

FIELD EXPERIENCE REPORT

**ALIGNING PUBLIC HEALTH AND SHELTER MEDICINE:
THE CONNECTION BETWEEN A VETERINARIAN AND THE PUBLIC**

by

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Summary

The field experience described in this report took place at the Animal Protective League in Springfield, Illinois during the months of December 2016 until March 2017. The field experience involved exploring the connection between shelter veterinary medicine and public health concepts and the connection a veterinarian has between the health of animals in the facility and the health of the public visiting the shelter facility. The experience enabled effective communication and educational opportunities between veterinarian, shelter staff and public patrons.

Subject keywords: shelter medicine, public health, zoonotic disease, communication, educational opportunities

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Introduction

Shelter Medicine

Shelter medicine was formally recognized as a veterinary specialty in 2014.¹ Shelter medicine incorporates a unique blend of population medicine in combination with individual animal assessment and treatment. It involves balancing an individual animal's needs along with the "herd" health of the shelter without compromising care. The main goal of a shelter veterinarian is to prevent disease. It is much easier to prevent disease in a population than to treat an outbreak if disease strikes. Issues that can arise in shelters that contribute to disease spread include overcrowding, constant influx of new animals to the population, poor facility design and limited methods of disease control. A common challenge experienced by shelter veterinarians is adequately caring for shelter animals with limited resources and housing space. Shelter medicine is still gaining acceptance and recognition as a distinct branch of veterinary medicine that requires its own training and experiences to develop expertise. For example, the first shelter medicine textbook, *Shelter Medicine for Veterinarians and Staff*, was not published until 2004.¹

Shelters are associated with increased risk for transmission of zoonotic disease due to the role that these facilities play in a community. The constant influx of new animals with unknown vaccination history and the stress of a new environment can lead to diseases such as rabies or cat scratch fever being transmitted to humans by bites or

¹ Miller, L. *Shelter Veterinary Medicine*. Retrieved March 3, 2017, from ASPCA Professional: <http://www.aspcapro.org/shelter-veterinary-medicine>

scratches.² Animals entering shelters that have been free-roaming or that have spent a majority of their time outdoors are more likely to have external parasites or dermatoses, some of which have zoonotic potential. If proper care is not taken when handling shelter animals, zoonotic diseases such as ringworm and rabies have the potential to be transmitted to shelter staff and volunteers.²

Often, shelter workers do not have sufficient knowledge of zoonotic disease and disease transmission to recognize potential consequences of human-animal interactions. Often it is a person's love and dedication to animals rather than specific training in animal care that leads them to a job in shelter medicine. A study conducted in 2010 showed that shelter workers had low baseline knowledge of zoonotic diseases such as leptospirosis, rabies, MRSA and plague.³ However, the study also showed that shelter workers' knowledge base of zoonotic disease increased after education and training.

The Association of Shelter Veterinarians has summarized characteristics a shelter veterinarian needs to possess. They state "shelter veterinarians must... have a thorough understanding of epidemiology, preventive medicine, infectious disease control, policy development, facility design, public health, animal behavior, and

² Humane Society of Portage County. (2017). *Zoonotic Diseases*. Retrieved March 2, 2017, from Humane Society of Portage County: <http://www.hspcwi.org/zoonotic-diseases.html>

³ Steneroden, K., Hill, A., & Salman, M. (2011). Zoonotic Disease Awareness in Animal Shelter Workers and Volunteers and the Effect of Training. *Zoonoses and Public Health*, 449-453.

veterinary forensics.”⁴ The Association of Shelter Veterinarians recognizes the benefit of having public health knowledge for shelter medicine veterinarians. While most shelters do not require a public health degree for employment as a veterinarian, an MPH degree confers an advantage for veterinarians interested in a shelter medicine career.

⁴ Association of Shelter Veterinarians, Inc. (n.d.). *Shelter Medicine Practice FAQ*. Retrieved March 27, 2017, from Association of Shelter Veterinarians: <http://www.sheltervet.org/assets/docs/smp-faq-final-2013-may.pdf>

Animal Protective League

Animal Protective League of Springfield (APL) is a private, not-for-profit organization dedicated to providing care and compassion to the stray and abandoned animals in the central Illinois region. In 1952 a group of local animal rescuers founded APL and in 1956 incorporated into a not-for-profit organization. The board of directors constructed a shelter facility to house sick, injured and homeless animals in addition to providing space for adoptable animals. APL operates solely through private donations from the community. The organization gives back to the community by providing housing for strays, and also by offering community animal-wellness programs, including low cost spay/neuter surgeries, vaccination clinics, and public educational and therapy programs.

Animal Protective League's mission statement summarizes their goals; the Animal Protective League is "dedicated to caring for ill, injured, and abused homeless animals and coordinating the adoption of those animals by responsible pet owners. It further is committed to ending companion animal overpopulation by offering high-quality, low-cost spay/neuter services".⁵

In 2016 the Animal Protective League rescued 518 dogs and 1,877 cats. 496 dogs and 1,618 cats were placed into homes in the same year. 2016 ended with an 88% adoption rate. The shelter also accepts animals that will never be placed into homes and instead remain at the shelter the entirety of their life. These animals include

⁵ Animal Protective League. (2007). *Animal Protective League*. Retrieved March 3, 2017, from About Us: <http://www.apl-shelter.org/dotnetnuke/AboutUs/tabid/73/Default.aspx>

paraplegic cats/dogs, leukemia-positive cats, as well as animals that require extensive medical attention.

The Animal Protective League's capability to house animals is greater than the capacity of their brick and mortar facility that is able to house 20-25 dogs and 100-150 cats. With an extensive network of foster homes and care providers the number of animals APL can impact is significant.

