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Assessment of Occupational Health and Safety Among Artisanal Electrical Workers in Effurun, Uvwie Local Government Area (LGA) in Delta State, Nigeria

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Abstract— *This study assessed occupational health and safety (OHS) practices among 45 artisanal electrical workers in Effurun, Delta State, providing quantitative insights into their safety behaviours and injury burden. The workforce was dominated by adults aged 41–50 years (31.1%), with females forming a slight majority (53.3%). Although 57.8% had received some form of safety training, only 48.9% consistently used personal protective equipment (PPE), and just 24.4% inspected their tools daily, while 22.2% never conducted inspections. Injury prevalence was high, with 60% reporting at least one work-related injury in the past year, yet only 57.8% sought medical care, indicating common underreporting and self-treatment. Chi-square analyses showed no statistically significant associations between key safety variables and injury outcomes. Safety training was not significantly associated with PPE use ($\chi^2 = 1.91$, $p = .167$), although trained workers were 2.34 times more likely to use PPE. No significant relationships were found between gender and injury ($\chi^2 = 2.14$, $p = .143$), age and injury ($\chi^2 = 0.76$, $p = .943$), years of experience and injury ($\chi^2 = 1.94$, $p = .584$), or PPE use and injury ($\chi^2 = 1.20$, $p = .273$). These uniform risk patterns suggest that injuries stem from systemic safety deficiencies rather than individual characteristics. Overall, the findings highlight hazardous informal work conditions marked by inconsistent safety practices and inadequate equipment, underscoring the need for system-level interventions.*

Keywords— *Artisanal electrical workers, Occupational health and safety, Personal protective equipment, Informal sector, Injury prevalence, Safety practices, Tool inspection, Apprenticeship training, Electrical hazards, Effurun, Nigeria.*

I. INTRODUCTION

Electricity remains fundamental to global socio-economic development, supporting domestic, commercial, and industrial activities. Its provision depends on electrical work—an occupation globally recognised as high-risk due to exposure to electrical currents, elevated work positions, and hazardous tools (International Labour Organization [ILO], 2019). In Nigeria, a substantial proportion of electrical services is provided by artisanal electricians working within the informal sector, who fill critical manpower gaps in rapidly urbanising areas such as Effurun in Delta State (Adebiyi & Olawale, 2020). However, the informal nature of their work exposes them to multiple hazards, including electric shocks, burns, arc flashes, falls, musculoskeletal injuries, and fires associated with faulty connections or substandard tools (Okoye & Ezeonu, 2018). Many rely on improvised or locally fabricated equipment that fails to meet recognised safety standards, while the absence of structured training, regulatory supervision, and periodic certification further heightens risks (Umeokafor et al., 2022). Their predominantly apprenticeship-based training model, centred on observation rather than instruction, contributes to poor risk perception and unsafe practices (Okojie & Isah, 2019). Financial limitations also constrain access to quality personal protective equipment (PPE), resulting in inconsistent or non-use.

Although international guidelines emphasise hazard identification, risk assessment, continuous training, and proper PPE use as essential components of electrical safety (National Institute for Occupational Safety and Health [NIOSH], 2020), these standards are rarely enforced in informal economies. Weak regulatory systems, inadequate enforcement, and socio-economic constraints in developing countries—including Nigeria—contribute to persistent injury rates among informal workers (Aghaulor & Orji, 2021). Existing research often generalises occupational health and safety (OHS) concerns across informal trades such as mechanics and welders, offering limited insight into the distinct hazards of electrical work or the relationships between safety training, PPE use, equipment inspection, and injury outcomes among artisanal electricians (Okojie & Isah, 2019). In Effurun, anecdotal reports show common unsafe practices such as minimal PPE use, worn-out tools, inadequate inspection routines, and frequent exposure to live wires (Okoye & Ezeonu, 2018). Yet systematic data on the prevalence, types, and determinants of injuries remain scarce, despite the highly technical and potentially catastrophic nature of electrical hazards (Adebiyi & Olawale, 2020; Umeokafor et al., 2022).

