

Role of Veterinarians in Public Health and One Health

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Over the past decade, a significant increase in the circulation of infectious agents was observed. With the spread and emergence of epizootics, zoonoses, and epidemics, the risks of pandemics became more and more critical. Human and animal health has also been threatened by antimicrobial resistance, environmental pollution, and the development of multifactorial and chronic diseases. This highlighted the increasing globalization of health risks and the importance of the human-animal-ecosystem interface in the evolution and emergence of pathogens. A better knowledge of causes and consequences of certain human activities, lifestyles, and behaviors in ecosystems is crucial for a rigorous interpretation of disease dynamics and to drive public policies. As a global good, health security must be understood on a global scale and from a global and crosscutting perspective, integrating human health, animal health, plant health, ecosystems health, and biodiversity. In this study, we discuss how crucial it is to consider ecological, evolutionary, and environmental sciences in understanding the emergence and re-emergence of infectious diseases and in facing the challenges of antimicrobial resistance. We also discuss the application of the “One Health” concept to non-communicable chronic diseases linked to exposure to multiple stresses, including toxic stress, and new lifestyles. Finally, we draw up a list of barriers that need removing and the ambitions that we must nurture for the effective application of the “One Health” concept. We conclude that the success of this One Health concept now requires breaking down the interdisciplinary barriers that still separate human and veterinary medicine from ecological,

evolutionary, and environmental sciences. The development of integrative approaches should be promoted by linking the study of factors underlying stress responses to their consequences on ecosystem functioning and evolution. This knowledge is required for the development of novel control strategies inspired by environmental mechanisms leading to desired equilibrium and dynamics in healthy ecosystems and must provide in the near future a framework for more integrated operational initiatives. Most veterinarians contribute, directly or indirectly, to public health goals and outcomes. Veterinary public health contributions can be categorized into six core domains. These are as follows: -

- Role of Veterinarians in elimination of Zoonotic Diseases.
- Role of Veterinarians in Food Safety.
- Role of Veterinarians in the Health Aspects of Laboratory Animal Medicine and Diagnostic Laboratories.
- Role of Veterinarians in Biomedical Research.
- Role of Veterinarians in Health Education and Extension.
- Role of Veterinarians in the Production and Control of Biologics, Medical Devices, and Pharmaceuticals.
- Role of Veterinarians in Government and Legislative Activity

Role of Veterinarians in elimination of Zoonotic Diseases

Most private veterinary practitioners contribute to public health during routine practice.

Both large and small animal practitioners become skilled diagnosticians for acute and chronic diseases of animals that may affect the owners and their families and the surrounding communities. Specific examples of public health activities include performing routine health examinations, maintaining vaccination regimens, implementing parasite control programs, advising on the risks of animal contact for immunocompromised individuals, facilitating the use of guide and service dogs for people with disabilities, and promoting the benefits of the human-animal bond (eg, for the disabled and elderly as well as veterans and others with posttraumatic stress disorder). Communities are best served when veterinarians approach collective health issues with a population health perspective, applying relevant epidemiological principles at the community or population levels. In addition to these direct services, veterinary practitioners report disease events and trends to state public health and regulatory agencies, collaborate with human medical counterparts on zoonotic disease prevention and control, and advise local health boards and commissions. These relationships would not exist if not for the inextricable link between animal and human health. Many factors contribute to the increasing vulnerability of production animals to infectious disease. These include increasing intensity and concentration of production agriculture, genetic convergence of many food-producing species, accessibility of production animals to external contact (despite rigorous biosecurity measures), scale and frequency of animal transport (domestic and international), increasing size of feedlots, lack of immunity to foreign animal diseases, the relatively porous nature of national borders, and the marked shortage of trained foreign animal disease

diagnosticians and epidemiologists. Many important zoonotic diseases transmitted by food-producing animals (eg, brucellosis and tuberculosis) have been eradicated or controlled in North America and Europe by pasteurization of dairy products, herd testing and culling, and inspections at slaughter. Other diseases transmitted to humans from food-producing animals (eg, campylobacteriosis, listeriosis, salmonellosis, staphylococcosis, and Shiga toxin-producing *E coli* disease) cause a sizable fraction of the national and international burden of foodborne morbidity and death.

Role of Veterinarians in Food Safety

Veterinarians in food-producing animal practice and government service contribute importantly to the safety of the food supply. Roles in food animal production can be categorized by stage of production. Antemortem activities include assurance of animal welfare, zoonotic disease recognition and prevention, inspection of preslaughter animals, and antimicrobial residue testing. Postmortem activities include carcass inspection and tissue residue determination. Veterinarians in food animal practice also contribute generally to public health through herd health programs, including disease treatment and prevention; husbandry, handling, and environmental advice; reproductive efficiency; vaccination regimens; nutrition; stress reduction; commodity group protocols (eg, the national Beef Quality Assurance program); and biosecurity and biocontainment plans. In addition to monitoring herd health, other important activities include appropriate and judicious use of antimicrobials, disease surveillance, outbreak investigation and mitigation, vaccination against specific high-consequence or high-prevalence pathogens (eg, *E coli* O157:H7 and *Salmonella*), collaboration with

other health professionals (One Health), food facility inspection (eg, production, retail, and storage), import-export examinations, health department leadership, public health (risk) communication, food supply after disasters, and research into safer food production processes.

