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INTEGRATING CONSTRUCTION VOCATIONAL TRAINING AND
WORKFORCE DEVELOPMENT FOR THE BUILT ENVIRONMENT**

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EVOLVING TECHNOLOGIES FOR SUSTAINABLE FUTURE INTEGRATING CONSTRUCTION
VOCATIONAL TRAINING AND WORKFORCE DEVELOPMENT FOR THE BUILT ENVIRONMENT



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Chairman's Address

It gives me immense pleasure to present this message as the Chairman of the Local Organising Committee for the 3rd International Conference of Environmental Sciences (ICES 2025). On behalf of the University of Ilorin and our international partner, Tallinn University of Technology, Estonia, I warmly welcome you to the published proceedings of this truly enriching and impactful conference.

ICES 2025 was convened under the theme: “Evolving Technologies for Sustainable Future: Integrating Construction Vocational Training and Workforce Development for the Built Environment.” This theme reflects the urgent global need to rethink how emerging technologies intersect with environmental sustainability, construction practice, vocational education, and workforce development. As the built environment continues to evolve in response to digital transformation, climate change, and socio-economic pressures, our academic and professional communities must remain proactive, innovative, and collaborative.

The conference attracted scholars, industry experts, policymakers, postgraduate researchers, and students from across Nigeria and several other countries. The diversity of perspectives represented in this volume is a testament to the interdisciplinary nature of environmental sciences and the built environment. The papers presented and published herein address critical areas, including digital technologies and artificial intelligence, sustainable construction materials, geospatial analysis, urban resilience, project management, vocational training systems, and policy frameworks for sustainable development.

The review process for ICES 2025 was rigorous and constructive. Our reviewers devoted significant time and expertise to ensuring that each manuscript met acceptable scholarly standards while providing authors with meaningful feedback to strengthen their work. I extend my profound appreciation to every reviewer, session chair, rapporteur, and member of the Scientific Committee for their efforts in upholding the academic integrity of this conference. I also acknowledge the invaluable contributions of our keynote and guest speakers, whose insights set the intellectual tone for the conference. Their thought-provoking presentations challenged us to consider not only where we are as a discipline but where we must aspire to be.

The Local Organising Committee worked tirelessly to ensure the smooth delivery of both physical and virtual sessions. Organising a hybrid international conference demands coordination,

adaptability, and teamwork, and I am deeply grateful to every committee member and volunteer whose dedication made ICES 2025 a resounding success.

As you engage with the papers contained in this proceeding, I encourage you to see them not merely as isolated research outputs but as part of a broader conversation. The ideas presented here should inspire further research collaborations, industry partnerships, and policy engagements that advance sustainable development within our communities and beyond.

It is our hope that ICES 2025 will serve as a catalyst for continued scholarly excellence and global collaboration. May the knowledge shared through this platform contribute meaningfully to shaping a more sustainable, technologically integrated, and resilient built environment.

Thank you for being part of ICES 2025, and I look forward to even greater strides in future editions of this conference.

With appreciation,

Dr T. O. O. Olowa

*Chairman, Local Organising Committee
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ASSESSMENT OF RESIDENTS' AWARENESS OF URBAN HEALTH HAZARDS IN INFORMAL SETTLEMENTS OF FEDERAL CAPITAL TERRITORY, NIGERIA

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Abstract

The rapid and often unregulated urban expansion in Nigeria has strained municipal systems, leading to widespread health hazards such as poor sanitation, polluted water, and exposure to hazardous materials particularly in informal settlements. Public awareness of these hazards is crucial, as it shapes health behaviours, community responses, and the effectiveness of environmental health policies and interventions. This study investigates residents' awareness level of urban environmental health hazards across three Area Councils of Abuja Municipal, Bwari, and Gwagwalada in FCT, Nigeria. Using a cross-sectional survey design, primary data were collected from 1,137 respondents through structured questionnaires and field observations. Residents' Awareness was measured on a 4-point Likert scale and analysed using descriptive statistics and the Kruskal-Wallis H test to evaluate spatial differences. The results revealed that across the Area Councils, most respondents (56.0%) have tertiary education, reflecting a relatively educated population. Results also show a high awareness of visible, day-to-day hazards (clogged drains, noise, waste), while awareness of less visible but harmful risks (asbestos and mould) remains low. The Kruskal-Wallis H test revealed no statistically significant differences in awareness levels across Councils ($p > 0.05$). Post-hoc pairwise comparisons using Mann-Whitney U tests confirmed this uniformity. These findings indicate the need for targeted education strategies to raise awareness about chronic and less perceptible health hazards, while supporting region-wide public health interventions that leverage the high educational attainment of the population. This study aligned with the SDG goal 11 which advocates for inclusive, safe, resilience and liveable cities especially in the developing countries.

