the Maldives. (Section 5.2)

WHO's support in the Low Emission Climate Resilient Development (LECReD) project is also noted. The project is a USD 9.2 million investment by the Danish government for the development of Laamu Atoll. For the implementation of this project, WHO worked as a partner with the Ministry of Health, Ministry of Environment and Energy, local government authorities, atolls and island councils, NGOS and UN partners. In addition to the establishment of an environmentally friendly healthcare waste

management system in Laamu Atoll, the project also launched a nationwide vector control campaign, an assessment of solar power feasibility for health facilities, procurement of air quality monitoring system for the Ministry of Environment and Energy and a survey to assess the vulnerability of healthcare facilities to disasters.

5.2.4 WHO SEAR

WHO SEAR consistently provides supervision and support to WHO CO on a regular basis, incorporating insights from Maldives' country experiences for regional benchmarking. Requests from the government, primarily through MOH, are channeled to WHO SEAR via WHO CO, for which WHO SEAR provides guidance for alignment with WHO conventions, resolutions, and regional flagships. Technical assistance, including guidance on environmental sustainability, equipment durability, and standards, is extended to WHO CO from WHO SEAR. Decisions at WHO SEAR is made with careful consideration of each country's existing capacities and needs.

While Healthcare Waste Management (HCWM) might not be a standalone priority, its integration with key areas like Water, Sanitation, and Hygiene (WASH) and Climate Change contributes to the accomplishment of diverse goals. A recent benchmarking assessment by WHO SEAR highlighted a deficiency in capacity building for healthcare waste management in the region. Consequently, this gap has been prioritized in the future plans, aiming for all countries to achieve milestones in implementing best practices. Biennium planning, centered around regional priorities, serves as a platform to streamline upcoming projects and activities. This comprehensive planning process is anticipated to conclude by the end of November this year.

5.2.5 National Priorities

Currently, healthcare waste management is considered as a priority within the Ministry of Health and MOH is undertaking development of healthcare waste management facilities across all government health centers and hospitals in the country. Through partnerships between the Ministry of Health, Ministry Environment, Climate Change and Technology, and international partners including the WHO, UNDP and the World Bank, provision of waste autoclaves, other relevant equipment, consumables and infrastructure are being provided to healthcare facilities with the aim of initiating adequate healthcare waste disposal mechanisms across the health sector.

According to the Ministry of Health, the Ministry will continue to provide consumables and other medical devices to small health facilities (health centers) that are under the administration of MOH. Nevertheless, semi-autonomous hospitals (tertiary hospitals) are expected to continue sustaining the services through the budget allocated to the hospitals. Healthcare waste infrastructure and human resources are being included within the infrastructural plans and organizational structures of new and upcoming hospitals. Nevertheless, new sites for autoclave use are being built in smaller islands. In this manner, the Ministry of Health is expecting a coverage of close to 80 health facilities (including LECReD project in Laamu Atoll) for the establishment of healthcare waste services. (Table 2).

Table 2: Upcoming projects and projects underway in MOH.

Grant/Project	Autoclave provision	Infrastructure
WHO-Canada Grant	40 islands will be provided with autoclaves, shredders and consumables.	8 health facilities
	Training of healthcare providers from all atolls.	
ADB	5 islands will be provided with autoclaves, consumables for 6 months	5 health facilities
Japan-UNDP	2 islands will be provided with autoclaves	2 health facilities
Japan Grant	------	18 health facilities
Environment Ministry and Maldives Clean Environment Project	22 islands will be provided with autoclaves and other items such as PPEs.	
UNOPS	9 islands will be provided with autoclaves	
UNDP and Environment Ministry	2 islands will be provided with autoclaves	2 health facilities

***Source: unpublished data from MOH.**

5.3.Service Delivery.

The healthcare sector of the Maldives is established as a 3-tier system, governed by the Ministry of Health, under which different divisions roles are divided into health service delivery, public health protection, procurement, quality assurance, human resources and others. Recently, there has been a boom in the growth of the health sector, leading to establishment additional small-scale healthcare facilities and expansion of services provided in hospitals across the country. The advancement in healthcare services, about availability of various specialist doctors, laboratory services, advanced radiological studies and blood services is expected to add to the burden of healthcare waste[15]. Currently, the health system of the Maldives, comprises of a total of 192 government facilities[17] (Table 3) and 215 private clinics[16].

Table 3: Number of health facilities by category

Health Facility	Private	Public	Total
1. Health Center		164	164
2. Atoll Hospital		13	13
3. Hospital	3	3	6
4. Regional Hospital		6	6
5. Tertiary Hospital	2	1	3
Total	**5**	**187**	**192**

5.3.1. Healthcare Waste Management Guideline

WHO CO's support to the development of healthcare waste management guidelines dates to 2007, "Current Status of Healthcare Waste Management and Proposed Policy & Guidelines for Maldives"[29]. In 2009, MOH drafted a guideline that emphasizes on waste reduction as well as other steps involved in the decontamination of healthcare waste. The guideline is very extensive and includes steps that need to be taken in case spills, radioactive substances, waste audits and waste water management. Moreover, the guideline explains on processed that need to be in place in hospital or health facility administration. Nevertheless, the guideline has not been finalized or endorsed till date[31].

According to MOH, the HCWM guideline was developed as a collaboration between HPA and QARD. The HCWM guideline (even though has not been finalized) is being implemented and is attached as a guiding document with the Maldives Healthcare Quality Standards. The inter-departmental collaboration has been effective, and results have been obtained in elevating quality of waste management across government and private health facilities in the country.

5.3.2. Maldives Healthcare Quality Standards

The Maldives Healthcare Quality Standards was developed with the overall objective of ensuring that health services provided within the health system of Maldives are honored and as a measure to leverage a conscious effort to provide quality, effective, safe and dignified services. In 2008, with support from WHO, Minimum standards for HCW management at health facilities was developed[36]. Later in 2018, as a collaboration between the QARD division of MOH and WHO CO, the MHQ standards was developed with technical assistance of WHO and was launched. The MHQ is a valued instrument for the Maldives, as it gives a measure of health facility adherence to the required standards as well as the overall performance of the health facilities. Based on a scoring system, the MHQ standards also provides a platform for guidance on specific factors that require improvement or support from MOH[32].

