Assessment of Clinical Laboratory Safety in Pathology Laboratories in a Tertiary Health Facility in Benin City, Nigeria

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ABSTRACT

Background: Clinical pathology laboratories are high-risk occupational environments. Despite the availability of national and international bio-safety frameworks, compliance within Nigerian tertiary health care facilities remains inconsistent. This study assessed the key components of clinical laboratory safety in the pathology laboratories of the University of Benin Teaching Hospital (UBTH), Benin-City, Nigeria.

Methods: A descriptive cross-sectional study conducted across four pathology departments. Total enumeration was employed and 185 valid structured questionnaires were analyzed. The instrument comprised 25 items across five domains: Demography, safety policies and infrastructure, hazard management and risk assessment, standard operating procedures, and safety training and culture. A composite safety score (0–100%) was computed per respondent from 20 scored items; a score ≥60% was classified as satisfactory. Inferential analyses included Kruskal-Wallis tests, chi-square tests of independence, and Spearman rank correlation (α=0.05).

Results: The mean composite safety score was 71.8% (SD±21.4%), with 144 respondents (77.8%) classified as satisfactory. Written safety policy availability was confirmed by 76.2% of the respondents and proficiency testing participation by 84.3%, whilst functional safety equipment was rated adequate by only 56.8%. Hazard awareness was high (93.0% favourable), but PPE was always available to only 38.9% of the respondents, and consistent PPE use was reported by 68.6%. SOP availability was strong for specimen handling (94.6%) and waste disposal (87.0%), but formal safety training in the preceding 12 months was received by only 62.2% of personnel. Composite scores differed significantly by professional cadre (Kruskal-Wallis H=36.53, p<0.001), department (H=9.85, p=0.020), and years of experience (H=10.32, p=0.006). Safety training receipt varied significantly across departments (χ^2=11.00, df=3, p=0.012). All four safety domains correlated strongly with the composite score (Spearman ρ range: 0.671–0.814, all p<0.001).

Conclusion: Safety infrastructure at UBTH was partially established but substantive deficiencies persist in equipment adequacy, PPE availability and consistent use, equitable training distribution, and incident reporting. Professional cadre, department, and experience were significantly associated with safety performance. A comprehensive, evidence-based institutional safety improvement programme is urgently required.

Keywords: Laboratory safety; Personal protective equipment; Safety culture, Occupational health.

INTRODUCTION

Clinical pathology laboratories are foundational to modern health care delivery, generating the diagnostic information that underpins an estimated 70% of clinical decisions (Briana, 2023). However, the routine processing of infectious biological specimens, toxic chemical reagents, sharps, and complex equipment renders these settings inherently high-risk for occupational injury and laboratory-acquired infection (Coelho et al., 2015). The World Health Organization (WHO) has consistently emphasized laboratory safety as a pillar of quality laboratory practice, affirming that safety failures can culminate in laboratory-acquired infections, chemical injuries, and deaths (WHO, 2020).

In Nigeria, clinical laboratories confront compounded safety challenges: an elevated burden of infectious diseases including HIV, viral hepatitis B and C, tuberculosis, and periodically emerging haemorrhagic fevers; resource constraints; and variable regulatory enforcement of bio-safety standards (Ekejindu et al., 2019; Ibekwe et al., 2020). However, there is a high rate of non-reporting of these incidents regardless of the many occupational hazards that may jeopardize the health of laboratory personnel (Isara et al., 2012; Alice et al., 2013). Whilst the Federal Ministry of Health has promulgated national bio-safety and bio-security guidelines as an accreditation framework, evidence consistently indicates sub-optimal compliance across Nigerian tertiary facilities, with documented deficiencies in personal protective equipment (PPE) procurement, safety equipment availability, waste management, and training frequency (FMOH,2016; MLSCN, 2017).