Keywords: Environment, Hazard, Informal Settlement, Urban health, Awareness, Urban vulnerability

Introduction

Urbanisation is one of the most transformative processes shaping the spatial, environmental, and socio-economic landscapes of Nigeria (UN-Habitat, 2020; National Bureau of Statistics, 2021). As cities expand to accommodate growing populations and economic activities, the burden on existing infrastructure and services continues to intensify. This phenomenon is particularly pronounced within the Federal Capital Territory (FCT) Abuja, which has witnessed rapid urban growth over the past two decades (Ajayi and Olanrewaju, 2020). The resulting urban sprawl often characterised by informal settlements, overcrowded housing, and inadequate municipal services has led to a heightened exposure to a range of housing and environmental hazards. These include, but are not

limited to inadequate sanitation, polluted water sources, improper solid waste management, overcrowding, poor ventilation, and exposure to hazardous materials such as asbestos and mould (Amegah and Jaakkola, 2016; Ezech et al., 2017).

The health implications of these urban health hazards are well documented, ranging from communicable diseases such as cholera and typhoid to chronic respiratory illness and increased vulnerability to physical injuries (WHO, 2021). However, the effectiveness of any public health or environmental intervention hinges not only on physical infrastructure but also on the level of residents' awareness and understanding within the affected communities (Wilkinson, et al., 2020; Olorunsogo, et al., 2024). Public awareness influences individual behaviours, community mobilisation, and overall receptiveness to policy and programme interventions. Therefore, assessing how well populations perceive and understand these environmental health threats is a critical precursor to the design and implementation of effective, inclusive, and equitable urban health strategies (MacCarthy et al., 2018).

Therefore, this study assesses the residents' awareness level of urban health hazards in the informal settlements of Abuja Municipal, Bwari, and Gwagwalada Area Councils of FCT. These Area councils represent varying degrees of urbanisation and socio-economic diversity, offering an opportunity to explore the interplay between spatial context and urban health hazards awareness. The central objective of the study is to determine whether significant differences exist in the perceived awareness of urban health hazards across these councils.

The study Area

This study was conducted within three Area Councils of the Federal Capital Territory (FCT), Nigeria (Abuja Municipal, Bwari and Gwagwalada). These Area Councils were selected to represent varying degrees of urban development, socio-economic diversity, and infrastructural capacity. The FCT is a region of intense urban growth, making it a suitable context for assessing public awareness of environmental health risks amid rapid spatial change.

Literature Review

Urban and Environmental Health in Urbanising Contexts

Urbanisation in the developing countries, particularly in sub-Saharan Africa, has been characterised by rapid, uncoordinated growth that often outpaces the development of infrastructure and social services (UN-Habitat, 2022). In Nigeria, urban areas have grown exponentially, with cities such as

Abuja experiencing some of the fastest rates of expansion in Africa (National Bureau of Statistics, 2021). While urbanisation offers economic and social opportunities, it also exacerbates environmental health risks, especially in informal and peri-urban settlements where basic amenities such as clean water, adequate sanitation, and waste disposal services are limited (Mohammed et al., 2019; Carrilho and Trindade, 2022).

The environmental determinants of health in urban settings are multifaceted and interconnected. Poor sanitation systems contribute to the spread of waterborne diseases; overcrowded housing exacerbates respiratory infections; and exposure to pollutants, including noise, solid waste, asbestos, and chemical toxins, has been linked to both acute and chronic health conditions (Ezeh et al., 2017; WHO, 2021). These challenges are particularly acute in developing countries, where weak institutional frameworks and inadequate funding hinder the implementation of comprehensive environmental health programs.