The MHQ standards encompass 25 criteria, out of which criteria 7 is dedicated for healthcare waste management, under which 5 standards are prescribed for health facilities. The MHQ standards attached with the HCWM guideline are key players in revolutionizing proper waste management in the Maldives. This is done through licensing of health facilities (both government and private), where health facilities are required to full fill the criteria set in the MHQ standards to obtain the license for service provision. Procedurally, monitoring of health facilities are mandated to be carried out annually by the QARD. Nevertheless, due to constraints in budget and resources, current annual monitoring encompasses only health facilities in the Greater Male' Area, and QARD is mostly dependent on Atoll hospitals for monitoring of health centers. An assessment carried out by MOH in 2022, showed very low compliancy of health care waste management across the health sector.

5.3.3. WHO's guidelines related to healthcare waste management.

WHO's support to the MOH in various interrelated areas is highlighted. Use of holistic approaches in different areas, is proved to be not only beneficial to MOH and HPA, but also reduces redundancy and

repetitions of activities and saves resources. Apart from the Maldives Healthcare Quality Standards[32] (Section 2.2), various other guidelines have been noted to include components of healthcare waste management. (Table 4).

Table 4: Summary of healthcare waste management guidance included within other guidelines.

Guidelines	Component that covers HCWM
1. Maldives National Policy on Health Laboratories 2020. (Policy/23-MOH/2020/01)[33]	Objective vii: to strengthen bio-safety practices and provide a waste management plan
	Infrastructure: infrastructure must align with requirements for laboratory waste management
	Bio-risk and bio-safety management: Monitoring of laboratory facilities for enforcing best practices in bio-safety and waste management.
	Bio-risk and bio-safety management: The MOH shall establish a code of bio-safety practice based on WHO recommended standards. Biosafety committees shall be established at all levels.
	Guidelines: Disposal of laboratory waste and biohazards.
2. The National Guideline on infection Prevention and Control (2022)[34]	Standard Precaution 1.1: Hand Hygiene
	Standard Precaution 1.2: Personal Protective Equipment
	Standard Precaution 1.4: Patient Placement
	Standard Precaution 1.6: Environmental Cleaning
	Standard Precaution 1.7: Handling of Waste and Linen
	Standard Precaution 1.9: Handling and Disposal of Sharps Disposing of Sharps and Syringes, Healthcare Workers Education,
	Standard Precaution 3.7: Management of Acute Gastroenteritis Due to Small Round Structured Virus (SRSV)
	Standard Precaution 4.3: Reducing Water-Borne Transmission
	5.1 Steps of Reprocessing of Reusable Medical Devices
3. Mercury Management Guideline for Health Care Facilities (MOH-HPA/G/19/74-0) (2018)[35]	Section 2.3: Pathways of mercury release to the environment
	Section 3.4: Mercury spill clean-up procedure
	Section 4.1: Storage of Mercury products and mercury waste
	Section 4.2: Important measures
	Section 5.1: Packaging, labelling and off-site transport, Storage of Mercury products and mercury use, Storage of Mercury waste, Storage of Mercury contaminated waste, Minimum criteria of the storage site as mentioned in the Waste Management Regulation R-58/2013
	Section 6.1: Record keeping, monitoring and evaluation

	Section 6.3. Training and Education
4. National Infection Prevention and Control Policy and Framework (Policy/23-MOH/2022/02) (2023)[37]	Policy direction 3: Implementation of measures, appropriate management of potentially infectious patients, availability of PPE, improved healthcare waste management and the safe use of injections, invasive devices, blood transfusions etc.
	Objective 2: Development or adaptation of guidelines and SOPs for prevention and control of infection, standard and transmission-based precaution, aseptic techniques, sterilization and disinfection of medical devices and waste management.
	Objective 7: Assurance of continuous procurement of adequate supplies relevant for IPC practices, including innovative equipment when necessary, WASH services and a health care waste disposal infrastructure.
	Objective 8: Assurance that patient care activities are undertaken in a clean and hygienic environment and supported by adequate infrastructures with compliance of proper biomedical waste disposal.
5. Mercury Free Policy for Health Care (Policy /23-MOH/2018/01) (2018)[38].	Objective 2: To link Mercury waste management in healthcare facilities with the national waste management policy
	Policy Intervention 4: Mechanism for safe collection, disposal of mercury wastes shall be established in line with the National Waste Management Regulation (2013/R58).
	Policy Intervention 7: Inventory for mercury containing equipment in health care facilities shall be maintained at central level linked with National Waste Management System.
	Policy Intervention 8: Sensitization and capacity development programs shall be carried out for policy makers, managers and health care professionals to enhance substitution of mercury containing products, management of mercury and mercury-containing wastes in health care facilities.
6. National Standards for Medical Laboratories (MOH-QA/G/22/113-0) (2022)[39].	Chapter 4: Technical Requirements: Accommodation and environment conditions, Post examination process and suggested model safety rules for health laboratories.
7. National Guideline on Clinical Use of Blood (MOH-MBS/G/22/114-0) (2022)	Section 3.16 At the end of blood transfusion
	Section 4.9 Selection of Rh compatible donor red cells:
	Section 4.18.2 Fresh Frozen Plasma (FFP)
8. National Patient Safety Framework Ensuring Quality and Safety (MOH-QA/S/21/109-0) (2021)	Core Priority 1.1: Establish the Structural System to support Patient Safety and Quality in Healthcare
	Advance Priority 1.2 Strengthen the regulatory framework for patient safety
	Core Priority 2.4: Promote safety through health care support processes
	Core Priority 3.3: To implement core components of infection prevention
	Core Priority 5.2: Promotion of information and education about Patient care and safety

5.4.Health Financing in healthcare waste management.

