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DISCUSSION PAPER

Hospital Waste Management and Environmental Disaster Risk: A Case Study of Lahore

Haider Waseem Anwar
Saba Shahid



HOSPITAL WASTE MANAGEMENT AND ENVIRONMENTAL DISASTER RISK: A CASE STUDY OF LAHORE

HAIDER WASEEM ANWAR AND SABA SHAHID

Key words:

Disaster risk reduction, medical waste, adaptive governance, public health, Covid-19, environmental degradation, environmental governance

1. Introduction

Hospitals in Pakistan generate over 250,000 tons of waste annually, yet studies¹ indicate that there is very little awareness or enforcement on hospital waste management processes despite there being adequate legislation and associated policy frameworks in place. With the spread of the Covid-19 pandemic in early 2020, there is growing acknowledgement of the manifold increase that this infectious disease has had on the volume of hospital waste across the world.² Not only is there a direct threat to public health given a rise in hazardous waste and non-biodegradable materials, there is also potential for environmental disaster risk caused directly and indirectly due to mismanagement of hospital waste.³ Public health concerns such as the spread of infectious diseases including HIV, Hepatitis B and C are a common threat, while environmental degradation due to contaminated groundwater, air pollution and consequent loss of biodiversity are amongst the several negative externalities of improper waste management. This paper attempts to assess the extent to which disaster risk reduction acts as a guiding principle for hospital waste management in Lahore. Our findings are based on in-depth interviews with experts in the field and a rigorous review of the existing literature on the subject. We argue that by building adaptive governance-policymaking that anticipates a matrix of development concerns, a public administration response can be cultivated that is able to respond to a dynamic governance challenge. Thus, reducing the risk of environmental disaster in the city.

¹ Kumar et al., "Healthcare Waste Management (HCWM) in Pakistan: Current Situation and Training Options." *Journal of Ayub Medical College, Abbottabad : JAMC* 22 (October 1, 2010): 101–5.

² Kalantary et al., "Effect of COVID-19 Pandemic on Medical Waste Management: A Case Study", *Journal of Environmental Health Science and Engineering* 19, no. 1 (June 1, 2021): 831–36. <https://doi.org/10.1007/s40201-021-00650-9>.

³ Hossain et al., "Clinical Solid Waste Management Practices and Its Impact on Human Health and Environment--A Review," *Waste Management (New York, N.Y.)* 31, no. 4 (April 2011): 754–66. <https://doi.org/10.1016/j.wasman.2010.11.008>.

1.1. Disaster Risk in the Context of Medical Waste

Disaster Risk

According to the United Nations Office for Disaster Risk Reduction (UNDRR), *disaster risk* is defined as “the potential loss of life, injury, or destroyed or damaged assets which could occur to a system, society or a community in a specific period of time, determined probabilistically as a function of hazard, exposure, vulnerability and capacity”.⁴ Furthermore, disaster risk reduction can be classified into three main areas.⁵

- I. *Reducing exposure*: mitigating the exposure of a population and its surrounding ecosystems to the hazard.⁶
- II. *Reducing vulnerability*: by providing livelihood opportunities and increasing resilience through better governance models.⁷
- III. *Reducing hazard intensity*: Environmental degradation and debilitating ecosystems may increase disaster risk. Restoring ecosystems and natural environmental conditions will help reduce the intensity of a particular hazard.⁸

The emerging policy frameworks, including the DRR resolutions adopted in the UN General Assembly (UNGA) Sessions 70th to 75th, and the Global Assessment Report for Disaster Risk Reduction 2019, recognize the growing concern of the impact of multiple hazards on disaster risk. This agenda in global policy also applies to hospital waste management and its impact on the environment, since mismanagement of hazardous and non-hazardous medical waste contributes directly and indirectly to various forms of environmental degradation, such as soil and water contamination, air pollution, carbon emissions, and the spread of pathogens in the environment, which all together contribute towards climate change.

Medical Waste from Hospitals

In Pakistan, safe and sustainable hospital waste management continues to be a challenge. From hospital level bottlenecks, to larger overarching governance issues,

⁴ UNDRR, “Disaster Risk”, <https://www.undrr.org/terminology/disaster-risk> (accessed September 2021)

⁵ UNDRR, “Understanding Disaster Risk”, <https://www.preventionweb.net/understanding-disaster-risk/component-risk/disaster-risk> (accessed September 2021)

United Nations, Office for Outer Space Affairs UN-SPIDER Knowledge Portal, “Disaster Risk Management”, <https://www.un-spider.org/risks-and-disasters/disaster-risk-management> (accessed September 2021)

⁶ i.e., Mangrove ecosystems mitigate the impact of coastal hazards such as storm surges, sea level rise, flooding, erosion, and salt intrusion; Spalding *et al.*, *Mangroves for Coastal Defence. Guidelines for Coastal Managers & Policy Makers*.

⁷ Mukherjee and Siddique, “Assessment of Climatic Variability Risks with Application of Livelihood Vulnerability Indices”, “Assessment of Climatic Variability Risks with Application of Livelihood Vulnerability Indices.” *Environment, Development and Sustainability* 22, no. 6 (August 1, 2020): 5077–5103. <https://doi.org/10.1007/s10668-019-00415-3>.

⁸ Peduzzi *et al.*, “Assessing Global Exposure and Vulnerability towards Natural Hazards”, *Natural Hazards and Earth System Sciences* 9, no. 4 (July 17, 2009): 1149–59. <https://doi.org/10.5194/nhess-9-1149-2009>.

safe and environmentally sustainable waste management poses a disaster risk to the country. Low levels of awareness, capacity issues of medical and janitorial staff, poor policy implementation and inadequate systems of monitoring, all contribute towards the problem. Currently, autoclaving, open dumping, shredding, sterilization and incineration remain the most common forms of waste disposal.⁹ While all forms of solid waste management have some environmental implications, incineration and open dumping are the least desirable methods when it comes to environmental protection (see *Table 2 on p.15 for details on the environmental impact of each waste disposal method*).

1.2. Types of Waste: Definition of Hazardous Waste and Ways of Disposal

1.2.1. According to the World Health Organization (WHO),¹⁰ which also is a source for many of Punjab's health waste disposal regulations, there are various types of waste and by-products produced from medicinal activity in hospitals. The major categories are described below:

- Hazardous Waste:
 - Chemical Waste is defined as all waste that results from, lab work, cleaning and disinfecting processes, and mercury waste due to broken clinical equipment and spills and also includes cadmium waste from broken batteries.
 - Genotoxic Waste; results from the vomit, feces or urine of patients that have received cytotoxic drugs and the drugs themselves. Such waste also includes syringes, vials that are used while making or administering these drugs.
 - Infectious waste: results from any contaminated material including by bacteria, viruses, parasites/fungi and lab cultures. It also involves waste from autopsies, infected patients, infected lab animals and contaminated associated equipment.
 - Radioactive waste: results from radionuclide contamination of liquid, gas, or solid materials.
 - Sharp material that could injure, cut or puncture someone, regardless of being contaminated or not, including syringes, needles, disposable scalpels, blades.
 - Pathological waste: human tissues, organs or fluids, body parts and contaminated animal carcasses.
 - Pharmaceutical waste: expired, unused and contaminated drugs and vaccines.
- Non-hazardous or general waste: waste that does not pose any particular biological, chemical, radioactive or physical hazard. Can include cardboard, paper, aerosols, packaging and food waste.

⁹ Mukhtar et al., "Hospital Waste Management: Execution In Pakistan And Environmental Concerns – A Review." *Environmental Contaminants Reviews* 1, no. 1 (June 1, 2018): 18–23. <https://doi.org/10.26480/ecr.01.2018.18.23>.

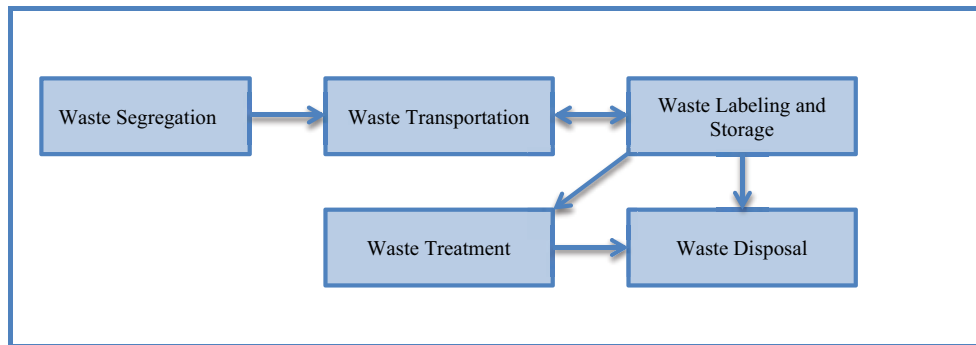
¹⁰ World Health Organization, "Health-Care Waste", <https://www.who.int/news-room/factsheets/detail/health-care-waste> (accessed October 10, 2021)

1.2.2. Ways of disposal:

Hospital Waste Management involves the entire process of “documentation, segregation, collection, transportation, storage, disposal and minimization and reuse” of all waste that is ‘risk or non-risk’. WHO highlights various techniques for hospital waste management according to the types of medical waste material and the international best practices provided by pertinent UN entities such as the Environmental Protection Agency (EPA).

