

SURVEILLANCE OF INFECTIOUS DISEASES IN ARIZONA: A MPH FIELD
EXPERIENCE REPORT

by

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Abstract

This document describes various experiences of Kansas State University graduate student Naomi Wheeler during her field experience for a Master's degree in Public Health and demonstrates her competent understanding of the principles of public health practice in relation to these field experiences. The student worked with the Arizona Department of Health Services, the Coconino County Health Department, the USDA Wildlife Services, and the Centers for Disease Control. With these organizations she worked in surveillance and control programs of rabies, West Nile virus, and Rocky Mountain Spotted Fever.

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Preface

During the summer of 2010, I was able to participate in many public health related experiences. These experiences were in cooperation with the Arizona Department of Health Services (AZDHS), the Coconino County Health Department, the United States Department of Agriculture – Animal and Plant Health Inspection Service (USDA-APHIS) Wildlife Services, and the Centers for Disease Control and Prevention (CDC). With these organizations I worked in surveillance and control programs of rabies, West Nile virus, and Rocky Mountain Spotted Fever

Arizona Department of Health Services

The Arizona Department of Health Services (AZDHS) is responsible for public health, behavioral health, the Arizona State Hospital, emergency medical services, the state laboratory, public health data and statistics, vital records, disease control, and licensing and certification of health and child care facilities. Their mission is to set the standard for personal and community health through direct care delivery, science, public policy and leadership.² Craig Levy, Program Manager of the Epidemiology & Disease Control program is the contact that I worked with the most at the AZDHS. As an unofficial summer intern, I was able to participate in several ongoing health control programs.

The AZDHS provides comprehensive services including: programs that emphasize nutrition in children and lower income families, award winning trauma care centers, youth tobacco abuse prevention programs and assistance for adults in quitting tobacco, viral and bacterial testing to identify and prevent the spread of diseases, and testing water samples for chemicals and bacteria to ensure the safety of drinking water for counties and cities. In addition to these they yearly compile the Arizona Health Status and Vital Statistics Report which highlights statewide trends and patterns in the general populations as well as inequalities in the health status among ethnic groups and communities, monitoring and tracking various diseases throughout the state.²

Arizona State Health Laboratory

The Arizona State Health Laboratory performs tests to insure the health and safety of residents of Arizona. The sections of the lab include serology, virology, bacteriology, environmental testing, and bio-terrorism prevention.³ The Newborn Screening Program is also a part of the lab. This program ensures that each of the 98,000+ newborns that are born in Arizona every year are tested for 28 inherited diseases and hearing problems. The goal is to help children avoid illness, developmental delays, and death. On any given day, the lab receives and tests from 600 to 1,500 blood spot samples to be examined for each of the 28 disorders. The team verifies results and confirms all of the data for each sample and sends the results to the health care provider. They also follow up on 140 potentially positive results each week, coordinate the confirmation tests and work with pediatricians, clinical specialists, and families. This and other support systems that are in place allow the newborn to receive early treatment and intervention

which can allow them to lead normal lives.¹ The state lab can also confirm the results from other laboratories for a number of tests through the Laboratory Licensure and Certification program.³

On June 8, 2010, I toured the Arizona State Health lab and saw all of the equipment and personnel used to perform these tasks. While on the tour, I observed a necropsy on a cat's head to test it for rabies infection, as well as examples of slides representing positive and negative test results for rabies direct immunofluorescent assays (IFA) as well as West Nile virus indirect IFA results. I also was allowed to see the infant screening cards being processed for testing. This experience taught about many different biological tests as well as the chance to observe a necropsy. The state health lab is an important part of maintaining the health of the citizens of Arizona.

