

Master of Public Health
Integrative Learning Experience Report

***THE DEVELOPMENT OF ZOO NOTIC DISEASE PREVENTION
EDUCATION MATERIALS FOR ANIMAL SHELTER WORKERS
IN KANSAS***

by

Katya Luckenbach

MPH Candidate

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Graduate Committee:

Dr. Ellyn Mulcahy

Dr. Justin Kastner

Dr. Paige Adams

Public Health Agency Site:

Kansas State University Shelter Medicine Mobile Unit Program

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Site Preceptor:

Dr. Brad Crauer

KANSAS STATE UNIVERSITY

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Summary

Diseases that result from the transmission of pathogens from animals to humans are referred to as zoonotic diseases. Individuals who work closely with animals on a daily basis have an increased occupational hazard of contracting a zoonotic disease. Holding a position in an animal related field, such as veterinary medicine, often requires an educational background and/or on the job training in zoonotic disease prevention. There are, however, other fields where employees are required to work closely with animals but are not provided adequate training on zoonotic disease prevention. Animal shelter workers and volunteers may be among those who are at the highest risk for contracting zoonotic diseases, yet they are not consistently provided educational materials or tools to help them prevent the spread of disease. While an abundant amount of primary literature has been published on zoonotic disease potential of pathogens commonly carried by dogs, cats, and other animals that might be living in animal shelters, there are arguably, no user-friendly guide books or guidelines designed to train shelter workers on zoonotic disease prevention. This project aims to identify which zoonotic diseases animal shelter workers are most at risk for contracting and to create user friendly educational materials for use in training animal shelter workers.

Subject Keywords: Zoonotic disease, animal shelter, shelter medicine, occupational hazard, education, staff training.

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Chapter 1 - Literature Review

Demonstrated need for education

The increased occupational hazard of contracting zoonotic diseases for individuals working in animal related fields is documented, but the exact level of risk remains vague [1-3]. Of particular interest is the occupational hazard that animal shelter workers are exposed to after accepting their position. As training can be inconsistent for animal shelter workers, especially volunteers, it is reasonable for shelter managers to seek additional training materials for their workers [2]. Currently, there are no user-friendly guidelines published for animal shelter workers to be trained on zoonotic disease prevention.

Following an extensive internet search, it was determined that there were likely two major resources that animal shelter workers may come across when trying to search for information on zoonotic diseases in shelter systems. The most relevant source is an American Humane Society guide that was published in 2010 [4]. The document is a 50-page guide that includes transmission modes, most common diseases, less common diseases, and breakdown by species [4]. While the guide is available to the general public, it seems to be a more complex resource that is intended for higher level shelter managers to be used to help them improve shelter operations to avoid zoonotic disease transmission. The resource is arguably lengthy and technical and would likely not be useful for training new staff and volunteers who have various levels of background knowledge on zoonotic diseases. The second resource that searchers are likely to come across is the Centers for Disease Control and Prevention (CDC) zoonotic disease general guidelines page [5]. This resource is user friendly but may be too vague to be useful for training animal shelter workers. The CDC also has user friendly internet pages on individual zoonotic diseases but searchers would likely need to already know which disease(s) to search for in order to come across these pages. The CDC does not have any sources that are specific to animal shelter systems. This being the case, there is room in the field for a more practical training guide.

Shelter workers themselves reported workplace hazards, a lack of zoonotic disease education, and a desire to be trained on zoonotic disease prevention [2, 3].

According to a set of animal shelter surveys in the United States, infectious disease training is provided to approximately 30% of staff members and approximately 35% of volunteers before they start working [3]. Even with this low number of staff being trained on zoonotic disease threats, over 90% of shelters reported that they thought they would benefit from training in infectious and zoonotic disease prevention [3]. Although shelter managers express a desire to train workers on zoonotic diseases, many shelter workers and volunteers were reported to have low levels of concern for zoonotic diseases that were endemic to their local area such as plague, tularemia, or leptospirosis [3]. This further demonstrates that there is a need for awareness and training in the field.