The University of Benin Teaching Hospital (UBTH), a 700-bed federal tertiary institution, serves as the principal referral centre for the South-South geopolitical zone of Nigeria. Its pathology division, comprising histopathology, chemical pathology, haematology and blood transfusion, and medical microbiology and parasitology, processes thousands of specimens annually from a high-risk patient population. No prior comprehensive, institution-specific safety assessment of these laboratories had been published. This study was therefore conducted to: (i) evaluate the adequacy of existing safety policies and infrastructure; (ii) characterize hazardous material management and risk assessment practices; (iii) assess standard operating procedure (SOP) availability; and (iv) quantify the level of safety training and awareness among laboratory personnel.

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MATERIALS AND METHODS

This was a descriptive cross-sectional study conducted in the pathology division of UBTH, Benin-City, Edo State, Nigeria. The four constituent departments are Histopathology, Chemical pathology, Haematology and Blood transfusion, and Medical Microbiology and Parasitology were all included and data collection was conducted over a four-week period.

The study population comprised all categories of laboratory personnel working in the pathology laboratories: consultant pathologists, resident doctors, medical laboratory scientists (MLS), medical laboratory technicians, laboratory attendants, and interns. A total enumeration (census) approach was adopted given the finite and accessible nature of the target population. All personnel who provided written informed consent and were present during data collection were eligible. A total of 185 laboratory personnel participated in the study.

Data were collected using a structured, self-administered questionnaire comprising 25 items across five sections, adapted from the WHO Laboratory Assessment Tool (WHO, 2012) and contextualized for the Nigerian laboratory environment. Section A captured socio-demographic data (cadre, departmental affiliation, years of laboratory experience). Section B assessed safety policies and infrastructure across five items. Section C evaluated risk assessment and hazard management, including biological and chemical hazard awareness, labeling and storage of hazardous materials, routine risk assessment conduct, and physical workspace adequacy and ergonomics. Section D assessed SOP availability across four categories: specimen handling, equipment use, decontamination and sterilisation, and waste disposal. Section E assessed safety training, spill and emergency response familiarity, incident reporting promptness, and overall safety culture satisfaction. The instrument was pilot-tested among ten laboratory workers at a comparable facility; Cronbach's alpha was 0.73, confirming acceptable internal consistency

A composite safety score was computed per respondent from 20 scored items across all five sections. Each item was dichotomised as favourable (score=1) or unfavourable (score=0): affirmative ('Yes') responses to binary items; 'Always' for frequency-scale items; and 'Strongly

Agree' or 'Agree' for Likert-scale items. Responses of 'Not Sure' were treated as missing for scoring purposes. The composite score was expressed as the percentage of favourable responses among all scoreable items answered (range: 0–100%). Respondents scoring ≥60% were classified as 'Satisfactory'; scores below 60% as 'Unsatisfactory'.

Statistical Analysis

Data were analysed using Python (v3.11) with pandas, numpy, and scipy libraries. Descriptive statistics (frequencies, percentages, means, standard deviations, medians, interquartile ranges) were computed for all variables. Given the non-normal distribution of composite scores, non-parametric inferential tests were used: the Kruskal-Wallis H test assessed differences in median composite scores by professional cadre, department, and years of experience; chi-square tests of independence examined associations between categorical variables; and Spearman's rank correlation coefficient (ρ) quantified domain-composite score relationships. A two-tailed $p<0.05$ was the threshold for statistical significance.

Ethical Considerations

Ethical approval was obtained from the Ethics and Research Committee of UBTH (ADM/E22/A/VOL. VII/1483130188). Written informed consent was obtained from all participants. Questionnaires were fully anonymized; data were stored in password-protected files accessible only to the principal investigators and used solely for research purposes.

RESULTS

Socio-Demographic Characteristics

A total of 185 valid questionnaires were analysed. Medical Laboratory Scientists constituted the largest cadre (n=91, 49.2%), followed by Consultants/Residents (n=36, 19.5%), Technicians (n=25, 13.5%), Interns (n=20, 10.8%), and Attendants (n=13, 7.0%). Microbiology was the most represented department (n=56, 30.3%), followed by Haematology (n=54, 29.2%), Chemical Pathology (n=39, 21.1%), and Histopathology (n=36, 19.5%). Almost half of the respondents (n=91, 49.2%) had fewer than five years of laboratory experience; 48 (25.9%) had five to ten years; and 40 (21.6%) had more than ten years (Table 1).

