ASSESSMENT OF PORT HEALTH OFFICERS' KNOWLEDGE, PRACTICES, AND PREPAREDNESS FOR DISEASE SCREENING AT NIGERIAN LAND BORDERS: EVIDENCE FROM SEME, CHIKANDA, AND JIBIYA BORDER POSTS

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Abstract

The increasing movement of people and goods across international land borders heightens the risk of cross-border transmission of infectious diseases. Nigeria shares extensive land boundaries with several neighboring countries and operates numerous formal and informal crossings, making effective exit and entry screening a critical component of national preparedness and response in line with the International Health Regulations (IHR, 2005). Evidence on port health officers' knowledge, practices, and preparedness for disease screening at Nigerian land borders remains limited. This study assessed the knowledge and practices of port health officers regarding exit and entry screening. A descriptive cross-sectional study employing mixed methods was conducted at three strategically selected Nigerian land borders: Seme (South-West), Chikanda (North-Central), and Jibiya (North-West). Quantitative data were collected using structured questionnaires administered to 203 port health officers selected through proportional allocation and simple random sampling. Qualitative data were obtained through focus group discussions and observational checklists. Descriptive and inferential statistics were used for quantitative analysis, while thematic analysis was applied to qualitative data. Findings revealed awareness of exit and entry screening protocols; however, practical knowledge and procedural competence were moderate. Core capacity requirements including trained personnel (38.4%), functional screening equipment (48.3%), and isolation or quarantine facilities (8%) were critically deficient. Primary screening capacity was universal (100%), with body temperature measurement (88%) and symptom/exposure questioning (94%) widely implemented. Secondary screening capacity was available in only 38% of facilities, on-site diagnostic services in 33%, and isolation facilities in only 8%. Environmental health officers, scientists, and record officers showed statistically significant associations with primary and secondary screening capacity ($p < 0.05$). Port health officers at Nigerian land borders demonstrate high awareness but inconsistent practices in disease screening, constrained by critical gaps in infrastructure, trained personnel, diagnostic capacity, and isolation facilities. Strengthening border health systems through sustained training, improved infrastructure investment, and enhanced compliance with IHR (2005) core capacities is essential to reduce the risk of disease importation.

Keywords: Exit screening; Entry screening; Land borders; Port health officers; Knowledge; Practices; Preparedness; Disease surveillance; Nigeria

Introduction

In the era of intensified globalization and mobility, the risks posed by the trans-national spread of infectious diseases have become increasingly prominent in public health policy and practice. According to data from the United Nations World Tourism Organization (UNWTO), international tourist arrivals exceeded 900 million in 2022, representing about 63% of the pre-pandemic 2019 levels (UNWTO, 2022). This volume underscores the enormous scale of cross-border human movement and, by extension, the potential for infectious diseases to traverse political boundaries rapidly. Border crossings whether by air, sea, or land thus act as critical nodes in national, regional, and global disease surveillance and control frameworks. The core international legal framework to address trans-border health

risks is the International Health Regulations (2005) (IHR). Under the IHR, States Parties are required to establish and sustain core capacities for surveillance and response, including at designated points of entry (PoEs) such as airports, seaports, and, where justified, ground crossings. The goal is to prevent, protect against, control, and provide a public-health response to the international spread of disease while avoiding unnecessary interference with international traffic and trade (WHO, 2021). Within this framework, exit and entry screening measures encompassing health declarations, temperature checks, symptom observation, and referral mechanisms are considered essential tools to bolster preparedness and response at points of entry.

Globally, the scientific evidence on the efficacy of such screening measures remains limited and variable. A recent WHO review on syndromic entry and exit screening at ground crossings reported detection rates through point-of-entry screening ranging from 8.8% to 99.6% in modelling studies, and between 2% and 77.9% in observational studies, depending on screening methods and disease context (WHO, 2024). Screening at points of entry often captures only a fraction of infected travelers, particularly those who are asymptomatic or in the incubation period. A rapid evidence review found that entry or exit screening identified just over half of infected travelers in some settings but missed nearly half or more (Chetty *et al*., 2020). Another review concluded that border screening during the 2009 influenza A(H1N1) pandemic and the SARS outbreak was largely ineffectual in stopping disease introduction, though it may have delayed spread by 7–12 days (Cowling *et al*., 2010). Kakulu *et al*. (2024) similarly concluded that entry and exit screening alone is insufficient unless supported by adequate human resources, standardized procedures, and digital surveillance systems.