According to the Maldives National Health Accounts 2015-2017, nearly 60% of all healthcare spending is directed towards outpatient care, followed by hospitalization (19%), medical goods (10%) and the rest is accounted for administration. Preventive care expenses accounted for less than 0.5 percent of overall spending during 2017. While it is unclear the expenditure specific for healthcare waste management, the share of medical goods was approximated to be 10% in the same year. Nevertheless, the report mentions that medical goods expenditure considered for the report reflects retail level medical goods[40]. It is important to note that, national programs and PHUs of health centers and hospitals received little government funding for healthcare waste management. Keeping up with provision of consumables needed for autoclave operations and other related work is reported as an adversity for sustaining the services.

Henceforth, the WHO's support to the Ministry of Health has been noted unanimously by all interviewed to be a critical factor in improving healthcare waste management in the Maldives. In alignment with the Country Cooperation Strategy, the WHO CO carries out planning activities with national focal points and stakeholders biannually. Even though WHO is not a funding agency, activities in the biennium plan carry budget allocations. Activity reports are posteriorly collected by WHO CO to assess how budget has been utilized. Between the evaluation timeframe, WHO had carried out important projects to support MOH in establishing healthcare waste management mechanisms in health facilities; Low Emission Climate Resilient Development (LECRED) Project in Laamu Atoll (Section 7) and the Healthcare Waste Management Project under Canada grant to WHO (Section 5.2). The Healthcare Waste Management Project under Canada grant to WHO is costed to be 1,349,971.92.00 CAD[42]. The LECReD project is a USD 9.2 million investment by the Danish government for development of Laamu Atoll, where WHO was awarded USD 621,500 from The UN Trust Fund for the project implementation[43].

During COVID-19, with support from WHO, close to 19 million MVR was mobilized from the Delegation of the European Union to the Maldives in 2021, as an assistance in operationalizing and managing COVID-19 cases admitted to the Hulhumale' isolation facility, setting up of an ICU and for green medical waste management in selected facilities. According to MOH, the facilities that received autoclaves during COVID-19 were; Ha. Hoarafushi, Hdh. Makunudhoo, R. Dhuvaafaru, Lh. Hinnavaru, K. Maafushi, Adh. Maamigli, F. Biledhoo, GA. Gemanafushi, Gdh. Gadhoo and S. Hulhumeedhoo. Nevertheless, the 90L autoclaves donated by WHO in these islands were not for waste, but for sterilizing medical instruments.

The Government Budget (2023), demonstrated a budget allocation of MVR 630.2 million for the development of waste management facilities across the country, which includes the Greater Male' Environmental Improvement and Waste Management Project. A budget of MVR 257.7 million is allocated for the Maldives Clean Environment Project and the Greater Male' Waste to Energy Project[41]. The report does not show specific expenditure for healthcare waste management. Nevertheless, MOH reports to have commenced development of healthcare waste facilities through collaborations with Environment Ministry and the Maldives Clean Environment Project, details of which is provided below (Table 5).

Table 5: Islands receiving autoclaves from Maldives Clean Environment Project.

#	Atoll	Island	Health Center Grade	Size of Autoclaves	Status
1	Lhaviyani	Hinnavaru	Health Center G4	60L	Not Installed
2	Meemu	Dhiggaru	Health Center G3	60L	Not Installed
3	Meemu	Mulah	Health Center G3	60L	Not Installed
4	Faafu	Nilandhoo	Atoll Hospital G1	100L	Not Installed
5	Dhaalu	Kudahuvadhoo	Atoll Hospital G2	100L	Not Installed
6	Thaa	Veymandoo	Atoll Hospital G2	100L	Not Installed
7	Thaa	Vilufushi	Health Center G3	60L	Not Installed
8	Thaa	Thimarafushi	Health Center G3	60L	Not Installed
9	Thaa	Guraidhoo	Health Center G3	60L	Not Installed
10	Noonu	Kendhikulhudhoo	Health Center G3	60L	(Not updated)
11	Noonu	Maafaru	Health Center G3	60L	Not Installed
12	Raa	Hulhudhuffaaru	Health Center G3	60L	Not Installed
13	Baa	Eydhafushi	Atoll Hospital G2	100L	Not Installed
14	Baa	Thulhaadhoo	Health Center G3	60L	Not Installed
15	Baa	Dharavandhoo	Health Center G3	60L	Not Installed
16	Baa	Goidhoo	Health Center G3	60L	Not Installed
					Total autoclaves: 16 autoclaves

***Source: unpublished data from MOH.**

5.5.Health Information system

WHO CO's support for MOH in monitoring of healthcare waste management project encompasses supporting MOH with project monitoring staff, through assessments and evaluations of projects. In this manner, WHO has provided with a staff to MOH as a project monitoring staff, under the Healthcare Waste Management Project under Canada grant to WHO, as well as conducted several nation-wide assessments on healthcare waste management status of health facilities. Lack of human resources being a critical factor within MOH, having a project staff solely for the purpose of gathering information and producing status reports is perceived as very useful to MOH.

5.5.1. Healthcare waste assessments

One of the initial healthcare waste assessment was carried out in 2005, where an expert from the World Health Organization (WHO), an expert from the Ministry of Health and UNEP's experts collaborated to carry out a Post-tsunami assessment of health care waste in several health care facilities in the Maldives. WHO's observed a lack of sound management of heath care waste. In general, health care waste was reported to be better managed inside facilities, especially in Male', regional and atoll facilities. However, in health centers, health posts and family health centers, waste management within facilities was sporadic. This assessment brought forward recommendations for health care waste management within post tsunami recovery plans[20].

The assessment that preceded the development Current Status of Healthcare Waste Management and Proposed Policy & Guidelines for Maldives in 2007, was very extensive and included healthcare waste estimation analysis as well as an evaluation of healthcare waste management practices. The outcome of this assessment encompassed policy directions, a detailed guideline for healthcare waste management and an action plan[29]. Following this assessment, in 2008, Ministry of Health developed the Minimum standards for HCW management at health facilities[36].

The development of the National Health Care Waste Management Policy[18] in 2016, was based on an analysis of data collected from all health facilities which were analyzed. However, this document was not located. Nevertheless, the policy mentioned various aspects in the status of healthcare waste management in the country. Some of these observations included, inadequate segregation of waste, inappropriate disinfection of infectious waste, administrative issues and waste collection problems[18]. Evidence from the assessment was used to formulate the policy.

