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Developing an Environmentally Sustainable Model for Health Care Waste Management: A Policy Framework Approach

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Abstract
The current study bridges the gaps and enriches new innovations how to manage waste especially during the pandemic and beyond. This is most challenging for Region XII for as of the current time there is no facility that is functional and accessible to help health facilities manage their hospital wastes. The study determined the healthcare waste management practices of the identified hospitals in Region XII as basis in developing an environmentally sustainable Waste Management Model for Policy Framework. Results revealed that awareness of hospital personnel on waste management was reported to a high extent, waste handling trainings were found to be complied to a high extent, infrastructure facilities were available to a moderate extent, healthcare waste practices were implemented to a high extent and Health Care Waste Management among hospitals was found to be implemented to a high extent but current practices must be instituted and intensified to improve compliance and adherence to health care waste management protocols in the hospitals as mandated by DOH and DENR. Institutionalize a policy framework proposed in this study capsulating all the current trends and practices generated from hospitals to develop an environmentally sustainable healthcare waste management protocols in the context of Region XII.

Keywords: Health Care Waste Management, Policy Framework

INTRODUCTION

Health care waste (HCW) contains potentially harmful microorganisms that can infect hospital patients, health workers, and the society in general. Another troubling reality is with the other drug-resistant microorganisms from health facilities which can possibly spread from health facilities and harm the people and the environment.

The current study bridges the gaps and enriches new innovations how to manage waste especially during the pandemic. The healthcare waste treatment facilities (HCWTFs) are now being challenged by the massive volume of waste materials as caused by the use of protective devices to promote health and safety of people in the community. This is most challenging for Region XII for as of the current time there is no facility that is functional and accessible to help health facilities manage their hospital wastes.

This current study added scientific value by addressing the problem of handling HCW generated during the pandemic and providing models to manage extra burden of the heavy loads of HCW in Region XII. The study of Heidari, Yazdanparast, and Jabbarzadeh (2019) provided a new model called Multi-Objective Mathematical Programming Model. There is a need to boost the recycling industries to sustain the waste

management program. For without these industries, sustaining waste management programs will become, readiness of the community and other stakeholders, political, technical and social factors and geographical, transportation and other factors.

The Department of Environment and Natural Resources (DENR) in the Philippines in 2020 reminds LGUs, hospitals anew on proper disposal of medical waste to ensure health and environmental safety amid the coronavirus pandemic. Making people aware by bringing to them the right information to make them understand the policy and driven by the fact that waste management problem is never about wastes alone but about the lifestyle of the people that changes through time which also the changes the way people buy and use things, and dispose.

Linchpin (2022) reported the waste management marketing and industry trends shaping 2022 including computer technology will be used in various ways to aid in waste management, composting initiatives will take place along with more recycling programs, Participation of various stakeholders, strong awareness campaigns, and promotion, and replication of innovative and appropriate technologies are necessary to achieve sound waste management and sustainable recycling industry.

Waste management is a sensitive issue all around the world most especially during this COVID-19 Pandemic. Ignorance and mishandling of healthcare wastes have created environmental problems. In the study of Khan, Cheng, Khan, and Ahmed in 2018, they referred healthcare waste as generally from the treatment, diagnosis, and immunization of humans and animals. As cases of COVID-19 piled up continuously it put pressure on hospitals, medical facilities seeing these as a surge in the volume of infectious medical waste. In the report of the Earth Journalism Network (2020) they referred as surge in waste.

In the report published by the Earth Journalism Network in 2020, it was mentioned that environmentalists warned the public that the additional infectious medical waste could have serious impacts on human health and the environment if not managed properly. In the study Khan, Cheng, Khan and Ahmed in 2019 which mentioned that adoption of new technologies can help in reducing the management cost with minimum labor requirements along with risk mitigation. It is recommended that the discovery of feasible solutions for healthcare waste management in developing countries. In the Philstar article (August 2020), it was reported that Region 12 was not included in the list of treatment, storage and disposal facilities by region during the Pandemic as medical waste piles up as COVID-19 cases rise.

