

Full Length Research Paper

Waste management and public health: An analysis of Nigeria's healthcare sector

Njideka Phina Onyekwelu¹, Onyekwelu Awel Okoro², Ngozi Doreen Nwaise³ and Ezieshi Francis Monyei^{4*}

¹Department of Business Administration, Nnamdi Azikiwe University, Awka, Anambra State, Nigeria.

²Department of Public Health, Imo State University, Owerri, Imo State, Nigeria.

³Department of Nursing Practice, Walden University, Washington DC. USA

⁴Department of Management, University of Nigeria, Nsukka, Enugu State, Nigeria.

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Waste management encompasses a wide range of planned procedures and activities, either from its generation to final disposal, as well as long-term strategy for ensuring environmentally sustainable waste management. While, public health, on the other hand, connotes an insight into illness prevention and personal care in connection with health promotion and social factors. In critically examining waste management and public health of the Nigeria's healthcare sector; this study specifically sought to evaluate the effect of knowledge and attitude of healthcare workers on waste management, and to also ascertain the effect of personnel training practices in the healthcare sector on waste management. The study adopted cross sectional survey method. Data were collected using the questionnaire research instrument and were manually administered to the respondents. Collected data were analysed using Simple percentage and Chi-square (X^2) statistical tool. The findings revealed that knowledge and attitude of healthcare workers has significant effect on waste management ($x^2 = 395.6$) > ($x^1 = 7.815$), and personnel training practices in the healthcare sector had significant effect on waste management ($x^2 = 373.53$) > ($x^1 = 7.815$). The study concludes that the healthcare sector is reputed to dispose of prodigious amounts of waste; due to their ability to manage its negative effects on their environment through effective awareness on how best wastes should be managed. It was recommended that there should be a continuous enlightenment, sensitization, and training on effective and safe waste management to aid the improvement of a more conducive and sustainable environment.

Key words: Healthcare, management, public, segregation, training, waste.

INTRODUCTION

The etymology of the word waste dates back to the 15th-century, it originated from the French word "*vastum*" which means empty or desolate; and was initially used to describe an uninhabited or neglected area. Globally, waste connotes any solid or liquid unwanted material,

capable of causing contagious infections, produced as a result of human activity, environmental sanitation, or through the vaccination of humans or animals (Barlase, 2014). Waste management and disposal are critical to the environment's long-term viability and the planet's

future, especially when more sophisticated components result in increased pollution and make waste disposal and management more challenging (Ola-Adisa et al., 2015; Alwabr et al., 2017). In June 1992, the United Nations Conference on Environment and Development (UNCED) in Rio de Janeiro identified healthcare, household, and industrial waste as one of the most pressing environmental sustainability concerns facing the world, even though healthcare waste makes up only a small percentage of total waste in a community. According to the United Nations Environmental Programme (UNEP) in their International Source Book on Environmentally Sound Technologies for Community Solid Waste Management, healthcare waste is one of the most problematic types of waste (Hassan et al., 2018). Governments, medical practitioners, and civil society groups in most countries now have a better understanding of the potential harm from healthcare waste. Healthcare practitioners/administrators and staff are being required to bear greater responsibility for the wastes they generate as a result of their therapeutic care and associated processes. The indiscriminate and erratic processing and disposal of waste in healthcare facilities are now well known as a source of some infection diseases, and it is associated with public perceptions of inadequate healthcare standards (Jang, 2011). Oloko (2016) posit waste as any material that has no direct value to the user and must be discarded. Waste also refers to the complete range of garbage generated by home, healthcare, industry, and commercial processes; and if not adequately managed can contribute significantly to environmental degradation in the form of solid, liquid, or gaseous waste. Udofia et al. (2017) assert that waste is any solid or liquid substance that can cause infections or ailments formed as a result of the ill-person diagnosis, treatment, or immunization of people or animals.

Healthcare waste is characterized with contaminated body fluids, syringes, needles, ampoules, organs/body parts, disposable plastics, and microbiological substances generated during the diagnosis, treatment, or immunisation of humans (Ola-Adisa et al., 2015). World Health Organization (WHO) and other international organisations refer to this waste as healthcare waste, even though not all waste generated by healthcare facilities is a clinical waste (Vaccari et al., 2018). Healthcare wastes are dangerous because they include infectious, harmful, and cytotoxic compounds that can induce infection, both within healthcare institutions and among people working outside of healthcare settings such as waste handlers, scavenging workers, and the general public. Infections, infertility, dermatitis, hormonally-

