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Clinical Waste Management Practices and its Impact on Human Health and Environment in the Islamabad Region: A Case Study of PIMs Hospital

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Abstract

In Pakistan, where the handling of trash exposes the people and the medical staff to risks, biological waste is still a significant problem for hospitals. Risks to persons and the environment may result from improper treatment of biomedical waste. The goal of the current study was to evaluate how wastes were handled, treated, and disposed of in various healthcare settings, including its impact on human health and environment. Descriptive methodology has been used for this research. Data has collected through direct observation, questionnaires, and interviews from the PIM hospital Islamabad. The objective of the study was to figure out the practices adopted for collection, segregation and disposed clinical waste. Another objective was to assess the risk of improper treatment of clinical solid waste on health and environment**.** This study's analysis demonstrates that hospitals are not properly segregating the diverse clinical wastes. Medical wastes have a serious negative effect on both human health and the environment. Furthermore, all staff members responsible for the management of clinical waste need training and skill building programs.

Keywords: clinical waste, incinerators, health, environment

Introduction of research

One of the most complicated institutions, hospitals are used by people from all facets of society, regardless of their age, sex, color, or religion. This is in addition to the typical hospital inmates, such as patients and employees. Due to scientific advancements, they all produce garbage, which is growing in quantity and variety and having an impact.

"Biomedical waste is defined as solid waste produced during the diagnosis, testing, treatment, research, or creation of biological products for humans or animals. It is also referred to as infectious waste or medical trash. Syringes, live vaccinations, laboratory samples, body parts, biological fluids and waste, sharp needles, cultures, and lancets are all examples of biomedical waste" (Chatterji, 2017).

Hospital waste management refers to the control of disease transmission through the management of trash generated by hospitals. Due to the provision of medical care services to the patients, hospitals are where infectious and non-infectious healthcare waste is generated. This garbage requires particular handling in order to be disposed of properly. However, ‘poor waste management has created significant environmental risks and is now recognized as a major public health concern on a global scale’ (Khan , Hamza, Zaffar, Mehmod, & Mushtaq, 2017).

The environment and the general public's health in particular may be threatened by biomedical waste. Before being finally disposed off, it needs to be handled and treated properly. A significant portion of the Bio Medical Waste (BMW) generated by the growing number of hospitals gets dumped untreated. No matter which wards are controlled by "bed occupancy," a patient typically produces 1.5 to 2 kg of garbage each day (Ali, Mahmood, Malik, Aziz, Naghman, & Ahmed, 2015). Both

domestic and hazardous waste, such as infectious, pathological, and sharps trash, are included in the waste.

In the recent decades, there has been an increased awareness of the need for better health care on a worldwide scale. To meet the requirements and desires of the growing population, hospitals in both the public and commercial sectors have quickly proliferated. It is ironic that the health care settings, which are designed to repair and preserve community health, are also endangering their well-being. As a result, "the amount of trash produced by these healthcare facilities has increased proportionately" (Shalini, Harsh, & Mathur, 2012).

Hospitals produce one of the most complex and challenging waste streams of any type of organization. Hospitals produce solid waste, hazardous chemical, infectious, and radioactive wastes in close proximity to humans, including both staff and patients, whose health and safety must be protected. "Hospitals are not factories with easily isolated dangerous processes or materials"(Ali, Ijaz , Aman , Nasir , Anjum , & Rhandawa, 2017) . Hospitals assist and cooperate with patients. Hospitals offer services to patients and their families throughout all of their locations.

Hospital waste has risen sharply in recent years as a result of population growth, an increase in the number and size of bio-medical institutions, and the usage of disposal products. This garbage contaminates the air, land, and water, which has a negative impact on the environment. Syringes that are not properly disposed of lead to the spread of diseases like hepatitis, HIV, and AIDS, and there is a high risk of infection as a result of poor hospital waste management (Ali, Ijaz , Aman , Nasir , Anjum , & Rhandawa, 2017). For health professionals and policy makers, these diseases are caused by the incorrect disposal of infectious hospital waste.

This study's main goal is to evaluate the clinical waste management procedures used in hospitals in Islamabad. The following precise goals were set in order to accomplish this goal: assess the current hospital waste management system's waste collecting and disposal techniques, as well as the effects of waste on the environment and public health in the Islamabad region.

