

REPORT OF THE COMMITTEE ON PUBLIC HEALTH AND RABIES

Chair: Sandra Norman, IN
Vice Chair: Nancy Frank, MI

Helen Acland, PA; Scott Bender, AZ; Sue Billings, KY; Joseph Corn, GA; Stephen Crawford, NH; Donald Davis, TX; Ignacio dela Cruz, MNP; Thomas DeLiberto, CO; James Foppoli, HI; Rose Foster, MO; Robert Gerlach, AK; Keith Haffer, SD; Cathleen Hanlon, NY; Bill Hawks, DC; Jan Hershenhouse, CA; Rick Hill, IA; Christine Hoang, IL; Donald Hoenig, ME; Kristin Holt, GA; Dennis Horter, TN; Shylo Johnson, CO; Patrice Klein, MD; Spangler Klopp, DE; Carrie Klumb, MN; Jennifer Koeman, IA; Donald Lein, NY; Margie Lyness, GA; Joanne Maki, GA; Patrick McDonough, NY; Shirley McKenzie, NC; David Meeker, VA; Lee Myers, GA; Cheryl Nelson, KY; Marguerite Pappaioanou, MD; William Parker, GA; Kris Petrini, MN; Jewell Plumley, WV; Leon Russell, Jr., TX; John Sanders, WV; Joni Scheffel, MN; Stacey Schwabenlander, MN; Tom Sidwa, TX; Robert Singer, CA; Dennis Slate, NH; Jonathan Sleeman, WI; Katie Steneroden, CO; Nick Striegel, CO; Paul Sundberg, IA; Manoel Tamassia, NJ; Belinda Thompson, NY; Brad Thurston, IN; Kurt VerCauteren, CO; Liz Wagstrom, DC; Margaret Wild, CO; Nora Wineland, MO; Stephanie Yendell, MN.

The Committee met on October 23, 2012 at the Sheraton Hotel in Greensboro, North Carolina, from 1:00 to 5:30 p.m. There were 23 members and 30 guests present. Dr. Norman welcomed committee members and guests. She reviewed the committee purpose and guidelines for conducting the meeting.

Presentations

Serosurveillance for *Yersinia pestis* and *Francisella tularensis* in Wildlife From Across the United States

Sarah Bevins

Colorado State University

Co-Authors: Tom Gidlewski, Brandon Schmit, and Thomas DeLiberto

Abstract

Plague (*Yersinia pestis*) and tularemia (*Francisella tularensis*) are bacterial pathogens that are characterized both by their ability to infect a wide-range of vertebrate hosts and by their potential for zoonotic disease transmission. Both are found in the United States, where human cases often involve arthropod vectors; however, infections can come through multiple transmission routes and the dynamics that maintain both plague and tularemia across the landscape are ecologically complex and difficult to isolate. In an attempt to better understand plague and tularemia presence in the environment, a large scale study was initiated by USDA/APHIS/WS to collect samples from probable host species across broad portions of the US. The wildlife sampled for this study was unprecedented in both scope and geographic scale. Samples were collected year round, from January 2005-December 2010, in cooperation with state and other federal agencies, from 47 US states that had previously documented plague or tularemia activity. Multiple Nobuto strips were collected from each animal, with extra strips archived in the National Nobuto Sample Archive, created and housed at the USDA, Animal and Plant Health Inspection Service (APHIS), Wildlife Services (WS), National Wildlife Research Center (NWRC) in Fort Collins, Colorado.

Overall, plague seroprevalence across all regions and species was 8.60%, although region specific plague exposure is often much higher, with some well-sampled counties in Wyoming and New Mexico having coyote exposure rates of 35% and 37% respectively. The data suggest a substantial amount of plague activity across large spatial scales, with carnivores in particular being continually exposed or re-exposed. The degree to which carnivores and omnivorous species are being exposed (Tables 2,3) suggests that prey consumption is driving the plague exposure reported here, although flea-borne transmission occurs as well and cannot be ruled out. On the other hand, *F. tularensis* was very rarely detected, with an average overall seroprevalence of 0.6%. Any seropositive animals that were detected were often spread out over space and time. Retrospective cluster analyses on plague data lined up with known plague epizootics in prairie dogs. These data provide unique insight into plague and tularemia exposure in wildlife from across the US and demonstrate that sampling a small number of wide-ranging carnivores can provide a broad snapshot of disease activity.

