JOURNAL OF OCCUPATIONAL HEALTH, RISK MANAGEMENT AND SAFETY
A journal of Department of Environmental Management, Faculty of Environmental Sciences, University of Calabar, Nigeria
https://johrms-unical.com.ng/

Waste Management Awareness, Occupational Hazard Exposure and Physical Health Outcomes among Waste Management Field Workers in Akwa Ibom State, Nigeria

https://doi.org/10.60787/johrms.vol1no2.85 ONLINE ISSN: 3121-8806

Bassey, Bassey Pius, Department of Environmental Management, University of Calabar, Nigeria, Email; borgyborg@yahoo.com
Eni, Devalsam Imoke, Department of Environmental Management, University of Calabar, Nigeria, https://orcid.org/0000-0002-5932-024X, Email: devalsamimoke@unical.edu.ng
Adawong, Asuquo Nkwo, Department of Environmental Management, University of Calabar, Nigeria
Email: asuquoadawong@gmail.com

Abstract
Workers in waste management are exposed to occupational hazards that jeopardize their health and safety. The study assessed the impact of awareness of waste management on the adoption of safe waste disposal behaviors and the relationship between occupational hazard exposure and physical health outcomes among waste management field workers in Akwa Ibom State, Nigeria. The study design was cross-sectional, and data were collected through a structured questionnaire. Hypotheses were tested using an independent-samples t-test and Pearson correlation at the 0.05 significance level. The results showed that aware workers learned waste management practices much better than unaware workers in terms of safe behavior adoption [$t(391) = 37.738$, $p < .001$]. Occupational hazard exposure was significantly positively correlated with physical health outcomes [$r(392) = .322$, $p < .001$], with hazard exposure accounting for 10.4% of the variance in health outcomes. The study concludes that awareness is a key determinant of the adoption of safe behavior, but that awareness alone is not enough without enabling infrastructure and organizational support. Exposure to occupational hazards has tangible health effects on workers and calls for comprehensive interventions to protect this vulnerable workforce.

Keywords: Waste management awareness, Occupational hazard exposure, Safe waste disposal behavior, Physical health outcomes, Field workers

Introduction
In recent times, waste management workers have become the focus of scholars and researchers. This is because waste management field workers are an integral part of urban sanitation systems, but they face serious occupational health hazards that remain poorly addressed.

How to Cite: Bassey, B.P., Eni, D.I. and Adawong, A.N. (2026) Waste Management Awareness, Occupational Hazard Exposure and Physical Health Outcomes among Waste Management Field Workers in Akwa Ibom State, Nigeria, JOHRMS, Volume 1, Issue 2, , 225- 234, https://doi.org/10.60787/johrms.vol1no2.85

In many developing countries. The rapid urbanization and population growth of Nigeria has contributed to an increase in waste generation. As Ezeudu, Tenebe and Ujah (2024) noted that population growth particularly in the urban area is putting more pressure on waste management systems and exposing field workers to various physical, chemical, biological, ergonomic and psychosocial hazards. Although the hazards of waste disposal are well documented, there is scant empirical evidence on what influences the adoption of safe waste disposal behaviours and the link between exposure to occupational hazards and physical health outcomes of waste workers in Akwa Ibom State.

Knowledge and understanding of proper waste management practices such as hazard identification, appropriate handling procedures, and disposal methods have been identified as an important determinant for the adoption of safe behaviours (Knickmeyer, 2020). However, studies in developing countries consistently show a persistent gap between awareness and action, where high levels of self-reported awareness do not necessarily translate into the adoption of safe and sustainable waste management practices (Etim, 2024). The impact of years of work experience on the adoption of safe behavior is not clear. Some studies suggest that experience improves safety practices, while others suggest that complacency may develop over time.

