

Public Health for the Twenty-First Century: What Role Do Veterinarians in Clinical Practice Play?

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KEYWORDS

- Public health • One health • Disease reporting
- Disease surveillance • Health education

A number of events around the turn of the twentieth century heightened our society's awareness of zoonotic diseases, the role of animals in society, and how the unique expertise of veterinarians in such areas as population health and comparative medicine help address public health problems. In 1999, following observation of increased morbidity and mortality among birds, horses, and humans, West Nile virus was first detected in the Western Hemisphere.^{1,2} In 2001, dried and purified *Bacillus anthracis* spores sent through the United States mail resulted in 22 persons becoming ill, leading to 5 fatalities, and over 10,000 persons being recommended antimicrobial prophylaxis.³ When Hurricanes Katrina and Rita struck the Gulf Coast region in 2005, reports about residents who refused to abandon their pets during an evacuation and the plight of animals left behind made glaringly obvious the adverse consequences of failure to include animals in disaster plans.⁴ These events have expanded the perceptions of many in government agencies and the general public regarding the roles that veterinarians play in maintaining public health and during public health crises.

Within the realm of veterinary medicine, public health is traditionally viewed as the investigation, prevention, and control of exclusively zoonotic diseases, such as rabies, psittacosis, and brucellosis. However, in reality, veterinarians lend their expertise to address a multitude of community health concerns, including emerging diseases, disaster preparedness and response, occupational health, bioterrorism, and environmental health. Most public health veterinarians work in settings that focus primarily on human-centered population health and food safety, such as in the uniformed services (eg, US Army, Air Force, and Public Health Service) and in government agencies (eg, Centers for Disease Control and Prevention, US Department of Agriculture, Food and

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Drug Administration, and state and local public health departments).⁵ Less than 4% of veterinarians in the United States hold positions in the uniformed services or federal, state, or local government agencies.⁶ However, all veterinarians, regardless of their formal job description, serve the public good and contribute to public health. The Veterinarian's Oath states that "the promotion of public health" is a primary function of the practice of veterinary medicine,⁷ regardless of setting or specialty (**Box 1**).

To be effective, public health officials do not operate in a vacuum, but rather in concert with a number of community, governmental, commercial, and private entities and partners, including veterinary practitioners. This article provides a brief overview of the basic functions of public health, while emphasizing the roles that clinicians play in public health in their day-to-day practice of veterinary medicine, and how they might extend their interest and involvement in this field.

When discussing public health, it is useful to consider its definition. Charles Winslow, a public health visionary in the early twentieth century who had a great influence on the development of public health services in the United States, defined it as "the science and art of preventing disease, prolonging life, and promoting health and efficiency through organized community effort."⁸ The World Health Organization defines veterinary public health as "the sum of all contributions to the physical, mental, and social well-being of humans, through an understanding and application of veterinary science."⁹ This article uses the broader term *public health* rather than *veterinary public health* to reflect the multidisciplinary nature of the field, which relies on collaboration among many professions, including physicians, veterinarians, nurses, microbiologists, pathologists, and ecologists. A joint publication by the Board on Health Promotion and Disease Prevention and the Institute of Medicine promotes a collaborative approach to addressing public health challenges through cultivation of a "well-educated interdisciplinary cadre of public health professionals who focus on population health and understand the multiple determinants that affect health."¹⁰ Further emblematic of the convergence of animal, human, and ecosystem health is the recent collaboration of the American Veterinary Medical Association and American Medical Association on the One Health Initiative to address "areas of mutual medical interest, such as pandemic influenza, bioterrorism risks, and biomedical research."¹¹ The recently released report of the American Veterinary Medical Association One Health Initiative Task Force is a call to action for individuals and professions to create partnerships to improve health worldwide.¹² It is anticipated that such developments will further expand and enhance the participation of veterinarians in the development and maintenance of healthy communities.

The practice of public health can be divided into several integrated functions, including (1) disease detection and reporting, (2) disease surveillance, (3) response, (4) health education and disease prevention, (5) program evaluation, and (6) research. The activities of veterinarians in clinical practice most frequently address the areas of

Box 1

Veterinarian's Oath

Being admitted to the profession of veterinary medicine, I solemnly swear to use my scientific knowledge and skills for the benefit of society through the protection of animal health, the relief of animal suffering, the conservation of livestock resources, the promotion of public health, and the advancement of medical knowledge.

I will practice my profession conscientiously, with dignity, and in keeping with the principles of veterinary medical ethics.

