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Knowledge Attitude and Practice of Healthcare Workers on Integrated Disease Surveillance and Response Tools in Karim Lamido LGA of Taraba State, Nigeria

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Abstract

Keywords

Healthcare Workers, Knowledge, Attitude, Practice Disease Surveillance, Primary Health Care

The effectiveness of the Integrated Disease Surveillance and Response (IDSR) system is largely dependent on the knowledge, attitudes, and practices of healthcare workers engaged in surveillance activities. Despite its critical role in early disease detection and response, there is a paucity of empirical evidence on these factors in rural primary healthcare settings in Nigeria, particularly in Karim Lamido Local Government Area (LGA) of Taraba State. This study assessed the knowledge, attitudes, and practices of healthcare workers on IDSR tools and examined their influence on disease surveillance activities in Karim Lamido local government area. A cohort study design complemented by a retrospective review of surveillance records was employed to provide a comprehensive assessment of IDSR implementation. The study was conducted across Primary Health Care Centres in Karim Lamido LGA, a predominantly rural setting reliant on primary healthcare services. The study population included Surveillance Focal Persons, Health Information Management personnel, the Disease Surveillance and Notification Officer, and the Assistant Disease Surveillance and Notification Officer. Data were collected using a structured, pre-tested questionnaire and an IDSR data extraction checklist adapted from the national reporting tool (Form 003). Analysis was conducted using descriptive statistics and inferential methods, including Pearson Product Moment Correlation and paired sample t-tests. Findings revealed a high level of knowledge of IDSR tools among healthcare workers, with strong awareness of reporting procedures, notifiable diseases, and surveillance protocols. Attitudes were generally positive, reflecting strong professional commitment and recognition of the importance of IDSR. Practices were also relatively good, with active engagement in reporting, outbreak investigation, and data use, although gaps existed in documentation and adherence to reporting timelines. Inferential analysis showed a strong positive and statistically significant relationship between knowledge and involvement in surveillance activities ($r = 0.85$, $p < 0.05$), a moderate significant relationship between attitudes and involvement ($r = 0.544$, $p < 0.05$), and a significant relationship between practices and surveillance implementation ($r = 0.618$, $p < 0.05$). Additionally, IDSR tools demonstrated high effectiveness, evidenced by a very strong correlation between suspected and confirmed cases ($r = 0.988$, $p < 0.001$). The study concludes that healthcare workers in Karim Lamido LGA possess adequate knowledge, positive attitudes, and fairly good practices regarding IDSR tools, which significantly enhance disease surveillance performance. However, continuous capacity building, supportive supervision, and strengthening of reporting systems are recommended to address identified gaps and optimize IDSR implementation in rural settings.

1. Introduction

Public health surveillance is universally recognized as one of the most essential functions of a health system because it provides the information required for the prevention, detection, control, and evaluation of diseases and other health events. By systematically collecting, analyzing, interpreting, and disseminating health-

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related data, surveillance systems facilitate early identification of disease outbreaks, monitor trends in communicable and non-communicable diseases, support evidence-based decision-making, and guide the implementation of timely public health interventions. The World Health Organization (WHO) defines public health surveillance as the continuous and systematic collection, analysis, interpretation, and dissemination of health data needed for planning, implementation, and evaluation of public health practice, emphasizing that surveillance is only effective when information generated is translated into appropriate public health action (World Health Organization {WHO}, 2017). Consequently, robust surveillance systems have become indispensable for achieving national health security, strengthening health systems, and ensuring compliance with international obligations such as the International Health Regulations (IHR 2005) (WHO, 2016).

The significance of disease surveillance has increased considerably over the past three decades due to the growing frequency of emerging and re-emerging infectious diseases, rapid urbanization, population mobility, climate change, humanitarian emergencies, antimicrobial resistance, and globalization. Recent outbreaks of Ebola virus disease, Lassa fever, cholera, yellow fever, COVID-19, and mpox (formerly monkeypox) have demonstrated that delayed disease detection and weak surveillance systems can result in rapid transmission, increased mortality, overwhelmed healthcare systems, and substantial socioeconomic disruption (World Health Organization, 2023; Africa Centre's for Disease Control and Prevention {Africa CDC}, 2022). The COVID-19 pandemic exposed significant deficiencies in surveillance capacity across many low- and middle-income countries, highlighting the importance of resilient surveillance systems capable of generating reliable information for rapid public health decision-making (WHO, 2021; Patel et al., 2021).

Nigeria continues to experience recurrent outbreaks of epidemic-prone diseases, including cholera, Lassa fever, measles, diphtheria, yellow fever, and cerebrospinal meningitis, highlighting the continuing importance of an effective surveillance system. According to the Nigeria Centre for Disease Control and Prevention (2022, 2023), early detection and rapid response remain essential for minimizing the health and economic consequences of these outbreaks. However, the effectiveness of these interventions depends largely on the functionality of surveillance systems at state and local government levels, where healthcare workers generate the surveillance data that drive public health action.