induced cancer, asthma, and neurological abnormalities in infants, as well as AIDS and other viral infections from blood-contaminated sharps, can all be caused by improper handling of medical waste (Jang, 2011). The proper management and disposal practices such as the general principle of hygiene and sanitation, waste minimization, segregation, transportation, and final disposal are used to protect medical staff, visitors to healthcare facilities, patients, and the general public from the dangers associated with waste (Alwabr et al., 2017). The entirety of environmental consequences caused by inappropriate dumping of hazardous waste in unauthorized locations, which contaminate soils and rivers, causing harm to plants, aquatic and animal life, can only be observed after a long period. As a result, the health concerns, increased burden for healthcare experts, and negative environmental repercussions necessitate a joint commitment from all healthcare personnel and the general public on waste management regulations. In general, healthcare facilities owe it to the environment and the public's health to follow the Basel Convention's member nations' agreement of 1999. The agreement stated explicitly that healthcare institutions are responsible for processing and disposing of waste created by them in a manner that does not have any negative health or environmental implications.

In an ideal scenario, healthcare centres, households, and communities would incorporate a highly effective waste management system into every aspect of their endeavours, because it is a prerequisite for environmental sustainability (Monyei et al., 2021). However, the environment is currently experiencing lingering turbulence occasioned by inappropriate management of waste (inclusive of classifying and disposing of waste in sanitary arena), which is adversely impacting on the quality of public health and has further transformed into a major problem being experienced globally (Kumar et al., 2016; Vaccari et al., 2018). The abysmal funding and legislative regulations for the management of waste; coupled with the asymmetry of information on the guidelines for waste management and disposal practices also poses serious challenges to effective waste management. Thus, waste management continues to permeate and pervade every facet of the environment, and has negatively impacted their overall routine which is also accounting for the morbidity and mortality of healthcare centres and humans respectively. This has even become more worrisome since the advent of the Covid-19 pandemic. The effects of this pandemic on all healthcare centres, households, and communities remain unresolved and unacceptable as improper, inconsistent and highly irritating. Waste management encompasses data collection, waste

*Corresponding author. E-mail: francis.monyei.pg82803@unn.edu.ng.

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treatment, disposal technology, and training, dedication, attitudes, administration, and effective laws. The risk of waste disposal in the environment has become a source of growing concern, prompting hospital administrators, citizens and government to look for new ways to manage waste in scientific, safe, and cost-effective method. Thus, keeping the populace informed about developments in this area to enhance healthy living. Minoglou et al. (2017) posits that newly challenges arise when there is an outbreak of communicable infections such as chronic diseases, and trauma, especially among vulnerable population. Poor citizens, institutionalized patients in long-term medical facilities, intravenous drug users, commercial sex workers, and refugees are among the vulnerable population, all of whom interact with the general public.

Conversely, public health is observed as the study of illness prevention and the administration of personal care concerning health and wellbeing. In recent years, public health has focused on the administration of health systems, advocacy, policy, and organized educational initiatives which have become critical to achieving better population health cost-effectiveness and efficiency (Nwaise, 2017). Case studies that help to highlight the broad features of public health stem from a meagre clinical-based experiment. Therefore, there is a strong call for research into waste management and its effect on public health (Hassan et al., 2018). Despite the growing number of healthcare centres in this study's geographical scope, empiricism on the construct variables is lacking. Hence, this study is timely as it is being undertaken to assess the present practice and commitment to environmental sustainability through the management of waste and its effect on public health in selected healthcare centres in Nigeria. This study specifically sort to: evaluate the effect of knowledge and attitude of healthcare workers on waste management; and ascertain the effect of personnel training practices in the healthcare sector on waste management.

MATERIALS AND METHODS

Cross-sectional survey research design was adopted for this study, this method is deemed fit because of its accuracy in the process of data collection. The total population of the study consist of medical personnel in the selected healthcare centres in Nigeria, the healthcare centres were purposively selected based on their proximity, and affiliation with the Nigerian Medical Association (NMA). A sample size of 365 was generated from the population with the aid of Freud and Williams's statistical formula. The deployed instrument for data collection in this study was structured questionnaire characterized with a close-ended response. Face and content validity test was conducted by academia and industry experts to ascertain the validity and viability of the research instrument, while the reliability test conducted revealed a Cronbach alpha coefficient of 0.801 which affirmed that the constructs in the structured questionnaire are reliable (see appendix III). Data was generated through primary and secondary source, structured questionnaire was used for data collection and the collected data

were presented in tables and was analysed with simple percentages, and Hypotheses were tested with Chi-square statistical tool.

$$X^2 = \frac{\sum (fo - fe)^2}{fe}$$

Where: X^2 = Chi-square; fo = Frequency Observed; fe = Frequency Expected; \sum = Summation

Decision rule state thus: At 0.02 degree of freedom and 0.05 level of significance, the critical value was denoted as ($x^t = 7.815$). If the calculated value of chi-square (x^2) is greater than the table or critical value ($x^t = 7.815$), reject the Null hypothesis and accept the Alternative and vice versa.

