

Effect of Capacity-building Intervention on Hospital Waste Management Practices in Northeast Nigeria.

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ABSTRACT

Current studies have revealed that there is significant low level of competency among hospital waste workers in developing countries like Nigeria, and capacity building intervention has shown to be potent means on enhancing competency of workers in different field of endeavour such as the health sector. Hence, this study was conducted to ascertain the effect of capacity building intervention on enhancing the competency of waste workers in hospital in Northeast Nigeria. The study adopted cross-sectional and quasi-experimental research design using two hospitals in two states within the Northeastern region namely Federal Teaching Hospital (FTH) Gombe State and Abubakar Tafawa Balewa University Teaching Hospital (ATBUTH) Bauchi State. The intervention program considered was Capacity Building FTH was sampled for the Capacity building program while ATBUTH was used as control group. 547 waste workers were sampled for the study (226 from FTH and 321 from ATBUTH) while 65 waste workers voluntarily participated in the intervention programs (35 from FTH and 30 for ATBUTH), The instrument used for data collection was test questions and training manual, while percentage test scores were used to assess the competency of the waste workers. Descriptive and inferential statistical analyses were carried out using SPSS vs 28.0. The results revealed that competency of the waste workers in the region is poor (mean score of 37.17% > 50%) and capacity building intervention program significantly improved the competency (from 37.17% to 55.00% at p-value of 0.000). It was concluded, among others, capacity building intervention programs are effective and suitable for training waste workers in order to enhance their competency in waste management. Therefore, it was recommended, among others, that hospital management and government should adopt capacity building intervention in training waste workers in order to improve their waste management competency.

Keywords: Capacity Building Intervention, Competency, Waste Management Practices, North-Eastern Nigeria.

INTRODUCTION

Hospital wastes are waste generated in the diagnosis, treatment or immunization of human beings or animals or in research in a hospital. Hospital waste is a special type of waste produced in small quantities but carrying a high potential of infection and injury (Shahida et al 2005). There are serious health effects from public health standpoint that can arise from improper management of hospital waste. Hospital waste management means “the management of waste produced by hospitals using techniques that will check the spread of diseases through hospital waste”. Hospital waste management is a significant environmental and social obligation, and hence

requires a proper plan. The hospital waste management plans are devised to incorporate a standard protocol for effective management of waste disposal. Hospital waste consists of both risk waste and non-risk waste. Generally, hazardous wastes from a hospital includes infectious waste, pathological, pharmaceutical, sharps, chemicals, geno-toxic and radioactive wastes. Non-hazardous waste includes garbage and general day-to-day waste produced by food stuff leftovers and their packaging. Developed countries often have properly organised infrastructure of hospital waste disposal. A properly trained team is responsible for handling various operational procedures related to waste disposal like segregation, internal transportation, and final disposal.

Medical or hospital waste management has become a crucial and critical issue as it poses potential health risks and damage to the hospital workers, the general public and the environment. It is also of greater significance because of its potential environmental hazards and public health risks with high propensity to result into epidemics. It continues to be a major challenge, particularly, in most healthcare facilities of the developing countries like Nigeria where proper management is hindered by technological, economic, social difficulties and inadequate training of staff responsible for handling of the waste. Poor conduct and inappropriate management and disposal methods pose increasing significant health hazards and environmental pollution/hazards due to the infectious nature and unpleasant smell of the waste. Despite the fact that current hospital waste management practices are different for different hospital settings, they all have similar problems at all the stages of the hospital waste management especially in developing countries like Nigeria,

In Nigeria, many healthcare workers are not aware that some hospital waste contributes significantly to environmental pollution and hazards and this lack of awareness is occasioned by lack of specific training procedure by the hospital management to address the issue of ignorance among hospital workers on menace that could be triggered by hospital. Because of the fact that some hospital wastes pose great threat and hazards if they are not managed properly, it becomes the duty of hospital management to handle public-health issues associated with hospital waste management and some of the approaches that could be considered are patient care and enlightenment, ensure clean and healthy environment for workers/community and deploying suitable education intervention program to enlighten the hospital workers on essence of proper waste management