Animal Protective League works closely with area shelters and rescue groups to reduce the number of animals on euthanasia lists. APL routinely accepts animals from these lists as space is available at the shelter. APL also focuses efforts on providing medical therapy to animals from area shelters that do not have veterinarians on staff or the medical equipment to provide intensive care by accepting transfers for medical treatment.

In central Illinois, animal control facilities without the finances, space, or staff able to care for cats and dogs affected by ringworm typically euthanize affected animals. In contrast, APL has the ability to treat these animals and adopt them into homes. In 2016, according to Dr. Kathleen Ritzmann, the Animal Protective League treated approx. 150-200 cats and dogs affected by ringworm. Without APL these animals would likely be euthanized at other animal control facilities.

Animal Protective League's most challenging issue is securing funding to cover the costs for medical treatment and daily care of the animals, employee salaries, and overall building operations. APL does not receive local or state government funding.

Zoonotic Diseases in Shelter Medicine

The potential for animal shelter staff and clients to encounter zoonotic diseases such as rabies, bartonellosis, leptospirosis, toxoplasmosis, toxocariosis, pasteurellosis, and dermatophytosis is an important concern. An important role for shelter veterinarians is to develop treatment and control interventions to prevent the transmission of these zoonotic disease risks.

Rabies is a Lyssavirus affecting the central nervous system in animals and humans. It is spread via saliva into bite wounds. In the United States, most cases of rabies are transmitted to animals and humans by wildlife reservoirs of the disease – skunks, foxes, raccoons, and bats. The disease process begins with cranial nerve dysfunction resulting in – a dropped jaw, hypersalivating, hoarse vocalization and then progression to ataxia, generalized seizures and eventually death. Behavior changes may include apprehension, nervousness, excitability, and aggression.⁶ Diagnosis can only be confirmed via post-mortem immunohistochemistry of brain tissue; ante-mortem diagnosis is not definitive.⁶ No effective treatment exists for rabies and most control measures are centered on prevention of the disease. Routine vaccination of cats and dogs has decreased the risk of human cases of rabies in the United States.

Infections of skin wounds with the bacteria *Bartonella spp.* causes the disease bartonellosis, also known as cat scratch disease. *B. henselae* is the most frequently isolated species responsible for cat scratch disease in cats and humans. This disease

⁶ Nelson RW, Couto CG, et al. (2014). *Small Animal Internal Medicine* (Fifth Edition). St. Louis: Elsevier Mosby.

causes generalized symptoms in cats, dogs and affected humans.⁶ Humans also experience arthralgia, headache, conjunctivitis and skin eruptions. Endocarditis, gingivitis, osteomyelitis, and cutaneous vasculitis can occur in cats and dogs affected by *Bartonella spp.* Transmission occurs via cat bites and scratches contaminated with flea dirt carrying the bacteria. Blood culture, PCR and serology are methods of diagnosing Bartonellosis; although a seropositive result does not definitively indicate a clinically affected animal - especially in cats where both seropositive and seronegative animals can be bacteremic.⁶ Current recommendations by the Association of Feline Practitioners advise only treating clinically ill animals with antimicrobials.^{7,8} In clinically ill dogs, a combination of doxycycline and fluoroquinolone antimicrobials is recommended; in cats, doxycycline is the antibiotic of choice. If response is noted in 7 days then treatment must continue for a minimum of 28 days.⁹ If no response is noted to doxycycline alone, then a switch to erythromycin or enrofloxacin is necessary.⁹ Prevention strategies are aimed at controlling flea populations to limit spread of the bacteria. Bradbury and Lappin demonstrated that the use of imidacloprid products in cats to control flea populations blocks the transmission of *B. henselae*.⁹

Many *Leptospira spp.* serovars can cause clinical leptospirosis. Animals can contract the disease by drinking water contaminated with urine of infected animals. Rojas demonstrated that 7% of dogs shed *Leptospira spp.* in their urine routinely so

⁷ Brunt J, et al. (2006). Association of Feline Practitioners 2006 Panel report on diagnosis, treatment, and prevention of *Bartonella spp.* infections. *Journal of Feline Medicine and Surgery*, 8:213.

⁸ Kaplan J, et al. (2009). Guidelines for prevention and treatment of opportunistic infections in HIV-infected adults and adolescents. Recommendations and reports, *MMWR* 58(RR04):1.

⁹ Bradbury C, & Lappin M. (2010). Evaluation of topical application of 10% imidacloprid - 1% moxidectin to prevent *Bartonella henselae* transmission from cat fleas. *Journal of American Veterinary Medical Association*, 236:869.

care should be taken when handling dog urine.¹⁰ Humans can be infected by contact with leptospira-infected urine through mucous membranes or broken skin. Infected cats are typically subclinical; however, in rare instances polyuria, polydipsia and renal insufficiency have been noted.¹¹ Symptoms of leptospirosis in dogs include fever, vomiting, diarrhea, hemorrhagic tendencies, hepatic and renal disease.⁶ Use of PCR tests of blood, urine or tissue samples is most reliable for a diagnosis.¹² Other diagnostic methods include culture, darkfield microscopy and elevated antibody titers in correlation with clinical signs. Treatment requires diuresis, as well as a minimum of treatment for 2 weeks with antimicrobials such as penicillin, fluoroquinolones or doxycycline. Limiting exposure to animal urine, as well as thoroughly disinfecting kennels helps to control transmission between animals. Humans should wear gloves when handling affected animals or when cleaning urine. Vaccination against the disease in high-risk areas helps reduce the number of affected animals.