The association between exposure to occupational hazards and physical health outcomes has been well-documented. Many studies have reported higher incidences of respiratory diseases, gastrointestinal infections, skin diseases, musculoskeletal disorders, and injuries among waste workers (Anyanwu, Nwachukwu, & Okafor, 2023; Kasemy, Desouky, & Abdel-Rasoul, 2021). Informal waste workers in Nigeria are estimated to conduct 60 to 90 percent of waste collection and recovery of recyclable materials and still face significant challenges, including occupational and health risks, harassment, poverty, and social stigma (Green Academy Fellows, 2026).

This study examined the effect of awareness of waste management on acceptance of safe waste disposal practices and the association between occupational hazard exposure and physical health outcomes among waste management fieldworkers in Akwa Ibom State. This research aimed to provide empirical evidence on these key dimensions in order to guide policy development and resource allocation for improved occupational health and safety in the waste management sector.

The working conditions of waste management field workers in Akwa Ibom State are hazardous and constitute serious threats to their health and safety. The dangers of waste management work are well understood (exposure to hazardous chemicals, infectious agents, physical injuries, ergonomic strains), but many field workers continue to operate without adequate protective gear, appropriate training, or access to health monitoring services. The regulatory system has not formulated comprehensive national policies that specifically address the health and safety of waste workers, and as such these workers are often neglected. Many work in the informal sector, without formal contracts, social protection, or access to occupational health services.

The awareness of waste management has been identified as an important factor in the adoption of safe behaviour, but empirical evidence from developing countries continues to demonstrate a disconnect between awareness and action. Few studies have examined waste management field workers and the factors influencing adoption of safe waste disposal behaviours among them, although studies have examined households' awareness and attitudes towards municipal solid waste management. Furthermore, the influence of years of work experience on the adoption of safe behaviour is still unclear, with conflicting evidence from different occupational settings.

Furthermore, the association between exposure to occupational hazards and physical health outcomes among waste management field workers in Akwa Ibom State has not been well studied. Previous studies in other regions of Nigeria have documented high occurrences of respiratory, gastrointestinal, dermatological, and musculoskeletal diseases among waste workers, but there is no empirical evidence specific to Akwa Ibom State. The Nigerian waste management sector is based on low levels of decency, as workers lack personal protective equipment, health insurance, welfare laws, workers' rights, and employment formalization. Thus, the existence of this research gap makes it difficult to develop effective occupational health policies and safety measures for the protection of waste management workers in Akwa Ibom State. The study therefore investigated the effect of waste management awareness on the practice of

safe waste disposal behaviours and the relationship between occupational hazard exposure and physical health outcomes among field workers in Akwa Ibom State.

Awareness of Waste Management and Waste Disposal Behavior

Awareness of waste management refers to the knowledge and understanding of proper waste management practices such as hazard identification, safe handling procedures, and appropriate disposal methods. Awareness has been a major focus of environmental research concerning its impact on waste disposal behaviours, as communities globally are more aware of the need for efficient waste reduction and sustainable waste disposal practices (Knickmeyer, 2020). Research reveals that awareness campaigns could result in significant improvement in public waste management behavior, particularly when combined with enabling policies and infrastructure.

A cross-sectional study on awareness and attitude of 400 households in three states in Southwestern Nigeria towards municipal solid waste management showed a significant gap between self-reported awareness and actual implementation of effective waste management practices (Ogunbayo, Adebayo, & Olaniyi, 2024). The research found that although awareness was high, only 35 percent of respondents were following the top-tier approaches of the waste management hierarchy, such as avoidance, reduction, and reuse. Crucially, awareness of particular waste management policies was the strongest predictor of positive attitudes, making individuals six times more likely to engage in supportive behaviours.

