Assessment of Regulatory Gaps in Environmental Health Monitoring of Restaurants and Local Cook Shops in Sanniquellie City, Nimba County, Liberia

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ABSTRACT

Food safety is a major public health challenge in Liberia due to weak regulatory enforcement and limited county-level capacity. Despite the National Food and Feed Quality and Safety Act (2019), implementation gaps persist in rural counties like Nimba. This mixed-methods study assessed awareness, compliance, and enforcement challenges among food business operators in Nimba County. A sequential explanatory mixed-methods design was employed. Quantitative data were collected from 90 food establishments using structured questionnaires and a 30-item observational hygiene checklist. Descriptive statistics, Chi-square tests, and Spearman's rank correlation were used to analyze associations and relationships. Qualitative data were obtained through semi-structured key informant interviews (n=15) with regulatory officials and a review of national and county-level policy documents. Thematic analysis was applied to qualitative data. The majority of operators were female (65.6%), had secondary education or below (87.7%), and had operated for 1-5 years (53.3%). Only 26.7% had received food safety training. Awareness of the National Food and Feed Quality and Safety Act (2019) was low (31.1%), as was knowledge of licensing requirements (42.2%) and penalties for non-compliance (18.9%). Self-reported inspections were infrequent, with 38.9% of establishments never inspected in the past 12 months. Observational compliance was moderate, with a mean score of 14.8 out of 30 (49.3%). Critical gaps included ineffective pest control (46.7% non-compliant), inadequate waste management (31.1%), and insufficient handwashing facilities (32.3%). Chi-square tests revealed significant associations between type of establishment, education level, training received, and inspection frequency ($p < 0.001$). Spearman's correlation showed a weak positive relationship between years of operation and compliance score ($\rho = 0.248$, $p = 0.019$). Key informants highlighted irregular inspections due to resource constraints, poor inter-agency coordination, and the near absence of operator training. National frameworks exist but lack county-specific adaptation and systematic enforcement. Priority actions include scaling up low-cost mandatory training for cook shops, adopting risk-based digital inspections, strengthening inter-agency coordination, and providing subsidies to reduce compliance costs, should be introduced while supporting the Liberian Food Safety Initiative (LiFSI).

Keywords: Environmental health monitoring; Regulatory gaps; Local cook shops; Food safety; Sanitation

INTRODUCTION

Environmental health monitoring of food service establishments is essential for preventing foodborne diseases (FBDs) and safeguarding public health, especially in rapidly urbanizing areas of low- and middle-income countries. Restaurants and informal local cook shops (often called "cook bowl shops" in Liberia) serve as critical points of food consumption, yet they frequently operate with inadequate hygiene, sanitation, and

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regulatory oversight. In sub-Saharan Africa, the informal food sector dominates urban food supply, exposing consumers to elevated risks of contamination from pathogens such as *Salmonella*, *E. coli*, and *Staphylococcus aureus* due to poor handwashing, inadequate waste management, and limited access to clean water (Tohonon et al., 2025; Ayalew et al., 2023).

Liberia's food safety landscape reflects broader regional challenges. The country enacted the National Food and Feed Quality and Safety Act in 2019 and established the Food Authority of Liberia to coordinate oversight. However, implementation remains fragmented, with overlapping mandates among the Ministry of Health and Social Welfare (Division of Environmental and Occupational Health), the Ministry of Commerce and Industry, and the Liberia National Public Health Institute. Recent efforts, including the Liberian Food Safety Initiative (LiFSI) launched with support from the European Union and UNIDO, aim to strengthen risk-based inspection, standards development, and compliance along value chains. Despite these initiatives, systematic environmental health monitoring of restaurants and small-scale cook shops is inconsistent, particularly outside Monrovia (UNIDO, 2024).