While it had been established that zoonotic disease training was both needed and desired, additional data would be needed to determine which prevention measures would be realistically and effectively implemented in a shelter setting. As shelter resources are limited and drastic changes in protocol would take time and resources, any recommended prevention measures should be easy to implement. For example, only 32% of animal shelters have rules about food consumption in animal housing areas [3]. Making recommendations about not eating near animals would likely be an easy change to implement at any given shelter and may encourage workers to be more aware of cross contamination. In contrast, it may be too complicated to make recommendations that shelter workers store their food in refrigerators that are designated for human food, as this may not be something that existing shelter infrastructure could accommodate. Approximately 69% of animal shelters reported that they have separate refrigerators for human food [3]. This means that at least 21% of animal shelters would have to use resources and space to obtain and install refrigeration units designated for human food. As this may be an impossible expenditure, a more realistic recommendation might be to instruct shelter workers to store their food in personal insulated bags in areas that are not close to the animals.

Disease selection

There are many diseases that cats, dogs, and other common shelter pets harbor that have zoonotic potential. Some of these pathogens have been found to consistently

cause disease in humans while others rarely cause disease or only cause disease in immunocompromised individuals [1]. It is important for shelter workers to be aware of diseases that can be spread by cats and dogs, diseases that can be spread by exotic pets, and potentially even diseases that can be spread by livestock and wildlife. It is also important for shelter workers to be aware of common misconceptions about zoonotic disease. In an effort to keep educational materials concise, a limited selection of diseases were chosen to be highlighted in educational materials for shelter workers. Diseases were chosen based on a review of the most common diseases [1]. An initial list of approximately 20 diseases was compiled based on current literature and then narrowed down to a final list of 12 diseases based on a combination of national prevalence and the project mentor's local experiences [1, 6, 9, 12-20]. A list of one dozen diseases was included in the zoonotic disease prevention guide based on zoonotic potential, endemic presence, and/or risk for causing fatal disease. The same diseases were highlighted in a companion pre-recorded training presentation. Table 1.1 summarizes the pathogens that were featured in the educational materials. The remainder of this section will individually summarize background information on each of the chosen zoonotic diseases.

Dermatophytosis

Dermatophytosis, also called ringworm, is one of the most common and well-known zoonotic pathogens in animal shelter settings. Ringworm is caused by dermatophyte species of fungi that cause skin infections in humans and many domestic animals [6]. Some dermatophyte species, such as *Trichophyton rubrum*, are considered anthrohilic and only infect humans [6]. Other species, such as *Microsporum canis*, are considered zoophilic and commonly infect animals including humans [6]. Not all cases of ringworm are zoonotic. Incidence of zoonotic ringworm in the United States is likely underestimated, as there are no national surveillance programs and most patients treated for ringworm do not have their infections cultured to confirm causative agent [9]. Approximately five million patients are treated for ringworm each year in the United States [9]. Humans acquire ringworm through contact with other humans or animals that have the infection or through contact with fomites or contaminated soil [9]. Humans who

work in close proximity to domestic animals, particularly cats, are at an increased risk for contracting ringworm [1]. The most effective way to prevent ringworm from transferring from cats to humans is to properly wash hands after animal handling, wear gloves and long sleeves when handling animals, and disinfect all potentially contaminated surfaces with appropriate agents such as a 1:10 diluted bleach solution [9]. Additionally, individuals who are immunocompromised (taking immunosuppressive drugs, currently undergoing chemotherapy, etc.) are more likely to contract ringworm and develop severe disease [9].

Scabies Infection

Scabies, a microscopic mite that causes intense itching in infected humans and animals, come in many different variants. When humans contract scabies, it is most commonly due to *Sarcoptes scabiei* var. *hominis*; however, it is possible for humans to become infected with animal variants too [10]. *Sarcoptes scabiei* var. *canis* can be passed from dogs to humans and cause clinical signs. The mites are transmitted from animals to humans through direct and prolonged contact. Scabies infections are usually self-limiting in humans but can cause more significant and prolonged clinical signs in immunocompromised individuals [10]. Shelter workers can prevent zoonotic scabies infections through wearing protective clothing, avoiding prolonged direct skin-to-skin contact with animals when possible, and taking note of shelter animals who exhibit signs of extreme itchiness [10].

Rabies Virus

Certain diseases, while uncommon, are dangerous enough to warrant time spent on education. Human cases of rabies virus, for example, are rare in the United States, but the disease is almost always fatal once clinical signs are present [11].