Nigeria continues to experience endemic and emerging infectious diseases including Lassa fever, cholera, and Mpox with significant cross-border spread potential. The country shares borders with the Republic of Benin, Niger, Chad, and Cameroon, with an estimated land-boundary length of about 4,045 km and approximately 1,500 identified land-border crossings, of which only about 84 are approved control posts (Economic Confidential, 2023; Oguntuase, 2024). Nigeria's first COVID-19 case was recorded in Lagos in February 2020, and by September 2022, about 265,105 confirmed cases and 3,155 deaths had been reported a case fatality rate of 1.2% (NCDC, 2020). In 2014, the Ebola outbreak in Lagos originated from an infected traveler from Liberia, resulting in 19 confirmed cases and 8 deaths before containment (Shuaib *et al*., 2014). Despite Nigeria's progress in strengthening Port Health Services, major gaps persist in inter-agency coordination, infrastructure, and compliance with IHR (2005) (Kakulu *et al*., 2024; Eteng *et al*., 2022). Despite the acknowledged importance of port health officers as the frontline of border disease surveillance, their knowledge, practices, and preparedness for disease screening at Nigerian land borders remain poorly documented. This study was therefore conducted to assess these dimensions at three strategically selected border posts, providing evidence to inform targeted improvements in border health capacity.

Research Objective

1. To assess the level of awareness and knowledge of port health officers regarding disease outbreak preparedness and response at Nigerian land borders**.**

Research Questions

1. What is the level of awareness and knowledge of port health officers regarding disease outbreak preparedness and response at selected ground crossings?

Research Hypotheses

H_0: There is no significant association between core capacity components and preparedness levels at the selected ground crossings.
H_1: There is a significant association between core capacity components and preparedness levels at the selected ground crossings.
H_0: There is no significant association between staff cadre and primary screening capacity at the selected ground crossings.
H_1: There is a significant association between staff cadre and primary screening capacity at the selected ground crossings.
H_0: There is no significant association between staff cadre and secondary screening capacity at the selected ground crossings.
H_1: There is a significant association between staff cadre and secondary screening capacity at the selected ground crossings.
H_0: There is no significant association between staff cadre and availability of isolation/quarantine rooms at the selected ground crossings.
H_1: There is a significant association between staff cadre and availability of isolation/quarantine rooms at the selected ground crossings.

Methodology

This study adopted a descriptive cross-sectional research design using a descriptive cross-sectional approach. The design allowed for quantitative data collection to evaluate preparedness and response strategies at selected land borders in Nigeria, with a specific focus on port health officers' knowledge, practices, and the implementation and capacity of **screening measures**. The study was conducted at three strategically selected land border areas of Nigeria representing different geopolitical zones: Seme border (South-West, Lagos State), Chikanda border (North-Central, Kwara State), and Jibiya border (North-West, Kano State). These locations were selected because of their high volume of cross-border human and goods movement, which makes them significant in assessing border health preparedness and disease screening response systems. The study population consisted of port health officers and relevant border health stakeholders stationed at the selected land borders. Using Cochran's formula for a large population ($Z = 1.96$, $p = 0.5$, $d = 0.05$), a minimum sample size of 384 was calculated. Adjusted for the finite population of 350 port health officers, this was corrected to 183 and further adjusted for a 10% non-response rate, yielding a final sample size of 203. Proportional allocation across the three sites gave 87 respondents from Lagos (Seme), 67 from Kano (Jibiya), and 49 from Kwara (Chikanda). A multi-stage sampling technique were employed. In the first stage, three borders were purposively selected based on their representation of major geopolitical zones and their level of cross-border activity. In the second stage, lists of all port health officers and border health stakeholders at each location were obtained. In the third stage, simple random sampling was used to select respondents for the quantitative component. Data were collected using three main instruments: (1) a structured questionnaire administered to port health officers to collect quantitative data on awareness, knowledge of entry and

exit screening measures. Content validity was ensured through expert review of draft instruments by public health and border health surveillance specialists. A pilot study was conducted in Ogun State with a small group of port health officers not included in the main study. Reliability was established using Cronbach's alpha coefficient, yielding a score of 0.82, indicating high internal consistency. Ethical approval was obtained from the appropriate review committee. Permission was secured from the Ministry of Health and the Port Health Services Department. Participation was voluntary, with identities anonymized to ensure confidentiality. Quantitative data were analyzed using descriptive statistics (frequencies, percentages, means, and standard deviations) and inferential statistics, including chi-square tests. Knowledge and practice levels were categorized as: Good (≥60%), Moderate (40%–59%), and Poor (<40%).