Occupational Health and Safety (OHS) refers to policies and practices aimed at preventing work-related injuries and illnesses through hazard identification, risk assessment, preventive controls, and continuous training (ILO, 2021). In electrical work, this includes safe tool handling, adherence to lock-out/tag-out procedures, proper PPE use, and compliance with safety protocols designed to prevent shocks, burns, falls, and related injuries (NIOSH, 2020). OHS implementation is generally weak in informal environments due to limited

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oversight, inadequate safety monitoring, and restricted access to formal training (Umeokafor & Isaac, 2022). Artisans often work in hazardous settings characterised by exposed wiring, unstable ladders, cramped spaces, poor lighting, voltage fluctuations, and widespread use of generators, which increase the risk of shocks, arc flashes, eye injuries, cuts, and falls (Okeke & Nwosu, 2021; Eze & Okonkwo, 2022; Osei-Tutu & Boateng, 2020). Poorly insulated or improvised tools further elevate these risks (Adebiyi et al., 2020).

Safety behaviour including tool inspection, PPE compliance, and adherence to procedures plays a crucial role in reducing injuries (Rahman & Sarker, 2021). However, PPE use remains low among informal workers due to cost, discomfort, limited awareness, and cultural emphasis on experience rather than protection (Abdullahi & Shehu, 2022). Practical, hands-on training improves safety behaviour more effectively than theoretical instruction, and access to affordable PPE and supportive safety cultures enhances compliance (Adeyemi & Ogunyemi, 2023; Nwachukwu & Eke, 2020). Nevertheless, injuries such as shocks, burns, lacerations, eye injuries, falls, and musculoskeletal strains remain common, especially among apprentices with limited supervision (Okoro & Chukwu, 2021; Udo & Inyang, 2022). Weak reporting systems in the informal sector further obscure the true burden of injuries (Umeokafor & Isaac, 2022).

Theoretical frameworks provide insight into accident causation. Heinrich's Domino Theory illustrates how unsafe acts and unsafe conditions interact to produce accidents (Badri et al., 2020; Aishatu & Dahiru, 2023). The Systems Theory emphasises failures within interactions among workers, tools, tasks, and environments, demonstrating how inadequate training, poor equipment, client pressure, and lack of oversight amplify risk (Zohar & Polin, 2021; Rahman & Sarker, 2021). Reason's Swiss Cheese Model highlights how weaknesses across multiple layers of defence training, PPE availability, supervision, procedures, and equipment quality align to permit accidents (Reason, 2020; Okoro & Chukwu, 2021). These models collectively reinforce the need for systemic and behavioural interventions.

Despite the broad literature on informal-sector hazards, significant gaps remain regarding the specific risks, behaviours, and injury patterns of electrical artisans in Effurun. Prior studies often group artisans with other trades, obscuring the unique risks of high-voltage contact, arc flashes, power fluctuations, and tool-related failures (Adebiyi et al., 2020). Few studies empirically examine how safety practices, training, PPE use, and demographic factors influence injury outcomes (Udo & Inyang, 2022), and research rarely integrates accident causation theories to explain systemic contributors to injuries (Aishatu & Dahiru, 2023; Okoro & Chukwu, 2021). Localised evidence is particularly lacking despite Effurun's rapid urbanisation and high demand for artisanal electrical services.

This study addresses these gaps by assessing OHS practices among artisanal electricians in Effurun. It describes their socio-demographic characteristics, evaluates safety practices including PPE use, training, and equipment inspection determines injury prevalence and types, and examines associations between demographic factors, safety behaviours, and injury outcomes. The findings aim to inform policy, improve vocational training, and support evidence-based interventions tailored to the realities of informal electrical work.

