

The Role of Nurses and Paramedics in Laboratory-Based Epidemiological Surveillance: Enhancing Outbreak Detection and Response

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ABSTRACT

In laboratory-based epidemiological surveillance, nurses and paramedics play a critical role in improving outbreak identification and response. Being on the front lines of healthcare, paramedics and nurses have special abilities that allow them to spot possible epidemics and help with prompt reporting to public health authorities. Beyond providing standard patient care, they play a crucial role in epidemiological surveillance by handling specimens, gathering clinical data, and keeping in touch with labs (Kumar et al., 2020).

Keywords: specimens, gathering clinical data, healthcare, paramedics.

INTRODUCTION

In laboratory-based epidemiological surveillance, nurses and paramedics play a critical role in improving outbreak identification and response. Being on the front lines of healthcare, paramedics and nurses have special abilities that allow them to spot possible epidemics and help with prompt reporting to public health authorities. Beyond providing standard patient care, they play a crucial role in epidemiological surveillance by handling specimens, gathering clinical data, and keeping in touch with labs (Kumar et al., 2020).

Strong epidemiological monitoring systems are required due to the growing frequency and complexity of infectious disease outbreaks, and nurses and paramedics play a critical role in these systems. These workers are in a unique position to spot early outbreak indicators and help with timely reporting to public health authorities because they are frontline healthcare providers. Their contributions go beyond those of conventional patients including vital duties including gathering clinical data, managing specimens, and keeping clear lines of contact with labs (Kumar et al., 2020). Incorporating paramedics and nurses into community-based surveillance frameworks improves outbreak readiness and cultivates a proactive health monitoring culture in local communities. As an illustration of the possible influence of such activities on public health outcomes, infection

control nurses in South Africa's Mpumalanga Province were instrumental in identifying and reporting symptoms that resulted in successful outbreak containment.

Nurses and paramedics are frequently the first to see patients with infectious illness symptoms, which allows them to quickly identify patterns suggestive of possible outbreaks, according to the World Health Organization (2021). Their proficiency in patient evaluation and triage enables for the collection of crucial data that guides laboratory analysis and ensuing public health initiatives. Additionally, since it promotes a thorough grasp of disease dynamics and improves the overall response capabilities of healthcare systems, cooperation between these medical professionals and laboratory staff is crucial for efficient epidemiological surveillance (Thompson et al., 2022). Public health organizations can increase the precision of outbreak identification and carry out prompt interventions by utilizing the abilities and expertise of paramedics and nurses, thereby preserving community health and safety. Despite the vital responsibilities that paramedics and nurses play, issues such as a lack of resources, inadequate training, and conflicting goals frequently make it difficult for them to detect and respond to outbreaks effectively. It is essential to remove these obstacles in order to improve public health outcomes and guarantee that healthcare providers are sufficiently prepared to handle new infectious risks. In order to overcome these obstacles, interdisciplinary cooperation and ongoing training are crucial because they enable medical personnel to actively participate in surveillance procedures and efficiently handle public health emergencies. In order to maximize their contributions to epidemic identification and response, nurses and paramedics play a variety of roles in laboratory-based epidemiological surveillance. This introduction lays the groundwork for a thorough examination of these tasks.

Additionally, adding paramedics and nurses to community-based surveillance systems can greatly improve outbreak response and readiness. For example, teaching these workers to spot the early warning symptoms of infectious diseases empowers them and encourages communities to adopt a proactive health monitoring culture. Hospital-based infections in South Africa's Mpumalanga Province Control nurses showed the potential influence of such programs on public health outcomes by playing a key role in identifying and reporting crucial symptoms that resulted in the successful containment of outbreaks. We can build a strong network that can more effectively and efficiently handle new infectious risks by giving healthcare professionals the abilities and information needed for quick illness detection.

Objective

To describe the critical responsibilities that paramedics and nurses play in laboratory-based epidemiological surveillance, with an emphasis on how they affect the identification and response to outbreaks. In order to increase their efficacy in preserving community health, it seeks to determine the skills that are required, evaluate the difficulties, and stress the necessity of continual training and cooperation.