RATIONALE

Laws and regulations related to solid waste management started in 1938 with Commonwealth Act No. 383 about anti-dumping law which prohibits dumping of refuse or substances of any kind into rivers. This also paved the way to series of enactments in 1975, 1976, 1978, 1990, 1991, 1998, 1999, and 2001.

This current study is anchored from Section 54 of the Republic Act No. 9003 on research on solid waste management encourages government and private agencies, institutions and individuals in the conduct and promotion of researches on solid waste management relating to specifically the development and application of new and improved methods of collecting and disposing of solid waste and processing and recovering materials and energy from solid waste.

RA 9003 is considered the most comprehensive solid waste management and was used as the jumping point in the holistic approach in addressing the solid waste management problems in the Philippines.

The United Nations Conference on the Environment and Development (UNCED) in 1992 led to the adoption of Agenda 21, which recommends a set of measures for waste management. The

recommendations maybe summarized as follows; a. prevent and minimize waste production, b. reuse and recycle the waste to the extent possible, c. treat waste by safe and environmentally sound methods, and d. dispose of the final residues by landfall in confined and carefully designed sites.

Thakur (2022) recommended from their study about locating temporary waste treatment facilities in the cities to handle the explosive growth of HCWs during pandemics that capacity building during the pandemics, collection, storage and transportation of HCWs during health outbreaks can be explored.

When health care waste management practices are identified and assessed versus WHO-DOH standards the study will produce a new model of developing environmentally sustainable healthcare and waste management methods.

Statement of the Problem

The study determined the healthcare waste management practices of the identified hospitals in Region XII as basis in developing an environmentally sustainable Waste Management Model for Policy Framework. Specifically, it answered the following:

1. The extent to which the sample hospitals adhere to:

1.1 RA 9003;

1.2 DOH-Health Care Waste Management manual 4th edition standards, specifics to:

The management of:

1.2.1 Hazardous

1.2.1.1 Sharps

1.2.1.2 Infectious

1.2.1.3 Pathological

1.2.1.4 Anatomical

1.2.1.5 Pharmaceutical

1.2.1.6 Genotoxic

1.2.1.7 Chemical

1.2.1.8 Radioactive

1.2.1.9 Pressurized containers

1.2.2 Non-hazardous or general wastes

1.2.2.1 Recyclable

1.2.2.2 Biodegradable

1.2.2.3 Residual

2 The extent to which the expected guidelines of RA 9003 and WHO-DOH manual as against the actual implementations by the hospitals;

3 Based on the findings, what Environmentally Sustainable Waste Management Model for Policy Framework can be proposed?

Significance of the Study

This study provided functional and practical innovations through the policy framework beneficial to the following line agencies of the government which include. The study was the first and foremost useful to the hospital facility management as it will provide them with ways and means in developing and innovating their current practices alongside management hospital wastes. It improved policies being promulgated by the management and develop strategies in the collection, transportation and management

of hospital wastes. This study will provide mechanisms for implementing and monitoring improved practices in managing hospital wastes. The data generated in the study will provide strategies for DOH to implement the recommended guidelines and protocols in management hospital waste as evidenced from the data collected from the survey.

Scope and Limitation of the Study

The study was all about the current practices of hospitals in managing healthcare wastes especially as it surged during the COVID-19 Pandemic. The increase in the volume of these hospital wastes was found so massive that managing them is found to be very challenging given the bulk and the kind of wastes produced during the pandemic. It was conducted to all the hospitals accredited by DOH and PhilHealth in Region XII, both public and private hospitals.

Conceptual Framework

Figure 1 shows the conceptual framework developed for the study. The current management practices in waste management of hospitals in Region XII were generated to develop as an output of the study a policy framework which will be adopted by various hospitals. These hospital practices are anchored from Republic Act 9003 and DOH-HCWM Guidelines and these government regulations will put impact to the compliance of hospitals in managing healthcare wastes.