Because of this issue, Awodele et al (2016) conducted an empirical study on seven hospitals in Lagos to assess the nature and procedures of hospital waste management, and they uncovered the waste management procedure in the hospital are mainly segregation, collections, storage and transportation however, the safety condition of the waste collectors are not properly managed. Ogbonna, (2011) carried out similar study in Port-Harcourt metropolis, Nigeria to assess hospitals waste management practice. It was further evident in this study that hospital waste management problems are not peculiar to Port Harcourt metropolis alone and the survey revealed that both hospital waste generators and handlers treat hospital wastes as a usual domestic waste. Ngwuluka et al (2009) carried out study on Health-Care Waste management in Jos Metropolis, Nigeria. This study revealed that the waste management options in the hospitals did not meet the standard practices Waste management with safe and environmentally sound methods cannot be over-emphasized. Oyekale and Oyekale (2017) conducted a detail and encompassing empirical study to assess the hospital waste management practices in Nigeria and to ascertain how these practices affect safety indicators in several Nigeria states using two states from the six geopolitical zones in Nigeria making it twelve state in all and the states includes Imo and Anambra for South-Eastern region, Bauchi and Taraba state in North-Eastern region, Niger and Kogi states for North central region, Kebbi and Kaduna states for North-western region, Bayelsa and Cross-river states for south-southern states. The results revealed that 79% of respondent agree there is no waste management guideline and training for hospitals in North Eastern region,

Capacity building is an intervention approach which focuses on developing the human resource and human element of any system at any level by enhancing their capacity and ability to perform better. UNDP (2019) defines capacity as ‘the ability of individuals, institutions and societies to perform functions, solve problems, and set and achieve objectives in a sustainable manner’. Capacity Building is therefore seen as the process through which the abilities to do so are obtained, strengthened, adapted and maintained over time. Capacity building assumes that if people are presented with evidence and the rationale for change, they will change.

Capacity building leans towards a perception that individual development, whether of people or organisations, is an appropriate and effective mechanism for whole system development. Based on the perspective of

organization development, capacity building intervention is viewed as a change management intervention, focused on organisational effectiveness (Cummins and Worley 2001). They define capacity building intervention as, ‘a set of sequenced and planned actions or events intended to help the organisation increase its effectiveness’. They describe four main types of interventions under capacity building as strategic intervention, techno-structural intervention, human resource management intervention and human process intervention. In this current study, human resource management intervention will be adopted because it aims at addressing issues concerning organisational performance, individual needs and development. The human resource management intervention approach used in this study is based on the five major steps for capacity development processes proposed by UNDP (2019) which includes, Engage the Workers or Stakeholder, Assess the Capacity assets and needs, Formulate the capacity development plan and response, implement the capacity development plan and response and evaluate the capacity development plan, these five steps will be adopted to enhance the competency of waste management workers in Northeast, Nigeria. Thus, the objectives of the study are to: determine the competency of hospital waste management workers in Northeast region, Nigeria, administer the capacity building intervention programs on the workers in North Eastern region, Nigeria and investigate the effect of capacity building on competency of hospital waste management workers in Northeast region, Nigeria

METHODOLOGY

Study Design

The study employed multiphase research design which involve the combination of cross-sectional and quasi-experimental research design. The cross-sectional design involves assessing respondents’ perceptions towards the waste management practices and training in the hospitals using questionnaire. Quasi experimental design involved conducting training sessions and the results of their pre and post-test performance scores was recorded and compared against a control group where the intervention program was not conducted

Study Area

The study area is Northeast region, Nigeria, the region comprises of six states namely Adamawa, Bauchi, Borno, Gombe, Taraba and Yobe state. It is one of the six geopolitical regions of Nigeria and also considered as the largest geopolitical region in terms of land mass because it covers nearly one third of Nigeria land mass. It is bordered in north by Chad republic, in the east end by Cameroon in the west by Benue, Nasarawa, Kano, Jigawa, and Plateau state and south by Cameroon. The population of this region is about 26 million. The region is basically an Agricultural dominant region and cultivates mostly cash crops like coffee, tea, groundnut, cotton and other crops like maize, rice, sorghum, millet, cassava, yam, they also rear cattle, sheep, and goat. See figure 1 for the map of Nigeria showing the Northeast region, Nigeria

