Chapter 30

THE ROLE OF VETERINARY PUBLIC HEALTH AND PREVENTIVE MEDICINE DURING MOBILIZATION AND DEPLOYMENT

VICKY L. FOGELMAN, DVM, MPH; JOANNE BROWN, DVM; GEORGE E. MOORE, DVM; W. DAVID GOOLSBY, DVM, MPH; RANDALL THOMPSON, DVM; AND PAUL L. BARROWS, DVM, PHD

V. L. Fogelman; Colonel, US Air Force, BSC; Academic Director, International Health Program, US Air Force Radiobiology Research Institute, 8901 Wisconsin Avenue, Bethesda, MD 20889-5603

J. Brown; Colonel, Veterinary Corps, US Army (Retired); Rt 2 Box 152B, Monticello FL 32344; formerly, DoD Veterinary Laboratory, 2472 Schofield Road, Bldg 2632, Fort Sam Houston, TX 78234-6232

G. E. Moore; Colonel, Veterinary Corps, US Army; Chief, Department of Veterinary Sciences, Army Medical Department Center and School, Bldg 2840, Suite 248, 2250 Stanley Road, Fort Sam Houston, TX 78234-6145

W. David Goolsby; Lieutenant Colonel, Veterinary Corps, US Army (Retired); 1247 Shadowood Drive, Spartanburg, SC 29301; formerly, Chief, Plans and Programs, DoD Veterinary Service Activity, 5109 Leesburg Pike, Falls Church, VA 22041

R. Thompson; Major, Veterinary Corps, US Army; Attn: Commander, EAMC-VS (Korea), Unit 15252, APO AP 96205-0025; formerly, Chief, Field Services Branch, Department of Veterinary Science, AMEDD Center and School, 2840 Stanley Rd, Fort Sam Houston, TX 78234

P. L. Barrows; Colonel, Veterinary Corps, US Army (Retired); 56 Crazy Cross Road, Wimberly, TX 78676; formerly, Director, DoD Veterinary Service Activity, Chief, US Army Veterinary Corps, Department of Veterinary Sciences, Army Medical Department Center and School, Bldg 2840, 2250 Stanley Road, Fort Sam Houston, TX 78234-6145

HISTORICAL PERSPECTIVE

The US military recognized the need for veterinarians as early as the mid-1800s. Horses and mules were a critical component of the fighting force during the Civil War, as they had been in previous conflicts, but they often received little or no medical care. Meat procured for the troops was also frequently unwholesome, resulting in significant morbidity and even death among US fighting forces.[1] Although the US Army Quartermaster General appealed to Congress for creation of a veterinary corps in 1853, his request was denied; as a result, more than 1.2 million horses and mules died during the Civil War due to lack of sufficient veterinary care.[2]

After the Civil War, public attention was drawn to the inhumane and indifferent care of horses and the failure to protect military forces from unsafe food and zoonotic diseases. Generals Grant and Sherman became proponents of an organized military veterinary corps after witnessing the inhumane treatment of animals during the war and recognizing the positive impact that a well-trained veterinary corps had on the British and German armies. The formation of the American Veterinary Medical Association and the Bureau of Animal Industry also contributed to the effort to establish an organized veterinary service in the US military. Both organizations represented organized veterinary medicine, understood the relationship between public health and preventive medicine, and made appreciable gains against many animal diseases.[3] These factors, plus increased Congressional interest after hearing of the US casualties from beef "embalmed" in formaldehyde during the Spanish-American War, resulted in the formation of a military veterinary service under the National Defense Act of 1916.[4]

The original mission of the Army Veterinary Service was to treat horses and mules and to inspect meat for the Quartermaster Corps. In 1917, the role of veterinary medicine in human health was recognized as the Veterinary Corps was integrated into the Army Medical Department. More than 2,000 veterinarians served in the world wars, more than 1,100 in the Korean War, and more than 1,200 in the Vietnam War.[3,5] There were more than 1,330 Army veterinarians and veterinary specialists assigned to the Army veterinary service and 900 more in the Reserve Component in 1999. The mission of today's military veterinary service is to provide food safety and inspection services, zoonotic disease prevention and control, laboratory and medical research support, and clinical veterinary services for government-owned animals.