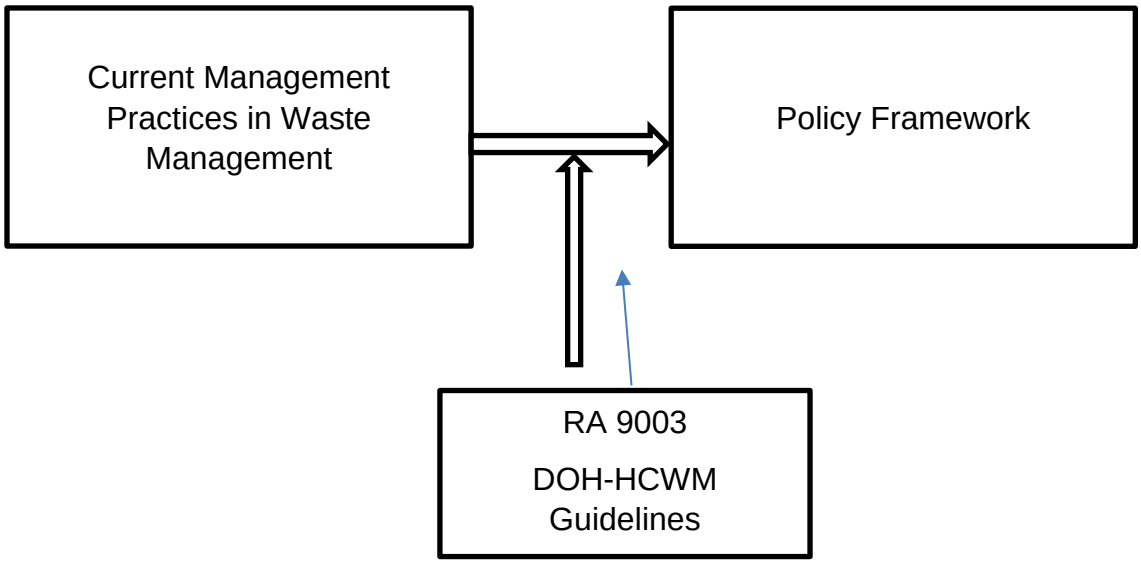


Figure 1. Conceptual Framework

Theoretical Framework

The current study was anchored from the Waste Management Theory. Waste Management Theory is used in this study as it is founded on the expectation that waste management is to prevent waste causing harm to human health and the environment. The proper definition of waste is crucial to constructing a sustainable agenda of waste management. It is largely the case that current legislation attends to existing waste.

The core justification of regulating waste disposal was to regulate waste disposal and even minimizing waste from the users and producers of these health care wastes. Indeed, in this context the key to sustainable waste management is waste minimization particularly reduction of waste at the source, or from the hospitals.

METHODOLOGY

The study used mixed method, a combination of the quantitative-descriptive research approach and qualitative approach using interview schedule for an in-depth interview. The acquired data is then evaluated using a variety of mathematical and statistical methodologies to arrive at conclusions and findings (Apuke, 2017).The study was conducted to all level 2 tertiary private and government hospitals in Region XII. Region XII or SOCSKSARGEN is situated in South Central Mindanao, Philippines. The respondents of the study were hospital administrators, biomedical and pollution control officers of all DOH and PhilHealth level 2 accredited hospitals in SOCSKSARGEN Region (Region XII). The maximum variation purposive sampling will be used in this study in which one is selected to provide a diverse range of cases relevant to a particular phenomenon or event (Crossman, 2020). The researcher constructed the research instrument in gathering valuable data from the respondents of the study. The instrument was validated and tested for reliability using Inter Rater Reliability (IRR). Identifying hospitals and acquiring approval from hospital administrators and medical directors were the identified preliminary steps after finalizing the list of hospitals in the region to be involved in the study and taking all as well their contact information. Hospital visits were done to orient possible respondents of the study and getting their consent while understanding data privacy clause of the study. Participating hospitals who provided permission to involve in the study were taken as the actual source of the generated information pertaining to healthcare waste management practices. The research used descriptive statistics using percentage and mean as statistical tools. Descriptive statistics is used to summarize data in an organized manner by describing the relationship between variables in a sample or population. Calculating descriptive statistics represents a vital first step when conducting research and should always occur before making inferential statistical comparisons (Kaur, Stoltzfus and Yellapu, 2021).

