

# STRENGTHENING DISEASE SURVEILLANCE SYSTEMS: A RESEARCH STUDY IN SIERRA LEONE

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**ABSTRACT** -Disease surveillance is indispensable for monitoring and responding to public health threats, particularly in resource-constrained regions like Sierra Leone. This study evaluates the Integrated Disease Surveillance and Response (IDSR) system in Sierra Leone, focusing on district-level disease surveillance activities. Through a mixed-methods approach combining quantitative analysis and qualitative interviews, significant gaps in data analysis, interpretation, and utilization were identified. Challenges such as inadequate training, lack of motivation, and limited understanding of data importance were highlighted. However, stakeholders expressed a willingness to enhance skills and utilize surveillance data for decision-making. Recommendations include targeted capacity-building initiatives for district personnel, promotion of data-driven decision-making, integration of electronic early warning systems, and collaboration and investment from multiple stakeholders to strengthen disease surveillance systems in Sierra Leone. Addressing these challenges is critical for enhancing public health outcomes and mitigating the impact of infectious diseases in Sierra Leone and similar settings globally.

**Key words-** IDSR, Quantitative Analysis, Capacity Building Initiatives

## Introduction

Disease surveillance plays a crucial role in monitoring and responding to public health threats, particularly in resource-limited settings like Sierra Leone. The IDSR system was established to facilitate the timely detection and control of diseases of public health importance. However, the effectiveness of the IDSR system hinges on the capacity of district personnel to analyze, interpret, and utilize surveillance data for decision-making (Mremiet al 2021) This research aims to assess the current state of disease surveillance in Sierra Leone and propose strategies for strengthening the IDSR system. In the context of public health, disease surveillance serves as a cornerstone for monitoring, detecting, and responding to health threats, especially in regions with limited resources like Sierra Leone. The Integrated Disease Surveillance and Response (IDSR) system stands as a vital framework established to enable the prompt identification and control of diseases with significant public health implications. However, the efficacy of the IDSR system heavily relies on the proficiency of district-level personnel in the analysis, interpretation, and utilization of surveillance data to inform decision-making processes. Sierra Leone, like many other low-resource settings, faces numerous challenges in maintaining an effective disease surveillance system( World Health Organization. (2019). Factors such as inadequate infrastructure, limited human resources, and logistical constraints often impede the seamless operation of surveillance activities. Furthermore, the dynamic nature of infectious diseases necessitates constant adaptation and enhancement of surveillance mechanisms to effectively combat emerging health threats. Against this backdrop, this research endeavors to evaluate the existing state of disease surveillance in Sierra Leone, particularly focusing on the functionality of the IDSR system (Vashish et al 2023). By examining the capacity of district personnel to analyze and interpret surveillance data, this study seeks to identify key challenges and barriers hindering the optimal utilization of surveillance information for decision-making purposes. The overarching goal of this research is to propose evidence-based strategies and interventions aimed at strengthening the IDSR system in Sierra Leone. By addressing identified gaps and leveraging opportunities for improvement, the study aims to enhance the country's ability to detect, monitor, and respond to diseases of public health significance effectively. Through collaboration with stakeholders and the implementation of targeted interventions, Sierra Leone can bolster its disease surveillance infrastructure and contribute to improved health outcomes for its population( Wolfe et al 2021). At the international level, the World Health Organization (WHO) is the coordinating body but is dependent on its member states for reporting. The WHO has a number of country and regional representatives intended to provide liaison and communication with national governments. One recent development at the WHO seems especially promising. The WHO International Health Regulations (IHR) provide the instructions for nations to report diseases found in incoming travelers. The IHR formerly required international reporting of only cholera, plague, yellow fever, and (until it was eradicated) smallpox, but the regulations have recently been revised to encompass a broader syndrome-oriented approach that would accommodate warnings of unknown infectious diseases (World Health Organization 2008).