Approximately 5,000 cases of rabies are reported in wildlife and domestic animals in the United States each year, and there have been less than 150 cases of human rabies over the past 60 years [11]. In the United States, populations of wildlife, such as bats, raccoons, and skunks, carry rabies [11]. The United States has been canine rabies free since 2007; however, it is still possible for unvaccinated dogs to be infected with rabies

after contact with rabid wildlife [11]. Although there have been no recent human cases of feline transmitted rabies in the US, some US feral cat populations who are in contact with wildlife have endemic rabies cases therefore pose a possible threat to shelter workers who come in contact with them [11, 12]. Rabies virus infects mammals and can be spread to humans through bite wounds or mucous membrane exposure [11]. As feral cats likely have an unknown vaccination status and may be more likely to cause bite or scratch wounds due to their temperament, they pose a distinct threat to shelter workers. After rabies exposure, there is a critical incubation period window where prophylactic medical intervention can prevent the development of rabies disease in humans [11]. As such, it is critically important that shelter workers know that a bite or scratch from an animal could potentially expose them to rabies and that they should report any bite wounds and seek medical attention immediately.

Toxoplasmosis

Other diseases, such as toxoplasmosis, may be familiar to shelter workers; however, their awareness on how the disease is transmitted may be low [11]. In the US, reports indicate that there is a low level of awareness about toxoplasmosis but a significant level of disease within the population is present [11]. Due to mixed-level awareness, shelter workers may have some pre-existing knowledge or misconceptions about this disease. While workers may commonly know that pregnant women can come in contact with the pathogen that causes toxoplasmosis (*Toxoplasma gondii*) through cleaning cat litter boxes, many workers may not know that they are more likely to come into contact with the organism through undercooked meat [12].

Toxoplasma gondii is a protozoan parasite commonly found in cats but can also be found in dogs, rodents, and birds. *Toxoplasma sp.* can be transmitted through animal feces, through raw or undercooked meat, and can be passed from pregnant women to their babies [12]. Fetuses from women who have not previously been exposed to *Toxoplasma sp.* are at an increased risk for infection [12]. In a shelter setting, it is important to practice good hygiene when handling litter boxes. Pregnant shelter workers may wish to avoid litter boxes all together to further minimize exposure risk. In other

areas, it is also important to follow food safety guidelines in order to best prevent the development of toxoplasmosis.

Giardiasis

Similarly, giardia has historically received media attention but many people are not aware that it is unlikely for them to develop a *Giardia* infection from an infected animal. Protozoan organisms from the genus *Giardia* are microscopic parasites that infect the intestines of humans, dogs, cats, livestock, and some exotic pet species. Dogs, cats, and humans can all carry different species-specific variants of *Giardia* [13]. *Giardia* species (*sp.*) are spread through feces and contaminated water sources. Most commonly, when humans become ill from *Giardia*, they have been infected with *Giardia duodenalis* from another human through unclean surfaces, poor hand hygiene, or contaminated food and water [13]. While there are a few case reports of humans becoming infected with *Giardia sp.* from dogs, cats, and livestock, zoonotic *Giardia* infections are very unlikely. It is much more common for humans to contract species-specific variants of *Giardia* [13]. However, it is important for shelter workers to take measures to prevent animal to human transmission of *Giardia* because it continues to be a possible zoonotic risk.

Helminth infections

Some zoonotic diseases that arise from different forms of a disease or disease vector can be commonly confused. Tapeworm infection, for example, can be contracted from multiple different species of tapeworm. Dogs carry different types of tapeworm but only some can be zoonotic [13]. The tapeworm species *Dipylidium caninum* has larva that live inside of fleas and could only be zoonotically transmitted if a human ingested a flea. When dogs groom themselves and ingest an infected flea, they can become infected with the tapeworm. While it is rare for humans to acquire this kind of tapeworm, young children that play with or kiss dogs and accidentally ingest a flea are at risk for becoming infected with a tapeworm [13]. Animal shelters may wish to consider this risk when deciding whether or not they allow children to visit and volunteer. The other type of tapeworm that a dog may have is an *Echinococcus* species of tapeworm.

Echinococcus granulosus is zoonotic and can be dangerous to a human who becomes infected due to its potential for forming cysts in the lungs and liver [14]. The most common way this type of tapeworm could be spread in an animal shelter setting would be through a fecal-oral route. When animal shelters regularly treat animals for fleas and test/treat them for tapeworms, it is less likely that shelter workers will become infected with tapeworms from these animals.

