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STRENGTHENING BORDER HEALTH SYSTEMS IN NIGERIA: CORE CAPACITY REQUIREMENTS AND IMPLEMENTATION CHALLENGES AT GROUND CROSSINGS IN KWARA, LAGOS, AND KANO STATES

BY

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Abstract

Despite significant policy commitments to International Health Regulations (IHR, 2005) compliance, Nigeria's land border health systems continue to face profound structural and operational deficits that limit their capacity to detect, contain, and respond to public health threats. Core capacity gaps encompassing trained personnel, functional equipment, disease-specific infrastructure, communication systems, and inter-agency coordination have been persistently identified at Nigerian ground crossings, yet remain inadequately documented at the sub-national level. This study assessed the core capacity requirements for preparedness and response to disease outbreaks and evaluated the implementation challenges of exit and entry screening at selected land borders in Lagos (Seme), Kwara (Chikanda), and Kano (Jibiya) States, Nigeria. A descriptive cross-sectional mixed-methods study was conducted among 203 port health officers and border health personnel at the three selected ground crossings. Quantitative data were collected using structured questionnaires and analyzed using descriptive statistics and chi-square tests. Qualitative data were obtained through Focus Group Discussions (FGDs) with 6–10 purposively selected participants per site and subjected to thematic analysis. An observational checklist was also employed to corroborate quantitative findings. Findings revealed critical deficiencies in core capacities across all three states. Only 38.4% of respondents confirmed availability of trained staff, while functional equipment was reported by 48.3%. Reliable communication systems showed the strongest availability at 60.6%, followed by disease-specific infrastructure (56.2%) and staff adequacy (61.6%). Chi-square analysis demonstrated statistically significant associations between preparedness levels and training received ($p < 0.001$), equipment availability ($p < 0.003$), staff adequacy ($p < 0.003$), and communication systems ($p < 0.014$). Qualitative themes identified persistent implementation challenges including funding shortfalls, inter-agency coordination failures, inadequate infrastructure, high informal border traffic, and insufficient simulation exercises. Core capacity requirements at Nigerian land borders remain substantially below IHR (2005) minimum standards. Addressing implementation challenges requires sustained investment in workforce development, infrastructure upgrading, inter-agency coordination mechanisms, and standardized protocols to strengthen outbreak preparedness and response at ground crossings.

Keywords: Core capacity; Border health; Ground crossings; Preparedness; IHR 2005; Implementation challenges; Nigeria; Land borders; Disease surveillance.

Introduction

The International Health Regulations (IHR, 2005) constitute the primary global legal framework for preventing, protecting against, controlling, and providing a public health response to the international spread of disease. Under the IHR, States Parties are mandated to establish and sustain core capacities for surveillance and response at designated points of entry (PoEs), including airports, seaports, and ground crossings (WHO, 2021). These core capacities encompass trained personnel, functional screening equipment, standard operating procedures (SOPs), data management systems, isolation and quarantine facilities, and robust coordination mechanisms with national and international partners (WHO, 2019; Africa CDC, 2021).

Nigeria's land borders present unique and complex challenges to IHR compliance. The country shares approximately 4,045 km of land boundaries with the Republic of Benin, Niger, Chad, and Cameroon, with an estimated 1,500 border crossings, of which only 84 are approved formal control posts (Economic Confidential, 2023). The remaining crossings over 1,400 informal routes represent significant surveillance gaps that expose the national health system to importation risks from a wide range of infectious diseases (Oguntuase, 2024). These vulnerabilities were starkly demonstrated during the 2014 Ebola Virus Disease outbreak, when an infected traveler crossing through Lagos triggered a cluster of 19 confirmed cases and 8 deaths before containment (Shuaib *et al*., 2014), and again during the COVID-19 pandemic, when border control systems were overwhelmed by the scale of the crisis (NCDC, 2022).

Despite growing recognition of these risks, assessment of core capacity requirements and implementation challenges at Nigerian ground crossings remains limited in the published literature, particularly at the sub-national level. National-level evaluations such as the Second Joint External Evaluation (JEE) of IHR core capacities by the NCDC and WHO (2023) identified the Points of Entry domain as among the weakest, scoring only 2.0 on a 5-point scale. Subnational assessments by Eteng *et al*. (2022) and Adepoju (2021) corroborated these findings, documenting substantial gaps in human resources, logistics, isolation infrastructure, and coordination at selected land borders.