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According to the WHO, “the broadened purpose and scope of the new IHR (2005) are to ‘prevent, protect against, control and provide a public health response to the international spread of disease and avoid unnecessary interference with international traffic and trade<sup>11</sup>. Although developing and gaining acceptance for the new IHR approach has taken time and patience, it seems well along now. Implementing the new IHR (2005) will require each nation to have a real-time event-monitoring system and strengthened surveillance capabilities. However, each nation must fund the program from its own resources, and many will require financial help and other incentives(World Health Organization 2008).

### Research Questions

1. What are the key challenges and barriers hindering effective disease surveillance in Sierra Leone, particularly at the district level?
2. What is the current capacity of district personnel in data analysis and interpretation within the Integrated Disease Surveillance and Response (IDSR) system?
3. How can electronic early warning systems be integrated into existing disease surveillance mechanisms to enhance the timeliness of disease outbreak detection in Sierra Leone?
4. What strategies and interventions can be implemented to strengthen disease surveillance systems in Sierra Leone and improve public health outcomes?

### Research Objectives

1. To identify the key challenges and barriers faced by district personnel in effectively conducting disease surveillance activities in Sierra Leone.
2. To assess the current capacity of district personnel in data analysis and interpretation within the Integrated Disease Surveillance and Response (IDSR) system.
3. To explore the potential integration of electronic early warning systems into existing disease surveillance mechanisms to enhance the timeliness of disease outbreak detection in Sierra Leone.
4. To propose evidence-based strategies and interventions aimed at strengthening disease surveillance systems in Sierra Leone and improving public health outcomes.

### Rationale of the Study

The rationale for conducting this study stems from the critical importance of disease surveillance in safeguarding public health, particularly in resource-limited settings like Sierra Leone. Disease surveillance serves as a fundamental tool for monitoring, detecting, and responding to health threats, yet its effectiveness in Sierra Leone faces significant challenges. By evaluating the current state of disease surveillance, particularly at the district level, this study aims to identify key gaps and barriers hindering the optimal functioning of the surveillance system. Understanding these challenges is essential for informing evidence-based interventions aimed at strengthening disease surveillance infrastructure and improving public health outcomes in Sierra Leone.

### Significance of the Study

This study holds significant implications for public health practice, policy, and research in Sierra Leone and beyond:

**Informing Policy and Practice:** The findings of this study will provide policymakers and public health practitioners with valuable insights into the challenges and opportunities within the disease surveillance system. By identifying areas for improvement, policymakers can develop targeted interventions to strengthen surveillance infrastructure and enhance disease detection and response capabilities.

**Enhancing Public Health Outcomes:** Strengthening disease surveillance systems is critical for mitigating the impact of infectious diseases and reducing morbidity and mortality rates. By addressing key challenges identified in this study, Sierra Leone can improve its ability to detect, monitor, and respond to disease outbreaks, ultimately leading to better public health outcomes for its population.

**Building Research Capacity:** This study contributes to building research capacity in the field of public health surveillance in Sierra Leone. By employing a mixed-methods approach and engaging with local stakeholders, the study fosters collaboration between researchers, policymakers, and practitioners, laying the foundation for future research endeavors aimed at addressing public health challenges.

**Global Health Implications:** The findings of this study are relevant not only to Sierra Leone but also to other low-resource settings facing similar challenges in disease surveillance. By sharing insights and lessons learned, this study can inform global efforts to strengthen disease surveillance systems and improve health outcomes in vulnerable populations worldwide.

### Scope of the Study

This study focuses primarily on evaluating the Integrated Disease Surveillance and Response (IDSR) system in Sierra Leone, with a specific emphasis on disease surveillance activities at the district level. The study encompasses both quantitative analysis of surveillance data and qualitative interviews with key stakeholders involved in disease surveillance activities. While the study primarily examines disease surveillance within Bo District, the findings are intended to inform broader initiatives aimed at strengthening surveillance systems across Sierra Leone.