II. Materials and Methods

2.1. Research Design

This study employed a descriptive cross-sectional survey design, which is appropriate for assessing occupational health and safety (OHS) practices at a single point in time. The design enables simultaneous measurement of exposure variables such as safety behaviour, hazard awareness, and PPE use and related outcomes like injury occurrence without manipulating conditions. It is also cost-effective and time-efficient, making it suitable for community-based studies where workers operate in dispersed and informal settings. Given that electrical artisans in Effurun work across roadsides, workshops, and residential areas, the cross-sectional approach allowed for efficient data collection and a broad representation of their safety practices. The design also supports both descriptive and inferential analyses, facilitating the exploration of relationships between demographics, safety behaviours, and injury experiences. Moreover, in the absence of centralised records for artisans, this approach enabled direct engagement with respondents in their natural work environments with minimal disruption.

2.2. Study Area

The study was conducted in Effurun, Uvwie LGA, Delta State, Nigeria, a rapidly urbanising economic hub with mixed residential, commercial, and light industrial land use. Effurun hosts numerous informal electrical workshops and roadside artisans providing wiring, appliance repairs, and general electrical services. These workplaces, ranging from makeshift stands to semi-permanent workshops, often lack structured safety systems or regulatory oversight. Most artisans acquire skills through informal apprenticeships that prioritise hands-on practice with limited theoretical safety training, increasing occupational health and safety (OHS) risks (Udo & Inyang, 2022). Effurun was selected due to its high concentration of informal electrical workers and limited documented evidence on their safety challenges, making it an ideal setting for generating localised data to guide targeted interventions.

2.3. Population and Sampling

The study population comprised artisanal electrical workers in Effurun, including roadside electricians, workshop technicians, and mobile repair artisans. Participants were required to be at least 18 years old and have a minimum of six months' experience to ensure sufficient exposure to work routines and hazards. Due to the absence of a central registry, a preliminary mapping identified active clusters across roadside workshops, markets, and neighbourhood installations. A purposive–systematic sampling approach was used, targeting eligible artisans while systematically selecting every second worker within clusters to ensure balanced representation and reduce selection bias. A total of 45 respondents were surveyed, providing a sufficient sample for exploratory analysis and chi-square testing of categorical occupational safety variables.

2.4. Instrument for Data Collection

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Data were collected using a structured, researcher-designed questionnaire covering demographics, safety behaviours, PPE use, safety training, equipment inspection, and injury history. Items were primarily closed-ended to facilitate coding and quantitative analysis. Content validity was established through review by three occupational and public health experts, whose feedback refined item wording and ensured alignment with study objectives. A pilot test with five artisans outside the study area assessed clarity, comprehension, and response consistency, leading to minor revisions. Reliability was confirmed via Cronbach's alpha, indicating acceptable internal consistency for measuring constructs related to safety practices and injury patterns.

2.5. Data Collection Procedure

Data were collected over a two-week period through face-to-face administration of questionnaires to accommodate varying literacy levels. The researcher visited each identified artisan cluster to introduce the study, explain its purpose, and obtain cooperation from workshop heads and senior technicians. Respondents were assured of confidentiality and voluntary participation. Completed questionnaires were reviewed on-site to reduce missing data and inconsistencies. Ethical principles, including informed consent, anonymity, privacy, and the right to withdraw, were strictly observed throughout the process.

2.6. Method of Data Analysis

Collected data were entered and cleaned in SPSS version 25, checking for missing values, coding errors, and logical inconsistencies. Descriptive statistics including frequencies, percentages, and tables summarised demographic characteristics and safety practices. Associations between categorical variables, such as safety training, PPE use, experience, and injury occurrence, were examined using chi-square tests of independence, with $p < 0.05$ indicating statistical significance. Findings were interpreted in the context of established accident causation models to provide a comprehensive understanding of observed relationships.

2.7. Ethical Considerations

Ethical principles guiding human research were strictly followed. Participants were informed of the study objectives, the voluntary nature of their involvement, and the confidentiality of their responses. No identifying information was collected and all data were used solely for academic purposes. Verbal consent was deemed appropriate due to the informal nature of the work setting and literacy variations among respondents.

