

Exposure, perception and institutional response at the abattoir community interface: quantifying the environmental-justice gap in complaint driven regulation in Bo and Kenema Cities, Sierra Leone

Augustine Bob Moseray

augustineb.moseray@njala.edu.sl

Njala University

Sullay Kalokoh

Njala University

Abdulai Augustus Brima

Njala University

Alhaji Brima Gogra

Njala University

Daniel Kamara

Njala University

Umaru Bangura

Njala University

Rashid Ansumana

Njala University

Research Article

Keywords: Abattoir, Risk perception, Environmental justice, Complaint behaviour, Regulatory governance, One Health, Sierra Leone

Posted Date: September 11th, 2026

DOI: <https://doi.org/10.21203/rs.3.rs-10516703/v1>

License:   This work is licensed under a Creative Commons Attribution 4.0 International License.

[Read Full License](#)

Additional Declarations: No competing interests reported.

Abstract

Background

Communities living around urban abattoirs in sub-Saharan Africa bear a substantial environmental burden, yet whether residents accurately perceive that burden, and whether regulatory systems respond to it, is poorly understood. We examined the relationship between measured environmental exposure and perceived health risk, and the performance of the community complaint-and-response system, at the abattoir community interface in Bo and Kenema Cities, Sierra Leone.

Methods

In a community-based cross-sectional study of 950 residents (Bo = 497; Kenema = 453) living around confirmed abattoirs, we measured a five-item nuisance exposure index (Cronbach's $\alpha = 0.802$), perceived health risk, awareness, complaint behavior and satisfaction with authorities, together with a facility assessment of 16 abattoir operators. Associations were tested with chi-square and Cramér's V, and the exposure perception relationship with Spearman correlation.

Results

Perceived risk correlated closely with measured exposure (Spearman $\rho = 0.723$, $p < .001$), indicating that residents were, in aggregate, accurate risk detectors. However, exposure and attribution decoupled for a substantial minority: 29.8% of highly odour-exposed residents were unaware of the nearby abattoir. Complaint propensity rose steeply across exposure tertiles (3.8% to 27.1%; $p < .001$), but so did the probability of institutional response among complainants (7.7% in the lowest to 56.8% in the highest exposure tertile). Thus, both complaint and response concentrated in the most-exposed, vocal households, leaving the quietly-exposed and the unaware doubly excluded. Facility assessment revealed pervasive deficiencies (PPE absent at 13 of 16 facilities; open dumping at 14 of 16).

Conclusions

Residents accurately perceive their environmental burden, but a complaint-driven regulatory system channels institutional response toward the most vocal, most-exposed households while systematically excluding the unaware and the quietly-exposed. Shifting regulatory triggers from citizen complaint to monitored exposure indicators would better align institutional response with actual environmental burden.

Background

Urban abattoirs in sub-Saharan Africa impose well-documented environmental burdens on neighbouring communities, including odour, effluent, vector proliferation and water contamination [1–3] Two questions that follow from this burden have received far less attention than the burden itself: do residents accurately perceive the risk they face, and does the regulatory system respond when they raise it?

Risk-perception research holds that lay judgements of hazard are shaped not only by objective exposure but by psychological and contextual factors including dread, familiarity, controllability and trust in institutions [4]. This predicts two testable phenomena at the abattoir interface: that perceived risk should broadly track measured exposure where residents are accurate detectors, and that perception and exposure may decouple residents can be objectively exposed yet fail to attribute risk to the abattoir. Environmental-justice theory adds a structural dimension, predicting that environmental burdens fall disproportionately on those least able to avoid them, and that complaint-driven regulation which acts only on those who complain systematically under-serves the most exposed [5, 6]

These predictions are consequential for policy but rarely tested with measured exposure data. In Sierra Leone, documented accounts describe residents complaining repeatedly to sanitary inspectors without result [7], but no study has quantified the exposure perception relationship or the performance of the complaint system around abattoirs in the provincial cities of Bo and Kenema. We therefore examined the relationship between measured exposure and perceived risk, and the community complaint-and-response pathway, in these two cities, supported by a facility-level assessment of the abattoirs themselves.