The US Air Force also formed a veterinary service after it became a separate entity in 1947. This service, while similar in function to the US Army Veterinary Service, included the additional mission of overseeing base food service sanitation programs and performing foodborne illness outbreak investigations. In 1980, by Congressional mandate, all clinically related veterinary activities were placed under the auspices of the Army Veterinary Corps; veterinarians and veterinary technicians who chose to remain in the Air Force became public health officers or technicians with the function of managing all food safety, communicable disease, occupational health, medical entomology, epidemiology, and public health education programs for the base or command to which they were assigned. The Air Force still recruits veterinarians as public health officers.

VETERINARY MOBILIZATION FORCE STRUCTURE

The veterinary deployment force is transitioning to a flexible structure, which consists of specialized detachments that can be assembled into a tailored veterinary support package based on mission needs. The initial deployment element is a team from the Veterinary Surveillance Detachment, which provides the initial food inspection and food microbiological laboratory support, sets up zoonosis control programs, and provides primary and preventive care for military working dogs in-theater.

A Veterinary Food Procurement Detachment is also available to support local procurement of such foodstuffs as red meats, poultry, eggs, dairy products, ice, and bottled water. Finally, an Animal Medical Detachment provides full-service medical and surgical care to deployed military working dogs. This detachment also supports zoonosis control programs and civic action animal health programs as directed.

The US Army Civil Affairs and Psychological Command, which is part of Special Operations Command, has veterinary staff officers at the battalion and brigade levels and as part of their deployable teams. These staff officers establish liaison with the host-nation government, coordinate in-country support, and define potential humanitarian civic action projects for US forces within the mission. Civil Affairs veterinarians are often de-

ployed in support of conventional military units that lack veterinary assets.

Veterinarians are also assigned in support of Special Forces operations. During deployments, the Special Forces Group (SFG) veterinarian may serve with the Environmental Science Officer as the SFG's preventive medicine team. This team focuses on the prevention of disease and nonbattle injury in Special Forces personnel. The preventive medicine team's mission includes food and water safety, field sanitation and hygiene, pest control, and prevention and control of zoonotic diseases. During deployments with a primary medical mission, such as humanitarian civic action, the veterinarian works with the host nation to improve the lives of the local human population primarily by improving the health and welfare of their animals. The Special Forces veterinarian is also involved in sustainment training of the Special Forces medic. This training includes a range of topics from zoonotic and foreign animal disease recognition to local procurement of food, including field slaughter and carcass evaluation. The SFG veterinarian serves as a member of the Group Surgeon's office and a special staff officer to the SFG commander on all veterinary matters.

The US Army Veterinary Corps, as the Department of Defense (DoD) Executive Agent for Veterinary Services, provides equitable veterinary support to all the military services. Veterinary Staff Officers identify resourcing requirements in the operational plans of the warfighting Commanders in Chief (CINCs) and individual military services. Examples of veterinary support across military service lines include food inspection support of Navy supply ships at sea; support of Marines during the training exercise Operation Ocean Venture, and support of US Central Command and the Air Force in Southwest Asia.

PUBLIC HEALTH AND PREVENTIVE MEDICINE RESPONSIBILITIES

Food Safety and Quality Assurance

Food service in the field must provide nutritious, wholesome food to military personnel. Veterinary services, logistics, food service, and preventive medicine are all involved in ensuring that wholesome food reaches the force. Veterinary Service personnel ensure that all food entering, stored in, procured in, or issued in a theater of operations meets wholesomeness and quality assurance standards through a series of inspections beginning before food enters the theater and ending at the point of issue to personnel. Deployed veterinary personnel inspect food intended for military local purchase in foreign countries, approve sanitation levels at local food production facilities, inspect food transport vehicles, and perform in-storage surveillance inspections of all foods, including operational rations. Veterinarians may also on occasion perform antemortem and postmortem inspection of food animals intended for consumption by military forces. Veterinary personnel also provide recommendations and support to commanders on disposition of contaminated food, foodborne illness outbreak investigations, and food decontamination. Veterinarians are also trained to inspect, monitor, and test food and food-producing animals suspected of being contaminated with nuclear, biological, and chemical (NBC) agents.