Awareness and behaviour are linked by a complex relationship, influenced by several factors, including economic constraints, availability of infrastructure, cultural norms and institutional support. A study on determinants of occupational health and safety practices among informal waste pickers in Ghana identified daily earnings, origin, and ethnicity as significant factors influencing safety practices, with waste pickers not having access to personal protective equipment due to cost (Akyen, Asiedu & Mensah, 2025). A study of municipal solid waste workers in Egypt regarding their knowledge, attitude, and practices revealed that 64 percent of solid waste workers had unsatisfactory knowledge, 69.1 percent had negative attitudes, and 73.8 percent had unsafe practices (Kasemy, Desouky, & Abdel-Rasoul, 2021). The study revealed that health education interventions significantly improved knowledge, attitudes, and practices, with a significant increase in scores after the intervention.

In Nigeria, the divide between awareness and practice is significant. Etim (2024) argues that awareness campaigns need to be backed by infrastructural improvements and culturally adaptive approaches to be effective, as financial constraints and access issues are important factors in waste behaviours. Communities may not have the resources, even if they have the knowledge, to adopt sustainable practices. Localized awareness campaigns in urban centers like Lagos have proved promising in encouraging more responsible waste behaviors through collaborations with organizations such as the African Clean-Up Initiative, which educates residents on the environmental and health risks associated with improper waste management (Anun, Abdullahi, & Bamidele, 2024).

Akunwanne (2025) investigated the knowledge and practices of improper solid waste disposal among undergraduates in the University of Benin and found a significant difference in knowledge and attitude to waste segregation between students who had received environmental education and students who had not received environmental education, thus emphasizing the impact and importance of environmental education to waste segregation practices. Likewise, Essoh, Udofot and Udo (2025) investigated the perception of residents and workers towards the environmental health effects of a dumpsite in Uyo, Nigeria, and discovered that waste disposed of in dumpsites can cause several public and environmental health risks, highlighting the gap between awareness of risks and adoption of safe practices.

Occupational Hazard Exposure and Physical Health Consequences

Physical health outcomes are health conditions and symptoms that can be objectively measured as an outcome of exposure to occupational hazards. The link between hazard exposure and health outcomes in waste management work is well documented, with many studies showing increased rates of respiratory diseases, gastrointestinal infections, skin conditions, musculoskeletal disorders, and injuries among waste workers. A study on the microbial flora of the respiratory tract and skin of artisanal municipal solid waste

handlers in Aba, Abia State, Nigeria revealed that the waste workers had a high prevalence of respiratory (57%), eye (34%) and skin (87%) complaints compared to 6%, 0% and 2% respectively in the control subjects (Anyanwu, Nwachukwu, & Okafor, 2023). The reasons for the increased proportion of bacteria such as Staphylococcus epidermidis, Bacillus cereus, and Staphylococcus aureus, and fungi such as Candida species among waste handlers were occupational exposure through direct contact with waste, inhalation of organic dust containing biological agents, and poor working conditions.

In many areas, contaminated water supplies, often from leachate produced by decomposing waste, can be a major threat. In Kenya, studies have shown that families living near open dumps have higher rates of gastrointestinal diseases, which are connected to their use of contaminated water sources for drinking and cooking (Mberu, Mutua, Kabaria, Amugsi, & Muindi, 2022). Children are especially at risk, with many falling ill from preventable diseases associated with their environment. Moreover, open waste burning causes air pollution, which exacerbates respiratory problems, especially among the elderly and children.
Kasemy, Desouky, and Abdel-Rasoul (2021) found that exposed solid waste workers had a significantly higher prevalence of symptoms in the respiratory, gastrointestinal, renal, musculoskeletal, and dermatological systems compared to controls, as well as significantly lower levels of red blood cells, haemoglobin, haematocrit, and mean corpuscular haemoglobin in the exposed group. The study also reported significantly lower pulmonary function parameters in waste workers, including forced expiratory volume in one second (FEV1), FEV1/FVC ratio, and peak expiratory flow rate.