Results

Socio-Demographic Characteristics of Respondents

A total of 203 respondents participated comprising port health officers (34.0%), environmental health officers (44.3%), immigration officers, and other cadres. The majority were within the 26–35 year age group (43.3%), followed by 18–25 years (28.6%). Males constituted 63.1% of the sample. Most respondents (73.4%) held Bachelor's degrees; 23.6% held Master's degrees. Regarding work experience, 47.3% had 3–5 years. Respondents were distributed across Lagos/Ogun (42.9%), Kano (33.5%), and Kwara (23.6%) states. Table 1 presents the complete socio-demographic profile of respondents.

Table 1: Socio-Demographic Characteristics of Port Health Officers at Selected Nigerian Land Borders (n=203)

Characteristic	Frequency (n)	Percentage (%)
Age Group (years)		
18–25	58	28.6
26–35	88	43.3
36–45	40	19.7
46–55	13	6.4
>55	4	2.0
Gender		
Male	128	63.1
Female	75	36.9
Border/State		
Seme — Lagos State	87	42.9
Jibiya — Kano State	68	33.5
Chikanda — Kwara State	48	23.6
Educational Qualification		
OND/NCE	5	2.5

HND/Bachelor's Degree	149	73.4
Master's Degree	48	23.6
PhD	1	0.5
Job Role/Cadre		
Environmental Health Officer (EHO)	90	44.3
Port Health Officer (PHO)	69	34.0
Community Health Officer (CHO)	22	10.8
Nurse	12	5.9
Record Officer / Other	10	5.0
Work Experience (years)		
<1 year	10	4.9
1–2 years	28	13.8
3–5 years	96	47.3
6–10 years	47	23.2
>10 years	22	10.8
Total	**203**	**100.0**

Awareness and Knowledge Levels of Port Health Officers

Table 1: Awareness levels of port health officers on exit and entry screening protocols at selected land borders in Nigeria

Awareness	Frequency	Percentage (%)
Yes	**203**	**100.00**
No	0	0.00

Source: Field Survey, 2024–2025

Table 1 reveals that all 203 participants (100%) indicated awareness of the existing entry and exit screening procedures, while 0% reported a lack of awareness. This demonstrates a universal level of awareness among respondents, suggesting effective dissemination of information and adequate sensitization regarding the screening protocols.

Table 2: Sources of information on exit and entry screening protocols among port health officers

Source of Information	Frequency	Percentage (%)
On-the-job training	67	33.0
World Health Organization (WHO) guidelines	59	29.1

Ministry of Health guidelines	52	25.6
Online resources	25	12.3
Total	**203**	**100.0**

Source: Field Survey, 2024–2025

On-the-job training was the most common source of information (33.0%), followed by WHO guidelines (29.1%), Ministry of Health guidelines (25.6%), and online resources (12.3%). This finding indicates that practical workplace training and official health guidelines play a more prominent role in disseminating information on screening protocols compared to digital or self-sourced platforms.

Table 3: Knowledge levels of port health officers on exit and entry screening protocols at selected land borders in Nigeria

S/N	Research Question	Response	Frequency	Percentage (%)
1	Did you carry out visual inspection?	Yes	123	60.59
		No	80	39.41
2	Did you check signs and symptoms of any disease of public health concern?	Yes	126	62.06
		No	77	37.94
3	Thermometer available for use	Non-contact infrared	75	36.95
		Thermal Scanner	0	0.00
		Digital thermometer	128	63.05
4	Most frequently checked signs and symptoms	Cough	87	42.85
		Body temperature	31	15.27
		Diarrhoea	23	11.34
		Fever	55	27.09
5	How often do you use the public health declaration form?	Regularly	15	7.39
		Occasionally	81	39.90
		Every day	12	5.92
		Never	95	46.79
6	Safety precaution — PPE	Yes	115	56.65

		No	88	43.35
	Safety precaution — Hand Hygiene	Yes	130	64.04
		No	73	35.96
7	Medical referring system	Available	114	56.16
		Not Available	89	43.84