Methods

Design, setting and participants

We conducted a community-based cross-sectional study in Bo City (Southern Province) and Kenema City (Eastern Province), Sierra Leone, between 11 and 26 July 2026, among adults (≥ 18 years) residing around confirmed operating abattoirs [8, 9] The study area, confirmed abattoir sites and sampled households are shown in Fig. 1. Households were sampled around each geolocated abattoir, and all accessible operators at confirmed sites were interviewed (census; $n = 16$). The sample size was determined using Cochran's formula [10], yielding a minimum of approximately 888; 950 residents were analysed.

Measures and analysis

A five-item nuisance exposure index (odour, flies/rodents, noise, wastewater flooding, water-source contamination; range 0–18; Cronbach's $\alpha = 0.802$) captured measured exposure. Perceived health risk, awareness of the nearby abattoir, complaint behaviour, complaint response and satisfaction with authorities were recorded as categorical items. The operator module assessed facility sanitation, waste management, personal protective equipment and regulatory compliance. Both the resident and operator

modules were administered as a single branching structured questionnaire programmed in KoboToolbox, developed by the study team for the present study; the full English-language instrument is provided as Additional file 1. Categorical associations were tested with the Pearson chi-square test with Cramér's V; the exposure perception relationship was assessed with Spearman's ρ . Ethical approval was obtained from the Njala University Institutional Review Board, and documented informed consent was obtained from all participants.

Results

Exposure and perceived risk

Perceived health risk was strongly structured by district the more heavily exposed city, Kenema, reporting far higher risk ($\chi^2(4) = 105.08$, $V = .333$, $p < .001$) and was closely correlated with measured exposure (Spearman $\rho = 0.723$, $p < .001$; Fig. 2a). Overall, 35.3% of residents rated the abattoir a high or very high health risk and 38.7% supported relocation of the facility. This alignment indicates that residents were, in aggregate, accurate detectors of their environmental burden.

Nonetheless, exposure and attribution decoupled for a notable subset. A number of residents reporting frequent odour simultaneously reported being unaware of a nearby abattoir (awareness differed by district: $\chi^2(1) = 41.66$, $V = .209$, $p < .001$), illustrating that objective exposure does not automatically translate into attribution of risk to its source.

The exposure complaint response cascade

Complaint behaviour was not random with respect to exposure. Complaint propensity rose steeply and monotonically across nuisance-exposure tertiles from 3.8% in the lowest-exposure tertile to 27.1% in the highest ($\chi^2 = 84.27$, $p < .001$; Fig. 3a) indicating that residents who complained were disproportionately those bearing the greatest burden. In this respect the system appears responsive to need.

However, a second, less visible pattern undermines that appearance. Among the 121 residents who did complain, the probability of receiving any institutional action *also* rose sharply with exposure: from 7.7% in the lowest-exposure tertile, to 18.5% in the middle, to 56.8% in the highest (Fig. 3b). Overall, only 43% of complainants received any action. Because both the propensity to complain and the probability of a response concentrate in the most exposed, most vocal households, two groups are systematically excluded from the regulatory system: the quietly exposed, who experience real but subthreshold burden and rarely complain, and the 29.8% of highly exposed residents who do not attribute their exposure to the abattoir and therefore never enter the complaint pathway at all.

Satisfaction with environmental-health authorities was correspondingly low and significantly patterned by district ($\chi^2(4) = 60.08$, $V = .251$, $p < .001$), with dissatisfaction concentrated in the more heavily burdened city.

Facility assessment

Assessment of the 16 abattoir operator interviews corroborated the community exposure data. Personal protective equipment was unavailable at 13 of 16 facilities, handwashing facilities at half, and vector control at half. Open dumping was the dominant solid-waste method (14 of 16 facilities), and several facilities operated without a valid permit. These deficiencies are consistent with the near universal picture of poor abattoir sanitation and weak regulation in the regional literature [3, 11, 12]