Toxocariosis, caused by the parasite *Toxocara canis* and *Toxocara cati*, can result in visceral larva migrans and ocular larva migrans in humans. Visceral larva migrans occurs when the nematodes migrate through the intestinal wall and travel via blood stream to other organs causing inflammation and tissue damage along their path. Ocular larva migrans affects older children and young adults when the larvae migrate to the retina. In young children, in addition to the migratory larva causing serious retinal

¹⁰ Rojas P, et al. (2010). Detection and quantification of leptospires in urine of dogs; a maintenance host for the zoonotic disease leptospirosis. *European Journal of Clinical Microbiology and Infectious Disease*. 29:1305.

¹¹ Arbour J, et al. (2012). Clinical leptospirosis in three cats (2001-2009). *Journal of American Animal Hospital Association*, 48:256.

¹² Harkin KR, et al. (2003). Comparison of polymerase chain reaction assay, bacteriologic culture, and serologic testing in assessment of prevalence of urinary shedding of leptospires in dogs. *Journal of American Veterinary Medicine Association*, 222:1230.

damage that can lead to blindness; skin lesions can also develop. Cats and dogs can be subclinical for disease or experience failure to thrive symptoms – poor weight gain, poor hair coat, vomiting or diarrhea. Seroprevalence of human exposure in the United States is approximately 14%.¹ Ingesting animal feces is the most common method of infection in children. Diagnosis in humans is typically done by biopsy or serology. In animals, a fecal float reveals the presence of oocysts. Treatment in animals is by administration of an effective anthelmintic. Prevention strategies center on prophylactic anthelmintic treatment in shelters and quick cleanup of fecal material.

Toxoplasma gondii is responsible for the clinical disease of toxoplasmosis. At least 30% of humans and cats have been exposed to *Toxoplasma* in the United States.⁶ Ingestion of sporulated oocysts or tissue cysts results in transmission between cats and humans. Transplacental transmission also occurs. Cats can be asymptomatic or symptomatic (signs include fever, uveitis, pulmonary disease, hepatic disease or CNS disease). Humans are generally asymptomatic or experience mild symptoms such as fever, lymphadenopathy and malaise. If women are affected by *T. gondii* for the first time during gestation, the fetus is at risk for more serious symptoms – stillbirth, hydrocephalus, hepatosplenomegaly and retinochoroiditis.⁶ Oocysts can be identified using fecal floats using a specific sugar solution.⁶ Serology combined with the presence of clinical signs are also diagnostic tools, but once a cat has been infected they remain antibody-positive for life. Treatment includes symptomatic care until the body can confer immunity – clindamycin and trimethoprim sulfa drugs have proven effective for limiting symptoms. Prevention to limit exposure in humans includes not eating undercooked

meat and removing feline fecal material within twenty-four hours to prevent contact with sporulated oocysts.

Bite wounds, especially cat bites, can lead to pasteurellosis, particularly in immunocompromised patients. It is estimated that 28-80% of cat bites are contaminated with *Pasteurella spp.*⁶ Immunocompromised people are at higher risk for developing severe infections from cat bites leading to meningitis, endocarditis, septic arthritis or septic shock. Positive culture growth definitively diagnoses pasteurella infections. Antibiotic therapy typically includes penicillin therapy but should be dictated by culture and sensitivity results. Avoiding cat bites and scratches limits disease. If bites occur, quick decontamination by cleaning with soap and water and consultation with a physician can limit serious infections.

Dermatophytosis, commonly referred to as ringworm, is a highly transmittable fungal zoonotic disease. *Microsporum gypseum* is the species responsible for approximately 80% of human and animal cases.⁶ Subclinical carriers do exist; and clinical lesions are characterized by a circular alopecia and erythematous skin lesion.¹³ Culture is the standard diagnostic tool. Woods lamps and direct microscopy can be beneficial but are not definitive. Ringworm infections are self-limiting and will resolve within 6-8 months. Multi-modal therapy shortens the duration of disease. Therapy includes topical antifungal creams, systemic antifungal drugs, and lime-sulfur dips for cats and dogs.¹⁴ Identifying carriers and affected individuals and isolation of these animals prevents spread to other animals in a shelter setting. Proper disinfection of

¹³ Saunders JD, Twedt, DC. (2009). Current Veterinary Therapy XIV. St. Louis: Saunders Elsevier.

¹⁴ Moriello KA. (2004). Treatment of dermatophytosis in dogs and cats; review of published studies. *Veterinary Dermatology*, 15:99.

kennels and carriers between animals - using bleach or quaternary disinfectants - can also limit exposure.

Animal shelters house a large number of animals in addition to having many people that interact with the animals daily. Staff, volunteers, and public all view and handle the animals at the shelter every day. Any situation with a high level of interaction between species provides ample opportunities for zoonotic disease spread. Rabies, bartonellosis, leptospirosis, toxocariosis, toxoplasmosis, pasteurellosis and dermatophytosis are zoonotic diseases seen in animal shelters. Education of staff and clients about these zoonotic diseases limits their spread and occurrence in shelters.

Focus and Scope of Work

From January to March, I clocked over 300 hours at the Animal Protective League. I spent most of my time managing cases in the shelter and providing care for the animals needing medical attention. I vaccinated, diagnosed and treated hundreds of animals during this period.

I worked closely with Dr. Kathleen Ritzmann who has been the shelter veterinarian at the Animal Protective League for eight years. She started work at APL in 2008, shortly after graduating from Kansas State University with both her DVM and MPH degrees. She believes both degrees are useful every day in practice. In veterinary school, population medicine relates primarily to livestock; however, shelters also treat animals based on population medicine.

Additionally, I observed the public visiting the animals and listened to the conversations between adopters and the staff at APL. With regards to the questions most commonly asked; it was interesting that the potential for zoonotic disease transmission was not of obvious concern. The adopters focused on learning what services the adoption fee covered, as well as what vaccinations the animal had received. They were also curious about the animals' personalities and characteristics. Rarely, someone would ask about an illness with one of the animals.

