STUDY OF KNOWLEDGE, PRACTICE AND ATTITUDE ABOUT BIO MEDICAL WASTE MANAGEMENT IN A COVID-19 ERA IN A HOSPITAL OF LUCKNOW

Dissertation Submitted to

The IIHMR University, Jaipur

for the partial fulfilment for the award of the degree of

Master of Business Administration (MBA)

in

Hospital and Health Management

by

Dr. Anubha Rastogi

(IIHMR-U/01/2020-22/1071)

Under the Supervision and Guidance of

Dr. Piyusha Majumdar

(Assistant Professor)

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DECLARATION

I hereby declare that this dissertation titled **STUDY OF KNOWLEDGE, PRACTICE AND ATTITUDE ABOUT BIO MEDICAL WASTE MANAGEMENT IN A COVID-19 ERA IN A HOSPITAL OF LUCKNOW**...is the bonfire record of my original research work. I declare that it has not been submitted to any other university or institution for the award of any degree or diploma. Information derived from the published or unpublished work of others has been duly acknowledged in the text.

(Signature)

Name of Student -Dr. Anubha Rastogi

Date

CERTIFICATE

This is to certify that **Dr. Anubha Rastogi** in partial fulfilment of the requirements for the award of the degree of MBA (Hospital and Health Management)/MBA (Pharmaceutical Management)/MBA (Rural Management) from the IIHMR University, Jaipur has successfully completed her/his internship under mentor during March 22, 2022 to June 19, 2022.

Place:
Date:

Preceptor/Head of the Organization
Name of the organization

CERTIFICATE

This is to certify that dissertation titled **... STUDY OF KNOWLEDGE, PRACTICE AND ATTITUDE ABOUT BIO MEDICAL WASTE MANAGEMENT IN A COVID-19 ERA IN A HOSPITAL OF LUCKNOW**.... is a record of the research work undertaken by Dr. Anubha Rastogi in partial fulfilment of the requirements for the award of the degree of MBA (Hospital and Health Management)/MBA (Pharmaceutical Management)/MBA (Rural Management) from the IIHMR University, Jaipur under my guidance and supervision and his/her approach to the research study has been sincere, scientific, and analytical.

Faculty Guide
IIHMR University, Jaipur

Date

School Dean
IIHMR University, Jaipur

Date

ACKNOWLEDGEMENT

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I perceive this opportunity as a big milestone in my career development. I will strive to use gained skills and knowledge in the best possible way, and will continue to work on the improvements, to attain desired career objectives.

I would like to thank all the members in my group of friends. It is their kind help and support that have made my research helpful. Finally, I would like to express my gratitude to my parents, my dear husband . Without their tremendous understanding and encouragement in the these months, it would be impossible for me to complete my study.

ABSTRACT

Introduction and objective-

The purpose of this study is to explore the relationship between the Covid-19 epidemic and biomedical waste management . As we all know, biomedical waste management is a critical activity performed by healthcare professionals in order to prevent health and environmental dangers. Proper management of biomedical waste created in a healthcare institution is a crucial job of a healthcare professional since inappropriate management not only endangers humans but also our environment. A cross-sectional research was conducted to analyze healthcare personnel' knowledge, practice, and attitude toward biomedical waste management when caring for COVID-19 patients, as well as its association with demographic characteristic in a Vivekananda hospital of Lucknow UP. If the enormous volume of medical waste is not managed by keeping correct and suitable norms, the possibilities of community-based COVID-19 transmission increase.

Objective-

1. To know the knowledge and awareness among the doctors and staff members, students,
2. To decide to use proper technique for the bio medical waste management.

Methodology-

The research was conducted in the Vivekananda hospital in Lucknow. It was a cross-sectional study in which survey was done with the help of questionnaire to test knowledge, attitude and practice among the doctors, interns, nurses, lab-technician, paramedical staff of this hospital. It has been noted that the composition of healthcare solid waste during the COVID-19 pandemic is more or less identical to that generated under normal conditions.

Results-

A survey study conducted at a Vivekananda polyclinic hospital in Lucknow to investigate the knowledge, attitudes, and practices of doctors, interns, nurses, laboratory technicians, and paramedical staff as it was shown that 150 HCP were surveyed which 22.6 percent had acceptable knowledge, 46.6 percent had intermediate knowledge, and 30.6 percent had poor understanding. It indicates that additional information should be increased through hospital-provided training and learning events.

The majority of HCPs had a negative perspective because BMW management risked transferring infectious infections, while 27 percent of those with a neutral attitude said that segregating hospital waste into separate categories was time consuming. Approximately 51% of HCPs strongly agreed that PPE was required while handling BMW and that cleaning and disinfection decreased infection. While treating COVID-19 patients, HCPs generally followed infection control procedures. As many as 16% of HCPs utilized and discarded all PPE while working with BMW. Approximately 73 percent of HCPs followed the colour labelling of containers based on the kind of waste during BMW disposal, as well as regulations categorizing trash into non-hazardous, hazardous, and sharp waste.

Discussion-

Our study was designed to analyze health care personnel' knowledge, practice, and attitude toward bio-medical waste management at the Vivekananda Polyclinic Hospital in Lucknow, India.

Training sessions should be provided on a regular basis to all levels of bio-medical waste management professionals. In this study, however, the majority of them utilized and discarded all personal protective equipment when handling biological waste, and they followed rules for sorting BMW into non-hazardous, hazardous, and sharp trash.

ABBREVIATIONS

Abbreviation	Full Form
HWM	Hospital waste management
BWM	Biomedical waste management
CPCB	Central Pollution Control Board
MT/M	Metric ton per month
M&H	Management &Handling
IMA	Indian Medical Association
WHO	World Health Organization
HIV	Human Immunodeficiency Virus
TB	Tuberculosis
CBWTF	Common Biomedical Waste Treatment Facilities
UPPCB	Uttar Pradesh pollution Control Board
CE	Combustion Efficiency
WM	Waste Management
EASEWASTE	Environmental assessment of solid waste systems technology
RDK	Rapid diagnostic kit

PPE	Personal protection equipment

CHAPTER 1

ABOUT THE HOSPITAL

The Vivekananda hospital-

The Vivekananda Polyclinic & Institute of Medical Sciences is sometimes referred to as the Vivekananda Hospital. It is a multi-facility hospital that was built in Lucknow with the purpose of giving sick and injured people medical care and treatment. This medical care facility bases its operations on Sri Ramakrishna Paramahansa's teachings, which claim that serving mankind (Jiva) with the highest devotion is equivalent to serving the Lord (Shiva). It is centered on offering affordable medical treatment to the underprivileged and middle class populations and is located in the city's center. As a result, individuals from all walks of life may visit this location and receive top-notch medical care at a reasonable price.

The hospital has been offering affordable allopathic, homeopathic, naturopathic, and ayurvedic care to people from both rural and urban regions. This makes quality care more accessible to those in the socioeconomically disadvantaged portion at reasonable costs. Without paying more than they can afford, consumers can seek treatment from a number of conditions.