Taraba State is among the Nigerian states that remain vulnerable to recurrent outbreaks of communicable diseases because of its geographical location, population mobility, predominantly rural settlements, and limited healthcare infrastructure. Karim Lamido Local Government Area comprises numerous primary healthcare facilities that constitute the first level of disease detection and reporting within the IDSR system. Nevertheless, empirical evidence regarding healthcare workers' knowledge, attitudes, and practices concerning IDSR tools within the Local Government Area remains scarce. Existing Nigerian studies have largely focused on southern states or evaluated surveillance performance at state or national levels, leaving an important evidence gap regarding frontline surveillance capacity in many rural northern communities.

Assessing healthcare workers' knowledge, attitudes, and practices regarding IDSR tools in Karim Lamido Local Government Area is therefore both timely and necessary. Such an assessment will identify existing strengths and deficiencies in surveillance implementation, provide evidence for targeted training and supportive supervision, and contribute to strengthening disease surveillance at the local level. Furthermore, findings from this study will assist policymakers, the Taraba State Ministry of Health, the Nigeria Centre for Disease Control and Prevention, Disease Surveillance and Notification Officers, and development partners in designing interventions aimed at improving the utilization of IDSR tools, enhancing reporting quality, and strengthening preparedness and response to epidemic-prone diseases. Ultimately, strengthening healthcare workers' capacity to implement IDSR effectively will contribute to improved health security, enhanced outbreak preparedness, and better health outcomes in Karim Lamido Local Government Area, Taraba State, and Nigeria as a whole.

2. Materials and Methods

2.1 Study Design and Setting

A facility-based cross-sectional study complemented by a retrospective review of surveillance records was conducted in Karim Lamido Local Government Area (LGA), Taraba State, Nigeria. Karim Lamido is a predominantly rural LGA with an estimated land area of 6,620 km² and comprises eleven political wards served by fourteen Primary Health Care Centres (PHCCs), which constitute the first point of contact for disease detection and reporting under the Integrated Disease Surveillance and Response (IDSR) system (Ojeh

et al., 2023). The retrospective review assessed routine IDSR reporting records to evaluate the utilization of IDSR tools, reporting completeness, and timeliness, while the cross-sectional component assessed healthcare workers' knowledge, attitudes, and practices (KAP) regarding IDSR tools.

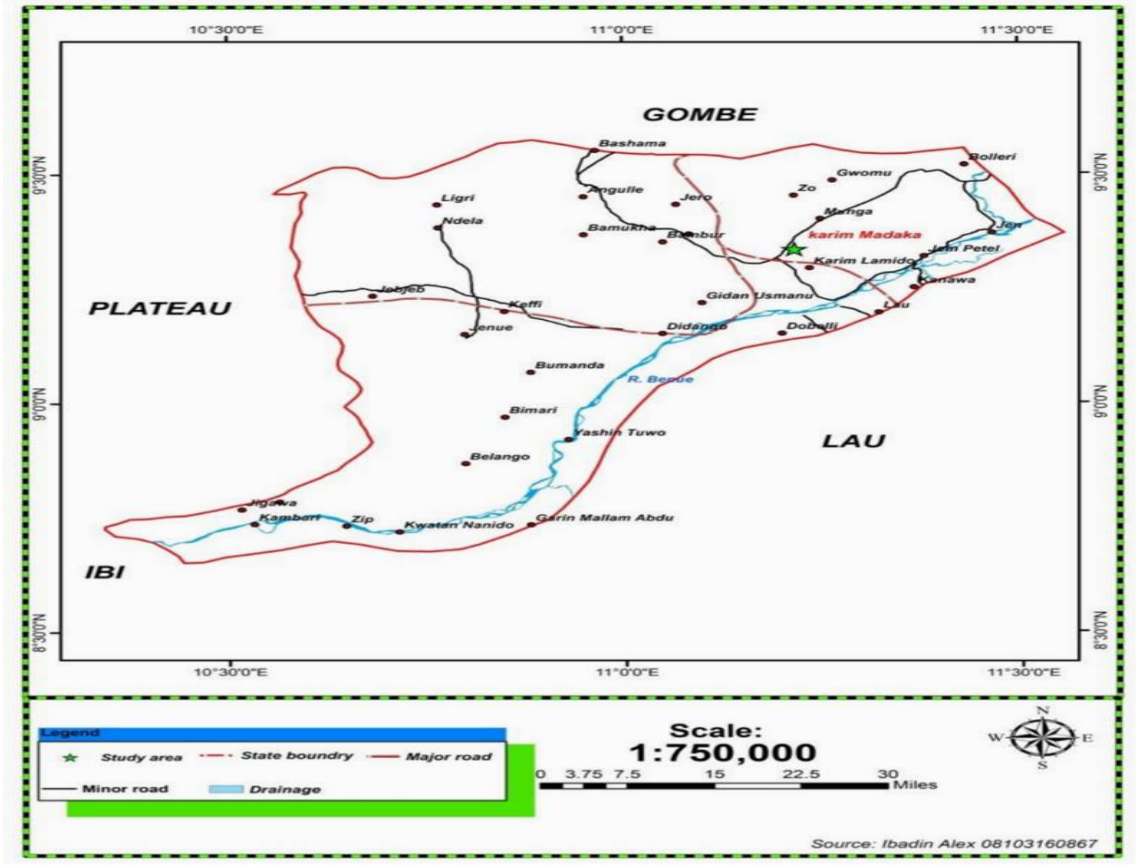

Figure 1 Map of Karim Lamido (Ojeh, 2023)