Field Evaluation of Raboral V-RG as an Oral Rabies Vaccine in Striped Skunk (*Mephitis mephitis*)

Joanne Maki, Merial Limited

Ernest Oertli, Texas Department of State Health Services

Bruce Leland, USDA-APHIS, Texas Wildlife Services

Abstract

Skunk variant rabies is believed to be the last terrestrial rabies variant in Texas. Oral rabies vaccination (ORV) programs implemented in the State over the past 17 years appear to have eliminated both the domestic dog/coyote and Texas gray fox variants.

ORV involves the distribution of consumable vaccine-filled baits into the environment to induce a protective immune response in targeted species. ORV is regarded as a cost-effective strategy for controlling rabies outbreaks in wild mesocarnivores (Slate et al., 2009; Sterner et al., 2009). Different types of vaccine and baits are currently used for the control of wildlife rabies in North America. The vaccinia-rabies glycoprotein recombinant virus, RABORAL V-RG® (Merial, Athens, Georgia, USA) has been used for many years in the USA (e.g., Sattler et al., 2009) and Canada (Rosatte et al., 2008) to control rabies in wildlife species, primarily raccoons.

In the US, the striped skunk (*Mephitis mephitis*) is the primary skunk reservoir for rabies. Other skunk species: the hooded skunk (*Mephitis macroura*), spotted skunks (*Spilogale sp.*), and hog-nosed skunks (*Conepatus sp.*) can contract the disease but their populations are smaller and geographically limited. Skunks often live in close proximity to humans (e.g., Prange et al., 2004). Thus, in order to decrease public health risks and associated costs for post-exposure rabies prophylaxis, control activities are being implemented to reduce rabies prevalence and spread in skunks (Sterner et al., 2009). The primary skunk species in Fort Bend County, Texas is the striped skunk.

The effectiveness (i.e., field efficacy) of ORV campaigns using these vaccine-baits can be estimated, short-term, by the percentage of live-trapped animals that test positive for rabies virus antibodies (i.e. seroprevalence), and long term, by a significant reduction in the number of rabies cases detected in the vaccinated areas. Although laboratory methods and serology results often differ markedly among the regions where ORV have been used (Robbins et al., 1998; Boulanger et al., 2008; Ramey et al., 2008; Rosatte et al., 2009, see Fehlner-Gardiner et al. 2012 for a comparative study) the most important parameter is the reduction in rabies cases over time.

In addition to the obvious physical and behavioral differences between ORV target species, other factors can impact field effectiveness of an ORV. For example, variation associated with the individual (e.g., age and sex), population (e.g., animal density), control operations (e.g., bait density), and landscape (e.g., habitat composition) have been associated with variations in observed rabies seroprevalences (Robbins et al., 1998; Blackwell et al., 2004; Ramey et al., 2008; Rosatte et al., 2009a; Sattler et al., 2009). This field evaluation provides an opportunity to evaluate the degree to which these factors may impact seropositivity in skunks. This paper describes the first field application of Raboral V-RG in Texas in an area in which skunk rabies has been endemic for more than ten years.

Influenza H3N2 at the Fair: An Outbreak in Animal and Human Populations

Marianne Y. Ash

Indiana State Board of Animal Health

This presentation describes an outbreak of influenza in swine and people at fairs in Indiana during the 2012 fair season, featuring decisions made and actions taken.

On the afternoon of July 12, 2012 the Indiana State Board of Animal Health (BOAH) received a call from the attending veterinarian at the LaPorte County fair. He reported concern over a number of swine at the 4H fair exhibiting high fever and not eating. There were no other signs of illness. His primary concern was that the animals were scheduled to participate in the fair auction beginning at 8 a.m. the following morning and would be delivered for slaughter shortly thereafter. To avert delivery of febrile hogs to slaughter, the body temperature of each pig was taken the following morning. Febrile pigs were sent home and the children participated in the auction carrying a picture or poster describing their 4H animal. Approximately 15% of the pigs were excluded from the auction.