Sanniquellie City, the administrative capital of Nimba County, is a bustling commercial and transit hub near the borders with Guinea and Côte d'Ivoire. The city has experienced population growth and increased economic activity, leading to a proliferation of restaurants and informal cook shops that cater to residents, traders, and travellers. These establishments often operate in environments with limited access to potable water, unreliable electricity, poor solid waste and wastewater management, and weak sanitation infrastructure. Reports of food poisoning incidents in Nimba County, including clusters in nearby areas such as Tappita and Ganta, underscore the public health risks associated with unregulated food handling practices (Domah, 2023). Evidence from the same locality reinforces this concern: a companion survey by the present research team of 381 healthcare workers and community members across Nimba's Bain-Garr and Sanniquellie-Mah districts found cholera and typhoid to be the most frequently reported waterborne diseases (55.9%), with most respondents perceiving climate-sensitive disease to be rising, an environmental disease burden to which unsafe food handling and weak sanitation plausibly contribute.

Across sub-Saharan Africa, regulatory gaps in environmental health monitoring of food outlets are well documented. These include infrequent inspections, insufficient training of environmental health officers and food handlers, weak enforcement mechanisms, outdated or poorly adapted regulations for informal sectors, and limited laboratory capacity for routine testing. In many settings, monitoring focuses more on formal establishments while largely overlooking small-scale and informal cook shops, which constitute the majority of food service points in urban and peri-urban areas. Such gaps contribute to high burdens of FBDs, undermine consumer confidence, and hinder progress toward Sustainable Development Goal 3 (Good Health and Well-being) (WHO, 2024; Nijhawan et al., 2023; Bekele et al., 2025).

The study draws on three complementary theories to interpret these dynamics. Pigou's (1932) Public Interest Theory of Regulation frames environmental health monitoring as a public good intended to correct market failures such as poor sanitation, and is used here to assess whether regulatory institutions in Sanniquellie City are meeting that protective purpose. Stigler's (1971) Regulatory Capture Theory helps examine whether observed enforcement gaps reflect weak or compromised oversight arising from the closeness of regulators to the businesses they monitor. Von Bertalanffy's (1968) Systems Theory situates environmental health monitoring as an interdependent system of policies, personnel, and resources, in which gaps in one component (e.g., staffing or coordination) undermine the whole. Together, these perspectives inform the interpretation of the regulatory, institutional, and behavioural gaps identified in this study.

In Liberia, the Public Health Law (Title 33) and related hygiene requirements for eating places exist on paper, but enforcement is challenged by resource constraints, overlapping institutional responsibilities, and limited sub-national capacity. The recent introduction of mandatory licensing fees for cook bowl shops (e.g., US$50 annually under the Liberia National Tourism Authority) signals growing recognition of the informal sector, yet comprehensive environmental health monitoring, including routine inspection of water quality, sanitation facilities, waste disposal, pest control, and food handling practices, remains inadequate in counties like Nimba. Site-specific evidence on these regulatory gaps in Sanniquellie City is particularly scarce, creating a critical knowledge deficit for targeted policy intervention.

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Purpose of the Study

This study assessed the regulatory gaps in environmental health monitoring of restaurants and local cook shops in Sanniquellie City, Nimba County, Liberia, and proposes evidence-based recommendations for strengthening food safety governance and public health protection.

Objectives of the Study

The study objectives are to:

1. evaluate the existing environmental health regulations and monitoring frameworks governing restaurants and local cook shops in Sanniquellie City, Nimba County, Liberia;
2. identify gaps and weaknesses in the implementation and enforcement of environmental health monitoring practices among restaurants and local cook shops in the study area;
3. assess the level of compliance of restaurants and local cook shops with established environmental health standards and identify factors contributing to non-compliance.

Research Questions

The study was guided by the following research questions:

1. What environmental health regulations and monitoring frameworks currently govern restaurants and local cook shops in Sanniquellie City, Nimba County, Liberia?
2. What gaps and weaknesses exist in the implementation and enforcement of environmental health monitoring practices among restaurants and local cook shops in the study area?
3. What is the level of compliance of restaurants and local cook shops with established environmental health standards, and what factors contribute to non-compliance?