Canine hookworms (*Ancylostoma caninum*), canine roundworms (*Toxocara canis*), and feline roundworms (*Toxocara cati*) are other types of zoonotic parasitic worm that animal shelter workers are likely to come in contact with [17, 18].

Roundworms, hookworms, and a variety of other parasitic worms can be transmitted from shelter animals to humans via the fecal-oral route. Juvenile animals are more likely to be infected with gastrointestinal parasites or to have a higher parasitic load, so shelter workers should exercise extra caution when dealing with puppy and kitten excrement [17]. Human children are more likely to become clinically ill from roundworm or hookworm infection but adults are also susceptible [17].

Hookworms pose an additional threat and can cause cutaneous larva migrans, a condition that occurs when hookworm larva penetrate and migrate through the skin, causing swelling and irritation [18]. This is most likely to happen when there is a large parasite burden in soil or sand that animals have defecated in [18]. In order to minimize risk for cutaneous larva migrans, shelter workers should regularly clean areas where animals go to the bathroom and should always wear protective footwear on an animal shelter premises.

Salmonellosis

A variety of bacterial infections, most notably salmonellosis, are easily transmitted from infected animals to humans [25]. *Salmonella sp.* can cause mild to severe gastrointestinal upset and impacts immunocompromised individuals to a higher degree [25]. Shelter animals such as dogs, cats, birds, and reptiles frequently shed *Salmonella sp.* even if they are not showing symptoms [25]. The bacteria can infect humans via the fecal-oral route. Once infected, humans can spread the bacteria to other humans through fecal contamination. For this reason, it is important for shelter workers

to always practice good hand hygiene and to swiftly clean up messes that involve fecal material.

Campylobacteriosis

Campylobacteriosis, traditionally known as a food-borne illness caused by the bacteria *Campylobacter jejuni*, is considered a zoonotic pathogen [26]. Although the vast majority of cases in the US are attributed to food-borne outbreaks from meat or milk, there is an increasing concern for zoonotic transmission of the pathogen via the fecal-oral route [26]. In 2016 and 2019, two large outbreaks of campylobacteriosis among puppies were identified in the US. These particular outbreaks were increasingly concerning because they involved a multi-drug resistant strain of *Campylobacter jejuni* [26]. Although the potential for direct fecal-oral transmission of the pathogen is relatively low, the impact of such a zoonotic event would be high because an infection with multi-drug resistant bacteria would be difficult or impossible to treat. As shelter workers work directly with puppies on a daily basis, it is important for them to be aware of this threat and exercise proper precaution when handling puppies and their fecal material.

Leptospirosis

Leptospirosis is a disease caused by *Leptospira spp.* bacteria that is commonly transmitted through animal urine [22]. Dogs often come in contact with leptospirosis through wild animal urine and can in turn pass the pathogen to humans they come in contact with [22]. Although leptospirosis is considered to be globally widespread among animals and humans, it is often underdiagnosed and can go untreated [23]. In humans, it produces a variety of “flu-like” symptoms including fever [22]. The disease is also not always easily recognizable in animal patients. Asymptomatic shedding among canine populations has been widely reported [24]. This means that animal shelter workers could come in contact with dogs who could be shedding the disease but not showing any clinical symptoms. Since the bacteria is shed in the urine and animals do not always show clinical signs, all urine messes should be considered contaminated. In general, urine messes should be treated in the same way that fecal messes are. Shelter

workers should take care to wear gloves, sanitize contaminated areas, and practice good hand hygiene after cleaning up messes.

While the above-mentioned diseases by no means represent an exhaustive list of potentially zoonotic threats in an animal shelter, they highlight some of the most important diseases to include in an animal shelter training guide. Many zoonotic diseases are still actively being researched [30]. As such, zoonotic potential and cases reported per year may be underestimated [30]. The ability for a pathogen to be transmitted from an animal to a human and cause disease, also known as “zoonotic potential”, can be difficult to quantify. Some diseases frequently and easily pass from animals to humans (high), others may tend to only be transmitted to immunocompromised humans (intermediate), and some pathogens are only transmitted to humans in rare or isolated events (low). Categorization of zoonotic potential was chosen by the author based on CDC data [5]. Table 1.1 summarizes what is currently known about route of transmission, zoonotic potential, and rate of disease for the pathogens selected to be included in the zoonotic disease training guide.