Apart from the policy guidance on medical waste management the prominent techniques of managing hospital waste in Pakistan include i) open dumping, ii) autoclaving, iii) incineration and iv) landfilling.¹¹ The main stages that are followed in Pakistan for the process of hospital waste management are delineated in Figure 1 below:

Figure 1: Stages of Hospital Waste Management in Pakistan



1.3 Hospital Waste in Lahore

Lahore is a large metropolitan city in the province of Punjab, with an estimated population of over 11.1 million people.¹² As an economic and commercial hub, it is growing on average at 3% annually.¹³ City planning and urban management continue to be a serious challenge given a thriving and persistently growing informal economy, attracting several types of workers traveling from neighboring cities and rural areas. As a result basic social services such as clean water and sanitation and access to quality healthcare services are inequitably provided in the city. The prevalence of alternative medicine and ‘quacks’ makes it hard to monitor the healthcare sector, consequently making it even harder to impose waste management regulations. Lahore has also been an epicenter of the

¹¹ Mukhtar et al., “Hospital Waste Management: Execution In Pakistan And Environmental Concerns – A Review.” *Environmental Contaminants Reviews* 1, no. 1 (June 1, 2018): 18–23. <https://doi.org/10.26480/ecr.01.2018.18.23>.

¹² This number is for Lahore District. Pakistan Bureau of Statistics, “Final Results (Census-2017)”, <https://www.pbs.gov.pk/content/final-results-census-2017> (accessed 30 September 2021).

¹³ Ibid.

Covid-19 pandemic in Punjab, recording one of the highest numbers of daily cases in the province on average. This in turn has translated into greater pressure on an ineffectively functioning health sector. Covid-19 protocols demanded frequent sanitation of medical facilities, an increased use of disposable medical and safety equipment, not to mention the mushrooming use of facemasks. Estimates from various countries suggest that the UK demands 24.4 billion masks a year, Japan requires 600 million a year, while China is producing around 14.8 million masks on a daily basis.¹⁴ Since majority of these masks contain plastic material, carbon polymers, and other ‘non bio-degradable’ chemical compounds, their waste, when not recycled, ends up in landfills or even the ocean, creating microplastic pollution¹⁵ and serious hazards for life on land and underwater.

Despite missing data on the number of health facilities in Lahore, each of which contribute to medical waste in the city, Table 1 summarizes the number and kind of hospitals currently in Lahore. There are around 152 public health care facilities, each of which generates their own medical waste.

Table 1: Public Health Infrastructure in Lahore (Punjab)¹⁶

<i>Public Teaching Hospitals in Lahore</i> (a)	19	<i>Number of Hospital beds in Punjab</i> (2019) (b)	60,387
<i>Lahore Tehsil Headquarter Hospitals</i> (c)	12	<i>Number of patients per hospital bed</i> (Using Punjab population for 2017 --110,012,442) (b)	1821.7
<i>Lahore Rural Health Centers</i> (c)	5	<i>Average percentage of household spending on medical care as percentage of average household income</i> (monthly Punjab) (d)	3.2%
<i>Lahore Basic Health Units</i> (c)	39	<i>Hospital Waste Generated</i>	<i>On average 2kg/day per patient</i>
<i>Lahore Dispensaries</i> (c)	78		

¹⁴ Selvaranjan et al., “Environmental Challenges Induced by Extensive Use of Face Masks during COVID-19: A Review and Potential Solutions.” *Environmental Challenges* 3 (April 2021): 100039. <https://doi.org/10.1016/j.envc.2021.100039>.

¹⁵ Ibid.

2. Institutional and Legislative Framework for Disaster Risk Reduction

2.1. Relevant Policy Guidelines

This section provides an overview of the government bodies and associated policy guidelines that are relevant to hospital waste management in the province of Punjab.

Environment Protection Agency Punjab:

In Lahore, the Environment Protection Department of the province of Punjab and its subsidiary, the Environment Protection Agency (EPA) act as the main government bodies responsible for providing guidelines on hospital waste management, including service regulations and standardized operating procedures to follow in the context of environmental protection

National Environment Policy 2005:

The National Environment Policy, 2005 delivers a broad framework that covers environmental issues from various aspects concerning Pakistan; in particular pollution of ground, surface and coastal waters, air pollution, proper waste management, deforestation, loss of biodiversity, desertification, disasters, and climate change, are covered. The NEP 2005 also outlines the management of hazardous and hospital waste, while asserts the implementation of strategies and integration into national, provincial and local levels. It aims to also achieve Sustainable Development Goals (SDGs) based on a participatory approach.

¹⁶ Refers data for Lahore District unless otherwise stated

Sources of the table are:

(a)

Specialized Healthcare & Medical Education Department. "Tertiary Hospitals List", <https://health.punjab.gov.pk/TertiaryHospitals.aspx> (accessed July 2021)

Specialized Healthcare & Medical Education Department, Division and District wise Facilities, https://health.punjab.gov.pk/directory/reports/Division_and_district_wise_facilities.pdf (accessed July 2021)

(b)

Pakistan Bureau of Statistics, Health, <http://www.pbs.gov.pk/sites/default/files//tables/rename-as-per-table-type/Hospital%20Dispancer-ies.pdf> (accessed 27 September 2020)

(c)

Primary & Secondary Healthcare Department, References, "Tehsil Headquarter Hospitals", <https://pshealthpunjab.gov.pk/Home/THQ> (accessed October 2021).

Primary & Secondary Healthcare Department, References, "Rural Health Center", <https://pshealthpunjab.gov.pk/Home/RHC> (accessed October 2021).

Primary & Secondary Healthcare Department, References, "Basic Health Unit" <https://pshealthpunjab.gov.pk/Home/BHU> (accessed October 2021).

Primary & Secondary Healthcare Department, References, "Dispensaries" <https://pshealthpunjab.gov.pk/Home/Dispensaries> (accessed October 2021).

(d) Pakistan Bureau of Statistics, "Household Integrated Economic Survey (HIES) 2018-19", Table 13 Table 21, <https://www.pbs.gov.pk/content/household-integrated-economic-survey-hies-2018-19> (accessed September 2021)

Pakistan Biosafety Rules 2005:

Highlight the topic of waste management or hospital waste/medical waste.

Hospital Waste Management Rules 2005:

The rules highlight the responsibility of a hospital to manage waste up until its final disposal in accordance with the given provisions. These Rules require every healthcare facility to constitute a waste management team and prepare and implement a waste management plan. There are guidelines for waste segregation, collection, transportation, storage, and disposal.

National Sustainable Development Strategy 2012

Sustainable development plays a significant role to mitigate the impact of climate change, environment degradation and disaster risk. In collaboration with the United Nations Development Program (UNDP), the Government of Pakistan has issued its National Sustainable Development (SDG) Strategy - Pakistan's Pathway to a Sustainable and Resilient Future in 2016. The SDG Unit in Punjab was soon after set up and is responsible for localizing the SDGs. In the context of waste management, goals 3 (good health and wellbeing), 6 (clean water and sanitation), 11 (sustainable cities and communities), 12 (responsible consumption and production), 13 (Climate action), 14 (Life below water) and 15 (Life on land) are particularly relevant.

Environmental and Medical Waste Management Plan 2013:¹⁷

This document presents the Environmental and Medical Waste Management Plan (EMWMP) of the proposed Punjab Health Sector Reforms Support Project (PHSRSP), that were initiated by Department of Health (DoH), Government of Punjab (GoPb), and was funded by the World Bank (WB) and Department for International Development (DFID). The present EMWMP has been prepared in compliance with the national regulatory requirements and WB Operational Policies. The main objective of this plan is to institutionalize the environment and medical waste management plan in the DoH's Health Programme supported by the World Bank and DFID. The study includes carrying out a situation assessment of the prevailing medical waste management practices in the government healthcare facilities in the Province, and preparing an environment and medical waste management plan for these facilities.

National Disaster Risk Reduction (DRR) Policy 2013:

The policy recognizes the role of national, provincial, district, and municipal government's role in risk-reduction from multiple hazards. However, it has no content that speaks out about waste management or medical waste. The policy barely covers the impact of biohazards.

¹⁷ Punjab Health Sector Reforms Support Project, *Environmental and Medical Waste Management Plan*, January 2013, <https://health.punjab.gov.pk/directory/reports/PHSRP-EMWMP-FINAL.pdf> (accessed September 2021).

