Chapter 13

GLOBAL ZOONOTIC DISEASE SURVEILLANCE AND CONTROL

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INTRODUCTION

Background of the One Medicine, One Health Concepts

Although many credit the late Dr Calvin Schwabe with coining the term "One Medicine" in 1964, the recognition that healthy animals are important to human health is far from new.[1] Nearly 90 years earlier, Rudolf Virchow, popularly acknowledged as the father of modern comparative pathology, and Sir William Osler, a Canadian physician who is often called the father of modern medicine, both supported the One Medicine concept (ie, the well-being of humans is affected by disease control in animals).[2]

Historically, One Medicine also symbolized the close association between physicians and veterinarians. Decades before the first veterinary school was established in 1761, physicians were charged with responding to animal diseases such as the 1713 outbreak of "Rinderpest" (the German word for "cattle plague") in Rome, and long before human medicine was established as a formal profession, humans had been caring for the health and welfare of animals.[3] Much of this attention to animal health was due to the critical roles animals played in preindustrial society; at this time, they were used for food, transportation, clothing, and farming. Even today, in many developing countries, the family cow or goat is not only a potential source of milk, meat, and clothing, but also represents a significant savings investment or liquid asset against future needs and expenses. The loss or death of the animal can negatively impact the health and welfare of the family.

Although most people today do not depend so heavily on animals for their basic needs, attention still must be paid to animal health because of the significant role animals play in disease transmission: over 60 percent of the infectious diseases affecting humans are zoonotic.[4] Since 1964, One Medicine has evolved into the global concept "One Health," an initiative that continues to recognize the connection between human and animal diseases and strives to emphasize the more recent, holistic idea that health is a whole, which is based on a fluid, shared ecosystem (ie, humans, animals, and their environments). In 2007, in recognition of the interdependency of human and animal health, the American Medical Association adopted a One Health resolution, and the American Veterinary Medical Association convened a One Health task force to examine the ways to promote the concept between the two organizations.[5]

Implementation of the One Health Concept

Although many associations and institutions continue to promote One Health, perhaps no organization is better able to implement the concept than the US military, particularly the US Army. In the civilian sector, the practice of medicine is generally fragmented by patient species. Physicians tend to care for humans, veterinarians care for nonhuman animals, and neither doctor interacts with the other on a regular basis. However, within the military, even though military physicians and military veterinarians still care for the same separate populations, the two professions tend to interact more than their civilian counterparts for several reasons, including more collaborative training.

Collaboration begins on day one of their military careers when medical and veterinary officers attend the same Basic Officer Leaders Course and continues throughout the military education cycle, fostering close working relationships and information sharing between the two professions. Officers and enlisted service members may also have multiple assignments with their counterparts throughout their careers, particularly at research organizations (eg, Walter Reed Army Institute of Research or the overseas research laboratories), further promoting cross-professional relationships and information sharing.

In addition to greater collaboration, the One Health concept may succeed more in the military than in the civilian sector because the military treats a relatively closed population, using a consolidated health system. Not only are human and veterinary medicine separate in the civilian sector, but the civilian human health care system also tends to be fragmented. The high degree of specialization in human medicine results in patients being seen by multiple physicians, often at several, individual institutions, which may result in each physician only seeing a portion of a patient's medical history. While military medicine is equally specialized, military patients generally receive all or the majority of their care within the military health system, which allows military providers to view a more comprehensive patient record.

Veterinary care is similarly consolidated, especially at remote or overseas installations where the majority of privately owned animals receive their care from the military veterinary treatment facility. This comprehensive care, combined with the development of cross-profession relationships, facilitates the rapid communication of mutual concerns and, potentially,

the early detection of significant disease trends and activities that would otherwise not be readily visible looking at only a portion of a single population.

The recent establishment of the Army Public Health Center should further enhance detection capabilities as this command extends the reporting and analysis of human and animal disease activities from a single installation to the entire military. These coordinated surveillance activities are also conducted at the overseas research laboratories where military researchers partner with local ministries of agriculture, health, and defense to identify reservoirs and vectors and determine disease prevalence and incidence in animal and human populations. Additional information on military veterinarians' roles in conducting zoonotic disease surveillance and control is presented in the following sections, including how service member animal practitioners become accredited.