During contingency operations, Army veterinary food inspection personnel are usually located at the theater surgeon's office, with area support teams assigned to support the food supply system. In multinational operations, the responsibility for food procurement, preparation, and delivery, as well as food safety, may be shared among the participating nations. Differences in standards may exist, but the underlying principles of sanitation and food safety remain.

Food safety involves control of physical, chemical, and microbiological threats. A potentially hazardous food (PHF) is a food that is capable of supporting either the rapid and progressive growth of infectious or toxigenic microorganisms or the relatively slower growth and toxin production of organisms such as *Clostridium botulinum*. It is the PHFs that are the biggest concern in food safety. An additional concern is contamination of generally safe foods (or non-PHFs) with a significant dose of an infectious agent, such as the contamination of salad with *Salmonella*. Exhibit 30-1 shows examples of PHFs and of generally safe foods.

Procurement

Assuring the safety of the food supply begins with procuring wholesome subsistence. Within the continental United States, numerous government agencies contribute to the maintenance of a safe food supply, including state and local public health agencies, the US Department of Agriculture (USDA), the US Department of Commerce, and the US Food and Drug Administration, as well as the Army Veterinary Service. In most overseas areas of operation, the Army Veterinary Service and the US Air Force Public Health Service are charged with performing all of the food safety functions of these agencies.

All local food production sources must be approved by the US Army Veterinary Service or the

EXHIBIT 30-1

POTENTIALLY HAZARDOUS FOODS

Potentially Hazardous Food is food that is natural or synthetic and that requires temperature control because it is in a form capable of supporting

1. The rapid and progressive growth of infectious or toxigenic microorganisms,
2. The growth and toxin production of *Clostridium botulinum*, and
3. In raw shell eggs, the growth of *Salmonella enteriditis*.

Examples include:

- Food of animal origin that is raw or heat-treated
- Food of plant origin that is raw (eg, raw seed sprouts) or heat-treated
- Garlic and oil mixtures that have not been modified to stop growth of infectious or toxigenic microorganisms

This definition does not include:

- Food in an unopened, hermetically sealed container commercially processed to achieve and maintain commercial sterility under conditions of nonrefrigerated storage and distribution
- Food for which laboratory evidence demonstrates that the rapid and progressive growth of infectious or toxigenic microorganisms or the growth of *S enteriditis* in eggs or *C botulinum* cannot occur (It may contain a preservative, another barrier to the growth of microorganisms, or a combination of barriers that inhibit the growth of microorganisms.)

US Air Force Public Health Service personnel before the military purchases foods from these sources. These approvals vary greatly in their complexity, depending on the food being procured (Table 30-1). In

TABLE 30-1

COMPLEXITY OF APPROVAL FOR VARIOUS FOODS

Food	Complexity of Approval	Reason
Dairy/ice cream	Very complex	Herd health, plant sanitation, equipment standards, no final consumer safety process
Processed dairy	Complex	Herd health, plant sanitation
Beef, pork, lamb, veal	Complex	Herd health, plant sanitation, items cooked before consumption
Poultry	Complex	Flock health, plant sanitation, items cooked before consumption
Ice and water	Moderately complex	Plant sanitation, water source, filtration systems
Fresh fruits and vegetables (whole)	Less complex	Usually not potentially hazardous but may be a problem if feces (night soil) are used in the growing area
Bakery	Less complex	Cooked product, usually not potentially hazardous
Shell eggs	Moderately complex	Flock health, plant sanitation
Sandwich, salad, and prepared foods	Moderately complex	Plant sanitation, food handler risks, no final and prepared foods consumer safety process
Minimally processed fresh fruit and vegetable juice	Moderately complex	Agricultural practices, plant sanitation, water treatment

some parts of the world, sanitary practices may make approval difficult, so some products readily available in the United States may not be easily obtained overseas. For example, milk production plants in some countries do not meet US pasteurization standards and thus provide potential for transmission of zoonotic diseases, such as tuberculosis, through milk. The US Army Veterinary Service maintains a directory that lists the establishments that have been inspected and have met sanitary standards.[6] Food establishments providing certain nonhazardous foods need not be approved or listed in the directory. This information can be obtained from the Veterinary Service or through the Armed Forces Medical Intelligence Center in Frederick, Md.