I accept as a lifelong obligation the continual improvement of my professional knowledge and competence.

disease detection, reporting, and prevention, though veterinarians may be involved in any of these functions to varying degrees. Each of these functions is discussed more in depth in the following sections, with the emphasis on those most directly related to clinical practice.

DISEASE DETECTION AND REPORTING

Clinicians in the front line to evaluate patients daily are in the best position to detect unusual diseases or potential disease outbreaks. Many diseases that affect animals also have public health implications because they are zoonotic, provide an early warning system for risk of human infection (ie, sentinels), or are economically important. **Table 1** lists some examples of diseases that a veterinarian working in a small-animal clinic may encounter.

Unfortunately, the agencies and processes by which reportable diseases are designated and reported are mostly independent for human and animal conditions. The Council of State and Territorial Epidemiologists composes a list of human diseases that state public health agencies report through the National Notifiable Diseases Surveillance System to the Centers for Disease Control and Prevention. As of 2008, the only animal condition reportable under this framework is rabies.¹³ A separate list of nationally reportable animal conditions under the US Department of Agriculture's National Animal Health Reporting System¹⁴ consists mainly of those diseases considered of economic concern to the livestock industry, such as foreign animal diseases. In addition to the nationally reportable diseases, each state public health and agricultural agency can require that health care providers report to their local or state agencies additional human and animal conditions of regional concern.

Because states and localities can vary about which human and animal diseases must be reported, veterinarians must maintain open lines of communication with local public health officials to find out what the local disease-reporting requirements are. A 2004 survey of over 4000 randomly selected veterinarians from New Hampshire, New Jersey, New York, and Pennsylvania found that 28% did not know if their community had a local public health agency.¹⁵ Although veterinarians may often be required to report reportable zoonotic diseases to state agencies, rather than to local health agencies, communication with local public health officials facilitates a more coordinated and timely response to such events as disease outbreaks.¹⁵ In addition, veterinarians may have a patient with signs that are consistent with those of a reportable condition, but no confirmation of the etiology, in which case local public health officials may be able to provide timely consultation on diseases of public health importance and access to diagnostic resources.

The growing recognition of animals as sentinels of public health events and of the frequent overlap between the health of humans and animals sharing the same environment has led to a greater appreciation of the value of having an integrated approach to disease detection and reporting. An integrated, streamlined approach that reduces the number of agencies and officials involved could facilitate a higher level of disease reporting, ensure more timely response, and foster closer collaboration between veterinarians and public health agencies. Given the potential for introduction of emerging pathogens (most of which are zoonotic)^{16,17} and threat of bioterrorism,^{18,19} veterinarians are a vital part of the disease-reporting network.

DISEASE SURVEILLANCE

The rote accumulation of disease reports is a fruitless exercise if those data are not used to motivate public health action. Surveillance is defined as the ongoing,

Table 1
Examples of diseases of public health significance that can affect small animals

Disease	Public Health Relevance	Species Affected	Mode of Transmission	Example
Plague (<i>Yersinia pestis</i>)	Zoonotic; animal sentinel	Mainly rodents and rabbits; also cats, dogs (rare) and humans ³⁸	Mainly bite of infected flea; also respiratory aerosol	23 cases of cat-associated human plague in United States from 1977 to 1998 ³⁷
Rabies (genus <i>Lyssavirus</i>)	Zoonotic; animal sentinel; economic (cost of postexposure prophylaxis)	In United States, mostly raccoons, insectivorous bats, and skunks ³⁸	Mainly bite or scratch from infected animal	665 persons received postexposure prophylaxis following exposure to rabid kitten ³⁹
Rocky Mountain spotted fever (<i>Rickettsia rickettsii</i>)	Zoonotic; animal sentinel	Humans, dogs, rodents ⁴⁰	Bite of infected tick	Fatal human case preceded by death of owner's two dogs ⁴¹
<i>Salmonella</i> spp	Zoonotic; economic	Poultry, swine, cattle, horses, dogs, cats, wild mammals and birds, reptiles, amphibians, crustaceans ⁴²	Food-borne and fecal-oral	Outbreaks of <i>S typhimurium</i> in 3 companion-animal clinics and 1 animal shelter; culture confirmation in 18 human and 36 animals ⁴³
Screwworm (<i>Cochliomyia hominivorax</i>)	Zoonotic; animal sentinel; economic	Mostly domestic livestock; rare in humans ⁴⁴	Eggs deposited directly in host tissue by female fly	Larvae detected in dog imported from Panama, preempting reintroduction into United States livestock ⁴⁵

systematic collection, analysis, and interpretation of outcome data.²⁰ This function is performed by public agencies, which often disseminate the data to such consumers as the health care workers who supply the disease reports, public health officials, researchers, and the scientific and popular media. Consumers can use the data to gain a better understanding of disease prevalence and trends in the community; to determine the need for new public health programs; to serve as the basis for epidemiologic studies and evaluation of public health programs; and to inform the public of preventive measures they can take to reduce their risk of illness.