On occasion, people talked about the cats sneezing and having a cold. They assumed touching these animals would transmit the cold virus to themselves. Once a

kennel assistant told a patron that the dogs received influenza vaccinations, to which the patron responded, “That’s good, because I didn’t get my flu shot this year and wouldn’t want to catch the flu.”

As another example of misinformation, the public thought they could become sick from the FIV or FeLV positive cats and that AIDS could be acquired by the affected cats. It became evident the public did not have the knowledge of zoonotic and species-specific diseases. In response, I created informational handouts regarding which diseases were zoonotic and transmissible to better inform the public.

Lastly, during my field experience, I observed cleaning and day-to-day practices among the staff. I watched and evaluated their biosecurity procedures. There were many instances where biosecurity measures could be improved. Proper use of disinfectants (contact time and number of cleanings between animals), proper sanitation of food and water bowls, changing the litter pans, and correct order of cage cleaning are examples of biosecurity procedures that were at times performed incorrectly.

Learning Objectives

Before my field experience I created a list of objectives on which I hoped to gain insight during my time at the Animal Protective League. My first objective was to learn how population based medicine better streamlines flow in an animal shelter. My second objective was to learn how public health and shelter medicine interact. The third objective was to learn how to educate and inform the public of zoonotic diseases. My final objective was to learn ways to prevent diseases from entering a shelter and how to treat and quarantine cases during an outbreak.

Activities Performed

In addition to performing duties as a veterinarian, I also reviewed biosecurity and cleaning procedures performed by the staff. It was in these activities that I witnessed how calicivirus (non-zoonotic) and ringworm (zoonotic) were being spread among the animals due to staff's lack of biosecurity measures.

While calicivirus is not a zoonotic disease, it is a highly transmissible disease among cats, especially when not observing proper biosecurity protocols. Animals identified with calicivirus have cage cards and signs on their cages alerting the staff to their condition. These cage cards indicate in which order for cage cleaning and animal medication based on severity of symptoms. The staff should handle the animals with the most obvious clinical signs for the disease last to prevent spread to healthy animals. Staff was also instructed to place cats with calicivirus into labeled carriers during cage cleaning. On multiple occasions I witnessed staff not following the desired animal handling order, not wearing gloves when handling the animals, or holding calicivirus-infected animals close to their clothes before moving on to healthy animals. My observations led to calicivirus protocols being selected as the next staff meeting topic. Dr. Ritzmann and I led this staff meeting. Afterwards, the staff understood that their actions were spreading the disease; they were more cautious and fewer mistakes were observed.

While observing biosecurity measures, I learned ways the shelter could handle transmissible disease outbreaks to prevent the entire shelter from shutting down. I paid particular attention to ringworm during my field experience. Most shelters cannot appropriately handle outbreaks of ringworm. In contrast, APL has experienced several

outbreaks over the years and currently maintains a ringworm isolation ward to treat both APL animals and animals from other shelters that would otherwise euthanize the affected animals. In the geographic area served by APL, cats seem to be the species most likely to be affected, so APL created a separate isolation ward within the isolation wing of the facility strictly for ringworm-positive cats. Designated staff enter the ringworm ward once a day. All the equipment needed to care for these animals is located in the ward and not removed. Staff wear disposable Tyvek suits, caps, boots, and gloves prior to entry into the ringworm ward. Cats are numbered within the ward to indicate which cats have the most lesions and need to be handled last. Once each week cats are dipped with a lime-sulfur product and as noticeable lesions disappear, the staff performs ringworm cultures. Two negative cultures allow an animal to be removed from the ringworm ward. All new admissions to the shelter with alopecia and erythematous lesions get evaluated with a culture and by a veterinarian. If deemed suspicious, the animal will go to the ringworm ward even without a positive culture. All animals assigned to free-roaming cat rooms must have a negative culture before they are exposed to the other cats in order to prevent outbreaks among shelter animals.

Lastly, by seeing cases on a weekly basis, I learned the importance of combining individual medicine with population medicine to minimize disease. I learned that in order to operate a smooth and effective shelter, one must rely heavily on the ability and knowledge of the staff to identify potential issues as soon as they arise and act quickly to prevent spread of disease.

Products Developed

During my time at APL I evaluated the most common zoonotic disease issues that could arise as the public interacts with animals at the shelter. I identified rabies as having the greatest human impact and ringworm as being the most common zoonotic issue at APL. Other considerations for zoonotic disease in shelter medicine include: toxoplasmosis, toxocariosis, pasteurellosis, and bartonellosis. In order to educate the public about zoonotic disease and transmission, I developed a flyer to display at the shelter as well as to provide as a handout to all adopters. I developed separate flyers for the most common zoonotic disease in the shelter (ringworm) and the most well-known zoonotic disease (rabies). The flyers are attached to the end of the report (**Appendix 2 & 3**). In the future, if received well, additional flyers could be created for other diseases.

While doing research at the shelter, I realized staff members did not know about zoonotic disease threats. I informally discussed zoonotic disease with three staff members that represent the areas of the shelter with the most public interactions (cat nook, kennels, and front office) and asked them the same three questions: 1. What does a zoonotic disease mean? 2. Does the shelter have any zoonotic diseases currently? 3. Can you name one zoonotic disease? The answers were as follows:

1. "A disease that is fatal" "A disease people can get from animals" "A disease that animals spread to each other"
2. "Yes" "Yes" "Yes"
3. "FIV" "Ringworm" "Kennel Cough"

After gathering these responses, I realized that the staff was not well informed on zoonotic diseases and further training about this important topic would be beneficial.

My observations led to the creation of a flyer identifying zoonotic diseases encountered in shelter medicine. This flyer is located at the end of this report (**Appendix 1**).