Discussion

In two Sierra Leonean cities, residents accurately perceived their environmental burden perceived risk tracked measured exposure closely ($\rho = 0.723$) and, superficially, the regulatory system appeared responsive, since both complaints and institutional responses rose with exposure. Yet this apparent responsiveness conceals a structural inequity. Because response is conditional on complaint, and complaint is conditional on both exposure and attribution, the regulatory system operates as a double filter: it serves the most-exposed and most-vocal, while systematically excluding two groups the quietly exposed, who's real but sub threshold burden rarely generates a complaint, and the 29.8% of highly-exposed residents who do not attribute their exposure to the abattoir and never enter the complaint pathway. This is a more precise formulation of the environmental-justice prediction that complaint driven regulation under-serves the exposed [13]: the failure is not that the exposed never get a response, but that the *mechanism of access* is filtered by voice and attribution rather than by measured burden.

The decoupling of exposure from attribution among a subset of highly exposed but unaware residents adds a further dimension. Where residents do not connect their exposure to its source, they are unlikely to complain at all, compounding the regulatory gap. These finding echoes documented accounts of unresponsive sanitary inspection in Freetown [7] and aligns with risk-perception theory's emphasis on attribution and trust [4].

The policy implication is that regulatory triggers should shift from citizen complaint to monitored exposure indicators odour, effluent, vector density so that intervention is driven by measured burden rather than by the uneven propensity and capacity of residents to complain. Facility-level reforms (provision and enforcement of PPE and handwashing, elimination of open dumping) address the supply side of the same problem.

Limitations

The cross-sectional design precludes causal inference, and self-reported measures admit bias. The operator arm was small ($n = 16$), supporting descriptive triangulation rather than facility level inference. Nonetheless, the convergence of community and facility data strengthens confidence in the overall picture.

Conclusions

Residents around abattoirs in Bo and Kenema accurately perceive their environmental burden, but the complaint-driven regulatory system systematically fails the most exposed households. Shifting regulatory triggers from citizen complaint to monitored exposure indicators, and strengthening facility level sanitation enforcement, would better align institutional response with actual burden.

Declarations

Ethics approval and consent to participate

Ethical approval was granted by the Njala University Institutional Review Board (NUIRB) on 14th January, 2026. All procedures involving human participants were performed in accordance with the ethical standards of the institutional review board and with the 1964 Declaration of Helsinki and its later amendments. Written informed consent was obtained from all participants.

Consent for publication

Not applicable.

Availability of data and materials

The datasets analysed during the current study are available from the corresponding author on reasonable request.

Competing interests

The authors declare that they have no competing interests.

Funding

This study received no specific grant. The authors will request a full article-processing-charge waiver under Springer Nature's policy for corresponding authors based in World Bank low-income economies (Sierra Leone), to be applied at submission.

Authors' contributions

ABM conceptualised and designed the study, developed the data-collection instrument, supervised fieldwork, curated and analysed the data, produced the figures, and drafted the manuscript. SK contributed to the study design, data collection, and validation of the dataset. AAB contributed to data collection, data cleaning, and interpretation of results. ABG contributed to the environmental-science framing, interpretation of the exposure findings, and critical revision of the manuscript for important intellectual content. DK contributed to data collection, project administration, and formatting of the manuscript. UB contributed to the methodological design, statistical interpretation, and critical revision

of the manuscript for important intellectual content. RA, as lead supervisor, provided overall scientific direction, methodological guidance and critical revision of the manuscript. All authors read and approved the final manuscript.

Acknowledgements

The authors thank the Bo and Kenema City Councils, the abattoir operators, the community participants, and the field enumeration team.