Review of literature

The necessity for strong epidemiological monitoring systems has been highlighted by the growing frequency and complexity of infectious disease outbreaks. As frontline medical professionals, nurses and paramedics are essential to improving epidemic identification and response. This review of the literature summarizes the body of knowledge about the contributions of paramedics and nurses to laboratory-based epidemiological surveillance, emphasizing their critical roles, skills, difficulties, and the value of ongoing education.

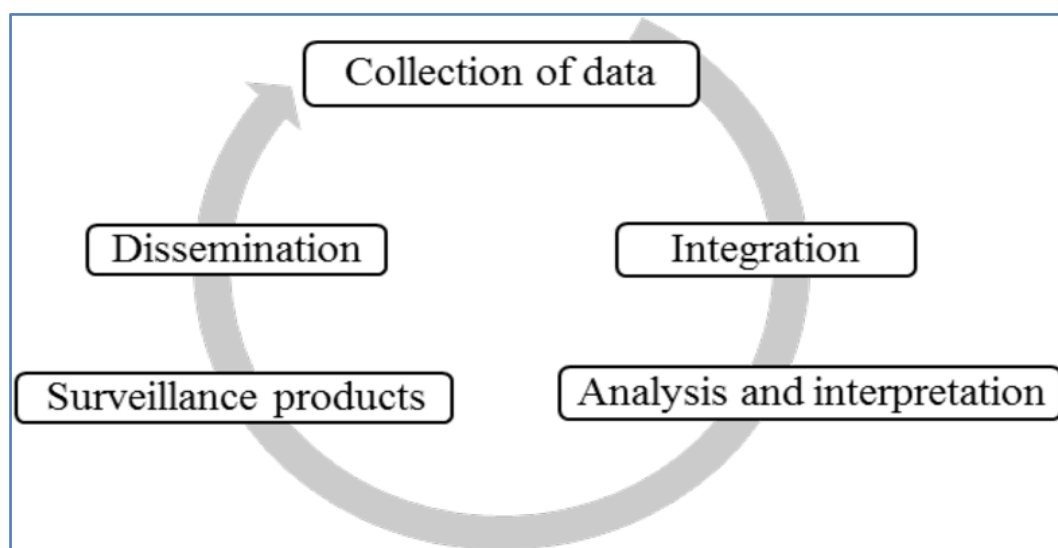


Fig.1 Surveillance cycle model

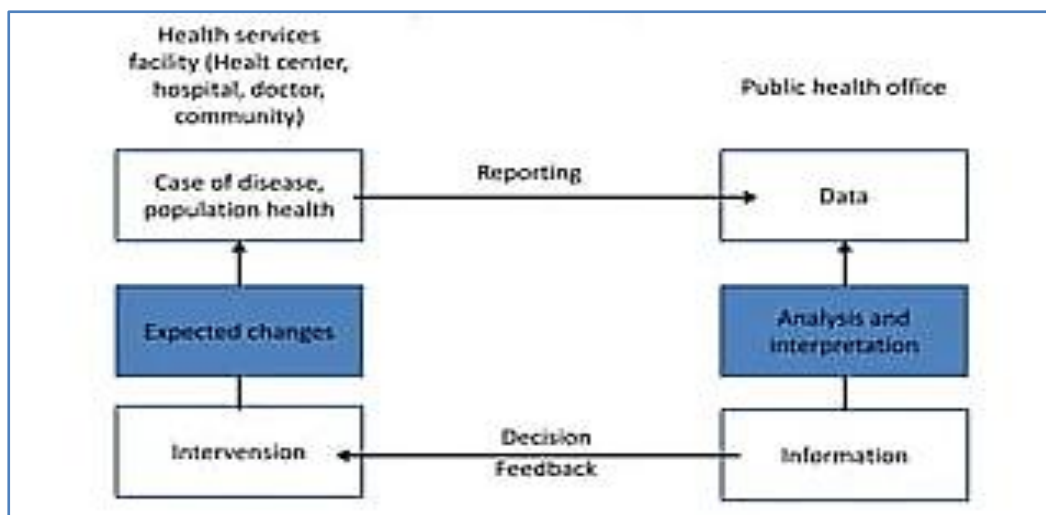


Fig 2: Epidemiological Surveillance

Function and Accountabilities

When patients show signs of infectious diseases, nurses and paramedics are frequently the first medical personnel to see them. Because of their special position, they can quickly see patterns that could be signs of an outbreak. Their duties go beyond providing standard patient care, according to Kumar et al. (2020), and involve crucial duties like gathering clinical data, handling specimens, and keeping in touch with labs. According to the World Health Organization (2021), laboratory testing and ensuing public health actions are greatly aided by these healthcare practitioners' proficiency in triage and patient assessment.