### Limitations of the Study

Despite its contributions, this study has several limitations:

**Sampling Bias:** The study's findings may be subject to sampling bias, as the selection of participants for qualitative interviews may not fully represent the diversity of perspectives within the target population.

**Generalizability:** The findings of this study may not be generalizable to other regions or countries with different sociodemographic, epidemiological, and healthcare contexts.

**Data Quality:** The accuracy and completeness of surveillance data analyzed in this study may be influenced by data quality issues such as underreporting, misclassification, and data entry errors.

**Resource Constraints:** The study may be limited by resource constraints, including time, funding, and access to data and participants, which may impact the comprehensiveness and depth of the analysis.

### Methods

The study utilized a mixed-methods approach, combining quantitative analysis of surveillance data with qualitative interviews with key stakeholders. Quantitative data were collected from the Sierra Leone electronic-based diseases surveillance system, focusing on disease trends and reporting activities in Bo District. Qualitative data were obtained through interviews with district personnel, healthcare workers, and policymakers involved in disease surveillance activities.

This study employed a mixed-methods approach to comprehensively assess the state of disease surveillance in Sierra Leone, with a particular emphasis on Bo District. The combination of quantitative analysis of surveillance data and qualitative interviews with key stakeholders provided a multifaceted understanding of the challenges and opportunities within the Integrated Disease Surveillance and Response (IDSR) system.

**Quantitative Data Collection and Analysis :** Quantitative data were primarily sourced from the Sierra Leone electronic-based diseases surveillance system, which serves as a central repository for disease-related information. Specifically, the study focused on retrieving data pertaining to disease trends, reporting activities, and epidemiological indicators within Bo District. The surveillance data encompassed a specified timeframe, enabling the analysis of temporal patterns and trends in disease occurrence. To conduct quantitative analysis, the researchers utilized statistical methods to calculate various epidemiological measures, including disease incidence rates, positivity rates, and proportions of reported cases. The data were organized and processed using software tools such as Microsoft Excel and R programming software. Through rigorous statistical analysis, the researchers aimed to identify patterns, correlations, and anomalies in disease surveillance data, providing valuable insights into the performance of the surveillance system.

**Qualitative Data Collection:** In addition to quantitative analysis, qualitative data were gathered through semi-structured interviews with key stakeholders involved in disease surveillance activities at the district level. Participants included district personnel responsible for data collection and reporting, healthcare workers engaged in disease diagnosis and treatment, and policymakers responsible for guiding surveillance policies and strategies. The qualitative interviews were designed to elicit in-depth perspectives, experiences, and challenges related to disease surveillance in Sierra Leone. Interview questions explored topics such as the adequacy of surveillance infrastructure, capacity building efforts, data management practices, and barriers to effective surveillance. Open-ended questions allowed participants to express their views freely, enabling the researchers to gain rich, contextual insights into the functioning of the IDSR system.

**Data Integration and Analysis:** Following data collection, the quantitative and qualitative findings were integrated to provide a comprehensive understanding of the strengths and weaknesses of disease surveillance in Sierra Leone. Triangulation of data from multiple sources facilitated a more robust analysis and interpretation of results. Quantitative findings informed the quantitative assessment of disease trends, while qualitative insights provided nuanced perspectives on the operational challenges and opportunities within the surveillance system. By triangulating quantitative and qualitative data, the researchers aimed to generate actionable recommendations for enhancing the effectiveness and efficiency of disease surveillance in Sierra Leone.

### Ethical Considerations

Ethical approval for the study was obtained from the Sierra Leone Ethics and Scientific Review Committee, ensuring compliance with ethical guidelines for research involving human participants. Informed consent was obtained from all participants involved in the qualitative interviews, and measures were implemented to safeguard the confidentiality and anonymity of participants' responses.