2.2 Study Population and Sampling

The study population comprises healthcare workers directly involved in disease surveillance and reporting in Karim Lamido LGA, including Surveillance Focal Persons (SFPs), Health Information Management personnel supporting surveillance activities, the Disease Surveillance and Notification Officer (DSNO), the Assistant DSNO, and other relevant healthcare workers involved in IDSR implementation. Because the target population was relatively small (N = 100), a total population (census) sampling approach was adopted, whereby all eligible healthcare workers were invited to participate. This approach eliminated sampling error and ensured complete representation of personnel responsible for surveillance activities within the LGA.

2.3 Data Collection

Data was collected over a three-week period using two structured instruments. The first was a structured, pre-tested questionnaire adapted from the Nigerian IDSR Technical Guidelines (Federal Ministry of Health [FMoH], 2016), which assessed respondents' socio-demographic characteristics, knowledge, attitudes, practices, availability of IDSR tools, and challenges affecting surveillance implementation. The second was an IDSR data extraction checklist, adapted from the national IDSR monthly reporting tool (Form 003), which was used to extract surveillance information from routine facility records and assess reporting completeness and utilization of IDSR tools. The instruments were reviewed by experts in epidemiology and health information management for content validity and pretested in Ardo Kola LGA, a neighboring area with similar characteristics. Reliability of the questionnaire was assessed using Cronbach's alpha, with a coefficient of ≥0.70 considered acceptable.

2.4 Data Analysis

Data was entered, cleaned, and analyzed using IBM SPSS Statistics version 28. Descriptive statistics, including frequencies, percentages, means, and standard deviations, were used to summarize respondents'

characteristics and KAP regarding IDSR tools. Chi-square tests were performed to determine associations between categorical variables, while binary logistic regression analysis was used to identify factors associated with good knowledge, positive attitudes, and appropriate surveillance practices. Statistical significance was set at $p < 0.05$.

2.5 Ethical Consideration

Ethical approval was obtained from the Adamawa State Ministry of Health and Human Services Research Ethics Committee. Permission to conduct the study was also obtained from the Director of Primary Health Care, Karim Lamido LGA. Written informed consent was obtained from all participants prior to data collection. Participation was voluntary, and confidentiality was maintained by anonymizing all data and reporting findings in aggregate form. Data were stored securely and accessed only by the research team.

3. Results

Table 1: Socio-demographic Variables

Variable	Categories	Frequency (n)	Percentage (%)
Age	20-29	17	17.0
	30-39	32	32.0
	40-49	31	31.0
	50 & above	20	20.0
Gender	Male	51	51.0
	Female	49	49.0
Years in service	1-2 years	23	23.0
	3-4 years	24	24.0
	5-6 years	11	11.0
	7-8 years	19	19.0
	9 years & above	23	23.0
Designation	Data Clerk	14	14.0
	Health Information Officer	37	37.0
	Health Records Assistant	17	17.0
	Health Records Technician	24	24.0
	Monitoring and Evaluation Officer	8	8.0

Table 2 Knowledge of HCWs on IDSR Tool

Variable	Categories	Frequency (n)	Percentage (%)
K1	Yes	76	76.0
	No	24	24.0
K2	Yes	73	73.0
	No	27	27.0
K3	Yes	88	88.0
	No	12	12.0
K4	Yes	80	80.0
	No	20	20.0
K5	Yes	78	78.0
	No	22	22.0
K6	Yes	75	75.0
	No	25	25.0
K7	Yes	72	72.0
	No	28	28.0
K8	Yes	88	88.0
	No	12	12.0

Table 2.1: Summary of Health Care Workers' Knowledge of the IDSR Tool

Knowledge Level	Score (%)	Frequency (n)	Percentage (%)
Good Knowledge	≥ 50%	79	79.0
Poor Knowledge	< 50%	21	21.0
Total		100	100.0

Table 3: Attitude of HCWs on IDSR Tool

Variables	SA	A	D	SD	n	Mean	Std Dev	Decision

A1	29	48	8	5	100	3.88	1.08	Accepted
A2	34	40	12	2	100	3.92	1.06	Accepted
A3	36	42	6	2	100	4.04	0.96	Accepted
A4	34	46	5	5	100	3.99	1.05	Accepted
A5	40	37	10	2	100	4.03	1.05	Accepted
A6	6	10	45	19	100	2.39	1.09	Rejected
A7	39	37	9	2	100	4.02	1.03	Accepted
A8	27	41	9	5	100	3.76	1.10	Accepted

Table 3.1: Summary of Health Care Workers' Attitude towards the IDSR Tool

Attitude Level	Criterion	Frequency (n)	Percentage (%)
Positive Attitude	Grand Mean ≥ 2.50	87	87.0
Negative Attitude	Grand Mean < 2.50	13	13.0
Total		100	100.0