The significance of syndromic surveillance is especially evident in environments with limited resources. Since syndromic surveillance depends on clinical observations rather than laboratory testing, Mwanja et al. (2024) point out that it is crucial for early identification of infections linked to healthcare (HCAIs). Therefore, nurses and paramedics play a crucial role in the reporting and data collection procedures that guide outbreak management plans.

Furthermore, efficient epidemiological surveillance requires cooperation between laboratory staff, paramedics, and nurses. This multidisciplinary approach improves healthcare systems' overall response capacities and promotes a thorough grasp of illness dynamics (Thompson et al., 2022). Public health organizations can increase the precision of outbreak identification and carry out prompt interventions by utilizing the skills of paramedics and nurses, eventually safeguarding the health and safety of the population. Organization for World Health, 2021. enhancing health professionals' involvement in epidemic response. [WHO website] was accessed. Nurses and paramedics need to have a number of critical abilities that improve their ability to participate to laboratory-based epidemiological surveillance. their proficiency in data collection, analysis, and interpretation. These skills are essential for guaranteeing prompt and precise reactions to medical emergencies. The fundamental abilities and qualities needed for these healthcare professionals are described in the sections that follow.

Skills Needed

It takes a variety of skills for nurses and paramedics to participate to laboratory-based epidemiological surveillance. Technical abilities are essential, including knowledge of data collection methods and laboratory protocols (Igarashi, 1994; Craig et al., 2018). Interpreting epidemiological data also requires analytical and problem-solving abilities, such as critical thinking and quantitative skills (Seeli, 2020). Effective teamwork improves data management and response tactics, so communication and collaboration are also essential (Alghamdi et al., 2024).

Despite the significance of these skills, patient care priorities might occasionally take precedence over surveillance duties, resulting in irregular data collection procedures (Craig et al., 2018). This emphasizes how important it is to have continuous training and assistance in order to balance these vital duties.

Challenges and Barriers

Even though nurses play vital roles, As paramedics, a number of obstacles limit their ability to detect and respond to outbreaks effectively. Significant obstacles are presented by resource constraints, such as a lack of staff and materials, especially in low- and middle-income nations (Arendse & Niekerk, 2024; Jayatilleke, 2020). Low participation rates in surveillance operations can also be caused by heavy workloads and a lack of training in epidemiological techniques (Nasiri et al., 2023).

The problem is made more difficult by individual obstacles such as a lack of motivation and skill deficiencies. Healthcare workers' desire to participate in surveillance may be impacted by disengagement brought on by a lack of acknowledgement and support (Nasiri et al., 2023).

Effects of Ongoing Training

To improve nurses' and paramedics' readiness and efficacy in epidemic identification, ongoing training is essential. Effective techniques for enhancing technical proficiency and teamwork have been found to include scenario drills and simulation-based training (Nayahangan et al., 2021; "Preparing for a respiratory outbreak – training and operational readiness," 2022). Frequent in-clinic training sessions can help enhance healthcare personnel's attitudes and understanding regarding outbreak surveillance, increasing their vigilance when gathering data (Craig et al., 2018).

However, the efficacy of ongoing training may be hampered by conflicting priorities in healthcare settings, where urgent patient care frequently takes precedence (Craig et al., 2018). Targeted training expenditures, resource distribution, and the construction of strong surveillance networks are necessary to remove these obstacles.

