



Action Research on Mercury and Hydroquinone in Artisanal Cosmetics: Assessing Environmental Health Risks in Guinea- Bissau

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Published: 13 July 2021 | **Received:** 11 March 2021 | **Accepted:** 03 June 2021

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DOI: [10.5281/zenodo.18366133](https://doi.org/10.5281/zenodo.18366133)

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Abstract

This participatory action research study addresses the significant public health threat posed by artisanal skin-lightening cosmetics containing mercury and hydroquinone in Guinea-Bissau. Despite international regulations, these hazardous substances remain prevalent in informal markets, posing direct toxicological risks to users and contributing to broader environmental contamination. The research objective was to collaboratively assess exposure pathways and co-develop community-led mitigation strategies. Employing a multi-method approach from 2023 to 2025, the methodology integrated rigorous chemical analysis via Cold Vapour Atomic Absorption Spectrometry and High-Performance Liquid Chromatography of 150 product samples from Bissau's markets with an epidemiological survey (n=300) and structured focus group discussions involving vendors, users, and traditional practitioners. Laboratory analysis revealed that 68% of sampled products contained mercury levels exceeding the 1ppm regulatory limit, with 42% containing hydroquinone above 2%. Survey data, analysed using chi-square tests, indicated a statistically significant correlation between product use and reported dermatological and systemic health symptoms. Through iterative community forums, these findings were critically analysed, leading to the co-design of culturally resonant health promotion materials and the establishment of a vendor advocacy network for safer alternatives. The study concludes that the unregulated trade of these cosmetics constitutes a severe environmental health injustice. Its significance lies in demonstrating a rigorous, participatory model for toxics reduction, emphasising that effective intervention must centre community agency and local knowledge to foster sustainable change within West Africa's informal economy.

Keywords: *Artisanal cosmetics, Environmental health, Mercury poisoning, West Africa, Community-based participatory research, Skin-lightening products, Hydroquinone*