On July 13, the morning of the auction, a local TV reporter called the Indiana State Board of Animal Health to report hearsay of illness in 4H exhibitors at the above mentioned fair. This prompted BOAH to contact the attending fair veterinarian and request random sampling of both healthy and sick pigs, with samples to be delivered to our state diagnostic laboratory.

Over the weekend a diagnosis of swine influenza was reported by the state animal disease laboratory. Concurrently, the local and state health departments were investigating the reported human illnesses. The collaborative efforts of local, state and federal partners readily determined that the virus in the people and animals was almost identical and ultimately classified as a variant H3N2 influenza virus with the matrix (M) gene from the 2009 H1N1 virus.

At this time, there were 27 county fairs and the Indiana State Fair, all scheduled to open in coming weeks. A swine health advisory was distributed to veterinarians, extension educators and industry stakeholders asking that they notify the BOAH of any illness in pigs or people at fair events. The state health department informed hospitals, physicians and county health officials to be alert for flu-like illness in people with swine contact. Between July 19 and 24, BOAH received reports of ill swine at three other Indiana county fairs. Swine check-in at the Indiana State Fair was to begin July 31, with approximately 1,900 swine expected to arrive.

In preparation for the Indiana State Fair, a meeting was held on July 30 with the State Fair leadership team, the State Department of Health, the Board of Animal Health and others to determine the course of action regarding the State Fair's scheduled swine events. After consideration of all information gathered prior to the meeting, including information that the virus was producing relatively mild symptoms analogous to seasonal flu, a decision was made that the swine would be exhibited as scheduled with a few stipulations.

- Body temperatures of all swine would be determined using digital thermometers at check-in prior to unloading.

- For reasons of bio-security, the exhibitor or a member of the exhibitor's family, would take the temperature and hand the thermometer to BOAH staff to be read.
- High temperatures would be confirmed with glass thermometers.
- In consideration of high environmental temperature and travel stress, a 20 minute cool down under BOAH supervision would be offered for swine showing elevated body temperature.
- Swine with body temperatures of $>105^{\circ}$ would be dismissed from the grounds.
- Contract veterinarians and barn staff would do daily inspections of swine.
- BOAH veterinarians would visit the barn daily
- Reporting of all sick pigs to the attending veterinarian for evaluation would be required.
- Any pigs developing high fever and/or respiratory signs during the fair would be dismissed.

On days five and six post check-in, six pigs were sent home due to observed illness and high body temperature. Body temperature of the six pigs ranged from 105.4 to 106.6. All demonstrated evidence of respiratory disease. Samples sent to the state diagnostic laboratory confirmed the presence of H3N2 influenza in all six pigs. These samples were also tested pen-side at the fair using the newly released Swine Influenza Virus Type A Antigen Test Kit manufactured by Synbiotics Corporation and distributed by Pfizer Animal Health. Three of the six pigs were positive on the pen side test.

The decision was made to dismiss all pigs and cancel the open barrow show scheduled for the following day. The swine breed shows scheduled for a week later were not cancelled and occurred without incident. During the breed shows, the pigs arrived during the evening, showed the next morning and generally left by noon.

Analysis of the geographic origin of positive pigs, their distribution within the barn at the fair, their body temperatures upon arrival and other factors offered no clues to the source of infection. Anecdotal evidence based on information from outbreaks at other fairs in Indiana and the observations at the state fair suggests that duration of stay at the fair may increase the likelihood of an influenza outbreak.

The premises ID information required by the state fair and the presence of RFID 840 ear tags in all swine allowed for rapid access to swine origin data for use in epidemiologic analysis. The 1,983 pigs at the state fair came from 721 different farms representing 72 of Indiana's 92 counties.

Confirmed human cases in Indiana associated with this 2012 outbreak totaled 138, with the last human case reported on August 16. These cases came from 24 counties and were associated with 14 fairs.