Ethical Consideration

The informed consent form will be written in language easily understood by the respondents, it will minimize the possibility of intimidation and the respondents will be given sufficient time to consider participation because this provision is included in the ethical considerations that participation is always voluntary. The voluntary expression of the consent by the respondents and the adequate information disclosure about the research are critical and essential elements of the informed consent process. The researcher will make sure that the respondent is able to comprehend the research-related information should personally decide and provide the consent on research participation. Since the target respondents of the study are not from vulnerable groups so the real participants will not go through serious trouble since the participants are able and are most willing to participate.

RESULTS AND DISCUSSION

The profile of the hospital in terms of bed capacity and average occupancy rate is presented in Table 1. It is revealed that 60% of the hospitals are having 100-150 bed capacity while 20% are in the range 151-200 bed capacity and another 20% in the bed capacity bracket of 201 and above. In terms of occupancy rate

50% of the hospitals are in the occupancy rate covering 3-year period within 41% to 60%. On the other hand, 20% or 2 hospitals reported average occupancy rate within 81% and above.

Table 1. Profile of the Hospital

Variable	Class	Frequency	Percentage
Bed Capacity			
	100-150	6	60
	151-200	2	20
	201 and above	2	20
Average Occupancy Rate Covering 3 Year Period			
	10%-20%	0	0
	21%-40%	1	10
	41%-60%	5	50
	61%-80%	2	20
	81% and above	2	20

Table 2 presents the volume of health care waste generation per kilo daily and per month. This is to show the massive load of health care waste being managed by hospitals. Ranked first are the Non-hazardous or general wastes. These wastes are wastes that had not been in contact with infectious agents, hazardous chemicals, or radioactive substances and does not pose any special handling problem or hazard to human health or to the environment which generated 67.98 kilos daily and an average monthly collection of 1,653.50 kilos. Second in rank are the Residual wastes. These wastes are general wastes that do not belong to recyclable and biodegradable categories with around 40.45 kilos daily and amounting to 1,154.10 kilos per month.

Pressurized containers including portable pressurized cylinders, cartridges, and aerosol cans are among the least generated health care waste among hospitals as it ranked the last among the identified health care wastes with only 0.163 kilos per day and with average 26.6 kilos monthly generation. Fernandez (2022) in her report with Eco-Business provided data that more than 234,0000 metric tonnes (MT) of healthcare waste, equivalent to about 6,000 trucks was generated from June 2021 to the end of January 2022 in the Philippines, and only 16.6% has been transported to waste treatment facility and around 13% were treated. These contextualized data from the report has relevant implications for which the current statistics provided a regionalized data valuation from daily and monthly waste generation.

Table 2. Volume of Healthcare Waste Generation

Healthcare Waste	AVERAGE HEALTHCARE WASTE (IN Kilos)			
	Daily		Monthly	
	Average in Kilos	Rank	Average in Kilos	Rank
Hazardous	37.97	4	941.89	4
Sharps needles, syringes, scalpels, saws, blades, broken glass, infusion sets, knives, nails, and other items that can cause a cut or puncture wound.	6.28	8	146.462	8
Infectious wastes	38.92	3	1152.50	3
Pathological/Anatomical	7.09	9	110.16	9
Pharmaceutical	14.63	10	32.517	10
Genotoxic	1.29	13	18.74	13
Chemical	6.03	7	206.20	7
Radioactive	0.80	19	19.00	19
Pressurized containers	0.163	11	26.6	11
Non-hazardous or general wastes	67.98	1	1653.50	1
Recyclable	10.44	6	393.45	6
Biodegradable	22.18	5	409.34	5
Residual	40.45	2	1154.10	2

