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Role of Policymakers and Major Stakeholders in Healthcare Waste Management in Kano State, Nigeria

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Abstract

Healthcare facilities save lives, but the waste they generate can endanger them. Roughly 15% of healthcare waste (HCW) is classified as hazardous including infectious sharps, pathological tissue, pharmaceuticals, and chemical residues and when it is mismanaged, it exposes health workers, waste handlers, patients, and surrounding communities to infection, injury, and environmental contamination. This study examines the roles of policymakers and major stakeholders in healthcare waste management (HCWM) in Kano State, north-western Nigeria. Eight in-depth interviews were conducted with key informants drawn from the Kano State Ministry of Health and its parastatals (the Hospitals Management Board, the Private Health Institutions Registration Unit, and the Directorate of Pharmaceutical Services), the State Primary Healthcare Development Board, the Ministry of Environment, the Refuse Management and Sanitation Board (REMASAB) and the National Environmental Standards and Regulations Enforcement Agency (NESREA), complemented by facility administrative records, a quantitative facility audit (n = 203 clinical units), and field observation. The findings show that segregation at source is poorly practised, largely because the supply of colour-coded containers depended on a donor project (JSI-MMIS, 2004–2009) that ended a decade and a half ago. REMASAB evacuates an estimated 155.8 tonnes (443.2 m³) of HCW monthly from nine secondary facilities in Kano Metropolis about 2.0% of the municipal solid waste stream—using non-dedicated open-body trucks, and disposes of untreated HCW at ordinary municipal dumpsites. Record keeping exists in only one of the facilities surveyed. Funding is ad hoc and donor-dependent, training is rare, and responsibility for HCWM is contested between the ministries of health and environment. The National Policy on Injection Safety and HCWM was unknown even to senior policymakers in the state, although its enforcement provisions have since been strengthened by the National Environmental (Healthcare Waste Control) Regulations of NESREA. The study concludes that sustainable HCWM in Kano State requires statutory policy domestication, dedicated budget lines, trained and protected waste handlers, specialised logistics, licensed private-sector participation, and a multi-agency coordination framework.

Keywords: healthcare waste management; waste segregation; environmental health policy; REMASAB; NESREA; environmental governance; Kano State; Nigeria.



Introduction

The provision of healthcare inevitably generates waste, and some of that waste is dangerous. The World Health Organisation estimates that of the waste produced by healthcare activities, about 85% is general, non-hazardous waste, while the remaining 15% is hazardous material that may be infectious, pathological, pharmaceutical, chemical or radioactive (WHO, 2014; WHO, 2024). It is this smaller fraction that carries most of the risk: used needles transmit hepatitis B, hepatitis C and HIV; contaminated dressings and laboratory cultures spread nosocomial infection; and expired drugs or incinerated plastics release toxic residues into soil, air and water. Safe management of healthcare waste is therefore not a janitorial afterthought but a core public health function, one that the WHO has long argued should be treated as an integral part of healthcare planning rather than an add-on (WHO, 1999; WHO, 2014).

In Nigeria, the governance of healthcare waste is complicated by institutional overlap. Federal bodies set standards the Federal Ministry of Health issued a National Policy on Injection Safety and Healthcare Waste Management in 2007, while NESREA administers the National Environmental (Sanitation and Waste Control) Regulations 2009 and, more recently, dedicated healthcare waste regulations. At the state level, ministries of health and environment, hospital management boards, primary healthcare development boards and sanitation authorities all touch some part of the waste stream, while local governments are statutorily responsible for primary health centres and their waste. Where these mandates are not clearly delineated, each institution tends to assume the problem belongs to someone else. In Nigeria, there is a general lack of adequate information and clear-cut guidelines on healthcare waste management (Olatubara and Olurin, 2007), resulting in confusion not only among the generators but also among the operators, decision makers and the general public. Moreover, poor municipal waste management in Kano Metropolis compounds these risks; unguided dumpsite location near residential areas continuously exposes local populations to waste-associated health hazards due to the absence of formal, regulated collection systems (Danbuzu et al., 2014).