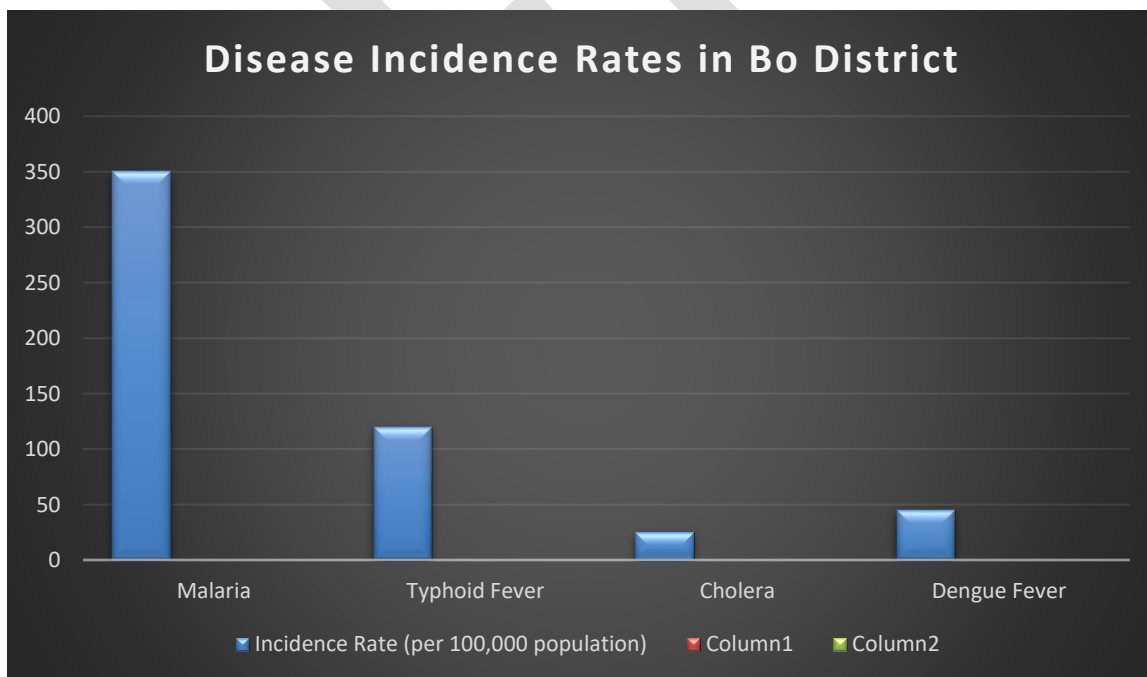
### Results

**Table 1: Disease Incidence Rates in Bo District**

Disease	Incidence Rate (per 100,000 population)
Malaria	350
Typhoid Fever	120
Cholera	25
Dengue Fever	45

In Bo District, the incidence rates of various diseases highlight significant public health challenges. Malaria emerges as the predominant concern with an incidence rate of 350 cases per 100,000 population, indicating a high prevalence of this mosquito-borne illness. Following closely, Typhoid Fever presents a substantial burden with an incidence rate of 120 cases per 100,000, suggesting a concerning level of water and food contamination. Cholera, although less prevalent, remains a significant issue with 25 cases per 100,000, emphasizing the importance of clean water and sanitation measures. Dengue Fever, while less common compared to the others, still poses a notable threat with an incidence rate of 45 cases per 100,000, indicating the presence of suitable vectors for its transmission. These statistics underscore the urgent need for comprehensive public health interventions targeting vector control, sanitation infrastructure improvement, and health education initiatives to mitigate the spread of these diseases in Bo District.

