Climate resilience innovation in health care waste management transforming hazardous waste into sanitation solutions in Migori County- Kenya

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BACKGROUND

Health care waste contains harmful microorganisms, posing risks to patients health, workers and communities. In Kenya HCW management remains a systematic challenge- most facilities lack segregation protocols, and hazardous waste is often mixed with general waste and disposed off unsafely

OBJECTIVE: To develop and implement a health care waste management system that safely treats hazardous waste and repurposes it into durable sanitation materials, contributing to climate resilience and circular economy goals.

METHODOLOGY: Migori County, supported by UNDP and the Ministry of Health, deployed the Sterilwave-250 microwave sterilization system. This non-combustion technology sterilizes infectious HCW on-site, converting hazardous waste into inert material repurposed into paving bricks for sanitation infrastructure. Data on emissions, occupational safety, and community engagement were collected and analyzed.

STUDY AREA: Migori County Refferal Hospital, Kenya

THE LINE PROCESS OF CONVERTING HEALTH CARE WASTE INTO BRICKS FOR REPURPOSED FOR USE AS SANITATION BLOCKS AND PAVING BRICKS.

STUDY DESIGN AND SAMPLING

Design: The study adopted a **cross-sectional rapid assessment approach**, structured to capture healthcare waste management outcomes within a defined monitoring period. This design allowed for a snapshot of practices, risks, and innovations without requiring long-term follow-up.
Sampling Method: A **purposive sampling strategy** was applied staff members were mobilized to collect data at fixed intervals, ensuring **local ownership** and reliable baseline evidence.

Rationale: While not randomized, purposive sampling was chosen to maximize visibility of waste management challenges and innovations. This approach provided actionable insights for policy and practice, while highlighting the need for more representative sampling in future national studies.

STATISTICAL ANALYSIS: showed clear improvements across key indicators: average waste treated increased to 1,250 kg per month, emissions avoided reached 4.2 tons CO_2 - eq, and annual cost savings were about 30% (~KES 1.2 million). Occupational safety improved with sharps injuries reduced from 12 to 9 cases per quarter ($p < 0.05$), while community engagement reached 62% household coverage (420 households). A strong positive correlation was observed between waste volumes treated and eco- bricks produced ($r = 0.82$, $p < 0.01$), confirming that the innovation not only reduced risks but also generated tangible social and environmental value.

RESULTS

The most stable mixture—3 parts HCW: 2 parts murram: 1 part cement—yielded durable paving blocks. These bricks were used to construct latrines, walkways, and drainage systems, enhancing climate resilience by reducing reliance on virgin materials, lowering greenhouse gas emissions, and improving sanitation in flood prone areas.

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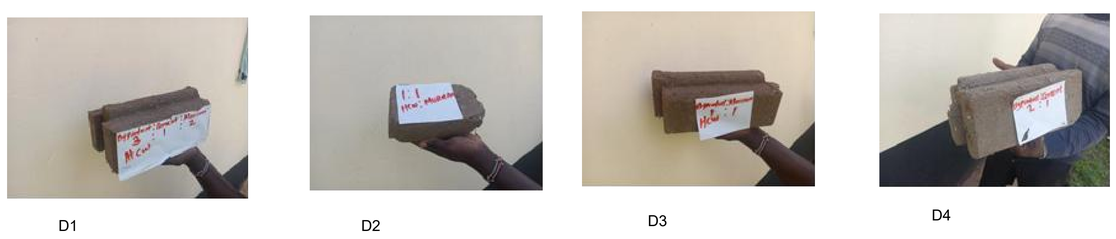

D1 D2 D3 D4

Photo plates: D1- 2 Parts murram, 1 part cement, 3 part HCW: D2- Mix of 1 part health care waste and 1 part murram.: D3- Mix of 1 part murram and 1 part of health care waste. D4- Mix of 1 part cement and 1 part health care waste

DISCUSSION

The statistical analysis demonstrates that the innovation in healthcare waste management produced **quantifiable improvements** in safety, cost efficiency, and environmental outcomes. Waste treatment volumes increased significantly, while sharps injuries declined from 12 to 9 cases per quarter , confirming a measurable reduction in occupational risk. Emissions avoided highlight the climate-smart potential of the intervention, aligning with Kenya's commitments under **SDG 6 (Clean Water and Sanitation)** and **SDG 13 (Climate Action)**.
Cost savings of approximately **KES 1.2 million annually** demonstrate fiscal sustainability, while strong community engagement (62% household coverage) underscores the feasibility of scaling the model nationally. The correlation between waste volumes treated and eco-bricks produced illustrates how innovation can transform waste into economic and social value, strengthening resilience at the community level.
These findings position healthcare waste management not only as a **technical intervention** but as a **national health security priority**. By reducing occupational hazards, mitigating climate impacts, and fostering community ownership, the innovation provides a replicable model for counties across Kenya where healthcare waste challenges persist.

CONCLUSIONS

This study demonstrates that circular economy approaches to healthcare waste can simultaneously reduce environmental hazards and strengthen public health resilience. These findings support integration of circular economy principles into Kenya's healthcare waste management policy and national health security frameworks.

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