MAY 2026 • Vol. 3 NO. 1 • WWW.NCID.SG/IDINTELLIGENCE • ISSN: 2972-3116

INFECTIOUS Disease Intelligence

Pathogens & Populations

National Centre for Infectious Diseases
NHG Health

About Us

Infectious Disease Intelligence is a quarterly publication by NCID for the community of practice in infectious diseases. Readership comprises physicians, epidemiologists, One Health practitioners, veterinarians, microbiologists, laboratorians, researchers, scientists, junior college students, and undergraduates.

A downloadable electronic format is available free online via our NCID website: ncid.sg/About-NCID/Pages/Infectious-Disease-Intelligence.aspx.

The material in infectious Disease Intelligence may be reproduced with proper citation of source as follows: [Author].[Article title]. Infectious Disease Intelligence [Year]; [Vol (Number)]:[inclusive page numbers]

Contribution by authors of articles to Infectious Disease Intelligence is a public health service and does not preclude subsequent publication in a scientific peer-reviewed journal. Opinions expressed by authors do not necessarily reflect the position of the National Centre for Infectious Diseases.

All images are AI-generated for illustrative purposes unless otherwise stated.

For more information on NCID, visit ncid.sg.
For comments and feedback on Infectious Disease Intelligence, email ncid.training@nhghealth.com.sg

