Email: biovetinnovator@gmail.com Official Website: https://biovetinnovator.in/
Fueling The Future of Science… ISSN: 3048-8397

Bio Vet Innovator Magazine

(Fueling The Future of Science…)

Volume 3 (Issue 1) JANUARY 2026

OPEN ACCESS Popular Article

Point-of-Care Diagnostics in Animal Health: Advancing Rapid Disease Detection

Bhuva Akash[1] and Manjali Rana[2]
1PhD scholar, Division of veterinary public health and epidemiology
2M.V.Sc., Division of Medicine,
ICAR-IVRI, Izatnagar,
Bareilly, U.P.-243122
***Corresponding Author:** akash1750patel@gmail.com
DOI: https://doi.org/10.5281/zenodo.18275695

Received: January 07, 2026
Published: January 14, 2026

Abstract:

Animal diseases often progress faster than conventional laboratory diagnostics can respond, particularly in intensive livestock systems and resource-limited settings. Delayed diagnosis can facilitate rapid disease spread, economic losses, and increased zoonotic risks. Point-of-care testing (POCT) has emerged as a vital tool in veterinary medicine by enabling rapid, on-site diagnosis at farms, clinics, markets, and wildlife interfaces. POCT platforms bridge the gap between disease suspicion and confirmation, supporting timely treatment, isolation, and control measures. The rising burden of emerging and re-emerging infectious diseases—driven by intensified animal production, increased animal movement, wildlife–livestock interactions, and climate variability—has further emphasized the importance of rapid diagnostics within the One Health framework. Diverse POCT technologies, including lateral flow assays, dipstick immunoassays, isothermal molecular methods, CRISPR-based diagnostics, biosensors, and molecularly imprinted polymers, offer advantages such as speed, portability, and affordability. Despite challenges related to sensitivity, standardization, and regulatory oversight, ongoing technological advances are strengthening the role of POCTs in disease surveillance, outbreak preparedness, and sustainable animal health management.

Introduction:

Animal diseases rarely wait for laboratory reports. Whether it is a sudden outbreak of avian influenza in poultry, Japanese encephalitis in pigs, or brucellosis in cattle, delays in diagnosis can result in rapid disease spread, substantial economic losses, and serious threats to public health. In intensive livestock systems, even a few days, delay can allow pathogens to disseminate within herds or flocks, making control far more difficult. In many parts of the world—particularly in rural and resource-limited settings—access to advanced diagnostic laboratories remains limited. This diagnostic gap has highlighted the urgent need for faster, simpler, and field-deployable diagnostic solutions.

Point-of-care testing (POCT) has emerged as a game-changer in veterinary medicine by addressing this critical need. Point-of-care tests are simple, portable diagnostic tools designed to deliver results at or near the site of the animal—on farms, in veterinary clinics, at livestock markets, border checkpoints, or even in wildlife habitats. Instead of sending samples to distant laboratories and waiting days for results, veterinarians can now make informed decisions within minutes or hours. As emphasized by Velayudhan and Naikare (2022), POCTs bridge the crucial gap between disease suspicion and confirmation, enabling faster initiation of treatment, prompt isolation of infected animals, and timely implementation of control measures.

Why Rapid Diagnosis Matters More Than Ever:

The frequency of emerging and re-emerging infectious diseases in animals has increased markedly over recent decades. Intensification of animal production systems, increased movement of animals and animal products, wildlife–livestock interfaces, and climate-driven changes in vector ecology have all contributed to the emergence of novel and re-emerging pathogens. Importantly, many of these diseases are zoonotic, meaning they can spill over from animals to humans, reinforcing the importance of early detection under the One Health framework (Hobbs et al., 2021).

Traditional laboratory diagnostics remain the gold standard for accuracy and confirmatory testing. However, they are often slow, expensive, and dependent on skilled personnel, sophisticated equipment, and reliable transport infrastructure. Improper sample collection, suboptimal storage, and delays during transport can compromise diagnostic accuracy. These challenges are particularly pronounced in developing countries and remote regions. POCTs overcome many of these barriers by offering rapid, on-site, and user-friendly diagnostics. Their ability to deliver actionable results in real time makes them especially valuable during outbreaks, emergency situations, and routine surveillance in hard-to-reach areas.

Common Types of POCTs used in Veterinary Practice:

Several POCT platforms are now widely used or under active development for animal disease diagnosis, each offering unique advantages depending on the field conditions and diagnostic requirements.

1. **Lateral Flow Assays (LFAs):**

   Lateral flow assays are among the most familiar and widely used POCTs. Similar to pregnancy test strips, they detect specific antigens or antibodies and produce visible test lines that can be interpreted by the naked eye. LFAs are inexpensive, portable, and require minimal training, making them ideal for use by veterinarians and para-veterinary workers in field settings. Their role in rapid screening for viral and bacterial diseases in livestock and poultry has been well documented, particularly for surveillance and preliminary diagnosis (Manessis et al., 2022).

2. **Dipstick Assays:**

Dipstick assays represent a further simplification of immunoassays, designed specifically for low-resource environments. These tests involve dipping a nitrocellulose strip into a prepared sample solution, eliminating the need for complex reagent handling or instrumentation. A notable example is the dipstick ELISA developed at ICAR-IVRI for Japanese encephalitis surveillance in swine, which demonstrated excellent diagnostic performance and strong field applicability (Chauhan et al., 2020). Such assays are particularly useful for large-scale screening during surveillance programs.