Maricopa County Vector Control

The Maricopa County Vector control team investigates citizen complaints dealing with mosquitoes, flies, and non-native rodents. They identify and treat mosquito breeding sites as well as performing surveillance to identify new and monitor old breeding sites. In addition, they work in conjunction with state officials for monthly testing of mosquito samples monitoring for arboviruses. They also provide mosquito eating fish to anyone with standing pools who request them in order to control mosquito breeding.¹⁵

Mosquito control is an important part of control of several diseases. In the southwest mosquitoes can carry West Nile virus (WNV), St. Louis encephalitis virus (SLEV), and Western equine encephalitis virus (WEEV). These viruses all cause severe neurologic symptoms in humans as well as animals.²⁶ In addition to transmitting disease mosquitoes in large enough numbers can cause blood loss in people. These factors in addition to the removal of the nuisance of mosquitoes biting humans are reasons why control of mosquito populations is important in urban environments. With the increase in foreclosed homes in many cities due to the housing market collapse, the increase of neglected pools makes controlling mosquito populations more difficult. Possible methods to determine the efficacy of any mosquito control effort include: obtaining counts of mosquito larvae before and after the treatment of pools, trapping and counting the number of adult mosquitoes in the area, and monitoring the increase or decrease of any mosquito borne diseases in the area through surveillance in local medical facilities.

On June 9, 2011, I had the opportunity to ride along with Vector Control Specialist Megan Sports. One of the things that we discussed was the fact that in the Phoenix area, mosquito eating fish are the best way to treat green pools (green pools are swimming pools that have been poorly cared for allowing algae and mosquitoes to breed, usually at foreclosed homes) to prevent mosquito breeding. This is due to the fact that chemical treatments are denatured within weeks or days because of the summer heat. According to the vector control team they have placed mosquito eating fish into pools with large numbers of visible mosquito larvae and have returned to these pools after a few weeks to find no larvae present and the fish reproducing well. We also talked about insecticide fogging to control adult mosquitoes in areas that exceeded a certain number in the standing mosquito traps that are checked regularly. We visited several foreclosed homes in order to monitor the status of their pools that had been previously treated. At one of these, we added more mosquito eating fish to the green pools. The others had the fish breeding sufficiently to control the mosquito larvae that would be in the pools. We also visited a house about which a neighbor had made a new green pool complaint. The owner of the home in question had recently treated their pool, so there was no need to do anything. The other complaint that we followed up on was a complaint of a homeowner that had a nest of wasps in his city water control box. The appropriate city authority was contacted to deal with the issue.

Arizona Infectious Disease Training & Exercise

This two day conference is held yearly in Phoenix as a source of continuing education (CE) credits for public health professionals throughout the state. I attended several talks in addition to assisting with the registration table. Some of the talks I attend included: “HIV: Social Determinants of Disease” (R.J. Shannon, BA – Minority AIDS Coordinator, AZDHS, Office of HIV/STD/Hepatitis C), “Healthcare-Associated Infections: Epidemiology & Prevention Strategies” (Alice Guh, MD, MPH – Medical Officer, CDC, Division of Healthcare Quality Promotion, Prevention & Response), ““Pandemic H1N1 Influenza” (Peter Kelley, MD – Infectious Disease Specialist, AZDHS, Public Health Emergency Preparedness), “2009 Tickborne Relapsing Fever Outbreak” (Hugh Murray, BS – Environmental Specialist, Coconino County Health Department), “Rocky Mountain Spotted Fever” (Marc Traeger, MD – Physician & Preventative Medical Officer, IHS, Whiteriver I.H.S. Hospital), “Rocky Mountain Spotted

Fever – South Central Arizona Investigation 2009” (Steven Baty, DVM, MPH – Epidemiologic Intelligence Officer, CDC), and “Zoonotic Disease Update” (Craig Levy, MS – Program Manager, AZDHS, Epidemiology & Disease Control, Infectious Disease, Vector-borne & Zoonotic Diseases). These talks gave a great deal of information that might be used throughout a public health career.