Pathogens & Populations

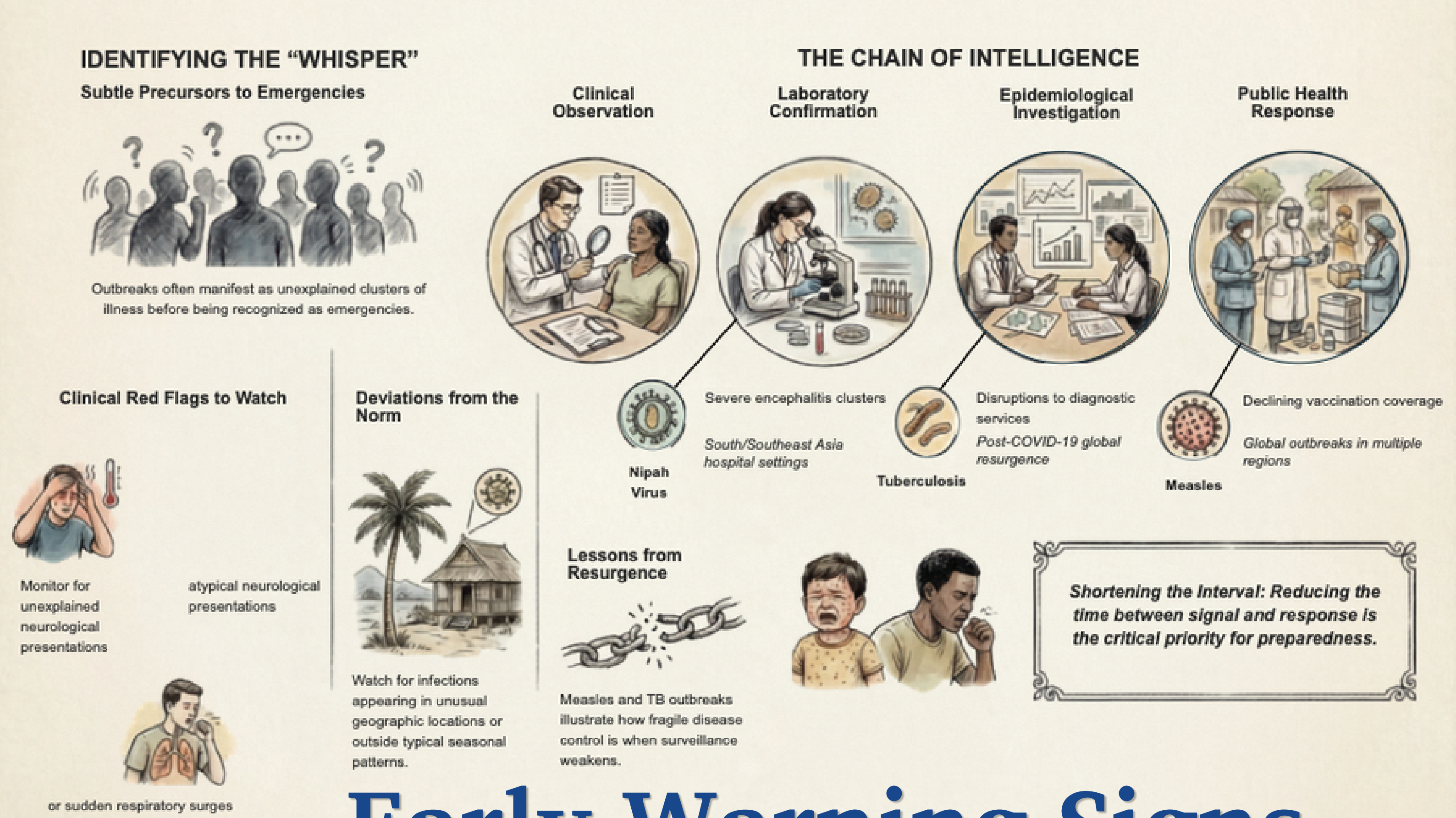
This Issue's Theme

Over the past decade, the global community has witnessed a series of infectious disease events that underscore the fragility of health security systems. The COVID-19 pandemic was followed by a sequence of other threats to our populations from pathogens including mpox, measles, and Nipah virus infection.

These dynamic events illustrate the reality of modern situations: emerging pathogens rarely appear without warning. Early signals are often detected within clinical practice, laboratory diagnostics, and syndromic surveillance systems before an outbreak becomes widely recognized. Frontline clinicians remain a critical component of infectious disease epidemic intelligence gathering.

At the same time, geopolitics affecting global health and the global resurgence of pathogens highlights persistent vulnerabilities in public health infrastructure. Disruptions to healthcare services, population displacement, and declining vaccination coverage all contributed to the re-emergence of infectious diseases once thought to be under control.

Strengthening infectious disease intelligence requires not only improved surveillance systems but also stronger integration between the fields of clinical medicine, epidemiology, and One Health practice.



Early Warning Signs - Vigilant Against Threats

Role of Clinical Vigilance

Frontline clinicians frequently serve as the first observers of emerging infectious disease threats[1]. Infectious disease outbreaks rarely occur without warning. They often begin with subtle epidemiological signals that emerge within healthcare systems before expanding into recognised public health emergencies[2].

Historical outbreak investigations have demonstrated that careful clinical observation can provide the earliest indication of unusual disease patterns[1,3]. Recognising these early signals is critical for enabling timely investigation and response[4].

Early warning signals may arise from unusual clinical presentations, unexpected laboratory findings, or surveillance systems detecting deviations from expected disease patterns[4]. Early recognition allows clinicians, epidemiologists and public health authorities to initiate investigations and implement response measures before transmission escalates[1].

Recognising these signals requires the integration between clinical observation, laboratory diagnostics and real-time surveillance systems.

Early warning signals may include:

- clusters of unexplained febrile illness
- atypical neurological presentations
- sudden increases in severe respiratory infections
- unusual geographic patterns of disease occurrence
- unexpected laboratory findings suggesting potential novel pathogens[4]

For example, the 1999 outbreak of Nipah virus infection in Singapore and Malaysia was initially recognised through a cluster of encephalitis cases before laboratory confirmation identified the zoonotic pathogen. This event highlighted the importance of strong collaboration between clinical medicine, laboratory science and epidemiological surveillance.

Similarly, the local emergence of Severe Acute Respiratory Syndrome (SARS) in 2003 demonstrated how unusual clusters of pneumonia cases identified within the healthcare system could signal the emergence of a novel pathogen requiring immediate investigation and coordinated international response[1,2].

These examples highlight the critical role of clinical vigilance and surveillance integration in detecting emerging infectious diseases before they become widespread outbreaks[5].

Public health surveillance systems have evolved significantly in response to the increasing complexity of infectious disease threats. Modern surveillance networks integrate clinical reporting, laboratory diagnostics, genomic sequencing, and digital epidemiology tools to detect early signals of emerging and re-emerging diseases[6].

Recent global outbreaks including measles resurgence in several high-income countries and the continued burden of tuberculosis highlight the critical role of these systems in early detection and response[7,8].

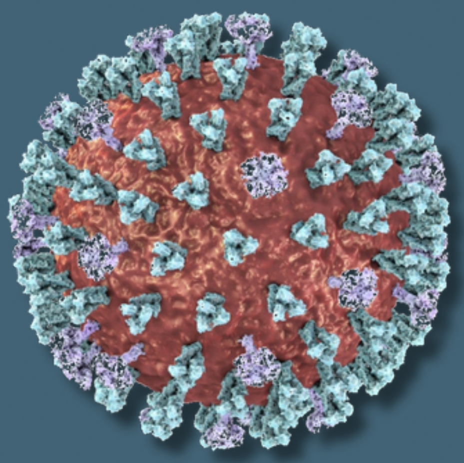
The re-emergence of measles, a vaccine-preventable disease once considered close to elimination in several regions, demonstrates how fragile herd immunity can become when vaccination coverage declines. Clusters of measles cases have recently been reported across Europe, North America and Asia, often linked to disruptions in routine immunisation programmes[7].