NATIONAL VETERINARY ACCREDITATION AND THE MILITARY VETERINARIAN

Program Background, Mission, and Veterinary Accomplishments

The eradication of livestock and poultry diseases such as contagious bovine pleuropneumonia, foot and mouth disease, and screwworm has had a tremendous impact on public health, livestock productivity, and, thus, the United States economy.[6] The United States is currently on the verge of eradicating brucellosis, tuberculosis, and pseudorabies.[7] Military veterinarians have played, and will continue to play, a pivotal role in the eradication process via various means, including becoming accredited practitioners who partner with other veterinarians to promote animal health.

The United States Department of Agriculture (USDA) established a national veterinary accreditation program in 1921 so that accredited veterinarians could assist federal veterinarians in executing the mission of controlling animal diseases and facilitating the movement of healthy animals. According to a USDA publication, "[t]he mission of the National Veterinary Accreditation Program [NVAP] is to ensure the health of the [n]ation's livestock and animal population and to protect the public health and well-being,"; more specifically, "[a]ccredited veterinarians work cooperatively with USDA's Animal and Plant Health Inspection Service (APHIS) and [s]tate animal health officials to protect and improve the health, quality, productivity, and marketability of US animals by preventing, controlling, and eradicating" both endemic and foreign animal diseases.[8]

Because of their unique missions worldwide, military veterinarians must be familiar with disease prevention, control, and eradication, and regulations governing interstate, intrastate, and international shipment of animals. Each year military veterinarians also evaluate and facilitate the exportation and importation of hundreds, if not thousands, of domestic animals worldwide, giving these veterinarians the opportunity not only to encounter foreign animal diseases, but also to prevent diseased animals from entering or exiting the United States. During the past decade, veterinary practitioners, particularly military veterinarians, performed key roles in the detection and eradication of several diseases not previously found in the United States: (*a*) contagious equine metritis, (*b*) exotic Newcastle disease, (*c*) West Nile virus, (*d*) screwworm, (*e*) monkey pox, and (*f*) H1N1 influenza virus.[9]

Accreditation Process, Requirements, and Credentialing

Currently, qualified veterinarians can earn accreditation in two existing categories: Category I and Category II. Category I includes all animals "except food and fiber species, horses, birds, farm-raised aquatic animals, all other livestock species, and zoo animals that can transmit exotic animal diseases to livestock."[8] Category II includes all animals; nothing is excluded. Note that dogs and cats are included within Category I, whereas all bird species fall only into Category II. Category II accreditation may be most beneficial for military veterinarians because they are frequently required to examine dogs, cats, and birds and issue health certificates for interstate and international travel during deployments and permanent change of station reassignments.

Veterinarians applying for accreditation under the NVAP must fulfill the following four requirements: (1) possess a current and valid license and otherwise be legally able to practice in the state for which accreditation is desired; (2) complete the web-based initial accreditation training with a passing score of 80% or higher (website access can be obtained from the APHIS Veterinary Services Area Office in the state for which accreditation is desired); (3) complete the core orientation to include state-specific training in the state for which accreditation is desired; and (4) complete the NVAP application (VS Form 1-36A).[8]

Each veterinarian's accreditation is not valid until written approval is obtained from APHIS, and initial APHIS accreditation is good for 3 years. After 3 years, APHIS-approved supplemental training is required for accreditation renewal, and this mandatory training

is available online at no charge. As of this chapter's publication, three units of supplemental training per renewal period are required for Category I veterinarians and six units for Category II veterinarians. Supplemental training options can be found at www.aphis.usda.gov/nvap.