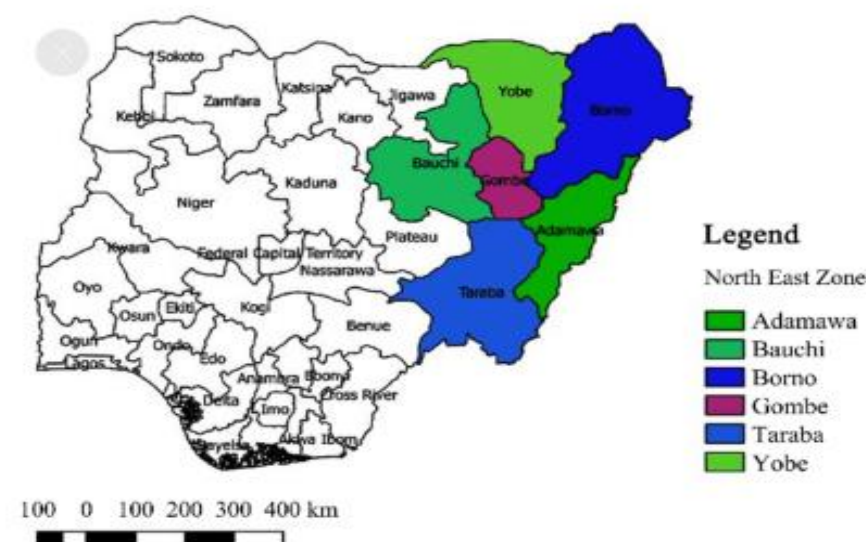


Figure 1 Map of Nigeria showing the Northeast region

Population of the Study

The population of this study was comprised of all the waste management workers in all the government owned tertiary Healthcare facilities in Northeast region, Nigeria.

Sample Technique and Sample Size

This study employed multi-stage sampling technique; Stage one: Random sampling technique was used to select two states out of the six states in the region (Gombe state. and Bauchi). Stage two, purposive sampling technique was used to select the government-owned tertiary health care facilities in the two states selected in stage one which comprises of Federal Teaching Hospital Gombe (Gombe State) and Abubakar Tafawa Belewa University Teaching Hospital (Bauchi State)

Stage three, purposive sampling technique was used to select all the waste management workers in the hospitals selected in stage two which comprise of 226 waste workers in Federal Teaching Hospital Gombe (Gombe State) and 321 waste workers in Abubakar Tafawa Belewa University Teaching Hospital (Bauchi State) has 321 waste workers making the Total of sampled waste workers 547.

Nature/ Source of Data

The study used primary data. The data comprise of the pre-test score used to ascertain the competency of the waste workers and post-text score obtained from the respondents after the administration of the intervention program. These different between the pre-and post-scores was used to ascertain impact of the intervention programs on the performance of waste and improvement in the waste management procedures.

Method of Data Collection

In the quasi-experiment phase, data collection was the score of the pre and post text which was obtained before and after training the HWM workers on the waste management practices using the capacity building intervention programs. In this study, two public owned hospitals were sampled: one public owned was trained using capacity building (experimental group A), while the second one served as the control group (not trained)

To determine the competency of the waste management workers in the sampled hospitals in the North Eastern region, Nigeria, the approach used was to determine the competency of the workers based on their knowledge of waste management practices using test assessment

In the assessment, sixty-five (65) waste workers volunteered to participate in the test; 35 waste workers in Federal Teaching Hospital (Gombe State) and 30 waste workers in Bauchi state specialist Hospital (Bauchi), 20 multiple choice questions on waste management practices were administered to the respondents and the workers were graded on percentage as follows

$$\frac{\text{Number of correct answers}}{\text{Total number of question}} \times 100$$

Such that; 0-39% is poor knowledge of waste management (poor competency), 40-49 is fair knowledge of waste management (fair competency level), 50-59 is good knowledge of waste management (good competency level), 60-69 is very good knowledge of waste management (very good competency level) and 70 and above is excellent knowledge of waste management (excellent competency level).

Instrument for Data Collection

Data was collected using training text questions and training manual designed by UNDP (2008) capacity development processes. The text question covered the scope of the training that was giving to the respondents on waste management practices and covered area such as waste collection, segregation, storage treatment and disposal as well as some tips on use of Personal protective equipment (PPE). Also, the training manual was designed based on WHO medical waste management training manual and guideline for UNDP (2008) training health workers on medical waste management by ministry of health.

Procedure for Administering Capacity Building Intervention Program

Capacity Building: the capacity building approach that was adopted in this study was based on the modified UNDP (2008) capacity development process stages, which includes

Step One: Engage the stakeholders on capacity development; this involves ascertaining information (through questionnaire or interview) from the necessary stakeholders in the hospitals waste management sections to determine the areas that requires intervention. It can also involve carrying out some personal observation using checklist to also note areas that requires intervention in the hospitals waste management sections.