Safety Policies and Infrastructure (Section B)

The presence of written laboratory safety policies was affirmed by 141 respondents (76.2%), whilst 18 (9.7%) denied their presence and 26 (14.1%) were uncertain. Only 109 (58.9%) agreed that Safety manuals and emergency contact information were visibly displayed in the laboratory. The number of respondents who affirmed that Incident records were maintained was 142 (76.8%) and equipment was serviced on time as reported by 122 (65.9%) respondents. Participation in external proficiency testing was affirmed by 156 respondents (84.3%). Functional safety equipment was rated as adequate by 105 respondents (56.8%), inadequate by 51 (27.6%), and entirely unavailable by 7 (3.8%). (Table 2)

Table 1: Socio-demographic characteristics of study respondents (N=185).

Variable	Category	Frequency (n)	Percentage (%)
Professional Cadre	Medical Laboratory Scientist	91	49.2
	Consultant/Resident	36	19.5
	Technician	25	13.5
	Intern	20	10.8
	Attendant	13	7.0
Department	Microbiology	56	30.3
	Haematology	54	29.2
	Chemical Pathology	39	21.1
	Histopathology	36	19.5
Experience	<5 years	91	49.2
	5–10 years	48	25.9
	>10 years	40	21.6
Total	—	**185**	**100.0**

Risk Assessment, Hazard Management, and PPE

Hazard awareness was rated favourable by 172 respondents (93.0%). Routine risk assessment before new procedures was confirmed by 116 respondents (62.7%). The laboratory atmosphere was perceived as satisfactory by 116 respondents (62.7%), whilst adequacy of workspace was affirmed by only 100 (54.1%) and ergonomic

sufficiency by 88 respondents (47.6%), indicating substantial environmental concerns. Hazardous materials were always properly labelled and stored according to 155 respondents (83.8%). However, appropriate PPE was always available to only 72 respondents (38.9%), with 100 respondents (54.1%) reporting it as only sometimes available; consistent PPE use was reported as 'always' by 127 participants (68.6%). Occupational incidents were always promptly reported by 116 respondents (62.7%), sometimes by 56 (30.3%), and never by 12 (6.5%). (Table 3)

Standard Operating Procedures

SOP availability across all four categories was high, with the presence of specimen handling SOPs affirmed by 175 respondents (94.6%), equipment use SOPs were said to be present by 155 respondents (83.8%), the presence of decontamination and serialization SOPs was affirmed by 136 (73.5%), and waste disposal SOPs said to be present by 161 respondents (87.0%). (Figure 1)

Table 2: Safety policies and infrastructure (Section B) (N=185). — = not applicable for this item.

Item	Yes n (%)	No n (%)	Not Sure n (%)
Written Safety Policy Available	141 (76.2%)	18 (9.7%)	26 (14.1%)
Safety Manual & Contacts Visible	109 (58.9%)	74 (40.0%)	—
Incident Records Maintained	142 (76.8%)	37 (20.0%)	1 (0.5%)
Equipment Serviced on Time	122 (65.9%)	59 (31.9%)	—
Proficiency Testing Participation	156 (84.3%)	23 (12.4%)	2 (1.1%)
Safety Equipment: Adequate	105 (56.8%)	Inadequate: 51 (27.6%)	Not Available: 7 (3.8%)

Safety Training and Safety Culture

Formal laboratory safety training in the preceding twelve months had been received by 115 respondents (62.2%), leaving 69 (37.3%) without recent training. Familiarity with spill management and emergency response procedures was reported by 126 participants (68.1%), whilst 22 (11.9%) indicated a lack of familiarity. Overall safety culture was rated favourable by 155 respondents (83.8%). Safety training receipt varied significantly by department (χ^2=11.00, df=3, p=0.012): training was most prevalent in Microbiology (44/56, 78.6%) and least common in Histopathology (17/36, 47.2%). (Table 4)