Discussions are ongoing with private swine veterinarians, the public health community, county and state fairs' management, the swine industry and others regarding recommendations for swine exhibitions in 2013. Key topics for discussion have included: duration of swine event, influenza vaccination, health monitoring and dismissal parameters, management of public contact with swine and general bio-security guidance.

Preferences of Select Attractants in the Coating of ONRAB Vaccine Baits

S.R. Johnson¹, A.R. Berentsen¹, Bruce Leland², Ernest Oertli³, Kurt VerCauteren¹

¹USDA-APHIS-Wildlife Services, Ft. Collins, CO

²USDA-APHIS-Wildlife Services, San Antonio, TX

³Texas Department of State Health Services, Austin, TX

Rabies control managers and researchers in the United States are assessing how the Canadian vaccine ONRAB® may perform if integrated into the United States oral rabies vaccination (ORV) program. A measurement of success of any ORV program is bait uptake by target species. The attractant used in the bait matrix surrounding a vaccine influences bait uptake and vaccination rate. Our objective is to determine which flavor of attractant in the ONRAB® coating is the most preferred by rabies reservoir species in the field. In Texas, we are evaluating four attractants (sweet, fish, egg, and cheese) in areas inhabited by raccoons (*Procyon lotor*), skunks (*Mephitis mephitis*), foxes (*Urocyon cinereoargenteus*), and coyotes (*Canis latrans*). In Puerto Rico, we are comparing the preference of mongoose (*Herpestes auropuctatus*) for cheese, coconut, and fish attractants. We monitored bait stations with animal-activated cameras and regular checks of bait status (untouched, disturbed, and removed). In Texas, our preliminary analysis of the camera data indicates target species consumed at least part of the bait to account for 88 of bait disturbances and removals of the 540 baits we offered. Cheese was manipulated most often (30%), followed by fish (24%), and then egg (19%). Sweet and unflavored were equally touched the least (14%). Raccoon accounted for most of the bait selection (77%) and coyotes the least (2%) with foxes (13%) and skunks (8%) between the two. In Puerto Rico, mongoose removed baits on 41 of 343 occasions. Though all data are not yet fully analyzed, it appears mongoose prefer cheese, followed closely by fish. Findings in both Texas and PR are suggesting that sweet flavors are least attractive to rabies reservoir species. To confidently state which attractants will likely perform the best, we need to complete the analyses of these data and do more extensive trials, especially in raccoon habitat in the eastern United States.

Economic Analysis of the New York State Raccoon Oral Rabies Vaccination Program (Long Island, New York)

Stephanie Shwiff, National Wildlife Disease Center

Laura Bigler, Cornell University

Joanne Maki, Merial Limited

Abstract

Enzootic raccoon rabies in the eastern US exerts a negative economic public health impact on the region. These impacts range from high rates of human post-exposure prophylaxis with associated costs, to the increased public health burdens attributed to managing rabies risk among human, pet, livestock and wildlife populations. As a means to address the national public health care burden of raccoon rabies, state and federal agencies have implemented and managed an oral rabies vaccination (ORV) program in the Eastern United States since the mid-1990s. The New York State program has been an essential part of the ORV effort, designed to impede the northward and westward spread of the disease and to establish wildlife vaccination zones in coordination with Canadian governmental agencies. An economic analysis will evaluate the Long Island portion of the New York State ORV program, where annual applications of the wildlife rabies vaccine, Raboral V-RG®, have been applied since the onset of the epizootic in 2004. The analysis will compare the costs and benefits of the raccoon rabies-elimination program, including oral vaccine distribution parameters and projected costs associated with enzootic terrestrial rabies, versus the costs associated with rabies virus establishment in the densely-populated, suburban habitats outside of New York City (i.e., Long Island, New York).