Punjab Hospital Waste Management Rules 2014:

One of the main documents that provides guidelines and regulations for handling and disposing of waste material generated from hospitals. It offers detailed rules and responsibilities for managing both hazardous and non-hazardous waste material, while it also shares details on disposal methods in order to prevent the impact of hospital waste on the environment. It is a guiding document for the Environmental Protection Agency-the main government body mandated with enforcing, monitoring, and facilitating hospitals on the proper processes of waste management. It is detailed in its classification of hospital waste, clarifying all materials that are encompassed under ‘hospital waste.’ (Refer to Annex I for more details).

Punjab Bio-safety Rules, 2014:

These highlight the housing, storage, and movement of regulated material including medical waste.

Punjab Environmental Quality Standards for Treatment of Liquid and Disposal of Biomedical Waste:

The notification dated in 2016 provides guidance according to the Punjab Environment Quality Standards for the Treatment of Liquid and Disposal of Bio-Medical Waste by incineration, autoclaving, microwaving, and deep burial.

2.2. Context of 18th Amendment

The devolution of power through the 18th Amendment to the Constitution of Pakistan has made ‘environmental pollution and ecology’ an exclusive subject of the provinces, which also entails legislation on climate change. Since, the federal government’s role coordinates a national response to climate change, and executes and ratifies international treaties, conventions and agreements, environmental issues in practice remain distributed with the federal government to some extent as well.

In the context of the impact of devolution on the Environmental Protection Agency (EPA) at the provincial level and the effects on the National Impact Assessment Programme (NIAP), the outcomes were not prolific. Firstly, devolution created an independent EPA entity at all provincial levels, including in Punjab. This led to several responsibilities being delegated to the provincial government without effective capacity enhancement. Secondly, the NIAP, which was supposed to enhance the Environmental Impact Assessment (EIA) methods in projects, was also compromised due to the lack of capacity, and the division of the responsibility of improving EIA in Pakistan, as the responsibility remained divided between Islamabad Capital Development Division and the EPA Punjab.¹⁸ The EPA works alongside individual hospital managerial teams to ensure hospital waste is collected,

¹⁸ Afridi, Fischer, and Khanum, *Environmental Impact Assessment Handbook for Pakistan*, Islamabad: IUCN, National Impact Assessment Programme, 2014.

stored, transported and then finally disposed in the correct manner. Fundamental to this process are members of the bureaucracy, the local government, medical officials and representatives of each hospital's management and administrative body. Figure 2 outlines in detail the division of responsibilities when it comes to hospital waste management.

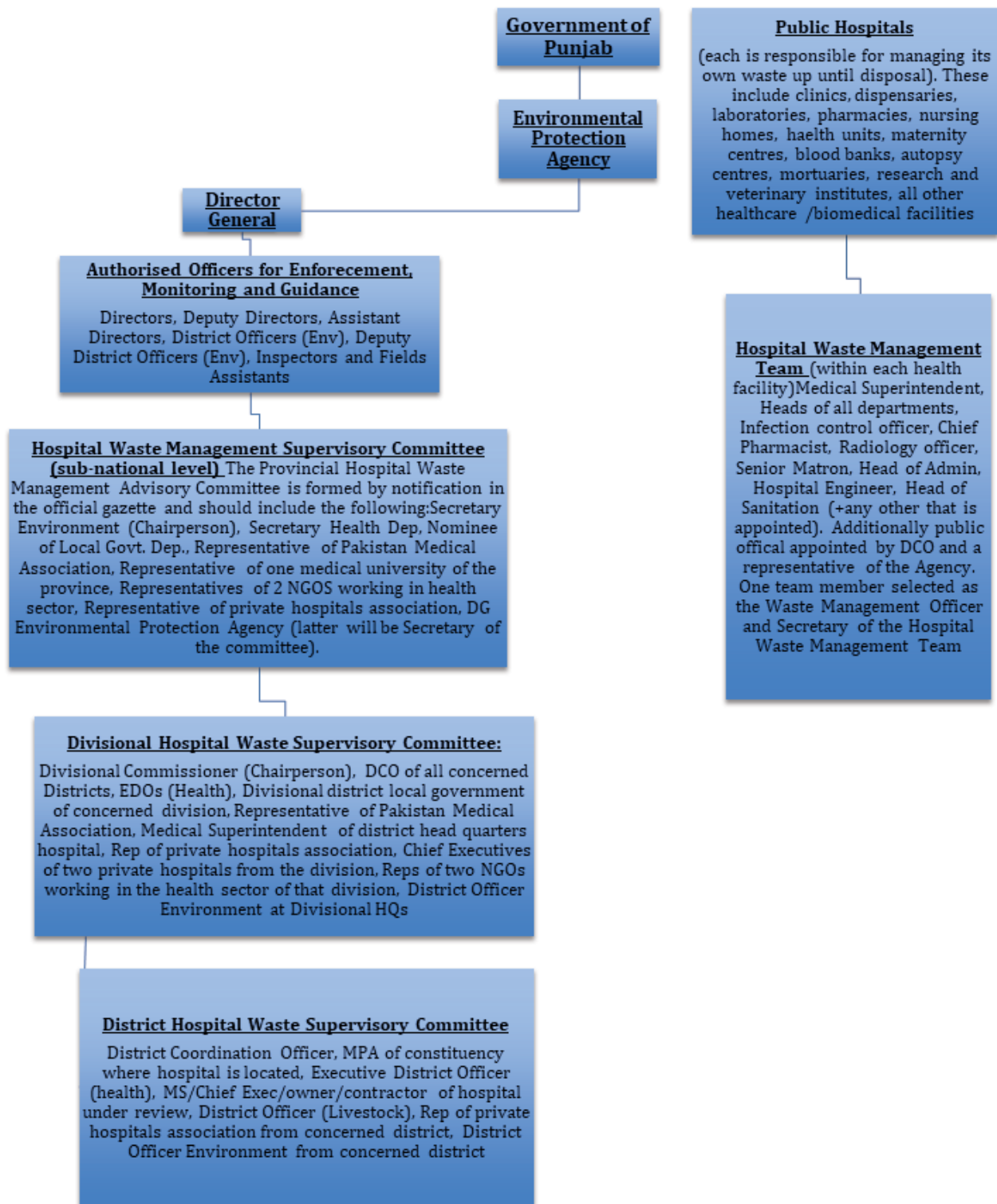
At the city level, the Lahore Waste Management Company (LWMC) was established in 2010, and is a primary public service provider when it comes to solid waste collection and disposal in the city. The company was established by the City District Government Lahore in 2010 under section 42 of the Companies Ordinance 1984 and was taking consultancy from ISTAC, (Istanbul Municipality). The LWMC has worked to establish the Lakhodair landfill site, removing the burden from the oldest dumpsite in Lahore (Mehmood Booti).¹⁹ The Company is also working alongside the specialized healthcare and medical education department (SHC&ME) of Government of Punjab on developing an environmentally friendly method for disposal of hospital waste. Amongst other things, the project entails the construction of 'yellow rooms' at hospitals for waste storage, collection and transportation of infectious waste, the management of incinerator at Children's Hospital, proper burial of waste at landfill site, awareness campaigns, capacity building activities and revenue generation at hospitals to ensure a sustainable system of waste management.²⁰

Given the regulatory framework and the 18th Amendment, unanticipated changes have occurred, which have created ambiguity between the pre-18th Amendment laws and the emerging governance dynamics. As Figure 2 illustrates, in the current scenario various provincial level departments are involved in the process of ensuring hospital waste is collected, transported and disposed effectively and safely. A top-down process is followed, although individual hospital level teams are also responsible.

¹⁹ "Lahore Waste Management Company", <https://www.lwmc.com.pk/about-us.php> (accessed 9 June 2021)

²⁰ "Hospital Waste Management Information System", <https://www.lwmc.com.pk/hospital-waste-management.php> (accessed 9 June 2021)

Figure 2: Hospital Waste Management Institutional Framework²¹



²¹ Hierarchy chart design based on the Punjab Hospital Waste Management Rules 2014; Ministry of National Health Services Regulations & Coordination, "Punjab Hospital Waste Management Rules 2014", <https://phkh.nhsrsc.pk/sites/default/files/2021-01/Hospital%20Waste%20Management%20Rules%20Punjab%202014.pdf> (accessed August 2021).