Research Question

Q no.1 What are the practices adopted by waste management authorities for the collection and disposed of clinical waste?

Q no.2 What is the impact of waste on human health and environment in the Islamabad region?

Objectives

I. To figure out the practices adopted for collection, segregation and disposed clinical waste

II. To assess the risk of improper treatment of clinical solid waste on health and environment

Research Significance

Clinical waste management continues to be a significant concern, particularly in the majority of healthcare facilities in the poor countries. Due to the infectious nature of the waste, improper handling and disposal practices when dealing with clinical waste are increasing serious health risks and environmental contamination. The current study will add to the body of academic literature on clinical waste management and examine the procedures used by hospital administration to collect, categorize, and dispose of garbage. The majority of economically developing nations face a serious issue with the improper management of clinical solid waste. However, a lot of researchers in poor nations have looked into the methods used to manage medical waste in a few particular hospitals there. In Islamabad, a part of developing country Pakistan, there have been very few studies on clinical waste management. This study calls attention to the waste management practices already in use. According to this research, hospitals maintain acceptable hygiene standards on their property. But effective waste segregation procedures, employee training on clinical waste management techniques, standard labeling, proper dumping, and transportation protocols fall short of the requirements.

Research gap

The topic of my research was waste management in a hospital. According to the research I conducted, I came to this conclusion that even though there has been done some efforts about the separation of clinical and general wastes, there are different colored bins for different types of wastes but there are no proper ways to carry that dump to the incinerators and no proper precautions are taken by the workers. And no research has been on this very topic and as a result no instructions were given by hospital management to cleaning crew members to raise awareness about possible hazards that can happen in case of contact to clinical waste that can also include some infectious blood samples.

Review of Literature

In recent years, the global healthcare industry has experienced some of the greatest growth. Every year, the amount spent on health care around the world rises to record levels. Around 10% of the world's gross domestic product (GDP) was spent on health in 2017, with an estimated global health budget of USD 7.8 trillion (kenny & Priyadarshini, 2021). Population growth and an increased need for healthcare interventions are to blame for this rise in spending. The world's population is growing and is predicted to do so indefinitely; it is anticipated to reach 8.6 billion people by 2030 and 9.8 billion by 2050. Since more healthcare interventions and treatments would be required as the population grows and lives longer, there would be more healthcare waste created than ever before.

The issue of waste management has taken center stage in underdeveloped nations when formal and informal environmental education awareness programmes are not being implemented. The main source of concern regarding medical waste is the presence of pathogenic microbes and organic materials in hospital solid wastes in significantly higher concentrations. This higher number of microorganisms of natural origin in solid waste raises the possibility of undiagnosed numbers of virulent virus strains and pathogenic bacteria. The hospital environment and the wider community suffer as a result of its inappropriate handling, which also increases the airborne harmful germs. It has a significant impact on human health due to aesthetic consequences in addition to damaging water, air, and soil.

Clinical waste management techniques vary widely from nation to nation depending on a variety of factors including socioeconomic situations, regulation, level of knowledge, resources available, treatment technology, and the ability to best control subpar practices. One important factor is the wide range of clinical waste management terminology used globally. In the United Kingdom (UK), "clinical waste" is a term for hazardous medical waste. The WHO's definition of "infectious waste" is ambiguous because it refers to the potential for infection, which may or may not mean the same thing depending on national circumstances, policies, and regulations (Canianto, Tudor, & Vaccari, 2015).

In the previous years, the number of healthcare facilities and associated trash has grown quickly, with hospitals being the main producers of medical waste. According to the U.S. EPA (2012), medical waste solely refers to the hazardous portion and is referred to as "hospital trash" (Fitria & Damanhiuri, 2017). Infectious waste and non-infectious waste were the two categories into which the hazardous wastes were categorized. Medical waste management is seen as a significant concern globally even if infectious waste makes up a relatively small fraction of the total garbage created in a society. It may have a negative impact and cause harm to patients, medical professionals, the general public, the community, the ecosystem, and the environment.