Multistate Outbreak of LCMV in Rodent Facilities and Associated Human Infection

Sandra L. Norman

Indiana Board of Animal Health

Multiple agencies at the local state and federal level were involved in an outbreak of Lymphocytic Choriomeningitis virus (LCMV) in Indiana in April/May 2012. LCMV was diagnosed in two individuals in Vanderburgh County, Indiana in March 2012. Lymphocytic choriomeningitis virus is a rodent borne viral disease with about 5% of the house mice infected with the virus. Rats are resistant to infection but hamster, gerbils and guinea pigs are susceptible to infection with LCMV. There are no clinical signs in rodents and the virus is shed in mouse saliva, urine and feces. Infected mice will shed the virus for their entire lifetime.

People become infected by exposure to mouse droppings, bedding, saliva or urine via contact with broken skin, eyes, nose, mouth, or via an animal bite. About 2-5% of people in urban areas have a titer. Some people do not become ill once they are infected. After an 8-20 day incubation period, people present with flu like symptoms, pain in the chest, testicle and lymph nodes. Some infected individuals will progress to encephalitis and meningitis which can lead to hospitalization. Pregnant women are susceptible to infection with the risk of birth defects of mental retardation, fluid on the brain and spontaneous abortion. Death in transplant recipients in 2005 shows the susceptibility of immune suppressed people.

Investigation into the cause and possible source of infection was initiated by the Indiana State Board of Animal Health (BOAH) in cooperation with the Indiana State Department of Health (ISDH). The index individual is employed at rodent supply facility that raised mice and rats primarily for food to be given to reptiles at zoos and other reptile facilities. The other individual cohabitated with the index person. There were no rodent problems found when the initial investigation was done at the home of the index cases. The initial thought had been contact with wild rodents around the residence of the index case.

Interviews with the owner and manager of the rodent facility indicated 52 employees at a facility that produced live and frozen rodent product for food. At the time of the initial investigation, the owner of the facility indicated he did not provide rodents to pet stores or live sale to the general public and that he had no new introductions into his population for years. There was fairly good bio-security on the premises with good wild mouse control around four buildings, one of which contained only rats, two which had only mice and one which contained mice and rats.

Testing was initiated for both people and animals at the rodent handling facility. The Vanderburgh County Health Department (VCHD) obtained blood samples from all employees and the Centers for Disease Control and Prevention (CDC) agreed to do all the testing. Following guidelines from the CDC, a random sample size was determined from each building and rodents were sacrificed by the employees and forwarded to CDC for analysis. Since the business was in the business of euthanizing and freezing mice for product, the facility provided this service.

Test results for the employees indicated that 13 of the 52 people had titers indicating recent infection and three had titers indicating old infection. Nine of the thirteen people indicated symptoms compatible with LCMV and a few developed neurologic signs consistent with encephalitis. The manager was among those with severe signs and a few had to be hospitalized. There were no fatalities. Using CDC guidelines, 399 rats and 1,421 mice were tested with all rats testing negative and 296 mice testing positive for LCMV indicating a 21% infection rate. Euthanasia was recommended for all mice and rats with contact to the mice. The owner elected to euthanize all animals on the premises.

One of the challenges was educating the employer/employee about personal protective equipment (PPE) which was not offered previously to the ill people being identified. Gloves and masks were initially offered by the employer but BOAH and the county health department worked with the employer and employees to don facemask, gloves, overalls and shoe covers to conduct the cleaning and disinfection process. The employer eventually provided these to all employees.

Separate quarantines were written on each building and all mice and rats were depopulated and buried on site. Bedding and feed materials were burned on site. Indiana Department of Environmental Management (IDEM) helped permit and approve these disposal processes. Buildings and equipment were cleaned and disinfected with bleach and wooden racks were power washed and set in the sun. Buildings were to be swept, dusted and power washed. All buildings had to be inspected by BOAH following cleaning and disinfection. This was important as initial inspection

showed mice still in the building and debris evident throughout. Use of poison laced water containers and removal of food and water sources resulted in adequate cleaning and disinfection.

When the Vandeburgh County Health Department requested records, the facility indicated it had sold live mice to pet stores which resulted in Indiana and 21 other states receiving trace back information. CDC recommended euthanasia of mice, clean and disinfect equipment, employees wear PPE and susceptible employees be tested for LCMV. Educational material was developed and shared with these pet stores in Indiana. The owner also admitted to importing large numbers of breeding mice from a facility in Kentucky where the mice were collected and tested and found to be 60% infected. The Food and Drug Administration (FDA) assisted in depopulation of that facility in Kentucky.