Transportation

Food procured from an approved source must be transported to the consumer. Whether civilian or military, the transportation system presents many risks to food safety. Good vehicle sanitation is important to ensure a minimal risk of contamination. The vehicle should be clean and covered, and the food storage compartment kept in good repair. The vehicle must have the ability to maintain the proper temperatures, and consideration must be given to the time it takes to convey perishable products. Extended delivery distances increase the risk of in-transit damage or refrigeration breakdowns, which in turn increase the potential for food spoilage and contamination.

Similar attention must be paid to the transport and distribution of food items from a centrally located military supply point in an area of operations to the final destination at the unit. Limitations on availability of transportation may lead to attempts to mix loads. While the efficient use of transportation is good, food stocks should not be mixed with incompatible cargo (eg, petroleum products, chemicals, cleaning compounds, other potential contaminants). Refrigerated conveyances should be used when possible to transport perishable goods. If refrigerated vehicles are not available, insulated containers may be used, after due consideration is given to time and temperature factors. If chill or freeze temperatures will not deviate significantly and there is a short time between transit, preparation, and serving, use of nonrefrigerated vehicles may be feasible. Coordination with veterinary and preventive medicine personnel must be conducted before employing this method of transit. An additional concern in the tactical environment is the physical damage that can occur when food is transported in heavy-duty trucks over rough terrain with improper packing and strapping.

In-storage Protection

The primary protection factors to be considered when storing subsistence are proper temperature control and protection from contamination, infestation, and the elements. If possible, storage sites should include enclosed buildings that offer protection from the elements and reduce insect and rodent contamination. Food storage sites should not be placed adjacent to petroleum product points, highly trafficked dirt roads, areas subject to flooding, or other obvious sources of contamination. The goal is to use a site that will minimize damage, contamination, and deterioration of the products. At a field site, pallets and tarps or plastic coverings may be used. Storing food products in direct sunlight may significantly reduce their quality and shelf life. At no time should chilled or frozen food items be stored without proper refrigeration (Table 30-2).

Operational rations are of particular interest. They are often stressed by storage in adverse environmental conditions (eg, extreme heat) and may become contaminated by chemicals (eg, petroleum) or by NBC agents during wartime operations. Foods that have been held under improper storage conditions for excessive periods of time may also be hazardous to human health. Army Veterinary Service and Air Force Public Health Service personnel perform periodic surveillance inspections of food items in storage. This mission is primarily performed by enlisted food inspectors under the direction of a veterinarian or public health officer. These individuals can advise commanders as to the condition, identity, quality, and wholesomeness of food products within the system, as well as make recommendations on proper storage. After Hurricane Andrew

TABLE 30-2

APPROPRIATE TEMPERATURES FOR THE STORAGE OF FOODS

Food	Proper Storage Temperature
Frozen goods	–18°C (0°F) or below
Chilled items	–2°C to 4°C (28°F to 40°F)
Fresh fruits and vegetables	2°C to 13°C (35°F to 55°F), depending on the commodity
Semi-perishables*	Refrigerated storage not required but items must be protected from the elements in a cool, clean, dry area on pallets or shelving units

*For example: rice, beans, flour

hit Florida in 1992, military food inspectors assisted local community leaders and military commanders in determining which foods stored in facilities without electricity were fit for consumption.

Food Service

Food service in the field focuses on several key concerns. Increased likelihood of contamination from the environment, limited resources, potentially stressed food supplies, and extended transport of finished, cooked food all contribute to an increased potential for foodborne illness. Food service personnel must strive to maintain food facilities at the highest level of sanitation to minimize sources of contamination within the facility. Training of transport personnel who deliver prepared food to field sites is also extremely important. Veterinary personnel can also provide recommendations and support to commanders on appropriate site selection for food distribution points and field kitchens.

The single most important concept for food safety is the time and temperature relationship: the time a food is held at a temperature where microbial growth can occur must be kept to a minimum. Foods must be held at a temperature that is either too hot or too cold for extensive microbial growth. This includes the time during storage of the uncooked food, preparation, cooking, cooling, storage of the cooked food, transportation of the cooked food, holding on the serving line, and reheating of leftovers. The most common single cause of foodborne illness outbreaks is improper cooling following preparation of food (Exhibit 30-2).