Whiteriver

The White Mountain Apache Indian reservation is located in the northeastern portion of Arizona. The administrative headquarters of the reservation are located in Whiteriver, Arizona. Before 2003, Rocky Mountain Spotted Fever (RMSF) was not found in Arizona. During 2003, there was an outbreak on the White Mountain Apache Indian Reservation and the disease has since become endemic in the White Mountain area in the brown dog tick (*Rhipicephalus sanguineus*). There have been more than 75 cases of RMSF in the area. The endemic is related to the large numbers of free roaming dogs with multitudes of ticks on them.¹⁵

Rocky Mountain Spotted Fever

Rocky Mountain Spotted Fever is a potentially fatal tick borne disease caused by the bacteria *Rickettsia rickettsii* and it is a reportable disease in the United States. It was first identified in Idaho in 1896 and its causative agent was discovered by Howard Ricketts in the early 1900's. It is most commonly carried by ticks of the species *Dermacentor variabilis* and *Dermacentor andersoni* and it can also be carried by *Rhipicephalus sanguineus* in the United States. It occurs throughout the United States with more cases occurring in the eastern portions of the country (see Figure 1).^{12,14,24}

Initially, the disease is characterized by sudden onset of fever (usually greater than 102°F), significant malaise, and severe headache, usually accompanied by myalgia, anorexia, nausea, vomiting, abdominal pain, and photophobia. During this phase, RMSF may be misdiagnosed as a viral illness.¹⁴ During the 2 weeks after a tick bite, the classic clinical triad of fever, headache, and rash is seen in 60–70% of patients.¹² A rash appears typically 2–5 days after onset of fever. First, the rash appears as small erythematous papules (1–5 mm diameter), on the wrists and ankles, which then spreads to the palms and soles. Then the rash spreads from the

wrists and ankles to the arms, leg, and trunk. However, 9–12% of patients do not break out in a rash. Lack of rash occurs most commonly in cases that are fatal, in older patients, and in those with darkly pigmented skin.¹² Other cutaneous manifestations include mucosal ulcers, post-inflammatory hyperpigmentation, and jaundice.¹⁴

Due to the nonspecific clinical signs of this disease, it is often misdiagnosed. This can lead to delay in treatment which increases the risk of complications and fatalities. Antibodies to *R. rickettsia* are not detectable until 7-10 days after the onset of disease¹² while delaying treatment 5 days or more increases the risk of patient death. Treatment should therefore not be delayed until serological confirmation and should be started as soon as the disease is suspected.¹⁴ Doxycycline is the drug of choice for treating adults and children due to its effectiveness, broad margin of safety, and convenient dosing schedule. One hundred milligrams twice a day for at least 7 days or until the patient has been afebrile for 2 days is recommended for adults. Children should receive 2–5 mg/kg per day in two divided doses with a maximum of 200 mg per day for the same number of days as in adults.^{12,14,19}

RMSF Prevention Activity

In the company of Craig Levy on the dates of June 21-24, I was able to participate in a RMSF control activity in Whiteriver. This activity was a cooperative effort of the Indian Health Services (IHS), Centers for Disease Control (CDC), and the Arizona Department of Health Services (AZDHS). The goal of the activity was to control the brown dog tick population of the White Mountain Apache Indian Reservation in order to prevent human cases of RMSF. In order to do this a large number of volunteers spread pyrethroid pesticides around the exterior of almost every residence on the reservation and flea and tick repellent collars were applied to a number of the dogs seen while spreading the pesticides. There were not enough collars available to put on dogs not claimed by specific owners, because of the danger of approaching unknown reservation dogs that may or may not be friendly. In addition to these activities, Craig and I placed tick traps at a number of houses before spreading the pesticides. We were able to trap ticks at eight sites which we took back to the state laboratory for analysis. None of the ticks that we recovered were positive for RMSF. We also set out mosquito traps for two nights. We set out four traps and captured an average of one hundred mosquitoes per trap. We then took the captured mosquitoes to the state lab for West Nile Virus (WNV) testing. They all tested negative. Due to the small

number of samples and the relatively few mosquitoes captured in each sample it is difficult to determine the significance of these negative results. However the negative results were not unexpected because there has yet to be positive WNV mosquitoes in this area. This experience provided hands on experience and taught sampling techniques, including the use of dry ice to trap both mosquitoes and ticks in order to obtain samples for testing.