III. Results and Discussion

3.1. Sociodemographic Characteristics of Respondents

A total of 45 artisanal electrical workers in Effurun participated in the study (Table 1). The workforce was dominated by adults aged 41–50 years (31.1%), indicating a mature group with substantial technical experience, consistent with findings in southern Nigeria (Adeyemi & Ogunyemi, 2023; Aishatu & Dahiru, 2023). Females comprised 53.3% of respondents, reflecting a growing trend of women engaging in skilled artisanal work due to economic pressures and expanded vocational opportunities (Abdullahi & Shehu, 2022), although they may face greater OHS risks due to limited formal training (Nwachukwu & Eke, 2020). Experience varied widely: 33.3% had less than one year, while 22.2% had over ten years of practice, highlighting the mix of novice and veteran artisans common in informal trade clusters (Udo & Inyang, 2022).

While 57.8% reported receiving some safety training, only 48.9% consistently used PPE, and just 24.4% inspected tools daily, with 22.2% never performing inspections, reflecting systemic barriers to safe work practices (Adebiyi et al., 2020; Okoro & Chukwu, 2021). Injury prevalence was high, with 60% reporting at least one work-related injury in the past year, yet only 57.8% sought medical care (Aishatu & Dahiru, 2023; Abdullahi & Shehu, 2022). These findings illustrate a workforce exposed to cumulative risks due to inconsistent safety behaviours, inadequate supervision, and weak preventive practices, underscoring the need for context-specific OHS interventions informed by accident causation frameworks (Reason, 2020; Badri et al., 2020)

TABLE 1: Summary of Respondent Characteristics and OHS Indicators (N=45)

Variable	Category	Frequency	Percent
Age Group	Under 20	7	15.6
	21-30	11	24.4
	31-40	7	15.6
	41-50	14	31.1
	Over 50	6	13.3
Gender	Male	21	46.7
	Female	24	53.3
Years of Experience	Less than 1 year	15	33.3
	1-5 years	8	17.8
	6-10 years	12	26.7
	More than 10 years	10	22.2
Regular Safety Training	Yes	26	57.8
	No	19	42.2
Use of PPE	Yes	22	48.9
	No	23	51.1
Frequency of Equipment Checks	Never	10	22.2
	Daily	11	24.4
	Weekly	9	20.0
	Monthly	10	22.2
	Rarely	5	11.1
Experienced Injuries (Past Year)	Yes	27	60.0
	No	18	40.0
Medical Assistance Sought	Yes	26	57.8
	No	19	42.2

Source: Field Survey, 2025

3.2. Association Between Safety Training and PPE Use

A chi-square test examined whether regular safety training influenced PPE use. Among 26 workers who received training, 15 reported PPE use, compared with 7 of 19 untrained workers (Table 2). Although the trend suggests higher PPE compliance among trained workers, the association was not statistically significant, $\chi^2(1, N = 45) = 1.91$, $p = .167$ (Table 3). Risk estimates indicated an odds ratio (OR) of 2.34, 95% CI = 0.69–7.87, with Cramer's V = 0.21 (small effect) and post-hoc power

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= 0.28. While trained workers were 2.34 times more likely to use PPE, the CI crossing 1.0 and low power indicate the effect is not statistically reliable.

The lack of significance may reflect the informal nature of training, which is often irregular, theoretical, or lacking practical demonstration, limiting behavioural impact (Zohar & Polin, 2021; Rahman & Sarker, 2021). Consistent with studies in the Niger Delta, OHS training alone does not reliably predict PPE compliance due to economic constraints, weak enforcement, and informal apprenticeship structures (Eze & Okonkwo, 2022; Abdullahi & Shehu, 2022). Effective PPE adoption requires practical, supervised, and resource-supported interventions.