Public Awareness and Urban Health Hazards Perception

Public awareness of urban and environmental health hazards plays a vital role in health behaviour change and the success of urban health interventions (Laddu, et al., 2021; Rahaman, et al., 2023). Awareness facilitates informed decision-making, enables early detection and prevention of illness, and encourages public support for environmental regulations. Studies have shown that where awareness is low, communities are less likely to participate in sanitation programmes, use protective equipment, or demand improved services (MacCarthy et al., 2018; Simiyu, et al. 2020).

Risk perception is not only influenced by the objective severity of urban environmental hazards but also by subjective factors such as education, income, media exposure, and cultural beliefs (Wilkinson, et al., 2020). For instance, residents may underestimate the dangers of asbestos exposure or mould infestation due to their invisible or delayed effects, while giving greater attention to more visible issues such as flooding or solid waste accumulation (Ajayi, et al., 2025). This highlights the importance of understanding the social and cognitive dimensions of environmental health awareness in urban settings.

Spatial Disparities in Awareness

Evidence suggests that awareness levels often vary across geographical areas, shaped by socio-economic status, urban infrastructure, access to information, and local governance (Amy and Tolu, 2019; Butt, et al., 2021). In Nigeria, studies have identified disparities in environmental awareness

between urban cores and peripheral settlements, with urban residents typically having better access to information and public services (Adewoyin, et al., 2024). However, no studies have systematically assessed whether such disparities exist within in the informal settlements of FCT. This gap is critical, as most existing research either generalises findings at the city or national level or focuses on infrastructure and health outcomes without assessing the public's perceptual and cognitive dimensions.

Research Methodology

Research Design

The study adopted a quantitative cross-sectional survey design, which allowed for the collection and analysis of standardised data across a diverse population at a single point in time. This approach enabled the comparison of awareness levels between the three Area Councils and the identification of spatial trends or disparities.

Sample Size and Sampling Technique

A total of 1,137 respondents participated in the study, with proportional representation of informal settlements from each Area Council distributed as follows: Abuja Municipal (383) respondent, Bwari (378) respondents, and Gwagwalada (376) respondents. The sample size was determined based on Cochran's formula for finite populations, adjusted to ensure adequate statistical power for non-parametric analysis. A stratified random sampling approach was used to ensure fair representation of respondents across wards within each Area Council.

Instrument for Data Collection

Primary data were collected using a structured questionnaire designed to assess respondents' awareness of common urban environmental health hazards. The indicators included a list of eleven urban health hazards such as contaminated water, inadequate sanitation, chemical pollutants, excessive noise, mould, asbestos, poor ventilation, and overcrowding. Respondents were asked to rate their level of awareness for each item using a 4-point Likert scale, 1 = Fully Unaware, 2 = Unaware, 3 = Aware, and 4 = Fully Aware. The questionnaire was administered through a face-to-face survey, ensuring inclusiveness of both literate and semi-literate participants.

Method of Data Analysis

Data were analysed using SPSS and the analysis was conducted in three stages: starting with mean awareness scores computed for each hazard across the three Area Councils. A weighted average score was also calculated to reflect overall awareness levels. To determine whether awareness levels differed significantly among the three councils, the Kruskal-Wallis H-test, a non-parametric was applied. This test is appropriate for comparing ordinal data across more than two independent groups without assuming normality. Post-hoc analysis was also conducted test where the Kruskal-Walli's test showed potential group differences at 95% confidence level ($p < 0.05$), Mann-Whitney U test was conducted for pairwise comparisons between Area Councils to isolate specific group differences.

Results and Discussion

Respondents Education Qualification

The analysis of educational attainment across Abuja Municipal, Bwari, and Gwagwalada Area Councils reveals that a majority of respondents (56%) possess tertiary education, while 31.4% have completed secondary education. As indicated in Table 1, this high level of formal education suggests a population with strong potential for understanding and engaging with environmental health information. Notably, Gwagwalada often perceived as more peri-urban has the highest share of tertiary-educated individuals (60.3%), which may explain the generally high levels of awareness observed across all Area Councils.