3. Nexus between Environmental Degradation- Hazardous Waste Management - and Disaster Risk Reduction

As indicated earlier, medical waste being discharged from the hospitals can be both hazardous or non-hazardous; however, it is important to understand that mismanagement of both types of medical waste can have a significant impact on the environment. The same holds true with the hospital waste being generated in Pakistan. The environmental impact and the disaster risk associated with handling the medical waste can be observed in various forms as follows:²²

i. Incineration of medical waste:

The treatment and disposal of medical waste from the hospitals are prominent contributors to environmental degradation. Proper incineration systems are required for the burning of medical waste as a means of disposal. Burning waste results in solid waste turning into ash, heat (energy) or flue gas. Incineration can release pathogens and toxic pollutants, which remain alive in untreated medical waste. Furthermore, to reduce the risk of high volumes of incineration, the amount of waste needs to be managed according to the capacity of each incinerator. Accumulating too much waste to burn in one area, only because an incineration facility is available there, can have detrimental consequences for the ecosystem and air pollution level in the area. Managing incineration of medical waste quantities can help reduce exposure and vulnerability to mitigate associated environmental and health risks.

- a. Materials containing chlorine, when incinerated, can produce dioxins and furans. These are carcinogens that can cause a variety of health hazards, and impact the quality of air.
- b. The practice of using the latest technology of incinerators should be adopted which operate at levels most conducive to incineration quality, such as 850-1100 °C, and that comply with international emission standards for reduction of dioxins and furans released into the environment. Moreover, incinerators that are able to convert the heat generated through combustion into renewable energy act as a cleaner way of solid waste management.
- c. Burning of waste in improper facilities can also contribute to the emission of greenhouse gases and lead to climate change.
- d. Medical waste containing high metal content, especially lead, mercury and cadmium, can release toxic metals into the environment when incinerated, therefore, medical waste with metal content (especially that metal which is hazardous) should be handled properly and the management capacity of such disposal should be enhanced according to the quantity of medical waste being produced.

²² Hossain et al., "Clinical Solid Waste Management Practices and Its Impact on Human Health and Environment--A Review," *Waste Management (New York, N. Y.)* 31, no. 4 (April 2011): 754–66. <https://doi.org/10.1016/j.wasman.2010.11.008>.

Methods such as autoclaving, steaming with internal mixing, and microwaving, that lower the reliance on incineration, can be used as alternatives that can reduce the emission of toxic and environmentally adverse gases and chemicals. Such methods are more costly solutions; therefore, they should be managed according to the availability of resources and the need of the area. For example urban locations that are under higher pressure due to the production of medical waste, poor air quality and environmental conditions can be a priority for adopting a diversity of treatments.

ii. Medical waste disposal on land:

The disposal of the untreated hazardous waste in landfills is another cause of environmental degradation. Ground and surface water can be contaminated, polluting even the channels that feed into the drinking water system, especially when the water distribution and pipeline infrastructure is compromised. The availability of landfills should be according to the amount of waste being produced in a region while the proper construction of a landfill for the type of hazardous waste and capacity needs to be developed in order to mitigate environmental impact.

a. The management process of the medical waste that ensures treatment before disposal is also important because the chemical disinfectants with which waste is treated can release other chemicals as by-products that can impact the environment. Dumping of medical waste at places nearby a hospital or using sites other than authorized landfills for dumping medical waste can result in incredible health hazards and environmental degradation.

iii. Medical waste impact on wildlife, ecosystems and oceans:

Medical waste can also have devastating impacts on wildlife, ecosystems and oceans. For example, runoff from storm water, illegal dumping, sewer overflow, inadequate handling of solid waste at landfills, and coastal transfers can lead to medical waste syringes, blood/ other samples, plastic, facemasks etc. ending up in the ocean.²³ This waste harms the oceanic life and eventually enters human food supply through the ingestion of seafood. Medical waste can also end up on the beaches as a pollutant - which includes hazardous material as well. In Pakistan, Karachi faces a similar problem where syringes, samples of blood, plastic and other medical waste harm the ecosystem significantly.²⁴ Overall, poorly disposed waste has detrimental impacts on any form of ecosystem since it deteriorates the quality of habitats, decreases biodiversity, and causes changes in its resilience.²⁵ Table 2 delineates various forms of environmental impact of solids waste management, which could be associated with medical waste from hospitals as well:

²³ Francisco, C. J., "Up from the Beach: Medical Waste Disposal Rules!", *Texas Medicine* 85, no. 7 (July 1989): 50–53.

²⁴ Drury, Flora. "Karachi's Clifton Beach Swamped by Syringes and Medical Waste." *BBC News*, September 3, 2019, sec. Asia. <https://www.bbc.com/news/world-asia-49562462>.

²⁵ Vallero, Daniel A., "Chapter 8 - Effect of Waste on Ecosystems", In *Waste (Second Edition)*, edited by Trevor M. Letcher and Daniel A. Vallero, 171–98. Academic Press, 2019. <https://doi.org/10.1016/B978-0-12-815060-3.00008-6>.

Table 2: Main Environment Impact of Municipal Solid Waste Management

Activity/ Impact	Water	Air	Soil	Landscape	Climate
<i>Landfilling</i>	Leachate (heavy metals, synthetic organic compounds)	CO ₂ , CH ₄ , odour, noise, VOCs	Heavy metals, Synthetic organic compounds	Visual effect, vermin	Worst option for greenhouse gases emission
<i>Incineration</i>	Fall-out of atmospheric pollutants	SO ₂ , NO, N ₂ O, HCl, HF, CO, CO ₂ , dioxins, furans, PAHs, VOCs, odour, noise	Fly ash, slags	Visual effect	Greenhouse gases emission
<i>Composting</i>	Leachate	Co ₂ , CH ₄ , VOCs, dust, odour, bioaerosols	Minor impact	Some visual effect	Small emission of greenhouse gases
<i>Landspread- ing</i>	Bacteria, viruses, heavy metals	Bioaerosols, dust, odour	Bacteria, viruses, heavy metals, PAHs, PCBs	Vermin, insects	Minor emissions
<i>Recycling Waste</i>	Wastewater spills	Dust, noise, CO ₂ , SO ₂ , NO ₂ , dust, odour, noise, spills	Landfilling of residues, Spills		Significant contribution of CO ₂

CO₂ = carbon dioxide; CH₄ = methane; VOCs = volatile organic compounds; SO₂ = sulphur dioxide; NO_x = nitrogen oxides; N₂O = nitrous oxide; HCl = hydrochloric acid; HF = hydrofluoric acid; CO = carbon monoxide; and PAHs = polycyclic aromatic hydrocarbons²⁶

3.1. The Local Scenario

The existing literature on healthcare waste management (HCWM) in Pakistan remains focused on the evaluation of hospitals and their effectiveness in disposing waste. They are limited in their exploration of the subject for a micro-level analysis of public health management. Yet several studies have been beneficial to our understanding of the local scenario.

²⁶ Giusti, "A Review of Waste Management Practices and Their Impact on Human Health," *Waste Management* 29, no. 8 (August 1, 2009): 2227–39. <https://doi.org/10.1016/j.wasman.2009.03.028>.

Ali et al. (2015) conducted field research on hospitals in Rawal Pindi and Islamabad and found that while the institutional framework; including policy instruments are in place, effective implementation of proper hospital waste management was not taking place. Although certain procedures were being followed, several administrative and managerial loopholes existed at each stage of the hospital waste management process. From the absence of a waste management committee, to improper waste storage, transportation and disposal, several inaccuracies were observed. They found that the public hospital they surveyed performed better in terms of transportation of waste compared to the private hospital. The researchers also recorded health and safety violations including the lack of personal protective equipment for workers during the process of waste disposal. They claim that there is very little understanding of the significance of effective waste management along the management hierarchy. Given that each patient on average, generates around 2 kg of waste each day,²⁷ improper disposal of hospital waste can be a public health threat, not to mention the adverse impact on the environment. The impact on workplace safety, including worker rights are also of serious concern given the hazardous environment medical staff including janitorial workers are exposed to. Access to safe and healthy working environments with dignified work conditions are a fundamental right all hospital employees should have. Poor funding, inadequate knowledge of the subject, insufficient public sector prioritization and little research on the subject are contributing factors to the situation.

While this study provides basic insight on what HWM might look like in Pakistan, it fails to develop a deeper understanding of the bottlenecks in the implementation process, nor does it provide an adequate explanation of the kind of environmental disaster risks that biomedical waste can generate. The recommendations also neglect to give specific solutions to a very pertinent governance challenge.

Mahmood et al. (2011) report that around 75-90% of waste generated at hospitals in Pakistan is non-risk while around 20% can be classified as risk waste. They outline several public health risks that can emerge from improper waste management. These include: risk of infection to the exposed including diseases such as HIV, HCV or HBV; the development of antibiotic-resistant microbes, burns or cuts by sharp objects; congenital anomalies, headaches and dizziness by radioactive materials and risk of catching life threatening zoonotically transmitted diseases. The environmental implications are significant including the risk of explosions and fires by chemical and pharmaceutical waste, contamination of sewage water that can impact the proper functioning of treatment plants and not to mention harm the surrounding ecosystems. On observing various hospital wards, the authors found that both public and private hospitals performed well on waste segregation, whereas the public hospital did a better job at waste collection and transportation to the disposal site, a finding similar to that of Ali et al. (2015). Better

²⁷ Ali et al., "Public Health and Preventive Medicine Current Hospital Waste Management Practices in Pakistan", *Journal of Preventive Medicine and Public Health* 1 (August 5, 2015): 125–29.

performance in the public sector maybe due to institutionalized practices however, given government directives of coordinating with the private sector on hospital waste management, there needs to be a better enforcement mechanism in place.²⁸

Habib Ullah et al. (2010) have surveyed 15 healthcare facilities in various districts of Punjab and found that less than 50% had a waste disposal mechanism in place. The study, although dated, indicates serious infrastructural, managerial and cultural bottlenecks in promoting and enforcing effective waste disposal mechanisms in hospitals.²⁹

Our study goes a step further and attempts to link the issue of medical waste with that of the environment and analyses it from the perspective of efficient policymaking.