Source: Field Survey, 2024–2025

Table 3 reveals varying levels of implementation across different screening indicators. About 60.6% of respondents reported conducting visual inspections, while 62.1% checked for signs and symptoms of diseases of public health concern, indicating a moderately high level of vigilance in disease detection. Digital thermometers were the most available (63.1%), followed by non-contact infrared thermometers (36.9%), with no facilities reporting the use of thermal scanners. The most frequently checked symptoms were cough (42.9%) and fever (27.1%), while diarrhoea (11.3%) and body temperature (15.3%) were less frequently monitored. A significant documentation gap was identified: 46.8% indicated that public health declaration forms were never used, while only 7.4% reported regular usage. For safety precautions, 56.7% reported PPE use and 64.0% practiced hand hygiene. Additionally, 56.2% confirmed availability of a medical referral system, while 43.8% indicated its absence.

Table 4: Categorized knowledge and practice levels of port health officers on exit and entry screening protocols

Screening Practice / Knowledge Area	Positive Response (%)	Category
Safety precaution — Hand hygiene	64.04	**Good**
Digital thermometer availability	63.05	**Good**
Check signs and symptoms of disease	62.06	**Good**
Visual inspection	60.59	**Good**
Safety precaution — PPE use	56.65	**Moderate**
Medical referring system availability	56.16	**Moderate**
Use of public health declaration form (ever used)	53.31	**Moderate**
Most frequently checked sign — Cough	42.85	**Moderate**
Non-contact infrared thermometer availability	36.95	**Poor**
Most frequently checked sign — Fever	27.09	**Poor**
Most frequently checked sign — Body temperature	15.27	**Poor**
Most frequently checked sign — Diarrhoea	11.34	**Poor**
Thermal scanner availability	0.00	**Poor**

Good ≥ 60%; Moderate = 40–59%; Poor < 40% | Source: Field Survey, 2024–2025

Table 4 categorizes knowledge and practice levels across 13 screening indicators. Four indicators fell in the good category: hand hygiene (64.04%), digital thermometer availability (63.05%), checking for disease signs and

symptoms (62.06%), and visual inspection (60.59%). Four indicators were rated Moderate: PPE use (56.65%), medical referral system (56.16%), use of public health declaration forms (53.31%), and cough checking (42.85%). Five indicators were rated Poor: non-contact infrared thermometer availability (36.95%), fever checking (27.09%), body temperature checking (15.27%), diarrhoea checking (11.34%), and thermal scanners (0%). These results reveal a pattern in which basic, low-technology screening practices are performed reasonably well, while advanced diagnostic tools and systematic documentation remain critically underdeveloped.

Table 5: Overall distribution of knowledge and practice levels across points of entry

Category	Lagos (%)	Kano (%)	Kwara (%)	Overall (%)
Good Knowledge/Practice (≥60%)	54 (62.1)	41 (61.2)	30 (61.2)	**61.6**
Moderate Knowledge/Practice (40–59%)	24 (27.6)	18 (26.9)	13 (26.5)	**27.1**
Poor Knowledge/Practice (<40%)	9 (10.3)	8 (11.9)	6 (12.3)	**11.3**

Source: Field Survey, 2024–2025

Table 5 reveals a consistent distribution of knowledge and practice levels across the three border sites. Lagos had the highest proportion demonstrating good knowledge and practice (62.1%), closely followed by Kano (61.2%) and Kwara (61.2%), yielding an overall good rating of 61.6%. Moderate performance was recorded in 27.1% overall, while poor knowledge and practice were least prevalent at 11.3%. The consistency across sites suggests that knowledge and practice gaps are systemic rather than site-specific.

Association between Cadre and Screening Capacity

Table 8: Association between cadre and primary screening capacity (χ^2, df = 5)

Variable	χ^2	df	p-value
Community Health Officer × Primary Screening Capacity	3.939	5	0.444
Environmental Health Officer × Primary Screening Capacity	4.775	5	0.038*
Nurse × Primary Screening Capacity	3.630	5	0.631
Scientist × Primary Screening Capacity	6.712	5	0.008*
Record Officer × Primary Screening Capacity	4.497	5	0.015*
Doctor × Primary Screening Capacity	0.323	5	0.860

** Statistically significant at $p < 0.05$ | Source: Field Survey, 2024–2025*

Table 8 shows that statistically significant associations with primary screening capacity were found for Environmental Health Officers ($\chi^2 = 4.775$, $p = 0.038$), Scientists ($\chi^2 = 6.712$, $p = 0.008$), and Record Officers ($\chi^2 = 4.497$, $p = 0.015$). No significant associations were found for Community Health Officers, Nurses, or Doctors.