Kano State presents a critical case. It is the most populous state in northern Nigeria, with 44 local government areas and a healthcare network spanning tertiary teaching hospitals, specialist hospitals, secondary facilities under the Hospitals Management Board, primary health centres under the State Primary Healthcare Development Board, and hundreds of registered private facilities. Murtala Muhammad Specialist Hospital alone records outpatient attendances in the thousands per day and serves referral catchments extending beyond Nigeria's borders (Yakubu et al., 2023). Managing the waste of such a system is a substantial governance challenge, and evidence suggests it is not being met: a recent study at that same hospital found that most health workers lacked knowledge of colour codes and recommended disposal sequences, only 29% had ever received waste management training, and 79% reported that colour-coded containers were not available in their departments (Yakubu et al., 2023).

This study set out to examine the role of policymakers and major stakeholders in healthcare waste management in Kano State: who is supposed to do what, what they actually do, and why the gap between the two persists. It draws on eight in-depth interviews with institutional actors, facility administrative records, a facility audit of 203 clinical units, and field observation carried out during the original investigation, and situates the empirical findings against current regulatory developments, including NESREA's dedicated healthcare waste regulations and recent pilot initiatives involving private waste contractors in the state.

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Methods

The Study Area

The study was conducted in Kano State, north-western Nigeria. Kano Metropolis, the state capital, is one of the largest urban centres in the country and concentrates most of the state's tertiary and secondary healthcare facilities, while primary health centres are distributed across all 44 Local Government Areas. The state therefore exhibits the full hierarchy of healthcare provision—tertiary, secondary, primary and private—within a single administrative territory, making it a suitable setting for assessing inter-institutional coordination in waste management.

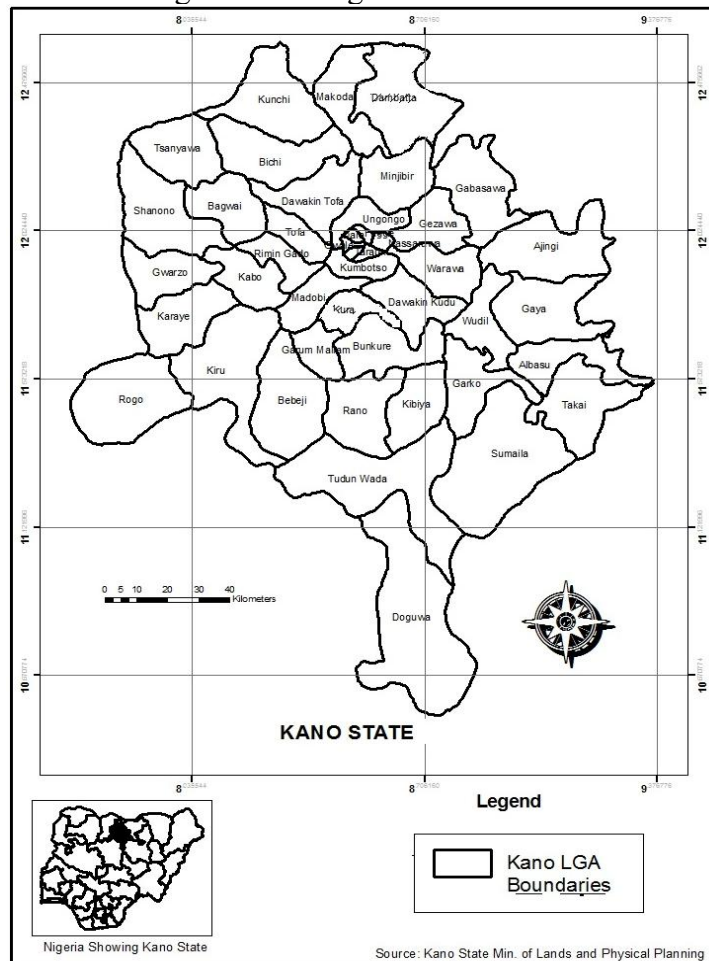


Figure 1: The Study Area

2.2 Research Design, Sampling, and Ethical Considerations

A mixed qualitative and observational study design was adopted. In-depth interviews were conducted with eight key informants purposively selected from the principal institutions with a stake in HCWM: the Kano State Ministry of Health (and its parastatals—the Hospitals Management Board, the Private Health Institutions Registration Unit, and the Directorate of Pharmaceutical Services), the State Primary Healthcare Development Board, the Ministry of Environment and REMASAB, and NESREA. Interview protocols covered two tracks: operational



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capacity (funding, staffing and training) and regulatory governance (policy awareness, legislation and enforcement).

