EMBRACING ARTIFICIAL INTELLIGENCE FOR SUSTAINABILITY & LIFE SKILLS

An International Bhutan Conference Proceedings

IJISEM
INTERNATIONAL JOURNAL OF INNOVATIONS IN SCIENCE ENGINEERING AND MANAGEMENT

International Journal of Innovations In Science Engineering And Management

To Assess The Awareness Among Health Personnal on Integration of Artificial Intelligence For Management of Bio Medical Waste in Hospitals of Rohilkhand Region

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OPEN ACCESS

Volume: 3

Issue: Special Issue 2

Month: December

Year: 2024

ISSN: 2583-7117

Citation:

Faiz Shamsi, "To Assess The Awareness Among Health Personnal on Integration of Artificial Intelligence For Management of Bio Medical Waste in Hospitals of Rohilkhand Region" International Journal of Innovations In Science Engineering And Management, vol. 3, no. Special Issue 2, 2024, pp. 32-39.

DOI:

10.69968/ijisem.2024v3si232-39

Abstract

Bio-medical waste means "any solid and/or liquid waste including its container and any intermediate product, which is generated during the diagnosis, treatment or immunization of human beings or animals or research activities pertaining thereto or in the production or testing of biological or in health camps. Biomedical Waste management (BMW) is generated from any health care institution or camps It can be highly infectious and toxic in nature. This waste if remain unsegregated or mixed up with general waste at any stage from handling to disposal can infect the 85% of general waste which is being produced in healthcare facility.

Keyword: Artificial Intelligence, Management, Bio Medical Waste In Hospitals

INTRODUCTION

Bio-medical waste means "any solid and/or liquid waste including its container and any intermediate product, which is generated during the diagnosis, treatment or immunization of human beings or animals or research activities pertaining thereto or in the production or testing of biological or in health camps.

Biomedical Waste management (BMW) is generated from any health care institution or camps It can be highly infectious and toxic in nature. This waste if remain unsegregated or mixed up with general waste at any stage from handling to disposal can infect the 85% of general waste which is being produced in healthcare facility

Bio medical waste handling rules have been into existence since 1998 and has been amended as well as modified time to time. Due to its severity and importance as it causes health hazard, toxicity and environmental degradation this rule has been converted into bio medical waste act. Despite of serious punishment and strict compliance segregation and disposal still remains the biggest gap which needs to be catered. Biomedical waste management is an essential yet challenging aspect of healthcare operations. The improper disposal of biomedical waste can lead to severe health risks and environmental pollution. With the growing amount of waste generated by healthcare facilities, traditional methods of waste management are becoming increasingly inadequate. This necessitates the exploration of advanced technologies, such as Artificial Intelligence (AI), to improve the efficiency and effectiveness of waste management systems. AI, with its ability to analyze large datasets, optimize processes, and predict outcomes, offers significant potential for transforming biomedical waste management

This paper aims to raise awareness among healthcare professionals about the benefits and challenges of integrating AI into biomedical waste management practices.

Current Challenges in Biomedical Waste Management-Biomedical waste management faces several challenges that can be broadly categorized as follows: - Waste Segregation: Proper segregation of biomedical waste is crucial to ensure safe disposal. However, human error, inadequate training, and inconsistent practices often lead to the mixing of hazardous and non-hazardous waste, increasing the risk of contamination. Collection and Transportation: Inefficient collection schedules and transportation routes can result in waste accumulation, leading to safety hazards and environmental risks.Regulatory Compliance: Ensuring compliance with local, national, and international regulations is complex, particularly with the increasing volume of waste generated by healthcare facilities.

Environmental Impact: Traditional waste management methods, such as incineration, contribute to environmental pollution, making it imperative to explore more sustainable solutions.

Potential Applications of AI in Biomedical Waste Management-AI offers several potential applications that can address the challenges mentioned above:

1. Waste Segregation and Identification AI-powered systems can automate waste segregation using machine learning algorithms and image recognition technology. These systems can accurately identify and categorize different types of waste, reducing human error and ensuring proper disposal.

2. Optimization of Collection and Transportation AI can optimize waste collection schedules and transportation routes based on real-time data and predictive analytics. This not only ensures timely waste collection but also reduces fuel consumption and minimizes the carbon footprint of waste management operations.