Step Two: formulate capacity development plan; this process involves designing a capacity development plan based on the information and details obtained in step one above. This will comprise ascertaining the kind of training required by the workers, the level of workers that require the training, designing the training material and procedures and best timing to deliver the training.

Step Three: Implement the capacity development plan; this process involves delivering the training as planned in step two to the workers based on their need in order to improve their skill and knowledge on the areas of need as identified in step one. It will require giving the trainees pre-test to actually know their level of knowledge in the subject areas before the training for better evaluation of their performance.

Step Four: evaluate the capacity development plan; this involves assessing the improvement or performance of the trainees to ascertain the impact of the training in achieving the aim of the process. This process will involve giving the trainees a post-test on the subject areas they are trained on to actually ascertain their performance and then compare the pre and post test results to ascertain the difference.

Consort Diagram for the Study

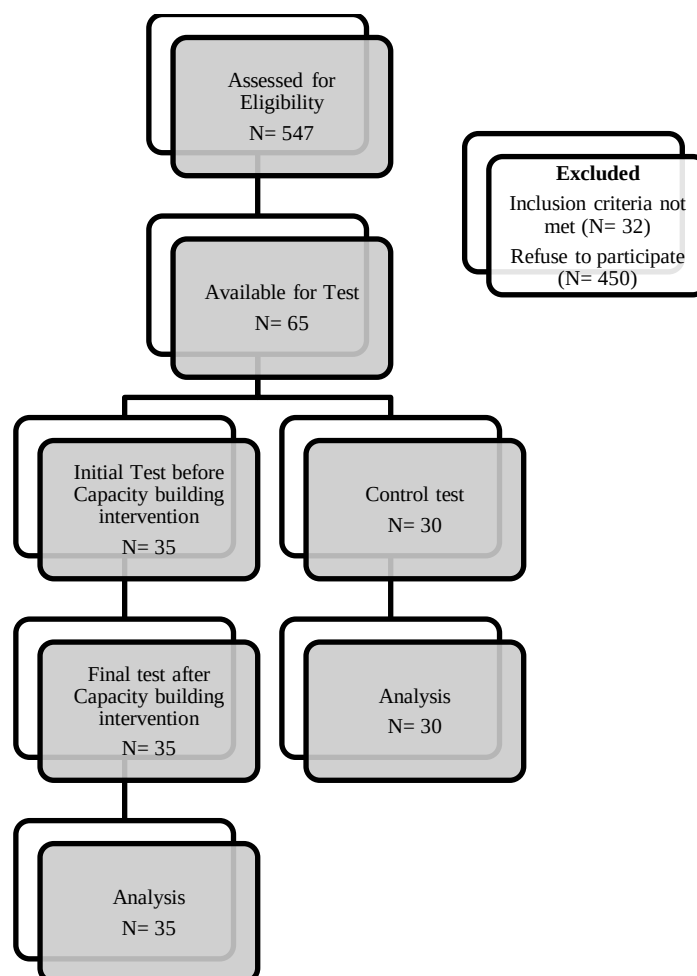


Figure 2 The consort diagram for the intervention programs

Methods of Data Analysis

The study employed standard technique and tools to analyse the data that were collected. The descriptive statistical technique (means, percentages, weight average, Histograms and bar-charts) and inferential statistics (T-test) and (Cohen-d) were used for data analysis. The inferential statistics was used to test the hypothesis on the impact of intervention program on improvement the competency of waste management workers which involve using T-test to ascertain the nature of difference between the mean performance of staffs involved in the intervention programs as against the control group. The Statistical Package for the Social Sciences (SPSS) application tool was used to carry out the analyses. Results of findings were presented on tables and charts.

RESULTS

The effect of the Capacity Building Intervention on the competency levels of hospital waste management workers in Northeast region, Nigeria

The effect of Capacity Building Intervention on the competency of the waste workers in hospitals in Northeast region Nigeria was determine based on the effect of the Capacity Building Intervention on their knowledge of waste management practices which was ascertained using difference between pre and post-test scores of the waste workers. This assessment was carried out by calculating the percentage test score of the waste workers on the twenty (20) multiple choice question which covered some crucial aspect of waste management practices. The percentage score of the sampled waste workers before and after administration of the Intervention training were recorded. The procedure for calculating and grading of the test score was explained in section two. The difference between their scores after the Capacity Building Intervention training and before the Intervention training shows the effect of the intervention on the competency of the waste workers. If the difference is positive, then the Intervention has positive effect on their competency, If the different is negative, it means that the Intervention has negative effect on their competency and if the difference is zero, it means that the Intervention has no effect on the competency. The results of the assessment as carried out the three sampled hospital are presented in Table 1