Coconino County Health Department

The Coconino County Health Department works to maintain the health and wellness of the residents of Coconino County in Arizona. This is done through various programs and services in cooperation with the Arizona Department of Health Services as well as other public health agencies.¹¹

On June 11, 2010, I met with Randy Phillips and Sabrina Ferrat of the Coconino County Health Department Environmental Services Division. We discussed the rabies oral vaccine bait dispersal that was coming up. They also gave me contacts with the USDA and the CDC that might be able to help with my project. They asked me to find out how they might be able to provide veterinarians with CE credits when they hosted educational meetings, so that the veterinarians might be more likely to attend the meetings. I contacted the Arizona Veterinary Licensing Board and discovered that they simply had to submit a request with information such as: who, what, when, where, and number of credits of the meeting to the licensing board. This information I then sent back to Sabrina and Randy. With this information, they will be able to better serve and educate their community.

USDA-APHIS Wildlife Services

The United States Department of Agriculture Animal and Plant Health Inspection Service (USDA-APHIS) Wildlife Services (WS) works to provide federal leadership and expertise to resolve wildlife conflicts to allow people and wildlife to coexist. One of the programs that the USDA works diligently on is the control of rabies spread throughout the country. In northern Arizona, the brown bat variant of rabies has spread to the skunk and grey fox populations (an abnormal occurrence in itself), so WS works with state and county officials on programs to contain and control this outbreak.³⁵

Rabies

Rabies is a fatal neurologic disease caused by a *Lyssavirus* spp. It causes severe neurological symptoms and is fatal in almost all cases once symptoms have begun (there have been two or three survivors total). It has been a public health issue for centuries. It can be found in any mammal species and causes similar symptoms and pathology in all of them. Until the start of national canine vaccination programs, the most common source of rabies exposure to humans was from dogs. In those countries that do not have effective canine vaccination programs, this is still the case. In countries where canine rabies has been controlled or eliminated through vaccination programs, the reservoir for rabies is in various wildlife populations. Figure 3 shows the various wildlife reservoirs of rabies in the United States for all animals except bats.⁷ During the 1980's an oral rabies vaccine (ORV) bait using a *Vaccinia* virus vector with rabies antigens was developed to vaccinate the red fox population of Europe which was the main wildlife reservoir for Europe at the time.⁶ Once this vaccine was developed, it was possible to orally vaccinate some wildlife populations to control the spread and/or contain the disease. Since the development of oral baits, they have been used to vaccinate fox populations in Europe and North America. As other formulations were developed, they have also been used to vaccinate raccoons and coyotes. ORV baits in combination with trap/vaccinate/release (TRV) programs have been used in the United States and Canada to control and/or eliminate raccoon and coyote rabies epizootics in these areas.^{6,9,23}

Several retrospective studies of ORV programs have shown savings on rabies spending despite the cost of the programs. When the cost of the programs was compared with the cost of human post-exposure treatments, positive animal diagnostic tests, and indemnity payments for livestock lost due to rabies, the differences were statistically significant.^{5, 13,18, 30,31} While the TRV programs are the most expensive due to labor and equipment costs they are currently the most commonly used method for skunk rabies control programs at the moment due to the fact that the current ORV baits are not immunogenic in skunks.