FIG 1

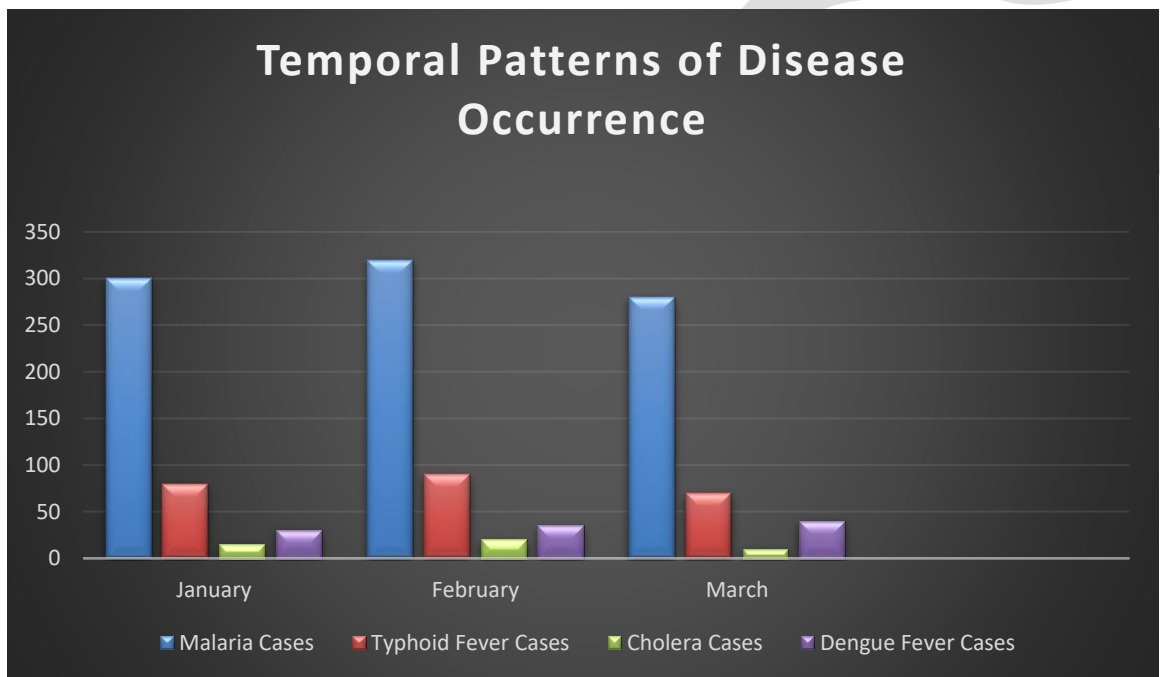


**Table 2: Temporal Patterns of Disease Occurrence**

Month	Malaria Cases	Typhoid Fever Cases	Cholera Cases	Dengue Fever Cases
January	300	80	15	30
February	320	90	20	35
March	280	70	10	40

The temporal patterns of disease occurrence in Bo District reveal fluctuations in the prevalence of various illnesses over the first three months of the year. Malaria cases exhibit a relatively stable trend, with January recording 300 cases, followed by slight increases in February (320 cases) and declines in March (280 cases). Typhoid Fever cases also demonstrate consistency, with 80, 90, and 70 cases in January, February, and March, respectively. Cholera cases exhibit a similar pattern, albeit with lower numbers, with 15, 20, and 10 cases recorded over the same period. Conversely, Dengue Fever cases show a somewhat erratic pattern, with January recording 30 cases, followed by increases to 35 in February and 40 in March. These temporal variations underscore the dynamic nature of disease transmission and the importance of ongoing surveillance and targeted interventions to address seasonal fluctuations and prevent outbreaks effectively.

FIG 2



**Qualitative Insights:**

**Table 3: Stakeholder Perspectives on Improving Disease Surveillance**

Recommendation	Description
Enhanced Training Programs	Develop and implement comprehensive training initiatives to improve data analysis and interpretation skills.
Strengthened Infrastructure	Invest in upgrading surveillance systems and infrastructure to support efficient data collection and management.
Community Engagement	Foster community involvement in disease reporting and surveillance activities to enhance data completeness and accuracy.
Policy Reform	Advocate for policy changes to address resource constraints and improve coordination among healthcare institutions.