To quantify operational realities, a quantitative facility audit was conducted across 203 clinical units sampled across the healthcare hierarchy (Primary: 32 units, Secondary: 115 units, Tertiary: 37 units, Private: 19 units). Data were collected using a structured observational checklist and facility administrative audit tool capturing monthly safety box fill rates, waste handler staffing, and non-personnel waste management expenditure. Administrative data were compiled from facility records, including safety box distribution and immunisation throughput records from the SPHCDB, drug destruction inventories from the Directorate of Pharmaceutical Services, and waste evacuation estimates from REMASAB.

Field observation was undertaken at points of waste generation, temporary storage sites, incinerators and needle pits, and municipal disposal grounds; photographic documentation of pharmaceutical destruction exercises formed part of this observational record and is reproduced in this paper as Plates 1–4. Interview transcripts and field notes were analysed thematically around segregation and storage; collection, haulage and disposal; pharmaceutical and anatomical waste; funding and staffing; training and supervision; institutional coordination; and policy enforcement.

Ethical approval for this study was granted by the Health Research Ethics Committee of the Kano State Ministry of Health. Informed verbal and written consent was obtained from all key informants and facility administrators before interviews and administrative record retrieval. Key informant quotes are attributed by institutional role rather than personal identity to preserve confidentiality. Historical administrative figures reported in this paper serve as a documented institutional baseline against which recent regulatory developments—specifically the 2025 NESREA Healthcare Waste Regulations and 2026 PHIMA private-sector pilots—can be evaluated.

Results

Generation, Segregation and Storage of Healthcare Waste

Segregation at source is the foundation of safe HCWM: separating hazardous streams from general refuse reduces the volume requiring treatment, protects handlers, and prevents environmental contamination (WHO, 1999; WHO, 2014). In Kano State, this foundation is weak. No state institution claimed responsibility for supplying colour-coded containers to healthcare facilities. Colour-coded bins had been introduced in public facilities by the Making Medical Injections Safer (MMIS) project of John Snow Incorporated between 2004 and 2009. When the project ended, so did the supply. Facilities that wished to continue segregation had to improvise with unstandardised containers from the open market an option few took up. The result, observed consistently across sampled facilities, was mixing of clinical and general waste from the point of generation.

The supply of safety boxes for sharps told a different, more encouraging story. Through the 'bundling system' administered by the National Primary Health Care Development Agency, safety boxes were distributed alongside syringes for routine immunisation and campaigns, channelled through the State Primary Health Care Development Board. Records from the Board show that 3,717,754 bundled injectable vaccinations were administered in Kano State between

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January and December 2015 equivalent, at 100 syringes per safety box, to roughly 3,098 safety boxes generated per month from immunisation alone.

Monthly safety box generation across 203 sampled clinical units varied sharply with facility hierarchy and patient load (Table 1). Overall, 35.0% of units filled only one safety box a month, while 11.3% of units concentrated in Accident and Emergency, immunisation and injection rooms filled twenty or more. Tertiary facilities accounted for the highest throughput: 29.7% of their units generated at least 20 safety boxes monthly.

Table 1: Number of safety boxes filled per month by facility hierarchy (n = 203 units)

Hierarchy	1/mo	2/mo	4/mo	6/mo	8/mo	12/mo	≥20/mo	Not indicated	Total
Primary	12 (37.5)	6 (18.8)	1 (3.1)	1 (3.1)	1 (3.1)	2 (6.2)	1 (3.1)	8 (25.0)	32 (100.0)
Secondary	49 (42.6)	16 (13.9)	8 (7.0)	5 (4.3)	6 (5.2)	0 (0.0)	11 (9.6)	20 (17.4)	115 (100.0)
Tertiary	5 (13.5)	3 (8.1)	5 (13.5)	1 (2.7)	4 (10.8)	5 (13.5)	11 (29.7)	3 (8.1)	37 (100.0)
Private	5 (26.3)	2 (10.5)	7 (36.8)	0 (0.0)	1 (5.3)	0 (0.0)	0 (0.0)	4 (21.1)	19 (100.0)
Total	71 (35.0)	27 (13.3)	21 (10.3)	7 (3.4)	12 (5.9)	7 (3.4)	23 (11.3)	35 (17.2)	203 (100.0)

Source: Fieldwork, 2015

Even where sharps were safely contained, their final treatment was rudimentary. Depending on the facility, filled safety boxes were disposed of by open burning, burn-and-bury, or low-temperature incineration; some were returned to local government immunisation offices for central destruction, usually by burial. None of these is among the methods recommended by the WHO (2014), and open burning in particular releases dioxins, furans and particulate matter into surrounding neighbourhoods. The MMIS project had installed a purpose-built incinerator and needle pits in one sampled facility, but such investment was not replicated after the project closed.