Another important assessment carried out in 2018, involved an on-the-ground assessment of several health-care facilities to assess the vulnerability of the health facilities in relation to the WHO model for climate-resilient health systems, the World Bank Climate-Smart Healthcare, Low-Carbon and Resilience Strategies for the Health Sector and Health Care Without Harm's Global Green and Health Hospitals (GGHH) Agenda. The assessment was carried out to comply with a request made by HPA with the overall goal of piloting a climate-smart health facilities program in the Maldives. Adopting a green, climate-smart approach to providing health care would allow adaptability to climate change, reduce carbon emissions, air and water pollution, promote sustainable use of resources, manage waste and reduce the use of toxic chemicals [22],[44].

For the Canadian grant, assessments were carried out in 11 atolls prior to the approval of the project, which was awarded on April 6th, 2021 (Table 6). The assessments continued till November 2021 and covered all atolls and islands of the Maldives. The assessment teams consisted of members from Ministry of Health, WHO and project implementation team visited the selected sites for assessment. The study consisted of exploration of healthcare waste generated from health facilities and gathered information on infrastructural capacity of the health facilities. A team consisting of members from Ministry of Health, WHO officials and project implementation team visited the selected sites for assessment[45]. Based on this assessment, MOH was able to identify the specific needs of health facilities for development of

healthcare waste disposal in the selected islands. The assessment was supported by WHO, under the Canadian grant.

5.5.2. Monitoring of healthcare waste management

QARD of MOH has the mandate to monitor of quality of health services, which also include monitoring healthcare waste. Currently, annual monitoring is carried out in the Greater Male' Area, and coverage of monitoring of health facilities is dependent on availability of funds and other resources. Therefore, QARD is reliant on atoll hospitals for quality supervisions. Feedback on findings of the study are shared with the relevant health facilities, MOH and policy-makers of MOH. The feedback given to health facilities are attached with a timeline of corrective measures to be taken. However, the follow-up of this communication to health facilities is not conducted on a regular manner.

With Support from WHO, QARD has been incorporated into a web-based digital platform, with self-assessments of MHQS standard compliance in health facilities. The project was launched in September 2022 and is currently implemented in the atoll hospitals and is expected roll out to health centers by the end of 2023. The digital platform will help in gathering information from atolls in a timely manner and QARD will be able to monitor all health facilities in the country more closely. Moreover, the digital platform will be more cost-effective, as travel logistics costs are very high in the country.

5.5.3. Monitoring of Supplies:

The supplies and management system within the Procurement Division of MOH, since a few years back has established a digital system to monitor medical products that are sent to health facilities. Nevertheless, the system is mostly used for monitoring of medicines and consumables, and equipment such as autoclaves are not monitored. The WHO CO had extended support to develop an integrated system for establishment of a logistic management system to the MOH. Nevertheless, the existing system was developed as a collaboration between MOH and Aasandha.

5.5.4. Monitoring of projects and plans

Monitoring of projects and plans are carried out through the Policy Implementation and International Relations (PIIR) Division of MOH. Projects are monitored through information reported from the project monitoring staff working at MOH. The WHO hired staff, stationed at the Regional and Atoll Health Services of MOH, reports to the PIIR. According to MOH, the mid-year report of Healthcare Waste Management Project under Canada grant to WHO did not show progress, as BOQs and other details are being finalized as of date.

PIIR also monitors the implementation of the Healthcare Waste Management Strategic Plan of HPA. Reports are sent to PIIR from HPA and other relevant divisions on activities in a systematic manner. According to MOH, The National Health Care Waste Management Strategic Plan 2016-2021 has progressed to an approximate 30% in completion of proposed actions.

5.6.Health Workforce and Infrastructure

WHO's technical assistance in developing human resources and support to infrastructure is highly praised and capacity building trainings are opiniated to be a very useful factor of motivation for healthcare workers, especially from the islands.

Lack of infrastructure and resources has been a critical issue in Maldives[15]. While some health facilities utilize autoclaving as a means of treating infectious wastes from health care facilities, others practice open burning within health facility premises. Recently built tertiary hospitals are equipped with infrastructure and facilities to cater for waste storage, waste segregation and treatment of infectious wastes. Many hospitals use autoclaves, shredders and other equipment in relation to healthcare waste management. The waste generated from autoclaves are then collected by state-owned corporations, such as WAMCO. Waste from Greater Male' Area are usually transported to Thilafushi for final disposal (incineration or closed contained burning).

Similarly, a significant percentage of healthcare workers in the Maldives comprises expatriates[47]. While this diversity enriches the Maldives' health system, it simultaneously contributes to a notable turnover of healthcare professionals within the sector. Consequently, retaining trained staff becomes a considerable challenge.

5.6.1. Capacity building and training

With support from WHO, a Training of Trainers (TOT) workshop was conducted in February 2019, on health care waste management and occupational health and safety. Atoll focal points, hospitals and state companies for waste management participated in this training. A similar TOT on healthcare waste management was also conducted in November 2015, involving atoll focal points. During the same month, an orientation session was conducted to the policy makers on Healthcare Waste Management Policy, which was followed by HCWM strategic discussions with policy makers in August 2016. Apart from training activities, various opportunities to participate in Regional meetings of SEAR and training at regional level are given to national program managers and atoll focal points.

Additionally, for the commencement of the LECReD project in Laamu Atoll, a training was conducted to the focal points of the atoll. IEC materials, stickers for use in healthcare waste management processes within the health facilities as well as SOPs (on process of waste management within the health facilities and SOPs on operating the autoclaves) were developed and handed over to the focal points. Approximately 40 participants were trained, including nurses, community health officers from PHUs and cleaners also participated. According to MOH, a similar smaller-scale training was conducted for health care workers from Raa Atoll.