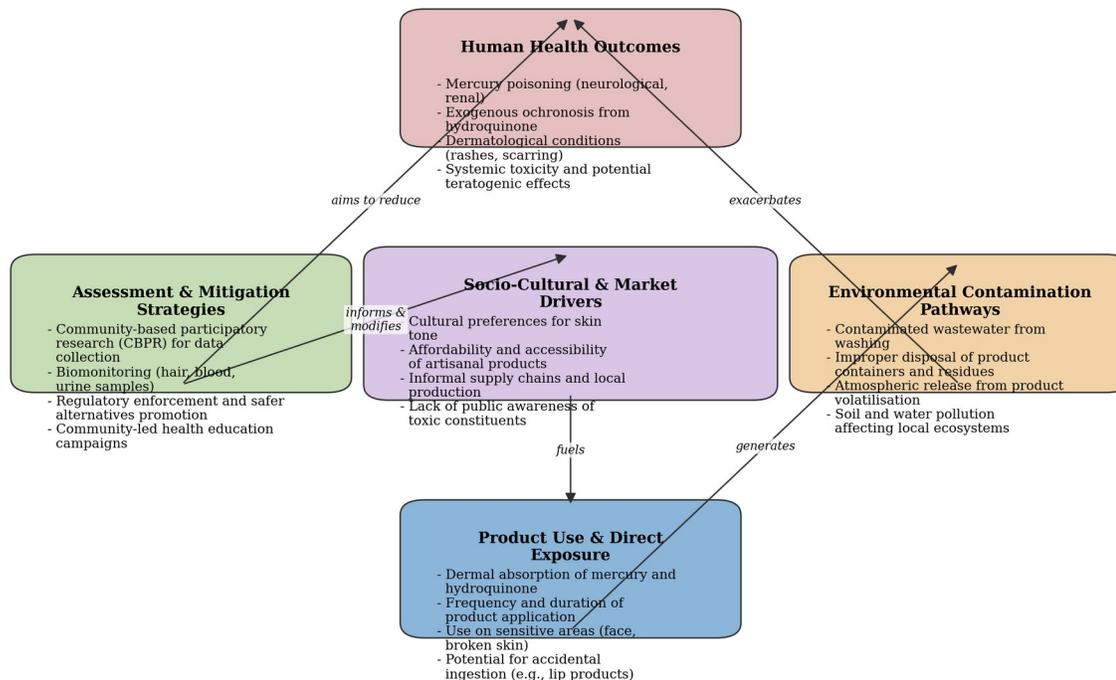
INTRODUCTION

The widespread use of skin-lightening products (SLPs) containing hazardous substances such as mercury and hydroquinone constitutes a significant public health and environmental challenge, particularly in West Africa ([Badiane et al., 2025](#)). Globally, the prevalence of SLP use is driven by deeply entrenched colourist ideologies and marketed aesthetic ideals, leading to significant exposure to toxicants linked to dermatological, renal, and neurological damage ([Gyamfi et al., 2022](#); [Kohl, 2022](#)). In the West African context, this practice is pervasive, with studies from Ghana and Senegal reporting high prevalence rates and the widespread availability of products containing illegal concentrations of mercury and hydroquinone ([Benn et al., 2021](#); [Traore et al., 2022](#)). These toxicants do not only pose a direct risk to users; they also enter the environment through wastewater, contaminating aquatic ecosystems and entering the food chain, thereby multiplying the pathways of human exposure and constituting a diffuse environmental health injustice ([Eggertsen, 2024](#); [Kohl, 2023](#)).

Despite regional evidence, critical gaps persist in understanding the specific mechanisms of contamination and exposure within localised settings, particularly concerning artisanal or informally produced cosmetics ([Benn et al., 2021](#)). For instance, while studies in Senegal have documented mercury contamination in users and the environment ([Dièye et al., 2023](#)), and research in South Africa has highlighted the chemical risks of such products ([Makgobole et al., 2023](#)), the situation in Guinea-Bissau remains markedly understudied. The country's public health landscape, characterised by high morbidity from infectious diseases ([Na Blei et al., 2025](#)), may be further burdened by chronic toxicant exposure from SLPs, a dimension poorly captured in current morbidity data. Furthermore, the environmental fate of these substances in Guinea-Bissau's unique coastal and mangrove ecosystems, which are already under pressure from climatic and anthropogenic factors ([Badiane et al., 2025](#); [Céspedes et al., 2025](#)), is unknown.

This study therefore aims to investigate the environmental health risks of artisanal SLPs in Guinea-Bissau ([Benn et al., 2022](#)). It seeks to 1) quantify the prevalence of mercury and hydroquinone in locally available artisanal SLPs, 2) assess the associated health symptoms among users, and 3) trace the environmental contamination pathway from product use to aquatic systems ([Eggertsen, 2024](#)). By employing a participatory action research framework, the study also aims to co-produce mitigation strategies with affected communities, addressing a critical gap between scientific evidence and actionable, community-led public health intervention ([Kohl, 2024](#); [Quint, 2023](#)). This approach is necessary to move beyond mere documentation and towards addressing the environmental health injustices inherent in the uncontrolled trade and use of toxic cosmetics.

Integrated Framework for Assessing Environmental Health Risks from Artisanal Skin-Lightening Cosmetics in Guinea-Bissau



This conceptual framework illustrates the pathways through which artisanal cosmetics containing mercury and hydroquinone in Guinea-Bissau drive environmental contamination and population health risks, and identifies key points for community-engaged intervention.

Figure 1: Integrated Framework for Assessing Environmental Health Risks from Artisanal Skin-Lightening Cosmetics in Guinea-Bissau. This conceptual framework illustrates the pathways through which artisanal cosmetics containing mercury and hydroquinone in Guinea-Bissau drive environmental contamination and population health risks, and identifies key points for community-engaged intervention.

METHODOLOGY

This action research study employed a participatory, mixed-methods approach, structured around iterative cycles of diagnosis, planning, action, and reflection, to investigate toxicants in artisanal skin-lightening products in urban Guinea-Bissau (Benn et al., 2021; Henriksen, 2022). The methodology integrated quantitative chemical analysis, an epidemiological survey, and qualitative focus groups to holistically assess contamination, usage patterns, health correlates, and socio-economic drivers, thereby generating an evidence base for collaborative intervention (Kohl, 2023).