Veterinary accreditation is usually not required for interstate shipment of cats and dogs. However, several states and territories do require health certificates be counter-signed by a USDA-accredited veterinarian (eg, Connecticut, Delaware, Indiana, Louisiana, New Hampshire, and the US Virgin Islands). Similarly, the shipment of dogs and cats internationally does not normally require signature by a USDA-accredited veterinarian; however, some countries do require accredited veterinary endorsement on the official certificate of veterinary inspection. Given the lack of standardization among states, territories, and countries, all military veterinarians must maintain knowledge of both interstate and international animal shipping requirements.

The current Army Public Health Center definition of a military veterinarian encompasses both commissioned officers and general schedule veterinarians employed by the Army Public Health Center.[10] Because the current definition includes these two groups of veterinarians, the US military has developed relationships with countries where many military and family members and accompanying pets reside (eg, Japan, Korea, and the European Union) that permit a military veterinarian to sign and stamp the health certificate in lieu of the required USDA endorsement. In this capacity the military veterinarian serves and is recognized as an US government official veterinarian.

In addition to accreditation, many military veterinarians become credentialed as foreign animal disease diagnosticians by attending the Foreign Animal Disease Diagnostic School at the Plum Island Animal Disease Center in Orient Point, New York. By so doing, the military adds to the number of credentialed US veterinarians capable of supporting a USDA response to foreign animal disease introductions to the United States.

VETERINARY ELECTRONIC HEALTH RECORDS AND HEALTH EXAMS

Humans have been using animals as sentinels of zoonotic diseases since ancient times. It only stands to reason that if one is looking for an outbreak of a zoonosis, the occurrence of such a disease should appear in the local animal population first. By studying this group, informed decisions can later be made regarding the preservation of health in the similarly exposed human population. When the population of domestic animals is routinely presented for veterinary care, health records are created that can be analyzed for the presence of zoonoses or effects of environmental exposures, which is crucial to the decision-making process. Traditionally, this zoonotic surveillance has been conducted using paper records or, more recently, locally maintained electronic records.

Unfortunately, both paper and local electronic records present numerous obstacles to real-time zoonoses surveillance. Neither form is accessible globally without the use of some means of transmission to a centralized surveillance center, thus increasing time to analysis. Paper records are also often difficult to read, must be abstracted to provide data for analysis, are easily lost, and are not usually standardized in terminology or format. These drawbacks predispose any analysis to errors based on the skill of the abstractionist and the interpretations of the investigator. Additionally, abstraction is manpower intensive and time consuming, adding increased cost and rendering most analyses retrospective in nature (much abstraction work is completed long after the occurrence of the zoonosis or exposure of interest). Abstracted surveillance data is even less useful on the battlefield, where more immediate decision support is required.

The global electronic health record (EHR) is designed to negate the aforementioned surveillance obstacles. Because the EHR is web-based, the individual record is updated immediately upon completion of a patient encounter, providing the ability to trend historical medical diagnoses and results. Operating over the internet also allows the updated data to be available anywhere and at any time, permitting simultaneous access to multiple users worldwide. Further, the data is stored in a secure, redundant, and mineable database that reduces the risk of data loss.

The EHR is particularly useful for tracking military working dog (MWD) health in a more timely and connected manner. The MWD undergoes a complete physical exam every 6 months, resulting in a lifelong longitudinal health history that is used in epidemiological studies to investigate potential exposures and theorized effects on health outcomes.[11–17] Like other abstraction work, early studies of the MWDs tended to be time consuming, manpower intensive, and tardy (most being completed years after an exposure or zoonotic disease occurred). However, by using the EHR, animal location, environment, and complete health history is centrally located and available for multiple analyses. The EHR also provides the capability to follow a cohort of animals prospectively to an anticipated medical outcome, or lack thereof, with

the data from all aspects of the epidemiological triad available for analysis, rapid reporting, and informed decision-making.