- Products and Services

The 350-bed hospital is equipped to handle emergencies around-the-clock. Every medical requirement of patients is met by the hospital's several departments. This hospital provides a

variety of services, including ENT, cardiology, asthma, dermatology, gastroenterology, gynecology, neurology, orthopedics, oncology, pathology, psychiatry, and radiology.

There are several auxiliary departments accessible at this hospital to support the regular departments.
Seven complementary therapies are added to the facility's Allopathic wing. These include Acupressure, Homeopathy, Yoga, Reiki, Naturopathy, and Ayurveda.

People with illnesses are free to select any therapy to suit their unique requirements.

With skilled and knowledgeable specialists, this Lucknow-based hospital offers care and therapy for Covid 19 and other chronic disorders. It is now one of Lucknow's top-rated Corona hospitals.

❖ **MISSION-**

• To encourage a culture at the hospital that encourages adherence to patient care standards and the defense of patients' rights.

• To incorporate both treatment and preventative health care techniques without regard to gender, ethnicity, language, or religion.

❖ **VISION**-To establish a standard of excellence for cutting-edge, multidisciplinary medical services in the area by offering high quality healthcare and tertiary care facilities.

❖ Bio-medical waste management and implementation of rules in the Vivekananda polyclinic -

A group of 20 people is in charge of managing biomedical waste. There were 802,912 patient treatments reported overall in a calendar year. The operating room produced the most trash (3.5 kg/day), followed by the ICU, NICU, and medical ward (3.4 kg/day) in that order. The amount of garbage produced by the gynecology and family planning wards is also mentioned. The usual daily patient count is 200, the occupancy rate is 112 percent, and the gross death rate is 3 to 4 percent in normal times, but it is presently 17.1 percent due to the COVID-19 pandemic.

The treatment and disposal methods-

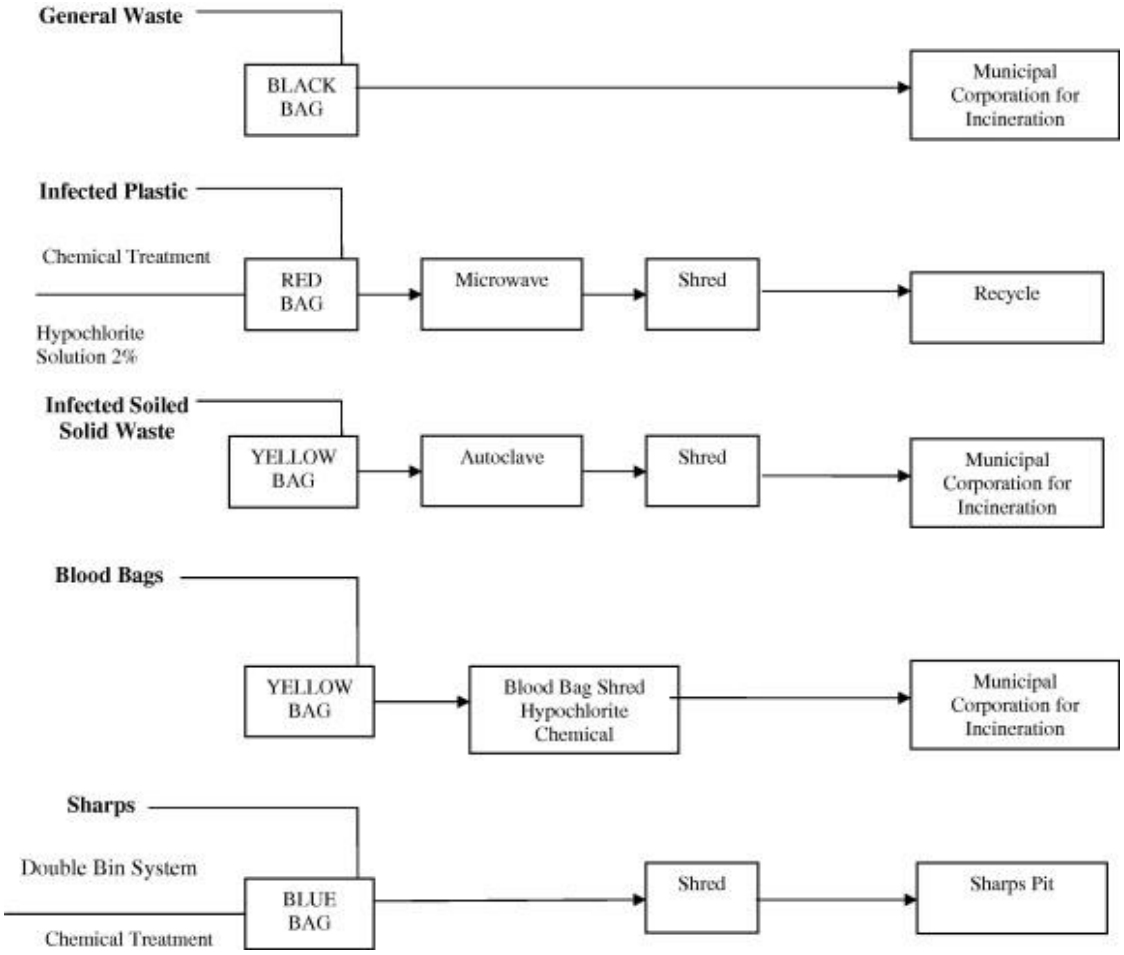
- Chemical treatment they use chlorine solution for disinfecting sharps and plastic waste.
- In thermal treatment they use autoclave ,hydraclave,microwave.
- Mechanical treatment uses compaction process involves compressing the waste into containers to reduce its volume and shredding includes granulation grinding pulping.

Disposal of human parts and organs from the hospital -

Amputated human organs, limbs, and surgically removed organs are packaged in PVC jars or bags, preserved in formaldehyde, and then sent to pathology labs for additional research. These organs are dumped in the trash or disposed of in the municipal waste when they are no longer needed and are not thought to be suitable for pathological examinations.

Waste from the departments of pathology, microbiology, anatomy, biochemistry, and pharmacology -

Office wastes and other types of trash are often gathered in containers and either burnt outside or disposed of in garbage pits. The remains of human organs preserved in formaldehyde for pathological investigation are then dug up and buried at least three feet deep in the department's backyard. After sporadic chemical decontamination procedures, unused blood specimens, sera, and complete bottles of expired blood are flushed down the drain and combined with sewage. Glass culture plates, pipettes, enzyme-linked immunosorbent assay plates, and other contaminated bacteriological and virological material are chemically or automatically cleansed. Glass objects are cleaned and reused.



Flow chart for bio medical waste management

CHAPTER 2

INTRODUCTION

Biomedical waste is described as trash produced during the diagnosis, testing, treatment, research, and creation of biological waste products for people or animals. It is sometimes referred to as infectious waste or medical waste. Syringes, live vaccinations, laboratory samples, body parts, bodily fluids, sharp needles, cultures, and lancets are examples of biomedical waste. Hospitals, doctors' offices, and labs are the primary producers of biomedical waste. The legislation requires such institutions to adhere to regulations that safeguard the public from coming into touch with biological waste since it can be harmful to human health. OSHA, the Food and Drug Administration (FDA), and the Nuclear Regulatory Commission are among the organizations that control various facets of biological waste.