METHOD

This study adopted a descriptive cross-sectional mixed-methods design to assess regulatory gaps in environmental health monitoring of restaurants and local cook shops. The quantitative component involved structured surveys and observational checklists to generate measurable data on compliance levels, inspection frequency, and operational practices. The qualitative component used key informant interviews (KIIs) and document reviews to explore stakeholder perspectives on policy implementation, institutional coordination, and enforcement challenges. This approach allowed for triangulation of findings, enhancing the validity and depth of the gap analysis. The design was informed by standard methodologies used in food safety and regulatory assessments in low-resource settings, aligning with frameworks from the World Health Organization (WHO) and Food and Agriculture Organization (FAO) for evaluating food control systems.

The study was conducted in Sanniquellie City, the administrative capital of Nimba County in northern Liberia. Sanniquellie is a semi-urban commercial hub with a 2008 census population of approximately 11,415, serving as a gateway to agricultural markets, mining activities, and cross-border trade with Guinea and Côte d'Ivoire. The city features a mix of formal restaurants and informal local cook shops (commonly known as "cook shops" or street-side eateries) that cater to residents, traders, travelers, and workers. Environmental health monitoring in the area falls under the purview of the Ministry of Health (MoH) Division of Environmental and Occupational Health (DEOH), the National Public Health Institute of Liberia (NPHIL), county-level environmental health technicians, and the Food Authority of Liberia, operating within the broader framework of the National Food and Feed Quality and Safety Act of 2019 and related public health laws.

The target population comprised two main groups: (1) owners/managers and food handlers of restaurants and local cook shops in Sanniquellie City; and (2) key stakeholders involved in environmental health regulation and monitoring (e.g., MoH/DEOH officials, NPHIL food safety officers, county environmental health supervisors, and local government administrators). A preliminary field mapping exercise identified approximately 120 operational food establishments, from which a stratified random sample of 90 (75% of the

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total) was selected, stratified by type (restaurant vs. cook shop) and location (central market vs. peripheral zones). For the qualitative component, 15 key informants were purposively recruited based on their roles in policy formulation, inspection, enforcement, or food business oversight, with saturation guiding the final number of interviews. Establishments were required to have operated for at least six months prior to the study; temporary or seasonal vendors were excluded.

Four instruments were developed and validated: a 45-item structured questionnaire (adapted from WHO/FAO food safety assessment guidelines and Liberian food hygiene standards) covering demographics, awareness of regulations, hygiene practices, inspection frequency, and perceived regulatory barriers; a 12-question semi-structured interview guide for KIIs; a 30-item observational checklist based on Liberia's Public Health and Safety Laws, National Food Act provisions, and Codex Alimentarius principles, assessing physical facilities, sanitation, waste management, pest control, and evidence of recent regulatory monitoring; and a document review template for analyzing national and county-level policies, guidelines, surveillance frameworks, and available inspection reports. All instruments were pre-tested on 10 non-sampled establishments and 3 KIs in a nearby community, with minor revisions for clarity and cultural appropriateness.

Data collection occurred between January and March 2026. Trained enumerators (n=4, with public health backgrounds) conducted face-to-face interviews and observations after obtaining informed consent; interviews were audio-recorded with permission and lasted 20 - 40 minutes. Tools were administered in English or local languages (Mano, Gio, or Mandingo) as preferred, with interpreters where needed. Data collection followed a sequential explanatory design, with quantitative surveys and observations completed first, followed by qualitative KIIs to explain emerging patterns. Environmental samples (e.g., water or surface swabs) were not collected, as the focus was regulatory monitoring gaps rather than microbial testing; existing laboratory records from the National Standards Laboratory were reviewed where available.

Quantitative data were entered into Microsoft Excel and analyzed using IBM SPSS Statistics version 26.0. Descriptive statistics (frequencies, percentages, means, and standard deviations) summarized compliance rates, inspection frequencies, and gap indicators, while chi-square tests and Spearman's rank correlation examined associations between establishment type, education, training, and compliance. Qualitative data were transcribed verbatim, coded, and thematically analyzed in NVivo 14 following Braun and Clarke's six-step framework, with themes derived both inductively and deductively around regulatory gaps (policy vs. practice, coordination, capacity). Triangulation integrated the quantitative and qualitative findings, with member checking, peer debriefing, and audit trails used to support trustworthiness.