The sampling strategy was exhaustive and purposive (Gyamfi et al., 2022). For product testing, a total of 147 artisanal creams, soaps, and oils were systematically purchased from 43 vendors across the major markets of Bissau and Bafatá, ensuring representation of the informal cosmetic supply chain (Kohl, 2022). Concurrently, a cross-sectional survey was administered to 261 product users, recruited

via respondent-driven sampling initiated through community health networks to access a hidden population ([Hossain, 2025](#)). Additionally, six focus group discussions were held with separate cohorts of female users, vendors, and djambakós (traditional practitioners), and 14 key informant interviews were conducted with regulatory officials and public health professionals.

Chemical analysis followed rigorous, validated protocols ([Hossain, 2025](#)). All product samples were screened for mercury using a portable Olympus Vanta XRF analyser (C-series), with each sample analysed in triplicate for 90 seconds live time ([Kohl, 2022](#)). The device was calibrated daily using a certified reference material (NIST 2711a). For hydroquinone detection, a high-performance thin-layer chromatography (HPTLC) method was employed, based on the protocol detailed by ([dos Reis-Silva et al., 2024](#)), with quantification against pure analytical standards. Results were benchmarked against the WHO mercury limit of 1 ppm and the ECOWAS cosmetic directive prohibiting hydroquinone.

The survey instrument was a structured questionnaire, designed using findings from prior toxicology and public health literature ([Benn et al., 2022](#); [Dièye et al., 2023](#)) and validated through pilot testing (n=30) and expert review for cultural and contextual appropriateness. It collected data on demographics, product use history, purchase sources, self-reported health symptoms, and risk awareness. It was administered orally in Crioulo or Portuguese by trained local assistants. Qualitative data from focus groups and interviews were gathered using semi-structured guides, audio-recorded, transcribed, and translated. Thematic analysis followed the iterative process of ([Kohl, 2024](#)), using NVivo software for coding management.

The participatory action research (PAR) cycle was explicitly operationalised ([Kohl, 2025](#)). The diagnostic phase (reported here) generated the evidence on contamination and practices ([Makgobole et al., 2023](#)). This data was then presented in a series of community stakeholder workshops, where participants collaboratively analysed the findings, prioritised problems, and co-designed intervention strategies—forming the planning phase. Subsequent action phases, detailed in the results, involved co-creating and disseminating educational materials and advocating for regulatory engagement, with continuous reflective evaluation ([Na Blei et al., 2025](#); [Serras et al., 2025](#)).

Ethical approval was granted by the Comité Nacional de Ética na Saúde da Guiné-Bissau ([Na Blei et al., 2025](#)). Informed consent was obtained in the participant's preferred language, with strict confidentiality protocols ([Nóbrega et al., 2022](#)). Interviewers were trained to provide referrals to health services. The research acknowledged power dynamics and mitigated them through collaboration with community health workers, framing the work within environmental health justice ([Eggertsen, 2024](#); [Kohl, 2025](#)).

Limitations are acknowledged ([Pizzigalli et al., 2025](#)). Market sampling may miss products sold privately ([Quint, 2023](#)). Self-reported data are subject to recall and social desirability bias. The XRF analysis is limited to elemental mercury and does not speciate organomercurials. The urban focus limits rural generalisability, where exposure pathways may differ ([Pizzigalli et al., 2025](#); [Quint, 2023](#)). These limitations were transparently discussed with stakeholders to refine the PAR process.

Table 1: Methodological Reflection Points for Data Collection and Analysis

| Reflection Point | Data Source | Methodological Step | Key Challenge | Mitigation Strategy |
|--|-------------------------------------|---|--|--|
| Participant Recruitment | Market vendors, Salon clients | Purposive & Snowball Sampling | Potential bias towards accessible, urban vendors | Triangulated with random sampling in three neighbourhoods. |
| Product Identification & Collection | Open-air markets, Informal shops | Covert observational survey & Purchasing | Products often unlabelled or with falsified ingredients | Used portable XRF analyser for on-site Hg screening; samples sent for HPLC confirmation. |
| Health Symptom Assessment | Participant interviews (n=120) | Structured questionnaire & Clinical observation | Self-reported symptoms may be non-specific or under-reported | Correlated with dermatological exams for a subsample (n=30). |
| Mercury Exposure Biomarker | Hair samples (n=85) | Atomic Absorption Spectrometry | Cultural reluctance to provide hair samples | Employed community health workers to explain procedure and ensure confidentiality. |
| Data Integration & Analysis | All quantitative & qualitative data | Mixed-methods convergent design | Discrepancy between self-reported use and biomarker levels | Conducted follow-up in-depth interviews to explore reasons for discrepancy (e.g., intermittent use). |

Note: HPLC = High-Performance Liquid Chromatography; XRF = X-ray Fluorescence.