However, a small but important portion of respondents (12.5%) reported having only primary or no formal education, which may limit their access to and understanding of complex or less visible environmental hazards such as asbestos exposure or mould. These individuals are potentially more vulnerable due to their limited ability to interpret health warnings or participate fully in awareness campaigns.

Table 1: Education Attainment of Respondents

Area Council	Primary level	Secondary level	Tertiary level	No formal education	Total
Abuja Municipal	41 (10.7%)	129 (33.7%)	198 (51.7)	15 (3.9)	383 (100%)
Bwari	28 (7.4%)	121 (32.0%)	212 (56.1%)	17 (4.5%)	378 (100%)
Gwagwalada	19 (5.1%)	107 (28.5%)	227 (60.3)	23 (6.1%)	376 (100%)
Total	88 (7.7%)	357 (31.4%)	637 (56.0%)	55 (4.8%)	1137 (100%)

Source: Author's Computation, 2025

Residents' Awareness level of Urban Environmental Hazards in the Study Area

The results of urban environmental health hazard of respondents' level of awareness across the three Area Councils (Abuja Municipal, Bwari, and Gwagwalada) shows a generally high level of public awareness for most observable and day-to-day health hazards. Hazards such as clogged or absent of drainage (3.26), excessive noise (3.23), improper solid waste disposal (2.72), and poor sanitation (2.69) have high weighted scores, indicating that residents are well aware of these issues (Table 2). These hazards are visible, disruptive, and frequently encountered in the informal settlements, which likely contributes to their salience in public perception. This trend is consistent across the Area Councils, reflecting a shared experiential understanding of the most immediate environmental challenges affecting daily life.

In contrast, awareness is significantly lower for less visible or chronic risks such as asbestos material used for ceiling (1.72), threat of mould in walls (2.18), and susceptibility to physical injury from unsafe structures environments (1.87). These health hazards may not present immediate or obvious symptoms and are often underestimated by the general public, despite posing serious long-term health threats

Table 2: Residents' Awareness level of Uirban Environmental Hazards

Hazards	Abuja Municipal	Bwari	Gwagwalada	Weighted Score	Awareness level
Contaminated and untreated water	2.69	2.70	2.67	2.69	Aware
Superstability to physical injury	1.90	1.73	1.97	1.87	Unaware
Chemical pollutants	2.52	2.65	2.63	2.60	Aware
Excessive noise	2.91	3.41	3.38	3.23	Aware
Threat of mould in wall	2.28	2.15	2.20	2.18	Unaware
Asbestos ceiling	1.80	1.71	1.64	1.72	Fully Unaware
Inadequate space and ventilation	2.46	2.70	2.55	2.57	Aware
Clogged/absence of drainage	3.45	3.18	3.14	3.26	Fully aware
Overcrowding in building	2.41	2.62	2.47	2.50	Aware
Poor sanitation	2.64	2.81	2.61	2.69	Aware
Improper Solid Waste & Disposal	2.79	2.76	2.63	2.72	Aware

Source: Author's Computation, 2025

The Kruskal-Wallis H test was applied to compare awareness levels of environmental and health effects across the three Area Councils (Abuja Municipal, Bwari, and Gwagwalada) yielded a H-statistic of 2.0 and a p-value of 0.368 for all items. This suggests that the differences in awareness levels among the councils are not statistically significant. The threshold for significance is typically 0.05. Since all p-values are greater than 0.05, therefore, the null hypothesis is accepted. Furthermore, the post-hoc test compares awareness levels between each pair of Area Councils for each environmental hazard. All p-values are 1.0, indicating no statistically significant differences in any pairwise comparison between Abuja Municipal and Bwari, Abuja Municipal and Gwagwalada, Bwari and Gwagwalada. This confirms the Kruskal-Wallis result that awareness levels are consistent across Area Councils for all housing and environmental effects evaluated.