It has been shown that Pakistan produces roughly 2 kg of biomedical waste per bed per day, with 0.5 kilogram of that being highly dangerous waste (Khattaq, 2009). Hospital waste output rates in underdeveloped nations range from 0.5 to 2.0 kilogram per bed per day, or 4 to 2,000 Kg of garbage per day, on average (Patil & Shekdar, 2001). Therefore, a comprehensive and safe treatment plan for biological waste is absolutely essential. A legal need as well as a social responsibility is the effective handling of biological waste.

It is a well-known truth that the "Hospital Waste" produced during patient care has a number of

negative and damaging consequences on the environment. The following statistics can be noticed when looking at the global output of medical waste: roughly 80% of the waste produced by healthcare activities is general garbage (kenny & Priyadarshini, 2021). The remaining 80% is classified as hazardous material, which may be radioactive, poisonous, or contagious. However, they mix up as a result of improper waste management, making the overall waste toxic. Approximately 16,000 million injections are given annually in the world, yet not all of the used needles and syringes are properly disposed off (Janagi, Shah, & Mehashwari, 2015). Waste from the healthcare and pharmaceutical industries contain potentially dangerous bacteria that could infect hospital patients, healthcare professionals, and members of the general public.

Medical waste is defined by law and good practice guidelines in industrialized nations, which also outline the many methods that can be used for its collection, transport, storage, and disposal. The development of options for the ethical disposal of medical waste with the fewest possible dangers to human health and the environment also makes use of the greatest technology now available. Medical waste materials, however, have not gotten enough attention in poor nations like Pakistan (Gupta & Boojh, 2007). According to estimates, 5.2 million people every year, including 4 million children, pass away from diseases associated to clinical trash (Akhter, 2000).

This issue has received substantial consideration on a global scale, and suitable waste management systems are being created and built. Many locations are experiencing a variety of challenges when putting this plan into action. All medical wastes that have the potential to spread bacterial, viral, or parasite infections are considered infectious waste (Radha, Kalaivani, & Lavanya, 2009). According to estimates, 7 to 10 billion tons of waste are produced annually around the world, but only 2 billion tons of that is municipal solid waste, of which only a minor amount comes from medical waste (Mugabi, Hattingh, & Chima, 2018).

Components and categories of biomedical waste

According to the World Health Organization (WHO) has divided medical waste into eight categories.

- Sharps,
- pharmaceuticals,
- infectious to possibly infectious waste,
- general garbage,
- pathological,
- radioactive,
- chemical,
- pressurized containers

Even while solid waste management has gained prominence, local governments still struggle to give some unique sources of garbage, including biomedical waste, the appropriate attention. Depending on the output, the sources of biomedical waste can be divided into primary and secondary sources. Even though tiny and sporadic sources may occasionally produce some biological waste in categories related to biomedical waste, their chemical makeup will differ (Tiwari & Kadu, 2013).

Methodology

Research methodology is a way used to answer research problem fully, research methods encompass all the strategies and procedures used for performing research. It is the science that examines “methodological aspects of research” (Mishra & Alok, 2011).

This was a descriptive study using a pre-structured questionnaire and queries from earlier research to learn more about the attitudes, knowledge, and practices of the medical personnel working in Islamabad, Pakistan's government-run hospitals. There was a mix of qualitative and quantitative research techniques. The benefits and drawbacks of various hospital waste management strategies were also tracked. The following are the research instruments utilized for data collection:

I. Direct Observation
II. Questionnaires

III. Interviews
IV. Literature of Review

Locale

The locale was PIMS (Pakistan Institute of Medical Sciences) located in Islamabad, Pakistan. One of the top tertiary hospitals in the area, it has 22 medical and surgical specialty centers. The institute was founded in 1985 and consists of three semi-autonomous hospitals: PIMS (Pakistan Institute of Medical Sciences), which has 592 beds and is spread out over 3.5 hectares; the Children's Hospital, which has 230 beds and is spread out over 1.6 hectares; and the Maternal & Child Health Care Center, which has 125 beds and is focused on obstetrics and gynecology.