In 2009, the CDC reported four human cases of rabies throughout the United States with one person surviving after showing symptoms. Of the thirty-one human cases of rabies reported to the CDC from 2000 to 2009, eight were infected outside the continental US occurring in countries where dog rabies is enzootic and involved dog rabies variants. Eighteen of the remaining twenty-three were infected with bat rabies variants, four of them received organs from

a donor infected with a bat rabies variant and the remaining case was infected with a raccoon variant. The raccoon rabies variant is the most significant wildlife variant in the United States with greater than 70% of the rabid animals other than bats reported in 2009 being traced to the raccoon variant (see Figure 4).⁷

Vaccination of domestic animals has been the most effective preventative measure for rabies. Since mass vaccination programs began in the United States, the rates of human cases have gone from more than one hundred annually to less than five annually. According to the CDC, the estimated public health costs associated with disease detection, prevention, and control exceed \$300 million annually in the United States. These costs include the vaccination of companion animals, animal control programs, maintenance of rabies laboratories, and medical costs, such as those incurred for rabies post exposure prophylaxis (PEP). Although the cost varies, a course of rabies immune globulin and five doses of vaccine given over a 4-week period typically exceeds \$1,000. The cost per human life saved from rabies ranges from approximately \$10,000 to \$100 million, depending on the nature of the exposure and the probability of rabies in a region.⁷ As ORVs improve, it might be possible to further prevent rabies by continuing to vaccinate wildlife. Rabies control and prevention has been and continues to be a goal of governments around the world in order to save lives and increase public health.

Oral Rabies Vaccine Bait Dispersion

Part of the program to control the spread of this variant of rabies is the dispersal of oral rabies vaccine baits throughout northern Arizona. Most of the baits are dropped by plane over the forested portions of the area. In the populated areas, volunteers are used to disperse the oral baits throughout the city. This dispersion of oral baits vaccinates the fox population against rabies and is done at the beginning of the summer. At the end of the summer, WS personnel trap foxes and draw blood to test their rabies titers in order to determine the success of the vaccination program.

On June 16, 2010, I participated as one of the volunteers dispersing oral baits in populated areas of Flagstaff. Each team dispersing baits were given 150-200 baits, depending on the size of the area where they were assigned to put the baits. Steve Baty, Craig Levy, and I were assigned to disperse baits in a specific area of town. Our group had been given 175 baits. We tried to find locations that foxes might frequent, including drain culverts, green belts, and other wildlife friendly areas. We spent three hours finding proper locations and dispersing the baits

into our area. The experience taught techniques of finding wildlife friendly areas within and urban environment, as well as the importance of spreading the ORV baits evenly.

Skunk Trap, Vaccinate, and Release

Whereas oral rabies vaccines work relatively well on foxes and most other mammals, they do not work at all on skunks. While researchers are trying to find oral baits that will work on skunks and have some promising leads at this point, skunks must still be vaccinated by injection. Throughout the summer, WS personnel trap, vaccinate, tag, and release the skunks in the Flagstaff area. They also draw blood in order to test for other diseases. Toward the end of the summer, they draw blood on the previously tagged skunks to test their rabies titers.

On June 16, 2010, after the oral bait dispersion, I was able to go out with a WS team (Stephanie Johnston and her husband) to check the skunk traps that they had placed that morning. We released a squirrel, replaced the peanut butter oat ball that served as bait, and left the traps until the next day. The next morning I went out with the team again to check the traps and place a couple more traps. We caught a skunk and they showed me how to vaccinate, tag, and release the skunk without sedation or getting sprayed by the skunk. After we had checked all of the traps, we went back to the campsite where they were staying. That evening we went out to check the traps again and made sure that no squirrels were trapped overnight. The morning of June 18th I went out with them again and caught the same skunk we had caught the day before.

With this training, I was able to trap skunks during the week of June 28th to July 2nd while the WS personnel were at a federal meeting. During the week, I placed ten skunk traps in various locations around Flagstaff that Sabrina Ferrat of the Coconino County Health Department helped me to locate. Over the week, I caught eight animals total with three of them being recaptures (including the same skunk that we had caught previously which I learned had already been caught a total of ten times). I vaccinated and tagged the skunks. Overall the skunk trapping gave important field experience and hands on skills dealing with wildlife.