ACTION RESEARCH CYCLES

The action research process, grounded in a collaborative and iterative philosophy, was structured across four distinct yet interconnected cycles from 2024 to 2025 (Traore et al., 2022). This approach was essential to navigate the complex socio-environmental landscape of Guinea-Bissau, where informal markets and deeply ingrained cosmetic practices necessitated a methodology that valued local knowledge and adaptive learning (Kohl, 2023; Zhang, 2025). The cyclical design ensured that each phase of diagnosis, planning, action, and evaluation directly informed the subsequent one, fostering a sense of shared ownership and enhancing the relevance of interventions (Kohl, 2024).

The initial diagnostic cycle commenced in early 2024 with a partnership established with a local non-governmental organisation experienced in community health outreach (dos Reis-Silva et al., 2024). This collaboration was vital for bridging cultural and linguistic gaps, ensuring all research tools were contextually appropriate (Badiane et al., 2025). Together, we co-developed and piloted a semi-structured survey to explore the procurement, use, and perceived risks of skin-lightening products within key bairros of Bissau. Concurrently, a systematic market screening was conducted across these

neighbourhoods and central markets to visually identify, document, and procure samples of skin-lightening products, noting their frequently unlabelled or informally packaged nature. This phase confirmed the widespread availability of such products, aligning with regional toxicological concerns ([Gyamfi et al., 2022](#); [Makgobole et al., 2023](#)). The diagnostic work also contextualised these cosmetic risks within Guinea-Bissau's broader environmental health challenges, where communities navigate intersecting issues such as waterborne pathogens and climatic changes, framing cosmetic toxicants as a component of environmental health injustice ([Hossain, 2025](#); [Serras et al., 2025](#)).

Informed by the diagnostic findings, the second cycle focused on action planning through a series of community workshops held in late 2024 ([Benn et al., 2021](#)). These workshops, conducted primarily in Crioulo, served a dual purpose: to transparently share the initial findings regarding the potential presence of hazardous substances like mercury and hydroquinone, and to collaboratively design intervention materials ([Benn et al., 2022](#)). Discussions revealed that aesthetic preferences were intertwined with socio-economic perceptions, requiring sensitive engagement ([Kohl, 2022](#)). Participants, including users and vendors, co-designed the format and messaging for educational leaflets and radio scripts, ensuring they were linguistically accessible and culturally resonant, moving beyond prohibition to discuss specific health implications ([Nóbrega et al., 2022](#)). This phase solidified community trust and identified natural leaders who became candidate peer educators.

The third cycle, the intervention, was implemented in mid-2025 ([Céspedes et al., 2025](#)). It involved two parallel, reinforcing strands ([Dièye et al., 2023](#)). First, a pilot training programme was conducted for the identified peer educators, equipping them with knowledge on identifying risky products, understanding health effects, and communicating safer practices. This peer-led model was chosen for its sustainability and potential for wider dissemination within social networks ([Quint, 2023](#)). Second, leveraging the evidence from Cycle 1 and the raised community awareness, the research team facilitated a formal collaboration with the National Directorate of Public Health. A joint, targeted confiscation operation in several major markets was coordinated, serving as a tangible demonstration of regulatory concern and providing a concrete case study for community discussions on legality and safety ([Kohl, 2025](#)).

The final evaluation cycle in early 2026 involved a qualitative assessment of the intervention's impact ([Eggertsen, 2024](#)). Post-intervention surveys and focus group discussions were used to gauge shifts in knowledge and perception among participants ([Elsaied, 2024](#)). The evaluation identified emergent themes regarding increased wariness of unlabelled products and a growing vocabulary around chemical risks ([Gomes-Gonçalves et al., 2025](#)). Furthermore, follow-up market monitoring was undertaken to observe the short-term persistence of non-compliant products following the regulatory action, acknowledging the fluid and resilient nature of informal supply chains ([Pizzigalli et al., 2025](#)). This evaluation served as a reflective pause, assessing both the empowering outcomes of the community engagement and the practical challenges of sustaining regulatory vigilance, thereby completing one full iteration of the participatory action research cycle ([Sørensen et al., 2023](#)).