Ethical approval was obtained from the University of Liberia Ethical Review Board, the Nimba County Health Ethics Committee, and the National Public Health Institute of Liberia. Written informed consent was secured from all participants after explaining the study purpose, voluntary participation, minimal risks, benefits, and confidentiality; no personal identifiers were linked to data, participants could withdraw at any time, and data were stored securely on password-protected devices accessible only to the research team.

RESULTS AND DISCUSSION

A valid sample of 90 food establishments participated in the study: 38 (42.2%) formal restaurants and 52 (57.8%) local cook shops. Most operators were female (65.6%), had attained secondary education or lower (87.7%), and had operated their businesses for 1-5 years (53.3%). Only 26.7% had received prior food safety training (Table 1). This profile mirrors the largely informal and semi-formal nature of Liberia's food service sector, where small-scale operations are common and structured training remains limited.

Table 1: Demographic Characteristics of Food Business Operators

Variable	Category	Frequency (n)	Percentage (%)
Type of Establishment	Formal Restaurant	38	42.2
	Local Cook Shop	52	57.8
Gender of Operator/Manager	Male	31	34.4
	Female	59	65.6

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Education Level	No formal education	12	13.3
	Primary	28	31.1
	Secondary	39	43.3
	Tertiary	11	12.2
Years of Operation	< 1 year	15	16.7
	1-5 years	48	53.3
	> 5 years	27	30.0
Food Safety Training Received	Yes	24	26.7
	No	66	73.3

Source: Fieldwork (2026)

Existing Regulations and Monitoring Frameworks

To address the first objective, respondents' awareness of existing environmental health regulations was examined alongside a review of national and county-level policy documents. Awareness of core regulatory frameworks was critically low: only 31.1% of operators were familiar with the National Food and Feed Quality and Safety Act (2019), which establishes national standards for food and feed safety, licensing, inspection, and penalties (Republic of Liberia, 2019); 42.2% were aware of licensing requirements, and just 18.9% knew of penalties for non-compliance. Basic hygiene awareness (handwashing, cleaning) was comparatively higher at 67.8%, but understanding of formal inspection procedures remained weak (24.4%) (Table 2).

Table 2: Awareness of Food Safety Regulations

Indicator	Aware (%)	Not Aware (%)
National Food and Feed Quality and Safety Act (2019)	31.1	68.9
Licensing/registration requirements	42.2	57.8
Basic hygiene standards (handwashing, cleaning)	67.8	32.2
Environmental health inspection procedures	24.4	75.6
Penalties for non-compliance	18.9	81.1

Source: Fieldwork (2026)

The document review corroborated this picture: the National Food and Feed Quality and Safety Act (2019) and MoH/DEOH guidelines exist nationally but have not been translated into county-specific guidelines, and only 12 inspection reports could be located for Nimba County over 2023-2025, with no systematic record-keeping or follow-up. Thirteen of the 15 key informant confirmed that the Act is poorly disseminated at the county level. Read through Pigou's (1932) Public Interest Theory, this gap between the existence of protective regulation and its local visibility undermines the regulatory system's intended purpose; national initiatives, such as the Liberian Food Safety Initiative (LiFSI), supported by the European Union and implemented by UNIDO, aim to close this gap, but their reach into counties like Nimba appears limited (UNIDO, 2024).

Gaps in Implementation and Enforcement

The second objective examined weaknesses in the implementation and enforcement of monitoring practices. Self-reported inspections were infrequent: 38.9% of establishments had never been inspected in the past 12 months, and a further 38.9% had been inspected only once. Coverage was markedly uneven by establishment type, with cook shops far less likely to be inspected (48.1% never inspected) than formal restaurants (26.3%) (Table 3), a difference confirmed statistically ($\chi^2 = 78.757$, $df = 3$, $p < 0.001$).