According to Modeling and Optimization of Biomass Supply Chains, 2017 as reported in Science Direct, biodegradable wastes are any waste that is capable of undergoing anaerobic or aerobic decomposition, such as food and garden waste, and paper and cardboard.

HEALTHCARE (ADMINISTRATIVE) MANAGEMENT SYSTEM

Health care waste management (HCWM) is a process to help ensure proper hospital hygiene and safety of health care workers and communities. In the report all the ten (10) hospitals have their own health care waste management committee. Of the ten hospitals only six (6) hospitals reported their annual budget for

health care waste management on the average amounting to PhP1,076,666.67. On the other hand, nine out of ten hospitals established their healthcare waste management plan for 1 to 5 years (90%).

Table 3. Healthcare Management System

Healthcare Management System	Frequency / Amount	Percentage
Health care waste management committee	9	90
Waste Management Committee not Yet Established	1	10
Healthcare waste annual budget	1,076,666.67	
Healthcare waste management plan		
1-5 year plan	9	90
6-10 year plan	0	0
Not Known	1	10

The level of awareness of hospital personnel on waste management is reported in Table 4. It can be noted that the highest mean is 3.50 for use of personal protective equipment of person-in-charge, waste separation, and waste disposal which are found to be aware to a high extent. The lowest mean is reported in the practice pertaining to waste minimization (2.70). The total level of awareness on biomedical waste management among health care personnel was found to be 60% (Nijiru and Gikunju, 2013). It is evident that the level of awareness of hospital personnel on waste management was found to a high extent, considering that these practices are well placed in the hospital setting.

The Ecological Solid Waste Management Act of 2000 mandates the segregation of solid waste at the source including households and institutions like hospitals by using a separate container for each type of waste from all sources (Section 21, Article 2, RA 9003).

Table 4. Level of Awareness of Hospital Personnel on Waste Management

Waste Management Practices	Mean	Interpretation
Use of Personal protective equipment of person-in-charge	3.50	Aware to a High Extent
Waste Minimization	2.70	Aware to a High Extent
Waste Separation	3.30	Aware to a High Extent
Waste Codification	2.90	Aware to a High Extent

Waste Handling	3.30	Aware to a High Extent
Waste Treatment	2.90	Aware to a High Extent
Waste Disposal	3.30	Aware to a High Extent
Waste Transportation	2.80	Aware to a High Extent
Overall Mean	3.09	Aware to a High Extent

Reducing the amount and toxicity of hazardous waste generated is the focus of waste minimization as a waste management approach. In addition to hazardous wastes regulated under The Resource Conservation and Recovery (RCRA) through EPA encourages the minimization of all wastes. Compliance to training on waste handling by hospital personnel is provided in Table 5. The highest mean in this category is 3.50 for color coding of waste. While the lowest mean is 2.90 for safe waste management.

Table 5. Personnel Training on Waste Handling

Trainings	Mean	Interpretation
Separation Process	3.10	Complied to a High Extent
Handling Procedure	3.20	Complied to a High Extent
Storage of Healthcare Wastes	3.20	Complied to a High Extent
Color Coding of Waste	3.50	Complied to a High Extent
Appropriate Methods of treatment	3.00	Complied to a High Extent
Disposal Techniques	3.30	Complied to a High Extent
Onsite Treatment	3.30	Complied to a High Extent
Offsite Treatment (Landfill)	3.00	Complied to a High Extent
Safe Waste Management	2.90	Complied to a High Extent
Protective Measures	3.20	Complied to a High Extent

Infection Control Measures	3.20	Complied to a High Extent
Overall Mean	3.17	Complied to a High Extent

Compliance to handwashing training was complied to a high extent. This is a best practice among hospitals as these are well-guided by protocols set by the Department of Health and local hospital-based regulatory committees.