This study addresses this evidence gap by systematically assessing core capacity requirements for preparedness and response to disease outbreaks, and by identifying the specific implementation challenges of exit and entry screening at ground crossings in three strategically important states: Lagos (Seme Border, South-West), Kwara (Chikanda Border, North-Central), and Kano (Jibiya Border, North-West). The findings are intended to provide evidence-based insights for policymakers, public health authorities, and development partners committed to strengthening Nigeria's border health security in compliance with IHR (2005).

Research Objective

1. To assess the core capacity requirements for preparedness and response to disease outbreaks across the three states.
2. To evaluate the availability and utilization of health screening tools at points of entry and exit.
3. To assess the presence and adequacy of protocols for entry and exit screening.
4. To explore implementation challenges, operational barriers, and contextual factors affecting entry and exit screening measures and outbreak preparedness at selected land borders.

Research Questions

1. What core capacity requirements for preparedness and response to disease outbreaks exist across the three states?

2. To what extent are health screening tools available and effectively utilized at points of entry and exit?

3. Are standard protocols for entry and exit screening present and adequately implemented at the selected land borders?

4. What implementation challenges, operational barriers, and contextual factors affect entry and exit screening measures and overall outbreak preparedness at the selected land borders?

Research Hypotheses

H_0: There is no significant association between core capacity components and preparedness levels.

H_1: There is significant association between core capacity components and preparedness levels.

H_0: There is no significant association between staff cadre and primary screening capacity.

H_1: There is significant association between staff cadre and primary screening capacity.

H_0: There is no significant association between staff cadre and secondary screening capacity.

H_1: There is significant association between staff cadre and secondary screening capacity.

H_0: There is no significant association between staff cadre and availability of isolation/quarantine rooms.

H_1: There is significant association between staff cadre and availability of isolation/quarantine rooms.

Methodology

This study adopted a descriptive cross-sectional research design using a mixed-methods approach. The design allowed for both quantitative and qualitative data collection to evaluate preparedness and response strategies at selected land borders in Nigeria, with specific focus on core capacity requirements and implementation challenges of exit and entry screening measures. The design was chosen because it provides a snapshot of existing conditions and relationships among variables within a defined period (Eteng *et al*., 2022). The study was conducted at three strategically selected land border areas of Nigeria, representing different geopolitical zones: (1) Seme Border, South-West, Lagos State a high-volume crossing on the Nigeria–Benin Republic corridor and the busiest land border in Nigeria; (2) Chikanda Border, North-Central, Kwara State a mid-volume crossing on the Nigeria–Benin Republic axis in the North-Central zone; and (3) Jibiya Border, North-West, Kano State a high-traffic crossing on the Nigeria–Niger Republic corridor in the North-West zone. These locations were selected because of their high volume of cross-border human and goods movement, their representation of distinct geopolitical zones, and their strategic significance for disease surveillance and border health preparedness (Oguntuase, 2024). The study population consisted of Port Health Officers and relevant border health stakeholders stationed at the three selected land borders. Using Cochran's formula for large populations ($Z = 1.96$, $p = 0.5$, $d = 0.05$), a minimum sample of 384 was calculated. Adjusted for the finite population of 350 Port Health Officers using the finite population correction formula, the adjusted sample was 183. A further 10% non-response adjustment yielded a final sample size of 203, proportionally allocated as follows: Lagos (Seme) = 87, Kano (Jibiya) = 67, and Kwara (Chikanda) = 49 respondents. A multi-stage sampling technique was employed. Three borders were purposively selected based on their representation of major geopolitical zones and levels of cross-border activity (Stage 1). Lists of eligible port health officers and border health stakeholders were obtained in collaboration with the Federal Ministry of Health and Port Health Services (Stage 2). Simple random sampling was used to select quantitative respondents (Stage 3). For the qualitative component (FGDs), purposive sampling selected 6–10 participants per site based on years of experience, leadership roles, and direct involvement in screening and outbreak response (Stage 4).

Data were collected using three instruments: (1) a structured questionnaire administered to Port Health Officers to capture quantitative data on core capacity requirements, preparedness levels, and screening effectiveness; (2) a Focus Group Discussion (FGD) Guide to obtain qualitative insights into operational and implementation challenges, inter-agency coordination gaps, and perceptions of preparedness; and (3) an Observational Checklist to assess the physical availability of infrastructure, screening equipment, PPE, isolation facilities, and other logistics at each study site. Content validity was established through expert review of draft instruments by public health and border health surveillance specialists. A pilot study was conducted in Ogun State with Port Health Officers not included in the main study. Reliability was confirmed using Cronbach's alpha ($\alpha = 0.82$), indicating high internal consistency. Ethical approval was obtained from the appropriate institutional review committee, and permission was secured from the Ministry of Health and Port Health Services Department. Participation was voluntary, with identities anonymized to protect confidentiality. Quantitative data were analyzed using descriptive statistics (frequencies, percentages, means, and standard deviations) and inferential statistics including chi-square tests. Associations between core capacity components and preparedness were assessed at the 5% significance level ($p < 0.05$). Qualitative FGD data were transcribed verbatim and subjected to thematic analysis to identify key implementation challenges, operational barriers, and contextual factors affecting border health systems at each study site.