In addition to being a risk to patients and workers who manage these wastes, hospital waste poses a hazard to public health and the environment. With improper biomedical waste management in mind, the Ministry of Environment and Forests issued the "Biomedical Waste (management and handling) Rules, 1998" in July 1998. According to these Rules (Rule4), it is the responsibility of every "occupier," i.e. a person who has authority over the institution and or its premises, to take all reasonable means to ensure that waste generated is managed in a manner that is safe for human health and the environment..

Therefore, it is necessary to build up the biological waste treatment facilities at hospitals, nursing homes, clinics, dispensaries, animal houses, pathological labs, etc. However, it is not necessary for every institution to maintain a separate waste treatment plant. However, it is the occupier's responsibility to make sure the garbage is handled within 48 hours. If garbage from healthcare facilities including infectious, biomedical, and radioactive material as well as sharps (hypodermic needles, knives, scalpels, etc.) is not appropriately treated/disposed of or is permitted to be combined with other municipal waste, it poses a serious concern. The efforts made for overall municipal waste management are jeopardized by its propensity to

promote the growth of different pathogens and vectors as well as its capacity to contaminate other non-hazardous/non-toxic municipal garbage.

Serious hazards to public health are posed by illnesses like cholera, the plague, TB, hepatitis (particularly HBV), AIDS (HIV), diphtheria, etc. in epidemic or even endemic forms. According to studies, non-hazardous and non-toxic waste makes up around three-fourths of the total trash produced in healthcare facilities. According to some estimates, infectious trash makes about 15% of total garbage, while other hazardous waste makes up 5%. Similar to how trash creation can be decreased with improved planning and administration, waste management costs as a whole can be kept under control. Healthcare staff should get motivational training and an organizational framework to help the situation significantly.

The ongoing alteration of the coronavirus's genomic sequence and its widespread transmission have increased the likelihood of verified COVID-19 cases and fatalities. Since there was a paradigm change in the form of the enormous number of wastes created as a result of this pandemic, biological wastes (BMW) affect not just doctors or nurses but also other HCPs including pharmacists, technicians, interns, and therapists in hospitals and all healthcare sectors. Disposable personal protective equipment (PPE) like gloves, surgical masks, N-95 masks, air-purifying respirators, goggles, face shields, safety gowns or suits, and shoe covers were used more frequently than expected. Plastic syringes and needles, high-flow nasal cannulas, and breathing circuits were also used more frequently. To the waste management system, these have imposed a tremendous amount of load.

It has also been noted that incorrect segregation at the point of origin results in the mixing of infected and non-infectious trash. BMW should be separated using color-coding systems that are rigorously adhered to. In order to prevent cross-contamination, wastes from COVID-19 wards should also be collected, held in separate records, and transferred directly to treatment facilities.

A strategic directive should be created in INDIA, Vivekananda polyclinic hospital Lucknow UP focusing on the current waste management knowledge, practice, and attitude (KPA) while handling, treating, and removing BMW produced during the identification, isolation, and management of COVID-19 patients. This is evident in light of all of the statistics mentioned above. Additionally, the KPA should be updated from the normal waste management procedures by organizing awareness-raising campaigns and standardizing policy.

OBJECTIVE-

- To know the knowledge, practice and attitude regarding BMW management among HCPs during COVID-19 crises in Vivekananda polyclinic healthcare sectors .
- To decide to use proper technique for the bio medical waste management.

Classification of biomedical waste

❖ **Non-hazardous waste** -
This constitutes about 85% of the waste generated in most healthcare set-ups. This includes waste comprising of food remnants, fruit peels, wash water, paper cartons, packaging material etc.

❖ **Hazardous waste** -
Biohazard: Biological hazards, also known as biohazards, refer to biological substances that pose a threat to the health of living organisms, primarily that of humans. This can include medical waste or samples of a microorganism, virus or toxin (from a biological source) that can impact human health. It can also include substances harmful to animals. The term and its associated symbol is generally used as a warning, so that those potentially exposed to the substances will know to take precautions.

❖ **Radioactive waste-**
It includes waste contaminated with radionuclide; it may be solid, liquid or gaseous waste. These are generated from in vitro analysis of body fluids and tissue, in vitro imaging and therapeutic procedures.

❖ **Chemical waste-**
It includes disinfectants (hypochlorite, gluteraldehyde, iodophors, phenolic derivatives and alcohol based preparations), X-ray processing solutions, monomers and associated reagents, base metal debris (dental amalgam in extracted teeth).

❖ **Pharmaceutical waste-**
It includes anesthetics, sedatives, antibiotics, analgesics etc.

❖ Biomedical Waste Management Rule -

The Bio-Medical Waste (Management and Handling) Rules, 1998, issued by the Ministry of Environment and Forests (MoEF), Government of India, and announced on July 20, 1998, provide consistent principles and a code of conduct for the whole country. The 'occupier' of an institution that generates bio-medical waste (such as a hospital, nursing home, clinic, dispensary, veterinary institution, animal house, pathological laboratory, blood bank, etc.) shall be responsible for taking the necessary steps to ensure that such waste is handled without having a negative impact on human health or the environment, as is expressly stated in this rule.

According to the Environment Protection Act of 1986, Bio-Medical Waste Management Rules were released on July 20, 1998. Each occupant of a facility that generates bio-medical waste, such as hospitals, nursing homes, clinics, dispensaries, veterinary institutions, animal houses, pathological laboratories, and blood banks, is required by this rule to take all reasonable precautions to ensure that the waste is handled in a way that protects both human health and the environment.

Each state and union territory (UT) government must create a designated authority for this purpose. The national governments would also form advisory panels to advise them on how to execute these guidelines. If the tenant or operator is aggrieved by any order of the authority, they may appeal to such other authority as the State/UT Government may deem appropriate. Prescribed Authorities formed thus far by various State Governments are mentioned in Annexure 7.3, as is the time restriction set forth in Schedule VI of the Bio-Medical (Management & Handling) Rules, 1998. trash disposal in a common waste treatment plant or any other waste disposal facility.

The Biomedical waste management rule, 1998 mainly comprise of:

1) Schedule I- Schedule I comprises biological waste categories. The physio-chemical and biological natures of these components, as well as their toxicity and possible hazards, differ, necessitating alternative methods/options for treatment/disposal. As a result, under Schedule I of the Bio-medical Waste(Management and Handling) Rules, 1998 (Annexure II), waste originating from various types of such institutions has been classified into ten separate categories, with treatment and disposal options given for each.

