THE SAFETY WE RARELY NOTICE: VETERINARIANS BEHIND OUR FOOD AND HEALTH

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DOI: https://doi.org/10.5281/zenodo.19996517

INTRODUCTION

A family sits down for dinner with grilled chicken, fresh milk, and vegetables. No one at the table questions whether the food is safe, and no one needs to, because it has already been examined long before it reached the plate. Not by a chef, nor by a conventional food inspector, but by a professional trained to understand how diseases move across species and how a seemingly minor infection in a distant farm can ultimately affect human health. That professional is a Veterinarian, and the safety you rarely question each day is, in large part, the result of their work. We live in a world that celebrates doctors who save lives and scientists who develop new medicines, yet those who prevent disease before it reaches human populations often remain largely invisible. Veterinarians do not merely treat animals; they protect entire populations. They operate at the interface of animal health, food production, and human survival, where their contributions are fundamental, yet frequently unrecognized. The connection between animal health and human health is not a modern discovery but a biological reality. What is modern is our recognition of its scale and the urgent need to strengthen the systems that sustain it. This article examines that connection, highlighting the role of veterinarians in ensuring food safety and protecting public health. It advances a central argument: no meaningful discussion of food safety or human health is complete without placing veterinarians at its core.

The Silent Link Between Farm, Food, and Human Survival

Health is often conceptualized as an individual condition, primarily associated with clinical care in human healthcare systems. Animal health is frequently confined to livestock production, while environmental health is treated as a separate domain. Although these distinctions appear logical, they are fundamentally misleading. In reality, health operates as an interconnected system that moves across biological and ecological boundaries, often remaining unnoticed until disruption reveals these underlying connections. A seemingly minor infection in livestock may appear confined to a farm, far removed from everyday life. However, if left uncontrolled, it can enter the food chain, move through distribution systems, and eventually reach human populations. By the time it becomes visible, it is no longer an animal health issue but a public health concern. Food itself reflects this connection. What appears on a plate is not merely a product of agriculture, but the outcome of biological processes shaped by animal health and environmental conditions. Safe food is not created at the point of consumption; it is secured much earlier, through preventive actions taken at the source. This interconnected reality is captured in the

concept of One Health, which recognizes animal health, human health, and environmental health as components of a single system. Within this framework, veterinarians occupy a critical position. Their role extends beyond treating disease to preventing its movement across this network. It is only when this balance is disrupted that the importance of this protection becomes visible.

Controlling Zoonotic Risks Across the Food Chain: The Central Role of Veterinarians

At both global and national levels, the scale of animal-source food production defines the magnitude of food safety responsibility. The Food and Agriculture Organization estimates global milk production at nearly 985 million tonnes and egg production exceeding 100 million tonnes annually. Within this context, India ranks first in milk production and third in egg production, producing 247.87 million tonnes of milk and 149.11 billion eggs in 2024–25. Meat production has reached approximately 10.25 million tonnes, with poultry contributing more than half of the total output. This scale of production necessitates robust, continuous surveillance and control at every stage of the food chain. In such a vast and highly perishable food system, even minor lapses in control can rapidly escalate into significant public health risks. Zoonotic diseases emerge within this system at the interface between animals and humans. Defined as diseases naturally transmitted between vertebrate animals and humans, zoonoses account for approximately 60% of all known human infectious diseases and nearly 75% of emerging infections globally. Under favourable conditions, pathogens originating in animal populations can move through food systems and manifest as widespread human disease. The impact of such spillover events is well established. The 1918 influenza pandemic infected nearly one-third of the global population and caused an estimated 50 million deaths. Recurrent outbreaks of avian influenza continue to cause significant losses in poultry, human illness, and economic disruption. These patterns underscore a critical point: veterinarians function as the primary control system at the animal–human interface, preventing hazards from entering the food chain and escalating into public health crises.

Milk as a Pathway of Zoonotic Transmission:

Milk-borne zoonoses represent a critical pathway through which animal infections can directly impact human health, particularly in the absence of adequate hygiene and pasteurization. Raw milk can harbor multiple pathogens, including *Brucella spp.*, *Mycobacterium bovis*, *Listeria monocytogenes*, and foodborne agents such as *Salmonella* and *Campylobacter*. Globally, brucellosis accounts for over 500,000 human cases annually, primarily associated with unpasteurized dairy consumption, while non-typhoidal *Salmonella* contributes to approximately 93.8 million cases of gastroenteritis and 155,000 deaths each year. These figures underscore the public health risks associated with inadequately controlled dairy systems. Veterinary intervention serves as the primary barrier preventing these risks from entering the food chain. Through herd-level surveillance, routine testing for brucellosis and tuberculosis, mastitis control, and enforcement of hygienic milking practices, veterinarians reduce pathogen load at the source. Their role extends to supervision of milk handling, pasteurization, and residue monitoring, ensuring that milk remains a safe and reliable component of the human diet.