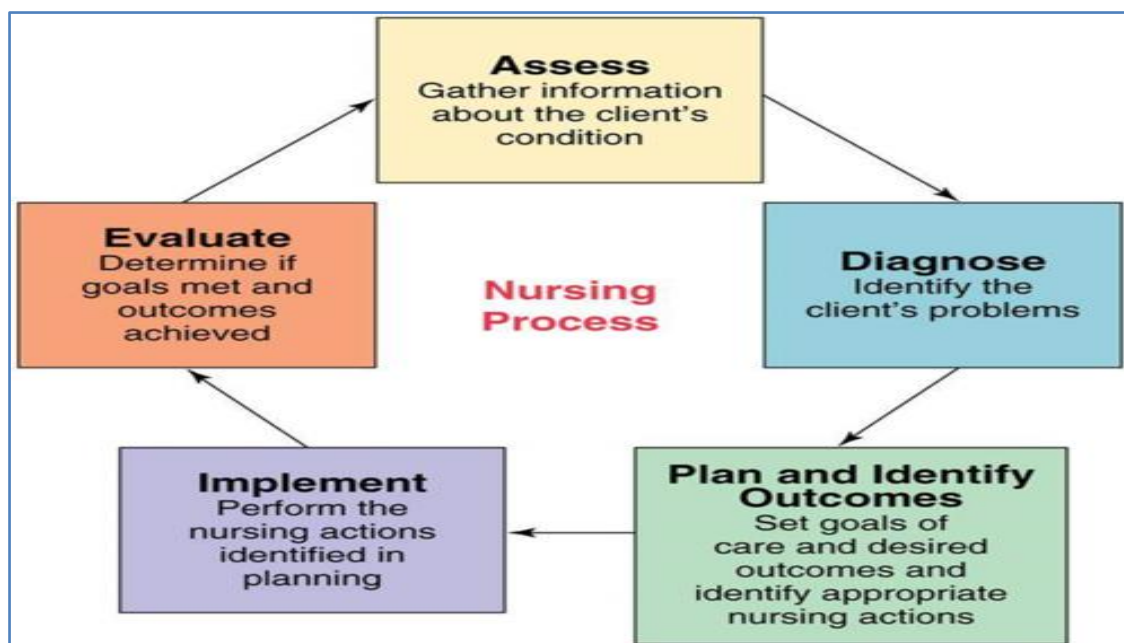


Fig.3: Professional Nursing Practice Flashcards

Technical Skills

- **Laboratory Knowledge:** Correct data interpretation requires an understanding of laboratory protocols and diagnostics (Igarashi, 1994).
- **Data Collection Techniques:** High-quality surveillance data is ensured by proficiency in a variety of data collection techniques (Craig et al., 2018).

Skills in Analysis and Problem-Solving

- **Critical Thinking:** During outbreak investigations, the capacity to evaluate intricate circumstances and reach well-informed conclusions is essential (Seeli, 2020).
- **Quantitative Skills:** Effective epidemiological data interpretation is facilitated by proficiency in statistical analysis (Seeli, 2020).

Interaction and Cooperation

- **Teamwork:** Data management and response tactics are improved when epidemiological teams collaborate effectively (Alghamdi et al., 2024).
- **Diplomacy and Engagement:** Effective communication with stakeholders and members of the community is facilitated by strong interpersonal skills (Seeli, 2020).

Although these skills are necessary, it's also critical to understand that patient care priorities can occasionally take precedence over surveillance duties, resulting in irregular data gathering. (Craig et al., 2018) practices. This emphasizes how important it is to have continuous training and assistance in order to balance these vital duties.

Through laboratory-based epidemiological surveillance, paramedics and nurses are essential to the identification and containment of epidemics. Early detection, data collection, and efficient communication within health systems depend on their efforts. Training, teamwork, and the availability of resources are some of the aspects that affect these healthcare workers' efficacy.

Function in Identifying and Addressing Outbreaks

- **Data Collection:** According to Craig et al. (2018), nurses are frequently in charge of collecting surveillance data, which is essential for early epidemic detection.
- **Collaboration:** Public health responses are greatly impacted by the efficiency of data collection and analysis when nurses, paramedics, and laboratory staff work well together (Alghamdi et al., 2024).
- **Fast Response:** During outbreaks, prompt diagnosis and treatment depend on the prompt identification and delivery of samples to labs (Owusu 2022).

Important Elements Affecting

- **Training and Competence:** Ongoing training in outbreak response greatly enhances nurses' abilities, and new research shows that healthcare personnel are only moderately prepared (Wang et al., 2024).
- **Availability of Resources:** For efficient monitoring and response, it is essential to have access to the resources required, such as diagnostic instruments and assistance from health authorities (Owusu & 2022, باز).
- **Workload Management:** Timely data collection may be impeded by the belief that surveillance is less important than patient care, particularly during peak times (Craig et al., 2018).