Category	Waste Content	Components	Method of treatment and disposal
Category No. 1	Human Anatomical Waste	Human tissues, organs, body parts	Incineration /deep burial
Category No. 2	Animal Waste	Animal tissues, organs, body parts carcasses, bleeding parts, fluid, blood and experimental animals used in research, waste generated by veterinary hospitals colleges, discharge from hospitals, animal, Houses	Incineration /deep burial
Category No 3	Microbiology & Biotechnology Waste	Wastes from laboratory cultures, stocks or specimens of micro-organisms live or attenuated vaccines, human and animal cell culture used in research and infectious agents and industrial laboratories, wastes from production of biologicals, from research toxins, dishes and devices used for transfer of cultures	Local autoclaving/ micro waving/ incineration
Category No. 4	Waste sharps	Needles, syringes, scalpels, blades, glass, etc. that may cause puncture and cuts. This includes both used and unused sharps	Disinfections chemical treatment /autoclaving/micro waving and mutilation shredding
Category No. 5	Discarded Medicines and Cytotoxic drugs	Wastes comprising of outdated, contaminated and discarded medicines	Incineration / destruction & drugs disposal in secured landfills
Category No. 6	Solid Waste	Items contaminated with blood, and body fluids including cotton, dressings, soiled plaster casts, lines, beddings, other material contaminated with blood	Incineration , autoclaving/ micro waving
Category No. 7	Solid Waste	Wastes generated from disposable items other than the waste sharps such as tubing's, catheters, intravenous sets etc	Disinfections chemical treatment /autoclaving/micro waving and mutilation shredding
Category No. 8	Liquid Waste	Waste generated from laboratory and washing, cleaning, house-keeping and disinfecting activities	Disinfections by chemical treatment and discharge into drains
Category No. 9	Incineration Ash	Ash from incineration of any bio-medical waste	Disposal in municipal landfill
Category No. 10	Chemical Waste	Chemicals used in production of biologicals, chemicals used in disinfection, as insecticides, etc	Chemical treatment and discharges into drains

(Source- The Bio Medical Waste (Management and Handling) Rules, 1998)

2) Schedule II- Colour coding & type of container for disposal of bio-medical waste

3) Schedule III- Different labels for bio-medical waste containers and bags shall be required for identification and safe handling Waste

4) Schedule IV- Label for transport of bio-medical waste containers /bags

5) Schedule V- Standards for treatment and disposal of bio-medical wastes

6) Schedule VI - Schedule for waste treatment facilities like incinerator/ autoclave / microwave system

❖ Identification of Various Components of the Waste Generated

According to Schedule II of the Bio-medical Waste (Management and Handling) Rules, 1998, such waste must be separated into containers/bags at the site of creation before treatment and disposal. Infectious waste bags and containers should be labeled with the Biohazard sign. Autoclaving should be used to sterilize highly infectious trash. Cytotoxic wastes must be collected in leak-proof containers properly labeled as such. Needles and syringes should be destroyed using the needle destroyer and syringe cutters provided at the moment of manufacture. Curved scissors should be used to cut infusion sets, bottles, and gloves.

Sharps, dirty linen, plastic, and rubber items must be disinfected at the point of manufacture using sodium hypochlorite with a minimum contact time of one hour. Each shift should start with a new solution. Staff must close the trash bags when they are three quarters full, either by tying the neck or by closing the bag. The kerbside storage space must be impermeable, hard standing, and well-drained. It should allow easy access to the garbage collection vehicle.

Within the hospital, biomedical waste should be transported using wheeled trolleys, containers, or carts that are not used for any other purpose. The trolleys must be cleaned on a daily basis. Off-site transportation vehicles should be labeled with the carrier's name and address. A biohazard emblem should be painted on the wall. A suitable technique for securing the cargo during transportation must be in place. A vehicle of this type should be easy to clean and have rounded edges.

Before returning to the seller, all discarded plastic should be shred. Biomedical waste can be finally treated using methods such as incineration, autoclave, hydro lave, or microwave.

❖ Waste storage -

The most crucial phase in the health care establishment's waste control program is systematic segregated storage. Color coding is required for ease of identification and handling, i.e., usage of distinct coloured containers with liner / sealed container (for sharps) for certain wastes. It should be noted that, according to the Rules, untreated garbage should not be held for more than 48 hours.

❖ Recommended Labelling and Colour Coding -

These must comply with Schedule II of the announced regulations. A simple and unambiguous sign indicating which garbage should go to which container and how frequently and where it must be routinely collected is to be put on the wall or in a visible position near the container. The notification should be written in English, Hindi, and the primary local language. It should preferably include illustrations that match the container's color to the type of trash it should hold.

Segregated Storage in Separate Containers -

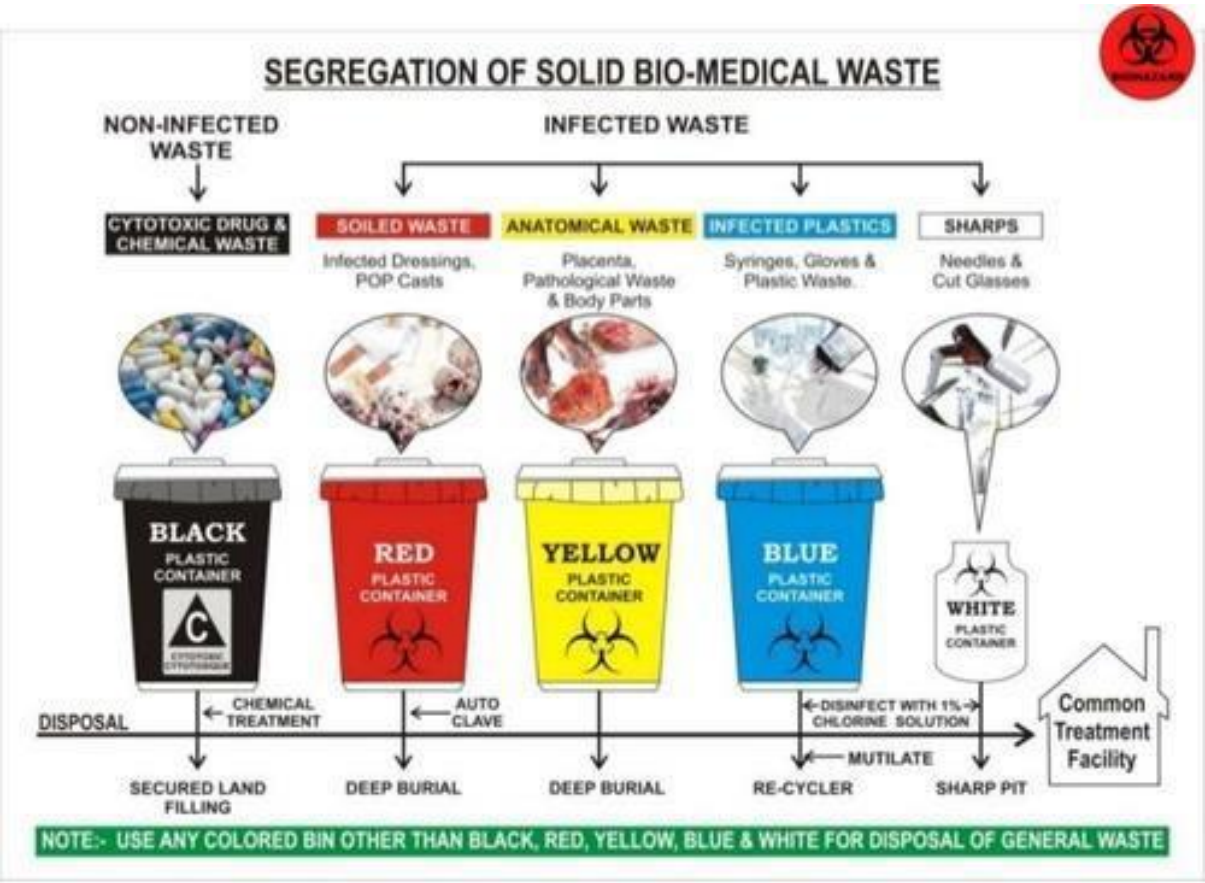
The system guarantees that waste bags are separated at the point of generation in line with Schedule I of the Bio-Medical Waste Regulations. Each waste type (according to the treatment choices specified in Schedule I of the regulations) must be kept separate in a suitable container or bag. The following characteristics should be present in such a container or bag:

1. It must be strong enough to withstand the waste's maximum volume and weight without being damaged. It should be free of any punctures or leaks.