Table 4: Practice of HCWs on IDSR Tool

Variable	Categories	Frequency (n)	Percentage (%)
P1	Yes	75	75.0
	No	25	25.0
P2	Yes	69	69.0
	No	31	31.0
P3	Yes	75	75.0
	No	25	25.0
P4	Yes	71	71.0
	No	29	29.0
P5	Yes	74	74.0
	No	26	26.0
P6	Yes	66	66.0
	No	34	34.0
P7	Yes	74	74.0
	No	26	26.0
P8	Yes	67	67.0
	No	33	33.0

Table 4.1: Summary of Health Care Workers' Practice of the IDSR Tool

Practice Level	Score (%)	Frequency (n)	Percentage (%)
Good Practice	≥ 50%	71	71.0
Poor Practice	< 50%	29	29.0
Total		100	100.0

Table 5: Test of Hypothesis One (H_{o1})

There is no significant relationship between the knowledge of healthcare workers and their involvement in disease surveillance activities across PHCs in Karim Lamido LGAs.

Variables	N	Mean	Std. Dev	r-value	p-value
Knowledge Score	100	6.21	1.31	0.85	0.039
Involvement in Disease Surveillance Activities	100	4.96	1.39		

Table 6: Test of Hypothesis Two (H_{o2})

Attitudes of health workers do not significantly influence their involvement in disease surveillance activities under the IDSR system.

Variables	N	Mean	Std. Dev	r-value	p-value
Attitude Score	100	26.04	4.88	0.544	0.046
Involvement in Disease Surveillance Activities	100	4.96	1.39		

Table 7: Test of Hypothesis Three (H_{o3})

Practices of health workers do not significantly affect the implementation of disease surveillance activities under the IDSR system.

Variables	N	Mean	Std. Dev	r-value	p-value

Practice Score	100	2.40	1.07	0.618	0.0102
Implementation of Disease Surveillance Activities	100	2.56	1.11		

Table 8 Paired Samples Statistics

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	Suspected	79.9041	73	188.35009	22.04471
	Confirmed	71.4932	73	193.37716	22.63308

Table 9 Paired Samples Correlations

		N	Correlation	Sig.
Pair 1	Suspected & Confirmed	73	.988	.000

Table 10 Paired Samples Test

		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference Lower	Upper			
Pair 1	Suspected – Confirmed	8.41096	30.34241	3.55131	1.33155	15.49037	2.368	72	.021

Table 4.11 Paired Samples Effect Sizes

			Standardizer[a]	Point Estimate	95% Confidence Interval Lower	Upper
Pair 1	Suspected – Confirmed	Cohen's d	30.34241	.277	.042	.510
		Hedges' correction	30.50160	.276	.042	.507

4. Discussion

Socio-demographic Characteristics of Respondents

The study population consisted predominantly of healthcare workers within the economically active age groups, with most respondents aged 30–49 years (63%). This age distribution indicates that the surveillance system in Karim Lamido LGA is largely operated by experienced personnel who are expected to possess adequate professional exposure for disease surveillance activities. Male respondents (51%) were only slightly higher than females (49%), demonstrating a balanced gender distribution. Health Information Officers constituted the largest professional category (37%), followed by Health Records Technicians (24%), suggesting that personnel directly involved in health information management formed the majority of the respondents. The distribution of years of service further showed that respondents possessed varying levels of experience, providing a representative assessment of IDSR implementation across different professional cadres.

Knowledge of Healthcare Workers on the Integrated Disease Surveillance and Response (IDSR) Tool

The study found that healthcare workers possessed generally high knowledge regarding the Integrated Disease Surveillance and Response (IDSR) programme. Between 72% and 88% of respondents correctly identified the objectives of the programme, reporting procedures, surveillance information flow, reporting timelines, standard reporting forms, and the roles of Health Information Management professionals. Particularly noteworthy was the high proportion of respondents who could identify notifiable diseases (88%) and understood the role of Health Information Management personnel (88%). Overall, the findings indicate that healthcare workers in Primary Health Care Centres across Karim Lamido LGA possess adequate knowledge required for effective surveillance activities.

The high level of knowledge observed in this study is encouraging because knowledge constitutes the foundation upon which surveillance activities such as disease detection, reporting, verification, and response are built. Effective disease surveillance requires healthcare workers to recognize priority diseases promptly,

complete surveillance forms accurately, and adhere to reporting timelines established within the national IDSR framework.

The findings agree with the study conducted by Kola Ademola Jinadu and colleagues among healthcare workers in Oyo State, Nigeria, which reported that approximately 70% of healthcare workers possessed good knowledge of epidemic-prone diseases, while about 90% demonstrated adequate knowledge of the IDSR surveillance data flow. The authors concluded that although knowledge of some reporting forms remained inadequate, healthcare workers generally understood the surveillance process and appreciated the importance of disease reporting.

Similarly, the present findings support evidence from Eastern Ethiopia where healthcare professionals with good knowledge of IDSR were significantly more likely to demonstrate good surveillance practice than those with poor knowledge. The Ethiopian study identified knowledge as one of the strongest predictors of effective disease surveillance implementation, emphasizing that healthcare workers who understand surveillance guidelines are more likely to participate actively in disease notification, reporting, and outbreak investigation.