Table 6 shows the infrastructure facilities managed by hospitals for health care waste. The highest mean is 3.70 for segregation facility or MRF which is found to be available to a great extent. The lowest mean in this category is 1.00 for incinerator or thermal destruction which is available to a little extent and also microwave (1.00) and compacting machine (1.00).

Table 6. Infrastructure Facilities

Facilities	Mean	Interpretation
Segregation facility/MRF	3.70	Available to a Great Extent
Incinerator (Thermal Destruction)	1.00	Available to a Little Extent
Chemical Treatment Facility	2.33	Available to a Moderate Extent
Autoclaving (Stem-Based Treatment)	2.78	Available to a High Extent
Microwave	1.00	Available to a Little Extent
Shredding Machine	2.89	Available to a High Extent
Compacting Machine	1.00	Available to a Little Extent
Landfill	2.13	Available to a Moderate Extent
Overall Mean	2.10	Available to a Moderate Extent

Failing to segregate health care wastes properly means that it will end up mixed in landfills the same way it was mixed in bins from hospitals. Non-hazardous waste items like food scraps, paper and liquid waste can mix and decompose, releasing run-off into the soil and harmful gas into the atmosphere but hazardous waste materials are indeed a great threat to the environment. Practicing waste segregation within the hospital facility must be instituted as it has economic implications, when wastes are sorted correctly it can eventually save time and money and in the long run saving the environment.

Table 7. HEALTHCARE WASTE MANAGEMENT PRACTICES

Healthcare Waste Management Practices	Mean	Interpretation
Segregation	3.70	Implemented to a Great Extent
Treatment	3.00	Implemented to a High Extent
Storage	3.30	Implemented to a High Extent
Transport	2.90	Implemented to a High Extent
Disposal	3.20	Implemented to a High Extent
Landfilling	2.50	Implemented to a Moderate Extent
Recycling	3.30	Implemented to a High Extent
Records Keeping	3.00	Implemented to a High Extent
Overall Mean	3.11	Implemented to a High Extent

Waste Management Committee

Absence of a legitimate committee was found out during the interview. Handling waste is just a part of the day-to-day operations of the health care facility and included in the function of the management committee (ManCom). In this study, administrators realize that a working waste management committee will help in internal-policy formulation, assessment of existing practices and budget allocation.

Training of person-in charge

Healthcare facilities, as directed by DENR, need pollution control officers (PCO) as a requirement for its operation. Among the ten hospital respondents, four are newly appointed and still on their adjustment and initiation phase. Others are not so familiar with the classification of wastes under the DOH HCWM 4th edition manual. All old and new PCOs have their proper training under DENR training providers and submit their monthly report to the agency. Periodically, the facility is inspected and these PCOs have to report their practices and to show their management strategies. With concerns affecting their function, a continuous retraining is suggested including benchmarking to other Healthcare facilities.

Budget allocation

The administration realized of the expense only when the issue was brought to their attention especially during the pandemic where HCW tripled and exploded in volume. Suddenly HCW management became a priority especially on handling, stocking, transportation and disposal. cost was analyzed and most of the

administrators have expressed to allocate funds for healthcare waste alone separate from the operational funds.

Plan

A tactical or strategic plan was asked during the interview and revealed that there was none. An annual plan carried over the previous year is the reference point for the current year. PCOs and supervisors have agreed to the importance of having a tactical plan that will serve as a guide for the next three years.