References

1. Adeniyi LA, Olatunji SA, Folorunso SA, Adesoye OP. Assessing environmental quality and health implications of slaughterhouses' operation within urban residential settings of a developing country. *Urbanization, sustainability and society* [Internet]. Emerald Publishing Limited; 2025 [cited 2026 June];2:180–97. <https://doi.org/10.1108/uss-08-2024-0052>
2. BELLO YO, Oyedemi DT. The Impact of Abattoir Activities and Management in Residential Neighbourhoods: A Case Study of Ogbomoso, Nigeria. *Journal of Social Sciences* [Internet]. 2009 [cited 2026 June];19:121–7. <https://doi.org/10.1080/09718923.2009.11892699>
3. Bekuma A, Galyuon I, Adjei M. Slaughterhouse facilities in developing nations: Sanitation and hygiene practices, microbial contaminants and sustainable management system. *Food Science and Biotechnology*. 2024;33:525–45.
4. Slovic P. Perception of Risk. *Science* [Internet]. American Association for the Advancement of Science; 1987 [cited 2026 July];236:280–5. <https://doi.org/10.1126/science.3563507>
5. Bronfenbrenner U. The ecology of human development: experiments by nature and design. DigitalGeorgetown (Georgetown University Library) [Internet]. Center for Security and Emerging Technology; 1979 [cited 2026 July]; <https://doi.org/10.4159/9780674028845?locatt=mode:legacy>
6. Heiman MK. WASTE MANAGEMENT AND RISK ASSESSMENT: ENVIRONMENTAL DISCRIMINATION THROUGH REGULATION. *Urban Geography* [Internet]. Taylor & Francis; 1996 [cited 2025 Nov];17:400–18. <https://doi.org/10.2747/0272-3638.17.5.400>
7. Groove 106FM. “Unhealthy abattoir” poses public health risk in Freetown. 2017;
8. Kenema District Council. About KENDC [Internet]. 2023. <https://kendc.sl/about-kendc/>
9. Bo District Council. About Bo District [Internet]. Bo District Council; 2023. <https://bodc.gov.sl/about/>
10. Cochran WG. Sampling Techniques. 3rd Edition. Zenodo (CERN European Organization for Nuclear Research) [Internet]. European Organization for Nuclear Research; 1977 [cited 2026 July]; <https://doi.org/10.5281/zenodo.15338807>
11. Hossain MdA, Ibrahim N, Barnett K. Hygiene practices in slaughterhouses and public health risk: A scoping review. *PLoS ONE* [Internet]. Public Library of Science; 2025 [cited 2026 July];20. <https://doi.org/10.1371/journal.pone.0334225>

12. Nigussie AG, Velde FV, Sarba EJ, Kumsa B, Gabriël S. African abattoirs: a scoping review of practices, factors influencing implementation of good practices, and recommended solutions for improvement. BMC Veterinary Research [Internet]. BioMed Central; 2025 [cited 2026 July];21:415–415. <https://doi.org/10.1186/s12917-025-04743-7>
13. Konisky DM, Reenock C. Compliance Bias and Environmental (In)Justice. The Journal of Politics [Internet]. University of Chicago Press; 2013 [cited 2025 Nov];75:506–19. <https://doi.org/10.1017/s0022381613000170>