The findings are also consistent with broader evidence from healthcare systems in low- and middle-income countries. A recent systematic review and meta-analysis from Ethiopia reported that approximately 74.5% of healthcare workers demonstrated adequate knowledge of infection prevention and surveillance-related practices, suggesting that educational interventions and continuous professional development remain essential components for improving public health programme implementation.

The relatively high knowledge level observed in Karim Lamido LGA may be attributable to previous IDSR training programmes, supportive supervision by Disease Surveillance and Notification Officers (DSNOs), and increasing awareness following recent epidemic events such as COVID-19, cholera, Lassa fever, and monkeypox, which have strengthened surveillance awareness throughout Nigeria.

Nevertheless, approximately one-quarter of respondents reported that they had never received formal IDSR training, while about 28% lacked knowledge of standard reporting forms. These findings suggest existing knowledge gaps that may affect surveillance quality if not addressed. Continuous capacity-building programmes, refresher training, mentorship, and supportive supervision should therefore remain priorities for strengthening IDSR implementation within Primary Health Care facilities.

Attitude of Healthcare Workers towards the Integrated Disease Surveillance and Response Tool

The study further demonstrated that healthcare workers exhibited a positive attitude toward the Integrated Disease Surveillance and Response programme. Respondents strongly agreed that IDSR is important for disease control (Mean = 3.88), expressed motivation to participate in surveillance activities (Mean = 3.92), considered surveillance responsibilities part of their professional duties (Mean = 4.04), and indicated willingness to attend future IDSR training programmes (Mean = 3.99). Respondents also agreed that regular feedback enhances participation in surveillance activities (Mean = 4.02) and expressed satisfaction with the current implementation of IDSR within their facilities (Mean = 3.76). Importantly, respondents generally disagreed that IDSR reporting constituted an unnecessary workload (Mean = 2.39).

These findings suggest that healthcare workers not only possess adequate knowledge of IDSR but also maintain favourable perceptions regarding its importance in protecting population health. Positive attitudes among healthcare workers are essential because willingness, motivation, and professional commitment directly influence surveillance performance, reporting completeness, and outbreak response effectiveness.

The findings corroborate those reported by Kola Ademola Jinadu et al. in Oyo State, Nigeria, where almost all healthcare workers agreed that reporting epidemic-prone diseases was necessary, and the majority considered IDSR tools simple and useful for surveillance activities. Their study concluded that favourable attitudes contributed significantly to sustained participation in disease surveillance despite deficiencies in knowledge of some reporting forms.

Similarly, evidence from Ethiopia demonstrated that health professionals with positive attitudes towards IDSR were significantly more likely to engage in surveillance practice than those with negative attitudes. The investigators reported that attitude independently predicted surveillance performance, highlighting the importance of motivational factors, organizational support, and supportive supervision in strengthening surveillance systems.

The finding that respondents rejected the statement that IDSR reporting unnecessarily increases workload is particularly encouraging. In many low-resource settings, surveillance systems are often criticized for increasing documentation requirements and administrative burden. The present finding suggests that healthcare workers in Karim Lamido recognize surveillance activities as integral components of routine clinical and public health practice rather than additional responsibilities. This positive perception may enhance reporting compliance and improve surveillance data quality.

Furthermore, respondents' strong agreement regarding the importance of regular feedback aligns with WHO recommendations that supportive supervision and continuous feedback constitute essential components of functional surveillance systems. Feedback reinforces data quality, improves staff motivation, and encourages timely reporting of priority diseases.

Practice of Healthcare Workers in the Core Functions of the Integrated Disease Surveillance and Response (IDSR) Tool

The findings revealed that healthcare workers generally demonstrated good practices regarding the implementation of the core functions of the Integrated Disease Surveillance and Response (IDSR) system. Most respondents reported participating in timely reporting of notifiable diseases (75%), IDSR data analysis activities (75%), outbreak investigations (74%), attendance at IDSR review meetings or supervisory activities (74%), and providing feedback to relevant facilities or departments (71%). In addition, 69% indicated that they properly documented cases using IDSR reporting forms, while 67% reported maintaining confidentiality and accuracy in handling surveillance data. However, only 66% reported consistently submitting IDSR reports within the stipulated reporting timelines, indicating that approximately one-third of the respondents still experienced challenges in meeting reporting deadlines.

These findings suggest that although the overall level of practice was satisfactory, important operational gaps remain in documentation, timely reporting, and data management. The effectiveness of any surveillance system depends not only on the knowledge and attitudes of healthcare workers but also on the consistent application of surveillance procedures in routine practice. Delays in reporting or incomplete documentation can compromise early outbreak detection and timely public health response.

The findings are consistent with those reported by Jinadu et al. (2018), who found that although healthcare workers in Oyo State possessed good knowledge and favourable attitudes towards IDSR, surveillance practice was constrained by incomplete reporting, inadequate availability of reporting forms, and irregular supportive supervision. The authors observed that timely reporting and complete documentation remained significant operational challenges despite high levels of awareness of surveillance procedures. These similarities suggest that implementation challenges continue to affect IDSR performance in many Nigerian primary healthcare settings despite improvements in workforce capacity.