TABLE 2: Crosstabulation for Regular Safety Training and Use of PPE

Regular Safety Training * Use of PPE Crosstabulation				
Count				
		Use of PPE		Total
		Yes	No	
Regular Safety Training	Yes	15	11	26
	No	7	12	19
Total		22	23	45

Source: Field Survey, 2025

TABLE 3: Chi-Square Test for Regular Safety Training and Use of PPE

Chi-Square Tests			
	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	1.910[a]	1	.167
Continuity Correction[b]	1.167	1	.280
N of Valid Cases	45		

Source: Field Survey, 2025

3.3. Association Between Gender and Injury Experience

Chi-square analysis examined the relationship between gender and injury experience (Table 5). Among respondents, 15 males and 12 females reported at least one work-related injury in the past year (Table 4). The association was not statistically significant, $\chi^2(1) = 2.14$, $p = .143$, indicating that injury risk does not differ by gender.

TABLE 4: Crosstabulation for Gender and Experience of Injuries

Gender * Experienced Injuries (Past Year) Crosstabulation				
Count				
		Experienced Injuries (Past Year)		Total
		Yes	No	
Gender	Male	15	6	21
	Female	12	12	24
Total		27	18	45

Source: Field Survey, 2025

TABLE 5: Chi-Square Test for Gender and Experience of Injuries

Chi-Square Tests			
	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	2.143[a]	1	.143
Continuity Correction[b]	1.343	1	.247
N of Valid Cases	45		

Source: Field Survey, 2025

This suggests that both male and female electrical artisans in Effurun face comparable hazards, with injury likelihood determined more by task exposure and safety practices than by gender. These findings are consistent with recent African studies showing that increased female participation in technical trades results in similar hazard exposure and risk patterns as males (Adebiyi et al., 2020).

3.4. Association Between Age and Injury Experience

Chi-square analysis showed no significant association between age and injury occurrence ($\chi^2 = 0.76$, $p = 0.943$; Table 7). Injury rates were similar across age groups, with younger (<20 years) and older (>50 years) workers reporting comparable experiences (Table 6).

This finding contrasts with literature suggesting higher accident rates among younger workers due to inexperience. In informal settings like Effurun, however, uniformly hazardous conditions such as poor wiring, limited PPE use, and minimal supervision expose all artisans to similar risks, mitigating age-related differences in injury prevalence (Umeokafor & Isaac, 2022).

TABLE 6: Crosstabulation for Age Group and Experience of Injuries

Age Group * Experienced Injuries (Past Year) Crosstabulation				
Count				
		Experienced Injuries (Past Year)		Total
		Yes	No	
Age Group	Under 20	5	2	7
	21-30	7	4	11
	31-40	4	3	7
	41-50	8	6	14
	Over 50	3	3	6
Total		27	18	45

Source: Field Survey, 2025

TABLE 7: Chi-Square Test for Age Group and Experience of Injuries

Chi-Square Tests			
	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	.763[a]	4	.943
Likelihood Ratio	.775	4	.942
N of Valid Cases	45		

Source: Field Survey, 2025

3.5. Relationship Between Work Experience and Injury

Chi-square analysis indicated no significant association between years of experience and injury occurrence ($\chi^2 = 1.94$, $p = 0.584$; Table 9). Although artisans with less than one year of experience reported slightly more injuries (n = 8), the difference was not statistically meaningful (Table 8).

TABLE 8: Crosstabulation for Years of Experience and Experience of Injuries

Years of Experience * Experienced Injuries (Past Year) Crosstabulation				
Count				
		Experienced Injuries (Past Year)		Total
		Yes	No	
Years of Experience	Less than 1 year	8	7	15
	1-5 years	6	2	8
	6-10 years	6	6	12
	More than 10 years	7	3	10
Total		27	18	45

Source: Field Survey, 2025

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This finding suggests that experience alone does not mitigate risk in informal electrical work, where systemic hazards prevail. Experienced workers may take unsafe shortcuts due to overconfidence, while novices face limited hazard awareness, resulting in comparable injury exposure across experience levels (Rahman & Sarker, 2021; Osei-Tutu & Boateng, 2020).