Evacuation, Transportation and Final Disposal

Off-site evacuation of healthcare waste in Kano Metropolis falls to REMASAB, the State sanitation authority. A senior REMASAB official described the agency's coverage plainly:

“We are concerned with the provision of litter buckets, evacuation and final disposal of healthcare wastes from only the secondary HCFs within Kano Metropolis... REMASAB is a state government agency responsible for all refuse management and sanitation activities in the state. However, its activities are restricted to public places and some state government institutions including HCFs. Private HCFs are owned by individuals as an investment for profit-making, while PHC facilities are under the care of the PHC departments in their respective Local Government Areas.”

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The coverage described is narrow: urban public secondary facilities, plus a few federal hospitals paying token service fees. Private facilities, primary centres and rural secondary facilities manage their own waste, each under a different authority. Estimates obtained from REMASAB (Table 2) indicate a monthly HCW evacuation volume of 443.2 m³, corresponding to an estimated weight of 155.8 tonnes across nine major secondary and specialist facilities in Kano Metropolis—roughly 2.0% of the 7,687 tonnes of municipal solid waste the agency collects monthly. Murtala Muhammad Specialist Hospital alone contributed 87.0 tonnes monthly (55.8% of total evacuated weight), consistent with its 808-bed capacity and outpatient load exceeding 7,000 per day; patient volume is a well-established driver of HCW generation rates (Longe & Williams, 2006; Coker et al., 2009).

Table 2: Estimated Monthly HCW Evacuation and Dumpsites for Selected HCFs in Kano Metropolis

S/N	Healthcare facility	Est. monthly volume (m ³)	Est. weight (tonnes)	Dumpsite
1	Murtala Muhammad Specialist Hospital	246.4	87.0	Court Road, Gyadi-Gyadi
2	Hasiya Bayero Paediatric Hospital	32.8	11.8	Court Road, Gyadi-Gyadi
3	Sabo Bakin Zuwo Maternity Hospital, Jakara	16.4	5.4	Court Road, Gyadi-Gyadi
4	Waziri Shehu Gidado General Hospital, Bachirawa	32.8	11.8	Hajj Camp
5	Infectious Diseases Hospital	16.4	5.4	Hajj Camp
6	Abubakar Imam Urology Centre	32.8	11.8	Hajj Camp
7	National Orthopaedic Hospital, Dala	16.4	5.4	Hajj Camp
8	Muhammad Abdullahi Wase Specialist Hospital	32.8	11.8	Maimalari Road, Bompai
9	Sir Muhammadu Sunusi Specialist Hospital	16.4	5.4	Maimalari Road, Bompai

Source: Fieldwork, 2016

Two structural flaws stand out. First, dumpsite selection is guided by proximity, not by sanitary design; untreated infectious waste is tipped alongside municipal refuse at unlined open



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dumps Court Road, Hajj Camp, Maimalari Road, Bompai creating clear pathways for leachate contamination of soil and groundwater (Longe, 2011; Nabegu, 2010). This environmental hazard aligns with broader empirical findings on solid waste governance in Kano Metropolis by Danbuzu et al. (2014). Their assessment demonstrated a direct relationship between poor solid waste management and localized disease burdens, revealing that in low- and medium-density urban areas lacking formal collection systems, unguided dumpsites are routinely cited in immediate proximity to residential homes and commercial shops. Tipping untreated, biohazardous healthcare waste into these unengineered, community-adjacent dumpsites drastically intensifies direct and indirect contact risks, heightening the surrounding population's exposure to waste-associated enteric and vector-borne diseases (Danbuzu et al., 2014). Second, the agency lacks the means to do the job properly: the Medical Waste Unit is overseen by a single officer, and there are no dedicated HCW transport vehicles. As the official put it, "there are no waste collection trucks dedicated to the evacuation of HCW... this leads to competition with MSW collection which affects the frequency of HCW evacuation." Healthcare waste therefore travels in open-body tipper trucks shared with general refuse, contrary to WHO guidance on sealed, marked and dedicated transport (WHO, 2014).