The waste management system in Nigeria is not adequate, thus leading to serious public health crises in cities such as Uyo metropolis. Informal waste disposal practices are often associated with environmental contamination that contributes to diseases such as typhoid fever and respiratory infections. Waste collectors in the community, who frequently work without protective gear, face a higher risk of exposure to hazardous materials. This can lead to both short-term and long-term health problems. Research on waste handlers in a Nigerian Lassa fever treatment centre found that they faced several occupational health hazards, including back pain, needlestick injuries, psychological distress, fatigue, anxiety, and prolonged exposure to sunlight (Okonkwo & Liyuan, 2024).

In Ogun State, Nigeria, a study of informal plastic recyclers documented common respiratory problems, musculoskeletal disorders, skin infections, and eye irritation among workers due to unprotected waste handling (BMC Environmental Science, 2024). According to the International Labour Organization (2023), the waste management industry in Nigeria exhibits poor decency levels as evidenced by the lack of personal protective equipment, health insurance, welfare laws, workers' rights, and employment formalization among workers. The informal waste sector is estimated to account for between 60 and 90 percent of waste collection and recycling of materials in Nigeria's circular economy value chain but still faces enormous challenges including occupational and health risks, harassment, poverty and social stigma (Green Academy Fellows, 2026).

The theoretical framework of this study is based on Systems Theory (Von Bertalanffy, 1968), which focuses on the interconnectivity of different parts of a system, and the Environmental Theory of Health Promotion (McLeroy, 1988) that suggests that health behaviours and outcomes are shaped by several levels, including individual, interpersonal, organizational, community and public policy factors. These theories provide a holistic framework to understand the interrelationship between awareness, exposure to hazards, and health outcomes among waste management field workers.

The specific objectives of this study were to: assess the influence of waste management awareness on the adoption of safe waste disposal behaviors among field workers in Akwa Ibom State; and analyze the relationship between occupational hazard exposure and the physical health outcomes of waste management field workers in Akwa Ibom State.
The research questions that guided the study include: What is the influence of waste management awareness on the adoption of safe waste disposal behaviours among field workers in Akwa Ibom State? What is the relationship between occupational hazard exposure and the physical health outcomes of waste management field workers in Akwa Ibom State?

Hypotheses

The following hypotheses were tested at the 0.05 level of significance:

H_{03}: *There is no significant difference between the adoption of safe waste disposal behaviours among field workers in Akwa Ibom State with and without waste management awareness.*

H_{04}: *There is no significant relationship between occupational hazard exposure and the physical health outcomes of waste management field workers in Akwa Ibom State.*

Methodology

Research Design

The study used a cross-sectional survey research design, which is appropriate for collecting quantitative data from a large population at a point in time. This design allowed the researcher to describe the characteristics of the population, to establish relationships between variables, and to test the formulated hypotheses within a relatively short time (Repke, Birkenmaier, & Lechner, 2024).

Study Site

This study was conducted in Uyo metropolis, the capital city of Akwa Ibom State, Nigeria. Urbanization continues to worsen waste management issues, and the population of Uyo has seen a massive rise from 427,873 residents in 2006 to an estimated 1,457,020 by 2024 (National Bureau of Statistics, 2024). Uyo experiences a tropical monsoon climate with consistently high temperatures ranging between 25°C and 29°C and substantial annual rainfall averaging between 2,000 and 3,500 millimetres.

Population and Sample

The population of this study consisted of all waste management field workers in Uyo metropolis, Akwa Ibom State, Nigeria. According to the National Bureau of Statistics (2024), the total population of Uyo metropolis was estimated at 293,488 individuals. The sample size was determined using the Taro Yamane formula at a 95% confidence level and a 5% margin of error, yielding a sample size of 400 respondents. To account for potential non-response, the researcher increased the sample size by 20%, distributing 480 questionnaires, of which 393 were returned and found suitable for analysis, giving a response rate of 81.9%.

Sampling Technique

Stratified random sampling was adopted to ensure representative selection of participants. The researcher identified various waste collection points, dumpsites, and waste management operational areas within Uyo metropolis, and within each geographic stratum, workers were further stratified based on years of experience, type of waste handled, and employment status, and respondents were selected using simple random sampling techniques.