Similarly, Nnebue et al. (2013), in their assessment of IDSR implementation among health workers in southeastern Nigeria, reported that while most respondents were aware of surveillance requirements, actual reporting practices were influenced by the availability of surveillance tools, regular supervision, logistics, and continuous staff training. The study concluded that knowledge alone was insufficient to guarantee effective surveillance practice, emphasizing the importance of institutional support and adequate surveillance infrastructure.

Comparable findings have also been reported outside Nigeria. Dagnew et al. (2023) found that healthcare professionals in Eastern Ethiopia who had received IDSR training, regular supportive supervision, and access to surveillance guidelines demonstrated significantly better surveillance practices than those lacking these resources. Their study identified training, supportive supervision, and availability of reporting tools as major predictors of good surveillance practice.

The present findings are further supported by evidence from the World Health Organization (WHO), which identifies timely reporting, case investigation, laboratory confirmation, data analysis, feedback, epidemic preparedness, and response as the core functions of an effective IDSR system (WHO Regional Office for Africa, 2019). The relatively high proportions of respondents participating in these activities indicate that the surveillance system in Karim Lamido LGA is generally functioning in accordance with recommended WHO standards. Nevertheless, the proportion of respondents failing to submit reports within required timelines highlights the need for continuous monitoring and strengthening of reporting mechanisms.

The observed deficiencies in documentation and reporting timelines may be attributable to heavy workloads, inadequate staffing, shortages of reporting forms, transportation difficulties, limited internet connectivity for electronic reporting, and insufficient supportive supervision. Similar operational barriers have been documented across several African countries implementing the IDSR strategy (Phalkey et al., 2015; WHO Regional Office for Africa, 2019).

Relationship between Knowledge of Healthcare Workers and Their Involvement in Disease Surveillance Activities

The first hypothesis examined whether there was a significant relationship between healthcare workers' knowledge of the IDSR programme and their involvement in disease surveillance activities. The Pearson Product Moment Correlation analysis revealed a strong positive relationship ($r = 0.85$, $p = 0.039$), indicating that healthcare workers with higher knowledge scores were significantly more involved in surveillance activities. Consequently, the null hypothesis was rejected.

This finding demonstrates that knowledge is a critical determinant of effective participation in surveillance activities. Healthcare workers who understand the objectives of IDSR, recognize priority diseases, know reporting procedures, and understand surveillance information flow are more likely to participate actively in case detection, disease notification, reporting, and outbreak response.

The finding agrees with Dagnew et al. (2023), who reported that healthcare professionals possessing adequate knowledge of IDSR guidelines were significantly more likely to demonstrate effective surveillance practices than those with inadequate knowledge. Their multivariable analysis identified knowledge as one of the strongest predictors of surveillance performance.

Similarly, Nnebue et al. (2013) reported that inadequate knowledge among healthcare workers negatively affected disease notification, reporting completeness, and surveillance performance in Anambra State, Nigeria. The authors concluded that continuous professional education significantly improved surveillance effectiveness.

The present finding is also supported by Phalkey et al. (2015), whose systematic review of IDSR implementation across the African Region identified inadequate knowledge and insufficient training as major barriers limiting surveillance system performance. The review concluded that strengthening workforce capacity through continuous education remains essential for improving surveillance quality across African health systems.

Furthermore, the WHO Regional Office for Africa (2019) emphasizes that competent healthcare workers constitute the foundation of effective disease surveillance systems. Knowledge enables health workers to recognize unusual disease events promptly, complete surveillance forms correctly, initiate appropriate reporting procedures, and contribute effectively to outbreak investigations.

The very strong correlation observed in the present study ($r = 0.85$) suggests that investments in IDSR training programmes are likely to yield substantial improvements in surveillance performance. Regular refresher training, mentorship, supportive supervision, and continuous professional development should therefore remain integral components of surveillance strengthening programmes in Karim Lamido LGA.

Influence of Attitude on Involvement in Disease Surveillance Activities

The second hypothesis investigated whether healthcare workers' attitudes significantly influenced their involvement in disease surveillance activities. The Pearson correlation analysis revealed a statistically

significant moderate positive relationship (r = 0.544, p = 0.046). Consequently, the null hypothesis was rejected.

This finding indicates that favourable attitudes towards IDSR significantly enhance participation in surveillance activities. Healthcare workers who appreciate the importance of surveillance, perceive reporting as part of their professional responsibility, and are motivated to participate are more likely to comply with surveillance requirements and contribute to effective disease detection.

The findings corroborate those of Jinadu et al. (2018), who reported overwhelmingly positive perceptions of IDSR among healthcare workers in Oyo State. The authors found that respondents regarded surveillance as an important public health responsibility and demonstrated willingness to participate actively in disease reporting.

Similarly, Dagnew et al. (2023) demonstrated that positive attitudes independently predicted surveillance practice among Ethiopian healthcare professionals. Their findings suggested that healthcare workers with favourable perceptions towards surveillance activities consistently demonstrated higher reporting performance than those with negative attitudes.