5.6.2. Healthcare Waste Management Project under Canada grant to WHO

One of the fundamental focus was to support the national efforts to implement the National Health Care Waste Management Strategy, in an environmentally sustainable way using green technology. The project

also includes management of healthcare waste generated from COVID-19 quarantine and isolation facilities. Additionally, procurement of waste autoclaves and consumables, strengthen infrastructure for waste management and trainings to cover 10 atolls of the country were included within the project. Through this collaboration, 40 islands within 11 atolls will be upgraded to environmentally sustainable health waste management (Table 6). WHO CO is aiming to have trained focal points in all health facilities of the Maldives through the Healthcare Waste Management Project under Canada grant to WHO Project. The plan is to revise and develop a training package for the Maldives.

In addition to the procurement of waste autoclaves and consumables, through the Canadian Fund infrastructure for waste management (site for autoclave and shredders/storage of waste) is currently being implemented. With expertise from WHO, the architectural designs of waste management sites were initially approved by QARD of MOH. However, as the initial design was aimed for sites at Atoll Hospitals, MOH had requested for support to scale down the design of sites to accommodate smaller health centers. Currently, with collaborative support from WHO CO, the redesigning (for hospitals and health centers) is carried out by UNDP, which has now been approved by the MOH. These architectural designs for autoclave sites in hospitals and health centers, will also be used by other stakeholders. Under the first phase of the Canadian grant, a total 8 facilities that will receive infrastructure from WHO-UNDP collaboration (Table 7) and the project is expected to be handed over to UNDP by the of 2023. Infrastructural constructions are aimed to be completed by the end of 2024. However, frequent change in decisions in the selection of health facilities was observed.

At the beginning of the Healthcare Waste Management Project under Canada grant to WHO, 2 project staff (engineer and a nurse) were placed in MOH by the WHO CO. Human resources, being one of the constraints on project completion and implementation of activities, SSAs were very useful to MOH. Nevertheless, placing staff under Special Service Agreement (SSA) was discontinued in 2021.

Table 6: List of atolls and health facilities included within the Canadian Grant.

#	Atoll	Healthcare Facility
1	Haa Alifu	Dhihdhoo Atoll Hospital
2	Haa Dhaalu	Khulhudhuffushi Regional Hospital
3	Shaviyani	Funadhoo Atoll Hospital
4	Kaafu	Thuslusdhoo Atoll Center
5	Alifu	Rasdhoo Atoll Hospital
6	Alifu Dhaalu	Mahibadhoo Atoll Hospital
7	Vaavu	Felidhoo Atoll Hospital
8	Gaafu Alifu	Villingili Atoll Hospital
9	Gaafu Dhaalu	Dr. Abdul Samad Memorial Hospital
10	Gnaviyani	Fuvahmulah Atoll Hospital
11	Seenu	Addu Equatorial Hospital

5.6.3. Integrating programs and building processes

The training modules used in the workshops on healthcare waste management were derived from WHO guidelines and SOPs. Made up of 25 modules, the guidelines accommodate subjects ranging from knowledge on healthcare waste to processes of healthcare waste handling and disposal, and to institutionalization of healthcare waste management[46]. For the purpose of the trainings conducted in the Maldives, the modules were adapted to the country context.

Activities are carried out in conjunction with WASH, MHQS, Infection Control Practices (ICP) and Climate Change at WHO CO, an WHO SEAR. This integration gives the unique opportunity to improve skill-mix among healthcare workers. Moreover, integration is also seen in the administration of practices, such as ICP committees that are formed at health facility level also undertake healthcare waste management within the health facilities.

Components of healthcare waste management are incorporated in the trainings conducted on inter-related areas. This was understood to be very useful for MOH as, given the few resources allocated for training through government funding. Examples include;

- Training workshop on Quality improvement for healthcare workers of HA, Hdh, Sh and Male' (December 2021)
- ICP training conducted with MNU, ADB and MOH (September 2022)
- ICP symposium, with participations from all hospitals and health centers (hybrid) accounting for 120 health centers and 78 hospitals from the atolls and Greater Male' Area. (October 2022)
- Infection control and use of PPE (July 2019).
- Training of Assessors on Maldives Healthcare Quality standards (December 2016).
- Training session for vector control staff in Male' City and Baa Atoll (April and January 2019).
- TOT on Water Sanitation and Hygiene in healthcare facilities with participation from hospitals and in Male and atoll (July 2019).

WHO CO works through the biennium plans developed with national stakeholders, aligning activities as per priorities of WHO and Country Cooperation Strategy through the General Program of Work (GPW14) and Sustainable Development Goals.

5.7.Medical Products.

Even though healthcare waste management was not a WHO Regional Flagship, WHO CO's contribution to the government of Maldives has paralleled the high priority level set by the MOH after the unprecedented COVID-19 pandemic.

5.7.1. Autoclave and consumables

WHO CO has provided 18 autoclaves and during COVID-19 (13 of 60L and 5 of 90L), along with shredders which were used in isolation facilities and treatment facilities. 10 additional 90L autoclaves

were bought through the Emergency Fund. However, these 10 autoclaves were used for sterilization of equipment within health facilities. The islands that received these 10 autoclaves were; Ha. Hoarafushi, Hdh. Makunudhoo, R. Dhuvaafaru, Lh. Hinnavaru, K. Maafushi, Adh. Maamigli, F. Biledhoo, GA. Gemanafushi, Gdh. Gadhoo and S. Hulhumeedhoo

Even though the Healthcare Waste Management Project under Canada grant to WHO, is planned to provide 40 health facilities with autoclaves, a total 13 facilities have been selected to be covered in the first phase. (Table 7). However as mentioned before, frequent change in decisions in the selection of health facilities was observed.