Role of Veterinarians in the Health Aspects of Laboratory Animal Medicine and Diagnostic Laboratories

The challenges of recognizing resurgent infectious diseases and developing novel therapeutics have placed unprecedented emphasis on managing and maintaining laboratory animal colonies and facilities for research and diagnostic efforts. Increasing emphasis is being placed on international collaboration and reference centers, many of which focus on zoonotic diseases and comparative medicine. Because most outbreaks of zoonotic disease occur in regions where local surveillance and diagnostic and response capacity is lacking, the role of these international collaboration and reference centers likely will expand, requiring larger numbers of trained, experienced veterinary personnel. Trained laboratory animal medicine practitioners are needed to maintain health laboratory animals and ensure their humane use for research and diagnostics.

Role of Veterinarians in Biomedical Research

Humans interact with animals in a variety of ways every day, from sharing a loving companionship with pets, to playing and competing together in sports, to managing herds and flocks that provide food. The health and well-being of the animals in our lives is remarkably tied to that of humans in a number of ways. Many naturally occurring diseases and disease processes in animals are identical to those in humans (eg, osteoarthritis, diabetes, and many cancers). Basic biomedical

research of these problems yields solutions that can benefit both animals and humans. Animals have benefited from many therapeutic advances adopted from human medicine. Conversely, clinical veterinary trials can inform promising therapies for use in humans. Building on the information from public health surveillance, research institutions must follow with a greater understanding of the interactions between hosts, parasites, vectors, pathogens, and the environment. Establishing a causal link between human and animal disease relies on such research efforts, often through some combination of molecular studies, mathematical theory, and experimental epidemiology, using either field or laboratory research. As highlighted by the World Health Organization (WHO), research of endemic and resurgent zoonoses is often limited by a lack of basic knowledge of host-pathogen interactions. For many zoonotic species, even the route of transmission to humans remains uncertain. In some cases, the molecular biology of the agents in human and animal hosts may be very different. For example, there are major research efforts aimed toward the identification of virulence factors for *E coli* O157:H7 and the reasons for their differential expressions in humans and cattle.

Role of Veterinarians in Health Education and Extension

Training new veterinary practitioners and disseminating new capabilities to those already in practice falls largely on the nation's academic (especially land-grant) institutions. At the collegiate level, this increasingly involves multidisciplinary relationships between schools of medicine, veterinary medicine, sociology, and basic sciences. Most epidemiologists are employed by governmental or industrial stakeholders, but virtually all veterinarians help educate the public on

the threat of infectious and non-infectious diseases. Veterinary practitioners have a responsibility to remain knowledgeable about disease threats and credible sources of that knowledge for their communities. Enabling appropriate knowledge and awareness among the public requires a blend of risk perception and awareness, especially because community stakeholders play important roles in risk resolution.

Role of Veterinarians in the Production and Control of Biologics, Medical Devices, and Pharmaceuticals

Ensuring that animal drugs, vaccines, and devices are safe and efficacious is a shared responsibility between veterinarians in FDA, USDA, and EPA. In general, FDA, specifically the Center for Veterinary Medicine, regulates animal drugs, animal feeds, and veterinary devices, whereas USDA regulates animal vaccines and biologics. Specific to pesticides, FDA regulates certain flea and tick products for animals, whereas EPA regulates others. Within each of these governmental agencies, veterinarians serve to encourage the development of novel products and, at the same time, protect the consumers of those products from false or misleading claims. Another important function regarding biological agents is the regulation of their storage, use, and transfer. Because of inherent virulence and transmissibility, access to many disease pathogens, termed select agents, has increasingly been limited to legitimate facilities for legitimate uses. The Federal Select Agent Program is jointly administered by CDC and USDA's Animal and Plant Health Inspection Service (APHIS). This effort oversees the possession, use, and transfer of certain biological agents and toxins that have the potential to pose a severe threat to the public, to

animal or plant health, or to animal or plant products.

Role of Veterinarians in Government and Legislative Activity

veterinarians are employed at various levels of state and federal government. More than 3,000 veterinarians are employed at the federal level, nearly two-thirds of which are with USDA. Other federal agencies employing large numbers of veterinarians include the Department of Defense (DoD) and the Department of Health and Human Services (DHHS; eg, in the CDC, FDA, and National Institutes of Health [NIH]). Public health programs comprise most of these employment opportunities, with direct animal care being a minor fraction. Examples include oversight of food safety inspection programs, disease surveillance and outbreak investigation, laboratory animal care, biomedical research, and public health program management and leadership. At the state level, each department of agriculture typically has a state veterinarian who is responsible for protecting the production animal, poultry, and aquaculture industries directly, and the public indirectly, through the prevention, early detection, containment, and eradication of economically important production animals, poultry, and fish diseases that, in many cases, are transmissible to humans. The state veterinarian's office regulates the importation, transportation, and processing of animals and is responsible for the control and eradication of poultry and production animal diseases, regulation of fish farming, and emergency response programs. Welfare of farm animals is monitored, and when necessary, the office of the state veterinarian conducts investigations and prosecutions relating to cases of cruelty to animals. Most states and territories employ veterinarians in their health departments as public health

veterinarians, who generally work in zoonotic disease control and prevention. However, they are increasingly involved in One Health efforts. Public health veterinarians typically work in communicable disease epidemiology, toxicology, or environmental health programs within state, regional, or local health departments. For more information, see National Association of State Public Health Veterinarians. A final category of governmental activity is legislative. A relatively small number of

veterinarians serve at various levels to promulgate laws, rules, and regulations that serve to protect public health, domestic preparedness, and national defence. Veterinarians serve in the US House of Representatives, in senior leadership positions of several US cabinet-level departments (including USDA, DHHS, DoD, and Department of Homeland Security [DHS]), and as legislative liaisons for professional associations such as the AVMA.

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