2. The container should have a lid, especially one that can be operated with one's feet. Plastic bags must be properly placed into a container in such a way that they remain in place during opening and closing of the lid and can also be removed without difficulty.

3. Sharps must be stored in puncture-resistant sharps containers. However, before placing them in the containers, they must be maimed with a needle cutter and placed in the department/ward.

4. The bags/containers should not be more than 3/4 full. Attempts should be made to establish fixed locations for each container so that it becomes a part of the normal situation and practice for the medical and nursing professionals involved.



Certification -

In order for the type of the waste to be immediately and accurately tracked back for proper remediation and, if required, the responsibility to be addressed, the containers should include the name of the department/laboratory from where the trash has been created. The date, name, and signature of the person in charge should also be written on the containers' labels. There would be more responsibility as a result. Name, address, phone, and fax numbers for both the sender and the recipient should be on the label. The person who is to be notified in an emergency should also be listed, along with their name, address, and phone and fax numbers.

Transportation of Waste Outside -

BMWM modules enable complete handover of the garbage at the storage area and double-check the waste information collected from each point to monitor waste malfeasance. The system allows for the implementation of at least two checking-barriers between waste source locations and their intended destinations. A method for specifying and enforcing the trolley

schedule and route is also included in the BMWM module. Each trolley may be set up to exclusively pick up a certain kind of garbage from the bins. Radio Frequency Identification (RFID) tags are affixed to the trolleys in order to track trolley movement. RFID scanners have been deployed on all trolley routes as well as those through Zero Tolerance Areas.

❖ Treatment and disposal techniques for biomedical waste -

There are several methods that have been successful in the treatment of infectious waste.

1) AUTOCLAVE-

To sanitize medical equipment, autoclaves are closed chambers that apply heat, pressure, and occasionally steam over time. Since over a century ago, autoclaves have been used to disinfect medical equipment before reusing it. Before being disposed of in a conventional landfill, autoclaves are used to eliminate any germs that could be present in medical waste. Autoclaves are easily scaled to fit the requirements of any medical institution and can handle up to 90% of medical waste. Enormous autoclaves are used to handle large amounts of medical waste, whereas small counter-top autoclaves are frequently used to sterilize reusable medical equipment.

2) INCINERATION

This is demonstrated by the fact that a rise in temperature produces dry oxidation. to minimize volume and weight of garbage that cannot be recycled, reused, or dumped in open fields by turning it into inorganic, noncombustible waste. The high capital and running expenses of contemporary technology are one of the disadvantages of incineration. Incineration has the benefit of not requiring pretreatment and being appropriate for modest heating volumes over 2000 Kcal/Kg for single chamber and 3500 Kcal/Kg for double chamber. The garbage must be flammable and have a moisture content of less than 30%.

3) THERMAL INACTIVATION

To destroy pathogenic organisms, trash is subjected to a process called thermal inactivation. Large quantities are often handled using this strategy. Waste liquid is gathered in a container and heated using heat exchangers or a steam jacket around the container. The temperature and time of treatment are based on the types of pathogens

present in the waste. Following treatment, the contents may be disposed of in a way that satisfies local, state, and federal regulations into the sanitary sewer. Compared to steam treatment, this approach necessitates greater temperatures and longer treatment cycles.

4) GAS/VAPOR STERILIZATION

Chemicals that are gaseous or evaporated are used in gas/vapor sterilization. The most often utilized agent is ethylene oxide, however it should be handled with caution because it may cause cancer in humans. The possibility of worker exposure occurs while handling sterilized goods since ethylene oxide may be deposited on the surface of treated objects.

5) CHEMICAL DISINFECTION

For liquid pathogenic wastes, chemical disinfection is the preferred method of treatment. Think about the following: microorganism kind, contamination level, Quantity of proteinaceous material present, Disinfectant kind, Contact time, and other pertinent variables including temperature, pH, mixing needs, and microorganism biology. Chemically treated garbage should be disposed of according to state and municipal regulations.

Disposal of treated waste:

If infectious trash has been successfully treated, it is no longer biologically dangerous and can be disposed of with regular solid garbage if it does not pose any additional risks that are governed by local, state, or federal rules. The EPA advises:

- Reaching out to state and local governments to find out what disposal methods are acceptable;
- Discharging treated liquids and pathological wastes into the sanitary sewage system after grinding; Obtaining approval from the local sewer authority.

CHAPTER 3

REVIEW OF LITERATURE

Review of Literature related to biomedical waste management a review of related Literature is an essential aspect of scientific research. It involves the systematic identification. Location security and survey of written material that contain information of a research problem (polit & hinges) keeping this in mind the investigator probed into the accessible some & gained an in-depth understanding from the related studies.

Authors(year)	Study location	Sample size	Sampling techniques	Salient features
1. Sahbanathul Misseriya Jalal (2021)	Al-Ahsa Saudi arabia	272	Randomization	According to a study on attitudes around BMW awareness, most healthcare professionals (93.3 percent to 98.9 percent) were aware that incorrect waste management was posing a number of health risks; (79.8 percent to 97.9 percent)
2. NAJIM Z.ALSHAHRANI (2021)	Aseer region Saudi arabia	429	Random	Healthcare workers had sufficient knowledge about COVID-19 and infection control measures with a mean of 11.42.

3. Anirban dalui (2021)	West Bengal	166	Random	A high mean score (14.4 ± 3.2) was obtained by doctors followed by nurses (13.6 ± 3.8). Regarding practice, the majority of HCWs (52.8%) followed the color-coding of BMW and 49.5% followed policies in separating the wastes according to hazard.
4. Lynda Andeobu (2021)	Australia	NA	Non-random	This study offers insights on immediate and long term solutions towards managing COVID-19 waste in Australia, taking into account the significant dangers associated and the need of proper handling and disposal of medical waste from COVID-19.
5. Aruna devi (2019)	Fatehgarh sahib district ,Punjab india.	120 healthcare facilities	Random	The primary determinants of health care facility performance were determined through the use of logistic regression. The results demonstrate that frequent training in BMW and enhanced infrastructure can improve BMW

				management practices.
6. Anita pandey (2016)	Meerut, India	100	Random	Though awareness about segregation of BMW was seen in 90% of the HCP, 30%-35% did not practice The transport, treatment and disposal of each collected waste were outsourced and carried out by 'Synergy' waste management Pvt. Ltd.
7. Sudhir Chandra joshi 2018	Ujjain india	75	Random	A gap between knowledge and actual practice regarding HCWM was highlighted in the perception of the hospital staff. The participants suggested organizational changes, training and monitoring to address this.
8. Rajeev Ranjan (2016)	Bhubaneswar, Odisha	500	Random	A bigger proportion of participants (61%) had no idea what recycling and reuse of biological waste even meant. Biomedical waste management necessitates an urgent academic assessment due to its effects on the environment in order to raise awareness during training sessions.