Record keeping, the basic tool of waste governance, was equally neglected: only one sampled facility maintained a waste inventory. Its records showed an average of 6,851 kg of partially segregated clinical waste treated monthly at a central mechanical incinerator, with Accident and Emergency the highest-yielding unit (about 40 kg/day), followed by the male medical ward, laboratory and labour room (20–30 kg/day), and physiotherapy the lowest (4 kg/day). Per-capita generation averaged 0.65 kg per patient per day close to the 0.60 kg/patient/day reported in Ibadan (Sridhar & Coker, 2006) and the 0.48 kg/bed/day reported for north-west Nigeria in a national survey (Federal Ministry of Environment, 2007). The comparison with Lagos is instructive: the Lagos State Waste Management Authority operates a structured HCWM system, contracts more than twenty licensed private collectors, and runs quarterly training for health workers (LAWMA, 2015; Longe, 2011). Kano has no equivalent arrangement—although encouragingly, a recent pilot led by the Kano Private Health Institutions Management Agency with donor support has begun engaging licensed private vendors for colour-coded segregation, collection and high-temperature incineration at private facilities, reporting movement from full non-compliance toward partial adherence among the first 50–56 facilities enrolled (Nigeria Health Watch, 2026).

Pharmaceutical and Anatomical Waste

Certain waste streams demand special handling because of their toxicity, resale value or public sensitivity. Expired and damaged pharmaceuticals from primary and secondary facilities are inventoried, labelled and returned to the Kano State Drugs and Medical Consumables Management Agency, which passes them to the State Task Force Committee on the Destruction of Fake and Counterfeit Drugs. Destruction takes place periodically on Executive directive rather than a fixed schedule by open burning at a designated ditch (Farawa, Kumbotso LGA, later the NDLEA premises on Airport Road for security reasons). Centralised destruction prevents diversion of expired drugs into markets, but open burning of pharmaceutical stock is environmentally unsound and increasingly difficult to justify given available alternatives. Plate 1–4 document this destruction exercise as observed during fieldwork.



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Plate 1: Heap of Expired drugs and other Items waiting for destruction



Plate 2: Getting ready for burning the items



Plate 3: Burning the items

Source: Ministry of Health Kano, 2016



Plate 4: Burning/ Destruction on progress



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The scale of pharmaceutical waste is not trivial: between November 2012 and December 2015, documented drug expiry losses were valued at ₦46,923,393 in secondary facilities (about 8% of stock) and ₦11,258,640 in primary facilities (about 4.3%). To curb this, the state replaced the traditional 'first-in, first-out' rule with 'first-expire, first-out' (FEFO) and a 1% expiry tolerance, and promoted bundling of syringes with safety boxes. Tertiary facilities dispose of pharmaceutical waste differently—incinerating combustibles, crushing and burying vials, and at Aminu Kano Teaching Hospital channelling liquid residues to the central sewage treatment plant. Anatomical waste (amputated limbs, placentas, tissue from biopsies and autopsies) is disinfected and buried in pits sized to the material, within or near facility grounds; during communal crises, unclaimed corpses and large anatomical volumes have been removed by REMASAB trucks for mass burial at Hawan Kalebawa, Dawakin Tofa LGA.

Funding and Staffing

Money is where policy meets reality, and in Kano the reality is thin. Healthcare waste operations are funded principally from facilities' own maintenance votes and Drug Revolving Fund proceeds. A Hospitals Management Board official described the arrangement: "HCWM funding is a collective responsibility between the Board and the HCFs... HCFs use their funds from maintenance (overhead) costs and DRF proceeds to cater for their waste. However, this does not include major works like construction of incinerators."

Local government authorities—statutorily responsible for primary facility sanitation—contributed virtually nothing, leaving facilities dependent on ad hoc donations from NGOs such as WASH partners, FHI 360 and Malaria Control Partners for basic supplies like personal protective equipment. This pattern of donor dependence instead of budget lines has been widely documented across Nigeria (Oyekale & Oyekale, 2017; Nigcamed & Federal Ministry of Environment, 2000).