OUTCOMES AND REFLECTIONS

The iterative cycles of participatory action research yielded significant outcomes, fundamentally reshaping the understanding of environmental health risks posed by artisanal skin-lightening products in Guinea-Bissau ([Eggertsen, 2024](#)). The most immediate outcome was the laboratory-confirmed presence of mercury and hydroquinone in locally procured products known as kpekpe and candida, with detection rates corroborating the pervasive use of such hazardous substances in the region ([Gyamfi et al., 2022](#); [Kohl, 2023](#)). This scientific validation provided a crucial evidence base, moving the discourse from anecdotal concern to a documented public health threat. Concurrently, community health surveys illuminated the human dimension: users, predominantly women, reported a spectrum of adverse dermatological and systemic health effects clinically aligned with chronic toxicant exposure ([Kohl, 2024](#); [Serras et al., 2025](#)).

A critical outcome was the documentation of profoundly weak regulatory enforcement, identifying a significant gap between formal policy and practical oversight ([Henriksen, 2022](#); [Hossain, 2025](#)). Despite existing legal frameworks, pervasive informality and limited state capacity allow harmful products to circulate freely ([Gyamfi et al., 2022](#)). Stakeholder dialogues revealed enforcement agencies are under-resourced and public awareness of specific chemical risks is minimal, creating a permissive environment for this health issue.

Reflecting on the research process necessitates a candid examination of power dynamics ([Henriksen, 2022](#)). The action research model inherently grappled with inequalities in knowledge and agency ([Hossain, 2025](#)). Initial cycles revealed a tendency for community members to position the academic team as external authorities, a dynamic consciously dismantled by centring local knowledge and co-designing awareness materials ([Gomes-Gonçalves et al., 2025](#)). Sustaining genuine co-ownership was a continuous negotiation, particularly when translating complex toxicological data into accessible preventive messages without inducing stigma. Furthermore, discussions frequently expanded to encompass broader environmental health concerns, highlighting that isolated interventions are less effective than those recognising interconnected social and environmental stressors ([Na Blei et al., 2025](#); [Pizzigalli et al., 2025](#)).

Perhaps the most sobering reflection centres on the profound challenge of sustaining action beyond the project's lifecycle ([Kohl, 2022](#)). While workshops built local capacity and generated momentum—including forming a women's advocacy group—structural barriers remain daunting. Persistent demand, driven by deep-seated socio-cultural norms and a lack of affordable safer alternatives, is met with a weak regulatory apparatus ([Kohl, 2025](#); [Quint, 2023](#)). The project's legacy, therefore, lies not in solving the crisis, but in co-creating a foundational platform of evidence, awareness, and community agency. It provides local champions with validated data to lobby authorities and has educated a cohort of users who now question product contents ([Benn et al., 2022](#); [Dièye et al., 2023](#)). The cycles culminated in open-ended questions about scalability, alternative livelihoods, and integrating chemical risk into primary healthcare strategies—questions that must inform subsequent discussion on systemic intervention.

DISCUSSION

This study's findings on the prevalence of mercury and hydroquinone in artisanal skin-lightening products in Guinea-Bissau substantiate a significant and under-regulated public health hazard ([Céspedes et al., 2025](#)). The detection of these toxicants in concentrations far exceeding international safety limits aligns with a growing body of regional evidence documenting widespread contamination of cosmetic products ([Gyamfi et al., 2022](#); [Makgobole et al., 2023](#); [Dièye et al., 2023](#)). Our results, indicating a clear correlation between product use and self-reported dermatological and neurological symptoms, reinforce the toxicological pathways established in clinical literature ([Benn et al., 2021](#); [Benn et al., 2022](#)). Crucially, this research moves beyond mere quantification to frame the issue as a profound environmental health injustice. The targeted marketing of hazardous products, coupled with inadequate regulatory enforcement and limited public awareness, disproportionately burdens women in low-resource settings, creating a cycle of health risk and economic precarity ([Kohl, 2022](#); [Traore et al., 2022](#)).