Meanwhile, tuberculosis continues to pose a major global health challenge. The rise of multidrug-resistant tuberculosis (MDR-TB) and disruptions to diagnosis and treatment services during the COVID-19 pandemic have contributed to persistent transmission in many regions[8].

To address these challenges, public health agencies increasingly rely on integrated surveillance systems that combine: clinical reporting networks; laboratory diagnostics; genomic sequencing; digital disease intelligence platforms; and international exchange of experiences and lessons

References

1. Morens, D. M., Folkers, G. K., & Fauci, A. S. (2004). The challenge of emerging and re-emerging infectious diseases. Nature, 430, 242–249.
2. Jones, K. E., Patel, N. G., Levy, M. A., et al. (2008). Global trends in emerging infectious diseases. Nature, 451, 990–993.
3. Chua, K. B. (2003). Nipah virus outbreak in Malaysia. Journal of Clinical Virology, 26(3), 265–275.
4. World Health Organization. (2023). Global surveillance strategies for emerging infectious diseases.
5. Centers for Disease Control and Prevention. (2022). Principles of epidemiologic surveillance.
6. Salathé, M., et al. (2012). Digital epidemiology. PLoS Computational Biology, 8(7).
7. World Health Organization. (2024). Measles and rubella surveillance data.
8. World Health Organization. (2024). Global Tuberculosis Report.



Recent global surveillance data indicate a significant resurgence of measles across multiple regions, including Europe, Southeast Asia and parts of the United States. The World Health Organization reported increases in measles cases during 2023–2024, largely associated with disruptions to routine immunization services during the COVID-19 pandemic.

Measles remains one of the most contagious human pathogens, with a basic reproduction number (R^0) estimated between 12 and 18. Even small declines in vaccination coverage can therefore lead to rapid outbreaks in susceptible populations.

The resurgence of measles highlights the importance of maintaining high vaccination coverage and robust surveillance systems capable of detecting clusters of vaccine-preventable diseases early.

Surveillance Implications

Clinicians should remain alert to:

- clusters of febrile illness accompanied by rash
- imported measles cases associated with international travel
- outbreaks occurring in under-vaccinated populations

At the systems level, strengthening surveillance requires continued investment in:

- digital disease intelligence platforms
- International data sharing
- Cross-border surveillance collaboration

Strengthening these systems will be essential for detecting and responding to the next generation of infectious disease threats in an increasingly interconnected global environment.

Clinical Surveillance in Emerging Infections

Clinical surveillance remains one of the most critical components of infectious disease intelligence. While laboratory diagnostics and genomic sequencing provide confirmation of pathogens, the earliest signals of emerging outbreaks are often first detected through frontline clinical observations[1]. Clinicians frequently encounter unusual disease presentations before they are recognized as public health threats. Early identification of atypical symptoms, unexpected clusters of illness, or severe disease patterns plays a key role in triggering epidemiologic investigation and public health response.

This form of surveillance involves the systematic observation and reporting of disease patterns within healthcare settings. Hospitals, primary care clinics, and emergency departments serve as essential sentinel points for detecting emerging infectious diseases[1,2]. Frontline healthcare workers contribute to surveillance by identifying unusual clinical presentations and reporting suspected cases through national disease notification systems. These reports allow public health authorities to identify potential outbreaks and initiate timely investigations.

Clinical surveillance is particularly important for detecting diseases that initially present with non-specific symptoms, such as fever, respiratory distress, or neurological complications[2]. A thorough history, including travel (from affected regions), occupation (e.g. laboratory exposure) and other exposures (e.g.. animal, environmental, sick contacts) is critical and often raises the alert for an emerging infectious disease.

Examples of clinical signals that may indicate emerging infectious diseases include:

- clusters of unexplained febrile illness
- atypical neurological symptoms such as encephalitis
- severe respiratory infections without an identified pathogen
- unusual geographic patterns of disease occurrence
- unexpected complications among otherwise healthy individuals

Such signals often prompt laboratory investigations and epidemiological analysis to determine the underlying cause.