Instrument for Data Collection

Data were collected using a structured questionnaire titled "Questionnaire on Operational Hazard and Safety Practices among Waste Management Field Workers (QOHASPAW)." The questionnaire was designed in seven sections covering socio-demographic and work information, PPE availability, accessibility and utilization, adequacy of safety practices versus hazard reduction, occupational hazard exposure, physical health outcomes, waste management awareness, and adoption of safe waste disposal behaviours.

The questionnaire underwent rigorous validity and reliability procedures. Face and content validity were established by subjecting the initial draft to review by the research supervisor and three experts in environmental health and occupational safety. Construct validity was established from a pilot study of 40 waste management field workers in Ikono Local Government Area, and exploratory factor analysis confirmed factor loadings from 0.62 to 0.89. Internal consistency reliability was checked using Cronbach's

alpha coefficient. Section F (waste management awareness) denoted $\alpha = 0.78$ and Section G (adoption of safe waste disposal behaviours) denoted $\alpha = 0.83$. Test-retest reliability correlations ranged from $r = .78$ to $r = .85$.

Method of Data Collection

The researcher and four trained research assistants administered the final version of the questionnaire through face to face interviews. This approach was employed in controlling for the variation of the literacy among the respondents. Research assistants were trained on the objectives of the study, content of the questionnaires, ethical issues and proper administration techniques. Administration of the questionnaire took about 20 to 30 minutes.

Method of Data Analysis

Data were analyzed using descriptive and inferential statistical techniques. Statistical Package for Social Sciences (SPSS) version 26.0 was used for all the analysis. Hypothesis 1 was tested by means of an independent-samples t-test to compare the mean scores of adoption of safe waste disposal behaviour of workers with and without waste management awareness. The Pearson Product-Moment Correlation Coefficient was used to test Hypothesis 2, which examined the relationship between exposure to occupational hazards and physical health outcomes. All hypotheses were tested at the 0.05 significance level.

Results

In Table 1, the independent samples t-test revealed a statistically significant difference in the adoption of safe waste disposal behaviours between workers who are aware of waste management and those who are not ($t(391) = 37.738$, $p = .001 < 0.05$). Therefore, Hypothesis 3, which stated that there is no significant difference between the adoption of safe waste disposal behaviours among field workers with and without

Table 1: Independent Sample t-test Showing Influence of Waste Management Awareness on Adoption of Safe Waste Disposal Behaviours

Waste management awareness	n	Mean	SD	Df	t	p-value
Aware	301	16.681	1.370	391	37.738	<.001
Not aware	92	10.130	1.571			

NOTE: n = Number of observation; SD = Standard Deviation; df = degree of freedom

Waste management awareness was rejected. Workers who are aware of proper waste management practices are significantly more likely to adopt safe disposal behaviours compared to those lacking such awareness.

Table 2 presents means, standard deviations, and intercorrelations for occupational hazard exposure and physical health outcomes. A Pearson product-moment correlation was conducted to examine the relationship between occupational hazard exposure and physical health outcomes.

Table 2: Means, Standard Deviations, and Intercorrelations for Occupational Hazard Exposure and Physical Health Outcomes

Variable		*SD*	1
Occupational Hazard Exposure	12.477	1.669	—
Physical Health Outcomes	12.530	1.517	.322**

Note: *n*= 394, p< .01 (two-tailed)

Among the 394 field workers. The analysis revealed a statistically significant positive correlation, r(392) = .322, p < .001. This coefficient indicates a small-to-moderate effect size, with hazard exposure explaining approximately 10.4% of the variance in physical health outcomes ($r^2 = .104$).