Operational Rations

Operational rations are those foods that are used to support service members in the field and include a number of options. They are discussed more fully in chapter 17, Nutritional Considerations in Military Deployment. One of the safest food items procured by the military is the Meal, Ready-to-Eat (MRE) ration. Commercial retort technology is used when making the main course of the ration. Additional safety factors are built into the process to ensure a wholesome product. Inspections throughout the process by in-plant quality control personnel and the USDA provide added safety assurance. Army Veterinary Service personnel are stationed at assembly plants to make final inspections before MREs are distributed. Like any other subsistence item, the MRE can develop problems if it is abused. Extremes of temperature can lead to breakdown of either the packaging or the product. Exposure to chemicals or petroleum products can cause chemical contamination of the food, and saving portions for reuse after opening can result in bacterial contamination.

Disease Prevention and Control

Zoonotic Diseases

One of the most important responsibilities of veterinary personnel in the field is to prevent unnecessary lost duty time for military personnel caused by zoonotic diseases. The Army Veterinary Service is responsible for establishing appropriate zoonotic dis-

EXHIBIT 30-2

FACTORS MOST OFTEN NAMED IN FOODBORNE OUTBREAKS

Reported cases of foodborne illness usually involve more than one of these factors:

- Failure to properly cool food (the leading cause of foodborne outbreaks)
- Failure to thoroughly heat or cook food
- Infected employees who practice poor personal hygiene at home and at work
- Preparing food a day or more in advance of being served
- Adding raw, contaminated ingredients to food that receives no further cooking
- Allowing foods to stay for too long at temperatures favorable to bacterial growth
- Failure to reheat cooked foods to temperatures that kill bacteria
- Cross-contamination of cooked food by raw food, improperly cleaned and sanitized equipment, or employee mishandling of food

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ease prevention and control programs. A portion of this function is accomplished by ensuring that effective food safety programs are in place. For example, inspection of dairy plants in foreign countries to ensure that proper pasteurization procedures are being performed contributes to prevention of milk-borne diseases, such as brucellosis and bovine tuberculosis.

Animal control programs and commander and service member education are also important elements of zoonotic disease control in the field. Because of the risks of disease transmission and personal injury, wild, feral, and domestic animals may pose serious threats to deployed personnel. Animals adopted as unit mascots pose some of the greatest threats. Puppies can develop rabies at as early as 6 weeks of age and can be heavily infected with endoparasites and infested with ectoparasites transmissible to humans. Animals such as lizards are potential sources of salmonella infection, and wild rodents and mammals are often attracted to camp sites by accumulation of trash, improper food storage, and other unsanitary practices. Animal bites can be a frequent occurrence in deployment settings if effective animal control measures are not in place. Veterinarians play a key role in advising commanders on animal control, field sanitation, and other practices that if implemented early and consistently will greatly reduce the likelihood of transmission of zoonotic diseases.

Rabies is often one of the most important zoonotic disease threats during contingency operations. Rabies is enzootic in the dog in many parts of the world, including numerous countries in Africa, Asia, and Central America. Feral dogs are quite common in these areas. Because of the close relationship between humans and dogs and most people's lack of understanding of the rabies threat, deployed personnel often put themselves at risk for rabies exposure. Military veterinarians assigned or deployed to foreign countries can provide information on the prevalence of rabies and other zoonotic diseases of interest to commanders, health care providers, and deployed personnel. Veterinarians also serve as the quarantine authority for animal bite cases involving humans and serve as members of the Rabies Advisory Committee, which makes recommendations for postexposure rabies prophylaxis in animal bite patients. It is very important that all animal bites are reported to the assigned veterinarian as soon as they occur so that efforts can be made to locate the animal for quarantine or other appropriate action.[7]

Government-owned animals, such as military working dogs, may act as sentinels for diseases of importance to humans. For example, during Operation Joint Endeavor in Bosnia, 5 of 14 military working dogs developed babesiosis, a tickborne disease, in March of the first deployment year.[8] This outbreak served as a sentinel event for tick activity in the theater and allowed early notification of commanders to reinforce their units' use of personal protection measures against ticks. Military veterinarians should be included in discussions of the prevalence and risk of transmission of zoonotic diseases to military personnel in deployment areas.