Composite Safety Score and Inferential Analysis

The mean composite safety score was 71.8% (SD±21.4%), with a median of 75.0% (IQR 60.0–89.5%). Overall, 144 respondents (77.8%) were classified as satisfactory (≥60%) and 41 (22.2%) as unsatisfactory. (Table 5)

Safety outcome (satisfactory vs unsatisfactory) was significantly associated with professional cadre (χ^2=40.76, df=4, p<0.001). Spearman rank correlation between domain-specific and composite scores revealed strong positive associations across all four domains: Safety Policies and Infrastructure (ρ=0.802, p<0.001); Risk Assessment and PPE (ρ=0.769, p<0.001); SOPs (ρ=0.671, p<0.001); and Training, Incidents, and Safety Culture (ρ=0.814, p<0.001). Training, Incidents, and Safety Culture exhibited the strongest correlation with the overall composite score.

Table 3: Risk assessment, hazard management and PPE

Item	Favourable Response	N	%
Hazard Awareness	Strongly Agree / Agree	172	93.0
Routine Risk Assessment Conducted	Yes	116	62.7
Lab Atmosphere Satisfactory	Yes	116	62.7
Workspace Adequacy Confirmed	Yes	100	54.1
Ergonomics Adequate	Yes	88	47.6
Hazardous Materials Always Labelled	Always	155	83.8
PPE Always Available	Always	72	38.9
PPE Always Used	Always	127	68.6
Incidents Always Promptly Reported	Always	116	62.7

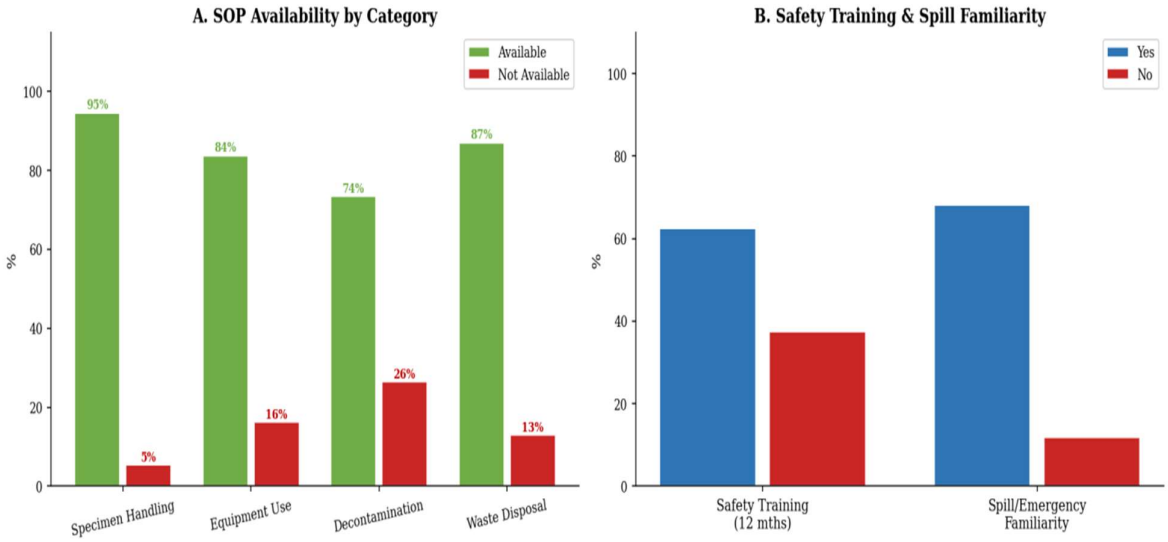

Figure 1: Standard operating procedure availability (N=185).

Table 4: Safety training, incident reporting and safety culture (Section E) (N=185).