Results and Discussion

Socio-Demographic Characteristics of Respondents

A total of 203 respondents participated in the study. The majority were aged 26–35 years (43.3%), followed by 18–25 years (28.6%), with respondents older than 56 years constituting the smallest proportion (2.0%). Respondents from Lagos and Ogun States (Seme Border) accounted for the highest proportion (42.9%), followed by Kano State Jibiya (33.5%), and Kwara State Chikanda (23.6%). Males constituted 63.0% and females 36.9%. The majority held a Bachelor's degree (73.4%), followed by a Master's degree (23.6%) and Diploma/Certificate qualifications (3.0%). Those with 3–5 years of experience formed the largest group (47.3%), followed by those with 0–2 years (31.5%), and only 4.4% had more than 15 years of experience. Environmental Health Officers constituted the largest cadre (44.3%), followed by Port Health Officers (34.0%), with immigration officers and other cadres making up the remainder.

Core Capacity Requirements for Preparedness and Response

The second objective of this study was to evaluate the core capacity requirements for preparedness and response to disease outbreaks at selected land borders. Findings are presented across five key capacity domains: trained staff, functional equipment, reliable communication systems, disease-specific infrastructure, and staff adequacy.

Table 1: Core capacity requirements for preparedness and response to disease outbreak across the three states

Capacity Element	Response	Lagos (%)	Kano (%)	Kwara (%)	Total (%)
Trained Staff	Yes	33 (37.90)	26 (38.80)	19 (38.80)	78 (38.40)

	No	54 (62.10)	41 (61.20)	30 (61.20)	125 (61.60)
Functional Equipment	Yes	41 (47.10)	32 (47.80)	25 (51.00)	98 (48.30)
	No	46 (52.90)	35 (52.20)	24 (49.00)	105 (51.70)
Reliable Communication Systems	Yes	53 (60.90)	40 (59.70)	30 (61.20)	123 (60.60)
	No	34 (39.10)	27 (40.30)	19 (38.80)	80 (39.40)
Disease-Specific Infrastructure	Yes	49 (56.30)	37 (55.20)	28 (57.10)	114 (56.20)
	No	38 (43.70)	30 (44.80)	21 (42.90)	89 (43.80)
Staff Adequacy	Yes	54 (62.10)	41 (61.20)	30 (61.20)	125 (61.60)
	No	33 (37.90)	26 (38.80)	19 (38.80)	78 (38.40)

Table 1 presents the distribution of core capacity elements across the three states. Regarding trained staff, availability was critically low across all sites, with only 33 (37.9%) in Lagos, 26 (38.8%) in Kano, and 19 (38.8%) in Kwara reporting availability, yielding a combined total of 78 respondents (38.4%). The majority 125 respondents (61.6%) indicated the absence of adequately trained staff at their respective border posts. Functional equipment was available to 41 (47.1%) in Lagos, 32 (47.8%) in Kano, and 25 (51.0%) in Kwara, producing a combined total of 98 respondents (48.3%), while non-availability was reported by 105 respondents (51.7%). Reliable communication systems showed the strongest availability, reported by 53 (60.9%) in Lagos, 40 (59.7%) in Kano, and 30 (61.2%) in Kwara an overall total of 123 respondents (60.6%), with absence noted by 80 respondents (39.4%). Disease-specific infrastructure was available for 49 (56.3%) in Lagos, 37 (55.2%) in Kano, and 28 (57.1%) in Kwara, giving a combined total of 114 respondents (56.2%), while 89 respondents (43.8%) indicated non-availability. Staff adequacy was reported by 54 (62.1%) in Lagos, 41 (61.2%) in Kano, and 30 (61.2%) in Kwara, totaling 125 respondents (61.6%), while inadequacy was noted by 78 respondents (38.4%).