3.2. Data Findings and Analysis - Capacity and Policy Issues Causing Disaster Risk and Environmental Degradation due to Poor Medical Waste Management

For the purpose of this research, several in-depth interviews were conducted in order to understand the governance and administrative challenges that the hospital waste management system in Lahore faces. Due to the Covid-19 pandemic, field research could not be conducted hence these interviews supplemented the existing literature review. Interviewees included provincial government officials, public health specialists, environmental technical experts, environmental lawyers and technical consultants.

1) Incineration and other causes of environmental degradation:

Availability of an incinerator might be a good option for medical waste management; however, mismanagement of the incinerator facility, improper setup or over reliance on the method of incineration for waste disposal can create more problems than solutions. According to a public health specialist³⁰ that we interviewed, there is a capacity issue as far as utilization of incinerators is concerned. They cost up to PKR 1.5 crore and can combust up to 1000kg of waste. However, despite the low volume of medical waste produced, the district and provincial governments in Punjab have adapted a misplaced policy of investing heavily in incinerators. This gives rise to several malpractices in medical waste management.

Firstly, using an incinerator for low volume of waste is not a cost effective nor environment

²⁸ Mahmood, Shahid, Najam ud Din, Jibrán Mohsin, and Hassan Javed, "Practices Regarding Hospital Waste Management at Public and Private Sector Hospitals of Lahore", *Annals of King Edward Medical University* 17, no. 2 (2011): 113–113. <https://doi.org/10.21649/akemu.v17i2.283>.

²⁹ Habib Ullah, Ahmad, and Khan, "Managing the Healthcare Solid Waste in Selected Districts of Punjab, Pakistan", *Pakistan Journal of Medical Science*, (October 1, 2010): 795–799.

³⁰ Dr. Samia Altaf is a public health specialist and physician. She has been Professor of Practice in Public Health/Director of Campus Health and Safety at LUMS, and also has distinguished career in public health policy in the USA.

Samia Altaf, interviewed by Saba Shahid and Haider Waseem, Zoom Call, Lahore, 16 July 2021.

friendly method. More feasible alternatives such as autoclaving can be prioritized given their reduced environmental damage/ carbon emissions. Furthermore, the budget spent on running or procuring incinerators, can be spent on other more viable alternatives (i.e. the incineration facility at the Children's Hospital Lahore has been used as an outsourced facility for many other hospitals in close vicinity).

Secondly, according to guidelines provided by WHO, an incinerator requires a certain temperature, of 850 to 1000 degree Celsius for it to function efficiently. However, in Pakistan at various locations throughout the country there is a shortage of gas, especially during the winter. This prevents proper 'gas pressure' to be provided including in main cities, not allowing the incinerators to achieve optimum temperature. Another source of mismanagement comes from the technicians operating the incinerators, who are often not qualified or trained enough, to know about the guidelines for safe disposal of post-incineration ash and other byproducts. As a result health and safety protocols are not followed. Finally, regulations demand that incinerators be placed at a safe distance from households and living spaces. Similarly, before setting up the machinery, a meticulous Environmental Impact Assessment (EIA) must be followed so that the ecosystem is not harmed, and the environmental risk in the form of water contamination, soil contamination and air pollution for the nearby public can be mitigated. Unfortunately, in many instances the incinerator project is set up without the procedural EIA, while the quality of many EIAs in Pakistan do not follow internationally accepted standards. While conducting an assessment of medical waste management in Punjab, our interviewee noted "...At many instances when I asked for the EIA report for the incinerator plants the officials prevaricate or didn't provide any detailed/ official EIA report."³¹ She also found that in a hospital in Kasur for instance, the incinerator was placed at close proximity to living quarters, violating protocols of safe distances.

Similarly, another interviewee, an environmental and climate governance specialist explained that in Pakistan the quality of EIAs in general is compromised, due a culture in the development sector, which does not prioritize field surveys including detailed environmental and social screening when conducting EIAs. Most EIAs are conducted as a desk job with little emphasis on incorporating ground realities and primary research. In theory these documents are supposed to be a guideline that help determine the course of action for a particular project in a way that reduces the environmental stress. Yet it is seen as a "checklist" and formality.³²

II) Medical waste management and alienation of the informal sector:

Solid waste management in general is a problematic public administration concern; from delayed waste collection to the illegal burial of waste.³³ Pakistan's informal labor bears the

³¹ Samia Altaf, interviewed by Saba Shahid and Haider Waseem, Zoom Call, Lahore, 16 July 2021.

³² Imran Khalid, interviewed by Haider Waseem, Zoom Call, Lahore, 9 August 2021.

³³ Farah Rashid, interviewed by Saba Shahid and Haider Waseem, Zoom Call, Lahore, 31 July 2021

Farah Rashid, is a former WWF Pakistan Waste Management Coordinator and currently works with ENGRO as a Pakistan Sustainability Officer.

burden of waste collection, segregation and management, and therefore several policy gaps remain. Medical waste segregation is a crucial source of disaster risk, given the possibility of hazardous and non-hazardous material mixing and contaminated material leaking into the environment³⁴. Yet informal workers are neither trained nor regulated and as a result not only remain exposed to hazardous work conditions, they contribute to the potential for disaster risk, including environmental degradation. An inclusive approach of managing waste and regulating the human capital already serving the purpose is a serious policy loophole.

Several experts in the interviews³⁵ we conducted pointed out that the informal labor working with waste collection in cities also ends up managing hospital waste. City level waste management companies work on collection and disposal, but this is a limited response, estimates suggest only 65% of waste is collected.³⁶ As a result informal workers including scavengers, *raddi walas* (informal recycle labor) and members from a more organized 'plastic mafia' gain a prominent part in managing waste. The systematic reliance on the informal sector in turn leads to room for corruption and a high risk of public health epidemics. Significantly, these waste collectors have no access to proper working gear or equipment and are at a risk of catching infectious diseases and transmitting them too. Because hospital waste can end up lying on the street in public garbage bins or make their way to open dump sites, informal workers are frequently exposed to hazardous waste like needles, syringes, and infectious plastic containers.



Image 1: Open dumping is a serious environmental disaster risk in Lahore
Photograph: Saba Shahid, 2021

³⁴ Public Official, interviewed by Saba Shahid, Zoom Call, Lahore, 14th July 2021

³⁵ Samia Altaf, interviewed by Saba Shahid and Haider Waseem, Zoom Call, Lahore, 16 July 2021.

Imran Khalid, interviewed by Haider Waseem, Zoom Call, Lahore, 9 August 2021.

Farah Rashid, interviewed by Saba Shahid and Haider Waseem, Zoom Call, Lahore, 31 July 2021

Public official, interviewed by Saba Shahid, Zoom Call, Lahore, 14th July 2021

³⁶ Farah Rashid, interviewed by Saba Shahid and Haider Waseem, Zoom Call, Lahore, 31 July 2021

III) Transportation issues and waste mafia:

Proper segregation of medical waste and adequate methods of transporting medical waste to the disposal sites are imperative to the waste management process. However, the segregation of medical waste at hospitals is barely performed according to required safety measures, while there is dearth of storage space and suitable vehicles which can store hazardous medical waste (the storage capacity to treat or prevent the spread of pathogens is a vital sub-step in transportation of hazardous waste).³⁷

According to our interviewees³⁸, because hospitals may not have on-site facilities such as incinerators available, they may need to transport it to hospitals with the relevant disposal infrastructure available. The Shalimar Hospital in Lahore, for instance, received waste from various surrounding hospitals and medical facilities. However, the hospital receives waste that is not treated and segregated according to protocols. Moreover, the transport vehicles are poorly designed to carry hazardous waste to the management facilities.

Most significantly, because the hospital waste needs to be transported to a disposal location, this stage acts as a major challenge to the entire process of safe and efficient waste management, allowing the infamous yet influential ‘waste mafia’ room to collude and interfere with the waste transporters.