Figures

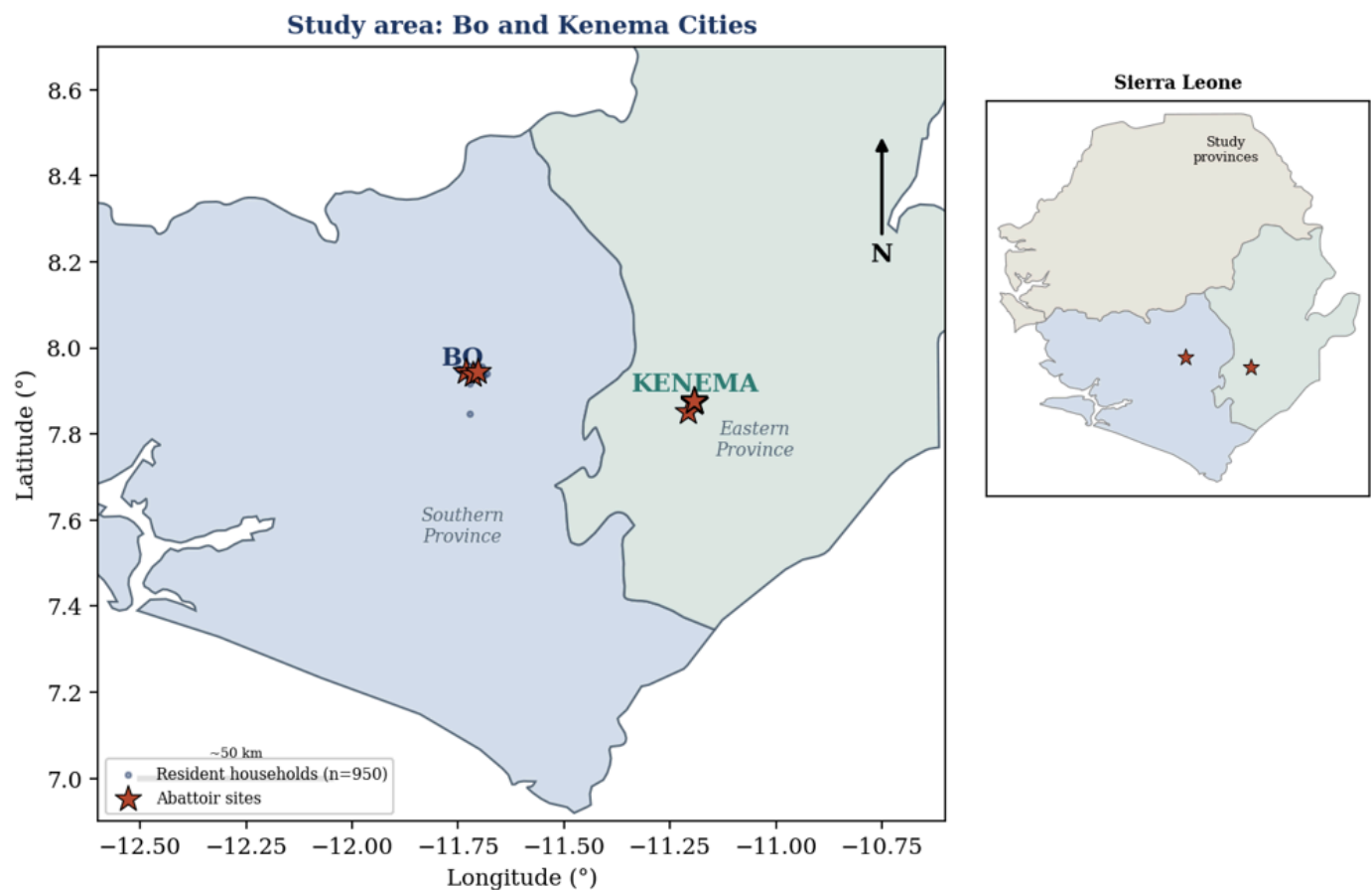


Figure 1

Study area. Southern and Eastern Provinces of Sierra Leone, showing Bo and Kenema Cities, confirmed abattoir sites (stars) and sampled resident households (points). Base boundaries from national administrative spatial data; survey points from field GPS. Inset: national locator.