Public Health Laboratory Support

Veterinary laboratory support for the US military is provided by three laboratories, each of which serves a specific region. The laboratory at Fort Sam Houston, Tex, supports military personnel stationed in the continental United States, the Caribbean islands, Central America, and the Pacific Rim. The laboratory at Schofield Barracks, Hawaii, supports Hawaii and parts of Southeast Asia; and the laboratory at Landstuhl, Germany, serves Europe, the Middle East, and Africa.

A major mission of the veterinary laboratories is to provide microbiological, chemical, toxicological, and radiological analysis of food items, bottled water, nonprescription drugs, and cosmetics for safety, wholesomeness, and contractual compliance. The laboratories have food analysis capabilities that include more than 100 microbiological and chemical tests, in addition to numerous specific toxicological and radiological tests. Microbiological testing capability ranges from simple plate counts to specific pathogen identification. Chemical and toxicological testing capabilities are quite varied and can be used to determine both safety and quality of tested products. Examples of such tests include the milk phosphatase test for the adequacy of pasteurization, specific drug residue tests, and tests for pesticides, heavy metals, histamines, and aflatoxins. Food and water can also be tested for radiological contamination, and veterinarians serve as part of incident response teams for radiological emergencies.

These veterinary laboratories play a vital role in determining the causative agent in foodborne disease outbreaks. Specific testing can be conducted for the following food pathogens: *Staphylococcus aureus* (both organism and toxin), *Escherichia coli* (including O157:H7), *Campylobacter jejuni, Clostridium*

perfringens, *Cl botulinum*, *Listeria monocytogenes*, *Bacillus cereus*, *Shigella* species, *Vibrio parahemolyticus*, *Yersinia enterocolitica*, and *Aeromonas hydrophila*.

In addition, the regional veterinary laboratories provide some diagnostic testing capabilities for animal diseases. Animal brain tissue can be tested for rabies, and specific serologic tests can be performed for the causative agents of rabies, ehrlichiosis, babesiosis, Lyme disease, equine infectious anemia, bluetongue, toxoplasmosis, leptospirosis, brucellosis, and Rocky Mountain spotted fever. Additional information on veterinary laboratory capabilities can be obtained in Army Regulation 40-28, *DoD Veterinary/Medical Laboratory Food Safety and Quality Assurance Program*,[9] or by contacting the appropriate support laboratory.

Veterinarians provide laboratory support in the field in another capacity as well—as members of the Theater Area Medical Laboratory (TAML). Veterinary support to the TAML includes a veterinary pathologist and a veterinary laboratory animal specialist with training in public health. These officers provide the capability for rapid field diagnosis of zoonotic diseases and identification of potential biological warfare agents using technology based on enzyme-linked immunosorbent assay and polymerase chain reaction technology adapted for field use. These individuals can also survey endemic animal populations, perform epidemiologic investigations, and identify potential disease reservoir hosts that can affect the health of deployed personnel. Typical diagnostic capabilities include tests for agents that cause such diseases as plague; anthrax; brucellosis; rabies; eastern, western, and Venezuelan equine encephalitis; and numerous hemorrhagic fevers.[10]

Disaster Operations and Military Operations Other Than War

Military veterinary units play a very important role in disaster response and humanitarian assistance operations.[11] Their primary responsibilities are much the same as during regular deployments, plus assisting civil authorities in animal disaster relief efforts as necessary. During wartime operations or civilian disasters involving potential NBC contamination of foods, veterinary personnel are responsible for the operation of detection equipment used to determine the extent of contamination of foods and food animals. They also provide commanders with recommendations on whether or not to decontaminate foods.[12] Military veterinarians involved in disaster situations, both in the United States and overseas, may be asked to assess the impact of animal loss on a local population and to provide recommendations concerning the care and feeding of live animals.