Item / Category	Yes n (%)	No n (%)	Not Sure n (%)
Formal Safety Training (last 12 months)	115 (62.2)	69 (37.3)	—
Spill/Emergency Response Familiarity	126 (68.1)	22 (11.9)	37 (20.0)
Overall Safety Culture (SA/Agree)	155 (83.8)	28 (15.1)	—
Training: Microbiology	44 (78.6)	12 (21.4)	—
Training: Haematology	33 (61.1)	21 (38.9)	—
Training: Chemical Pathology	21 (53.8)	18 (46.2)	—
Training: Histopathology	17 (47.2)	19 (52.8)	—

SA = Strongly Agree. — = not applicable.

Table 5: Composite safety scores by cadre, department and years of experience.

Group	n	Mean ± SD	Median	Satisfactory n (%)	Test Statistic
Professional Cadre	—	—	—	—	KW H=36.53, p<0.001
MLS	91	77.2 ± 15.1	80.0	82 (90.1)	—
Consultant/Resident	36	50.1 ± 23.2	48.5	14 (38.9)	—
Technician	25	79.8 ± 21.1	85.0	21 (84.0)	—
Intern	20	74.0 ± 22.3	77.5	17 (85.0)	—
Attendant	13	75.3 ± 16.1	80.0	10 (76.9)	—
Department	—	—	—	—	KW H=9.85, p=0.020
Microbiology	56	77.5 ± 19.6	80.0	—	—
Haematology	54	71.1 ± 22.8	72.5	—	—
Chemical Pathology	39	70.9 ± 21.4	72.5	—	—
Histopathology	36	64.9 ± 20.5	65.0	—	—
Years of Experience	—	—	—	—	KW H=10.32, p=0.006
<5 years	91	76.0 ± 20.5	80.0	—	—
5–10 years	48	70.6 ± 20.8	72.5	—	—
>10 years	40	63.7 ± 21.8	65.0	—	—
Total	**185**	**71.8 ± 21.4**	**75.0**	**144 (77.8)**	**—**

KW = Kruskal-Wallis. MLS = Medical Laboratory Scientist. — = not computed for this sub-row.

DISCUSSION

The composite safety performance observed in this study falls within a range that has been characterized as intermediate across sub-Saharan African tertiary laboratory settings neither critically deficient nor comprehensively adequate. Comparable studies conducted in Kenya and Gabon have documented similar intermediate levels of bio safety compliance in tertiary referral laboratory environments, suggesting that our findings are not anomalous but rather reflect a systemic pattern common to resource-limited institutional settings where partial safety infrastructure has been established without the organizational mechanisms needed to ensure consistent implementation (Manouana et al., 2021; Mutisya et al., 2022). What distinguishes the profile in this study, however, is the marked intra-institutional heterogeneity captured by the high standard deviation of the composite score: safety performance which varies substantially across individuals, cadres, and departments rather than being uniformly distributed, a pattern with direct implications for improvement interventions. The inclusion of SOP items for specimen handling and equipment use noted in this study, inflates the composite score relative to instruments that weight hazard management and training items more heavily.

This study revealed a structural gap between the formal documentation of safety policies and their operational realization at the point of work. The WHO Laboratory Bio safety Manual (WHO, 2020) and ISO 15190:20205 (ISO, 2020) both stipulate that safety documentation must not be merely present but actively accessible to all personnel during the performance of relevant tasks. Compliance with the letter of these requirements while violating their spirit by confining policy documents to administrative offices is a finding that Nzinga et al. (2022) documented across multiple African hospital settings. The inadequacy of functional safety equipment represents a more fundamental compliance failure. Unlike the accessibility of documentation, which is addressable through procedural changes at minimal cost, equipment deficits require capital investment that is directly constrained by institutional resource allocation decisions. The evidence from East African teaching hospitals (Mwangi et al., 2023) and from south-western Nigerian laboratories (Ogunnowo et al., 2018; Adegboye et al., 2021) indicates that this deficit is structural and systemic, not incidental, and will not be resolved without sustained financial commitment from hospital management and federal health authorities alike.