As indicated earlier, medical waste often ends up discarded in open dumps or landfills, from here it is collected and segregated by informal waste collectors – frequently these are Afghan refugees or members from marginalized communities³⁹. The poverty and vulnerability of these informal workers is often exploited by the plastic/waste mafia, which has a high demand in particular for the plastic waste coming from medical facilities. This plastic is of very high quality and can be reused, hence the value attached to it. Some hospitals have even been involved in scandals where, the contractual management company, instead of ensuring the waste was incinerated, ended up selling it for recycling.⁴⁰ Additionally, other forms of waste are also embezzled during the transportation process. One interviewee spoke of her experience interacting with drivers of hospital waste transportation vehicles. She noted discrepancies in the weight of waste, which left hospitals and the waste that arrives at the disposal facility—this difference is often accounted for by false documentation and sale of the valuable waste to the ‘plastic mafia’.⁴¹

We interviewed a public official with experience in the medical waste management sector. He indicated that the Lahore Waste Management Company attempted to correct for

³⁷ Farah Rashid, interviewed by Saba Shahid and Haider Waseem, Zoom Call, Lahore, 31 July 2021

³⁸ Samia Altaf, interviewed by Saba Shahid and Haider Waseem, Zoom Call, Lahore, 16 July 2021.

³⁹ Farah Rashid, interviewed by Saba Shahid and Haider Waseem, Zoom Call, Lahore, 31 July 2021

⁴⁰ Samia Altaf, interviewed by Saba Shahid and Haider Waseem, Zoom Call, Lahore, 16 July 2021.

⁴¹ Farah Rashid, interviewed by Saba Shahid and Haider Waseem, Zoom Call, Lahore, 31 July 2021

such practices by geo-tagging their vehicles and digitizing the transportation process.⁴² Monitoring ‘yellow rooms’ where waste is stored and using barcoding mechanisms to regulate the volume of waste was also a priority. Yet, as our interview underscored, program sustainability is challenged by frequently changing policies and erratic financial flows. While public hospitals are better able to comply with regulations due to the institutional support they receive, private hospitals are unwilling to share the financial burden of waste management and are hence less likely to comply.

Overall, a mismanaged transportation system in the medical waste management process causes hazardous waste to be leaked out into the hands of illegal groups who may create more risk by improperly reusing the hazardous plastic and other waste. Similarly, the inadequate treatment, segregation and easy seepage of hazardous medical waste causes open dumping, plastic pollution and other environmental risks.

IV) EPA and institutional capacity issues:

According to an interviewee, who is an eminent Pakistani environmental lawyer and activist, Pakistan’s case of waste management is a complex one as the urban landscape is characterized by poor infrastructure and city planning is haphazard. It is due to this that one can observe radioactive waste being dumped into open sewage for example, or bloody needles accumulating in open dumping sites. Moreover, health waste management is a local government issue, so the policy prioritization and leadership should come from there.⁴³ However the Environmental Protection Department (EPD) as the relevant authority faces capacity issues especially after the devolution of power following the 18th Amendment. According to an interviewee, prior to the devolution of power in Punjab, the EPD did not have capacity issues and worked relatively effectively.⁴⁴ However following devolution, the EPD was unable to garner the administrative, human capital and financial strength to tackle the issue in the provinces.⁴⁵ Since hospital waste management comes directly under the EPD in Punjab, the medical waste management capacity also suffers immensely. An interviewee noted that accountability was a major impediment to the smooth functioning of their system; staff can be bribed and that creates a vicious cycle of poor management.⁴⁶

Speaking to a government official on the subject, we found that worker motivation in the EPD remains a challenge as well⁴⁷ which contributes to the inefficiency of the

⁴² Public official, interviewed by Saba Shahid, Zoom Call, Lahore, 14th July 2021

⁴³ Rafay Alam, interviewed by Haider Waseem and Saba Shahid, Zoom Call, Lahore, 3 August 2021

Mr. Rafay Alam is an environmental lawyer and co-founder of the law firm Saleem, Alam & Company. He has conducted various consultancies on environmental protection including with the Punjab Government.

⁴⁴ Imran Khalid, interviewed by Haider Waseem, Zoom Call, Lahore, 9 August 2021.

⁴⁵ Saleem, Alam, & Company, EY, and Pakistan Urban Unit, “Restructuring and Capacity Building of Environment Protection Department Punjab - Gap Analysis Report,” <https://epd.punjab.gov.pk/system/files/2.0%20GAP%20Report.pdf> (accessed September 2021).

⁴⁶ Farah Rashid, interviewed by Saba Shahid and Haider Waseem, Zoom Call, Lahore, 31 July 2021

⁴⁷ Rabeya Yasmin interviewed by Saba Shahid and Haider Waseem, Zoom Call, Lahore, 2 August 2021

department. She noted that the department is responsible for monthly reporting on the implementation of PHWMR 2014 (through a hospital waste management standardized form) and in terms of environmental protection; the department's strategy is to make sure environmental impact assessments are followed.⁴⁸

Additionally, the performance of environmental tribunals is not promising. These tribunals are responsible for looking at various cases of waste disposal compliance, and whilst there is an institution set up that deals with the legal aspect of this issue, the system of prosecution however not very effective.⁴⁹ One of our interviewees noted that environmental governance in Pakistan follows a top-down approach, it is not participatory which eventually leads to loopholes that people take advantage of.

However the impacts of improper management of hazardous waste go beyond a particular community, no one is safe in case of a public health or environmental disaster, regardless of income level.⁵⁰ Environmental impacts like water pollution and air pollution have lasting effects that tend to adversely affect all.

V) Awareness and availability of records:

Public agency in Pakistan suffers substantially due to the lack of transparent information and documentation of public sector departments. Evidence based policymaking is impeded by the lack of proper data and analytical tools that should otherwise lead the medical waste management process. This in turn has dire consequences as far as environmental risk and disaster risk is concerned.

According to an interviewee, public information is rarely available regarding hazardous waste treatment and the relevant disposal facilities.⁵¹ He shared that often conflict within the institutional structure can impede the decision-making process, making it less driven by scientific methodologies and more by personal gains, all of which results in low transparency.

Consequently, lack of information leads to low levels of accountability allowing mismanagement in the disposal of medical waste. Another interviewee shared similar findings based on her experience in public health work in the United States; she found that societies that have access to public health finances and hospital management policy decisions, exercise better agency in rectifying issues of public health or environmental hazard.

⁴⁸ Rabeya Yasmin is Assistant Director Environmental Protection Department Punjab (Directorate of Environmental Health, Dengue Control and Hazardous Waste)

⁴⁹ Rafay Alam, interviewed by Haider Waseem and Saba Shahid, Zoom Call, Lahore, 3 August 2021

⁵⁰ Imran Khalid, interviewed by Haider Waseem, Zoom Call, Lahore, 9 August 2021.

⁵¹ Rafay Alam, interviewed by Haider Waseem and Saba Shahid, Zoom Call, Lahore, 3 August 2021

Overall, the public health policy is not structured well, and the policy decisions are not documented into structured plans. These issues cause lack of documentation to be produced and made available to the public; which could otherwise explain to the public why a certain policy decision was taken, and which could allow the public to exercise their agency.

3.3 Building an Adaptive Governance Approach to Hazardous Waste Management in a Post-Covid-19 Context

Because environmental risks are dynamic, our policy responses need to be adaptive and dynamic too. Adaptive governance can be understood as *“flexible and learning-based collaborations and decision-making processes involving both state and nonstate actors, often at multiple levels, with the aim to adaptively negotiate and coordinate management of social–ecological systems and ecosystem services across landscapes and seascapes.”*⁵² It involves predicting various development scenarios and developing proactive methods to deal with these challenges. Because the process cuts across various economic sectors, the natural environment, human society and institutions, adaptive governance by definition calls for constant review and upgrading of our policy tools.

The Covid-19 pandemic, that has claimed millions of lives and affected billions of livelihoods, has once again brought to attention the need for innovative policy strategies that have disaster risk reduction at the core of their design. A public health crises, such as that posed by the Covid-19 pandemic had spillover effects that impacted the economic, societal, political and cultural aspects of human and animal life. From death and disease to unemployment, displacement, and conflict, Covid-19 has had a profound affect on people’s welfare. Similarly, our planet’s wildlife is being affected; biodiversity and ecosystem are also impacted as health waste makes it way into the environment. Facemasks are strangling animals, birds and sea-life are ingesting plastic, and consequently the food life-cycle also indicates that waste makes it way back into human diet (seafood is a source of micro-plastics).