Table 9: Association between cadre and secondary screening capacity (χ^2, df = 5)

Variable	χ^2	df	p-value
Community Health Officer × Secondary Screening Capacity	9.769	5	0.053

Environmental Health Officer × Secondary Screening Capacity	**8.866**	5	**0.033***
Nurse × Secondary Screening Capacity	0.431	5	0.435
Scientist × Secondary Screening Capacity	**7.803**	5	**0.014***
Record Officer × Secondary Screening Capacity	**5.436**	5	**0.011***
Doctor × Secondary Screening Capacity	0.824	5	0.500

** Statistically significant at p < 0.05 | Source: Field Survey, 2024–2025*

Table 9 reveals significant associations with secondary screening capacity for Environmental Health Officers (χ^2 = 8.866, p = 0.033), Scientists (χ^2 = 7.803, p = 0.014), and Record Officers (χ^2 = 5.436, p = 0.011). Community Health Officers showed borderline significance (p = 0.053). Nurses and Doctors showed no significant associations.

Table 10: Association between cadre and availability of isolation/quarantine rooms (χ^2, df = 5)

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

** Statistically significant at p < 0.05 | Source: Field Survey, 2024–2025*

Table 10 indicates statistically significant associations between staff cadre and isolation/quarantine room availability across almost all cadre categories, with p-values ranging from 0.010 to 0.045. This finding confirms that cadre-specific roles and responsibilities meaningfully influence access to containment infrastructure at border points. The breadth of significance across cadres for isolation facilities the most critically deficient screening resource underscores the urgency of addressing this gap as a priority.

Discussion

The predominantly young workforce (43.3% aged 26–35 years) reflects a pattern consistent with Nigerian studies examining border health personnel, where younger and mid-career staff dominate operational roles due to the physically demanding nature of screening activities (Adepoju, 2021; Tambo *et al*., 2021). The high proportion of Bachelor's degree holders (73.4%) suggests an adequate educational foundation for implementing technical screening guidelines, and prior studies have noted a positive association between higher educational attainment and improved compliance with IHR (2005) at points of entry (Adepoju, 2021; Eteng *et al*., 2022). The male-dominated workforce (63.0%) aligns with research documenting male prevalence in border security and environmental health roles in sub-Saharan Africa (Adepoju, 2021; Tambo *et al*., 2021), though evidence increasingly points to the value of gender-balanced teams in sensitive screening contexts (Adiama *et al*., 2022). Environmental Health Officers constituted the largest cadre (44.3%), which is consistent with their central role in disease surveillance, inspection, and enforcement of public health measures at Nigerian land borders (Adepoju, 2021; Adiama *et al*., 2022).

The study revealed 100% awareness of exit and entry screening protocols a finding consistent with Nigerian studies documenting high awareness among port health officers following Ebola and COVID-19 emergencies (Adepoju, 2021; Lee *et al*., 2023). Adiama *et al*. (2022) similarly observed that awareness is generally high due to routine trainings, outbreak-driven briefings, and enforcement of IHR (2005) at points of entry. Comparative studies in Ghana and Kenya further highlight that institutionalization of IHR frameworks contributes to high awareness levels among border health personnel (Tambo *et al*., 2021). On-the-job training as the predominant source of information (33.0%) aligns with evidence from West African border health settings, where knowledge transfer is predominantly experiential rather than through self-directed digital learning (Adiama *et al*., 2022; Adepoju, 2022). Studies from Ethiopia and Uganda similarly report limited reliance on online platforms due to infrastructural constraints and high workloads at points of entry (Tambo *et al*., 2021). Despite this universal awareness, moderately high knowledge was observed only for basic screening practices visual inspections (60.6%) and symptom checking (62.1%) both falling just above the 'good' threshold. This pattern is consistent with Nigerian and South African studies showing visual observation and symptom checks as the most routinely applied measures at points of entry (Adepoju, 2021; Lee *et al*., 2023). Significant gaps were identified in advanced screening tools: digital thermometers were relatively available (63.1%), but non-contact infrared thermometers were limited (36.9%), and thermal scanners were entirely absent. Similar disparities have been reported at Nigerian land borders due to limited funding and uneven resource allocation (Adepoju, 2022; WHO, 2023c). Respiratory symptoms cough (42.9%) and fever (27.1%) were the most frequently assessed indicators, reflecting heightened awareness from COVID-19 (Adepoju, 2021; Tambo *et al*., 2021). However, a major documentation gap was identified: nearly half of respondents (46.8%) had never used public health declaration forms. Adiama *et al*. (2022) highlighted documentation as a persistent weakness in Nigerian border health surveillance, often attributable to paper-based systems, time pressure during peak traffic hours, and inadequate digital infrastructure. Shehu, Olalubi, and Sawyerr (2018) similarly found that a substantial proportion of frontline health workers had not received training on IHR core functions. Moderate compliance with PPE use (56.7%) and medical referral availability (56.2%) suggests that safety and escalation systems function but are far from optimal, consistent with Nigerian studies documenting inconsistent IPC adherence outside of outbreak periods (Adepoju, 2021; Lee *et al*., 2023).