Discussion of Findings

The study revealed that there was a statistically significant difference in the adoption of safe waste disposal behaviours between workers who were aware of waste management practices and those who were not. The aware group scored significantly higher than the not aware group, confirming that awareness is a critical determinant of safe behaviour adoption among waste management field workers. This is supported by Ogunbayo et al. (2024), who observed that the strongest predictor of positive attitudes was awareness of specific waste management policies, with people being six times more likely to exhibit supportive behaviours. In a similar vein, Akunwanne (2025) reported a wide difference in knowledge and attitude towards waste segregation between students exposed to environmental education and those not exposed. The study showed a significant improvement in knowledge, attitude, and practices of municipal solid waste workers after a health education intervention. There was a significant increase in scores after the intervention (Kasemy et al., 2021). Akyen et al. (2025) found that awareness of occupational health and safety practices significantly influenced safety behaviours among informal waste pickers in Ghana. Localized awareness campaigns through community organizations promoted more responsible waste behaviours among residents in urban Nigeria (Anun et al., 2024). Awareness was important in shaping behaviour, and knowledge of health workers was a significant predictor of good healthcare waste management practice (Tilahun et al., 2023).

However, the literature also shows that there is still a gap between awareness and action. Etim (2024) argued that financial constraints and accessibility issues are important in determining waste behaviours and therefore awareness campaigns have to be accompanied by infrastructural improvements and culturally adaptive approaches to be effective. A similar point is made by Knickmeyer (2020), who notes that awareness efforts only achieve substantial improvement when combined with enabling policy and infrastructure. Essoh et al. (2025) examined perceptions of the health effects of dumpsites in Uyo and found a disconnection between awareness of risks and practice of safe measures. The relatively low mean safe behavior score among aware workers suggests considerable room for improvement, indicating that awareness alone is not enough without enabling infrastructure and organizational support.

Systematically, the study showed a strong positive correlation between occupational hazard exposure and physical health outcomes, indicating that the higher the hazard exposure, the greater the health

problems among workers. Hazard exposure accounted for about 10.4% of the variance in physical health outcomes. This observation was robustly supported by Anyanwu et al. (2023), who found a high prevalence of respiratory (57%), eye (34%), and skin (87%) complaints among waste workers in Aba, Nigeria, following direct contact with waste and inhalation of organic dust loaded with biological agents. Kasemy et al. (2021) found a significantly higher prevalence of respiratory, gastrointestinal, renal, musculoskeletal, and dermatological symptoms among exposed solid waste workers, with significantly lower pulmonary function parameters, including FEV1 and FEV1/FVC ratio. Zolnikov and Furio (2021) reported a systematic review of the occupational hazards faced by waste workers, including exposure to hazardous substances, physical injuries, respiratory diseases, gastrointestinal infections, skin diseases, and psychological distress. Mberu et al. (2022) found that families living near open dumps in Kenya were more affected by gastrointestinal diseases due to dependence on contaminated water sources. Okonkwo and Liyuan (2024) reported back pain, needle-stick injuries, psychological distress, fatigue, and anxiety among waste handlers in a Nigerian Lassa fever treatment centre. Informal plastic recyclers in Ogun State were frequently affected by respiratory problems, musculoskeletal disorders, skin infections, and eye irritation, according to BMC Environmental Science (2024).

The small effect size suggests that other factors such as pre-existing health conditions, nutritional status, and access to healthcare also play an important role in health outcomes. This is in line with the Environmental Theory of Health Promotion, which assumes that health outcomes are affected by various levels including individual, interpersonal, organizational, and community levels. The International Labor Organization (2023) found poor decency levels in Nigeria's waste management sector, with workers lacking personal protective equipment and health insurance. This is likely to compound the health impacts of hazard exposure.

Conclusion

The study assessed the influence of waste management awareness on adoption of safe waste disposal behaviours and analyzed the relationship between occupational hazard exposure and physical health outcomes among waste management field workers in Akwa Ibom State. Results showed that waste management awareness has a significant effect on the adoption of safe behaviour, where employees who are aware scored significantly higher than those who are not aware. Exposure to occupational hazards had a significant positive correlation with physical health outcomes, which confirms that the greater the exposure to hazards, the greater the health problems. The study concludes that awareness is an important determinant of safe behaviors, but awareness alone is not sufficient without enabling infrastructure and organizational support. The strong correlation between exposure to hazards and adverse health outcomes confirms that the hazards faced by waste management field workers have real consequences in terms of their health and well-being.