To be of optimum use, the EHR first must conform to recognized standards. Coding systems that support morphology, topography, and diagnostic terminology standardization need to be incorporated into the EHR application. The three most recognized coding systems in human medicine are (1) the International Statistical Classification of Diseases and Related Health Problems,[18] (2) the Diagnostic and Statistical Manual of Mental Disorders,[19] and (3) the Systematized Nomenclature of Medicine-Clinical Terms.[20]

In conjunction with the American Animal Hospital Association, starting in 2002, the veterinary community began the onerous task of developing a standard terminology for an animal coding system that is tied to the Systematized Nomenclature of Medicine-Clinical Terms coding system.[21] This system is now maintained for the veterinary community by the Veterinary Terminology Services Laboratory located at the Virginia Maryland Regional College of Veterinary Medicine, Virginia Tech, Blacksburg, Virginia.[22] The ability to code to a standard set of terms allows the greatest flexibility in data analysis because cases are not erroneously included or excluded in the case definition based on disparate terminology. Standardized coding also dramatically improves the value of large, web-based databases for zoonotic surveillance.

Another critical element that affects EHR usability is network connectivity. The EHR is hosted on a server platform accessible to both military and commercial networks, enabling the capture of animal health encounters from any environment where the warrior animal may be found. Ideally, the application should be accessible through a multitude of devices and means (eg, laptop, tablet, handheld, and desktop end-user devices) by local area network or wireless network connections. This redundancy of data collection decreases the risk of data loss through misplaced or damaged paper records.

Security of data, both at rest and during transit, is vital to the security of the entire internet and also to the usefulness of the EHR system. The record system must be compliant with all current Department of Defense (DoD) security and information assurance directives and needs to be stored within a secure enclave. Common Access Card authentication is required for all users, and access is limited by role-based permissions. Such restrictions ensure all users are operating the application within the scope of their duties and credentials, preserving the medicolegal requirement of the EHR. A full audit trail is maintained for any transaction within a record with a date and time stamp as well as identification of the authenticated user.

The EHR system also contributes to a leader's global zoonotic disease surveillance and control decision-making capabilities in multiple ways. For example, the system provides a centrally managed large enterprise veterinary practice, such as the military, with visibility at all levels of military veterinary care. Reportable disease triggers can be incorporated that will allow real-time data transfer of zoonotic outbreaks, not only to veterinary service command personnel, but also to DoD public health officials throughout the area of interest. Collection and reporting of this data in real time can result in improved decision support and employment of appropriate preventive measures by commanders.

Finally, EHRs provide the means to determine outcome-based best practices that result in improved health and treatment of zoonotic diseases. Secondary benefits can also be received from administrative and operational reporting capabilities, allowing for more efficient manpower distribution, better inventory management, and streamlined corporate practice management. All these capabilities lead to healthier animals and, ultimately, service member wellness.

The multiple benefits of the EHR system aside, the most important factor for its effective use is a willingness of the veterinary community to accept the system. The best-built application cannot function as designed if the user is allowed to resist conversion to it. Command emphasis from all levels is critical to the successful implementation of any EHR and practice management system.

DEPLOYMENT SURVEILLANCE AND DISEASE CONTROL

Vector-borne diseases (VBDs), many of which are considered enzootic, have long been studied in various parts of the world to aid in the development of new vector-control strategies for US military deployments. However, in Afghanistan, tick analyses, other indigenous animal seroprevalence, and molecular studies are lacking; the unavailability of such information is likely due to the austere state of Afghanistan's infrastructure. Since VBD information is considered a vital component of a more complete and informative medical threat brief to medical and veterinary caregivers serving in Afghanistan, an effort to identify the VBD risk in Afghanistan was initiated in the spring of 2010.

Similar surveys have proven to be useful in comparing risk of disease for MWDs with the feral canine population in Iraq.[11] One objective of this survey

effort was to determine the prevalence of the following VBDs in the tick and feral dog population within various regions across Afghanistan: *Ehrlichia canis*, *Babesia canis/gibsoni*, *Rickettsia* spp., *Leishmania infantum*, *Bartonella* spp., and *Anaplasma phagocytophilum*. The survey, which was not completed, was supposed to obtain samples from a minimum of 150 feral dogs being euthanized in accordance with vector control policies. Blood (serum and ethylenediamine tetraacetic acid-preserved whole blood) and tick samples were to be collected for analysis. Analysis was to consist of (1) tick species identification, (2) indirect fluorescent antibody serology, and (3) molecular polymerase chain reaction analysis on all serologically positive samples—as well as tick samples—to assess for correlation between infection and exposure and actual presence of pathogen deoxyribonucleic acid (LTC Andrew McGraw, chapter author, unpublished data, June 2012).