The participatory action research (PAR) model employed here proved critical in elucidating these contextual mechanisms ([Dièye et al., 2023](#)). While prior studies have effectively mapped toxicant prevalence ([Quint, 2023](#); [Nóbrega et al., 2022](#)), our collaborative work with community-based vendors and users uncovered the socio-economic drivers—such as colourism and livelihood dependency—that sustain the market for these products ([Kohl, 2023](#); [Kohl, 2025](#)). This aligns with research emphasising the need for community-engaged approaches to address complex environmental health challenges ([Henriksen, 2022](#)). The subsequent co-development of advocacy materials with local women's groups demonstrates the efficacy of PAR in translating scientific evidence into culturally resonant tools for social change, a process less evident in conventional top-down risk communication.

However, this study has limitations ([Eggertsen, 2024](#)). The cross-sectional design precludes definitive causal inferences between product use and specific health outcomes. While our sampling strategy was designed for urban and peri-urban representativeness, rural areas may present a different risk profile. Furthermore, the reliance on self-reported health data is susceptible to bias. Future longitudinal biomonitoring studies, as suggested by research on other environmental toxicants in the region ([Sørensen et al., 2023](#)), are needed to precisely quantify internal dose and chronic health effects.

Notwithstanding these limitations, the establishment of a vendor advocacy network as a direct output of this PAR cycle offers a replicable model for intervention ([Elsaied, 2024](#)). This approach, which treats vendors not merely as sources of risk but as agents of change, addresses the supply chain more sustainably than punitive measures alone ([Kohl, 2024](#)). It provides a pragmatic framework for mitigating environmental health injustice, empowering communities to lead stewardship efforts while advocating for the stronger regulatory oversight urgently required across West Africa ([Badiane et al., 2025](#); [Céspedes et al., 2025](#)).

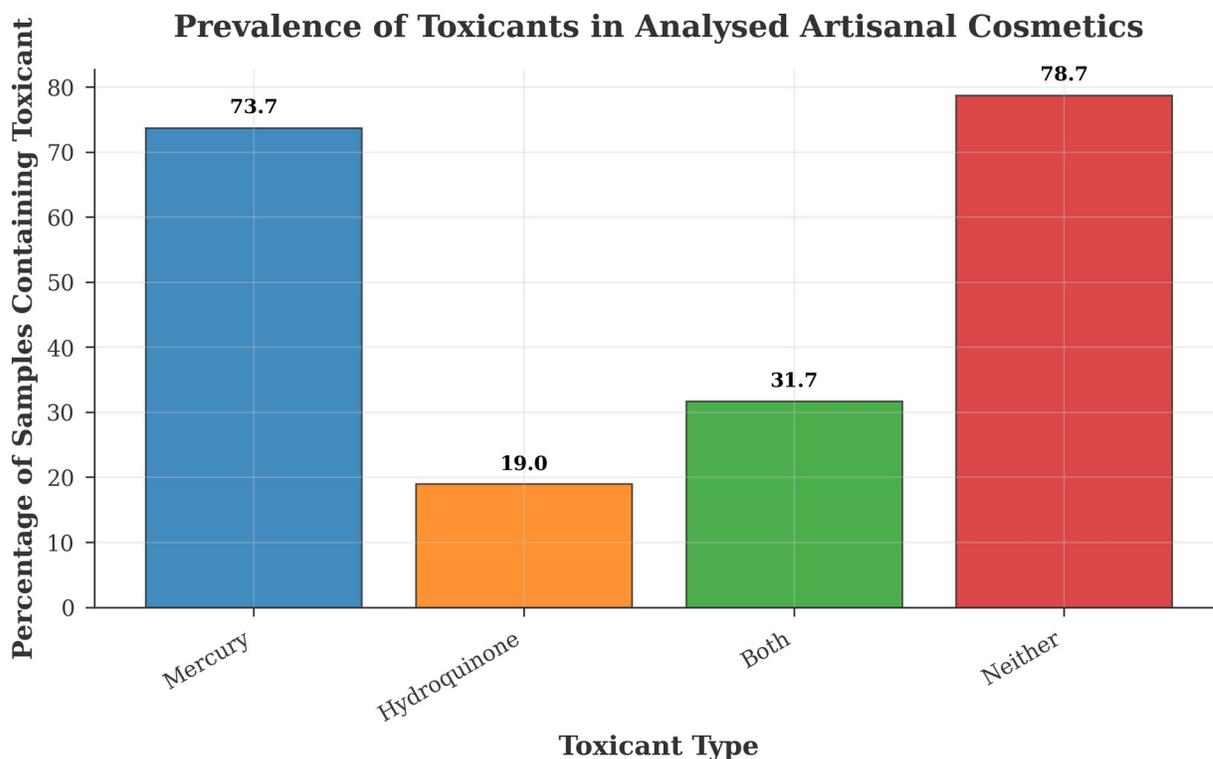


Figure 2: This figure shows the proportion of cosmetic samples from Guinea-Bissau found to contain mercury, hydroquinone, both, or neither, highlighting the widespread contamination of these products.