9. Landenla lama 2016	Darjeeling district, India	NA	Clustered	The study also revealed that the amount of staff needed to manage healthcare waste was constrained; as a result, additional manpower is needed to facilitate the application of laws and regulations.

CHAPTER 4

METHODOLOGY

Healthcare waste is often the garbage produced by hospitals, research institutes, and labs related to medical treatments. Between 75 and 90 percent of healthcare solid waste is comparable to household garbage, hence it is labeled as "non-hazardous" or "general healthcare" waste. In actuality, administrative, culinary, and cleaning tasks at healthcare and medical facilities produce significant waste. Hazardous waste, which is defined as the remaining 10–25 percent of garbage, poses major environmental and health dangers. With the exception of the production of a sizable amount of plastics and microplastics, it has been noted that the composition of healthcare solid waste during the COVID-19 pandemic is more or less identical to that generated under normal conditions. However, the epidemic has resulted in a much higher production of garbage. The composition of healthcare solid waste is crucial, as is evident under normal conditions, since this determines its capacity for recycling and sustainably managing, both of which are essential during the present epidemic.

RESEARCH METHODOLOGY

This includes the research's methodology, design, demographic, setting, inclusion and exclusion criteria, study instrument, sample size, and sampling strategy for data collecting and analysis. This study was conducted to evaluate medical professionals', paramedical staff members', and students' knowledge, practice, and attitudes about the management of biomedical waste.

RESEARCH DESIGN-

The cross-sectional design used in this study.

SETTING OF THE STUDY -

The study was conducted to assess the knowledge, practice and attitude on BMW management among various healthcare employees, who are involved in caring for COVID-19 patients in healthcare sector, The Vivekananda polyclinic hospital of Lucknow UP.

RESEACH APPROACH-

The quantitative approach was used in this study.

STUDY POPULATION-

The target population of the study involves Doctors, Post graduates, interns, staff nurses, laboratory technicians, Housekeeping staff.

HYPOTHESIS -

- Doctors, interns, and paramedical workers' knowledge, attitudes, and practices in connection to the management of biomedical waste are significantly correlated with certain demographic factors, including age, gender, occupation, and level of education..

Inclusion criteria-

Participants in the study included all HCPs, including doctors, nurses, pharmacists, laboratory technicians (LTs), medical interns, and nurse interns, who were 20 years of age or older, both sexes, worked at the Vivekananda Polyclinic Hospital with a minimum of 6 months of professional experience and cared for COVID -19 patients. The study comprised HCPs who gave informed permission and were accessible for data collection.

Exclusion criteria- Few Paramedical workers who are not willing to participate in the study.

STUDY TOOLS-

- Surveys
- Questionnaires

SAMPLE SIZE -

The sample size consists of 150 workers who are working in hospitals who full filled the inclusion criteria of sample selection.

SAMPLING TECHNIQUE-

Random sampling is done in this study.

OPERATIONAL DEFINITION-

• Knowledge- This relates to the staff members' and doctors' understanding of biomedical waste management as demonstrated by their responses to the structured questionnaire.

• Attitude-How staff members, lab technicians, and medical professionals feel and act toward BMW. The sum of each respondent's scores for the attitude questions was tallied, and the mean score was used to classify respondents as having a good or bad attitude.

• Practice- The regular participation of doctors, lab technicians, and staff members in the management of biowaste. Total scores for each of the respondents' individual responses to the attitude questions were computed, and the mean score was used to classify respondents as having good or bad practice.

• Waste management-Solid trash and resource conservation goals are achieved by managing waste using a variety of strategies. Among the methods are waste reduction, reuse, and recycling.

DATE COLLECTION PROCEDURE

Data were collected through scheduled by using semi structured questionnaire and checklist to assess the knowledge ,attitude and practice regarding biomedical waste management.

ETHICAL CONSIDERATIONS

Ethical concerns demand that healthcare organizations understand and act on their obligation to avoid the potentially detrimental impacts of hazardous waste created during the delivery of healthcare services.

The first step in acknowledging the significance of hazardous contamination is to commit to taking action on the issue in a methodical and deliberate manner. This may include forming a task force with a deadline to give recommendations, or contacting the AHA or a group like Health Care Without Harm for assistance in determining how to proceed.

The fact that many healthcare personnel and members of the public are not yet aware of the health dangers involved with medical waste disposal is not cause for concern. Much current research is accessible, and the ideas outlined above are useful for thinking about environmental stewardship when the data is not fully understood by everyone.

Medical waste creates problems that must be treated seriously as they are important to the job of healthcare. They are not frivolous matters that may be postponed until other, more important challenges in the company are addressed.

DATA ANALYSIS

The analysis of the sample and interpretation of data to determine the Knowledge ,Attitude and Practice regarding biomedical waste management among doctors,nurses,laboratory technicians ,paramedical workers in selected at Vivekananda polyclinic hospital Lucknow, UP India. Analysis is done with the help of software Microsoft 365 ,Excel version 16.62.

CHAPTER 5

RESULTS AND INTERPRETATION

- Percentage distribution of the samples according to their selected demographic variables of age ,gender, job description. (n=150)

Table -1 shows demographic variables

Age(years)	20-30 years 31-40 years 41-50 years More than 50 years	30% 36% 10% 9%
Gender	Male Female	56% 43.3%
Job description	Physician Interns Nurse Lab technician Paramedical staff	23% 10% 35% 15% 18%