Foster “parents” provide an important source of animal housing and care-giving to enable APL to take in more animals than the main shelter facility can hold. However, foster “parents” range greatly in their understanding of biosecurity principles and zoonotic disease risks. Improved education and training of the foster network on the basics of biosecurity and disease management will help prevent zoonotic and readily transmissible animal diseases. To prevent disease spread among animals, foster homes should have an all-in, all-out protocol. Animals should not be added into the home until all the animals are released for adoption. Some fosters have separate rooms for different aged animals (i.e., kitten room, adult room, etc.). For these fosters, the foster should keep materials segregated to each room – separate bedding, food bins, etc. The foster should also change clothing and wash hands before entering a new room. Gloves should be worn when handling the animals in separate rooms. Foster homes should be able to segregate their own animals from the foster animals to prevent spread of disease from their own animal to the fostered animals. Each foster home should ideally be treated as a “mini shelter” setting and should adhere to the same biosecurity procedures that are in place at the shelter.

Appendix 5 contains a prioritized list of biosecurity measures that should be enforced at APL and adapted for use in foster homes as well. The list prioritizes measures based on feasibility for APL determined by a combination of the current facility design, finances, and already instated protocols.

Lastly, I created a table that highlighted zoonotic diseases encountered in shelter medicine. It provides shelter veterinarians with a list of disease highlights, symptoms, treatments, and prevention strategies. (**Appendix 4**)

Alignment with Public Health Competencies

Throughout my field experience I gained insight about the public health competencies and how the courses I completed prior to the experience prepared me for my time at APL. Each of the competencies were useful during my field experience as outlined below:

Core Competencies

- **Biostatistics** – Although I did not directly use statistics during this field experience, numerous ideas on how to use biostatistics came to mind when brainstorming other potential studies that would be useful for the Animal Protective League. Some future studies for APL could include analyzing adoption/return statistics. Do medical reasons play a factor in return of animals? Do animals that had a history of being ill while in the shelter get returned at a higher rate than those that were apparently normal? Do animals adopted out as puppies/kittens get returned more or less frequently than older animals? Is there a statistical significance of the spread of disease in isolation given time of the year or do staff members play a role?
- **Environmental Health Sciences (epidemiology)** – Understanding how the disease can spread in the shelter environment was very important to this field experience and epidemiology played a huge factor. Understanding how the shelter setup and environment could potentially increase or decrease the risk of transmission was vital to learning how to implement changes that would limit contraction and spread of infectious diseases.

- Health Services Administration – This was a very educational course which helped me to understand how people perceive and communicate regarding health care information. While I dealt more with health care of animals, the same principles were applicable throughout the experience.
- Social and Behavioral Sciences – This course helped me to understand why the public seeks certain information regarding the animals and also why they are misinformed on zoonotic. Also, it helped me to understand the behavior of the staff members and how misinformation and lack of knowledge can lead to lapses in adherence to protocols.

Elective Competencies

- Veterinary Bacteriology and Mycology - This course provided insight into the transmission and life cycle of ringworm. Understanding how transmission occurs helped me evaluate protocols on how ringworm was handled in the shelter.
- Veterinary Virology – Virology was important in understanding the transmission of rabies and how to better educate the public about this fatal disease.
- Veterinary Immunology – Immunology was helpful in understanding how the immune system of an animal would respond to a given pathogen. It helped me anticipate how animals would react when given vaccines and at what time as well as how they responded when exposed to communicable diseases.
- Trade and Agriculture Health – I did not use this class specifically in my experience. I did learn a lot about state regulations while researching regulations and codes of standards for shelter medicine.

- Overview of Food Safety and Security – This class helped with understanding the biosecurity principles one needs to apply when handling animals that could potentially transmit zoonotic disease.
- Qualitative Analysis – I did not collect any numerical data during my experience. This class prepared me to set up excel sheets and data logging that could be used for future experiences or research at the Animal Protective League. For example, one could investigate effectiveness of treatments or the time required to clear ringworm in cats in a shelter setting vs a foster home.
- Strategic Health Communication – In this course I learned how to identify an issue and effectively communicate a response and solutions to the issue. This helped address which diseases were common misconceptions and which diseases were priorities for education of the staff and public.

Conclusions

In conclusion, Animal Protective League, and other shelter medicine groups, provide an extraordinary service to the public and animals. However this does not come without difficulties and obstacles. By far the biggest challenge is melding the treatment of animals individually with the concept of population medicine applied to the entire shelter. It is easy to focus on treating the individual and forgetting that the decisions could have an impact on the rest of the shelter population. Another big challenge is educating the public and shelter staff about zoonotic disease. Zoonotic diseases can easily be transmitted from the animals to the public if proper protocols are not in place to limit transmission.

Many of the shelter staff have had limited exposure to zoonotic disease and concepts concerning their control. By educating the staff members on the basics of zoonotic diseases in shelter setting, we equip them to pass along their knowledge to the public. Providing owners with information prior to adoptions will hopefully minimize the return of animals and also help place animals with diseases such as Feline Leukemia Virus and Feline Immunodeficiency Virus into appropriate homes.

Stressing the importance of zoonotic transmission at the Animal Protective League helped the staff follow the protocols more diligently. They understood the reasoning behind the cleaning procedures and quarantine. Staff are more likely to follow guidelines if they understand the necessity and value of those procedures.

Overall, shelter medicine is very closely linked to public health in many aspects of daily operations. It is important the animals and people stay healthy and limit the

transmission of disease. A shelter veterinarian is tasked with the difficult job of juggling public health, population medicine and individual assessments on a daily basis.

I strongly encourage any dual DVM/MPH student who has an interest in shelter medicine to consider doing a field experience at an animal shelter. It is amazing the way these two fields merge together to create the diverse specialty of shelter medicine. The Animal Protective League is a well-established, highly respected animal shelter in the central Illinois area with a strong reputation for success. I enjoyed my time at the shelter and was able to learn quite a bit as well as make suggestions and implement changes to improve the shelter's policies. Veterinary medicine is an ever-changing and exciting field. There is a considerable amount one can do with a DVM degree and with the addition of the MPH degree the veterinary world can be viewed from a different perspective.