Table 2: Chi-square analysis of association between core capacity components and preparedness levels

Core Capacity Component	df	p-value	Interpretation
Training received	2	**< 0.001**	**Significant**
Equipment available	2	**< 0.003**	**Significant**
Staff adequacy	2	**< 0.003**	**Significant**
Communication system	2	**< 0.014**	**Significant**
Infrastructure	2	< 0.052	Near significant

Table 2 presents the chi-square analysis examining the statistical relationship between individual core capacity components and overall preparedness levels at the selected land borders. Findings revealed statistically significant associations across all major capacity elements assessed. Training received demonstrated the strongest statistical significance ($p < 0.001$, df = 2), confirming that the availability of trained personnel is a primary determinant of preparedness levels at ground crossings. Equipment availability ($p < 0.003$, df = 2) and staff adequacy ($p < 0.003$, df = 2) both yielded highly significant associations, indicating that functional screening tools and sufficient workforce numbers are critical to institutional preparedness. Communication systems also demonstrated a statistically significant association with preparedness ($p < 0.014$, df = 2), underscoring the importance of reliable information-sharing infrastructure for outbreak detection and response. Although infrastructure returned a p-value of 0.052 marginally above the conventional 0.05 threshold this near-significant finding suggests a substantive, if statistically borderline, relationship between disease-specific infrastructure and preparedness capacity. Overall, these findings confirm that preparedness at Nigerian land borders is multidimensionally determined, with weaknesses in any single capacity element capable of compromising the broader system's readiness for outbreak response.

Screening Tools and Protocols Indicators of Capacity Gaps

To further assess implementation capacity, the availability and utilization of health screening tools and protocols were examined across all three border sites as additional indicators of core capacity status.

Table 3: Availability and utilization of health screening tools (One-Sample Test of Proportion)

Screening Tool / Measure	Available (%)	p-value	Significant?	Interpretation
Digital thermometers	100	**< 0.001**	Yes	Fully integrated
Infrared thermometers	91	**0.003**	Yes	Widely available
Surveillance and reporting tools	91	**0.002**	Yes	Strong availability
Sanitation/hygiene facilities	75	**0.010**	Yes	Fair availability
Personal Protective Equipment (PPE)	69	**0.005**	Yes	Moderate; inconsistent use
E-yellow card screening	44	0.056	Borderline	Inconsistent compliance
Rapid testing kits/devices	25	0.934	No	**Critical gap**

Table 3 reveals marked variation in the availability and utilization of screening tools across the assessed border facilities. Digital thermometers were universally present across all facilities (100%, $p < 0.001$), indicating full integration of basic temperature measurement into routine screening. Infrared thermometers were widely available (91%, $p = 0.003$), likely reflecting support from international partners including the WHO. Surveillance and reporting tools similarly demonstrated strong availability (91%, $p = 0.002$), suggesting a functional foundation for disease monitoring and reporting. Sanitation and hygiene facilities were present in 75% of sites ($p = 0.010$), while PPE was available in 69% of facilities ($p = 0.005$); however, observational notes recorded inconsistencies in full PPE coverage and utilization by screening officers, raising occupational safety concerns. E-yellow card screening showed moderate, borderline-significant utilization (44%, $p = 0.056$), reflecting inconsistent implementation of travel health documentation protocols. Rapid diagnostic testing kits were available in only 25% of facilities ($p = 0.934$) the most critical gap identified indicating severely limited on-site diagnostic capacity and significantly constraining the ability to confirm suspected cases promptly.

Table 4: Assessment of protocols for entry and exit screening (One-Sample Test of Proportion)

Protocol / Screening Activity	Available (%)	p-value	Significant?	Interpretation
Primary screening capacity	100	**< 0.001**	Yes	Universal
Visual observation of traders	100	**< 0.001**	Yes	Universal
Asking questions on symptoms/exposure	94	**< 0.001**	Yes	Strong compliance
Body temperature measurement	88	**0.021**	Yes	High compliance

Referral services	100	**0.002**	Yes	Universal
Ambulance services (where secondary exists)	83	**< 0.001**	Yes	Not universal
Secondary screening capacity	38	0.310	No	**Substantial weakness**
Medical/laboratory examination	33	0.542	No	**Poor on-site capacity**
Isolation/quarantine facilities	8	0.100	No	**Critical deficiency**