3. **Isothermal Molecular Tests (LAMP and RPA):**

Isothermal molecular tests, such as loop-mediated isothermal amplification (LAMP) and recombinase polymerase amplification (RPA), bring molecular-level sensitivity to point-of-care settings. Unlike conventional PCR, these techniques operate at a constant temperature and do not require expensive thermal cyclers. RPA combined with lateral-flow detection has shown superior sensitivity for avian influenza H9 detection, highlighting its potential for rapid, highly sensitive field diagnosis during outbreaks (Wang et al., 2019). These methods are increasingly viewed as molecular POCTs capable of bridging the gap between laboratory and field diagnostics.

4. **CRISPR-Cas–based Diagnostics:**

CRISPR-Cas–based diagnostics represent the next generation of POCTs. These assays use programmable CRISPR enzymes to recognize specific genetic sequences of pathogens and generate amplified, easily detectable signals. CRISPR-based POCTs are rapid, highly sensitive, and adaptable to a wide range of pathogens, making them highly promising tools for future veterinary diagnostics and outbreak response systems (Rasool et al., 2024).

5. **Biosensors and Lab-on-chip Devices:**

Biosensors and lab-on-chip devices integrate biological recognition elements with electronic or optical transducers to detect disease markers. These platforms allow miniaturization, automation, and even multiplex detection of multiple pathogens in a single test. Advances in biosensor technology are pushing POCTs toward real-time monitoring, digital readouts, and seamless integration with mobile devices and data networks (Issadore et al., 2014; Mehrotra, 2016).

6. **Molecularly Imprinted Polymers (MIPs):**

Molecularly imprinted polymers, often described as “plastic antibodies,” offer a synthetic alternative to biological receptors. MIPs are highly stable, cost-effective, and resistant to harsh environmental conditions, making them particularly suitable for field diagnostics. Their successful application in detecting viral pathogens such as avian influenza demonstrates their potential to expand the range of durable POCT platforms available for veterinary use (Cabaleiro-Lago et al., 2023).

Benefits and Current Limitations:

The advantages of POCTs are substantial. They provide rapid results, are portable and affordable, and significantly improve access to diagnostics in underserved regions. POCTs enable early intervention, reduce unnecessary or empirical antimicrobial use, and support better herd- and flock-level disease management. By strengthening disease surveillance at the human–animal–environment interface, POCTs directly contribute to One Health objectives (Hobbs et al., 2021).

However, POCTs are not without limitations. Some assays may have lower analytical sensitivity compared to centralized laboratory methods, and test performance can be influenced by environmental conditions, storage, or operator skill. In addition, challenges related to quality control, standardization, validation, and regulatory oversight remain key barriers to widespread adoption in veterinary diagnostics (Manessis et al., 2022).

Future of POCTs:

The future of point-of-care testing in veterinary medicine lies in smart, connected, and integrated diagnostic systems. Smartphone-based readers, artificial intelligence–assisted result interpretation, multiplex assays capable of detecting multiple pathogens simultaneously, and real-time data integration into digital surveillance networks are rapidly becoming realities. As these technologies mature, POCTs will play an increasingly central role in early warning systems, outbreak preparedness, and sustainable animal health management, particularly in low- and middle-income countries (Velayudhan and Naikare, 2022).

In Summary:

Point-of-care testing is transforming animal disease diagnosis by making rapid, reliable information available exactly where it is needed. While laboratory confirmation will always remain essential, POCTs empower veterinarians, farmers, and surveillance systems to act faster, reduce disease spread, and minimize economic and public health impacts. As innovation continues, these small diagnostic tools will have an increasingly big impact on animal health, food security, and global One Health resilience.

References:

Cabaleiro-Lago, C., Hasterok, S., Gjörloff Wingren, A., & Tassidis, H. (2023). Recent advances in molecularly imprinted polymers and their disease-related applications. *Polymers*, 15, 4199.

Chauhan, J., Dhanze, H., Chethan Kumar, H. B., Kumar, M. S., & Bhilegaonkar, K. N. (2020). Development of dipstick enzyme linked immunosorbent assay for on-site sero-diagnosis of Japanese encephalitis in swine. *Journal of Virological Methods*, 280, 113876.

Hobbs, E. C., Colling, A., Gurung, R. B., & Allen, J. (2021). Diagnostic point-of-care tests for infectious and zoonotic animal diseases in developing countries. *Transboundary and Emerging Diseases*, 68, 1835–1849.

Issadore, D., Park, Y. I., Shao, H., et al. (2014). Magnetic sensing technology for molecular analyses. *Lab on a Chip*, 14, 2385–2397.

Manessis, G., Gelasakis, A. I., & Bossis, I. (2022). Point-of-care diagnostics for farm animal diseases.

Biosensors, 12, 455.

Mehrotra, P. (2016). Biosensors and their applications. *Journal of Oral Biology and Craniofacial Research*, 6, 153–159.

Rasool, H. M. H., Chen, Q., Gong, X., & Zhou, J. (2024). CRISPR/Cas system and its application in animal disease diagnosis. *FASEB Journal*, 38, e70252.

Velayudhan, B. T., & Naikare, H. K. (2022). Point-of-care testing in companion and food animal disease diagnostics. *Frontiers in Veterinary Science*, 9, 1056440.

Wang, Z., Yang, P. P., Zhang, Y. H., et al. (2019). RT-RPA-lateral flow assay for avian influenza H9N2 detection. *Transboundary and Emerging Diseases*, 66, 546–551.