Canine Blood Draws

Another thing that I did with the USDA-APHIS team was to go to a small town called Many Farms on one of the northern Arizona Apache Indian reservations and assist in drawing blood from 25 male dogs that were participating in a chemical sterilization study. This was the fifth week of the study and the blood draws and exams had been done once a week. I got to the

location at 8 am on July 20, 2010 and we began sedating the dogs because they were mostly feral. We then took vital statistics including temperature and heart rate, examined the testicles of each of the dogs for changes from the previous weeks and drew 6ml of blood in order to test the hormone levels and other factors. According to the team who had been previously working with these animals, the testicles of the dogs had been swollen after the initial treatment with the agent but by this point the testicles had returned to normal size or even begun to atrophy. The outcome of the study is unknown the study was incomplete, but a safe, inexpensive injectable sterilization agent would be helpful in rural canine population control.

Other methods that might have been used to determine the success of the sterilization agent could include sperm counts. Ultrasound of the testicles prior to injection of the agent as well as progressively throughout the study has been used in other sterilization studies to monitor progression of atrophy.³³ Chemical sterilization would be a good method of canine population control, especially in rural areas or areas where surgical sterilization is expensive or culturally inappropriate. Chemical sterilization of large numbers of male dogs in rural areas could lead to significantly decreased stray or feral dog populations. This in turn would increase public health and safety by decreasing human contact with possibly dangerous animals as well as decreasing reservoirs for zoonotic diseases.

Centers for Disease Control

The CDC works to control and prevent disease, illness, and injury nationwide. It does this through many different programs based out of several different offices throughout the country. The CDC dispatches teams to assist local authorities with unexpected and unusual disease outbreaks that might otherwise overwhelm the local authorities.⁸

West Nile Virus

West Nile virus (WNV) is an enveloped single stranded, positive-sense RNA virus belonging to the genus *Flavivirus* in the family *Flaviviridae*. *Culex* spp. mosquitoes are the principal vectors of WNV, although the virus has been found in at least 43 other mosquito species. Virus amplification occurs in susceptible birds, which are believed to be the principal vertebrate reservoir hosts. In addition to birds, a very wide range of vertebrate species may present with clinical disease including horses, humans, juvenile squirrels, and even reptilian species such as alligators. WNV was first identified in the United States in New York City in

1999.²¹ The CDC in 2003 requested that WNV become a reportable disease on ArboNET, the national surveillance system for arboviral diseases.²² From 1999 to 2004 it spread across the continental United States and within 10 years was considered endemic throughout the United States. Approximately 1000+ cases are reported to the CDC yearly from throughout the US.²¹

The incubation period from infection to onset of clinical illness in humans varies between 2 and 14 days. About 80% of human cases of WNV infection are asymptomatic, while 20–30% experience mild infection. Fewer than 1 % of patients develop neuroinvasive disease, characterized by meningitis (WNM) and/or encephalitis (WNE). The mild form of the disease can present clinically with any of the following symptoms: fever, fatigue, malaise, lymphadenopathy, periocular pain, gastrointestinal symptoms, such as nausea, vomiting and abdominal pain, myalgias, headache, and occasionally a maculopapular rash. Although certain aspects of the acute presentation typically resolve after 1 week, many of the symptoms can persist. Patients can experience fatigue and muscle weakness for more than 30 days. Other symptoms such as joint pain, headache and difficulty concentrating persist in 20–40% of patients. Patients aged >50 years are at highest risk of developing neuroinvasive disease, which clinically presents as meningitis and/or encephalitis. Encephalitis can present with altered mental status including confusion, disorientation, and coma. Case fatality rate in encephalitis cases can be around 15 %. Acute flaccid paralysis (AFP) occurs in 5–15 % of patients with neuroinvasive disease. AFP can present with symptoms ranging from single extremity weakness to quadriplegia including paralysis of the respiratory muscles. The prognosis for patients with WNV AFP is poor. The mild form of WNV usually resolves on its own with the patients often not knowing they had the disease (thinking they had the flu). The more severe forms of the disease require hospitalization and intense medical treatment.²²