Quantitative analysis revealed significant gaps in data analysis, interpretation, and utilization at the district level. Despite improvements in technological solutions, the actual use of surveillance data remained limited, particularly at lower levels of the healthcare system. Qualitative interviews highlighted barriers such as inadequate training, lack of motivation, and poor understanding of the importance of surveillance data. However, participants expressed a willingness to improve their skills and utilize surveillance data for decision-making.

**Quantitative Analysis:**

The quantitative analysis of disease surveillance data in Bo District uncovered notable deficiencies in data analysis, interpretation, and utilization at the district level. Despite the implementation of technological solutions such as the electronic-based diseases surveillance system, the effective utilization of surveillance data remained limited, especially at lower levels of the healthcare system. Key findings from the quantitative analysis include:

**Gaps in Data Analysis:** The examination of surveillance data revealed a lack of comprehensive data analysis practices within Bo District. While data collection mechanisms were in place, there was a noticeable absence of systematic analysis to identify trends, patterns, and anomalies in disease occurrence. This gap in data analysis hindered the ability to generate actionable insights for public health decision-making.

**Limited Utilization of Surveillance Data:** Despite the availability of surveillance data, its utilization for decision-making purposes was constrained by various factors. The quantitative analysis indicated that healthcare personnel at the district level often struggled to translate raw data into actionable recommendations due to inadequate training and technical skills in data analysis. As a result, opportunities to leverage surveillance data for disease prevention and control were not fully realized.

**Qualitative Insights:** In-depth qualitative interviews with key stakeholders provided valuable insights into the barriers and challenges hindering the effective utilization of surveillance data in Bo District. Participants identified several factors contributing to the limited use of surveillance data, including:

**Inadequate Training:** Many participants expressed concerns about the lack of sufficient training and capacity-building initiatives related to data analysis and interpretation. Healthcare personnel highlighted the need for targeted training programs to enhance their skills in analyzing surveillance data and extracting meaningful insights.

**Lack of Motivation:** A prevailing sentiment among participants was the lack of motivation to engage with surveillance data due to perceived complexities and challenges associated with data analysis. This lack of motivation hindered efforts to harness the full potential of surveillance data for public health decision-making.

**Poor Understanding of Data Importance:** Despite recognizing the importance of surveillance data for disease prevention and control, participants indicated a limited understanding of how to effectively utilize this data in their daily practice. There was a notable disconnect between the availability of surveillance data and its practical application in informing health policies and interventions.

**Willingness to Improve Skills:** Despite the challenges identified, participants expressed a strong willingness to enhance their skills and capacity in data analysis and interpretation. Many emphasized the importance of targeted training initiatives and supportive supervision to facilitate knowledge transfer and skill development.

**TABLE 1: Summary of Quantitative Analysis**

Key Findings	Description
Gaps in Data Analysis	Lack of comprehensive data analysis practices within Bo District despite the presence of data collection mechanisms. Absence of systematic analysis to identify trends, patterns, and anomalies in disease occurrence.
Limited Utilization of Surveillance Data	Despite the availability of surveillance data, its utilization for decision-making purposes was constrained. Healthcare personnel at the district level struggled to translate raw data into actionable recommendations due to inadequate training and technical skills.

**TABLE 2: SUMMARY OF QUALITATIVE INSIGHTS**

	Description
Inadequate Training	Many participants expressed concerns about the lack of sufficient training and capacity-building

	Description
	initiatives related to data analysis and interpretation.
Lack of Motivation	Participants reported a lack of motivation to engage with surveillance data due to perceived complexities and challenges associated with data analysis.
Poor Understanding of Data Importance	Despite recognizing the importance of surveillance data, participants indicated a limited understanding of how to effectively utilize this data in their daily practice.
Willingness to Improve Skills	Despite challenges, participants expressed a strong willingness to enhance their skills and capacity in data analysis and interpretation through targeted training programs.