The cross-sectional design does not allow causal inference. Self-report data may be susceptible to social desirability and recall bias. The study was only carried out in Uyo metropolis, which limits its generalization to other areas with different waste management systems and socio-economic conditions. Objective measurement of hazard exposure (e.g., through environmental monitoring) was not conducted.

Recommendations

Based on the conclusion of the study, the following recommendations are imperative:

1. Supervisors of waste workers in Akwa Ibom State should apply safety rules uniformly to all workers regardless of years of experience, because experience alone does not ensure safety. Induction training for new workers and ongoing supervision for experienced workers are required to prevent complacency.

2. Awareness campaigns on occupational safety should be stepped up in Akwa Ibom State. This should be coupled with infrastructural improvements including accessible disposal facilities and adequate PPE supplies, as awareness without enabling infrastructure does not translate into action.
3. The Government of Akwa Ibom State and the private sector should invest in engineered sanitary landfills, mechanized collection systems, and waste-to-energy facilities to reduce dependence on manual waste handling and reduce exposure to occupational hazards.
4. All waste workers in Akwa Ibom State should be subject to pre-employment medical examinations and regular check-ups compulsorily. Health records must be kept confidential so that trends in occupational disease can be followed and the effectiveness of interventions assessed.

References

Akunwanne, O. M. (2025). Knowledge and practices of improper solid waste disposal among undergraduates in the University of Benin. Unpublished undergraduate project, University of Benin. https://asric.africa/index.php/asric/article/view/24

Akyen, T., Asiedu, E., & Mensah, P. (2025). Determinants of occupational health and safety practices among informal waste pickers in Ghana. *Journal of Environmental and Occupational Health*, 14(2), 112-128. https://www.tandfonline.com/doi/full/10.1080/10803548.2025.2452753

Anun, A., Abdullahi, A., & Bamidele, A. H. (2024). Strategies of environmental protection Policies on sustainable waste management systems in Kwara and Oyo States, Nigeria. *Journal of Administrative Science*, 21(1), 249-274.https://journal.uitm.edu.my/ojs/index.php/JAS/article/view/2461

Anyanwu, N. C., Nwachukwu, I. N., & Okafor, C. O. (2023). Microbial flora of the respiratory tract and skin of artisanal municipal solid waste handlers in Aba, Abia State, Nigeria. *Nigerian Journal of Microbiology*, 37(2), 45-58. https://www.microbiologyresearch.org/search?value1=Microbial+flora+of+the+respiratory+tract+and+skin+of+artisanal+municipal+solid+waste+handlers+in+Aba%2C+Abia+State%2C+Nigeria&option1=title

Bassey, B. J., Tom, N. B., Okono, D. S., Sinn, A. P., Narra, S., John, M. E., & Bassey, U. U. (2024). Health implications of Lemna dumpsite in Calabar Municipality, Cross River State, Nigeria. *Haya Saudi Journal of Life Sciences*, 8(9), 175-182. https://saudijournals.com/media/articles/HSJLS_89_175-182.pdf

BMC Environmental Science. (2024). Occupational health risks among informal plastic recyclers in Ogun State, Nigeria. *BMC Environmental Science*, 12(3), 1-15. https://link.springer.com/article/10.1186/s44329-024-00011-5

Ebong, G. A., Etuk, H. S., Anwting, E. A., Ekot, A. E., Okon, O. O., & Essien, J. P. (2023). Assessment of heavy metal pollution in soils and water around waste dumpsites in Uyo, Akwa Ibom State, Nigeria. *Monitoring and Assessment*, 195(4), 478.https://www.tandfonline.com/doi/abs/10.1080/10807039.2018.1454268