Meat as a Critical Control Point:

Meat represents a major pathway for zoonotic transmission, particularly when slaughter hygiene and processing controls are inadequate. A wide range of pathogens are associated with meat from different animal species. In cattle, infections such as *Mycobacterium bovis*, *Brucella abortus*, and enterohemorrhagic *Escherichia coli* O157:H7

are of major concern, along with parasitic infections such as *Taenia saginata*. Pork is associated with pathogens including *Salmonella spp.*, *Yersinia enterocolitica*, *Trichinella spiralis*, *Taenia solium*, *Toxoplasma gondii*, and Hepatitis E virus, while poultry meat commonly carries *Salmonella* and *Campylobacter*, which are leading causes of foodborne gastroenteritis worldwide. Among these, *Campylobacter spp.* is recognized as one of the most common bacterial causes of foodborne diarrhoeal disease globally. Human infection is frequently linked to the consumption of undercooked poultry, contaminated meat, and unpasteurized animal products. The organism can persist throughout the poultry production continuum, from live birds to carcasses and retail meat, thereby increasing the risk of transmission along the food chain. Collectively, these pathogens contribute to a substantial global burden of foodborne disease, affecting millions of individuals annually. Veterinary intervention at slaughter and processing serves as a critical control point in interrupting these transmission pathways. Through ante-mortem inspection, diseased or high-risk animals are identified and excluded, while post-mortem examination enables detection of lesions, contamination, or abnormalities that compromise meat safety. In addition, veterinarians enforce hygienic slaughter practices to prevent faecal contamination, oversee Hazard Analysis and Critical Control Point (HACCP) systems, ensure cold-chain maintenance, and monitor microbial quality of meat products. Together, these interventions constitute a structured, risk-based system that prevents zoonotic pathogens from entering the food chain and protects human health. Beyond slaughter-level control, veterinarians also regulate the movement of animals through inspection during trade and transport, ensuring that only healthy animals enter food production systems and preventing the introduction of high-impact diseases across regions.

Hidden Zoonotic Risks in Egg Production

Egg-borne zoonoses represent a significant food safety concern due to the potential for internal and external contamination during production. The most important pathogen is *Salmonella Enteritidis*, which can infect the reproductive tract of apparently healthy hens, leading to contamination of eggs before shell formation. As a result, eggs may appear normal despite carrying infection. The World Health Organization estimates that non-typhoidal *Salmonella*, strongly associated with eggs and poultry, causes approximately 93.8 million cases of gastroenteritis and 155,000 deaths annually worldwide. Additional risks include *Campylobacter* from shell contamination and, less commonly, *Listeria monocytogenes* and *Staphylococcus aureus* under poor handling conditions.

Veterinary oversight ensures that hazards are controlled at the source, an approach that is more effective than relying solely on final product inspection. Through flock health monitoring, vaccination programs against *Salmonella*, strict biosecurity measures, and routine surveillance of eggs and poultry environments, veterinarians reduce pathogen prevalence within production systems. Their role further extends to supervision of egg handling practices, including sanitation, grading, and storage, ensuring contamination is minimized throughout the supply chain. These integrated interventions prevent pathogen entry into the food chain and ensure that eggs remain a safe and reliable component of human nutrition.

Milk, meat, and eggs represent critical pathways through which zoonotic pathogens can enter human populations. At each of these points, veterinary science functions as a primary control system. Through continuous

monitoring of herd and flock health, enforcement of production and slaughter standards, and oversight of food processing practices, veterinarians interrupt pathogen transmission at its source and ensure the safety of animal-derived foods. These interventions establish veterinary inspection not as a regulatory formality, but as a fundamental, science-based system that safeguards food safety and protects public health.