3. Predictive Maintenance of Waste Management Equipment AI can monitor the condition of waste management equipment, such as autoclaves and incinerators, and predict when maintenance is needed. This helps prevent equipment failures and ensures continuous operation.

4. Data-Driven Decision Making AI can analyze historical data on waste generation and predict future trends, enabling better resource allocation and planning. This can also assist in maintaining regulatory compliance by generating accurate reports for authorities.

5. Environmental Impact Reduction AI can contribute to reducing the environmental impact of biomedical waste management by optimizing processes, such as waste treatment and disposal, to be more energy-efficient and sustainable.

MATERIAL AND METHODS

This study is conducted among health personal of Rohilkhand region. Health personals willing to participate were included in the study. A total of 200 health personals including doctors, nurse and allied staff were randomly selected through random number table, and a self-administered questionnaire was given to the respondents. The questionnaire consisted of 10 structured questions to assess the awareness Results were computed using SPSS version 23

QUESTIONNAIRE

TO ASSESS THE AWARENESS AMONG HEALTH PERSONAL ON INTEGRATION OF ARTIFICIAL INTELLIGENCE FOR MANAGEMENT OF BIO MEDICAL WASTE IN HOSPITALS OF ROHILKHAND REGION
1. Have you heard about Artificial intelligence application in bio medical waste management?
2. In which area of bio medical waste management you can imagine artificial intelligence in bio medical waste management?
3. How would you rate your facility's current biomedical waste management practices?
4.What methods you think is best for managing bio medical waste?
5. In which area you face challenge in bio medical waste management?
6. Are you aware of the use of artificial intelligence (AI) in biomedical waste management?
7. How could AI improve biomedical waste management in

your facility?
8.Would you be open to using AI tools to assist in biomedical waste management?
9. What concerns, if any, do you have about implementing AI in waste management?

10. What kind of training would you require to effectively use AI in waste management?
11.Do you think AI could reduce the risks associated with biomedical waste handling?

DISCUSSION AND RESULT

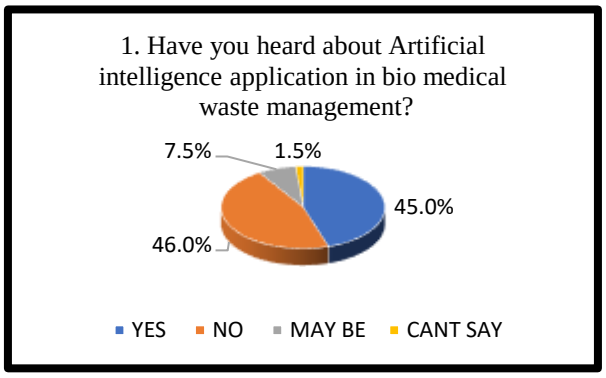
TABLES

TO ASSESS THE AWARENESS AMONG HEALTH PERSONAL ON INTERGRATION OF ARTIFICIAL INTELLIGENCE FOR MANAGEMENT OF BIO MEDICAL WASTE IN HOSPITALS OF ROHILKHAND REGION	**OPTION 1 (%)**	**OPTION 2 (%)**	**OPTION 3 (%)**	**OPTION 4 (%)**
1. Have you heard about Artificial intelligence application in bio medicalwaste management?	YES	NO	MAY BE	CANT SAY
	45.0%	46.0%	7.5%	1.5%
2. In which area of bio medical waste management you can imagine artificial intelligence in bio medical waste management?	SEGREGATION	TRANSPORTATION	DISPOSAL	CANT SAY
	55.00%	7.50%	25.50%	12.00%
3. How would you rate your facility's current biomedical waste management practices?	EXCELLENT	GOOD	FAIR	POOR
	28.50%	40.00%	24.00%	7.50%
4. What methode you think is best for managing bio medical waste?	MANUAL SORTING BY STAFF AFTER WARDS	SEGREGATION WHILE GENERATION	OTHER	AUTOMATIC SEGREGATION
	16.50%	45.00%	2.50%	36%