West Nile Virus Outbreak

In 2009, there were 20 total human cases of WNV in Arizona with no fatalities. By July 23, 2010, there were 18 confirmed human WNV cases with two fatalities all within the same south eastern region of the Phoenix metro area. The CDC was contacted and agreed to send a team to assist with the outbreak investigation. The team was sent from the Fort Collins CDC office and contained both epidemiologists and entomology experts.

On July 29, 2010, the CDC team arrived in Phoenix and had their first meeting with representatives of the AZDHS, Maricopa County Department of Health, Maricopa County Vector Control, as well as representatives from Pinal County, which also had a few cases. The plan of investigation was outlined to have the entomology teams go out and investigate the home sites of the cases as well as any controls that might be identified to see if any differences could be seen. The rest of the team would contact cases (those who had been positively identified with WNV) and controls (those who lived in similar areas but did not have WNV) to ask questions about work, travel, and home habits to identify any differences between them. They continued to meet by conference call every couple of days to keep everyone updated.

On July 30th and 31st, 2010, I was able to go out with the entomology team to assist in various home visits as well as place mosquito traps in some sections of the outbreak area. John-Paul Mutebi, PhD, was the head of the entomology team and he compiled a survey with questions that could be answered about each house, so that analysis could be done later. I assisted with both talking to the homeowner/patient about the situation as well as answering the environmental survey questions (both answering the questions and recording the answers). I was also able to go out with Dr. Mutebi on August 7th and August 13th to assist him in his effort to do site visits for all of the cases and identified controls.

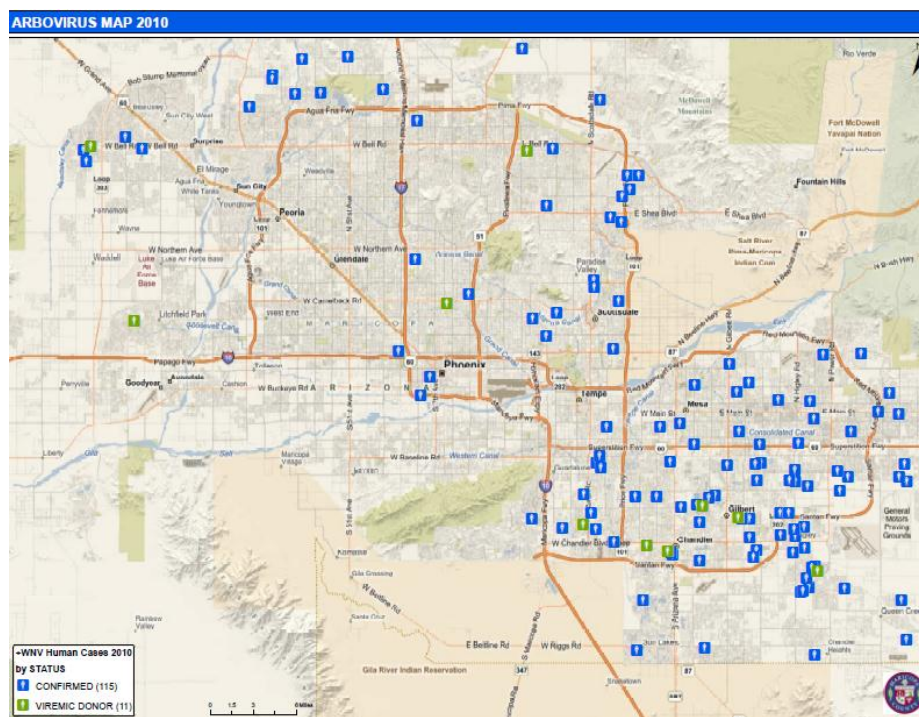
From August 1st to August 18th 2010, I worked with the office team to identify controls in order for the CDC to have a case control study. Controls were identified from lists of patients provided by the local laboratories that were tested for WNV during the study period, but the results were negative. Only patients living in the outbreak area (addresses within the same zip codes as cases) with negative test results were included. Once the controls were identified, they were contacted to ask if they wished to participate in the study. If they agreed, they were asked the same questions that the cases had been asked. Then they were asked if they would allow a site visit from the entomology team. If the answer was affirmative, a visit was scheduled. I was also able to assist with entering all of the survey and site visit data into the database for later ease of analysis.