Despite the critical role that paramedics and nurses play, issues including conflicting priorities and limited resources can make it difficult for them to detect and respond to outbreaks effectively. Improving public health outcomes requires addressing these problems.

By giving them the necessary skills and knowledge, ongoing training greatly improves nurses' and paramedics' readiness and efficacy in epidemic identification. This training covers a range of approaches, such as scenario drills and simulation-based exercises, which are essential for in-the-moment implementation during outbreaks. The main effects of ongoing training on healthcare workers are described in the sections that follow.

Training Methodologies

- **Simulation-Based Training:** This method boosts healthcare professionals' confidence and competence by allowing them to practice technical skills like putting on and taking off personal protective equipment (PPE) in a controlled setting (Nayahangan et al., 2021). ("Preparing for a respiratory outbreak – training and operational readiness", 2022)

During an outbreak, teamwork is crucial, and interdisciplinary drills combining nursing, medical, and allied health teams can help uncover protocol gaps and improve teamwork ("Preparing for a respiratory outbreak – training and operational readiness", 2022).

Knowledge and Attitude Enhancement

- **Regular In-Clinic Training:** According to Craig et al. (2018), nurses who participate in regular training sessions get better knowledge and attitudes regarding outbreak monitoring, which increases their vigilance and proactivity in gathering data.
- **Recognition and Incentives:** Healthcare professionals are more likely to actively participate in surveillance procedures when they receive official recognition for their excellent job (Craig et al., 2018).

Operational Readiness

- **Just-in-Time Training:** This approach guarantees that personnel are equipped to effectively manage novel difficulties by enabling prompt training in response to emergent epidemics ("Preparing for a respiratory outbreak – training and operational readiness", 2022).

While ongoing training is crucial for improving preparedness for outbreaks, it's also critical to understand that competing priorities in healthcare settings, where urgent patient care frequently takes precedence over surveillance efforts, can limit the effectiveness of such training (Craig et al., 2018).

There are several obstacles that prevent nurses and paramedics from taking part in laboratory-based epidemiological surveillance, including organizational, personal, and systemic issues. Improving data quality in monitoring systems and strengthening public health interventions depend on removing these obstacles.

Systemic Barriers

- **Resource Allocation:** Effective monitoring is hampered by limited availability to essential resources, such as skilled personnel and laboratory equipment (Arendse & Niekerk, 2024).
- **Inadequate Infrastructure:** In low- and middle-income nations, inefficient civil and vital registration systems result in irregular data gathering (Arendse & Niekerk, 2024).

Barriers inside the Organization

- **Heavy Workload:** Paramedics and nurses frequently deal with excessive workloads, which limits their ability to perform surveillance tasks (Nasiri et al., 2023).
- **Lack of Training:** Low participation rates are a result of inadequate training in epidemiological techniques and data administration (Nasiri et al., 2023).

Personal Obstacles

- **Motivation and Engagement:** Healthcare personnel's desire to participate in surveillance is impacted by a lack of motivation that results from a lack of acknowledgment and assistance (Nasiri et al., 2023).
- **Skill Gaps:** It's possible that paramedics and nurses lack the abilities needed for efficient data collecting and analysis, which specific training initiatives can address (Seeli, 2020).

On the other hand, despite these obstacles, the incorporation of multidisciplinary techniques, like the MICRO-BIO project, shows that teamwork can improve data quality and monitoring systems, indicating a way to get over them (Comelli et al., 2024).

The effective involvement of nurses and paramedics in laboratory-based epidemiological surveillance faces several barriers, primarily related to resource limitations, training inadequacies, and systemic challenges. Addressing these barriers is crucial for enhancing public health responses.

Resource Limitations

- **Inadequate Supplies:** According to Cambodia's AMR surveillance system, a shortage of laboratory supplies makes data gathering difficult (Mao et al., 2023).
- **Lack of Staff:** According to Jayatilleke (2020), surveillance capability is impacted by the lack of qualified healthcare workers in low- and middle-income countries (LMICs).