The finding is further supported by behavioural theories such as the Theory of Planned Behavior, which posits that favourable attitudes towards a behaviour increase behavioural intention and actual performance. In the context of disease surveillance, positive attitudes strengthen healthcare workers' willingness to report diseases promptly, attend surveillance meetings, participate in outbreak investigations, and comply with surveillance guidelines.

Nevertheless, attitude alone may not guarantee optimal surveillance performance. Even highly motivated healthcare workers may experience operational constraints such as inadequate logistics, shortages of reporting forms, poor internet connectivity, insufficient laboratory capacity, and delayed feedback. Consequently, positive attitudes should be complemented by adequate institutional support to achieve optimal surveillance outcomes.

Effect of Healthcare Workers' Practices on the Implementation of Disease Surveillance Activities under the IDSR System

The third hypothesis examined whether the practices of healthcare workers significantly affect the implementation of disease surveillance activities under the Integrated Disease Surveillance and Response (IDSR) system. The Pearson Product Moment Correlation analysis demonstrated a statistically significant strong positive relationship between healthcare workers' practices and the implementation of disease surveillance activities (r = 0.618, p = 0.010). Consequently, the null hypothesis was rejected, indicating that good surveillance practices significantly enhance the implementation of IDSR activities across Primary Health Care (PHC) facilities in Karim Lamido Local Government Area.

This finding underscores the importance of translating knowledge and positive attitudes into consistent surveillance practices. While knowledge equips healthcare workers with the necessary understanding of surveillance procedures and positive attitudes encourage participation, it is the routine execution of surveillance activities—including timely reporting, accurate documentation, data analysis, feedback provision, outbreak investigation, and adherence to reporting timelines—that ultimately determines the effectiveness of the IDSR system.

The findings are consistent with those of Dagnew et al. (2023), who reported that healthcare workers who consistently practiced surveillance activities such as routine reporting, use of surveillance guidelines, participation in outbreak investigations, and regular data review demonstrated significantly better IDSR implementation than those with poor surveillance practices. Their study further showed that surveillance practice was strongly influenced by access to training, supportive supervision, and the availability of reporting tools.

Similarly, Phalkey et al. (2015), in a systematic review of IDSR implementation across countries in the WHO African Region, concluded that deficiencies in routine surveillance practices—including incomplete reporting, delayed notification, poor documentation, weak feedback systems, and inadequate supervision—

were among the major barriers limiting surveillance effectiveness. The review emphasized that improving routine surveillance practices is essential for strengthening early warning systems and outbreak preparedness across African health systems.

The findings also agree with Nnebue et al. (2013), who reported that healthcare workers who consistently adhered to surveillance reporting procedures demonstrated better disease notification performance than those who did not. The authors observed that regular supportive supervision and availability of surveillance tools significantly improved surveillance practices and reporting quality within health facilities.

Furthermore, the observed relationship aligns with the recommendations of the World Health Organization Regional Office for Africa (2019), which identifies case detection, case registration, laboratory confirmation, reporting, data analysis, feedback, epidemic preparedness, response, monitoring, and supportive supervision as the essential core functions of the IDSR strategy. The relatively high proportions of respondents participating in timely reporting (75%), outbreak investigation (74%), IDSR review meetings (74%), and surveillance data analysis (75%) suggest that these core surveillance functions are being implemented satisfactorily within the study area.

Despite these encouraging findings, the study identified notable gaps in surveillance practice. Approximately one-third of respondents reported not consistently submitting surveillance reports within the required timelines, while similar proportions indicated deficiencies in documentation and data management. Such operational shortcomings may reduce the sensitivity and timeliness of the surveillance system, delaying outbreak detection and public health response. Similar implementation challenges have been documented in several African countries where inadequate logistics, shortages of surveillance forms, poor transportation systems, insufficient laboratory capacity, and limited supportive supervision adversely affected surveillance performance (Phalkey et al., 2015; WHO Regional Office for Africa, 2019).

Extent to Which IDSR Tools Support the Timely Detection and Confirmation of Priority Diseases

The fourth hypothesis examined whether IDSR tools significantly support the timely detection and confirmation of priority diseases in Karim Lamido Local Government Area. To evaluate this objective, paired-sample statistical analyses were conducted using surveillance data on ten priority diseases reported between January and June.

The findings demonstrated that suspected disease cases recorded a mean of 79.90, while confirmed cases recorded a mean of 71.49, indicating that more cases were initially identified through surveillance than were subsequently confirmed. The paired-samples correlation analysis showed an exceptionally strong positive relationship between suspected and confirmed disease cases ($r = 0.988$, $p < 0.001$), suggesting a high level of consistency between initial case detection and subsequent laboratory or clinical confirmation. Furthermore, the paired-samples t-test revealed a statistically significant difference between suspected and confirmed cases ($t = 2.368$, $p = 0.021$), while the calculated effect size (Cohen's $d = 0.277$) indicated a small but practically meaningful effect.