Thematic Analysis with Significant Statements

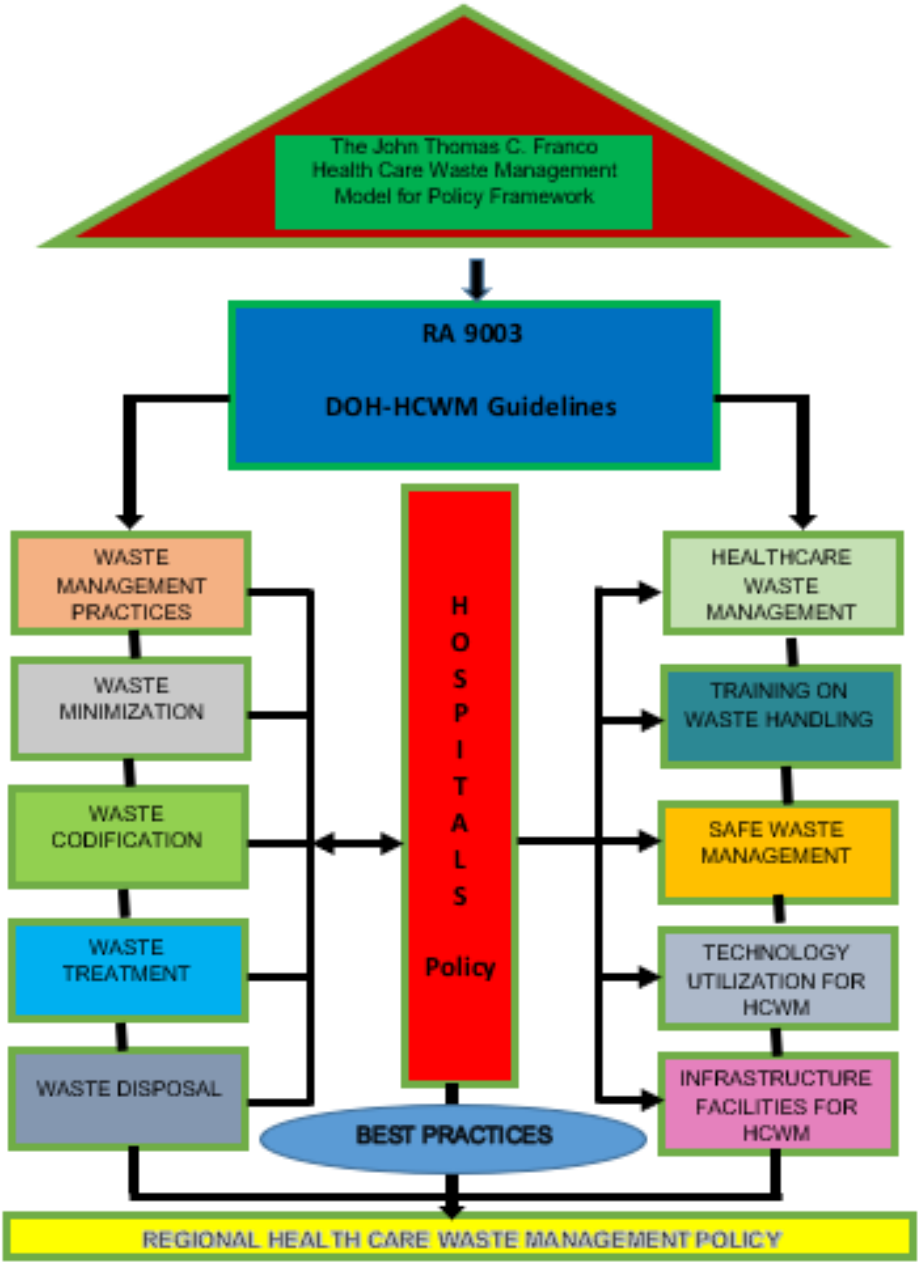
The study developed seven (7) themes and 23 sub-themes derived from the conductged in-depth interview. Themes include response to regulatory agency, environmental preservation, dynamic information sharing, Safe and Preventive Measures in Handling and Transporting HCW and Technology and Innovations.