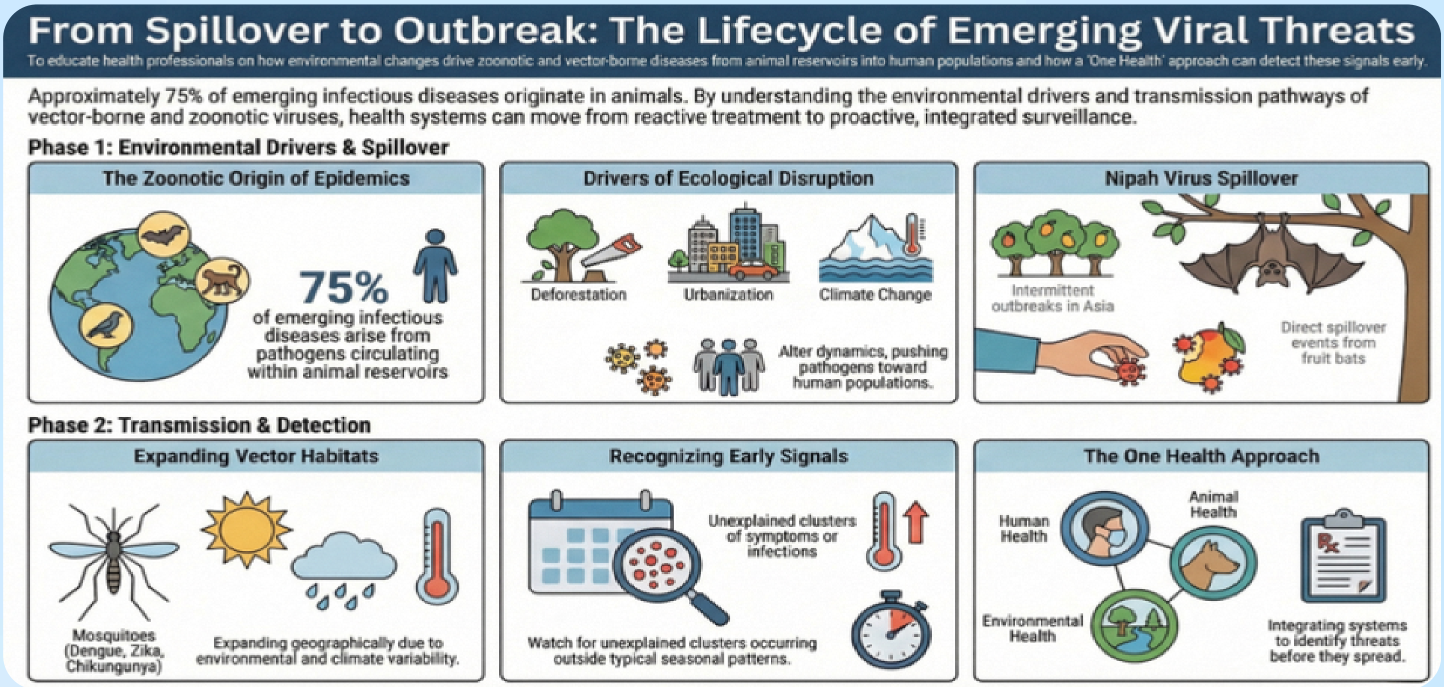
Strengthening clinical surveillance requires coordinated efforts across multiple sectors, including:

- training healthcare professionals to recognise unusual disease patterns
- improving integration between clinical reporting and laboratory diagnostics
- expanding digital surveillance platforms for real-time data sharing
- strengthening collaboration between clinicians, epidemiologists and public health authorities

Investments in these systems help ensure that early signals of emerging infectious diseases are detected and investigated promptly[1,2].

References

1. World Health Organization. (2023). Global surveillance strategies for emerging infectious diseases.
2. Centers for Disease Control and Prevention. Principles of Epidemiologic Surveillance.
3. Solomon, T. (2022). Emerging viral infections and global health surveillance.
4. Chua, K. B. (2003). Research on Nipah virus and emerging zoonotic diseases in Southeast Asia.



Hidden Drivers of Emerging Epidemics

Enemines In Our Midst

Approximately 60–75% of emerging infectious diseases are zoonotic, originating from pathogens circulating in wildlife or domestic animal reservoirs before crossing into human populations[1,2]. These spillover events represent a critical pathway through which new infectious disease threats emerge.

Zoonotic outbreaks have demonstrated that healthcare settings can amplify transmission when early detection and infection control measures are delayed. Rapid case recognition, infection prevention measures and contact tracing are therefore critical in limiting outbreak spread[3].

Nipah virus, for example, has been linked to spillover events from fruit bats to humans through contaminated food sources or close contact with infected animals[2]. These events illustrate how environmental disruption, and human activity can facilitate pathogen transmission across species barriers.

Pathogen Spotlight: Nipah Virus

Nipah virus remains one of the most concerning emerging zoonotic pathogens due to its high case fatality rate, often ranging from 40% to 75% and its potential for human-to-human transmission[3].