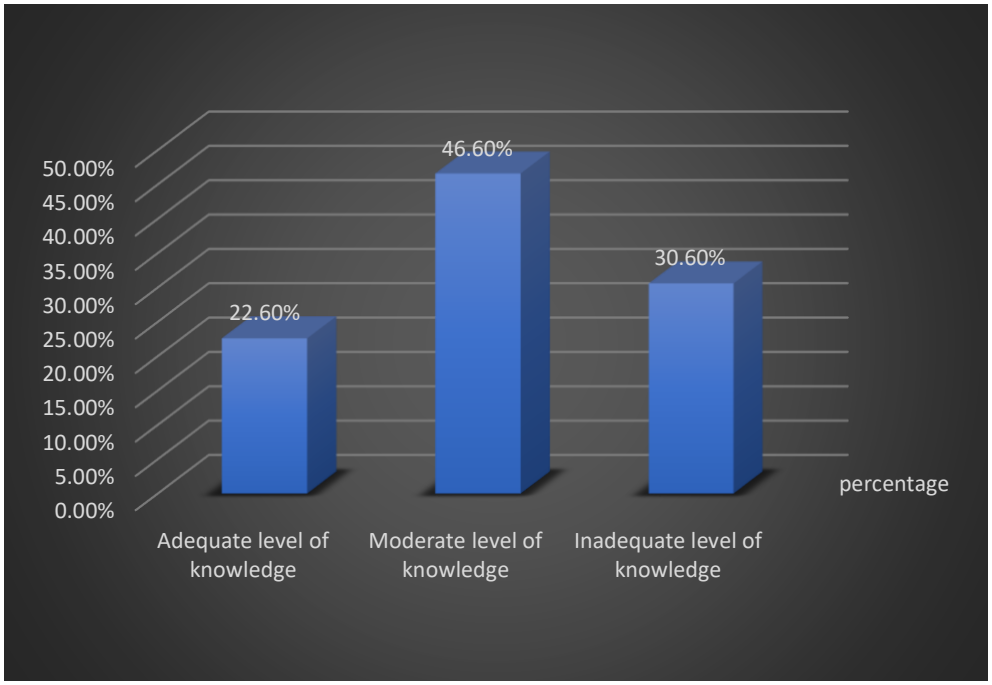
Out of 150 healthcare professional included in the analysis 36% were in the age of 31-40 years, 30% were in 20-30 years ,10% were in 41-50 years ,9% were in more than 50 age group .They had more male workers i.e 56%. The study population consisted of mix there were 23% of physicians, 35% were nurses, and 10%were interns. The paramedical staff were 18% and lab technician were 15%.

- Distribution of level of knowledge regarding biomedical waste management among doctors,nurses,laboratory technicians and paramedical workers .

Table-2 shows level of knowledge

S.No	Level of knowledge	Percentage
1	Adequate level of knowledge	22.6%
2	Moderate level of knowledge	46.6%
3	Inadequate level of knowledge	30.6%

- The table above depicts the percentage distribution of samples based on the knowledge score of doctors, interns, nurses, lab technicians, and paramedics related biomedical waste management. It was shown that 22.6 percent had adequate level of knowledge, 46.6 percent had moderate knowledge, and 30.6 percent had inadequate understanding.



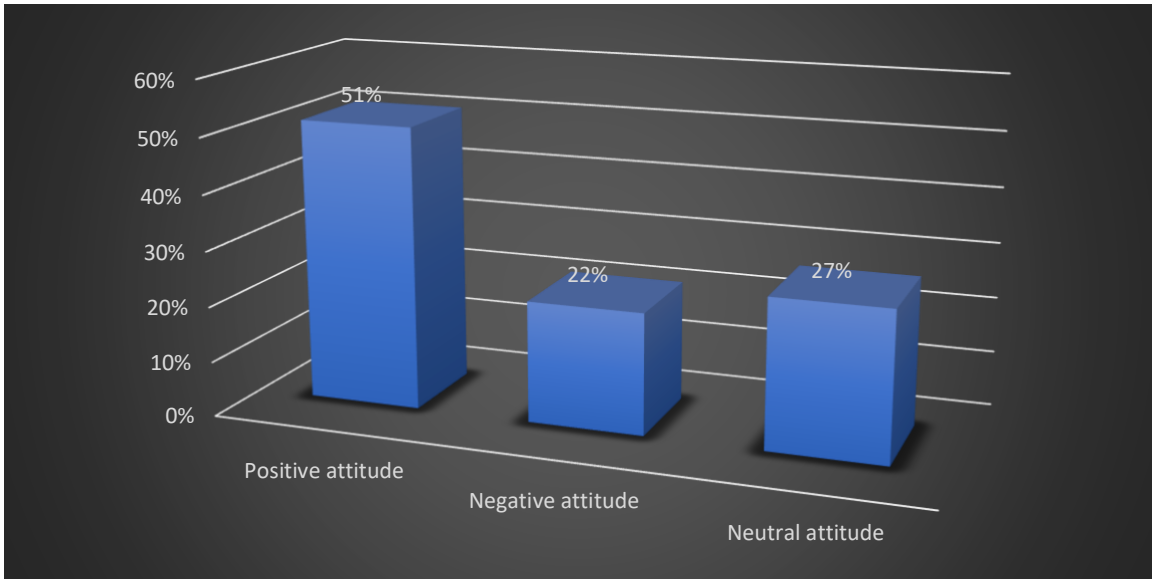
- Distribution of level of Attitude regarding biomedical waste management among workers.

Table -3 shows level of attitude

S.No	Level of attitude	Percentage
1	Positive attitude	51%
2	Negative attitude	22%
3	Neutral attitude	27%

- The table above depicts the percentage distribution of samples based on the attitude score of doctors, interns, nurses, lab technicians, and paramedics toward biomedical waste

management. It demonstrates that 51 percent had a good attitude toward waste management, 22 percent had a negative view, and 27 percent had a neutral opinion.

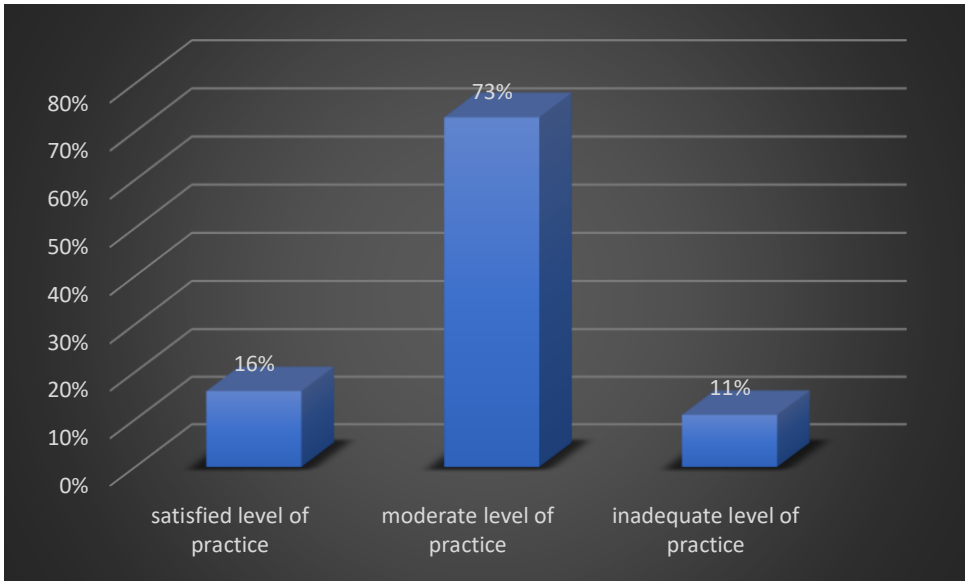


- Distribution of level of practice regarding biomedical waste management among paramedical workers,nurses,lab technicians.

Table -4 shows level of practice

S.No	Level of practice	Percentage
1	Satisfied level of practice	16%
2	Moderate level of practice	73%
3	Inadequate level of practice	11%

- The table above depicts the percentage distribution of samples based on the practice score of doctors, interns, nurses, lab technicians, and paramedics regarding biomedical waste management. It demonstrates that 73 percent of had a moderate level of practice, 11 percent had insufficient practice, and 16 percent had an satisfied degree of practice.