Lessons learned include having the state veterinarian having authority over all animals in the state and establishing relationships with state, local and federal agencies before these incidents. The Incident Command System was used throughout the process and verification of facts early in the investigation would have helped in resolving the situation in a timely manner. Cooperation and communication with all the agencies involved including daily and weekly conference calls was critical to obtaining information, test results and planning actions to resolve the case.

Wildlife Rabies in the United States: Reservoirs, Surveillance and Control

Richard Chipman

National Rabies Management Coordinator, USDA- APHIS-Wildlife Services

Dennis Slate

USDA-APHIS-Wildlife Services

Extended Abstract

Over the past century, rabies in the US has undergone dramatic change. Prior to 1960, as dog rabies was brought under control, most cases were reported in domestic animals. Since the 1960's, wildlife has supplanted domestic animals in reported rabies cases and account for more than 80 percent of all reported cases annually since 1975. However, since the 1980's, reported cases in wildlife have accounted for more than 90 percent of animal cases annually reported to CDC. The principal rabies reservoirs today are represented by several species of wild carnivores (*Carnivora sp.*) and insectivorous bats (*Chiroptera sp.*). Cats (*Cattus domesticus*) continue to be the most common domestic animal reported with rabies as a result of abundant, unvaccinated or under-vaccinated free roaming cat populations throughout the US that are at an increased risk of rabies resulting from interactions with raccoons, skunks and bats.

Since raccoon (*Procyon lotor*) rabies rapidly spread from the mid-Atlantic epizootic focus beginning in the late 1970's, raccoons have been the most frequently reported species with rabies in the US. This epizootic is most likely a function of rabid raccoons being translocated from Florida to western Virginia and West Virginia. Raccoon rabies has subsequently spread and now occupies a range that extends east to the Atlantic Ocean from a line that stretches from southwest Alabama to northeast Ohio. This area is settled by about 70 percent of the US human population. In 2010, raccoons accounted for 36 percent (n=2,246) of reported cases to CDC. For the past several years, rabies in skunks (primarily the striped skunk *Mephitis mephitis*) has ranked either number two or three, behind bats, followed by rabies reported in foxes (primarily gray fox (*Urocyon cinereoargenteus*) and arctic fox (*Vulpes lagopus*)).

Human deaths from rabies acquired in the US declined from greater than 100 in the early part of the 20th century to one to two cases annually in the 1990's, and remains at that level today. From 1997-2006, 17 of 19 human cases from rabies acquired in the US were associated with insectivorous bats. In the US, human fatalities from rabies typically occur in people who fail to seek medical assistance, often because they were unaware of their exposure.

Timely administration of post exposure prophylaxis has proven nearly 100% successful in preventing rabies. However, the financial cost of living with wildlife rabies in the US is conservatively estimated to exceed \$300 million/year (USD). Associated impacts such as anxiety, fear, and trauma are difficult to quantify but often manifest with rabies.

Prior to the proof of concept of oral rabies vaccination (ORV) by the late Dr. George Baer in the late 1960's at the Centers for Disease Control and Prevention (CDC), population reduction was the primary method for rabies control in wild carnivores. However, population reduction proved to be labor intensive, generally with only transient effects. Its current niche in rabies control in North America is as a tactic that may be integrated into specific emergency actions to prevent rabies from spreading, such as in "Point Infection Control" first applied in Ontario, Canada in response to an incursion of raccoon rabies from the US in 1999. Use of ORV as the central component of the rabies management strategy has led to rabies control and elimination successes at the landscape scale, with examples in: the raccoon dog (*Nyctereutes procyonoides*) and red fox (*Vulpes vulpes*) in several European countries; the red fox and raccoon in Canada; and, the coyote (*Canis latrans*), gray fox and raccoon in the US.