Conclusion

This study assessed the knowledge, practices, and preparedness of port health officers for disease screening at three selected Nigerian land borders Seme, Chikanda, and Jibiya. Findings demonstrate that while universal awareness of exit and entry screening protocols exists (100%), significant gaps persist between awareness and consistent, effective practice. Basic screening activities visual inspection, symptom assessment, and temperature measurement were well understood and widely implemented, but critical weaknesses were identified in documentation practices, use of advanced diagnostic tools, secondary screening capacity, and isolation infrastructure. Core capacity for preparedness was found to be moderate at best, constrained primarily by critically low availability of trained staff (38.4%), functional equipment (48.3%), and isolation or quarantine facilities (8%). Chi-square analysis confirmed that each of these core capacity elements has a statistically significant association with overall preparedness, demonstrating that the deficiencies are not incidental but structurally linked to screening outcomes. The primary screening capacity was strong, but secondary and containment capacity were severely limited, underscoring a two-tier problem: reasonable capacity for detection but severely inadequate capacity for confirmation and containment. Environmental health officers, scientists, and record officers showed significant associations with both primary and

secondary screening capacity, identifying these cadres as priorities for targeted training and investment. In conclusion, Nigeria's land borders at Seme, Chikanda, and Jibiya possess a solid awareness foundation but are constrained by systemic gaps in trained human resources, diagnostic tools, and containment infrastructure. Strengthening these areas through continuous training, improved infrastructure investment, risk-based screening approaches, and enhanced compliance with IHR (2005) core capacities is essential to reduce the risk of cross-border disease importation and protect public health.

Recommendations

1. Port health officers should ensure consistent use of public health declaration forms and proper record-keeping during entry and exit screening. Given the observed gaps in documentation despite high awareness, routine supervisory checks and internal audits should be instituted to improve compliance.
2. Officers should consistently use personal protective equipment and maintain hand hygiene practices even outside outbreak periods. Continuous reinforcement of IPC protocols is necessary to reduce occupational exposure and prevent cross-border disease transmission.
3. Where suspected cases are identified, port health officers should strictly follow escalation protocols, including secondary screening and prompt referral. Regular simulation exercises and drills should be conducted to strengthen practical response skills and ensure readiness beyond primary screening.

4. The Federal and State Governments should establish mandatory and periodic training programmes for port health officers focused on outbreak preparedness, advanced screening techniques, and the application of IHR (2005) core capacities at ground crossings.
5. Priority investment should be directed toward equipping land borders with functional screening equipment, on-site diagnostic services, and most urgently isolation and quarantine facilities. The near-total absence of isolation rooms (8%) at assessed sites must be addressed as a national border health security priority.
6. Government should transition from predominantly procedural screening to risk-based approaches integrating epidemiological risk profiling, traveller risk stratification, and intelligence-driven protocols to enhance efficiency and effectiveness of disease detection.
7. Improved collaboration between port health services, immigration, customs, and security agencies is essential to ensure seamless implementation of screening protocols and to close the gap between primary detection and secondary confirmation at ground crossings.

8. Development partners and NGOs should fund and implement targeted training programmes on border health surveillance and outbreak preparedness, particularly at under-resourced land borders.

9. NGOs and supporting partners can assist in providing rapid testing kits, mobile diagnostic tools, information management systems, and screening equipment to address the most critical gaps in secondary screening and diagnostic capacity.

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