There is additional research that can be performed at Animal Protective League for the next MPH students. Follow-up from my experience could include assessment of protocols developed during my time. The next student could analyze the cases of ringworm, calicivirus and herpes virus at the shelter on their arrival. They then could implement a few of the strategies that were devised during my experience and gauge the prevalence of disease after a pre-determined time frame. Another project could include whether animals sent to foster homes are at greater risk for disease if foster "parents" are bit educated about proper protocols. If it is determined that animals in a foster home have a greater risk for disease or do not clear disease as quickly as in the shelter, then the next student should establish educational training periods for the foster parents as well.

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Appendix 1

Poster illustrating potential zoonotic diseases encountered in shelters

What is a Zoonotic Disease?

Infectious disease that can be transmitted between animals and humans.


Zoonotic diseases can be transmitted by direct transmission (air or saliva) or indirectly through an intermediate host such as an insect.

Zoonotic Diseases in Shelters


- ✓ Rabies
- ✓ Ringworm
- ✓ Toxoplasmosis
- ✓ Toxocariosis
- ✓ Pasteurellosis
- ✓ Cat Scratch Fever

Mistaken Zoonotic Diseases

- ✗ Seasonal Influenza (flu)
- ✗ Feline Leukemia Virus
- ✗ Feline Immunodeficiency Virus



Ringworm lesion from a shelter cat



FIV positive shelter cat

Appendix 2

Flyer summarizing rabies virus and zoonotic potential

Rabies

Rabies is a zoonotic disease that can be transmitted to humans from a bite of a rabid animal or from getting saliva from an infected animal into a bleeding wound.

6,000 – 10,000 diagnosed animal cases of rabies in the United States every year

30,000 – 40,000 humans exposed to rabies every year in the United States

Typically 1 – 4 cases of rabies in humans in the United States per year

Signs of Rabies in Cats/Dogs

- Frothy salivation, excess drooling
- Behavior change: aggression or unusual shyness
- Paralysis
- Seizures
- Lack of muscle coordination



Rabies is an often fatal but preventable disease in cats and dogs. Please keep your pets up to date on their vaccinations and seek immediate veterinary care if they get bitten by another animal.

Appendix 3

Flyer summarizing ringworm and potential zoonosis

Ringworm

(*Microsporum canis*)

Young, Senior and Immunocompromised people and animals are most at risk



Signs: Typically a red, inflamed, ring-shaped lesion with crusting and hair loss

Common places to see ringworm in cats and dogs – ears, face, feet and tail. Can be found on any part of the animal.



Prevalent in hot and humid environments

Can be transmitted by direct contact, airborne or by fomite transmission. Spores can live on inanimate objects for years.

Although self-limiting and typically infection will clear on its own in 3-5mo; treatment helps to expedite resolution and also prevent spreading

Appendix 4

Zoonotic Diseases in Shelter Medicine

Disease	Symptoms	Diagnostics	Individual Treatment	“Herd” Treatment	Prevention strategies at the animal level	Prevention strategies at a herd level
Rabies	Apprehension, nervousness, irritability, excitability, biting at surroundings, ataxia, generalized seizures, death, difficulty swallowing, drooling, hoarse vocalization, dropped jaw ¹⁵	Post-mortem dx – rabies virus antigen immunohistochemistry of brain tissue ¹	No treatment	No treatment	Vaccination required for all animals over 4mo of age; minimize exposure of humans to those animals with fast progressing neurological disease	Vaccinations required for all animals over 4mo of age; minimize exposure of humans to those animals with fast progressing neurological disease
Leptosporosis	Cats – generally subclinical but can shed the virus; PU/PD, renal insufficiency ¹⁶ Dogs – fever, anterior uveitis, hemorrhagic tendencies, vomiting, diarrhea, muscle pain, hepato/renomegaly, PU/PD, icterus, coughing, respiratory disease, thrombocytopenia, azotemia, decreased urine concentration, bilirubinemia/uria,	Urine, blood or tissue culture; darkfield microscopy of urine; PCR of blood, urine, tissue ¹⁷ , Increased Ab titers with appropriate clinical signs and response to therapy	Diuresis, penicillins, fluoroquinolones, doxycycline	No herd treatment – treat individuals as affected	Handle urine with gloves; avoid letting animals drink from standing bodies of water or ingest other animals’ urine	Handle urine with gloves; avoid letting animals drink from standing bodies of water or ingest other animals’ urine, disinfect kennels and cages with detergents between animals; vaccination in high risk areas

¹⁵ Nelson RW, Couto CG, et al. (2014). *Small Animal Internal Medicine* (Fifth Edition). St. Louis: Elsevier Mosby.

¹⁶ Arbour J, et al. (2012). Clinical leptospirosis in three cats (2001-2009). *Journal of American Animal Hospital Association*, 48:256.