DATA PRESENTATION, ANALYSIS AND DISCUSSION

Objective 1: To evaluate the effect of knowledge and attitude of healthcare workers on waste management.

Research question 1:

i) Healthcare workers are properly orientated about waste management and also have adequate knowledge on colour coding methods, segregation of waste and the importance of disinfecting hospital waste before disposal. Table 1 shows the questionnaire distribution and return while Table 2 show that out of the total respondents, 329(90%) are of the view that healthcare workers in Nigeria health sector have adequate knowledge on waste management; while 36(10%) opines that healthcare workers in Nigeria health sector are not knowledgeable of appropriate waste management.

ii) Healthcare workers in Nigeria adheres to world health organization's (WHO) safety precautionary measures of waste disposal in specified colour code containers to avert injuries that can likely emanate from improper disposing of sharp and contaminated/effected objects.

Table 3 revealed that out of the total respondents, 309(85%) perceive that healthcare workers in Nigeria health sector exhibit positive attitude waste management; while 56(15%) thought otherwise.

Objective 2: To ascertain the effect of personnel training practices in the healthcare sector on waste management.

Research question 2: Healthcare worker personnel in Nigeria are adequately trained on hospital waste disposal and waste management to improve hygiene in the environment.

Table 4 portrays that out of the total respondents, 308(84%) affirmed that healthcare workers in Nigeria health sector are properly trained with respect to effective waste management; while 57(16%) thought otherwise.

Test of hypothesis

i) H_0 : The knowledge and attitude of healthcare workers

Table 1. Questionnaire distribution and return.

| Respondents variable | Frequency | % |
|----------------------|-----------|-----|
| Doctor | 97 | 27 |
| Nurse | 105 | 29 |
| Laboratory scientist | 100 | 27 |
| Sanitary Staff | 63 | 17 |
| Total | 365 | 100 |

Source: Field survey, 2022

Table 2. Evaluation of respondents' knowledge on waste management.

| Response | Doctors | Nurses | Lab scientists | Sanitary staff | Frequency | % |
|-------------|---------|--------|----------------|----------------|-----------|-----|
| Yes | 85 | 99 | 95 | 50 | 329 | 90 |
| No | 12 | 6 | 5 | 13 | 36 | 10 |
| Indifferent | 0 | 0 | 0 | 0 | 0 | 0 |
| Total | 97 | 105 | 100 | 63 | 365 | 100 |

Source: Field survey, 2022.

Table 3. Evaluation of respondents' attitude on waste management.

| Response | Doctors | Nurses | Lab scientists | Sanitary staff | Frequency | % |
|-------------|---------|--------|----------------|----------------|-----------|-----|
| Yes | 85 | 89 | 85 | 50 | 309 | 85 |
| No | 12 | 16 | 15 | 13 | 56 | 15 |
| Indifferent | 0 | 0 | 0 | 0 | 0 | 0 |
| Total | 97 | 105 | 100 | 63 | 365 | 100 |

Source: Field survey, 2022.

Table 4. Evaluation of respondents' personnel training practices on waste management.

| Respondent | | | | | | |
|-------------|---------|--------|----------------|----------------|-----------|-----|
| Response | Doctors | Nurses | Lab scientists | Sanitary staff | frequency | (%) |
| Yes | 94 | 89 | 80 | 45 | 308 | 84 |
| No | 3 | 16 | 20 | 18 | 57 | 16 |
| Indifferent | 0 | 0 | 0 | 0 | 0 | 0 |
| Total | 97 | 105 | 100 | 63 | 365 | 100 |

Source: Field survey, 2022.

has no significant effect on waste management.

$$= \frac{365}{3} = 121.5$$

H₁: The knowledge and attitude of healthcare workers has significant effect on waste management.