Data analysis

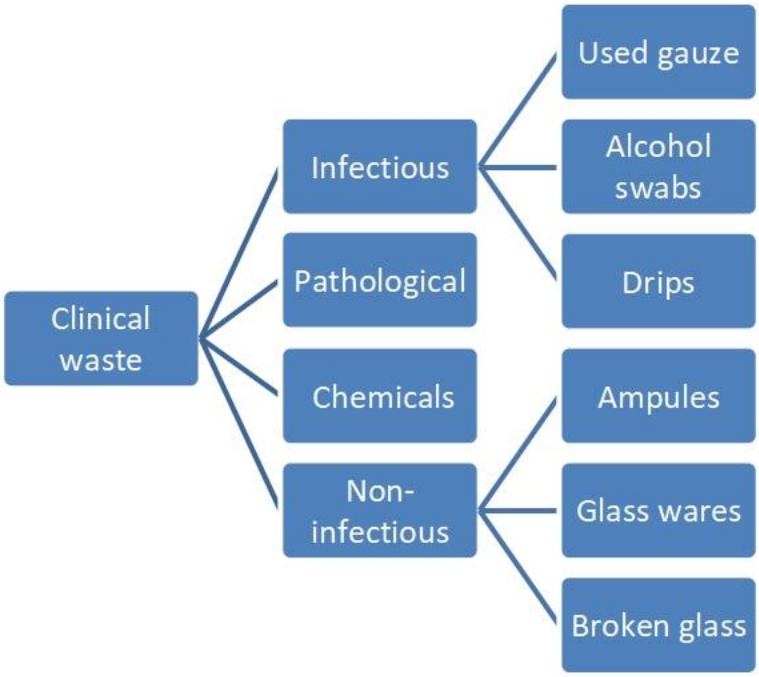
The procedure of inspecting, purifying, manipulating, and modeling data in order to find relevant information, support inferences, and help decision-making. Data analysis is the act of taking actual data and turning it into information that users can use to make decisions. On the basis of these preliminary results, additional research would seek out structures and links in the data using multiple regression or even a variance analysis (Lacey & Luff, 2007).

Analysis of objective 1;

I. To figure out the practices adopted for collection, segregation and disposed clinical waste

Hospitals produce garbage, which is growing in quantity and variety. Hospitals generate a wide variety of waste.

Type of waste generated by hospitals



Different waste types require different handling techniques. Just consider the need to segregate hazardous clinical chemical waste from other wastes in order to safely process it. Waste segregation is crucial to minimizing both the environmental impact of waste disposal and the potential health risks associated with poorly managed toxic waste.

The hospital has its own waste management policy and qualified workers, according to the hospital

executives' comments. The usage of color-coded disposable bags for segregation, as well as the use of needle cutters and puncture-proof boxes for sharps, was also noticed. The evaluation of how hospital trash was ultimately disposed of was the most important aspect of this study. It was a welcome surprise to learn that they have an incinerator and that they burn infectious waste in it.

Usage of color code bags for segregation of waste

The main purpose of color coding is to make it simple to identify between the various kinds of biological waste by classifying them into groups according to a single color. This table shows the different color codes bins used in the hospital of Islamabad.

Table no. 1

Color codes	Type of waste	Waste
Red	**Sharps**	Blood Vials and Tubes
		Big glass and Vials
		Glass Tubes
Yellow	**Infectious waste**	Used Gauze
		Alcohol Swabs
		Masks, Gloves, Gowns
		Drips
		Blood Suction Drain
		Colostomy Bags
		Urine Bags
		Fluid Bags
Blue	**Non Clinical waste**	Vegetables and fruits leftover
		Disposable cups, bottles
		Tissues papers
		Wrappers
Danger Box	**Medical glass ware waste**	Small Broken Glasses
		Ampules
		Glass wares

These practices were not according to international standards and not enough for proper segregation of waste. Even they are using different color coding bags but waste is not dump according to proper standards sometimes waste throw into other color code bin which elevate the risk of health and environmental issues. Those areas where they keep dustbins they also placed the written instructions on the wall about color coding but due to negligence of the staff they usually ignore and do not follow proper protocols. So this behavior of staff and workers create problems which are more inclined toward health issues and environmental hazardous.

Practices adopted by waste management authority

After collection of data from different wards it takes to the final disposal.