Table 7: List of health facilities for healthcare waste management development through Canadian Grant (First phase)

Atoll/Island	Health Facility	Autoclaves		Site for HCW management
		Capacity	Status	
HA. Dhihdhoo	Atoll Hospital G2	100L	Not installed	Pending infrastructure
HDh. Kulhudhuffushi	Regional hospital G3	60L	Relocate	To be sent to Vaikaradhoo
HDh. Kulhudhuffushi	Regional hospital G3	60L	Relocate	To be sent to Finey
Sh. Maaungoodhoo	Health Center G2	60L	Not installed	Pending infrastructure
Sh. Milandhoo	Health Center G4	100L	Not installed	To be sent to Sh. Komandoo.
Sh. Kanditheem	Health Center G3	60L	Not installed	Pending infrastructure
Sh. Feevah	Health Center G2	60L	Not installed	Pending infrastructure
Sh. Feydhoo	Health Center G2	60L	Not installed	Pending infrastructure
AA.Rasdhoo	Atoll Hospital Grade 1	60L	Relocate	To be sent to Mathiveri
AA.Rasdhoo	Atoll Hospital Grade 1	60L	Relocate	To be sent to Feridhoo
ADh. Mahibadhoo	Atoll Hospital Grade 2	100L	Not Installed	Pending infrastructure
GA. Villingili	Atoll Hospital G2	100L	Not installed	Pending infrastructure
GDh. Thinadhoo	Regional Hospital G3	100L	Not installed	Pending infrastructure

***Source: unpublished data from MOH.**

Under the Low Emission Climate Resilient Development (LECReD) Program initiated in 2014, WHO has awarded autoclaves, shredders, consumables, training, back-up generator for GRH and support in construction of waste management site to Laamu Atoll. Details of autoclaves donated Laamu Atoll islands are described below. (Table 8). (Section 7)

Table 8: Support from WHO to Laamu Atoll islands

Laamu Atoll Islands	HCF Grade	Equipment
Gan	Regional Hospital G3	60L Autoclave (2) 650 L autoclave (1) Back-up generator (1)
Isdhoo	Health Center G3	60L Autoclave (1)
Dhanbidhoo	Health Center G2	60L Autoclave (1)
Maabaidhoo	Health Center G2	60L Autoclave (1)
Mundoo	Health Center G1	60L Autoclave (1)
Fonadhoo	Health Center G3	60L Autoclave (1)
Hithadhoo	Health Center G3	60L Autoclave (1)
Kunahandhoo	Health Center G1	60L Autoclave (1)
Maamendhoo	Health Center G2	60L Autoclave (1)
Maavah	Health Center G3	60L Autoclave (1)

***Source: unpublished data from MOH.**

MOH is also taking forward projects in collaboration with other international organizations, such as ADB, Japan, UNOPs etc. While provision of consumables for use of autoclaves are embedded within proposals of some projects, other projects solely provide autoclaves. (Table 2). Once projects are implemented, providing consumables for operations of autoclaves will be undertaken by the MOH for the health centers that are under the direct administration of MOH. However, once completed the initial phase of establishing autoclaves and sites have been contracted, bigger hospitals, such as tertiary hospitals are mandated to continue procurement of consumables.

5.7.2. Procurement, transport and logistics of equipment

Owing to delays in the approval of standards and the finalization of lists of health centers by MOH, the initially planned project outcomes had to be revised due to inflation in prices within the year. Consequently, the initial target number of islands was reduced. Additionally, there have been changes in the locations of autoclaves between islands done by MOH, even after their delivery.

Concerns have been raised regarding the substantial logistical expenses associated with transporting and storing large equipment from Male' to the islands. The absence of specialized equipment, such as machinery for lifting items between boats and land vehicles, poses a risk to workers who are compelled to manually lift and transport equipment through alternative means. At times, certain sea vessels decline to transport larger equipment to the islands. Furthermore, in some islands, inadequate warehouse space

results in large equipment being left outdoors, albeit covered with water-resistant materials. Consequently, some machines occasionally incur damage before installation. In addition to this, the verification processes for sent and received items are suboptimal, characterized by delays in verifying equipment at the receiving health facilities.

5.7.3. Maintenance of autoclave operations.

A Biomedical Unit is established within the MOH, which oversees all medical equipment maintenance in all health facilities. Now equipped with 3 staff, the unit is very active in travelling to islands to attend to technical issues of medical equipment. Henceforth, preventive and regular maintenance is almost nil. The organizational structures in tertiary hospitals allow hiring of biomedical technicians, who oversees and travel to islands of the atoll whenever need raises. However, regular maintenance is rarely carried out in the islands. When an equipment, such as an autoclave encounters and issue, biomedical technicians (if available in the atoll hospital) visit the island and attends the issue. If not resolved, BM unit at MOH is informed who will travel to the island for evaluation of the issue and required action. This is a costly process to the MOH and often delays occur in resolving technical issues with large equipment like autoclaves.

6. Pilot project for Health Care Waste Management in Laamu Atoll: Case Study

The Low Emission Climate Resilient Development (LECReD) Program, launched in May 2014 aimed to assist government authorities in the Maldives in building capacities at national and local levels to support low carbon life-styles, climate change adaptation, and disaster risk reduction. As one of the key objectives, the LECRED project aimed to develop healthcare waste management in Laamu atoll as a pilot project, which was strongly based on environmentally friendly principles. The aim is that the local development plans will evolve from stand-alone action plans into more strategic and evidence-based instruments, which are climate smart. The project also supported other activities in Laamu Atoll, such as a campaign for Dengue control, donation of air quality measuring devices and a vulnerability assessment of health facilities to disasters[43].

6.1. Gan Regional Hospital

Site visit and a Focus Group Discussion was carried out in Gan Regional Hospital (GRH) in Laamu atoll to explore WHOs contribution for health care waste management, effectiveness of training and the status of health care waste management within the hospital.

The autoclave, other devices, consumables and the construction of waste handling site provided under the LECReD project was extremely useful for health care waste management particularly during the peak of COVID-19, however, in 2021 its operation stopped due difficulties in sourcing a spare part, which till date has not been provided to the hospital. The hospital noted that the capacity of the autoclave was very large and did not match with the amount of health care waste generated by the hospital. Furthermore, the high-power requirement to operate the machine was not met by the hospital's power supply. Hence, an additional power generator was provided to GRH by WHO. GRH also noted that the

electricity issues have been solved at the hospital and the hospital now has a backup system in place for emergencies.