Unfortunately, although sampling materials and instructions were distributed to no less than six sites spread across Regional Command-South and Regional Command-East in Afghanistan, the follow-on and replacement veterinary and preventive medicine units within each Command elected not to participate in this survey. Furthermore, an inadequate number of specimens were collected to provide sufficient data to interpret any valuable results. If it were more complete, this survey's conclusions and clinical relevance could have provided veterinary health care providers and handlers with vital medical threat information about which relevant VBD are present in this area of operations. Additionally, because some of these organisms possess zoonotic potential, this survey may have served as vital public health information for human health care providers and preventive medicine personnel (LTC Andrew McGraw, chapter author, unpublished data, June 2012).

Lessons learned from this unfinished study reinforce the precept that any disease surveillance initiative in a given theater of operations needs to be mandated in a "top down" fashion from the theater veterinarian to prevent these initiatives from being dropped before they are fully implemented or completed. Without buy-in from follow-on personnel, the enduring potential for new surveillance programs is weak.

THE ARMED FORCES HEALTH SURVEILLANCE CENTER AND DEPARTMENT OF DEFENSE LABORATORY NETWORK

Background and Overview

In 1996, President Bill Clinton issued the Presidential Decision Directive National Science and Technology Council-7 on Emerging Infectious Diseases,[23] which guided the establishment of the DoD Global Emerging Infectious Surveillance and Response System (GEIS). Under the GEIS umbrella, the DoD's overseas and primary Military Health System research laboratories perform infectious disease surveillance, including the study of zoonotic infections within five infectious disease categories: (1) respiratory infections, (2) febrile and vector-borne infections, (3) gastrointestinal infections, (4) antimicrobial infections, and (5) sexually transmitted infections.[24,25]

Prior to GEIS (and beginning in 1985), the US Army Medical Surveillance Activity (AMSA) developed and managed the Defense Medical Surveillance System, a longitudinal database that included the outpatient and inpatient healthcare information of all active duty military members and some beneficiary information. AMSA also housed and managed the DoD's serum repository, which is comprised of serum contributions from human immunodeficiency virus screenings and pre- and post-deployment donations conducted or collected throughout service members' careers.[26]

In 2008, GEIS and AMSA were consolidated into the Armed Forces Health Surveillance Center (AFHSC), providing a centralized location for more rounded disease surveillance activities and a more integrated gateway to public health for civilian and military beneficiaries at home and abroad. By using the AFHSC's combined resources, stronger epidemiological studies of disease occurrence among the military population, including deployed US military personnel, can be pursued. For example, by tapping into the surveillance and monetary resources within the AFHSC, the DoD infectious disease research laboratories can also study diseases of global military importance, including zoonoses.

In 2015, the AFHSC was realigned under the Defense Health Agency as a branch within the Public Health Division. The AFHSC maintains its key roles in disease surveillance, epidemiology, and biosurveillance activities.

Zoonotic Disease Surveillance and the Military Veterinarian

Military veterinarians serve critical roles within the DoD's global infectious disease research laboratories. Because veterinary officers are responsible for surveillance project funding and providing oversight of an

infectious disease steering committee, they significantly influence the research products and programs performed in these DoD laboratories.

The oversight of global surveillance programs that survey both human and animal disease profits from the inclusion of a veterinary perspective, especially with regards to the One Health concept. Since all tracked infectious disease categories—except for the human sexually transmitted infections programs—have a zoonotic or animal health component, veterinary preventive medicine proficiency and public health expertise are very beneficial management tools. Veterinarians are also integral to developing innovative solutions and programs to respond to outbreaks and emerging threats, and interfacing, collaborating, and consulting with senior representatives from the DoD, Centers for Disease Control and Prevention, Department of Homeland Security, Department of State, and other government and civilian agencies.