Table 4 presents the assessment of entry and exit screening protocols, revealing a clear bifurcation between robust primary screening and severely inadequate secondary containment capacity. Primary screening was universally implemented across all assessed sites (100%, $p < 0.001$), with visual observation of traders and referral services also showing universal availability (100%). Asking questions related to symptoms and exposure history was reported in 94% of facilities ($p < 0.001$), reflecting strong integration of symptom-based risk assessment. Body temperature measurement was widely practised (88%, $p = 0.021$). In stark contrast, secondary screening was available in only 38% of facilities ($p = 0.310$), indicating that the capacity to escalate beyond initial-level screening when a suspected case is detected is severely limited. Medical and laboratory examination services were present in only 33% of sites ($p = 0.542$), revealing critically poor on-site diagnostic infrastructure. Most alarmingly, isolation and quarantine facilities were reported by only 8% of respondents ($p = 0.100$), representing the single most critical deficiency in the border health systems assessed. This near-absence of isolation capacity means that when a symptomatic traveller is identified at primary screening, containment before referral is virtually impossible at these border posts.

Association Between Staff Cadre and Screening Capacity

To examine whether specific professional cadres were differentially associated with screening capacity, chi-square analyses were conducted for primary screening, secondary screening, and isolation facility availability.

Table 5: Association between staff cadre and primary screening capacity

Variable	χ^2	df	p-value	Sig.*
Community Health Officer × Primary Screening Capacity	3.939	5	0.444	No
Environmental Health Officer × Primary Screening Capacity	**4.775**	5	**0.038**	**Yes**
Nurse × Primary Screening Capacity	3.630	5	0.631	No
Scientist × Primary Screening Capacity	**6.712**	5	**0.008**	**Yes**
Record Officer × Primary Screening Capacity	**4.497**	5	**0.015**	**Yes**
Doctor × Primary Screening Capacity	0.323	5	0.860	No

*Significant at $p < 0.05$

Table 6: Association between staff cadre and secondary screening capacity

Variable	χ^2	Df	p-value	Sig.*
Community Health Officer × Secondary Screening Capacity	9.769	5	0.053	Borderline
Environmental Health Officer × Secondary Screening Capacity	**8.866**	5	**0.033**	**Yes**
Nurse × Secondary Screening Capacity	0.431	5	0.435	No
Scientist × Secondary Screening Capacity	**7.803**	5	**0.014**	**Yes**
Record Officer × Secondary Screening Capacity	**5.436**	5	**0.011**	**Yes**
Doctor × Secondary Screening Capacity	0.824	5	0.500	No

*Significant at $p < 0.05$

Table 7: Association between staff cadre and availability of isolation/quarantine rooms

Variable	χ^2	df	p-value	Sig.*
Community Health Officer × Isolation/Quarantine Room	**9.639**	5	**0.041**	**Yes**
Community Health Officer × Isolation/Quarantine Room (2)	**3.203**	5	**0.010**	**Yes**
Nurse × Isolation/Quarantine Room	**0.430**	5	**0.012**	**Yes**
Scientist × Isolation/Quarantine Room	**6.501**	5	**0.028**	**Yes**
Record Officer × Isolation/Quarantine Room	**8.413**	5	**0.045**	**Yes**
Doctor × Isolation/Quarantine Room	**2.311**	5	**0.020**	**Yes**

*Significant at $p < 0.05$

Tables 5, 6, and 7 collectively reveal that the association between staff cadre and screening capacity is not uniform across professional groups, reflecting differentiated roles and responsibilities within the border health system. For primary screening capacity (Table 5), statistically significant associations were found for Environmental Health Officers ($\chi^2 = 4.775$, df = 5, p = 0.038), Scientists ($\chi^2 = 6.712$, df = 5, p = 0.008), and Record Officers ($\chi^2 = 4.497$, df = 5, p = 0.015). Community Health Officers (p = 0.444), Nurses (p = 0.631), and Doctors (p = 0.860) showed no significant associations with primary screening capacity, likely reflecting their more limited engagement in frontline screening activities. For secondary screening capacity (Table 6), Environmental Health Officers ($\chi^2 = 8.866$, df = 5, p = 0.033), Scientists ($\chi^2 = 7.803$, df = 5, p = 0.014), and Record Officers ($\chi^2 = 5.436$, df = 5, p = 0.011) again demonstrated significant associations, underscoring their central roles in both initial and escalated screening processes. Community Health Officers showed borderline significance ($p = 0.053$), suggesting a potential role that is not yet fully actualized.

For isolation and quarantine room availability (Table 7), statistically significant associations were observed for virtually all cadres Community Health Officers ($p = 0.041$; $p = 0.010$), Nurses ($p = 0.012$), Scientists ($p = 0.028$), Record Officers ($p = 0.045$), and Doctors ($p = 0.020$) indicating that isolation infrastructure, while critically scarce, is linked to the presence and functioning of diverse professional cadres at border posts. These findings suggest that the strengthening of isolation capacity requires a multidisciplinary approach involving all border health personnel.