TABLE 9: Chi-Square Test for Years of Experience and Experience of Injuries

Chi-Square Tests			
	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	1.944[a]	3	.584
Likelihood Ratio	1.993	3	.574
N of Valid Cases	45		

Source: Field Survey, 2025

3.6. Relationship Between PPE Use and Injury Occurrence

Chi-square analysis showed no significant association between PPE use and injury experience ($\chi^2 = 1.20$, $p = 0.273$; Table 11). Among PPE users, 15 reported injuries, while 12 non-users also sustained injuries (Table 10).

This counterintuitive result reflects patterns common in informal work settings, where PPE use is often inconsistent, improper, or reliant on damaged or improvised equipment, limiting its protective effect. Additionally, workers performing the riskiest tasks may be more likely to use PPE, potentially inflating injury counts among users (Aishatu & Dahiru, 2023).

TABLE 10: Crosstabulation for Use of PPE and Experience of Injuries

Use of PPE * Experienced Injuries (Past Year) Crosstabulation				
Count				
		Experienced Injuries (Past Year)		Total
		Yes	No	
Use of PPE	Yes	15	7	22
	No	12	11	23
Total		27	18	45

Source: Field Survey, 2025

TABLE 11: Chi-Square Test for Use of PPE and Experience of Injuries

Chi-Square Tests			
	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	1.201[a]	1	.273
Continuity Correction[b]	.626	1	.429
N of Valid Cases	45		

Source: Field Survey, 2025

IV. Conclusion

This study assessed occupational health and safety (OHS) practices among artisanal electrical workers in Effurun, Delta State, highlighting systemic safety challenges rather than individual-level risk factors. Injury prevalence remained high across all age, gender, and experience groups, indicating that demographic characteristics do not significantly influence risk (Aishatu & Dahiru, 2023; Umeokafor & Isaac, 2022; Okoro & Chukwu, 2021). Key hazards included inconsistent use of personal protective equipment (PPE), irregular tool inspections, and limited access to structured, practical safety training. The lack of significant associations between training, PPE use, and injury occurrence suggests that existing interventions are often theoretical, insufficiently supervised, or resource-constrained (Adeyemi & Ogunyemi, 2023; Rahman & Sarker, 2021; Eze & Okonkwo, 2022). Findings align with Heinrich's Domino Theory and Reason's Swiss Cheese Model, illustrating how unsafe acts, hazardous conditions, and weak safety barriers converge to produce accidents (Badri et al., 2020; Reason, 2020). The results underscore that systemic and structural factors weak governance, fragmented apprenticeship systems, inadequate supervision, and limited safety resources—drive injury risk more than personal attributes. The study contributes to knowledge on informal-sector OHS by providing empirical evidence on artisanal practices, demonstrating the limited role of demographics in predicting injuries, and highlighting structural deficiencies that compromise safety. Effective risk reduction requires multi-layered interventions encompassing practical training, improved supervision, stronger regulation, and accessible, quality PPE (Abdullahi & Shehu, 2022; Okeke & Nwosu, 2021).

V. Recommendations

1. Strengthen Training & Apprenticeships: Implement structured, competency-based OHS training with mandatory refreshers; integrate practical safety instruction and mentorship into apprenticeships (Adeyemi & Ogunyemi, 2023; Rahman & Sarker, 2021).
2. Improve Safety Resources: Enhance access to quality PPE through subsidies or bulk procurement; train artisans on routine tool inspections (Eze & Okonkwo, 2022; NIOSH, 2020).
3. Enhance Oversight & Collaboration: Enforce safety regulations; encourage injury reporting; promote multi-stakeholder initiatives involving government, unions, NGOs, and communities (Abdullahi & Shehu, 2022; Okeke & Nwosu, 2021).

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