Discussion

The findings of this study reveal a uniform distribution of urban environmental health awareness across the three Area Councils despite their socio-spatial differences. This consistency suggests that residents across these councils are exposed to similar housing and environmental conditions. This pattern aligns with prior research indicating that in contexts where environmental degradation is visible and persistent, awareness levels tend to rise uniformly across spatial units, even in the absence of targeted interventions (Olorunsogo, et al., 2024).

The analysis further indicates that public awareness is relatively high for overt and easily observable hazards, such as clogged drains, excessive noise, and improper solid waste disposal. These are issues with immediate, visible impacts that are frequently encountered in the daily lives of residents, often prompting discomfort, inconvenience, or community-level complaints. As noted by MacCarthy et al. (2018), such tangible risks tend to generate higher awareness because they directly affect quality of life and are more likely to be discussed in local discourse or highlighted in public media.

In contrast, awareness was found to be significantly lower for more insidious or less visible hazards including exposure to asbestos materials and physical injuries resulting from unstable building structures. These findings are consistent with existing literature suggesting that invisible or chronic risks often receive less public attention, especially in low-income settings where immediate survival needs overshadow long-term health considerations (Wilkinson, et al., 2020; WHO, 2021). For example, exposure to asbestos although scientifically linked to serious illnesses such as mesothelioma and lung cancer remains poorly understood among the general public in many developing countries, including Nigeria (Ajayi, et al., 2025). Similarly, structural hazards may be

normalized in informal settlements due to prolonged housing deficits and a lack of regulatory enforcement.

Conclusion

This study assessed residents' awareness of urban environmental health hazards in informal settlements across Abuja Municipal, Bwari, and Gwagwalada within Nigeria's Federal Capital Territory (FCT). The findings revealed that awareness levels are generally high for immediate and visible environmental hazards such as clogged drainage, poor sanitation, and excessive noise. These hazards tend to disrupt daily living conditions and are more likely to be recognised and discussed by the public. In contrast, awareness is notably lower for less visible, chronic, or long-term risks such as exposure to asbestos, mould growth, and structural instability. Despite the socio-economic and infrastructural variation across councils, statistical tests revealed no significant differences in awareness levels among the three Area Councils, indicating a relatively homogenous pattern of environmental health perception.

The uniformly high education level particularly the prevalence of tertiary education among respondents likely contributes to the consistency in awareness across councils. However, the lower awareness of less tangible health risks raises concerns about information accessibility, health literacy gaps, and potential underestimation of long-term environmental hazards in informal settlements. This underscores the need for targeted, context-sensitive awareness strategies that go beyond generic public health issues and solutions.

Recommendation

(i) Target Under-Recognised Hazards in Awareness Campaigns

Public health authorities such as FCT Health and Human Services and Abuja Environmental Protection Board (AEPB) should develop communication strategies specifically addressing low-awareness hazards such as asbestos exposure, mould infestation, and physical injury risks from unstable structures. These campaigns should simplify technical information and use culturally relevant language and visuals.

(ii) Leverage High Education Levels for Peer-Based Education

The high prevalence of tertiary-educated residents provides an opportunity to train local health champions or community educators to disseminate accurate environmental health

information, especially in informal settlements and this is to be done by the FCT Area Councils Health Department.

(iii) Utilize Multiple Communication Channels

FCT Broadcasting Department to launch awareness campaigns by employing a mix of mass media (radio, television), community outreach (town hall meetings, market sensitisations), and mobile platforms (SMS, WhatsApp) to reach both literate and semi-literate populations effectively.

(iv) Integrate Awareness Programs with Urban Upgrading and Health Services

Urban development and upgrading projects should incorporate components on environmental health risk awareness by the FCT Satellite Development Department in conjunction with Area Councils Planning Units. These can be embedded within primary healthcare delivery, water and sanitation programmes, and housing schemes.

(v) Implement Continuous Monitoring and Feedback Mechanisms

All relevant agencies of government are to ensure regular assessments of public awareness and this should be institutionalised to evaluate the effectiveness of environmental health campaigns. Feedback mechanisms such as community reporting platforms or participatory mapping can help identify emerging risks.

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