Table 1; Analysis results on the effect of capacity building intervention on competency of waste management workers in teaching hospital

Group	Competency Score – estimate (95%CI)			t-test _{df= 29} (p-value)	Diff in diff – estimate (95%CI)	Effect Size – Cohen D
	Pre- Intervention	Post- Intervention	Mean difference			
Control	37.17(34.33, 40.45)	37.17 (34.67, 39.83)	0.00 (-4.41, 4.41)	1.00	17.85	0.705
CBI	37.17(34.33, 40.45)	55.00(52.33, 57.83)	17.83 (15.60, 20.06)	0.000		

Note; CBI means Capacity Building Intervention

Table 1 showed the analysis results carried out to ascertain the effect of supportive supervision on waste collection efficiency of waste management department in the tertiary medical facilities which was basically a comparison of the change in waste collection efficiency of the waste management department before and after supportive intervention and change in waste collection efficiency of the waste management department in the control group.

For the supportive intervention group, the results revealed that the change in waste collection efficiency of the waste management department before and after supportive intervention is 7.10 and p-value of the test is 0.004 which is less than 0.05 significant level. This results supposed that there is a positive and statistically significant different between the change in waste collection efficiency of the waste management department before and after supportive supervision intervention, For the control group, the change in waste collection efficiency of the waste management department in the control group is 0.3 and P-value of 0.896 which is greater than 0.05 significant level. This result implies that there is positive but statistically insignificant different between the means of waste collection efficiency of the control group.

This implies that supportive supervision intervention has a notable effect in improving the waste collection efficiency of the waste management department in terms of their waste collection duties while there was negligible effect in the control group. The Cohen-d value of 0.589 means that there is large effect size between the difference in means of waste collection efficiency of supportive supervision group and difference in means of the waste collection efficiency of the control group.

Test of Hypothesis

In this study, hypothesis was raised and tested using paired sampled T-test, The hypothesis is as follows: Capacity building intervention does not have significant effect on the competency of hospital waste workers North Eastern Nigeria

The paired sample T-test was used to test the hypothesis on whether there is no significant difference between the competency of waste management workers who are involve in capacity building intervention and the control group waste management workers who are not involves in the capacity building intervention in North Eastern region, Nigeria. This test was basically carried out to ascertain whether the difference between the mean test score of the waste workers after administration of capacity building intervention training (sample A in Taraba State) and the mean test score of waste management workers in control group hospitals (sample C in Bauchi State) in North Eastern region occurred due to chance or actually due to the administration of the intervention program. The result of the T-test is presented in three pairs in Table 2

Table 2 Result of the paired t-test for comparison of pre- and post-scores for various groups on competency

Parameter	Pre-Intervention Mean (95%CI)	Post-Intervention Mean (95%CI)	Change (95%CI)	r (95%CI)	t-test df = 29	P-value
Pair 1 (Control CC)	37.17(34.33, 40.45)	37.17 (34.67, 39.83)	0.00 (-4.41, 4.41)	-0.02 (-0.36, 0.32)	0.00	1.000
Pair 3 (CBIT CC)	37.17(34.33, 40.45)	55.00(52.33, 57.83)	17.83 (15.60, 20.06)	0.74 (0.55, 0.87)	16.36	0.000

Note; CBI means Capacity Building Intervention CC is Competency

The hypothesis stated that “Capacity building intervention does not have any statistically significant effect on the competency levels of hospital waste management workers in Northeast Nigeria” also in Table 2, it was observed that the competency level of the waste management workers before and after the capacity building intervention was 37.17 and 55.00 respectively which represented 17.83% increase in the competency level. Also, the P-value of the paired sampled T-test is 0.00 which is less than 0.05 significance level meaning that there is statistically significance difference between the competency score of the waste worker before and after intervention. This means that capacity building intervention has a statistically significant effect on the competency levels of hospital waste management workers in Northeast Nigeria. Hence, the null hypotheses which stated that “capacity building intervention does not have any statistically significant effect on the competency levels of hospital waste management workers in Northeast Nigeria” was rejected while the alternate hypothesis which stated that “capacity building intervention has a statistically significant effect on the competency levels of hospital waste management workers in Northeast Nigeria” was accepted

DISCUSSION

The results indicate a concerning lack of competency among hospital waste management workers in North Eastern Nigeria, with the majority exhibiting poor knowledge of waste management practices. This deficiency is most likely attributable to inadequate training and highlights the urgent need for structured educational programs tailored to healthcare waste management. The study’s focus on capacity-building interventions demonstrates their effectiveness in enhancing workers’ competency, as evidenced by significant improvements in test scores post-intervention. This finding is consistent with previous research underscoring the role of training and capacity-building initiatives in strengthening healthcare waste management (Blenkharn & Vaughan, 2019).