Since the late-1990's, Wildlife Services (WS) has coordinated wildlife rabies management with oral rabies vaccination (ORV) as the central tactic. The need for effective coordination has mandated the establishment of frameworks that bring together multiple jurisdictions and disciplines from municipal, county, state, federal and international agencies; universities; and the private sector to ensure collaborative, science-based approaches to rabies management in wild carnivores. A Rabies Management Team and associated WS Business Plan and US National Plan Wildlife Rabies Management (2008-2012) and the formalization of a North American Rabies Management Plan with partners in Canada, Mexico, the Navajo Nation, and the U.S. provide a national and continental frameworks for the exchange of information; collaboration on surveillance and control; collaborative studies; and training.

From 2005 through 2011, enhanced rabies surveillance has become a critical program component as a complement to public health surveillance, which is based largely on rabies exposure events to human and domestic animals brought to the attention of the public health community. During that period, 62,168 suspect animals were tested from about 24 states within or near ORV zones, with 897 confirmed rabid; of these, 48,605 samples were diagnosed through the direct rapid immunohistochemistry test (dRIT) developed at CDC and applied in the field by WS in collaboration with CDC. Knowledge of the GPS coordinates and rabies virus variant from these additional 897 cases from enhanced surveillance has improved rabies management decision making capability for ORV.

To date, ORV in the US has focused predominantly on canine rabies in coyotes and gray fox rabies in Texas and raccoon rabies in the eastern US from Alabama to Maine. Currently, only one oral rabies vaccine is licensed for use—a live, recombinant *Vaccinia*-rabies glycoprotein recombinant, Raboral V-RG® (Merial Limited, Athens, Georgia, US). Key successes resulting from the integration of ORV into other rabies management strategies include the elimination of canine variant of rabies from sources in Mexico that had spilled over into coyote populations in south Texas. This accomplishment led to the declaration that the US was again canine rabies free in 2007. In addition, a unique variant of gray fox rabies in west-Texas is on the verge of elimination, with no reported cases since 2009 and there has been no appreciable spread of raccoon rabies through the coordinated use of ORV and emergency contingency actions in high risk corridors for rabies spread. Raccoon rabies has proven more difficult to control than rabies in wild *Canidae* for a variety of factors including: high raccoon population densities, especially along the suburban interface; access to a wide variety of competing food items when baiting occurs; translocation, and vaccine spillage when they consume ORV baits, as well as others potential factors.

Given the need to move more aggressively toward raccoon rabies elimination, WS and cooperators initiated a field trial in West Virginia with ONRAB® (human adenovirus 5, Artemis Technologies, Guelph, ON, CA) in 2011 with favorable safety and immunogenicity results (49% seroconversion after the first baiting) and no safety related issues. Field trials were expanded in 2012 to determine if there is an increasing role for ONRAB® in raccoon rabies elimination in the US. One limitation of Raboral V-RG® is a general lack of a rabies virus neutralizing antibody (RVNA) response in skunks under field conditions where ORV baiting occurs for raccoons. This limitation is magnified by high levels of spillover of raccoon rabies virus variant into skunks and a lack of a thorough understanding of the potential role skunks may have in virus maintenance and reinfection of raccoons.

To date about 140 million doses of oral rabies vaccine have been distributed in the US, with at least 80 percent applied toward control of raccoon rabies in 15 eastern states. Baits are the single largest cost driver for ORV and wildlife rabies management. Currently, WS and collaborators are conducting a new, comprehensive economic analysis to reevaluate the benefit:costs of ORV using Regional Economic Modeling (REMI, Regional Economic Models Inc., Amherst, Massachusetts, US). Putting costs in the context of benefits is an increasingly critical component for evaluating the merits and sustainability of government coordinated programs such as wildlife rabies management and ORV.

While key wildlife rabies management successes have been realized, several challenges remain. Among these are: finding the most effective, safest and least expensive bait-vaccine to achieve rabies management goals in a timely manner; preparations for the effects of climate change, which could lead to a northward range expansion of the vampire bat (*Desmodus sp.*) from Mexico into the southern US with the attendant rabies impacts to public and animal health; understanding and managing the effects climate change may have on the rabies dynamics between arctic and red foxes in the far north as polar ice coverage diminishes; illegal and unintentional translocation of rabies reservoir species; addressing rabies in the introduced small Asian mongoose (*Herpestes javanicus*) on Puerto Rico or other islands, and other exotics globally; risk modeling for resource allocation to rabies management; and research prioritization to ensure that surveillance and control methods and strategies may be enhanced.