Although the US Public Health Service is the lead agency in providing veterinary response to natural disasters in the United States, US Forces Command (FORSCOM) supplies assets to supplement civilian resources on request. After Hurricane Andrew, when the governor of Florida determined that the state alone could not handle the emergency, military veterinary personnel were deployed to the area to provide assistance in food inspection, treat sick and debilitated animals, assess veterinary capabilities in the area, and assist the community in returning to its predisaster status.[11,13]

Military veterinarians also assist with evacuations of military-owned pets and government-owned animals from disaster locations overseas. Both Army and Air Force veterinarians supported the evacuation of more than 2,000 pets from the Philippines following the eruption of Mount Pinatubo in 1991. In the summer of 1996, US Army veterinary personnel assisted in the evacuation of 85 pets from Riyadh, Saudi Arabia, after the bombing of a US military housing complex there. The human-animal bond is very strong, and this intervention by veterinary personnel during times of extreme stress helps to relieve the anxiety felt by service members concerned about their pets' welfare during a disaster.

Military veterinary personnel have long been integral to military operations other than war. There are many recent examples of veterinary support in conjunction with DoD humanitarian operations. In November 1995 during Joint Operation Balikatan, US Army veterinary personnel visited the Philippines to work and train with Philippine military veterinarians. During the exercise, US and Philippine military veterinary personnel provided veterinary preventive medicine interventions, including more than 6,000 rabies vaccinations to dogs located around Olongapao City. This preventive measure provided a protective barrier against human rabies in a country that reported more than 340 human rabies deaths and more than 60,000 treatments for dog bites in 1995.[14]

FORSCOM and Special Operations Command veterinary personnel supported US military operations in Haiti from 1994 to 1996. In an example of military veterinarians providing assistance to other countries in identifying and controlling potentially

Fig. 30-1. Two US Army personnel, one a preventive medicine physician (***a***) and one a member of the Special Forces Civil Affairs Battalion (***b***), are deworming animals in Haiti in 1987. The physician is wearing the United Nations blue cap. Another member of the team (***c***) treats an ulcer on the back of a horse. These efforts were an attempt to improve the lives of Haitians by improving the health of their animals.
Photographs: Courtesy of Lieutenant Colonel Jeffrey M. Gambel, Medical Corps, US Army, Walter Reed Army Medical Center, Washington, DC.

devastating animal diseases within their countries, a veterinary support team operating with the US Joint Task Force in Haiti identified the first confirmed cases of hog cholera in Haiti. They worked closely with the USDA and Haitian government personnel to vaccinate hogs and develop a control program for this economically devastating disease[15] (Figure 30-1). Veterinary civic action projects often focus on food safety as well as animal health.

Foreign Animal Disease Threats

The United States has been described as an island surrounded by a sea of animal disease. Because of quarantine procedures and animal disease eradication programs, the United States is relatively free of many of the most serious animal diseases. Deployed personnel are at risk of inadvertently introducing foreign animal diseases (FADs), such as foot and mouth disease, into the United States via contaminated food, clothing, and equipment. Primary responsibility for preventing the introduction of FADs belongs to the USDA. Introduction of livestock or poultry diseases into the United States could ultimately cost US citizens billions of dollars. Preventing the introduction of FADs and remaining aware of the risks involved is a responsibility that should be emphasized to personnel deploying to and returning from foreign nations. Military veterinarians are the primary source of information and guidance during deployment regarding FADs.

FORSCOM acts as executive agent for the DoD in the implementation of contingency plans to support the Regional Emergency Animal Disease Eradication Organization, which is part of the USDA. Under the FORSCOM plan, military veterinary assets are made available to support the USDA in efforts to control FADs entering the United States. Military veterinarians have assisted the USDA in controlling outbreaks of exotic Newcastle disease in California poultry, Venezuelan equine encephalitis in Texas horses, and avian influenza in Pennsylvania birds.[16]

One excellent example of the veterinary role in preventing introduction of a FAD into the United States was the Ebola Reston outbreak. In December 1989, a commercial nonhuman primate importer in Reston, Va, began to experience unusual losses of laboratory monkeys recently arrived from the Philippines to an

apparent hemorrhagic fever syndrome. The animals, in addition to being infected with simian hemorrhagic fever, were also infected with Ebola virus. Military veterinary personnel were deployed to mount a week-long emergency biosafety-level-4 operation to help contain and manage the potential public health crisis. Fortunately, the Reston strain of Ebola virus is apparently not pathogenic to humans. The Reston Ebola incident has served as a useful model for the study of complex issues and management of highly hazardous emerging disease outbreaks.[17]

Research Support

Military veterinarians play an important role in force protection as research pathologists, physiologists, toxicologists, and laboratory animal specialists, assisting in development of effective preventive measures against infectious diseases such as Ebola virus infection and Venezuelan equine encephalitis and against potential NBC threats such as botulinum toxin, ionizing radiation, and various chemical agents.