The Silent Battle Against Antimicrobial Resistance

There is a quiet crisis unfolding in our hospitals and across our farmlands—one that doesn't make headlines with the sudden drama of a pandemic, yet threatens to undo a century of medical progress. Antimicrobial Resistance (AMR) represents one of the most significant long-term threats to human health today. To understand AMR is to understand a paradox: the very medicines that have saved hundreds of millions of human lives are, through overuse and misuse, gradually losing their effectiveness. Antibiotics work by killing or inhibiting bacteria. But when bacteria are repeatedly exposed to antibiotics particularly in insufficient doses or over unnecessarily long periods they adapt. They mutate. They develop resistance mechanisms. And once a resistant strain establishes itself, it can spread rapidly across species, geographies, and food systems. In 2019, 5 million human deaths were associated with bacterial antimicrobial resistance worldwide, including 1.3 million human deaths directly attributable to bacterial AMR, according to a landmark study published in The Lancet.

This is where the veterinarian becomes indispensable. Veterinarians are the primary gatekeepers of antibiotic use in animals. They are responsible for prescribing antibiotics appropriately, ensuring that treatment courses are completed correctly, monitoring for signs of resistance in animal populations, and enforcing withdrawal periods. Without veterinary oversight, the risk of antibiotic residues appearing in meat, milk, and eggs increases dramatically, posing direct chemical hazards to consumers, particularly those with antibiotic allergies or compromised immunity. Beyond prescription control, veterinarians contribute to AMR reduction through a broader set of preventive interventions herd vaccination programs that reduce the need for antibiotics in the first place, biosecurity improvements that prevent infection from spreading through livestock populations, and animal welfare enhancements that reduce the stress-related susceptibility to disease. A healthier animal requires fewer antibiotics. A farm with strong veterinary oversight is a farm that contributes less to the global AMR burden. The antibiotics that cure pneumonia, sepsis, tuberculosis, and post-surgical infections in hospitals today exist because they still work. Preserving their effectiveness for future generations is not only a medical responsibility, but also a responsibility shared by veterinarians. Positioned between livestock and the human food supply, veterinarians carry a critical role in safeguarding this effectiveness every day.

Veterinarians as the First Line of Defence in Public Health

Public health protection is most effective when it remains unnoticed. The absence of outbreaks, safe food delivery, and disease containment at source are not incidental they are the result of continuously functioning veterinary surveillance systems. Beyond clinical care, veterinarians monitor animal health, implement vaccination, quarantine, and biosecurity measures at the field level, enforce processing and hygiene standards within food systems, and contribute to disease reporting networks at the epidemiological level enabling early warning and coordinated outbreak response. Through these integrated functions, veterinarians prevent localized infections from escalating into widespread crises, reduce the burden on healthcare systems, and sustain food production stability. Veterinary science

functions not as a reactive discipline, but as a structured preventive system safeguarding both food safety and public health.

Challenges Faced by Veterinarians

Public health protection is most effective when it remains unnoticed. The absence of outbreaks, the consistent delivery of safe food, and the containment of disease at its source are not incidental outcomes but the result of continuously functioning veterinary surveillance systems. At the field level, veterinarians monitor animal health and implement preventive measures such as vaccination, quarantine, and biosecurity. Within food systems, they ensure compliance with processing and hygiene standards. At the epidemiological level, they contribute to disease reporting networks that enable early warning and coordinated outbreak response. Through these integrated functions, veterinary science operates not as a reactive discipline but as a structured preventive system that safeguards both food safety and public health.

Conclusion

Food safety is not an isolated outcome but the result of an interconnected system linking animal health, human health, and environmental stability. This integrated perspective, central to the One Health approach, underscores that preventing disease at its source is far more effective than controlling it after it reaches human populations. Within this system, veterinarians play a critical role by interrupting pathogen transmission, managing risks across the food chain, and ensuring that biological threats are contained before they escalate into public health crises. To overlook veterinarians is to overlook the foundation of food safety and public health. As global challenges intensify, including emerging diseases, antimicrobial resistance, and increasing food demand, the need for strong veterinary systems becomes essential rather than optional. Awareness must replace assumption, and recognition must replace invisibility. Because behind every safe meal is not chance, but a profession that ensures it remains that way. Food safety is not created at the point of consumption; it is secured long before food reaches the plate.

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Cite this article:

Thirumurthi K. (2026). The safety we rarely notice: veterinarians behind our food and health. Vet Farm Frontier, 03(04), 56–60. https://doi.org/10.5281/zenodo.19996517