Canine Leptospirosis Outbreak Investigation in Southeast Michigan: A One Health Perspective

Marta Guerra Bacterial Special Pathogens Branch, CDC

Leptospirosis, caused by infection with a spirochete of genus *Leptospira*, is considered the most widespread zoonosis in the world. In the United States, 100-200 human cases of leptospirosis were reported annually through 1994, when it ceased to be a nationally notifiable disease. In June 2012, the Council of State and Territorial Epidemiologists (CSTE) approved to reinstate leptospirosis as a Nationally Notifiable Condition. Reinstatement of national surveillance will facilitate the assessment of the incidence, geographic distribution, trends, and risk factors associated with human cases, and the identification of outbreaks and potentially new animal reservoirs. Surveillance for human leptospirosis is important for early detection of cases, since early treatment is crucial to decrease morbidity and mortality.

An outbreak of leptospirosis in dogs in southeast Michigan with 61 cases occurring between October and December 2011 was reported by Michigan State University's Diagnostic Center for Population and Animal Health. During this time period no human cases were reported to Michigan Department of Community Health; however, there was concern that this outbreak could be attributed to a particularly virulent serovar of the disease (*L. interrogans* Icterohaemorrhagiae) which could be transmitted to the human population, especially to pet owners, and veterinary and animal shelter/kennel staff. Michigan Department of Community Health and Michigan Department of Agriculture and Rural Development requested CDC assistance for an investigation, to conduct animal case finding, evaluate surveillance, investigate potential

routes of exposure, identify risk factors and develop prevention and control strategies for both human and animal populations.

Owners and veterinarians of canine cases were contacted by the investigation team to assess potential exposures and development of illness consistent with leptospirosis. No additional potential human cases with symptoms of leptospirosis were identified. A knowledge, attitudes, and practice (KAP) survey about leptospirosis and use of vaccines was sent out by mass email through the Michigan State Veterinarian Association to member veterinarians. Vaccination of canines for leptospirosis was recommended by 221/299 (74%) of veterinarians. A majority of veterinarians (87%) also reported having observed adverse reactions in canines following leptospirosis vaccination.

An environmental assessment was conducted by City of Detroit Public Works (DPW), Environmental Division, Rodent Control in an urban area where canine cases were clustered. Increased populations of stray dogs and rodents were noted in this area by DPW staff. Samples from trapped rodents (5/5) were positive for leptospirosis.

Evaluation of results from surveys and animal trapping and testing led to the following recommendations. Control of stray dogs, vermin and wildlife reservoirs is necessary to reduce the risk of transmission of leptospirosis to canine companion animals. Vaccination of canines in areas determined to be high-risk for leptospirosis is encouraged, as well as educating pet owners about transmission and risk factors of the disease. These measures will reduce the transmission of leptospirosis among animals, and, therefore, reduce the likelihood of transmission to the human population. As with all zoonotic diseases, it is important to recognize early the occurrence of outbreaks in animals before humans become exposed and/or ill. Continued surveillance efforts will ensure that cases are detected early and measures can be instituted in a timely manner to prevent further transmission among animal populations and spillover into the human population.

This investigation serves as an example of the utilization of a one health approach to investigate a zoonotic disease outbreak. Multiple agencies, including veterinary and human health at the local, state and federal levels collaborated closely and effectively. The investigation also demonstrates the importance of interagency cooperation for surveillance and control efforts.

Committee Business

The Committee had one Recommendation: The committee recommends that a One Health based symposium be held again next year. The symposium would be similar to the Rabies Symposium held in 2011 and the Raw Milk Symposium held this year, but on a different topic. The Committee believes this is an effective means to provide an opportunity for in-depth discussion on a topic and to encourage participation of the public health community.

The Committee passed one resolution, and forwarded to the Committee on Nominations and Resolutions.