The disconnect between high theoretical hazard awareness and deficient operational risk management practice is one of the most instructive findings of this study. Knowledge of hazards, whilst necessary, is insufficient to guarantee safe behaviour in the absence of institutional systems that translate that knowledge into structured procedural action. The under-performance on routine pre-procedure risk assessment reflects the absence, in most African tertiary laboratories, of a dedicated safety officer role; a position whose existence correlates strongly with proactive risk management practice in higher-income settings (Acheampong et al.,2023). The WHO Laboratory Biosafety Manual (WHO, 2020) and ISO 15190:2020 (ISO, 2020) are unambiguous in requiring systematic hazard assessment before the introduction of new procedures; the gap between policy mandates and ground-level implementation in this tsudy echoes findings from Ghanaian tertiary laboratories reported by Acheampong et al., 2023. The widespread dissatisfaction with the physical working environment encompassing workspace adequacy and ergonomics reflects a dimension of laboratory occupational risk that has historically received insufficient institutional attention in African settings. Bello et al. (2022) documented significant musculoskeletal morbidity among Ghanaian laboratory workers attributable precisely to the ergonomic deficiencies described in this study, and have argued that ergonomic safety must be integrated into laboratory safety governance frameworks alongside more traditionally emphasised biological and chemical hazard controls.

The tension between reported PPE use rates and confirmed PPE availability rates where a higher proportion of personnel claim always to use PPE than confirm it is always available points to one of two interpretive possibilities: either availability is underestimated through response bias, or PPE use is overestimated through social desirability. Both effects are well-established in self-reported occupational safety research. (Acheampong et al., 2023). What the data unambiguously establishes however, is that PPE procurement remains inadequate relative to institutional need, a finding with direct life-safety consequences in a laboratory environment where blood-borne pathogen exposure is an ever-present occupational risk. Gebreyesus et al. (2021) demonstrated that in Ethiopian clinical laboratories, even where PPE were physically present, consistent use across all

specimen-handling activities was not guaranteed, attributing the residual gap to normalized risk perception and inadequate supervisory enforcement. Suleiman et al. (2020) contextualized this further in the Nigerian hospital setting, demonstrating that the attitude of perceived invulnerability in which experienced workers come to regard infectious exposures as routine rather than hazardous is a primary driver of PPE non-compliance that procurement alone cannot address. The implication is that a dual strategy is required: closing the supply gap through sustained procurement, and closing the behavioural gap through supervisory reinforcement and targeted attitude-change interventions.

The strong SOP documentation profile particularly for specimen handling and waste disposal represents a genuine institutional strength and distinguishes the centre of this study from many comparable African facilities where procedural documentation has been reported as wholly inadequate (Adegboye et al., 2021) However, it would be analytically premature to equate SOP availability with SOP adherence: the laboratory safety literature consistently demonstrates that the existence of documented procedures does not guarantee their consistent application, particularly in resource-constrained environments where supervisory oversight is limited and workload pressures are high. The relative weakness in decontamination and sterilization SOP availability; a procedure with direct infection control implications is a prioritized remediation target, and institutional leadership should ensure that SOP development efforts extend to encompass this domain comprehensively and that all documentation is subject to periodic review and revision in line with emerging evidence and evolving practice standards.

The sub-optimal coverage of formal safety training, with more than one-third of personnel reporting no training in the preceding year, falls meaningfully below the standard of regular, documented safety instruction required by the WHO (WHO, 2020) and ISO15190:2020 (ISO, 2020) for all laboratory personnel. More concerning still is the statistically significant inter-departmental disparity in training coverage: the gradient from Microbiology to Histopathology reflects an institutional pattern whereby biological containment training has been historically prioritized in infection-focused departments whilst other pathology disciplines where chemical, physical, and carcinogenic hazard exposures are arguably more acute have been systematically under-served. This pattern was similarly documented by Fwembe et al. (2022) in Zambian tertiary hospitals and reflects a structural inequity in safety education investment that perpetuates differential occupational risk across professional groups and disciplines. A way forward is a fundamental redesigning of the institutional training framework to include all cadres and all departments equitably, with content tailored to the discipline-specific hazard profiles of each laboratory unit.

