



## The Emerging Role of One Health in Veterinary Science

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### Introduction

Veterinary science, once narrowly defined as the clinical care of animals and the management of livestock, has undergone a profound transformation in recent decades. Today, it occupies a central role in addressing some of the most pressing global challenges, including zoonotic disease emergence, antimicrobial resistance, food security, animal welfare, and environmental sustainability. This evolution is best captured through the lens of the One Health framework, an integrative approach that acknowledges the inextricable links between human health, animal health, and ecosystem health (WHO, 2021) [1].

The significance of One Health is neither abstract nor distant. More than 70% of emerging infectious diseases in humans originate in animals, both domestic and wild (Jones et al., 2008) [2]. The world has repeatedly witnessed the devastating consequences of zoonotic spillovers, from avian influenza and Ebola to Nipah virus and COVID-19. These events have underscored the indispensable role of veterinarians—not only as clinicians but as front-line actors in disease detection, surveillance, prevention, and global health preparedness.

This article reflects on the emerging responsibilities of veterinary science in the 21st century and examines its critical intersections with public health, antimicrobial stewardship, animal welfare, and sustainable development within the One Health paradigm.

### Zoonotic diseases and the veterinary frontier

The COVID-19 pandemic has served as a global case study in the costs of delayed preparedness and the value of early detection. Veterinary epidemiology and wildlife surveillance are crucial for predicting and mitigating zoonotic spillovers. Without systematic monitoring of animal reservoirs, humans remain vulnerable to future pandemics.

Veterinary services therefore require closer integration with public health infrastructure and environmental monitoring sys-

tems. Collaborative disease surveillance networks enable rapid detection, while joint training of veterinarians, physicians, and ecologists strengthens response capacity. The need for such integration has been repeatedly highlighted by outbreaks across continents, confirming that veterinary science must be recognized as an essential pillar of pandemic preparedness and biosecurity.

### Antimicrobial resistance: A shared threat

Among the most urgent challenges confronting veterinary science is antimicrobial resistance (AMR). The misuse and overuse of antibiotics in livestock production is a well-established driver of resistant bacterial strains (FAO, 2020) [3]. Resistant organisms can transfer from animals to humans via direct contact, contaminated food, or environmental pathways, thereby undermining decades of medical progress (O'Neill, 2016) [4].

Veterinarians, positioned at the intersection of animal health and food production, are uniquely situated to lead antimicrobial stewardship. Their responsibilities extend beyond clinical prescription to include:

- Educating farmers on prudent antibiotic use and alternatives such as vaccination and biosecurity.
- Promoting surveillance systems to track resistance patterns and guide evidence-based interventions.
- Advocating for policy reforms that regulate antibiotic distribution and incentivize sustainable practices.

By championing science-based stewardship, the veterinary profession can mitigate one of the greatest global health threats of our time.

### Animal welfare and ethical responsibility

Veterinary science is equally accountable for upholding the welfare of animals under human care. The role of companion animals in households has amplified expectations for compassionate vet-

erinary practice. Simultaneously, livestock production systems face scrutiny over confinement, transportation, and slaughter practices.

Animal welfare is no longer confined to the ‘Five Freedoms’; it now incorporates the principle of ensuring that animals live ‘lives worth living’ (Mellor, 2016) [5]. This ethical expansion compels veterinarians to balance moral obligations with the imperatives of food security and sustainable agriculture. Advocacy for humane husbandry practices, science-driven welfare standards, and public engagement is a central responsibility. Through this lens, veterinarians act not only as clinicians but as moral agents shaping society’s relationship with animals.

**Veterinary science, food security, and sustainability**

As the global population continues to expand, the demand for safe, sustainable, and ethically produced food intensifies. Veterinary science contributes directly to food security by ensuring healthy livestock, safeguarding product quality, and reducing the risk of zoonotic foodborne illnesses. At the same time, veterinary expertise is critical in promoting sustainable livestock systems that minimize environmental impacts such as greenhouse gas emissions, land degradation, and biodiversity loss.

One Health underscores that food systems are ecological systems; the health of humans is contingent on the resilience of animals and the environments they inhabit. Veterinarians are therefore at the forefront of reconciling productivity with sustainability, guiding the transition to agricultural practices that serve both nutritional needs and planetary health.

**Education, research, and interdisciplinarity**

The broadening scope of veterinary science necessitates parallel reforms in education and research. Universities must design curricula that equip students with interdisciplinary competencies spanning epidemiology, ecology, genetics, public health, and social sciences. This requires not only strong technical training but also cultivation of systems thinking and ethical reasoning.

Research priorities must likewise expand. Areas such as disease ecology, climate change impacts, and sustainable animal production demand urgent attention. Integrating veterinary research with global agendas on biodiversity conservation and climate resilience ensures that the profession remains scientifically relevant and socially impactful.

Interdisciplinary collaboration is fundamental. Veterinarians must work in partnership with medical doctors, environmental scientists, policy analysts, and community stakeholders. The One Health framework provides the necessary scaffolding for such col-

laboration, ensuring that veterinary science is embedded in broader strategies for global health and sustainable development.

**Policy, advocacy, and the expanding mandate**

Veterinarians increasingly influence policy beyond the confines of animal health. Their expertise informs national strategies on disease preparedness, contributes to global discussions on antimicrobial resistance, and shapes legislation on animal welfare and sustainable farming.

Investment in veterinary infrastructure is crucial. Strengthened diagnostic capacity, expanded laboratory networks, and enhanced workforce training all underpin effective One Health implementation. Policymakers, funders, and educators must recognize veterinary science not as an auxiliary discipline but as a central partner in building resilient health systems.

**Conclusion**

Veterinary science is entering an era of unprecedented responsibility and opportunity. The profession stands at the nexus of animal, human, and environmental health, uniquely positioned to address defining challenges such as pandemic prevention, antimicrobial resistance, animal welfare, and food system sustainability.

The One Health framework provides both a vision and a mandate. By embracing this integrative approach, veterinary professionals can reimagine their roles—from clinicians treating individual animals to global health actors safeguarding entire ecosystems. Achieving this vision requires sustained investment in education, research, and interdisciplinary collaboration, as well as strong advocacy for ethical and sustainable practices.

Ultimately, the future of veterinary science lies not only in serving animals but in safeguarding communities, protecting ecosystems, and contributing to the resilience of our shared planet.

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