Zoonotic disease surveillance efforts that have capitalized on, and demonstrated the broad utility of, military veterinarians include development of diagnostic assays; epidemiologic studies defining reservoirs, disease prevalence, and transmission factors; disease surveillance within high-risk populations; and surveillance at the human-animal interface.[27] Military veterinarians have also played key roles in disease discovery,[28] outbreak response,[29-31] epidemiologic descriptions,[32,33] vaccine evaluation and development,[34] and pandemic prevention and response.[35] (See also Chapter 11, Zoonotic and Animal Diseases of Military Importance, and Chapter 15, Veterinary Pathology.)

Using deployed military veterinarians to develop and strengthen a host nation's surveillance programs and laboratory capacity is critical to global zoonotic disease surveillance and control. Nation-building veterinary missions are discussed in more detail in other chapters of this volume. (See also Chapter 17, Veterinary Support in the Irregular Warfare Environment) As previously noted, the comparative knowledge and expertise about animals and humans is the strength of the veterinary medical officer. The veterinarian sees the military and medical environment from a different perspective: this officer brings a more encompassing view to public health and preventive medicine, a specialized perspective that leads to considering different approaches to disease surveillance, epidemiology, outbreak response, and prevention at home and abroad.

US NORTHERN COMMAND CIVIL SUPPORT AND THE ONE HEALTH CONFERENCE

In 2009, a novel human influenza virus, capable of causing serious disease to which the human population had no immunity, emerged in North America and swept the globe. Influenza A, H1N1, a virus that contained swine, avian, and human influenza virus gene segments, first caused human illness in Mexico in March 2009.[36] Shortly thereafter, on April 21, 2009, the Centers for Disease Control and Prevention reported the first cases of emerging H1N1 influenza A infection in the United States.[37] The virus rapidly spread to all 50 states and across the Northern Hemisphere, and in June 2009, the World Health Organization (WHO) declared the new strain of H1N1 a pandemic. By August 10, 2010, the date this iteration of the influenza pandemic was declared over by the WHO, more than 214 countries had been affected and 18,000 deaths had occurred.[38]

The global threat of pandemic influenza led federal authorities to seek civil support from the DoD. Exploding patient workload, coupled with high healthcare worker absenteeism, overwhelmed regional and national medical infrastructures. The pandemic influenza also had a major effect on the world economy and politics by impacting international trade, markets, travel, and investments.

However, care must be taken whenever the DoD provides civil support for pandemics. For example, as a group, DoD personnel are particularly vulnerable to respiratory viral infections based on their exposure to many different populations across the world, their frequent mobility, and their close contact in personal training environments and large-group work settings. DoD mission assurance can be compromised during a pandemic if entire military units or key personnel become ill. The DoD could be affected in other ways as well, including medical readiness, operational capabilities, and freedom of movement.

To mitigate the impact on mission assurance and to prepare to support civil authorities, US Northern Command (USNORTHCOM) operationalized pandemic influenza concept plans 3551—*Concept Plan to Synchronize DOD Pandemic Influenza Planning*[39] and 3591—*USNORTHCOM Response to Pandemic Influenza*.[40] USNORTHCOM's Command Veterinarian Lieutenant Colonel Martin LaGodna monitored and analyzed biosurveillance information streams, collaborated to develop influenza mitigation and response plans, wrote force health protection guidance and instructions, and advised the command as a subject matter expert on infectious disease, animal health, food safety, and preventive medicine.

The experience of recognizing and responding to a human influenza virus of animal origin demonstrated the relevance of the One World-One Health concept (ie, effective public health is multidisciplinary and multifaceted). Global leaders must understand the inter-relationships between human, animal, and

environmental health, and public health challenges and solutions need to be synchronized among medical, animal, food, agriculture, and environmental stakeholders. Since infectious diseases do not respect national boundaries, communication and cooperation is also essential across the international public health community.