Above survey study conducted at a Vivekananda polyclinic hospital in Lucknow to investigate the knowledge, attitudes, and practices of doctors, interns, nurses, laboratory technicians, and paramedical staff regarding medical waste management revealed that there was significant agreement among the participants on the proper segregation of medical waste to be carried out at the point of generation. As a proportion of samples based on doctors, interns, nurses, lab technicians, and paramedics' understanding of biomedical waste management. It was shown that total there were 150 HCP was surveyed in which ,22.6 percent had acceptable knowledge, 46.6 percent had intermediate knowledge, and 30.6 percent had poor understanding. It indicates that additional information should be increased through hospital-provided training and learning events.

The findings revealed that samples were selected based on the attitudes of doctors, interns, nurses, lab technicians, and paramedics toward biomedical waste management.

The majority of the physicians and nurses were more upbeat than others. HCPs agreed that the safe disposal of BMW was required for healthcare locations with the use of teamwork. The majority of HCPs had a negative perspective because BMW management risked transferring infectious infections, while 27 percent of those with a neutral attitude said that

segregating hospital waste into separate categories was time consuming. Approximately 51% of HCPs strongly agreed that PPE was required while handling BMW and that cleaning and disinfection decreased infection. The majority believed that competent BMW management improved the quality assurance of healthcare sectors and that updated understanding of BMW management was required.

The majority of HCPs always followed the Ministry of Health (MOH) standards for BMW management. While treating COVID-19 patients, HCPs generally followed infection control procedures. As many as 16% of HCPs utilized and discarded all PPE while working with BMW. Approximately 73 percent of HCPs followed the color labeling of containers based on the kind of waste during BMW disposal, as well as regulations categorizing trash into non-hazardous, hazardous, and sharp waste. And kept track of BMW records. Regarding sharps-related injury prevention, such as avoiding recapping used needles, 11% of HCPs were careful, and HCPs avoided contamination while handling objects from COVID-19 patients and other non-COVID-19 patients.

CHAPTER 6

DISSCUSION

Every healthcare industry must safeguard our public health from environmental threats by adhering to effective bio-medical waste management. During the COVID-19 pandemic, numerous government organizations, including MOH, have issued guidelines for the handling of trash generated during COVID-19 treatment, diagnosis, and isolation. It must be appropriately handled to avoid the serious risk of contamination and disease transmission. Our study was designed to analyze health care personnel' knowledge, practice, and attitude toward bio-medical waste management at the Vivekananda Polyclinic Hospital in Lucknow, India.

Training sessions should be provided on a regular basis to all levels of bio-medical waste management professionals. In this study, however, the majority of them utilized and discarded all personal protective equipment when handling biological waste, and they followed rules for sorting BMW into non-hazardous, hazardous, and sharp trash.

According to the findings of our survey, physicians and nurses had the largest number of favorable sentime. This sudden COVID-19 event altered healthcare systems, and the pandemic issue compelled many hospitals to reconfigure their healthcare systems. As a result, this study was conducted to determine the degree of knowledge, practice, and attitude of HCPs about BMW management during this pandemic.

The findings highlighted the importance of organizing continual training programs on BMW management in the form of symposia, seminars, and workshops to raise awareness among HCPs. The current study recommends a high degree of expertise in the correct management of PPE. In the current context, training may be a critical aspect for HCPs to effectively manage BMW. As a result, the responsible authorities should prioritize the development of a nationally recognized standard guideline in all health sectors to control BMW andreduce the risk of the pandemic spreading in the community.

CHAPTER 7

CONCLUSION AND RECOMMENDATION

Due to the current COVID 19 pandemic's rapid spread, healthy environments all over the world have already been transformed into a living nightmare, with significant death tolls and ongoing lockdowns in practically every region. One big issue that might cause substantial chaos among all the issues it has already caused in a city with a high population density is improper treatment of medical waste.

If the enormous number of medical wastes cannot be controlled by keeping appropriate and sufficient rules, possibilities of community. The COVID-19 virus might expand beyond its capacity and claim additional lives in the following days. Incineration is the preferred method for managing biomedical waste, to put it simply. It has a very high disinfection effectiveness and is suitable for all pathogenic waste, the majority of chemical waste, and pharmaceutical waste.

As emerging nations move to become developed nations, the need for healthcare is growing. As a result of these economic improvements, the output of bio-medical waste is also growing quickly.

BMW is a major issue in India. It is occasionally discovered that hospitals are discharging waste into ground or rivers, which is extremely dangerous because it contains hazardous and infected materials like blood, skin, transplanted organs, syringes, and needles, among others. This is due to a lack of awareness and strict rules and regulations.

All individuals supporting and funding health-care operations have a social and legal obligation to manage biological waste (BMW) in a safe and sustainable manner. A clean environment and healthy people depend on effective BMW management.

It is our duty as conscientious citizens to develop practical approaches to handling biomedical waste appropriately and to educate healthcare professionals through training sessions. We must try to build systems that correctly handle bio-medical waste so that the impact on rivers and the environment is minimal. It is our responsibility to turn a product into a useable product so that it may be reused.

REFFERENCES

1. Lee et al., 2002,Analyses of the recycling potential of Medical Plastic Wastes. Waste Management. 2002;22(5):461–70.
2. Kerkar, S. S., and S. S. Salvi. "Application of eco-enzyme for domestic waste water treatment." International Journal for Research in Engineering Application and Management 5.11 (2020): 114-116.
3. Nguyen, L. H., Drew, D. A., Joshi, A. D., Guo, C.-G., Ma, W., Mehta, R. S., … Chan, A. T. (2020). Risk of COVID-19 among frontline healthcare workers and the general community: A prospective cohort study. MedRxiv. doi: 10.1101/2020.04.29.20084111
4. Azage, M. (2013). Healthcare waste management practices among healthcare workers in healthcare facilities of gondar town, northwest ethiopia. Health Science Journal, 7(3).
5. Sushma MK, Bhat S, Shetty SR, Babu SG. Bio-medical dental waste management and awareness of waste management policy among private dental practitioners in Mangalore City, India. Tanzania Dent J 2010;16:39-43.
6. YOUSEFI, M., OSKOEI, V., JONIDI JAFARI, A., FARZADKIA, M., HASHAM FIROOZ, M., ABDOLLAHINEJAD, B. AND TORKASHVAND, J.Municipal solid waste management during COVID-19 pandemic: effects and repercussions.
7. DALUI, A., BANERJEE, S. AND ROY, R.Assessment of knowledge, attitude, and practice about biomedical waste management among healthcare workers during COVID-19 pandemic in a health district of West Bengal.
8. Baghele ON, Phadke S, Deshpande AA, Deshpande JP, Baghele MO. A simplified model for biomedical waste management in dental practices-A pilot project at Thane, India. Eur J Gen Dent 2013;2:235-40.
9. Bio-Medical Waste (Management and Handling, 1998) Rules. New Delhi: Government of India Publications; 1998. Ministry of Environment and Forests Notification; pp. 276–84.
10. The Gazette of India Biomedical Wastes (Management and Handling) Rules. India: Ministry of Environment and Forests, Government of India; Notification Dated; 20th July, 1998.

THE END

THANK YOU