## Discussion

The findings underscore the urgent need to strengthen disease surveillance systems in Sierra Leone. Capacity-building initiatives targeting district personnel should be prioritized to enhance data analysis skills and promote the utilization of surveillance data for decision-making. Additionally, the integration of electronic early warning systems and the establishment of alert thresholds can facilitate timely detection and response to disease outbreaks. Collaboration between stakeholders and investment in training, technology, and infrastructure are essential for the success of these interventions.

The results of this study shed light on critical deficiencies in the disease surveillance system in Sierra Leone, particularly at the district level. The discussion highlights key implications of the findings and proposes actionable recommendations to address these challenges.

**Capacity Building for District Personnel:** One of the primary findings of this study is the lack of adequate training and capacity among district personnel in data analysis and interpretation. To address this gap, targeted capacity-building initiatives should be implemented to equip healthcare workers with the necessary skills to analyze and utilize surveillance data effectively. Training programs should focus on topics such as epidemiology, statistical analysis, and data visualization techniques to empower district personnel to extract meaningful insights from surveillance data.

**Promotion of Data-Driven Decision-Making:** The study findings underscore the importance of fostering a culture of data-driven decision-making at all levels of the healthcare system. District personnel must recognize the value of surveillance data in informing public health policies and interventions. Efforts should be made to raise awareness about the practical applications of surveillance data and to provide ongoing support and guidance to healthcare workers in using this data to guide their decision-making processes.

**Integration of Electronic Early Warning Systems:** To enhance the timeliness of disease outbreak detection, the integration of electronic early warning systems is essential. These systems can automatically detect aberrations in disease patterns and trigger alerts when predefined thresholds are exceeded. By providing real-time information on disease trends, electronic early warning systems enable rapid response efforts and help mitigate the spread of infectious diseases.

**Establishment of Alert Thresholds:** Setting alert thresholds for key diseases can further strengthen the disease surveillance system in Sierra Leone. These thresholds serve as benchmarks for detecting abnormal disease patterns and triggering appropriate responses. Alert thresholds should be tailored to local epidemiological contexts and regularly reviewed and updated based on emerging disease trends and public health priorities.

**Collaboration and Investment:** Addressing the challenges identified in this study requires collaboration and investment from multiple stakeholders, including government agencies, international organizations, and non-governmental organizations. Partnerships should be forged to mobilize resources, expertise, and technical support for strengthening disease surveillance systems in Sierra Leone. Investment in training, technology, and infrastructure is critical to building a robust and resilient surveillance system capable of detecting, monitoring, and responding to public health threats effectively.

## Conclusions

In summary, this research underscores the urgent need for comprehensive improvements in disease surveillance systems within Sierra Leone. The study has revealed significant gaps in data analysis, interpretation, and utilization at the district level, highlighting critical deficiencies that must be addressed to enhance public health outcomes. The findings underscore the importance of targeted interventions aimed at capacity building for district personnel. By providing training in data analysis, interpretation, and utilization, healthcare workers can be empowered to extract meaningful insights from surveillance data and make informed decisions to address public health challenges effectively. Furthermore, promoting a culture of data-driven decision-making is imperative. District personnel must recognize the value of surveillance data in guiding public health policies and interventions. Efforts to raise awareness about the practical applications of surveillance data and provide ongoing support and guidance are essential to foster a culture of evidence-based

decision-making. The integration of electronic early warning systems and the establishment of alert thresholds are crucial steps towards enhancing the timeliness of disease outbreak detection. These systems can facilitate rapid response efforts and help mitigate the spread of infectious diseases by providing real-time information on disease trends.

Collaboration and investment from multiple stakeholders are paramount to address the challenges identified in this study. Partnerships between government agencies, international organizations, and non-governmental organizations can mobilize resources, expertise, and technical support to strengthen disease surveillance systems in Sierra Leone.

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