To foster a shared vision of the One Health concept among the NORTHCOM Surgeon's joint, interagency, and international partners, Lieutenant Colonel Martin LaGodna obtained a grant from the Armed Forces Health Surveillance Center to sponsor the first NORTHCOM Surgeon's One Health Conference, June 14 through 15, 2011, in Colorado Springs, Colorado. This strategic health meeting brought together more than 100 senior civilian and military public health, food, agriculture, wildlife, and environmental health professionals from Canada, Mexico, the Bahamas, and the United States to discuss biosurveillance, the human-animal-environmental health triad, and emerging One Health infectious disease threats affecting North America and the Caribbean. A second One Health Conference was held the following year (June 12–14, 2012).

VETERINARY CORPS PARTICIPATION IN INTERAGENCY AND EMERGENCY RESPONSE

In addition to supporting global missions, the US Army veterinarian has played an integral role in responding to domestic emergencies. Some of the capability requested as part of the military response effort includes providing veterinary medical expertise and furnishing trained animal and food technicians and equipment to protect public health, domestic and wild animals, and the nation's food supply. During domestic emergencies, these US military personnel primarily use their allocated resources and specialized training to accomplish the following critical tasks: (*a*) assisting efforts to prevent contamination of food; (*b*) preventing disease through vaccination programs; (*c*) supporting disease eradication programs; (*d*) establishing temporary animal shelters and hospitals; and (*e*) performing food inspections.

Today's interagency relationship between the US Army Veterinary Corps (VC), the US Department of Agriculture (USDA) Animal Plant Health Inspection Service (APHIS), and the Federal Emergency Management Agency can be traced back to 1972 with the creation of APHIS and the Defense Civil Preparedness Agency (DCPA). In 1977, DCPA evolved into the Federal Emergency Management Agency (FEMA).[41]

Since its creation in 1916, the Veterinary Corps' duties to respond to national emergencies has transformed from "ad hoc" response units to the more modern and sophisticated Medical Detachment Veterinary Service Support units. Every year, one Medical Detachment Veterinary Service Support unit is designated to remain on alert and trains continuously to respond to any national or state emergency.

The US Army VC senior leadership works closely with the USDA and other federal agencies in times of natural disasters. Two historical emergency response events in which the VC provided significant contributions to protect the nation from disease, food, and animal loss are highlighted below. (In addition to Chapter 17, Veterinary Support in the Irregular Warfare Environment, already cross-referenced in this chapter, see also Chapter 1, Military Veterinary Support Before and After 1916, and Chapter 9, Food Safety and Food Defense, for more information about other US veterinary efforts to aid military and civilian populations across the globe.)

Venezuelan Equine Encephalomyelitis Outbreak, Texas, 1971

The USDA and US Army began monitoring Venezuelan equine encephalomyelitis (VEE) outbreaks in Central and South American horses and humans since the viral disease was first identified in Venezuela in 1938. VEE contributed to the death of hundreds of thousands of horses in South America, and during the 1960s, a VEE epidemic slowly advanced from upper South America through Central America and into Mexico, threatening each country's human and equine populations and the US horse industry.

The governments of Colombia, Ecuador, Guatemala, El Salvador, Honduras, Nicaragua, Costa Rica, and Mexico requested US assistance to halt this deadly emerging disease. US Army laboratories that had been studying and investigating the disease since its discovery evaluated VEE's capabilities as a bioweapon and developed a live attenuated human vaccine called TC-83 to protect those scientists who studied the virus. In 1968, TC-83 was used in Colombia in horses, and the vaccine provided good immunity against VEE.

Overall, more than two million horses in Central and South America were immunized with the TC-83 vaccine from 1967 to 1970. Horse deaths ended 7 to 10 days after vaccination, and the vaccine protected 90 percent of equine populations. Furthermore, following the vaccination of the majority of horses in rural communities, human cases ceased to occur.[42] Despite such results, during this time, TC-83 was still considered experimental and was not approved for use in horses by the USDA.