The rejection of the null hypothesis implies that IDSR tools significantly support the timely detection, reporting, screening, and confirmation of priority diseases within Karim Lamido Local Government Area. The observed difference between suspected and confirmed cases reflects an effective surveillance process whereby suspected cases undergo systematic verification before final confirmation. Such a pattern is consistent with the fundamental principles of surveillance systems, which prioritize high sensitivity during case detection while maintaining specificity through laboratory and clinical confirmation.

The findings strongly support the objectives of the Integrated Disease Surveillance and Response strategy developed by the World Health Organization Regional Office for Africa (2019), which emphasizes early detection, prompt reporting, laboratory confirmation, timely response, and continuous monitoring as critical components of disease surveillance. The exceptionally high correlation between suspected and confirmed cases observed in the present study suggests that surveillance personnel are accurately identifying priority diseases before confirmation, thereby facilitating rapid public health interventions.

These findings agree with Phalkey et al. (2015), whose systematic review concluded that effective implementation of IDSR significantly improves early outbreak detection, disease reporting, laboratory confirmation, and public health response across African countries. The review highlighted that countries with functional IDSR systems consistently demonstrated improved surveillance sensitivity and more rapid outbreak response compared with systems lacking standardized surveillance procedures.

Similarly, the findings are consistent with evidence reported by Mwatondo et al. (2016), who evaluated the implementation of Integrated Disease Surveillance and Response in Kenya and found that strengthened surveillance systems improved disease detection, reporting completeness, and outbreak investigation, although challenges relating to laboratory capacity and reporting timeliness remained.

The present findings also support the observations of Nsubuga et al. (2010), who emphasized that surveillance systems should be evaluated based on attributes such as sensitivity, timeliness, data quality, representativeness, stability, flexibility, and predictive value positive. The very strong correlation observed between suspected and confirmed cases indicates that the surveillance system in Karim Lamido demonstrates excellent internal consistency and satisfactory predictive performance in identifying priority diseases.

Although the statistically significant difference between suspected and confirmed cases indicates that not all suspected cases were eventually confirmed, this should not be interpreted as a weakness of the surveillance system. Rather, it reflects the expected functioning of an effective surveillance system, in which all potential cases are initially captured to maximize sensitivity before laboratory and epidemiological investigations eliminate false positives. Such an approach minimizes the likelihood of missing genuine outbreaks while ensuring that only confirmed cases are included in official surveillance statistics.

The relatively small effect size observed (Cohen's d = 0.277) further indicates that the difference between suspected and confirmed cases was modest. From a public health perspective, this finding suggests that the surveillance system demonstrates good screening accuracy, with relatively few suspected cases failing confirmation. Consequently, the IDSR tools appear to provide an efficient balance between early case detection and accurate disease confirmation.

The findings of this study demonstrate that healthcare workers in Primary Health Care facilities in Karim Lamido Local Government Area possess adequate knowledge, favourable attitudes, and generally good practices regarding the implementation of the Integrated Disease Surveillance and Response (IDSR) system. Furthermore, knowledge, attitude, and practice were all found to be significant determinants of disease surveillance implementation. The evaluation of surveillance records also showed that IDSR tools effectively support the detection and confirmation of priority diseases.

Collectively, these findings reinforce the conceptual basis of the IDSR strategy, which recognizes competent healthcare workers as the cornerstone of effective disease surveillance. The observed relationships among knowledge, attitude, practice, and surveillance implementation suggest that strengthening human resource capacity remains central to improving disease surveillance performance in Nigeria. Although the findings indicate satisfactory implementation of IDSR within the study area, persistent gaps in reporting timelines, documentation, and supportive supervision suggest opportunities for further strengthening surveillance performance through continuous training, adequate resource provision, regular supportive supervision, and expanded laboratory capacity.

5. Conclusion

The study concluded that healthcare workers in Karim Lamido Local Government Area demonstrated adequate knowledge, positive attitudes, and good practices regarding the Integrated Disease Surveillance and Response (IDSR) system. Knowledge, attitude, and practice were found to significantly influence healthcare workers' involvement in disease surveillance activities. Furthermore, the findings showed that the IDSR system effectively supports the timely detection, reporting, and confirmation of priority diseases, thereby strengthening disease surveillance and early outbreak response in the study area. However, improvements are still needed in timely reporting, supportive supervision, and continuous capacity building to further enhance IDSR implementation.

6. Recommendations

Based on the findings of the study, the following recommendations are made:

1. Regular training and refresher programmes should be conducted to strengthen healthcare workers' knowledge and competencies in IDSR implementation.
2. Government and health authorities should strengthen supportive supervision and provide regular feedback to improve surveillance performance.
3. Adequate IDSR reporting tools, guidelines, and logistics should be made available in all Primary Health Care facilities to facilitate timely and accurate reporting.
4. Measures should be implemented to improve adherence to reporting timelines and the completeness and quality of surveillance data.
5. Periodic monitoring and evaluation of IDSR implementation should be conducted to identify operational gaps and strengthen the effectiveness of disease surveillance in the LGA.

Disclaimer (Artificial Intelligence)

Author(s) hereby declares that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc) and text-to-image generators have been used during writing or editing of this manuscript.

Competing Interests

Authors have declared that they have no known competing financial interests or non-financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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