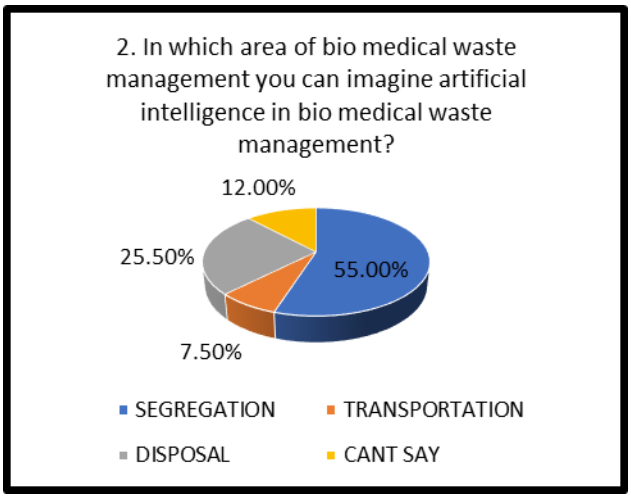
5. In which area you face challenge in bio medical waste management?	SEGREGATION	TRANSPORTATION	COLLECTION	DISPOSAL
	68.50%	4.50%	12.00%	15.00%
6. Are you aware of the use of artificial intelligence (AI) in biomedical waste management?	YES	NO	VERY LESS	MOSTLY
	33.00%	43%	21%	3%
7. How could AI improve biomedical waste management in your facility?	BETTER WASTE SEGREGATION	PREDICTING WASTE GENERATION PATTERNS	MONITORING COMPLIANCE WITH REGULATIONS	ALL OF THE ABOVE
	12.00%	4.50%	1.50%	82.00%
8. Would you be open to using AI tools to assist in biomedical waste management?	YES	NO	MAY BE	CANT SAY
	65.50%	4.50%	22.50%	7.50%
9. What concerns, if any , do you have about implementing AI in waste management?	PRIVACY AND DATA SECURITY	COST OF IMPLEMENTATION	COMPLEXITY OF USING AI TOOLS	RELIABILITY OF AI SYSTEMS
	24.00%	31.00%	16.50%	28.50%
10.What kind of training would you require to effectively use AI in waste management?	HANDS - ON TRAINING WITH AI TOOLS	REGULAR UPDATE ON AI ADVANCEMENTS	TROUBLESHOOTING AND SUPPORT	ALL OF THE ABOVE
	13.50%	4.50%	0%	82.00%
11. Do you think AI could reduce the risks associated with biomedical waste handling?	STRONGLY AGREE	AGREEE	NEUTRAL	DISAGREE
	36.00%	52.00%	10.50%	1.50%

Table above, and Graph below shows the awareness of biomedical waste management and legislation among the health carepersonal

GRAPHS

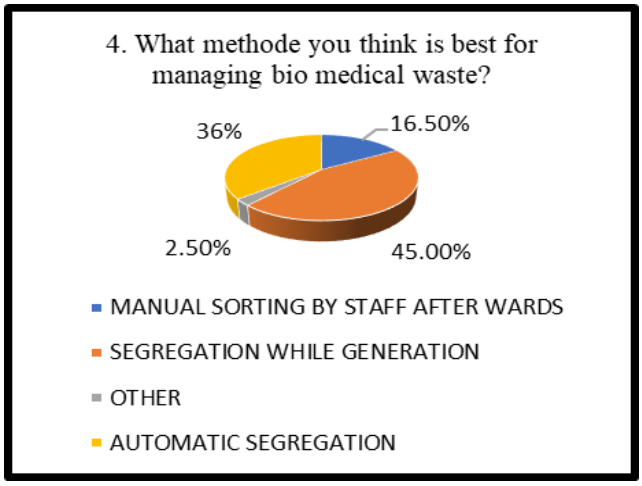


People have not heard about Artificial intelligence application in bio medical waste management is nearly the same as those who have heard about it

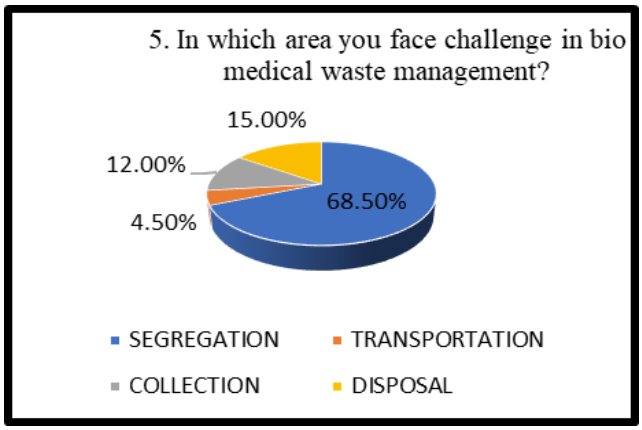


Majority of respondents want Artificial Intelligence application in segregation part