There are several limitations that might be considered with the setup of this case/control study. One of these is the bias in how the controls were selected. A better way to select controls would be to randomly choose participants in the affected area and have them tested for WNV. However this would be time consuming and require a number of medical personnel to draw

blood for the necessary testing. Also once potential controls were identified they had to agree to participate in the study which creates more bias. Another limitation is the fact that there is only the data from this single year to work. Continued surveillance of the area might help to determine if this is a one-time outbreak or a new endemic strain. Also it would be good to determine if there was any unusual bird or other wildlife activity in the area to see if they might have been the source of the outbreak in the area. Molecular testing on the viral strain might also help determine the source of this particular problem.

By the time the CDC team left Phoenix to return to Fort Collins, there had been 60+ human cases reported in Maricopa County with five fatalities. We had been able to identify and survey 40 controls with accompanying site visits. I do not know the final outcome of the case control study because I have not received that data from the CDC. The human cases of WNV were almost all along the same main road in the southeastern portion of the Phoenix valley. The CDC and the AZDHS were planning additional studies to determine why.

Figure 1 – Maricopa County WNV Human cases 2010¹⁶



Conclusion

My field work in disease control, prevention programs, and outbreak investigation was not only interesting, but provided me with valuable experience. I participated in ongoing infectious disease surveillance and control programs where I gained knowledge about trapping wildlife and conducting outbreak surveys. These experiences gave me a base of skills to draw on while participating in these types of projects in the future. In doing so, I will be able to share my expertise with the community and be an active participant in promoting public health

Through my MPH coursework and field experience, I have studied the ten core areas of public health: Biostatistics, Epidemiology, Health Services Administration, Health Education, Behavioral Science, Environmental Health, Maternal and Child Health, Public Health Nutrition, Public Health Practice and Public Health Administration and Policy. These courses have provided me with theory and statistics that act as a reservoir of knowledge in the area of public health. My understanding has increased through the application of my knowledge in participating in my field work experiences. This combination will prove invaluable as I work to improve public health throughout my career.

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Appendix A - Abbreviations Used

AZDHS – Arizona Department of Health Services

IFA – immunofluorescent assay

RMSF – Rocky Mountain Spotted Fever

IHS – Indian Health Services

CDC – Centers for Disease Control and Prevention

WNV – West Nile Virus

USDA – United States Department of Agriculture

APHIS – Animal and Plant Health Inspection Service

WS – Wildlife Services

WIC – Women, Infants, and Children Nutrition Program

ORV – Oral rabies vaccine

TRV – Trap/vaccinate/release

PEP – Post exposure prophylaxis

SLEV – St. Louis encephalitis virus

WEEV – Western equine encephalitis virus

Appendix B - Summary of Activities Table

Date	Agency	Main Activity	Skills Utilized
June	AZDHS	Overview, tour	Overview of a State Health department and laboratory; surveillance and testing
June	MCVC	Ride along	Surveillance, vector control
June	AZDHS	RMSF Activity	Tick trapping, mosquito trapping, surveillance, vector control
July	AZDHS	Conference	Educational seminars
June/July	USDA	Field	ORV dispersal, Skunk TVR, Canine blood draws
July/August	CDC	WNV	Outbreak investigation, case control study