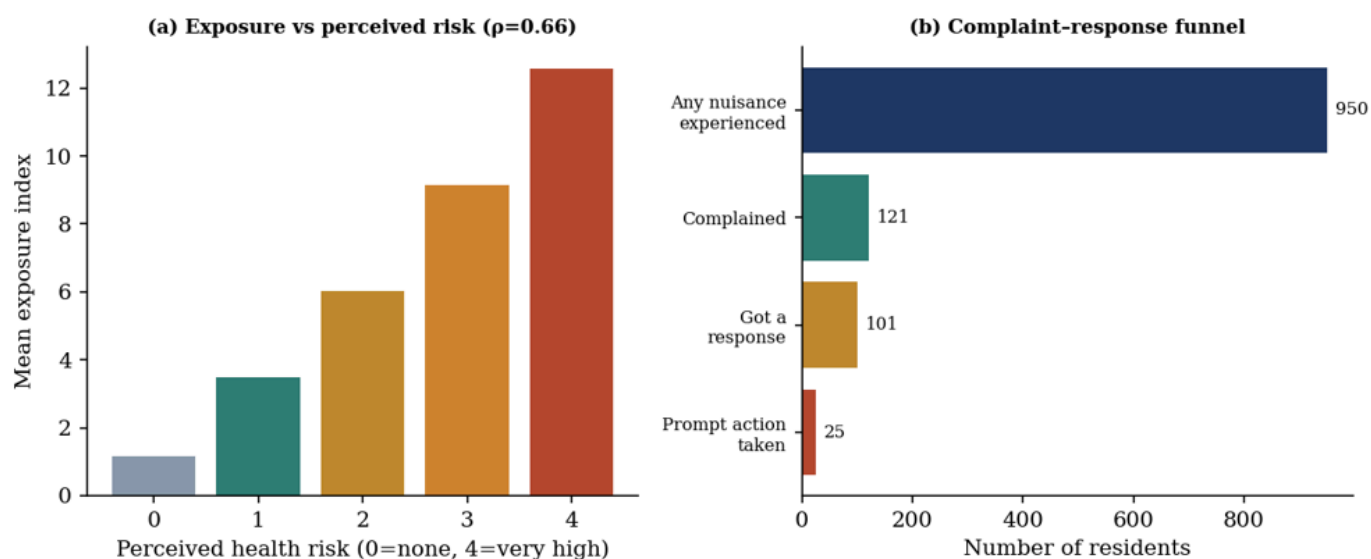


Figure 2

(a) Mean nuisance exposure by perceived-risk category, showing close alignment between measured exposure and perception. (b) The community complaint-and-response funnel, showing attrition from nuisance experience to prompt institutional action.

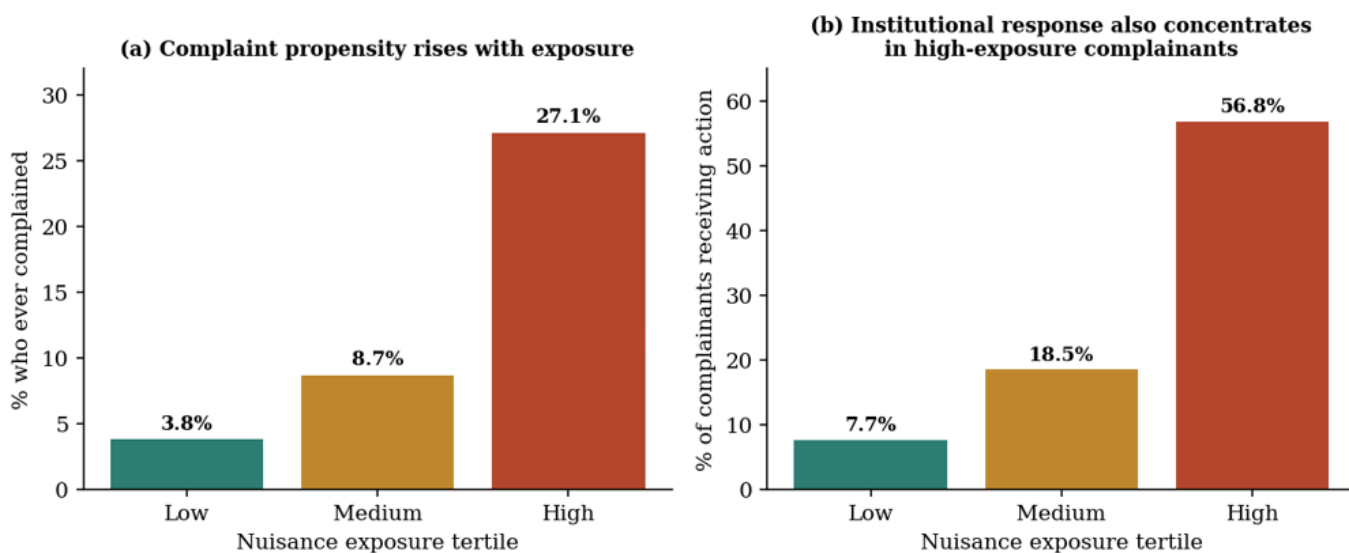


Figure 3

The exposure complaint response cascade. (a) Complaint propensity rises steeply with nuisance-exposure tertile. (b) Among complainants, the probability of receiving institutional action also rises with exposure, concentrating regulatory response in the most exposed, most vocal households.

Supplementary Files

This is a list of supplementary files associated with this preprint. Click to download.

- [Additionalfile1DataCollectionInstrument.docx](#)