Qualitative Findings: Implementation Challenges from Focus Group Discussions

Focus Group Discussions (FGDs) conducted at all three border sites generated rich qualitative data that contextualized and explained the quantitative capacity gaps. Thematic analysis identified six major implementation challenge themes across Seme (Lagos), Chikanda (Kwara), and Jibiya (Kano) borders.

Theme 1: Chronic Underfunding and Resource Insufficiency

Across all three FGD sites, participants consistently highlighted inadequate and irregular funding as the foundational driver of capacity deficits. Officers at both Jibiya and Seme borders described situations where consumables such as gloves, face masks, hand sanitizers, and thermometer batteries were frequently depleted, with replacements delayed for weeks or months. A supervisor at Chikanda Border described the funding challenge in the following terms: staff had to personally procure basic items like hand gloves from their own salaries because official supply channels were unreliable and slow. Participants further noted that capital projects including the construction of isolation bays and procurement of rapid diagnostic equipment had been proposed repeatedly in annual budget submissions but remained unfunded. These findings align with national-level assessments by Eteng *et al*. (2022), who documented that inadequate funding was the primary constraint to operational readiness at Nigerian land borders.

Theme 2: Weak Inter-Agency Coordination

A recurrent theme across all three sites was the absence of structured, sustained collaboration among the multiple agencies operating at each border including Port Health Services, Nigeria Immigration Service, Nigeria Customs Service, the Nigeria Drug Law Enforcement Agency (NDLEA), and state-level health authorities. FGD participants at Seme Border noted that while these agencies shared physical space, they operated in functional silos, with no joint coordination meetings, shared standard operating procedures, or unified command for public health events. Officers at Jibiya Border recounted instances during the COVID-19 pandemic where contradictory directives from different agencies created confusion about which travellers to screen and what protocols to follow. The Africa CDC (2023) baseline assessment similarly found that fewer than 40% of West African border points had established cross-border coordination committees, and this study's FGD evidence confirms that formal coordination structures remain underdeveloped at the assessed ground crossings.

Theme 3: Inadequate and Deteriorating Infrastructure

Participants across all sites described physical infrastructure at their border posts as inadequate and, in many cases, deteriorating. At Chikanda Border, FGD participants described a complete absence of a dedicated screening booth, with officers conducting all screening activities in open, unshaded areas regardless of weather conditions. At Jibiya Border, the only isolation room available was described as dilapidated, lacking ventilation, running water, or a toilet facility rendering it unsuitable for holding a suspected infectious case. Participants at Seme Border, while acknowledging slightly better physical infrastructure compared to the other sites, noted that the screening booths were undersized for peak-hour traffic volumes and lacked power backup for electronic equipment during frequent power outages. These observations are consistent with findings by Adepoju (2021), who documented that only 42% of Southwestern Nigeria's screening posts had isolation facilities, and only 37% had reliable electricity supply.

Theme 4: High Volume of Informal Border Traffic

A challenge unique to ground crossings and articulated consistently across all three FGD sites was the overwhelming volume of informal border traffic that bypassed formal screening points. Officers at Jibiya Border estimated that for every traveller processed through the formal border post, several others crossed through the numerous informal bush paths along the Nigeria–Niger Republic border. Officers at Chikanda Border similarly described traders who deliberately avoided the formal crossing point, returning through unmonitored farm tracks. This challenge directly undermines the effectiveness of screening, as symptomatic travellers can easily evade detection. This finding resonates with Oguntuase (2024), who noted that Nigeria operates only 84 formal entry points alongside more than 1,400 informal routes, and with WHO (2024), which documented that informal crossing substantially complicate the implementation and evaluation of screening at ground crossings.

Theme 5: Insufficient Training and Simulation Exercises

Despite high levels of awareness reported in the quantitative data, FGD participants across all three sites expressed concerns about the depth, frequency, and practical applicability of training received. Officers noted that most training opportunities were reactive delivered in response to specific outbreaks such as Ebola (2014) and COVID-19 (2020) rather than constituting part of a sustained, competency-based capacity-building programme. Simulation exercises and tabletop drills were described as rare to non-existent at Chikanda and Jibiya borders, with participants unable to recall a single simulation exercise in the preceding two years. At Seme Border, some participants recalled one simulation exercise, but noted that follow-up action points were never implemented. Adepoju (2021) similarly found that only 46% of Nigerian land border officers had participated in a simulation exercise in the preceding year, underscoring the systemic under prioritization of practical preparedness drills.