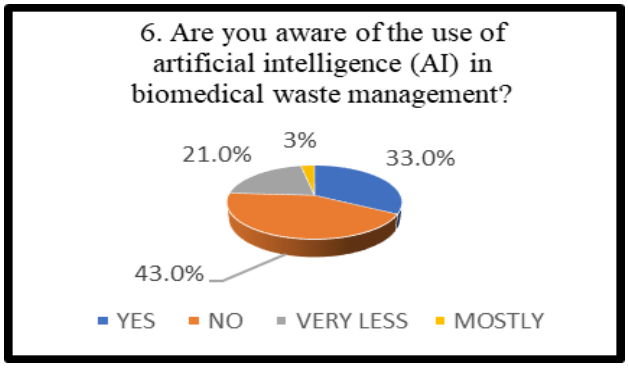
Every one considered Good Bio Medical Waste Management practice in their facility

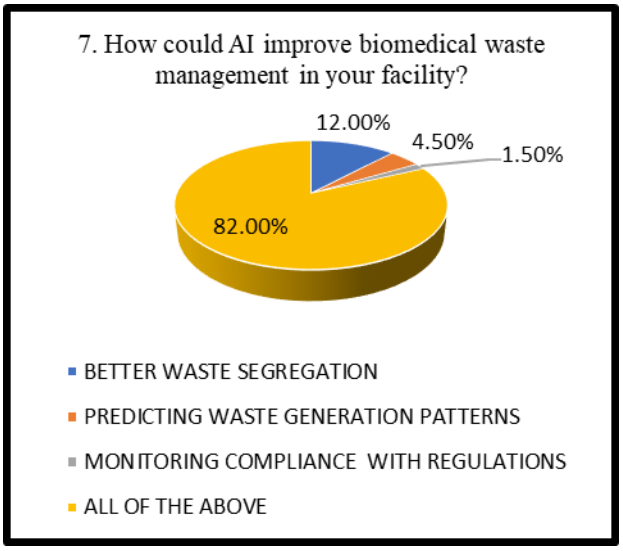


Segregation while generation was chosen by majority leaving behind artificial intelligence application may be due to lack of awareness about the advantages of AI in bmw management

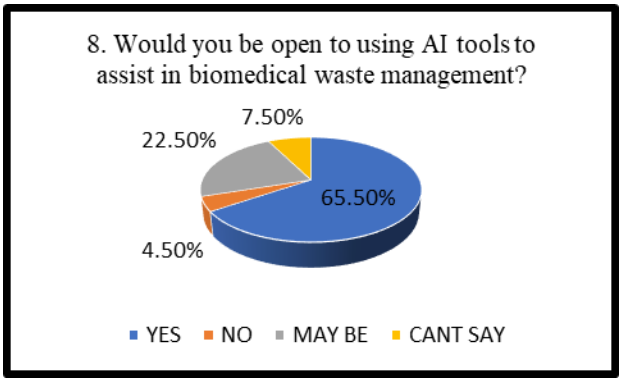


Majority of respondents face challenge in complying to segregation so majority wanted Artificial Intelligence application in segregation part

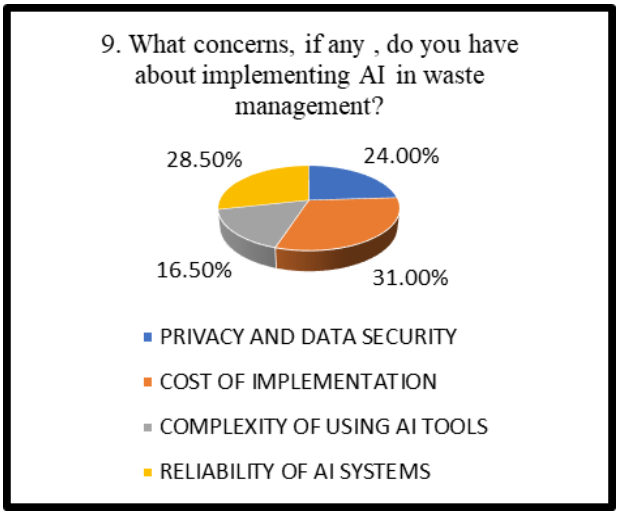




Majority believe that AI will improve waste segregation, pattern prediction and monitoring of compliance