These trends reinforce the idea that people live and function in diverse ways, and a one-size-fits all, blanket policy cannot be a solution. High population density and intergenerational households made guidelines of social distancing difficult to enforce in large metropolitans such as Lahore. Moreover urban poverty and illiteracy impacted the adoption of hygiene protocols differently in various locales. While high-income and high education households were better geared to adapt, communities with low room-to-family member ratios struggled with following SOPs. Religious and cultural sentiments that encouraged large gatherings also posed as a public administration challenge in Pakistan,

⁵² Schultz et al., “Adaptive governance and natural capital”, Proceedings of the National Academy of Sciences Jun 2015, 112 (24), pp. 7369-7374; DOI: 10.1073/pnas.1406493112

⁵³ Rafay Alam, interviewed by Haider Waseem and Saba Shahid, Zoom Call, Lahore, 3 August 2021

particularly in an urban centre like Lahore. These trends demand policy responses that were able to address the multi-faceted nature of the crisis.

Speaking to different people from the government and public sector in Lahore, Punjab, it is apparent that ‘disaster risk reduction’ is understood from the limited perspective of check-listing established rules and guidelines. This is a very static way of looking at a very dynamic public policy concern. Climate change, demographic changes, and urban planning are all intricately related to environmental degradation and public health. Believing that the compliance of hospital waste management regulations and implementation of related legislations will be enough is an unsettling thought.

Additionally, it is crucial that we be mindful of the changing nature of technological innovations that can help mitigate the impact of hospital waste on the environment. Do our public policy responses account for the availability of new technology, our access and ability to disseminate that technology? Can disaster risk reduction be understood as a way to adopt and adapt new creative solutions to rapidly evolving scenarios? These are questions stakeholders should be asking themselves. Foremost, as an interviewee argued, environmental prioritization needs to come from the agenda of the political parties, who include disaster risk reduction as a mainstream development goal. The fact is however, that decision makers have not come to realize how serious climate change and environmental protection are. Moreover the small funding climate change and environment protection ministries receive do not reflect the gravity of the situation. In fact, according to the Punjab Government’s Medium Term Development Framework (MTDF) 2021-24, of the 560,000 mn Rs allocated in 2021-22, only 5000 mn Rs is reserved for the Environment and Climate Change-less than 1%. While other sectors’ budget may contribute to managing the environmental crisis, as a development agenda, the financial allocation does not illustrate the urgency of the situation. Additionally, since there is risk of the issue becoming politicized, an integrated response is needed whereby industry and business leaders engage with scientists, academics, and local communities to find tailor-made solutions. One needs to ensure that the industrial policy doesn’t contradict the environmental policies.⁵⁴ For example subsidizing electric cars and small automobile manufacturers without putting restrictions on emissions and car safety regulations while also managing public transportation networks can be problematic.

What can we do to promote a cross-sectoral and multi-pronged approach to tackling hospital waste? Starting a conversation through awareness campaigns is key in developing a culture that promotes sustainability and environmental protection. From tapping into corporate social responsibility as a means to invest in media campaigns, to seminars and workshops in schools; there are several ways in which the general public can be sensitized on the salience of disaster risk reduction. This will eventually

⁵⁴ Rafay Alam, interviewed by Haider Waseem and Saba Shahid, Zoom Call, Lahore, 3 August 2021

create the demand-driven push needed for environmentally friendly waste management, particularly in the public health sector.

On the supply-side, whilst the government needs to play a leadership role in establishing environmentally safe waste disposal mechanisms, the private sector also has a role to play. Small-scale, community based initiatives such as 'waste busters' are trying to make a difference. Their work is motivated by the fact that 60-70% of solid waste is organic, and can be used to make compost. Refuse Derived Fuel (RDF) is also a byproduct that allows an alternative form of waste-to-energy creation. Replicating successful models, particularly with non-hazardous solid waste is something the health sector can adopt. Private technology and innovation firms can also engage with the municipality and Environment Protection Department on adopting and disseminating cleaner more efficient technologies of managing hospital waste.

4. Concluding Remarks and Recommendations

Our research has shown that in Lahore, the approach to environmental protection seems to be quite static, and unable to account for the environment as a dynamic space impacted by factors like migration, population growth, climate change, public infrastructure, industrial production and patterns of consumption.

Given the limitations on primary data collection and fieldwork plus the Covid-19 pandemic, this research has aimed to highlight the nexus between hospital waste-disaster risk- and adaptive governance. Hospital waste management is a challenging public policy issue in Pakistan and the city of Lahore is no different. Various causes of mismanagement lead to ineffective waste disposal; from financial and human capital capacity issues, to the presence of a black market for hospital waste, several policy loopholes remain. Yet on paper, the institutional framework, including existing policy guidelines, provide an adequate structure for the relevant stakeholders including hospitals, the municipality and regulatory and enforcement bodies. The root of the problem however is policy enforcement.

A limitation of our study has been the small sample size of our interviewees, yet our qualitative assessment does allow us to claim that the impact of poor hospital waste management on the environment is one that demands serious attention. Experts in the field indicate strong evidence of hazardous waste leaking into the environment, through ground water channels, through solid waste dumped openly, or through waste that is smuggled for illegal re-sale. Yet, there is little evidence that the relevant stakeholders are aware or conscious of developing a proactive approach to hospital waste management

in terms of mitigating disaster risk. Ground realities indicate that workers are ill prepared, unaware and lack proper training on following standardized operating procedures.

The recommendations proposed in the following paragraphs aim to reinforce the need for adopting adaptive governance as a guiding principle for public policy stakeholders associated with city administration in Punjab, and across Pakistan. Our findings also point to the need for further data collection and research, ideally quantitative in nature, that is able to determine the impact of hazardous waste mismanagement on years of life (average life expectancy) and in terms of environmental quality (using metrics assessing air, soil and water quality) in areas surrounding waste disposal sites.

4.1 Recommendations

4.1.1. Diversify Waste Disposal Techniques

It is evident that incinerators cause pollution through gaseous emissions and the residual ash generated, more so if not operated at the correct temperature. Therefore, alternative methods such as autoclaving or ‘chemical-physical and biological treatment’ before incineration should be given priority. Depending on the volume of medical waste and need of disposal, alternatives should be assessed against incineration, in the risk assessment portion of any policy strategy report that aims to invest in incineration plants.

- Better guidance in the framework of EPA Punjab should be provided for conducting risk assessment of waste disposal plants/ techniques. Incinerators should also be discouraged based on the low volume of medical waste being generated overall.
- Where incinerators are already placed, proper provision of gas supply, pressure equipment and technicians must be ensured for the operations. This will safeguard against high carbon emission by maintaining adequate temperature.
- Alternatively, high medical waste volume at one place can be accumulated, through better collaboration strategies - a place where incineration operations are practiced under quality safeguards and gas pressure is readily available. Transportation cost may be offset by reduction in the high purchase cost of setting up incineration plants and high maintenance and running cost.

4.1.2. EIAs must be Conducted and Audited Strictly

On paper, The Pakistan Environmental Protection Agency, Regulations, 2000 do provide Initial Environmental Examination and Environmental Impact Assessment guidelines for ‘waste disposal’ projects, yet EIA quality in Pakistan is weak and EPA at provincial level has less capacity to monitor and hold accountable the practice of high-quality EIA which is aligned with the data pertaining to ground realities.⁵⁵ The gap between policy and actual

⁵⁵ Khan et al., “Performance of EIA Authority and Effectiveness of EIA System in Pakistan.” *Environmental Impact Assessment Review* 81 (March 1, 2020): 106357. <https://doi.org/10.1016/j.eiar.2019.106357>.

practice, concomitant with the lack of capacity of EPA to provide M&E for several projects, leads to an increase in risk and environmental degradation. Improved transparency of EIA reports and improved capacity for EIA quality monitoring is essential in medical waste management as well. Ensuring the location of disposal facilities safeguard the health and safety of surrounding communities is also a vital component of the EIA process.

4.1.3. Transportation of Hazardous Waste be Linked to Medical Waste Management

Transportation issues linked to medical waste management - which broadly include, improper hazardous waste transfer, stealth of medical and plastic waste, and collection and segregation of medical waste – should be dealt with focused policy, incentivization of improved hazardous waste vehicles and risk aware methods, strict action against waste mafia and better SOP implementation.⁵⁶ Improved transportation systems can reduce high investment in disposal plants in several locations, moderate volumes of medical waste can be managed better with adequate accumulation and disposal methods.

- This may also firstly, include improving frameworks to enhance collaboration among hospitals and labs, through the use of e-governance and other technology. Secondly, this may require adapting to an inclusive policy of incorporating the informal waste collection sector and providing better training, equipment, and management to the informal waste collectors.

4.1.4. Invest in Re-designing ‘Public Awareness’ Campaigns

Reducing information deficits through campaigns on the relationship between public health governance, medical waste management and disposal methods, is also a critical part of good governance. Public accountability and agency of the people plays a huge role in developing better policies. Same is the case with medical waste management and its impact on the ecosystem and the environment degradation. Better disclosure of EIA and public health fund investment, including in medical waste disposal technology can allow increased public awareness. Legal institutions have played a prominent role in the past for monitoring the activities and improving accountability of policy related to medical waste disposal techniques, these institutions can help set up sustainable mechanisms or keep playing an active role for accountability and creation of public awareness programs.