The finding that the most highly trained and most experienced personnel within the pathology division exhibit the weakest safety performance on both the composite score and the satisfactory rate is counter-intuitive but conceptually coherent within the occupational safety literature. The inferior performance of Consultants and Resident Doctors relative to all other cadres has a straightforward explanatory basis: the medical training curriculum, unlike the laboratory science formation, has not traditionally incorporated laboratory-specific occupational safety instruction, leaving medically trained personnel without the procedural safety knowledge that bench-level laboratory staff acquire through professional education and daily supervised practice. Ihejirika et al. (2023) documented precisely this differential in a Nigerian teaching hospital and made the same observation that Xu et al. (2003) had confirmed through accident analysis in research laboratories globally: that gaps in safety knowledge among senior or highly qualified personnel constitute a disproportionate institutional risk because such individuals may simultaneously underestimate their own exposure, be less subject to supervisory correction, and model unsafe behaviours for junior staff who are inclined to defer to their seniority. Mandatory, laboratory-specific safety training for all clinical staff accessing pathology laboratories regardless of professional rank is therefore an intervention of the highest priority. There was an inverse relationship between years of laboratory experience and safety performance in our study. Whereas the cadre effect is primarily attributable to differential professional formation, the experience effect reflects a temporal process of risk habituation whereby repeated exposure to occupational hazards without adverse outcomes engenders what the occupational health literature terms 'normalization of deviance' the gradual acceptance of non-compliant behaviours as organisationally and personally acceptable (Xu et al., 2003). Experienced laboratory workers may genuinely perceive additional safety precautions as unnecessary given their proficiency in routine

tasks, even though their proficiency does not reduce the underlying biological or chemical hazard. Gebreyesus et al. (2021) and Osei et al. (2021) have both documented this pattern in African laboratory settings, and their findings collectively support the imperative that refresher safety education programmes are necessary to actively and recurrently re-engage the most experienced members of the laboratory workforce. The high overall safety culture satisfaction rate is difficult to reconcile with the specific safety deficiencies documented across multiple domains. This discordance is analytically consistent with the broader observation in the occupational safety literature that subjective perceptions of institutional safety climate are a poor surrogate for objective safety performance, and may reflect the operation of cognitive dissonance whereby individuals maintain a coherent positive institutional narrative that accommodates specific non-compliant behaviours by framing them as isolated exceptions rather than systemic failures (Osei et al., 2021; Acheapong et al., 2023). The important implication is that safety culture surveys that measure satisfaction or perceived institutional commitment to safety should not be interpreted as performance metrics: they measure attitudes, not behaviours, and the two frequently diverge. Objective, observational safety audit methods would provide a more reliable and valid complement to questionnaire-based self-report, and their incorporation into future safety assessments is strongly recommended. It is clear from our findings that incident reporting norms and emergency preparedness are the most powerful determinants of aggregate safety performance. This finding is consistent with the theoretical modelling of Naji et al. (2021) who demonstrated through structural equation analysis that safety culture exerts both direct and indirect effects on safety outcomes, and with the empirical evidence assembled by Ezenwa et al., (2022) who showed that safety culture improvements are durable only when institutionally sustained rather than episodically reinforced.

CONCLUSION

This study provides the first comprehensive, institution-specific assessment of clinical laboratory safety in the pathology laboratories of the University of Benin Teaching Hospital. Our findings indicate a broadly adequate but heterogeneous safety performance. SOP documentation is strong, particularly for specimen handling and waste disposal; however, significant deficiencies persist in functional safety equipment availability, PPE procurement, pre-procedure risk assessment, equitable safety training distribution, and incident reporting. Professional cadre, departmental affiliation, and years of experience are strong determinants of safety outcome. These findings challenge assumptions about seniority and safety competence. Safety training and institutional culture are the strongest predictors of aggregate safety performance. A comprehensive, multi-pronged institutional safety improvement strategy is urgently required. The findings in this study contributes to the limited evidence base on laboratory safety in Nigerian tertiary hospitals and offers a replicable assessment methodology for comparable institutions across the country.

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Conflicts of interest
None declared

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