The existence of disparate tracks for disease-reporting systems for humans and animals, as discussed above, often limits the quality and usefulness of these surveillance data to the community. Moreover, neither system efficiently captures data from the small-animal clinic setting. For any given disease, there may be human data but no animal data, or vice versa. Or, if data exist for both animals and humans, they may have been collected under different criteria, in different data formats, or with varying degrees of completeness, making direct comparisons impossible. As a result, coordination among public agencies is hindered. An example of the kind of coordinated surveillance that can be achieved is the surveillance system developed in response to the importation of West Nile virus in 1999. In this multipronged system, data from humans (clinical cases and asymptomatic blood donors), animals (horses, wild birds, sentinel chickens), and vectors (mosquitoes) are collected by numerous state and local agencies using mutually agreed upon surveillance guidelines, then submitted to the Centers for Disease Control and Prevention for collation.²¹ The existence of integrated surveillance data for West Nile virus further facilitates coordination among stakeholders by allowing consideration of animal data as a predictor of human cases. For instance, increases in crow mortality due to West Nile virus have been shown to be predictive of human cases.²² Other factors that serve as a measure of arboviral transmission risk, and are consequently used by local agencies to direct their mosquito adulticiding and larviciding efforts, include environmental or climactic conditions, abundance of mosquito vectors, virus infection rate of mosquito vectors, sentinel chicken seroconversions, and human infections.²³ Such integrated surveillance provides one potential model for the development of a surveillance system to facilitate standardized reporting of all reportable conditions from both animals and humans. Unfortunately such integrated surveillance is currently the exception rather than the rule.

RESPONSE

Local, state, and federal public health and agricultural agencies respond to a variety of community concerns, ranging from the seemingly common, such as routine inspection of sanitation and food-handling practices at restaurants, to the catastrophic, such as dealing with the aftermath of a large-scale earthquake. These agencies are assigned the task of providing a coordinated response to such events as disease outbreaks and natural and man-made disasters (ie, bioterrorism and agroterrorism). Many public health officials, including veterinarians, focus primarily on preparedness and response for natural and manmade disasters. In addition, veterinarians participate in the many volunteer and nonprofit animal response groups that work closely with government agencies to provide assistance with disaster response. For instance, veterinarians, animal health technicians, pharmacists, epidemiologists, safety officers, logisticians, communications specialists, and other support personnel can volunteer for the National Veterinary Response Team to assist with animal care, animal-related issues, and public health during disasters.^{24,25} Veterinarians in the private practice sector can also participate in disaster relief efforts through state and

local animal-response teams. As the majority of veterinarians are employed in small-animal practice,⁶ having these veterinarians available to serve in a surge capacity as regulatory veterinarians or disaster responders during times of public health crises could constitute an invaluable resource to our nation's response capabilities.²⁶ Small-animal veterinarians could be readied to mobilize in such capacities through government-administered accreditation processes, similar to the US Department of Agriculture's voluntary National Veterinary Accreditation Program.²⁶ Given the potential scale of some disasters and the constant threat of bioterrorism, agroterrorism, and accidental introduction of emerging and foreign animal diseases, there is a real need for veterinarians, with their expertise in such areas as population health, comparative medicine, zoonotic diseases, and emergency medicine, to get involved in planning and response efforts.

EDUCATION AND DISEASE PREVENTION

Veterinarians are an important source of information for their clients on such public health topics as zoonotic diseases, dog-bite prevention, and disaster planning for pets. A survey of pet owners found that they acquired pet information more frequently from their veterinarian than from friends or family or from the World Wide Web, and they reported more confidence in information received from veterinarians than from other sources.²⁷ As such, veterinarians are in a position to proactively educate their clients as well as correct erroneous information they may receive from other sources, including other health care providers or the popular media.