Table no. 2

Questions	Yes	No
Do they have separate routes for transportation of clinical waste		No
Do they separate the time for the transportation of general rubbish and clinical waste to prevent the mingling of waste?		No
Do they use separate trolleys for different colored bins?		No
Do they have designated location where waste is kept after collection?	Yes	
Are storage areas impervious to water supply?	Yes	

Has the waste been kept for longer than 48 hours?		No

According to the data that has been collected it shows that hospital clinic crew does not use a separate route for the transport of clinical waste. Clinical waste is carried along with other waste and is carried by the same person as well. There is no specified route taken to dump the clinical waste it is because the hospital management has not facilitated the clinic crew of the hospital in order to make sure that no such contact with the waste occurs that can cause any possible harm to any individual in any possible way. The garbage handlers who generated the Bio-Medical waste delivered it manually to the agency workers hired for the treatment of trash. Although there was no specific route for waste transportation and no trolleys for proper transportation, the rubbish was typically hauled in the morning.

The clinical waste is carried by the clinic crew without taking proper precautions. It may have disaster effects on human health as well as environment. People using the route may have contact with waste and it is also possible that some of the waste is dropped on the floor leaving the germs behind but no proper head is paid by the hospital management to this grave issue.

As explained above since the hospital clinic crew does not use separate routes for the transport of clinical waste they also don't have separate time for the transportation of general waste and clinical waste. Hospital clinic crew has little knowledge that preventing the mingling of waste is such an important step to make sure that no possible harm occurs to any individual including the person himself who is carrying the litter to its specified destination.

As it is known to everyone that the people having jobs as a member of cleaning crew, they are usually those who have little educational career or are not able to enjoy the facility of education and are illiterate. Hence they have very less knowledge of the possible damages that they are being exposed to. But the hospital management, being very well aware of this fact pay no heed to have this system improve to prevent any sort of harm done to those people who have maximum possible chances to have any kind of contact with the waste.

Daily collected clinical waste was dumped at a single location nearby an incinerator and transported there before being burned. As part of the waste management process, some needles, syringes and sharps were autoclaved first and then recycled. To dispose of yellow bags, the hospital has an incinerator plant. Municipalities got rid of the blue bags with their regular trash. The main issue with trash disposal was segregation because infectious garbage was frequently discovered mixed in with regular waste, posing a serious concern.

Analysis of objective no 2

II. To assess the risk of improper treatment of clinical solid waste on health and environment

It has been reported that the careless and indiscriminate disposal of this material by healthcare facilities may help the general population and those who touch it become infected with dangerous illnesses including hepatitis and AIDS (HIV). According to the report, sometime contagious and non-infectious wastes are gathered and deposited together on hospital property, mingling the two before being discarded with municipal waste at city dump sites.

Health care professionals are not well-informed about the dangers posed by medical waste. According to studies, workers handling medical waste face biological, physical, and chemical risks include burns, eye and back injuries, cuts, falls, sprains, and fractures. Exposure to medical wastes both inside and outside hospital grounds resulted in a number of accidents, including hand cuts from handling broken glass.

As more waste is shipped to be burned, incinerators will release more poisons and pollutants that are bad for the local air quality. The impact of incinerating waste is more detrimental to local air quality. Heavy metals, gases, and other xenobiotic substances are only a few of the harmful pollutants that incinerators may release. These contaminants may have both cancer-causing and non-cancerous effects on human health when inhaled. Environmental pollutants from medical waste, such as heavy metals, are persistent in the air.

Conclusion

Medical wastes have a serious negative effect on both human health and the environment. Information on medical waste management methods and their effects in underdeveloped nations and developed nations is insufficient.

This study's analysis demonstrates that hospitals are not properly segregating the diverse clinical wastes. Furthermore, all staff members responsible for the management of clinical waste need training and skill building programs.

Due to the poisonous nature of medical waste, poor treatment could result in the environment being destroyed. The balance of the current ecology may eventually be thrown off by this. There are still linked environmental effects even though both the private clinic and hospital have established medical waste practices aimed to minimize health concerns. The government of Mauritius is wholly committed to improving public health, workplace safety, and environmental protection. Therefore, in order to lower the risk to human health and the environment, significant funding must be allocated for the proper handling of medical waste.

Additionally, there are deficiencies in the management and disposal of medical waste. However, it is clear from this study that there is a pressing need to increase knowledge and instruction about medical waste issues. To maintain the safety of people and the environment, proper waste management practices are needed. The standard operating procedures and hazardous waste management policies must be put into full effect in line with national and international law.

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