¹⁷ Harkin KR, et al. (2003). Comparison of polymerase chain reaction assay, bacteriologic culture, and serologic testing in assessment of prevalence of urinary shedding of leptospires in dogs. *Journal of American Veterinary Medicine Association*, 222:1230.

	increases in liver enzymes ¹					
Toxocariosis	<p>Dogs/cats – vomiting, diarrhea, failure to thrive, poor haircoat and poor weight gain; subclinical</p> <p>Humans – visceral larva migrans, ocular larva migrans¹</p>	<p>Fecal float, identification of worms in vomitus or stool</p> <p>Human dx: biopsy or serology¹</p>	Positive fecal floats should be treated with appropriate anthelmintic	Deworm entire population in a shared space when positive results are seen	Wear gloves when handling stool samples; routine deworming	Wear gloves when handling stool samples; discard feces regularly; routine deworming
Toxoplasmosis	<p>Cats – subclinical, self-limiting diarrhea, fever, uveitis, pulmonary disease, hepatic disease, CNS disease</p> <p>Humans – generally asymptomatic, self-limiting fever, lymphadenopathy, malaise</p> <p>Affected during gestation – stillbirth, hydrocephalus, hepatosplenomegaly, retinochoroiditis¹</p>	<p>Fecal float with sugar solution can reveal oocysts, serology can prove helpful but is not definitive for clinical disease as the organism cannot be cleared so cats remain antibody positive for life¹</p>	Supportive care – clindamycin or TMS drugs x 4wks	No population treatment – treat clinical individuals	Do not feed undercooked meat	Scoop litter boxes daily especially in free-roaming cat rooms to prevent oocyst sporulation
Pasteurellosis	Humans – infected wounds can lead to meningitis, endocarditis, septic arthritis, osteoarthritis, septic shock ¹	Culture of infected wounds	Penicillin antibiotics	Penicillin antibiotics for animals with wounds	Caution when handling animals; avoid bites	Limit interactions between animals to avoid bites between them
Dermatophytosis	Hair loss, scaling, and crusting lesions; subclinical carriers ¹⁸	Culture is standard of care	Self-curing; topical antifungal creams + systemic anti-fungal; lime-sulfur dips twice weekly ¹⁹	Isolate affected animals quickly; routine washing of bedding and decontamination of kennels; also individual tx	Isolate healthy animals from those with suspected ringworm	Known positives should be isolated; proper biosecurity procedures when handling affected

¹⁸ Saunders JD, Twedt, DC. (2009). Current Veterinary Therapy XIV. St. Louis: Saunders Elsevier.

¹⁹ Moriello KA. (2004). Treatment of dermatophytosis in dogs and cats; review of published studies. *Veterinary Dermatology*, 15:99.

						animals; ringworm positive animals should be handled after healthy animals
Campylobacter spp.	Cats and dogs – mucoid diarrhea, anorexia, fever, chronic diarrhea, vomiting ⁶ Humans – vomiting and diarrhea	Fecal smear, fecal PCR ⁶	Erythromycin, neomycin, fluoroquinolones ⁶	Isolation of affected animals, quick disposal of feces, individual tx	Do not feed raw diets, quick disposal of feces, proper sanitation	Proper sanitation and cleaning of kennels, quick disposal of fecal material, limit overcrowding
Salmonellosis	Cats and dogs – acute/chronic diarrhea, septicemia, sudden death, severe neutropenia ⁶ Humans – vomiting and diarrhea	Blood culture, fecal PCR ⁶	Fluid therapy, NSAIDs, abx when septicemic ⁶	Isolation of affected animals, quick disposal of feces, individual tx	Do not feed raw diets	Do not feed raw diets, quick disposal of fecal material, proper disinfection methods, limit overcrowding
Giardia spp. (assemblages A and B)	Cats and dogs – small bowel diarrhea, weight loss	Zinc sulfate or sugar centrifugation ²⁰	Fenbendazole, metronidazole	Fenbendazole, metronidazole	Yearly fecal exams	Yearly fecal exams, thorough hand washing; proper disinfection of kennels
Brucellosis	Dogs – abortion, stillbirth, failure to conceive, orchitis, epididymitis, vaginal discharge, uveitis, discospondylitis, bacteremia Humans – intermittent fever, depression, malaise ⁶	Serology or culture			OHE/Castration limits contamination	Avoid contact with vaginal and preputial discharge in dogs
Ancylostoma spp.	Cats and dogs – Subclinical; poor haircoat, poor weight gain, vomiting, diarrhea,	Fecal float	Fenbendazole	Fenbendazole	Fecal floats and routine deworming	Routine fecal floats and routine dewormings;

²⁰ Scorza AV, et al. (2012). Comparisons of mammalian *Giardia duodenalis* assemblages based on the B-giardin, glutamate dehydrogenase and triose phosphate isomerase genes. *Veterinary Parasitology*. 189:182.

	pale mm with severe infections Humans – pruritic, erythematous skin lesions, abdominal pain with intestinal infection ⁶					quick cleanup of fecal material
Insect – transmitted zoonotic diseases						
Ehrlichiosis	Dogs and cats – subclinical, fever, anorexia, lethargy, weight loss, joint pain, pale mucous membranes, splenomegaly, dyspnea, lymphadenopathy ⁶ Humans – fever, polysystemic disease	Clinical signs, serology in dogs, response to tx, PCR is test of choice in cats ⁶	Cats - Doxycycline, imidocarb dipropionate Dogs – tetracyclines, chloramphenicol ⁶	Individual tx	Tick preventives	Tick preventives, screening of blood donor dogs
Borreliosis (Lyme Disease)	Dogs and cats – subclinical, fever, polyarthritis, lameness, anorexia, nephropathy ⁶ Humans – polyarthropathy, cardiac and CNS disease	Serology, response to abx, clinical signs; biopsy ⁶	Doxycycline, amoxicillin, ampicillin, clavamox, cephalexin; tx for at least 4 weeks ⁶	Individual tx	Tick preventives, vaccination	Vaccination in high risk areas; tick preventives
Tularemia	Cats – generalized lymphadenopathy, organ abscesses, fever, anorexia, death	Culture of exudate, increasing antibody titers, necropsy ²¹	Streptomycin, gentamicin	Individual tx	Tick preventatives, limit exposure to wild rabbits	Tick preventives, avoid contact with wild rabbits
Rocky Mountain Spotted Fever	Dogs – subclinical, fever, depression, interstitial pulmonary disease, dyspnea, cough, GI signs, petechiae, epistaxis, hyphema, hyperemia, vasculitis, hemorrhage, seizures, paresis, tremors, cardiac arrhythmias ²²	Neutrophilic leukocytosis with left shift and toxic cells is supportive; clinical history and signs in combination with seroconversion or increasing titers ¹³	Fluid therapy, doxycycline, chloramphenicol, and enrofloxacin ¹³	Treating individual animals	Tick preventatives	Tick preventatives

²¹ Magnarelli L, et al. (2007). Detection of Antibodies to *Francisella tularensis* in cats. *Research in Veterinary Science*, 82:22.