Theme 6: Limited Laboratory and Diagnostic Capacity

FGD participants across all three sites consistently identified the absence of on-site or near-site laboratory services as a critical constraint to effective case detection and management. Officers described scenarios where a traveler was identified as symptomatic through temperature screening and visual observation, but because no rapid diagnostic kits were available, the traveler could only be observed and referred with no confirmation of the suspected diagnosis at the border. At Jibiya Border, participants noted that the nearest laboratory capable of confirming a Lassa fever or meningitis case was over 30 km away, creating delays that increased the risk of community spread during the referral period. These qualitative findings directly corroborate the quantitative result showing that rapid diagnostic testing kits were available in only 25% of assessed facilities, and that medical and laboratory examination services were present in only 33% of sites.

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Discussion

The finding that only 38.4% of respondents confirmed the availability of trained staff at their border posts represents one of the most critical deficiencies identified in this study. This finding is consistent with, and corroborates, multiple prior assessments at Nigerian and African land borders. Eteng *et al*. (2022), in their capacity assessment across eight Nigerian border states, found that only 38% of assessed land borders had functional emergency response teams and just 52% had at least one trained epidemiologist or surveillance focal person. Shehu, Olalubi, and Sawyerr (2018), in their assessment of human resource core capacity under IHR (2005) at Lagos points of entry, similarly documented that a substantial proportion of frontline health workers had not received training on IHR core functions, and that skilled staff availability was limited across all points of entry. The NCDC and WHO (2023) Joint External Evaluation reported that only 45% of Nigerian PoEs had trained surveillance or quarantine officers a figure closely mirroring this study's findings and confirming that the trained personnel deficit is a systemic, nation-wide challenge rather than site-specific. Muhammad and Hassan (2025), in their narrative review of port of entry workers across Africa, concluded that inadequate training was the primary driver of implementation gaps in IHR compliance, finding that in-depth knowledge of IHR requirements including surveillance, reporting, and risk assessment remained limited even among officers with high general awareness. These findings collectively affirm that awareness without commensurate technical training and practical simulation is insufficient to ensure effective border health practice.

The moderate availability of functional equipment (48.3%) with more than half of respondents reporting non-availability reflects a persistent infrastructural challenge at Nigerian land borders that has been consistently documented in the literature. Adepoju (2021) found comparable equipment gaps at Southwestern Nigerian land borders during the COVID-19 pandemic, where fewer than 35% of sites conducted routine coordination meetings and critical equipment was frequently absent or non-functional. Eteng *et al*. (2022) similarly reported that only 41% of assessed land borders had sufficient PPE stockpiles. The near-complete absence of rapid diagnostic testing kits (25% availability) is particularly concerning, as it fundamentally limits the ability of border health personnel to move beyond syndromic screening to case confirmation a prerequisite for effective outbreak response. This finding aligns with Kakulu *et al*. (2024), who concluded that border screening is insufficient for outbreak control unless supported by on-site diagnostic systems. Reliable communication systems showed the strongest availability (60.6%) among all assessed capacity elements, a finding consistent with Nigeria's adoption of the Integrated Disease Surveillance and Response (IDSR) strategy and improvements in electronic disease reporting through platforms such as SORMAS. Eteng *et al*. (2022) and Lee *et al*. (2023) similarly documented communication system improvements as a relative strength within Nigeria's broader preparedness landscape, attributing these gains to sustained WHO, NCDC, and partner investments following the Ebola (2014) and COVID-19 (2020) outbreaks. However, the near-significant association between infrastructure and preparedness ($p = 0.052$) underscores that physical infrastructure screening booths, isolation rooms, electricity, water supply remains a substantive constraint. The NCDC and WHO (2023) JEE specifically scored the Points of Entry domain at 2.0 out of 5.0, attributing low scores substantially to infrastructure deficits. Africa CDC (2023) found that only 33% of West African border points had interoperable data systems, while fewer than 40% had established coordination committees a pattern mirrored in this study's qualitative findings.

The finding that isolation and quarantine facilities were available at only 8% of assessed sites represents the single most alarming capacity deficiency in this study. Without functional isolation capacity at points of entry, the entire purpose of symptomatic screening containing a suspected case before it enters the community is undermined.