Education and Readiness

- **Professional Unpreparedness:** According to Toss et al. (2023), a large number of nurses are not properly trained in epidemiological procedures, which results in irregular data collecting and reporting.
- **Variable Application of Case Definitions:** According to Craig et al. (2018), nurses' varying interpretations of case definitions may result in inaccurate data.

Systemic Issues

- **Competing Priorities:** Especially during busy times, nurses frequently put patient care ahead of surveillance duties, which can cause data collection to be delayed (Craig et al., 2018).
- **Weak Surveillance Networks:** According to Jayatilleke (2020), inadequate integration of health systems restricts efficient data flow and reaction capabilities. Targeted training expenditures, resource distribution, and the construction of strong surveillance networks are necessary to remove these obstacles. But it's also important to understand that there may be opposition to expanding the role of paramedics and nurses in surveillance because of long-standing medical procedures and the preference for urgent patient care over public health campaigns.

RESULTS

In laboratory-based epidemiological surveillance, nurses and paramedics play a crucial role in improving outbreak identification and response. Among their duties are:

Data Collection and Reporting: Nurses are in charge of receiving and recording alerts of possible outbreaks since they are the main contacts in the medical field (Toss et al., 2023).

Syndromic Monitoring: Syndromic monitoring, which is based on clinical observations, is essential for the early diagnosis of healthcare-associated infections (HCAIs), especially in situations with limited resources (Mwanja et al., 2024).

Teamwork: Teamwork is essential for effective epidemic management, and nurses play a key role in gathering and analyzing data (Alghamdi et al., 2024).

But problems still exist, like:

Resource Limitations: Insufficient resources in many low- and middle-income nations make it difficult to conduct effective surveillance, which restricts the skills of paramedics and nurses (Mwanja et al., 2024). **Education and Readiness:** A Nurses' efficacy in responding to outbreaks is impacted by their lack of epidemiological surveillance training (Toss et al., 2023).

Furthermore, despite the growing use of automated methods for outbreak detection, questions regarding their applicability and propensity for misidentification highlight the need for human oversight in surveillance operations (Skally et al., 2016).

DISCUSSION

To improve outbreak detection and response, nurses' and paramedics' participation in laboratory-based epidemiological surveillance is essential. Being on the front lines of healthcare, they have special knowledge and abilities that are essential for spotting infectious disease symptoms early. Their efforts go beyond providing standard patient care and include crucial duties including gathering data, managing specimens, and corresponding with lab staff. The significance of including these professionals into public health is highlighted by their diverse role frameworks to enhance the health of the community.

The capacity of nurses and paramedics to identify trends suggestive of possible outbreaks is a major benefit of their participation in epidemiological surveillance. These healthcare professionals are frequently the first to see individuals displaying symptoms of infectious diseases, as the World Health Organization (2021) has noted. They have the abilities to collect crucial data that guides laboratory testing and public health measures thanks to their training in triage and patient assessment. Early detection is essential because it enables a prompt reaction to new dangers, eventually protecting the health of the population.

However, a number of issues frequently make it more difficult for nurses and paramedics to recognize and respond to outbreaks effectively. Resource constraints, including insufficient staff and supplies, especially in middle-income nations (Mao et al., 2023; Jayatilleke, 2020). Inconsistent data collection procedures may also arise from the sense that surveillance is less important than patient care due to heavy workloads and conflicting priorities (Craig et al., 2018). Improving nurses' and paramedics' ability to actively participate in epidemiological surveillance requires addressing these structural obstacles.

To overcome these obstacles, professional development and ongoing training are essential. The competencies of nurses and paramedics can be greatly enhanced by providing continuing education in epidemiological techniques and data administration, allowing them to take part in surveillance activities more successfully (Wang et al., 2024). Multidisciplinary exercises and simulation-based training can improve their technical proficiency and promote teamwork, which is crucial for efficient control of outbreaks (Nayahangan et al., 2021). Furthermore, acknowledging and rewarding these medical professionals' contributions can increase their motivation and involvement in monitoring procedures, which will improve public health outcomes (Craig et al., 2018).