²² Fritz CL, et al. (2012). Tick infestation and spotted-fever group *Rickettsia* in shelter dogs, California, 2009, *Zoonoses Public Health*, 59:4.

	Humans – fever, polysystemic disease					
Bartonellosis	<p>Cats – fever, lethargy, lymphadenopathy, uveitis, gingivitis, neurologic disease, endocarditis, myocarditis, osteomyelitis, hyperglobulinemia, cutaneous vasculitis¹</p> <p>Dogs – endocarditis, fever, arrhythmias, hepatitis, granulomatous lymphadenitis, cutaneous vasculitis, rhinitis, polyarthritis, meningoencephalitis, thrombocytopenia, eosinophilia, monocytosis, IMHA, epistaxis, idiopathic cavity effusion, uveitis¹</p> <p>Humans – lymphadenopathy, fever, malaise, weight loss, myalgia, headache, conjunctivitis, skin eruptions, arthralgia¹</p>	Blood culture, Blood PCR, serologic testing (serum antibodies) ¹	Only treat clinically ill animals ²³²⁴ Doxycycline + fluoroquinolone for dogs; treat cats for 7d with doxycycline – if positive response continue treatment for minimum of 28d ⁴	Treat clinically ill animals in the population – no herd treatment	Clip nails; humans with an immunodeficiency should avoid kittens (more likely to cause injury); all cat wounds should be evaluated by a physician	Monthly use of imidacloprid products in cats prevents transmission of <i>B. henselae</i> ²⁵
Plague	Cats – bubonic, septicemic, pneumonic plague, fever, weakness, suppurative lymphadenitis ²⁶	Cytology of exudate, confirmation via fluorescent antibody staining, culture ¹⁵	Doxycycline, fluoroquinolones, chloramphenicol, aminoglycosides ¹⁵	Isolation of animals with exudative wounds, plus treatment of	Flea control	Flea control, keep cats indoors

²³ Brunt J, et al. (2006). Association of Feline Practicioners 2006 Panel report on diagnosis, treatment, and prevention of Bartonella spp. infections. *Journal of Feline Medicine and Surgery*, 8:213.

²⁴ Kaplan J, et al. (2009). Guidelines for prevention and treatment of opportunistic infections in HIV-infected adults and adolescents. Recommendations and reports, *MMWR* 58(RR04):1.

²⁵ Bradbury C, & Lappin M. (2010). Evaluation of topical application of 10% imidacloprid - 1% moxidectin to prevent Bartonella hensalae transmission from cat fleas. *Journal of American Veterinary Medical Association*, 236:869.

²⁶ Gage KL, et al. (2000) Cases of cat-associated human plague in the Western US 1977-1998. *Clinical Infectious Diseases*.30:893.

	<p>Dogs – not associated with zoonotic transfer</p> <p>Humans – bubonic, septicemic, pneumonic plague – fever, headache, weakness, malaise</p>			individual animals		
Scabies	<p>Cats and dogs – alopecia, pruritus, erythema</p> <p>Humans – pruritus, rash</p>	Skin scraping	Selamectin is treatment of choice; imidaclopramid/moxidectin, ivermectin are also effective ²⁷	Isolation of affected animals, tx of individual animals	Isolate affected animals, thoroughly clean all bedding	Isolate affected animals, thoroughly clean all bedding, PPE should be worn when handling affected animals
Cheyletiella	<p>Cats and dogs – pruritus, scaling, alopecia</p> <p>Humans – pruritic rash</p>	Tape impression, fecal float	Imidaclopramid/moxidectin, selamectin, permethrin ²⁸	Treat individual animals	Isolate affected animals, clean all bedding	Isolate affected animals, clean all bedding, organophosphate insecticides for the environment

²⁷ Shanks DJ, McTier TL, Behan S, et al. (2000). The efficacy of selamectin in the treatment of naturally acquired infestations of *Sarcoptes scabiei* on dogs. *Veterinary Parasitology*. 91:269.

²⁸ Bowman D. (2009). *Georgis' Parasitology for Veterinarians* (Vol. 9). St. Louis: Saunders Elsevier.

Appendix 5

Proposed Biosecurity Measures at APL

- (highest priority) – Gloves must be worn when handling any animal and must be changed between animals.
- Animals should be transported to different locations by carrier or wrapped in a towel. These items should then be cleaned between animals. Animals should not be held against clothing.
- Sick animals should be handled last in a room and their cages cleaned after all apparently healthy animals have been addressed.
- Staff should change clothes when an animal has soiled their clothing or come into contact with their clothing.
- Dog feces should be picked up immediately and disposed of. Cat litterboxes should be scooped at minimum once daily and completely changed once weekly.
- All cages, kennels, and carriers should be disinfected once an animal is no longer using the housing.
- All-in, all-out population protocol for isolation areas should be implemented.
- Designated staff should be assigned for isolation and ringworm areas, that solely deal with these animals and not the general population during a given day.
- Ringworm and isolation should have their own entrance/exits from the building.
- (least priority) – Redesign facility design to better flow through the building – isolation units should be at the end of the building where there is limited access, separate entry/exit, and separate ventilation systems.