Table 8. Research Findings based on Main Themes

Sub-themes	Themes
Monthly monitoring of waste generated, Awareness on waste management, Contract with provider for disposal of end of life equipment, Contract with provider for return of excess packaging Solid waste management monitoring logbook for station nurse DOH and LGU Approval	Response to Regulatory Agency
Waste minimization. Clean and Green Program Composting Zero Plastic	Environmental Preservation
Series of Lectures and Trainings Putting of warning signs for hazardous and infectious waste, also by following 3Rs – Reduction, Reuse and Recycle.	Dynamic Information Sharing
Wearing of complete PPEs before handling and transporting HCW Putting of warning signs for hazardous and infectious waste, also by following 3Rs – Reduction, Reuse and Recycle.	Safe and Preventive Measures in Handling and Transporting HCW

Reduce, reuse, recycle, zero paper waste, vermi-composting	Healthcare Waste Management Practices
Segregation, disinfection, autoclave and storage	
Establishment of hospital waste management committee.	
Proper designation of hospital waste -disposal, treatment, etc.	
Strengthening of hospital waste minimization.	
Hospital zoning for infectious waste.	
Continuing of recycling, segregation, color coding	
Creation of the 5 year plan on waste management	Future Strategies for HCW
Utilized recyclable waste for income generation, Water treatment. Green practices.	
Clean and healthy environment with Safe food and water.	
Proper waste segregation, storage, handling and disposal, no pests such as flice, cockroaches and mosquitoes.	
Continuous compliance on health improvement and environmental regulations. Sustain healthcare waste management practices.	
Waste minimization technology	Technology and Innovations
Technologically advanced equipment.	
Collection and treatment technology.	
Extension and Landfill.	
Continuously conduct of staff orientation on proper waste segregation, storage, handling and disposal.	
Create/plan activities that will encourage hospital personnel to practice 4Rs- reduce, reuse, recycle and recover. Sustain healthcare waste management practices and continuous monitoring of healthcare waste management plan implementation	

In the policy framework it is evident that waste management practices must be intensified by managing health care waste in the most innovative way and starting with promoting waste minimization adherence of hospitals.



References

1. Cabico, G.K. (2020). In the Philippines, medical waste piles up as COVID-19 cases rise. Philstar. https://earthjournalism.net/stories/in-the-philippines-medical-waste-piles-up-as-covid-19-cases-rise
2. Crossman, A. (2020). Understanding Purposive Sampling. An Overview of the Method and Its Applications. https://www.thoughtco.com/purposive-sampling-3026727
3. DENR (2020). DENR Reminds LGUs, Hospitals Anew on Proper Disposal of Medical Waste. https://www.denr.gov.ph/index.php/news-events/press-releases/1862-denr-reminds-lgus-hospitals-anew-on-proper-disposal-of-medical-waste

4. Fernandez, H.A. (2022). Piles of Medical Waste in Philippine hospital highlight country's COVID 19 trash problem. https://www.eco-business.com/news/piles-of-medical-waste-in-philippine-hospital-highlight-countrys-covid-19-trash-problem/
5. Padmanabhan, K.K. and Barik, D. (2019). Health Hazards of Medical Waste and Its Disposal. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7152398/
6. Pongracz, Phillips and Keiski (2004). Evolving the Theory of Waste Management: defining key concepts. https://www.witpress.com/Secure/elibrary/papers/WM04/WM04046FU.pdf
7. Science Direct- Modeling and Optimization of Biomass Supply Chains. (2017). Biodegradable Waste. https://www.sciencedirect.com/topics/engineering/biodegradable-waste
8. Thakur, V. (2022). Locating temporary waste treatment facilities in the cities to handle the explosive growth of HCWs during pandemics: A novel Grey-AHP-OCRA hybrid approach. https://pubmed.ncbi.nlm.nih.gov/35528480/