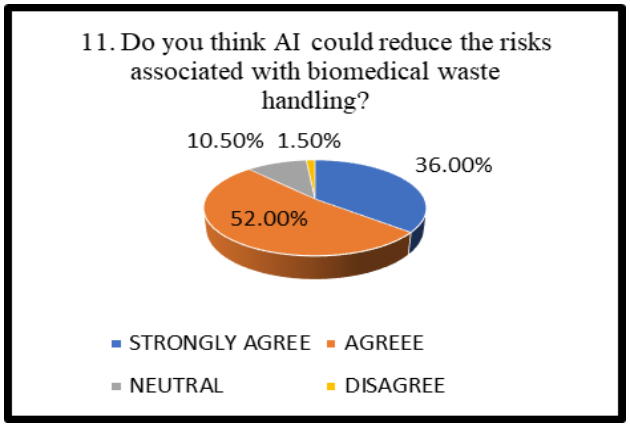


Majority of Health personnel wanted Ai in managing bio medical waste although lots of factors bother them for its integration as below like cost, support, training and privacy



Majority of people are bothered about cost of implementation of integration of AI with BMW

Health personnel wanted training, regularupdate, support for effective utilization of AI



Most of the health personal agree and strongly agree about increase of safety to bio medical waste handling if AI is integrated with its manage

DISCUSSION BASED ON ABOVE FINDINGS

Benefits of Integrating AI into Biomedical Waste Management

1. Increased Efficiency By automating processes such as waste segregation and optimizing collection routes, AI can significantly increase the efficiency of waste management operations.

2. Enhanced Safety AI reduces human involvement in the handling of hazardous waste, thereby lowering the risk of exposure and contamination.

3. Improved Compliance AI systems can monitor and ensure compliance with waste management regulations in real-time, reducing the risk of penalties and legal issues.

4. Cost Savings Despite the initial investment, AI can lead to long-term cost savings by reducing waste, optimizing resource use, and minimizing the need for manual labor.

CHALLENGES AND CONSIDERATIONS

1. Data Privacy and Security The use of AI in biomedical waste management requires the collection and analysis of data, raising concerns about data privacy and security, especially in healthcare settings.

2. Implementation Costs The cost of implementing AI solutions can be a barrier for some healthcare facilities, particularly smaller ones with limited budgets

3. Staff Training and Adoption Successful integration of AI requires training healthcare personnel to use new technologies. Resistance to change and a lack of understanding of AI can hinder its adoption.

4. Ethical Considerations AI systems must be designed to make transparent and accountable decisions, particularly when dealing with hazardous materials that can impact public health.

RECOMMENDATION

Proposed Framework for AI Integration in Biomedical Waste Management

To effectively integrate AI into biomedical waste management, the following framework is proposed:

1. Assessment and Planning Healthcare facilities should conduct a comprehensive assessment of their current waste management practices and identify areas where AI can be beneficial. This should be followed by detailed planning, including cost analysis and resource allocation

2. Pilot Programs Before full-scale implementation, pilot programs should be conducted to test AI solutions in a controlled environment. This allows for the identification and mitigation of potential challenges

3. Staff Training Healthcare personnel must be trained on how to use AI tools and understand their benefits. Ongoing training programs should be established to keep staff updated on new developments.

4. 4 Continuous Monitoring and Evaluation AI systems should be continuously monitored to ensure they are functioning as intended. Regular evaluations should be conducted to assess their impact on waste management efficiency, safety, and compliance.

CONCLUSION

The integration of Artificial Intelligence into biomedical waste management has the potential to revolutionize the way healthcare facilities handle waste. By addressing current challenges and enhancing the efficiency, safety, and compliance of waste management systems, AI can contribute to a cleaner, safer, and more sustainable healthcare environment. However, careful planning, consideration of ethical issues, and investment in staff training are crucial for successful implementation.

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