The financial survey of sampled facilities showed wide disparities. Only about 10% of facilities spent more than ₦100,000 monthly on waste management. The vast majority spent less than ₦5,000 monthly sums administrators themselves described as grossly inadequate for purchasing basic bins, liners, and PPE, or for maintaining incinerators.

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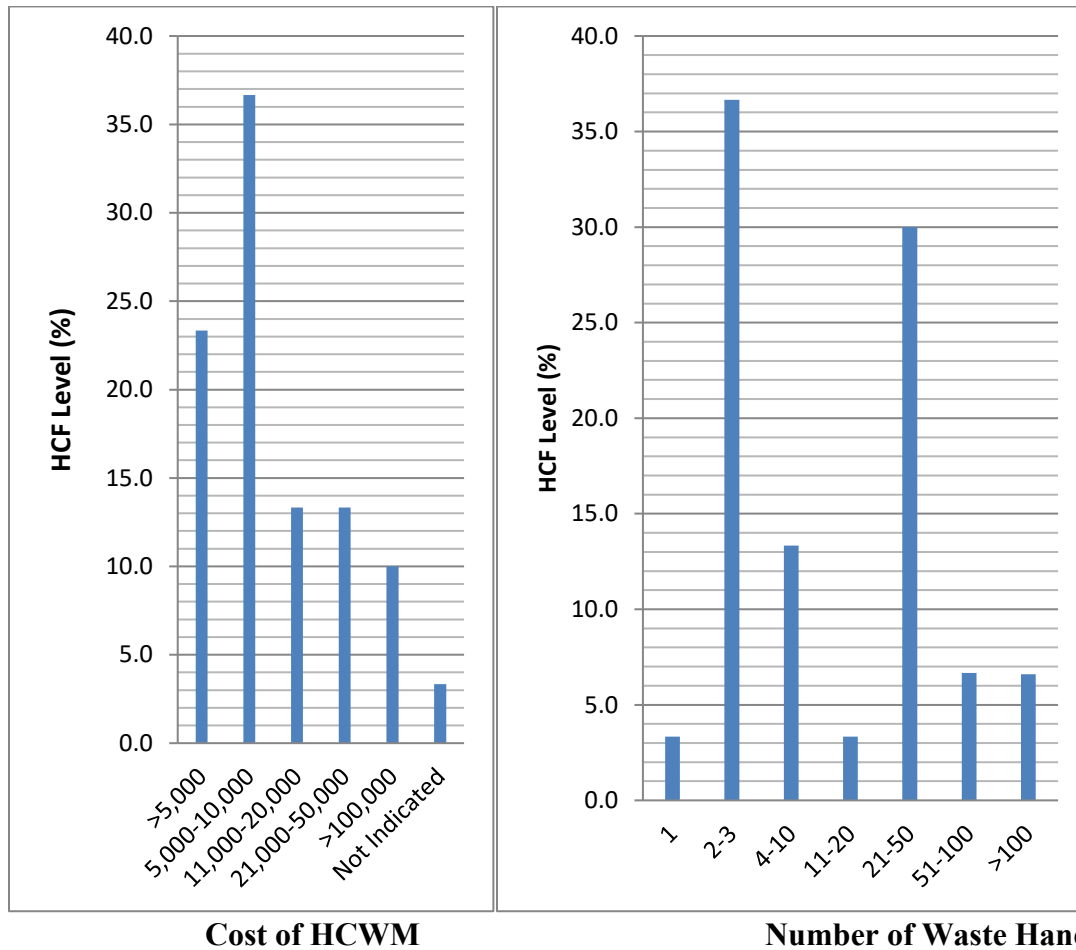


Figure 2: Monthly Cost of HCWM at HCF level **Figure3: HCW staffing at HCF level**

Staffing allocations followed a similar steep hierarchy. Primary health centres typically operated with two or three cleaners acting as untrained waste handlers. Secondary healthcare facilities fielded between 21 and 50 handlers. Only large tertiary teaching and specialist hospitals maintained dedicated teams exceeding 100 personnel. Facility managers across all tiers judged their waste staffing inadequate, and private facilities typically relied on daily-paid casual collectors with no formal employment protections or occupational health coverage (Figure 2 and 3).