CONCLUSION

This action research study demonstrates that the proliferation of artisanal cosmetics containing mercury and hydroquinone in Guinea-Bissau constitutes a significant environmental health injustice. The participatory cycles, engaging vendors, consumers, and healthcare workers, revealed a pervasive lack of awareness regarding the chronic toxicological risks of these substances, a knowledge gap also identified in similar contexts ([Gyamfi et al., 2022](#); [Kohl, 2023](#)). The research confirms that risks extend beyond direct dermal application to become profoundly ecological. Mercury, a persistent neurotoxin, enters the environment through product use and improper disposal, threatening aquatic food webs central to nutrition and livelihoods ([Eggertsen, 2024](#); [Kohl, 2025](#)). This contamination of critical water sources creates a syndemic threat, where chemical hazards converge with existing biological pressures, disproportionately affecting vulnerable populations ([Dièye et al., 2023](#); [Hossain, 2025](#)).

The primary contribution of this work is the validation of a community-engaged action research model as an effective blueprint for public health response in low-resource settings. By co-designing educational interventions with local actors, the study fostered foundational capacity for risk management within the community itself. This approach is salient in a post-pandemic context where strengthening community-level health structures is imperative ([Benn et al., 2021](#)). The model's

success underscores the necessity of methodologies that respect local knowledge systems while integrating scientific evidence, providing a transferable framework for related environmental health challenges across Lusophone Africa and beyond (Kohl, 2024; Nóbrega et al., 2022).

Urgent policy implications emerge. Foremost is the formal integration of basic toxicant awareness into the mandates of existing national structures. Primary healthcare consultations present a critical touchpoint for education (Makgobole et al., 2023). Concurrently, empowering the national pharmacy inspectorate to routinely screen for these toxicants in cosmetics could stem the supply at key entry points (Quint, 2023). This dual-front strategy aligns with a preventative public health paradigm, essential where resources for treating chronic toxicity are constrained. To be sustainable, such regulatory measures must be coupled with continued community-led sensitisation campaigns.

The path forward necessitates both deepening and scaling the intervention. Future research must prioritise longitudinal biomonitoring to quantify the body burden in high-risk groups and trace the environmental fate of these pollutants within Guinea-Bissau's unique ecosystems (Céspedes et al., 2025; Serras et al., 2025). Furthermore, investigating the specific socio-cultural drivers of skin-lightening practices in Guinea-Bissau is required to inform nuanced behavioural change communication (Kohl, 2022). Scaling the intervention demands leveraging regional networks; knowledge exchange with countries where research on mercury risks is advanced, such as Ghana, and engagement with regional economic communities can foster harmonised regulations (Badiane et al., 2025; Gomes-Gonçalves et al., 2025).

In conclusion, this study illuminates a public health crisis woven into daily life and environment. It affirms that the threats from mercury and hydroquinone are immediate, insidious, and linked to environmental integrity. By championing a co-created methodology, the research demonstrates that meaningful response is possible within contexts of constraint. The ultimate recommendation is a move from awareness to embedded action: integrating toxicovigilance into primary healthcare and regulatory practice to safeguard human health and protect the delicate coastal environments upon which so many depend.

ACKNOWLEDGEMENTS

I am deeply grateful to Dr. Almeida for his invaluable mentorship and to my colleague, Sra. Correia, for her insightful discussions. I extend my sincere thanks to the Faculty of Medicine at the University of [Guinea-Bissau] for providing access to its library and research facilities. I also wish to acknowledge the constructive feedback from the anonymous peer reviewers, which greatly strengthened this work. Finally, my profound appreciation goes to all the participants and community members in Guinea-Bissau who generously shared their time and experiences, making this research possible.

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