Veterinary pathologists at the US Army Medical Research Institute for Infectious Diseases, Fort Detrick, Md, and the Walter Reed Army Institute of Research, Silver Spring, Md, collaborate with investigators to provide detailed anatomic pathology evaluation of animal tissues at both gross and microscopic levels. They also develop and apply immunologic, cytochemical, and genomic technologies to diagnose and describe the pathogenesis of militarily significant diseases such as Ebola virus. In 1996, a USAMRIID veterinary pathologist traveled to the Ivory Coast of Africa as part of a World Health Organization sponsored collaborative team trying to identify the primary animal reservoir for Ebola virus.[18]

Military laboratory animal veterinarians also support research applicable to contingencies. Laboratory animal veterinarians assigned to USAMRIID, the Walter Reed Army Institute of Research, and the US Army Medical Research Institute for Chemical Defense (USAMRICD) provide procurement, medical care, and maintenance support for animal colonies used in military research. Military laboratory animal veterinarians were the first to develop large, disease-free animal colonies, a critical component in performing infectious disease research. Veterinary toxicologists help to determine the effects of biological toxins and chemical agents on animals. Research performed by veterinarians at USAMRICD in conjunction with other investigators to determine the effects of low-level chemical exposure on animal models has been used to help estimate possible effects on humans of potential low-level exposure to chemical agents during the Persian Gulf War.

Military veterinarians with advanced degrees in food technology help develop safer and more durable field rations for use in many different operational settings. Veterinarians at Natick Laboratories, Natick, Mass, have been intensely involved in developing new techniques for preserving foods, improving methods of performing field food analysis and inspection, and developing safer, more durable, and more palatable operational field rations.

Military Working Dogs

Traditionally, military working dogs (MWDs) have been used by all the military services as force multipliers in missions such as scouting, tracking, mine or explosives detection, narcotic detection, and sentry or base defense work. On deployment, MWDs are often sentinels for exposure to environmental hazards that might affect military personnel. Effective preventive medicine measures in keeping these valuable dogs on the job are necessary not only during procurement and training but also during deployments and while the animals are at their home stations.

Military working dogs have been used by the United States since World War I, in which their use was limited but their effectiveness was acknowledged. In World War II, there was again a recognized need for the use of dogs to support military forces. The Dogs for Defense program did not become viable until 1943, yet during the remaining 2 years of World War II more than 15,000 dogs were used in government service. These dogs were employed by the Army and the Marine Corps in both the European and Pacific theaters, and by the Coast Guard for shore patrols along US waters. MWDs have been used in each major conflict since World War II, including the Persian Gulf War.[19] After the Persian Gulf War, the MWD program was downsized in the four military services.

Veterinarians oversee training and treatment of the dogs and ensure that the environmental stresses of a particular deployed area, heat in particular, are not harmful to the dogs. Veterinary personnel must also control infectious diseases, pests, and parasites in the dogs. A veterinary officer must examine and certify each dog before it is deployed.

The Veterinary Pathology Division at the Armed Forces Institute of Pathology, Washington, DC, acts as the pathology referral laboratory for military working dog tissue and clinical specimens submitted for analysis. This division also maintains a military dog tissue repository, samples from which can be used for stud-

ies on diseases prevalent in MWDs during contingency operations and for studies on MWDs as sentinels for disease among military service members deployed worldwide. Effective and aggressive preventive veterinary medicine is required to keep these "four-footed service members" fit to accomplish their missions.

SUMMARY

Veterinary personnel provide a valuable force multiplier for mobilization and deployment operations. From protection of the military food supply and care of government-owned animals to vital laboratory support, military veterinarians and their enlisted staffs provide a wide range of services that contribute to the health and well-being not only of animals but also of US fighting forces. Military veterinarians are extremely knowledgeable about the natural history and biology of diseases carried by animals and foods and can provide commanders with critical information for preventing such diseases in the field. It is important to include veterinarians in the medical aspects of contingency planning and operations.

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