The initial training provided by WHO and HPA to all health care workers in the atoll was effective and knowledge from the training was utilized to establish and improve healthcare waste management in at GRH. Nevertheless, such trainings have not been carried out since then. Although GRH has had participated in a recent training conducted in IGMH on ICP, the need to have refresher trainings on healthcare waste management was expressed by the staff. Concerns on the turnover of health staff who participated in the initial training provided by WHO and MOH added to the training needs of GRH.

At the commencement of the project, proper protocols have been followed by the healthcare workers in terms of handling and segregation of healthcare waste, with use of color-coded bins and bags. However, there were some hindrances, as some areas of the hospital were not built in line with the standards prescribed. Examples of this include, absence of separate pathways for healthcare or infectious waste and absence of a drainage system in OT, whereby staff are required to use buckets to dispose of liquid waste from OT. The hospital's blueprint was approved by MOH. However, some of these factors may have been overlooked.

Additionally, when the 6-month consumables provided with the project ran out, there was difficulty in obtaining required supplies. According to GRH, there was interruption in the provision of supplies by MOH, and some supplies like biohazard bags and waste segregation containers were often unavailable. Given all the bottlenecks and inability to procure the spare needed to repair the autoclave, use of autoclave was discontinued.

Given these reasons, the practices of appropriate healthcare waste management in the hospital is limited to in-hospital processes, such as waste segregation at points of care, use of sharp bins, color coded bins for waste collection, use of PPES by healthcare workers and quality assurance through Patient safety and infection control committee. The committee is made of staff from all departments of the hospital and till date is functional. Currently, segregated waste gets mixed up with general waste at waste collection and storage site, before being taken to the waste disposal municipal area, including infectious waste and sharps. Concerns were raised on the public health risk that accompanies these practices. At the municipal waste management site, open burning is carried out for disposing of waste. Additionally, the Public Health Unit of the hospital collects vaccines and drugs and openly burns them in a designated area given by the local council.

The participants identified key areas of concern and challenges with regards to implementation of a sustainable health care waste management system utilizing the equipment and infrastructure provided by WHO. The reasons preventing continuous operation of the autoclaves was the difficulties in accessing funds and the lack of effective pathways for procurement of spare parts and consumables. Moreover, the biomedical technician at Gan Regional Hospital does not have specific training on the maintenance of the autoclave, routine preventative maintenance of the machine was not conducted. Another issue noted

by GRH is the fact that waste collection has been outsourced and managed by the island council with no proper equipment, training, or PPEs for safe handling or disposal.

The hospital is currently developing a 5-year strategic action plan with aims to address health care waste management. Renewed efforts to train, provide resources, infrastructure, and funding is required for the implementation of the GRH Action Plan as well as health care waste management policies.

6.2. Laamu Atoll Health Centers

Healthcare workers from 9 health facilities of Laamu Atoll were interviewed. The evaluation found that equipment, consumables, training and standard operating procedures have not been sustained. Except for 2 autoclaves donated under the LECReD project, all others are not in working conditions. The evaluation also found that the processes of healthcare waste management followed by health centers greatly varied, owing to challenges confronted by the health facilities. Difficulty in obtaining consumables, electrical issues, hindrances in repair of autoclaves and lack of training have been noted as some of the challenges. Even though training was conducted at the beginning of the project, training opportunities have been scarce in the recent years. The details of these findings are elaborated in the following table. (Table 8)

Table 8: Findings from Laamu Atoll Health Centers.

Components	Details
1. Usefulness	9/9 HCs think that having using autoclaves for management of healthcare waste is an important and effective measure.
2. Status of autoclaves	2/9 Autoclave in working conditions and used for waste autoclaving (Fonadhoo HC, Maamendhoo HC)
	1/9 Working under temporary repair that requires permanent repair, not used for 1 week (Hithadhoo HC)
	2/9 autoclave not working due to electricity issues (Isdhoo HC: for the last 3-4 months, Maabaidhoo HC: 1 year)
	2/9 autoclave is under working conditions, but not utilized due to in availability of consumables. (Dhanbidhoo HC: 2 years, Kunahanadhoo HC: 1 year)
	2/9 not working as needed repair has not been solved. (Mundoo HC: 8-10 months, Maavah HC: 1 year)
3. Autoclave site	8/9 HCs have a constructed site for waste management
	1/9 HCs use garage as autoclave site
4. Health facility processes (at service areas)	9/9 HCs reported to have good processes within the health facilities till waste collection.

5. SOPs and guidelines	1/9 has SOPs and instructions pasted on walls
	1/9 has SOP for laboratory waste and in the process of developing other SOPs
	1/9 follow the standards instead of having SOPs.
	6/9 do not have and do not have displayed SOPs for staff.
6. Storage of waste	5/9 HCs have no separate waste storage.
	2/9 HCs use autoclave site for waste storage
	2/9 HCs have separate sites for waste storage
7. PPE for waste handling	2/9 HCs difficulty in obtaining PPEs sometimes.
	5/9 HCs say they use PPEs adequately
	2/9 HCs report some incompliance among cleaners and staff.
8. Repair and maintenance of autoclave	8/9 HCs said maintenance of autoclaves is not carried out regularly, issues are attended.
	1/9 HC carries out regular maintenance through other staff with such technical staff.
9. Training	9/9 HCs think trainings are very useful and effective
	9/9 HCs changed/improved HCWM processes within HC after the training/LECReD project.
	7/9 HCs have a trained person(s).
	1/9 HCs has not retained the trained staff
	1/9 HC FPs were given instructions/guidance from GRH
10. Consumables	7/9 HCs reported interruptions in availability of consumables (distilled water, autoclave bags)
	2/9 HCs reported not receiving consumables lately.
11. Disposal	1/9 HCs autoclave infectious waste and disposed at municipal waste management area.
	1/9 HCs autoclave infectious waste and burnt by HC staff at municipal waste management area.