Furthermore, the study's application of paired sample T-tests provides robust statistical evidence of the positive impact of capacity-building interventions on workers' knowledge and skills. By closing critical competency gaps, such interventions have the potential to improve waste management practices in healthcare facilities, ultimately contributing to public health protection and environmental sustainability (Ismail et al., 2020; Oyedepo et al., 2019). The findings also align with earlier studies emphasizing the significance of training in healthcare waste management (Blenkharn & Vaughan, 2019; Hossain et al., 2018). However, the study's emphasis on waste collection efficiency as the primary outcome may limit understanding of broader aspects of waste management performance, such as segregation, treatment, and disposal methods, which warrant further investigation.

A key consideration emerging from this study is the sustainability of capacity-building interventions. While the immediate post-training improvements are promising, sustaining these gains requires well-structured follow-up mechanisms to monitor long-term behavioral and institutional changes. Continuous refresher training, routine supervision, and integration of waste management practices into hospital policies could help institutionalize improvements beyond the short term. Additionally, incorporating qualitative feedback from participants would complement quantitative results by offering richer insights into contextual challenges such as workload pressures, infrastructural limitations, and organizational support that may affect the long-term effectiveness of training programs. This combined approach could guide the design of more sustainable, context-responsive interventions.

Implications of the Findings

The findings suggest several practical implications for healthcare waste management in hospitals across North Eastern Nigeria. Firstly, the study highlights the urgent need to strengthen the competency of waste workers through regular and structured training programs tailored to local healthcare settings.

Secondly, the results emphasize the importance of ensuring that capacity-building interventions are sustainable and supported by follow-up mechanisms. Establishing systems for ongoing supervision, refresher training, and monitoring of behavioral change will be critical in maintaining competency gains and embedding improved practices into routine hospital operations.

Thirdly, the findings underscore the importance of governmental support and sustained investment in healthcare waste management infrastructure and equipment. The uneven availability of essential waste management resources across sampled hospitals highlights the need for consistent provision, maintenance, and upgrading of facilities such as waste recycling, treatment, and disposal systems.

Finally, the study affirms the value of supportive supervision as a driver of improved waste management practices among hospital workers. The significant improvement in waste collection efficiency following such interventions demonstrates their potential to enhance performance. Incorporating workers' feedback into future capacity-building programs will further strengthen their design, relevance, and sustainability, ensuring long-lasting improvements in healthcare waste management.

Strengths and limitations of the study

The study comprehensively assesses waste management practices in hospitals across administrative, operational, and equipment domains. It demonstrates the positive impact of capacity-building interventions on waste worker competency and practices. This study has provided valuable evidence in the North Eastern region of Nigeria. However, limitations include potential sampling biases, limited insight into long-term outcomes post-intervention, and reliance on self-reported data from waste workers, which may introduce response bias. Additionally, the relatively small sample size used for the intervention group limits the generalizability of the findings. Future research should employ larger and more diverse samples to validate these results and provide broader insights into healthcare waste management practices across different contexts.

CONCLUSION

In conclusion, the study highlights a concerning lack of competency among hospital waste management workers in North Eastern Nigeria, indicating the need for tailored training programs. Capacity-building interventions

demonstrate effectiveness in improving workers' competency, supported by robust statistical evidence. Implications suggest a need for enhanced governmental support and regular training programs. Based on the conclusions above it was recommended that: One, The hospital management in collaboration with ministry of health and environment should organize regular and suitable waste management training for the waste workers in order to keep them appraised and current in the technique and procedures for handling hospital-based waste knowing the peculiarity in the nature and type of hospital wastes and two, Hospital management and ministry of health and environment should also consider adopting capacity building intervention programs as means of conducting training for the waste workers in order to also improve their competency in waste management operation and also their waste collection and handling efficiency

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