Since the late 1990s, Nipah virus outbreaks have occurred intermittently in South and Southeast Asia, highlighting the importance of integrated surveillance across human, animal and environmental health systems[1].

First identified during an outbreak in Malaysia in 1998–1999, the virus has since caused recurrent outbreaks in South and Southeast Asia, particularly in Bangladesh and India[1]. The virus is believed to circulate naturally in fruit bats (Pteropus species) and can spill over into humans through contaminated food products or direct contact with infected animals[2].

From a global health security perspective, Nipah virus remains a priority pathogen requiring strengthened surveillance, rapid diagnostics and coordinated response systems across human and animal health sectors[3]. Physicians involved in the Kerala Nipah outbreak response have highlighted the importance of early case identification, strict infection prevention measures and rapid contact tracing in limiting transmission during outbreaks[3].

Addressing such threats requires strengthening the One Health approach, recognizing the interconnected nature of human, animal and environmental health[4].

Nipah Virus Infection

SECRET AGENTS FILE

Causative Agent

Nipah virus, a member of the Paramyxoviridae family.

Incubation Period

Typically, 4-14 days; range is up to 2 months.

Infectious Period

Human-to-human spread reported but sustained transmission rare. Duration of infectiousness is unknown.

Transmission

Animal-to-human transmission occurs via direct contact with infected pigs or horses and their secretions or tissues or through ingestion of raw fruits contaminated with urine or saliva of infected fruit bats. Human-to-human transmission is believed to occur through direct contact with secretions of infected individuals.

Epidemiology

Nipah virus was first identified in 1999 during an outbreak of encephalitis that occurred among people in close contact with pigs in Malaysia (pig farmers). The outbreak resulted in nearly 300 human cases and more than 100 deaths and spread to Singapore which experienced 11 cases and 1 death among abattoir workers. More than a million pigs were culled to control the outbreak.

It is a recurring risk in parts of South Asia, including Kerala and West Bengal, as the animal reservoir (fruit bats) is widely distributed across the region and transmission is mainly by exposure to bats, and date palm sap or fruits contaminated by bats. At present, there is no indication of sustained community transmission. Cases among healthcare workers may indicate nosocomial transmission.

NOTIFIABLE DISEASE: YES

Who should notify	When to notify	How to notify	Notification time line
Medical practitioners	On clinical suspicion	Call CDA Surveillance Duty Officer and submit MD131 Notification Form via CDLENS (https://de-rom.moh.gov.sg/cdlens/auth/login)	Immediately
Laboratories	Upon laboratory confirmation		

Expert Insight

In managing Nipah virus infections, clinical and public health experts involved in outbreak readiness and research have emphasized the importance of rapid clinical recognition and collaborative surveillance.

In addition, vector-borne viruses including dengue, chikungunya and Zika represent an important subset of One Health threats. Their transmission dynamics are strongly influenced by ecological changes such as deforestation, urbanization and climate change, which can alter the distribution of vectors and animal reservoirs[4].

Mosquito-borne diseases such as dengue and chikungunya continue to expand geographically, particularly in tropical and subtropical regions. At the same time, zoonotic viruses associated with wildlife reservoirs remain a persistent source of emerging outbreaks.

These experiences demonstrate how strong coordination between clinicians, epidemiologists, and One Health practitioners in a multisectoral approach can significantly reduce the impact of emerging zoonotic threats.

A national training framework on competencies in One Health field epidemiology is being offered in Singapore as a collaborative between NCID, NUS and CDA, and core learning activities are being taught in applied epidemiology courses.

References

1. Chua, K. B. (2003). Nipah virus outbreak in Malaysia. Journal of Clinical Virology, 26(3), 265–275.
2. Luby, S. P., Gurley, E. S., & Hossain, M. J. (2009). Transmission of human infection with Nipah virus. Clinical Infectious Diseases, 49(11), 1743–1748.
3. World Health Organization. (2023). Nipah virus infection. WHO.
4. Communicable Diseases Agency Singapore. (2024). Emerging zoonotic disease surveillance and response. CDA.

Announcing...

NCID
SYMPOSIUM 2026

PATHOGENS & POPULATIONS

Translating Signals into Solutions

Clinical Sciences Building Auditorium
Lee Kong Chian School of Medicine
Singapore

7-8 September 2026

An invitation for Thought Leaders to:

- A Global Dialogue on Emerging Infectious Threats
- The Launch of NCID Academy
- Clinical Decision Making and Applied Epidemiology
- Behind-the-scenes Engineering and Technical Visits
- Shaping the Future of Outbreak Preparedness