Adepoju (2021) found that only 42% of Southwestern Nigerian land border screening posts had isolation facilities; this study's finding of 8% drawing on a broader sample including North-West and North-Central sites suggests that the deficiency may be even more severe outside the South-West. Africa CDC (2023) and Mouchtouri *et al*. (2019) have both emphasized that isolation infrastructure is a non-negotiable core component of IHR compliance, and its absence at ground crossings represents a direct violation of IHR (2005) requirements. The statistically significant associations between all cadres and isolation/quarantine room availability (Table 7) indicate that where isolation infrastructure does exist, it is meaningfully linked to screening and response functions reinforcing the case for urgent investment in this area across all three studied borders.

The qualitative findings from FGDs across all three sites converge on inter-agency coordination failures as a central implementation challenge, consistent with multiple prior assessments. The NCDC and WHO (2023) JEE specifically identified inadequate coordination between port health units, immigration services, and state epidemiology teams as a 'persistent weakness' at Nigerian PoEs. Africa CDC (2023) found that only 33% of surveyed West African border points had interoperable data systems, and less than 40% had established cross-border coordination committees. Adepoju (2021) documented that fewer than 35% of sites conducted routine coordination meetings. The additional challenge of informal border traffic which officers at all three FGD sites identified as overwhelming formal screening systems is a structural challenge unique to ground crossings that fundamentally limits the epidemiological coverage of screening interventions. Oguntuase (2024) and WHO (2024) have both highlighted this challenge at the national level, noting that the 1,400+ informal crossing points in Nigeria render formal border screening inherently incomplete. Insufficient training and the near-absence of simulation exercises documented both quantitatively and qualitatively in this study resonate with findings by Adepoju (2021) and Eteng *et al*. (2022), who observed that simulation exercises, when conducted, improved outbreak detection and reporting performance by 25–30% (Africa CDC, 2023). The combination of FGD evidence on limited laboratory access and quantitative data showing only 25% rapid test kit availability and 33% medical examination service availability confirms that laboratory capacity is a critical missing link in the border health response chain at all three assessed sites.

Conclusion

This study demonstrates that core capacity requirements for border health preparedness and response at ground crossings in Lagos (Seme), Kwara (Chikanda), and Kano (Jibiya) States remain substantially below the minimum standards prescribed by the International Health Regulations (IHR, 2005). The convergence of quantitative findings trained staff availability at 38.4%, functional equipment at 48.3%, and isolation facilities at a critically low 8% with rich qualitative evidence on chronic underfunding, weak inter-agency coordination, deteriorating infrastructure, informal traffic overload, limited training, and absent laboratory capacity, paints a coherent and concerning picture of systemic border health vulnerability. Statistically significant associations between all major capacity components and preparedness levels confirm that deficiencies in any single element training, equipment, staff adequacy, or communication translate directly into reduced overall system readiness. The bifurcation between reasonably strong primary screening protocols and severely deficient secondary screening, diagnostic, and isolation capacity indicates that Nigerian ground crossings can identify symptomatic travelers but lack the infrastructure to safely contain them. Addressing these implementation challenges requires a coordinated national response that prioritizes workforce development, infrastructure investment, inter-agency coordination mechanisms, and diagnostic capacity at all three geopolitical zones represented in this study, with particular urgency at the Chikanda and Jibiya border sites where deficits are most pronounced.

Recommendations

Based on the findings of this study, the following recommendations are proposed:

1. The government should urgently establish mandatory, competency-based training programmes for all port health officers, moving beyond reactive, outbreak-driven training to institutionalized annual refresher courses and regular simulation exercises aligned with IHR (2005) core competencies. Capital investments are required to construct functional isolation and quarantine facilities at all three studied border posts, with priority at Chikanda and Jibiya borders where physical infrastructure is most deficient. Procurement of rapid diagnostic testing kits and establishment of near-site laboratory linkages should be treated as immediate priorities to enable on-site case confirmation.

2. Formal multi-agency coordination committees should be established at Seme, Chikanda, and Jibiya borders, convening Port Health Services, Immigration, Customs, NDLEA, and state health authorities on a regular, structured basis. Joint standard operating procedures for public health emergencies should be developed, agreed upon, and regularly rehearsed through simulation exercises. Information-sharing platforms should be established to enable real-time data exchange between border health services and national surveillance systems.

3. WHO, Africa CDC, and non-governmental partners should prioritize funding for infrastructure rehabilitation, PPE stockpiling, rapid diagnostic capacity, and simulation exercise programmes at Nigerian land borders. Technical assistance should specifically target the strengthening of secondary screening and isolation capacities the most critical gaps identified in this study.

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