In computing the expected frequency (fe), we have the following:

$$\text{Expected Frequency (fe)} = \frac{\text{All observed frequencies}}{\text{Number of observation}}$$

The analysis in Tables 5 and 6 shows that the calculated chi-square value is ($x^2 = 395.6$) is greater than the table or critical value ($x^t = 7.815$). Thus, the Null hypothesis was rejected while the alternative hypothesis which states that the knowledge and attitude of healthcare workers has significant effect on waste management was accepted. This result is in agreement with the study of

Table 5. Analysis of responses from table 2 – 3.

| Responses | Q1 | Q2 | Total | Average | Fo |
|-------------|-----|-----|-------|---------|-----|
| Yes | 329 | 309 | 638 | 638/2 | 319 |
| No | 36 | 56 | 92 | 92/2 | 46 |
| Indifferent | 0 | 0 | 0 | 0 | 0 |
| Total | 365 | 365 | | | 365 |

Source: Field survey, 2022.

Table 6. Computation of Chi-square.

| Response | fo | fe | (fo - fe) | (fo - fe) ² | $\frac{(fo - fe)^2}{fe}$ |
|--------------|-----|-------|-----------|------------------------|--------------------------|
| Yes | 319 | 121.5 | 197.5 | 39006.25 | 321.0 |
| No | 46 | 121.5 | -75.5 | -5700.25 | -46.9 |
| Indifferent | 0 | 121.5 | 121.5 | 14762.25 | 121.5 |
| Total | 365 | | | | 395.6 |

Source: Field survey, 2022.

Table 7. Analysis of responses from Table 4.

| Response | F | Total | Average | Fo |
|-------------|-----|-------|---------|-----|
| Yes | 308 | 308 | 308/1 | 308 |
| No | 57 | 57 | 57/1 | 57 |
| Indifferent | 0 | 0 | 0/1 | 0 |
| Total | 365 | 365 | | 365 |

Source: Field survey, 2022.

Rao et al. (2018) who affirmed that doctors desired more knowledge about medical wastes than other units such as the scavengers, and residential persons.

ii) **H₀**: Personnel training practices in the healthcare sector has no significant effect on waste management.

H₁: Personnel training practices in the healthcare sector has significant effect on waste management.

In computing the expected frequency (fe), the authors have the following:

$$\begin{aligned} \text{Expected Frequency (fe)} &= \frac{\text{All observed frequencies}}{\text{Number of observation}} \\ &= \frac{365}{3} = 121.5 \end{aligned}$$

The analysis in Tables 7 and 8 shows that the calculated chi-square value is ($x^2 = 373.53$) is greater than the table or critical value ($x^t = 7.815$). Thus, the Null hypothesis was rejected while the alternative hypothesis

which states that which states that Personnel training practices in the healthcare sector has significant effect on waste management was accepted. This finding aligns with the result of Kumar et al. (2015); Nwaise (2017); and Manzoor and Sharma (2019) whom are of the view based on the result from their study that inadequate training of personnel on waste disposal has negative effect on the environment. Hence, there is a need for a heightened sensitization of persons on how best to dispose of wastes to avoid or reduce the risks of exposure and escalation to infectious diseases of any kind.

SUMMARY OF FINDINGS, CONCLUSION AND RECOMMENDATIONS

Based on the analysis of data and test of hypothesis, the study revealed that:

i) Knowledge and attitude of healthcare workers has significant effect on waste management ($x^2 = 395.6$) > ($x^t = 7.815$).

ii) Personnel training practices in the healthcare sector has significant effect on waste management ($x^2 = 373.53$) > ($x^t = 7.815$).

Conclusion

This study concludes that the healthcare sector understudy is reputed to dispose of prodigious amounts of waste; although, it has been able to manage its negative effects on their environment due to their

Table 8. Computation of Chi-square.

| Response | <i>f_o</i> | <i>f_e</i> | <i>(f_o - f_e)</i> | <i>(f_o - f_e)²</i> | $\frac{(f_o - f_e)^2}{f_e}$ |
|-------------|----------------------|----------------------|--|--|-----------------------------|
| Yes | 308 | 121.5 | 186.5 | 34782.25 | 286.27 |
| No | 57 | 121.5 | -64.5 | -4160.25 | -34.24 |
| Indifferent | 0 | 121.5 | 121.5 | 14762.25 | 121.5 |
| Total | 365 | | | | 373.53 |

Source: Field survey, 2022.

effectiveness in creating awareness on how best those wastes should be managed.

Recommendations

Based on the findings of the study, it is therefore recommended that: healthcare experts must be abreast with the processes required to successfully dispose wastes in the environment. The attitude of workers should be such that wastes are not allowed to remain in the hospitals or environment for a long period so that the risks of being infected would be minimized. Furthermore, there should be a continuous enlightenment, sensitization, and training on effective and safe waste management to aid the improvement of a more conducive and healthy environment for the general public.

CONFLICT OF INTERESTS

The authors declare no conflict of interests.

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