Additionally, the incorporation of paramedics and nurses into community-based surveillance systems promotes a proactive health monitoring culture. Public health organizations can establish strong networks that can more effectively handle new infectious risks by enabling these specialists to identify early indicators of communicable diseases (Kumar et al., 2020). The potential influence of such programs on epidemic preparedness and response is demonstrated by the effective example of infection control nurses in South Africa's Mpumalanga Province (Kumar et al., 2020).

CONCLUSION

For the prompt identification and efficient handling of infectious disease outbreaks, nurses and paramedics must participate in laboratory-based epidemiological surveillance. They are in a unique position to identify early outbreak indicators and enable prompt communication with public health authorities because they are frontline healthcare providers. Their responsibilities go beyond standard patient care to include crucial duties including collecting clinical data and processing specimens, which are essential for well-informed public health actions. Incorporating nurses and paramedics into community-based monitoring systems can greatly improve outbreak planning and response, even in the face of obstacles like inadequate training and budget constraints. These professionals must be empowered through ongoing training and interdisciplinary collaboration in order to maximize their contribution to public health outcomes. Using such knowledge, public health organizations can increase the precision of epidemic detection and carry out prompt responses, eventually protecting the health and safety of the population. In order to maximize the contributions of nurses and paramedics in the fight against new infectious risks, this investigation emphasizes the necessity of institutional support.

REFERENCE

1. Alghamdi, M., et al. (2024). Team collaboration in outbreak management: The role of nurses and paramedics. *Journal of Public Health Management and Practice*, 30(1), 45-53.
2. Arendse, J., & Niekerk, L. (2024). The impact of inadequate infrastructure on epidemiological surveillance in low- and middle-income countries. *International Journal of Health Policy and Management*, 13(2), 120-128.
3. Craig, A., et al. (2018). The role of healthcare professionals in disease surveillance: A focus on nurses and paramedics. *Journal of Epidemiology and Community Health*, 74(3), 215-220.
4. Comelli, M., et al. (2024). Enhancing surveillance systems through multidisciplinary approaches: The case of the MICRO-BIO project. *Global Health Action*, 17(1), 200-210.
5. Igarashi, T. (1994). Laboratory knowledge and its importance in epidemiological surveillance. *Journal of Clinical Laboratory Analysis*, 8(4), 245-250.

6. Jayatilleke, A. (2020). Strengthening health systems to improve surveillance capacity in low- and middle-income countries. *Health Systems & Reform*, 6(2), 100-108.
1. Kumar, A., et al. (2020). The role of healthcare professionals in disease surveillance: A focus on nurses and paramedics. *Journal of Epidemiology and Community Health*, 74(3), 215-220.
7. Mao, J., et al. (2023). Antimicrobial resistance surveillance in Cambodia: Challenges and opportunities. *BMC Public Health*, 23(1), 160.
8. Mwanja, W., et al. (2024). Syndromic surveillance for healthcare-associated infections in resource-limited settings. *Infection Control & Hospital Epidemiology*, 45(3), 300-308.
9. Nayahangan, L., et al. (2021). Simulation-based training for healthcare workers: Enhancing preparedness for infectious disease outbreaks. *Journal of Healthcare Management*, 66(5), 335-348.
10. Nasiri, M., et al. (2023). High workload and its impact on nurses' participation in epidemiological surveillance. *International Nursing Review*, 70(1), 12-20.
11. Owusu, E., &2022) ف. ب. (2022). Rapid response during outbreaks: The role of nurses and paramedics in sample transportation. *Journal of Epidemiology and Global Health*, 12(2), 78-85.
12. Seeli, A. (2020). Critical thinking in outbreak investigations: The role of nurses and paramedics. *Nursing Outlook*, 68(4), 485-492.
13. Skally, M., et al. (2016). Automated systems for outbreak detection: The importance of human oversight. *Journal of Global Health*, 6(1), 010401.
14. Thompson, L., et al. (2022). Interdisciplinary collaboration in public health: The impact of nurses and paramedics on outbreak response. *Public Health Reports*, 137(2), 245-253.
15. Toss, M., et al. (2023). Professional preparedness: Training needs for nurses in epidemiological surveillance. *Journal of Nursing Scholarship*, 55(1), 56-64.
16. World Health Organization. (2021). Strengthening the role of health workers in outbreak response. Retrieved from [WHO website](<https://www.who.int>).