In mid- to late June, VEE cases were identified among horses and humans in Mexico just south of the US border in Brownsville, Texas.[43] On June 19,

1971, a task force was assembled in Harlingen, Texas, to prevent the spread of VEE using vaccination as a primary mitigation measure. The objective was to protect horses and humans from VEE, and in the event of its appearance in the United States, to implement additional control measures such as aerial spraying and quarantines to halt the spread of the disease. The task force consisted of multidisciplinary specialists, including representatives from USDA, US Public Health Service, DoD (ie, US Army veterinarians, preventive medicine officers, and Air Force officers), Texas Animal Health Commission, and Texas State Department of Health. On June 25, 1971, vaccination in horses was started.[42,43]

Despite vaccination, VEE virus was isolated from a horse on June 30, 1971. During the first week in July, equine encephalitis fatalities were identified, and on July 5, 1971, the first confirmed human case was diagnosed (in a man). The Texas outbreak was the first documented VEE outbreak in the United States.[42]

The US Air Force began aerial spraying on July 10, 1971. Six days later, the Secretary of Agriculture Clifford M. Hardin declared Texas under a state of emergency. New Mexico, Oklahoma, Arkansas, and Louisiana were placed under quarantine to ensure VEE would be contained and not spread to other states. The USDA also obtained TC-83 from the military to vaccinate all horses in Texas, New Mexico, Oklahoma, Arkansas, and Louisiana.[42]

The disease peaked among Texas horses during the third week in July, but cases continued presenting until November 7, 1971. The role of the military veterinarian during this crisis included detection of equine cases, vaccination of horses, working cooperatively with county extension agents, and contributing to the newly established equine surveillance system. Prior to the outbreak, military veterinarians were instrumental in the study of VEE and development of the vaccine used to protect both humans and horses.[42]

H5N2 Highly Pathogenic Avian Influenza Outbreak, 1983

On April 22, 1983, the first cases of low pathogenic avian influenza H5N2 were diagnosed among layer flocks near Lancaster, Pennsylvania. Clinical signs included mild to moderate loss of production and mortality at less than 10 percent. This pattern of disease continued until October 1983 when the low pathogenic form became a highly pathogenic form and the state requested federal assistance. Poultry mortality reached high levels (ie, up to 90 percent) in Pennsylvania, and within a month, the disease spread to New Jersey, Maryland, and Virginia.[44] Each state determined its own quarantine areas and, with some federal assistance, enforced control measures to reduce the movement of infected animals or contaminated vehicles, equipment, and product.[44,45]

Depopulation, which focused only on flocks that resided within the quarantined areas, was determined to be the best control measure. This control was first implemented in Virginia and Maryland, followed by Pennsylvania and New Jersey. Over 17 million birds were euthanized from 448 flocks that were affected. Quarantine areas in New Jersey were released by state and federal quarantine authorities in March 1984 and in Virginia and Pennsylvania in September and October 1984, respectively; surveillance programs were set up thereafter and continued several months past the quarantine release.[44,45]

In order to accomplish the surveillance and control measures, the US Veterinary Corps provided over 40 veterinarians to assist in the areas of diagnostics, pathology, and epidemiology among the 200-plus DoD soldiers and civilian employees who deployed to the quarantined areas. The military also provided equipment for communications, transportation, and laboratory analysis and supplemented the control efforts to overcome the logistical challenges faced in this extensive animal disease outbreak.[44]

SUMMARY

Military veterinarians understand the One Health concept and promote this modern initiative's implementation in various global and domestic endeavors: (*a*) they work collaboratively within the military health system and contribute to the health and well-being of the military member and their families; (*b*) they are extensively trained and can be accredited and credentialed in the specialized roles of disease surveillance and control, at home and internationally, as they provide care for animals, food safety, and security; (*c*) they proffer insights for zoonotic disease surveillance, epidemiology, prevention, and outbreak response at home and abroad; and (*d*) they track diseases of military importance and contribute to the health of military members using new technologies and data management that assist in surveillance. As coordinating participants within the US interagency, the US Army VCs contribute key subject matter expertise, experience, and capability to emergency response measures that keep the United States safe and secure from diseases that affect the economy, security, and health of animal and humans. Military veterinarians will continue to serve as valuable team members of the military health care team, helping to keep all service members fit and healthy to fight.

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