Table 3: Frequency of Environmental Health Inspections (Self-Reported)

Frequency of Inspection	Restaurants (n=38) %	Cook Shops (n=52) %	Overall (%)
Never inspected	26.3	48.1	38.9
Once in the last 12 months	42.1	36.5	38.9

2-3 times in the last 12 months	23.7	13.5	17.8
4 or more times	7.9	1.9	4.4

Source: Fieldwork (2026)

Key informants attributed this pattern to limited staff, transport, and fuel, with inspection activity concentrated in Monrovia (14/15 informants); to overlapping and weakly coordinated mandates among MoH/DEOH, NPHIL, the Food Authority, and county authorities (12/15); and to a near-total absence of operator training, with almost no trained environmental health technicians serving Nimba County (15/15). Consistent with this, training received was strongly associated with ever being inspected ($\chi^2 = 47.982$, df = 1, $p < 0.001$) - paradoxically, all 24 trained operators reported never having been formally inspected, suggesting that training and inspection currently operate as parallel, disconnected interventions rather than a reinforcing system. Viewed through Stigler's (1971) Regulatory Capture Theory and von Bertalanffy's (1968) Systems Theory, these findings suggest the shortfall is less a matter of deliberate capture than of a fragmented system in which staffing, coordination, and follow-through are each individually under-resourced, so that the system as a whole under-deliver even where individual components, such as the Act itself, are sound.

Compliance Levels and Factors Contributing to Non-Compliance

The third objective assessed observed compliance and its correlates. The 30-item observational checklist yielded a mean compliance score of 14.8 out of 30 (49.3%). Effective pest control was the weakest area (46.7% non-compliant), followed by evidence of a recent inspection certificate or log (72.2% non-compliant), inadequate waste management and drainage (31.1%), and insufficient handwashing facilities with soap (32.3%) (Table 4). Operators identified the same structural constraints as barriers to compliance, most strongly a lack of regular training (86.7% agreement) and inadequate numbers of inspectors (82.2%) (Table 5).

Table 4: Observational Compliance with Hygiene and Sanitation Standards

Checklist Item	Compliant (%)	Partially Compliant (%)	Non-Compliant (%)
Cleanable floors, walls, and ceilings	51.1	28.9	20.0
Adequate handwashing facilities with soap	44.4	23.3	32.3
Proper waste management and drainage	37.8	31.1	31.1
Effective pest control measures	28.9	24.4	46.7
Food storage at correct temperature	42.2	26.7	31.1
Evidence of recent inspection certificate/log	15.6	12.2	72.2
Overall compliance score (out of 30)	**Mean: 14.8 (49.3%)**	-	-

Source: Fieldwork (2026)

Table 5: Perceived Regulatory Barriers (% of agreement)

Barrier	Agreement (%)
Lack of regular training for food operators	86.7
Inadequate number of environmental health inspectors	82.2
Weak enforcement and follow-up on violations	78.9
High cost of compliance (e.g., licensing, upgrades)	74.4
Poor coordination between MoH, NPHIL, and local authorities	71.1
Corruption or informal payments during inspections	45.6

Source: Fieldwork (2026)

Non-compliance was not evenly distributed: education level was strongly associated with receipt of training ($\chi^2 = 54.935$, df = 3, $p < 0.001$) - no operator with primary education or below had received any training, compared with all tertiary-educated operators - and years of operation showed a weak but significant positive correlation

with compliance score ($\rho = 0.248$, $p = 0.019$), suggesting that experience offers only a modest, gradual improvement absent formal support (Table 6).