Training, Awareness and Supervision

Most waste handlers and many health workers had never received instruction in segregation, containment or occupational safety; where training occurred, it was usually a one-off workshop delivered by a donor project. Ward-level standard operating procedures and disposal charts were largely absent. The consequences show up in the facility-level evidence: at Murtala Muhammad Specialist Hospital, fewer than half of surveyed health workers knew the correct sequence of waste management, only about a quarter knew the relevant colour codes, and only 29% had ever attended any waste management training (Yakubu et al., 2023). Similar deficits have been reported among health workers in south-west Nigeria (Amaike et al., 2025) and among waste



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handlers in a Lassa fever treatment centre, where inadequate PPE and absent training translated directly into needlestick injuries, psychological distress and back injuries (Global Health Journal, 2025). Without trained personnel and visible supervision, written policy changes little at the bedside.

Institutional Coordination

Perhaps the most consequential finding is that no single institution considers healthcare waste its core business. Ministry of Environment officials argued that injection safety and clinical waste "is the responsibility of Ministry of Health, not Environment." Their counterparts in the Ministry of Health formally the custodians of health policy conceded unawareness of the National Policy on Injection Safety and HCWM: "we cannot domesticate what we are not aware of. All I know is that we collaborate with NGOs to train healthcare personnel." NESREA invoked its statutory powers under its establishing Act and the 2009 sanitation regulations, but in practice prioritised industrial effluent; its HCW inspections, undertaken jointly with PHIRU, targeted private clinics, leaving the larger and more complex public hospitals effectively unmonitored. PHIRU, meanwhile, polices private facilities under the Kano State Public Health Edict of 1985 four decades old and can and does order temporary closures for non-compliance, but its remit is registration and general sanitation rather than technical waste auditing.

The predictable outcome of this fragmentation is a system in which secondary and primary facilities receive neither technical support nor enforcement, private facilities receive sporadic attention, and tertiary facilities rely on their own institutional capacity. Overlapping mandates without coordination produce not redundancy but neglect.

Policy and Regulatory Environment

Nigeria's formal framework is not absent it is unimplemented. The National Policy on Injection Safety and Healthcare Waste Management (Federal Ministry of Health, 2007) assigns responsibilities to every level of government, and the National Environmental (Sanitation and Waste Control) Regulations 2009 (Federal Republic of Nigeria, 2009) criminalise unsafe disposal. Yet in Kano State the national policy was unknown to the very officials who would be responsible for domesticating it; only two tertiary facilities possessed a copy, and implementation even there was partial. This disconnect between federal formulation and state implementation mirrors the situation the WHO documented across South-East Asia, where most facilities lacked waste management plans and several countries lacked legislation altogether (WHO, 2000; Akter et al., 1998; Johannessen, 1997).

The regulatory landscape, however, has shifted since the fieldwork was concluded. NESREA has now promulgated dedicated National Environmental (Healthcare Waste Control) Regulations, which for the first time impose specific, enforceable obligations on healthcare waste generators, handlers and treatment facilities in Nigeria: mandatory healthcare waste management plans, segregation using prescribed colour-coded containers, prohibition of open burning, licensing of treatment facilities, and graduated penalties including daily fines for continuing offences (NESREA, 2025). Whether these regulations succeed where the 2009 framework faltered will depend on exactly the factors this study identifies—domestication into state law, dedicated enforcement staffing, and budgetary backing—rather than on the text of the regulations alone.



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General Discussion

Read together, the findings describe a governance failure that operates at three linked levels. At the operational level, segregation fails because the simplest inputs colour-coded bins have no supplier; collection fails because a single officer and shared tipper trucks cannot serve a metropolis of hospitals; and disposal fails because proximity, not protection, selects the dumpsite. At the institutional level, funding exists only as facility overhead, staffing is skeletal, training is occasional, and supervision is largely absent. At the policy level, mandates are contested, the national policy is unknown, and enforcement is directed at the periphery (private clinics) rather than the centre (public hospitals).

Each level reinforces the others. Without budget lines, ministries cannot procure bins or trucks; without trained staff, bins are misused; without enforcement, non-compliance carries no cost; and without a designated owner, every agency can deflect responsibility. Recent evidence from within Kano State confirms that facility-level practice tracks precisely these institutional inputs: where dedicated waste managers, disposal charts, guidelines and training exist, adherence rises; where they do not, knowledge degrades into hazardous habit (Yakubu et al., 2023).