	1/9 HCs autoclave infectious waste and then carried out open burning within health center premises.
	2/9 HC carries out open burning within HC premises before discarding in municipal waste area.
	1/9 HC carries out open burning near HC by HC cleaners.
	3/9 HC mixes infectious and general waste at collecting points and discarded in municipal area.
12. Challenges for Health Centers	9/9 HCs lack of training/refresher training.
	8/9 HCs reported difficulty in obtaining consumables (autoclave bags, distilled water, biohazard bags, PPEs)
	2/9 HCs reported lack of human resources
	1/9 HC reported outsourcing waste management to council
	3/9 HCs reported maintenance/repair of equipment.
	2/9 HCs having electrical issues
	1/9 HC reported no having enough funds for improvement in HCW management.

7. Conclusions and Recommendations:

The evaluation of effectiveness of the healthcare waste management project in the Maldives, has provided valuable insights into the present state of WHO-supported health care waste management initiatives within the country. The evaluation shed light on WHO's pioneering role in instigating policy transformation in the Maldives, notably through the formulation of the National Healthcare Waste Management Policy. Moreover, guidance from WHO on strategic direction is exemplified by the development of the National Healthcare Waste Management Strategy. Considering the existing shortage of expertise in healthcare waste management in the country, the technical assistance extended by the WHO proved to be highly advantageous. WHO's continuous support effectively addresses the deficiency in technical expertise in the Maldives.

While the support provided by WHO to strengthen healthcare waste management in the Maldives is duly appreciated and acknowledge by the Ministry of Health (MOH), Health Protection Agency (HPA) and other health facilities, there remains a notable gap in sustaining the projects initiated by the WHO. The information collected and analyzed demonstrated that a significant number of autoclaves were found to be non-functional, necessary repairs have not been undertaken, and supply of essential consumables have not been adequately maintained. These factors have resulted in discontinuity of projects and programs,

highlighting the need for support in ensuring sustained success of healthcare waste management initiatives in the country.

WHO's initial assessments provided crucial insights and evidence regarding the state of healthcare waste management practices across the islands. These assessments not only pinpointed areas for improvement but also outlined the necessary resources, laying the groundwork for strategic directions and optimal resource allocation. Furthermore, the provision of additional staff to the Ministry of Health (MOH) by WHO, designated as project personnel, proved to be effective in supporting the demand for human resources in the health sector. Despite the existence of a monitoring mechanism within the MOH, the overall system (for project as well as supply monitoring) remains weak and lacks proactivity. Strengthening this monitoring framework is essential to ensure the ongoing effectiveness of healthcare waste management initiatives.

The training facilitated through collaborations with WHO has been widely recognized as exceptionally valuable, especially during the unprecedented COVID-19 pandemic. The knowledge gained from these sessions has played a pivotal role in driving positive changes and improvements within health facilities. Regrettably, several health centers experienced a turnover in staff, resulting in the loss of trained individuals. Compounded by the operational challenges associated with healthcare waste autoclaves, a considerable number of WHO support-provided healthcare facilities find themselves non-compliant, resorting to environmentally detrimental practices like open burning. The pressing need for refresher training and the presence of experts in this field within the country is palpable. Addressing these issues is crucial for sustaining effective healthcare waste management practices and ensuring the continued success of initiatives in the long term.

7.1.Summary of Challenges:

Despite WHO's exemplary role in the successful implementation of healthcare waste management in the Maldives, various obstacles have hindered the sustained continuity of success. The challenges are summarized below:

1. Lack of priority at policy level initially, that has now shifted to higher priority level after the COVID-19 pandemic.
2. While international partnerships are actively pursued to supply health facilities with the necessary equipment for establishing healthcare waste management infrastructure, the planning for consumables is typically limited to a 3 to 6 months timeframe within projects. Given the relatively small percentage of government funding allocated to prevention, concerns arise regarding the sustainability of these initiatives.
3. Disruptions in the availability of consumables crucial for the proper functioning of autoclaves and lack of appropriate means of transfer and storage in islands.
4. Inadequate infrastructure in hospitals and health centers to fully comply with healthcare waste management standards.
5. The scarcity of human resources in health facilities, coupled with irregular training opportunities and staff turnover, results in a shortage of trained personnel within health facilities

6. Lack of a robust biomedical maintenance and repair system coupled with challenges in procuring spare parts for equipment repairs.
7. The supply and inventory management system within MOH does not accommodate supply of equipment from donations or projects.
8. Delays in the finalization and approval processes of projects have led to subsequent increases in project costs over time, ultimately necessitating a reduction in the initially planned project outcomes.

7.2. Factors that influenced successful outcomes:

The Ministry of Health (MOH), Health Protection Agency (HPA), and various health facilities sincerely appreciate and recognize the support provided by WHO in advancing healthcare waste management in the Maldives. The findings of this evaluation underscore the key driving factors that have played a pivotal role in achieving successful outcomes in the establishment of healthcare waste management in the Maldives. These findings include:

1. WHO has demonstrated proactive leadership on the global stage, particularly in fostering partnerships, especially crucial during pivotal moments like the COVID-19 pandemic.
2. here has been a paradigm shift in WHO's approach, wherein they now provide resources comprehensively, covering elements such as infrastructure, human resources, training, and assessments. This holistic approach offers valuable evidence for effective project planning and delivery.
3. WHO's collaboration with both national and international partners in project implementation reflects a thoughtful consideration of the strengths and roles of various organizations within the country.

8. Limitations of the evaluation

The evaluation of WHO's contribution to the implementation of the Health Care Waste Management project in the Maldives from 2016 to 2021, took place between October and November 2023, coinciding with the presidential elections of the same year. Given the establishment of a new government in November 2017, potential changes in health policies may be anticipated. Consequently, healthcare waste management initiatives should prioritize advocacy efforts directed towards policy decision-makers and necessitate an assessment of the current government's priorities.

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Annex 1: Photo gallery

Photo 1: Waste management site at GRH, the storage is now used as cleaner's room.

Photo 2: Waste autoclave of 650L at GRH, now not functional.

Photo 3: Generator donated to GRH by WHO.

Photo 4: Side view of Autoclave 650L donated under LECRED

Photo 5: Focus group discussion with GRH.

Photo 6: New and upgraded back-up generator house of GRH.

Annex 2: List of participants in interviews.

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22. Mariyam Khathuma, Mundoo Health Centre.
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