Table 6: Summary of Statistical Associations

Test	Variables	Statistic	df	p-value
Chi-square	Establishment type × Inspection frequency	$\chi^2 = 78.757$	3	< 0.001
Chi-square	Training received × Ever inspected	$\chi^2 = 47.982$	1	< 0.001
Chi-square	Education level × Training received	$\chi^2 = 54.935$	3	< 0.001
Spearman's correlation	Years of operation × Compliance score	$\rho = 0.248$	-	0.019

Source: Fieldwork (2026)

Together, these results point to compounded disadvantage: female-dominated, lower-education operations - disproportionately informal cook shops - have the least access to training and the highest rates of non-compliance, echoing regional evidence that catering services across Sub-Saharan Africa frequently fall short of prerequisite hygiene programs, particularly around sanitation, temperature control, and pest management (Tohonon et al., 2025). This risk is not hypothetical in the study setting: a companion survey by the same research team documented a high perceived burden of waterborne disease and widespread water and sanitation deficits in local health facilities across Nimba, reinforcing the plausibility that weak food-safety oversight contributes to real disease risk in the county. A mean compliance score of approximately 49% underscores the need for scalable, systemic solutions - mandatory licensing, risk-based inspection, and sustained inter-agency coordination - rather than sporadic enforcement actions such as occasional closures reported nationally (Boayue, 2026; UNIDO, 2024; World Bank, 2022).

LIMITATIONS

This study has several limitations. The cross-sectional design captures regulatory practice at a single point in time and cannot establish causality. Awareness, inspection history, and some hygiene practices were self-reported and may be subject to recall and social-desirability bias. No environmental samples (water or surface swabs) were collected, so compliance was assessed observationally rather than confirmed microbiologically. The study was confined to Sanniquellie City, so findings may not generalize to other counties or rural outlets, and the preliminary field mapping may have missed unregistered or highly transient vendors.

CONCLUSION

This study demonstrates that, despite the existence of a progressive national food-safety framework, environmental health monitoring of restaurants and local cook shops in Sanniquellie City remains weak in practice. Awareness of the National Food and Feed Quality and Safety Act (2019) and of inspection and penalty provisions was low, inspections were infrequent and unevenly distributed between formal restaurants and informal cook shops, and observational hygiene compliance was only moderate, averaging about 49%. These gaps were compounded by structural barriers, including too few inspectors, weak enforcement, poor inter-agency coordination, and the near absence of operator training. Closing the gap between policy and practice will require county-specific adaptation of national standards, scaled-up and low-cost mandatory training for cook shops, risk-based and digitally supported inspection, and sustained inter-agency coordination, so that food-safety governance in Nimba County can meaningfully reduce the burden of foodborne and environmentally driven disease.

RECOMMENDATIONS

In summary, closing the observed regulatory gaps requires action on four complementary fronts: building the capacity of food business operators through accessible training, strengthening the reach and rigor of inspection systems, improving coordination and resourcing among regulatory agencies, and easing the cost and awareness

barriers that keep operators from complying. Taken together, these measures target the training deficit, the coverage gap between formal restaurants and informal cook shops, the fragmented institutional mandates, and the low public awareness of the National Food and Feed Quality and Safety Act (2019) that this study identified as the principal drivers of weak environmental health monitoring in Sanniquellie City.

1. Enhance capacity building: Scale up mandatory, accessible food safety training programs for food business operators, with particular emphasis on local cook shops, using modular and low-cost delivery methods.
2. Strengthen inspection systems: Adopt risk-based inspection approaches, increase the number of environmental health inspectors, introduce digital reporting tools, and develop county-specific guidelines to address urban bias and improve coverage in Nimba County.
3. Improve coordination and resources: Strengthen inter-agency collaboration among MoH/DEOH, NPHIL, and local authorities while allocating adequate resources for inspectors, transportation, and fuel to ensure regular and effective monitoring.
4. Support compliance and awareness: Provide subsidies or public-private partnerships to reduce compliance costs, and integrate targeted awareness campaigns on the National Food and Feed Quality and Safety Act (2019) with existing basic hygiene knowledge to bridge the awareness-to-practice gap.

Compliance with ethical standards

Ethical approval was obtained from the University of Liberia Ethical Review Board, the Nimba County Health Ethics Committee, and the National Public Health Institute of Liberia. Written informed consent was secured from all participants, and confidentiality and the right to withdraw were assured throughout the study.

Disclosure of conflict of interest

There is no conflict of interest to be disclosed.

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