The same lesson emerges nationally and beyond: Nigerian studies repeatedly identify inadequate funding, weak legislation and absent training as the binding constraints (Oyekale & Oyekale, 2017; Awodele et al., 2016), and comparative reviews of China and Nigeria attribute the persistence of these constraints to ineffective legislation and limited financing rather than to any lack of technical knowledge (Waste Management & Research, 2024). Notably, the recent Kano pilot linking PHIMA with licensed private vendors suggests that when segregation equipment, trained focal persons and a fee-for-service collection arrangement are supplied together, compliance responds quickly (Nigeria Health Watch, 2026) evidence that the bottleneck is institutional, not cultural.

The study further reveals that ownership status and location of HCFs are not significant determinants of variations in healthcare waste management practices in the study area. This is linked to the homogeneity in the management of healthcare facilities at the same levels irrespective of location and ownership. Hierarchy and institutional support proved more important than ownership status and location in explaining variations in practice.

Conclusion

Healthcare waste management in Kano State remains precarious. Hazardous waste is commonly mixed with general refuse from generation to final disposal; evacuation is infrequent, undedicated and terminates at open municipal dumpsites; record keeping exists in only a handful of facilities; funding is ad hoc and donor-dependent; training is rare; and responsibility is fragmented across agencies, none of which regards the problem as fully its own. The root causes are institutional: absent policy domestication, absent budget lines, absent coordination, and weak enforcement. The enactment of dedicated federal healthcare waste regulations offers a fresh statutory basis for reform, but it will change practice on the ground in Kano only if the state domesticates it, funds it, and staffs its enforcement.

Recommendations

Based on the findings, the following measures are proposed:

I. At Healthcare Facility Level



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1. Provide standardised colour-coded containers and liners in all clinical areas, with segregation enforced at source and supervised daily.
2. Construct secure secondary storage points, with waste held no longer than 48 hours.
3. Integrate mandatory orientation and refresher training into facility routines, supported by visual SOPs at waste points.
4. Equip all waste handlers with complete PPE, hepatitis B immunisation and risk-adjusted allowances.
5. Designate literate record officers to maintain daily waste ledgers.
6. Engage licensed HCW collectors where on-site treatment is infeasible.

II. At Government and Regulatory Level

1. The National Policy on Injection Safety and HCWM (2007) should be enacted into law and domesticate it, together with the new NESREA healthcare waste regulations, into binding state legislation.
2. Create dedicated budget lines for HCWM in all public secondary and primary facilities, ending reliance on donor cycles.
3. Restructure and adequately staff REMASAB's Medical Waste Unit, equip it with closed, dedicated, compliant transport vehicles, and bar the co-disposal of HCW with municipal refuse.
4. Deploy environmental health officers to all facilities above 200 beds and constitute facility infection control and waste management committees.
5. Install modern emission-controlled incinerators at large facilities and organise regional treatment arrangements for smaller ones.
6. Apply FEFO stock management and phased framework supply contracting through the central medical store to minimise pharmaceutical expiry.
7. Scale up the emerging public-private model licensed vendors, colour-coded systems and high-temperature treatment beyond its current pilot coverage of private facilities.
8. Establish a standing multi-agency HCWM steering committee (Ministries of Health, Environment and Local Government; REMASAB; NESREA; KSHMB; KSPHCDB; PHIMA; donor and NGO partners) to eliminate mandate overlap and enforce collective accountability.

Additionally, the National Curriculum Development Committee of the Federal Ministry of Education, in collaboration with the Ministry of Health and all relevant academic institutions, should ensure that healthcare waste management is included in the training curricula of all medical and para-medical institutions as a way of inculcating the spirit of better healthcare waste management practices right from schools.

Finally, given the decade-long interval since the primary baseline data were gathered, there is an urgent need for policymakers and major stakeholders—including the Ministry of Health, Ministry of Environment, NESREA, and donor agencies—to commission updated, state-wide empirical research. Conducting contemporary assessments will bridge the existing data gap, quantify changes in generation volumes following recent regulatory updates, and enable key decision-makers to evaluate stakeholder performance and drive evidence-based environmental health policy across Kano State.



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