There are multiple opportunities to educate clients within the small-animal hospital environment. The most direct approach is to engage the client in a discussion of preventative measures for zoonotic and chronic diseases, such as control of intestinal and ectoparasites and the importance of regular exercise, good nutrition, and vaccinations. Data from Banfield, the Pet Hospital, for 2007 show that 3.5% of canine patients and 5% of feline patients had a diagnosis of a zoonotic disease, such as roundworm, hookworm, or tapeworm infection, all of which can be prevented by deworming, use of flea control products, and good hygiene practices.²⁸ Such a discussion of preventive health measures could be incorporated into routine wellness visits, particularly those for puppies and kittens. This is also golden opportunity for the veterinarian to highlight the inextricable link between human and animal health by illustrating our common risk for many conditions, including tick-borne diseases, enteric pathogens, and obesity. Educational brochures, posters, and videos in waiting areas and examination rooms can serve as excellent sources of additional information for clients and help them focus on specific topics or questions of interest to discuss with the veterinarian, thereby optimizing the use of the time spent during the office visit. There are many good resources available on the Internet, including those offered by the American Veterinary Medical Association,²⁹ the Center for Food Security and Public Health,³⁰ and the Centers for Disease Control and Prevention,³¹ to which veterinarians can refer as well as direct their clients.

Another area where veterinarians can have a positive impact is through community involvement and outreach.³² For instance, veterinarians can share educational resources or deliver a presentation to members of organizations, such as schools, children's clubs (eg, Boy Scouts), church groups, service organizations (eg, Rotary Club), and senior citizen groups. In addition, the small-animal veterinarian should reach out to organizations and associations of other health care providers, such as physicians, nurses, pharmacists, and dentists, to provide information on such topics as zoonotic and emerging diseases, animals as sentinels, or the epidemiology of

animal-bite injuries. Such outreach efforts also serve to establish a dialog with other partners in administering to the health of the community. Veterinarians should take every opportunity to raise awareness among health providers, health care organizations, and the public at large of specific health topics and of the diverse contributions of veterinarians to the human-animal bond, food safety, zoonotic disease prevention, and environmental health.³²

Public health agencies and nonprofit groups often undertake large-scale disease education and prevention campaigns directed at the public. These campaigns disseminate information through various forums, including public service announcements, media interviews, print media, and posters. Some recent topics have included mosquito avoidance to reduce the risk of West Nile virus³³ and safe food-handling practices to reduce the incidence of food-borne illness.³⁴ Veterinarians in public agencies are often a central part of such campaigns.

PROGRAM EVALUATION

When a disease education or prevention campaign is implemented, typically by a government or nonprofit agency, the primary outcome of interest is the impact of the program (ie, did it produce the desired effect on the target population?). This measurement process can be viewed as a systematic way to improve and account for public health actions.³⁵ Without such feedback, it is not possible to objectively gauge how effectively program money and resources are being spent. Such information can be gathered using a variety of research techniques, including administration of surveys on attitudes, knowledge, and behaviors before and following the campaign or evaluation of surveillance data to determine if rates for the condition or behavior of interest changed following the campaign. For example, an oral rabies vaccination campaign targeting coyotes and gray foxes in Texas was evaluated by comparison of prevalence of protective immunity in targeted species before and after the vaccination campaign.³⁶

OTHER RESEARCH

Other forms of public health research can encompass a wide range of activities, including those directed toward learning more about the development of antibiotic resistance and the transmission, epidemiology, treatment, and prevention of infectious diseases. This process of discovery also encompasses noninfectious conditions, such as mental health, cancer, heart disease, and injury. Veterinarians are a vital part of this research landscape, whether at academic institutions, government or nonprofit agencies, or clinical practices. For instance, veterinarians in clinical practice are involved in research efforts in various ways. They publish case reports that stimulate further studies, assist researchers with the identification of study populations, oversee clinical trials, and partner with researchers to observe and collect outcome data. The ultimate goal of public health research is the improvement in the health of humans and animals, and protection of the environment.

SUMMARY

The small-animal clinician plays many roles in protecting the health of the community. Rather than practicing in a vacuum, clinical veterinarians are in an ideal position to detect activity, such as disease outbreaks or emerging diseases, that is highly relevant to others in the community. In addition, veterinarians are a valuable resource for educating their clients, other health professionals, and the general public on many

topics, including zoonotic diseases, bioterrorism, disaster preparedness for pets, and dog-bite prevention. Clinicians and local health agencies both stand to benefit from a close working relationship that is open to collaboration. Although the majority of local health departments do not have a veterinarian on staff, other officials, such as the health officer, public health nurses, and microbiologists, can all be valuable resources to veterinarians who wish to consult on cases of suspected public health significance or to submit specimens for diagnostic testing. Local health officials in turn benefit from having a veterinary resource to consult with as well as additional sets of eyes and ears in the community to alert them to events of potential public health significance. Through coordination and open lines of communication with other health care providers, public health agency officials, and the general public, the full contributions of veterinarians to the community can be realized.

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