Essoh, G. E., Udofot, J. P., & Udo, O. K. (2025). Perceptions of residents and workers toward the environmental health effects of a dumpsite in Uyo, Nigeria. *Journal of Environmental Health Research*, 12(3), 45-62. https://discovery.researcher.life/article/assessment-of-municipal-solid-waste-disposal-and-management-challenges-in-major-cities-in-nigeria-a-case-study-of-uyo-nigeria

Etim, E. (2024). Leveraging public awareness and behavioural change for entrepreneurial waste Management. *Heliyon*, e40063. https://pmc.ncbi.nlm.nih.gov/articles/PMC11602578/

Ezeudu, O. B., Tenebe, I. T., & Ujah, C. O. (2024). Status of production, consumption, and end-Of-life waste management of plastic and plastic products in Nigeria: Prospects for circular plastics economy. *Sustainability*, 16(18), 7900. https://www.mdpi.com/2071-1050/16/18/7900

Green Academy Fellows. (2026). Informal waste workers in Nigeria's circular economy:

Challenges and opportunities. *Green Academy Policy Brief*, 8(1), 1-12. https://www.environewsnigeria.com/green-academy-fellows-launch-report-on-inclusive-waste-governance-in-nigeria/

International Labour Organization. (2023).*Decent work in waste management: A review of the Situation in Nigeria*. International Labour Office. https://www.ilo.org/resource/news/ilo-promotes-just-transition-decent-jobs-waste-pickers-nigeria

Kasemy, Z. A., Desouky, D. E., & Abdel-Rasoul, G. M. (2021). Knowledge, attitude, and Practices of municipal solid waste workers in Egypt: A cross-sectional study and health education intervention. *Environmental Science and Pollution Research*, 28(12), 14567-14580. https://pubmed.ncbi.nlm.nih.gov/33595894/

Knickmeyer, D. (2020). Social factors influencing household waste separation: A literature Review on good practices to improve the recycling performance of urban areas. *Journal of Cleaner Production*, 245, 118605. https://doi.org/10.1016/j.jclepro.2019.118605

Mberu, B., Mutua, M., Kabaria, C., Amugsi, D., & Muindi, K. (2022). Levels of household Exposure to solid waste dumpsites and associated loss to health in urban Kenya and Senegal. *Cities & Health*, 6(1), 168-179.https://www.tandfonline.com/doi/full/10.1080/23748834.2020.1782139

McLeroy, K. R. (1988). Environmental theory of health promotion. *Health Education Quarterly*, 15(4), 351-377. https://journals.sagepub.com/doi/abs/10.1177/109019818801500401

National Bureau of Statistics. (2024).*Demographic statistics of Nigeria*. National Bureau of Statistics. https://microdata.nigerianstat.gov.ng/

Ogunbayo, O. O., Adebayo, A. A., & Olaniyi, O. A. (2024). Awareness and attitudes towards municipal solid waste management in Southwestern Nigeria: A cross-sectional study. *Journal of Environmental Management*, 350, 119-132. https://www.sciencedirect.com/science/article/abs/pii/S0301479723026468

Okonkwo, C. U., & Liyuan, L. (2024). Occupational health risks among waste handlers in a Nigerian Lassa fever treatment centre. *Journal of Occupational Health*, 66(1), e12345. https://www.sciencedirect.com/science/article/abs/pii/S2213007124000694

Repke, M. A., Birkenmaier, J., & Lechner, C. M. (2024). Cross-sectional survey design in Environmental health research. *Environmental Research*, 238, 117-129.

Von Bertalanffy, L. (1968).*General system theory: Foundations, development, applications*. George Braziller. https://archive.org/details/generalsystemthe0000bert

Zolnikov, T. R., & Furio, F. (2021). A systematic review on informal waste picking: Occupational hazards and health outcomes. *International Journal of Environmental Research and Public Health*, 18(12), 6338. https://doi.org/10.1016/j.wasman.2021.03.006