4.1.5. Enhance the Institutional Capacity of the EPD through Greater Financial and Human Capital Investments

Gaps highlighted in medical waste management reports on Lahore⁵⁷ emphasized the

⁵⁶ Olmez et al., “Medical Waste Management Report (Oct 2012) – Consulting Services for Integrated Solid Waste Management of Lahore City of the State of Punjab” n.d. <https://lwmc.com.pk/uploads/istac%20reports/Medical%20Waste%20Management%20Report%20of%20LWMC.pdf>.

⁵⁷ Ibid; Lahore Waste Management Company, “Hospital Waste Management Information System”, <https://www.lwmc.com.pk/hospital-waste-management.php> (accessed June 2021).

need for better capacity of the main governing body that is, the Environmental Protection Department of Punjab.⁵⁸ Diversifying funding sources including the possibility of international aid for the projects of environment risk reduction and waste management is another policy area to consider. Increased financial capacity will ensure improved medical waste management through better opportunities of training and incentives for staff. Proper access to equipment and infrastructure needed for safe waste disposal is a pivotal element to the discussion.

The entire hierarchy of health workers, managers, technicians and janitorial staff involved in the collection, segregation, transportation and disposal of hospital waste management must receive appropriate training and access to the personal protective equipment. Their efficiency must be monitored and penalized where appropriate. Keeping worker motivation high is also a part of this process, given the local scenario indicates that this as a challenge. Decent and dignified working conditions, an ambit of Goal 8 of the Sustainable Development Goals, demands that workers receive the institutional support they need when working in hazardous environments—this is an imperative step towards safeguarding our international commitments on protecting labor rights. Moreover, the human capital involved in the process of hospital waste management are first line responders when it comes to managing environmental disaster risk. Their knowledge and technical expertise cannot be compromised in this regard.

Restructuring the EPD may also entail clarifying bureaucratic and local government responsibilities as well as those that fall on the individual hospitals. Correcting for internal political strife that impacts efficiency is also important.

Finally, efficient health waste management is a serious public policy concern for Lahore. Its impact on the environment and potential for disaster risk demands that it is prioritized as a mainstream development objective. Adopting an adaptive governance approach will allow for an integrated response that is able to mitigate threats and safeguard people's lives and livelihoods.

⁵⁸ Saleem, Alam, & Company, EY, and Pakistan Urban Unit, "Restructuring and Capacity Building of Environment Protection Department Punjab - Gap Analysis Report." <https://epd.punjab.gov.pk/system/files/2.0%20GAP%20Report.pdf> (accessed September 2021).

ANNEX I Punjab Hospital Waste Management Rules 2014

The Punjab Hospital Waste Management Rules 2014 also refers to 'hospital waste management supervisory committees' that are present at the subnational level, required to guide and direct hospitals on waste management. The committee can be created and provincial, divisional, district down to tehsil and rural health centre levels.

Hospital Waste Management Teams on the other hand are referred to as the team responsible within the hospital/health care facility for waste management that is curated by the Medical Superintendent, CEO of the hospital/institution. These are responsibilities divided within various employees of the said institutions. Following the Medical Superintendent, the team comprises of: Heads of all departments, Infection control officer, Chief Pharmacist, Radiology officer, Senior Matron, Head of Admin, Hospital Engineer, Head of Sanitation (+any other that is appointed). Additionally public official appointed by DCO and a representative of the Agency. One team member is selected as the Waste Management Officer and Secretary of the Hospital Waste Management Team. This team is meant to conduct review meetings every month. The Medical Superintendent, in addition to providing guidance and enforcement of the management practices, is responsible for organizing external audits of the hospital waste management system in coordination with the region's DCO. Effective financial and human resource management is also expected from the Medical Superintendent including investing in capacity-building programs through training courses.

Meanwhile, the Waste Management Officer (WMO) plays a direct and significant role in supervising the entire process of waste management at the hospital including timely collection, storage and disposal. The following also fall under this role:

- Ensuring waste is not kept at hospital premises for more than 24 hours and coordinating with local councilors and incinerator operators.
- Documenting the amount of waste generated on a weekly basis for each hospital department.
- Ensuring the emergency plan is followed efficiently in case of any incident.
- Developing a waste management plan in coordination with the waste management team. This plan should outline the entire financial, human resource, administrative and physical assets needed to ensure an efficient and timely process of hospital waste management. International standards must be followed.

This document is an important one because it clearly delineates the process of hospital waste management. From the organizational and human resource apparatus needed, down to details on transportation and disposal, it demonstrates that there is a well thought-out policy framework that can act as a guiding principle for hospitals in the country. The document also indicates the role of the Provincial hospital waste management advisory committee including monitoring, implementation and enforcement. There are similar

rules for the Division and District as well. Below is a summary of the relevant Articles:

- Articles 8 through 13 outline the responsibilities of each team member and indicate the division of duties within the hierarchy of the hospital management (pp.49-50)
- Article 16 summarizes in detail the waste segregation and collection procedures including information on the types of containers that should be used for each kind of hospital waste. Local Councils are then meant to take on the lead from collection to disposal of hospital waste.
- Article 17 has details on waste collection, particularly highlighting the importance of timely collection
- Article 18 outlines transportation protocols, which fall under the purview of the local council. A direct route to disposal/storage facilities is advised here. SOPs on transport personnel and vehicle requirements are indicated.
- Article 19 is on waste storage stressing the need to clearly indicate any hazardous material
- Article 20 mentions that for waste disposal all waste be first made risk-free before it is disposed which means treatment methods including incineration or thermal and chemical filtration be used. There are guidelines on how to carry out the process of incineration or burial in landfills and the proper documentation required for the use of incineration facilities. Protocols to ensure environmental protection against hazardous waste are also outlined such as the need for hospitals to conduct environmental impact assessments to determine method of disposal. The Local Council is required to conduct assessments of the landfills as well to ensure there is no groundwater or air pollution.
- Article 21 summarizes actions to be taken in extraordinary circumstances such as accidents. The need to train staff in accordance to emergency plans is also mentioned.

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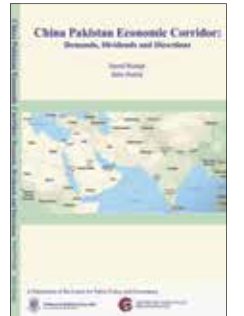
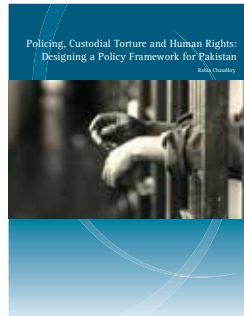
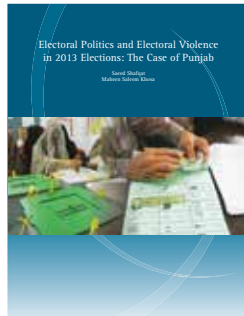
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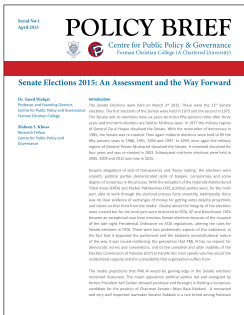
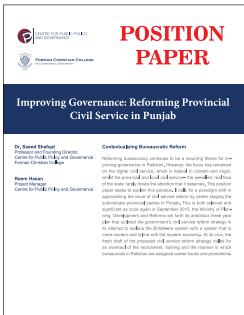
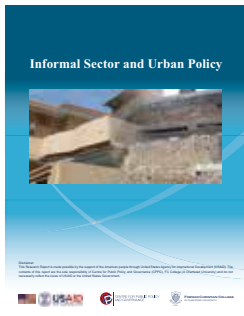
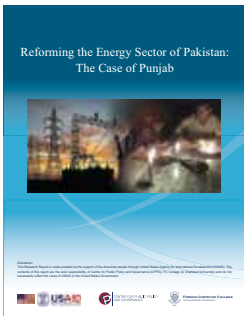
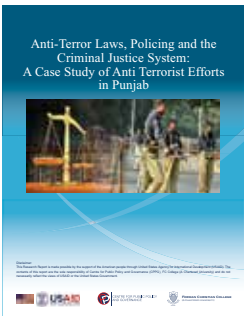
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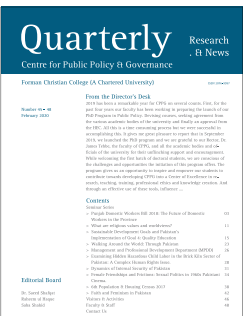
Monographs



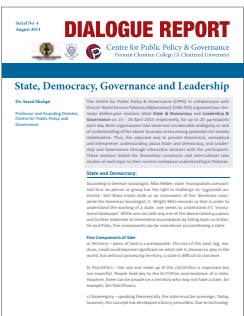
Reports



Quarterly



Dialogue Report



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