Table 1.1 Summary of Selected Zoonotic Diseases

Pathogen Type	Pathogen	Disease Common Name	Route of Transmission	Zoonotic Potential	Estimated US Cases Per Year
Fungi	<i>Microsporum canis</i>	Ringworm	Direct skin to skin contact or fomite	High, more severe in immunocompromised	5 million <i>(including zoonotic and human to human spread)</i> [6]
Parasitic Mite	<i>Sarcoptes scabiei</i> var canis	Scabies	Direct contact or fomite	High, more severe in immunocompromised	3,000 <i>(including zoonotic and human to human)</i>

					spread)[10, 17]
Parasitic Helminth	<i>Dipylidium caninum</i>	Tapeworm	Flea ingestion	Low, most common in children	Sporadic case reports [19]
Parasitic Helminth	<i>Echinococcus sp.</i>	Tapeworm	Fecal/oral	Low	<50 [18]
Parasitic Helminth	<i>Toxocara canis</i>	Roundworm	Fecal/oral	Intermediate	10,000 [19]
Parasitic Helminth	<i>Ancylostoma caninum</i>	Hookworm	Skin penetration	Intermediate	Sporadic case reports [20]
Parasitic Protozoa	<i>Toxoplasma gondii</i>	Toxoplasmosis	Ingestion of undercooked meat, fecal/oral, transplacental	High	1 million (including food-borne) [21]
Parasitic Protozoa	<i>Giardia duodenalis</i>	Giardiasis	Ingestion of contaminated water or fecal oral	Low	Sporadic Case Reports [15]
Bacteria	<i>Leptospira sp.</i>	Leptospirosis	Ingestion of infected urine or urine contaminated water	Intermediate	150 [22]
Bacteria	<i>Salmonella sp.</i>	Salmonellosis	Fecal oral, direct contact, or undercooked meat	High	1.3 million (including food-borne) [25]
Bacteria	<i>Campylobacter</i>	Campylobacteriosis	Undercooked meat or fecal/oral	High	1.5 million (including food-borne) [26]
Virus	Rabies virus	Rabies	Direct contact through bite wound or	High	1-3 [9]

			mucous membrane exposure		
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Prevention measures

As can be seen from the above disease summaries, there are a variety of ways to prevent zoonotic disease spread. The education materials for this project included methods for prevention of each featured disease and highlighted measures that workers could take to protect themselves from multiple diseases at once. Fortunately, the measures that can be taken to prevent a common disease like ringworm can also be used to prevent other zoonotic diseases that workers encounter in the shelter system. For example, wearing gloves and washing hands to mitigate the spread of ringworm can also protect workers against zoonotic organisms that are transmitted via the fecal-oral route such as *Toxocara canis*, *Salmonella sp.*, or *Campylobacter jejuni* [1]. Wearing long sleeves and other protective clothing to prevent ringworm can also protect against diseases that may be transmitted through bite or scratch wounds such as rabies virus or *Bartonella henselae* [1, 10]. Encouraging workers to form habits that prevent them from acquiring a common zoonotic pathogen like ringworm will likely also protect them against contracting some rarer zoonotic diseases.

Agency and project mentor

The Shelter Medicine program at Kansas State University is an extension of the Kansas State Veterinary Health Center (VHC) and provides services to animal shelters and underserved communities across Kansas. The program has a small fleet of mobile surgical suites and medical units that are sent to a variety of Kansas shelters on a rotating basis. Each day, a small group of three to four senior veterinary students, one to two mentor veterinarians, and support staff travel to their designated location to offer no-cost medical services. The majority of trips involve taking the mobile surgical suite to an animal shelter to conduct/perform high quality high volume spay and neuter (HQHVSN) surgeries on soon to be adoptable shelter pets. The animal shelters benefit from the access to surgeries to make their pets adoptable, the veterinary students

benefit from the chance to practice surgical skills, and the community benefits from the reduction of stray cats and dogs that may potentially harbor diseases.

The shelter medicine program also assists local shelters by periodically providing educational presentations on effective shelter management. This is a particularly helpful aspect of the program because even when shelters are provided with supplemental resources, such as free surgical procedures, poorly managed shelters still struggle with common problems, such as overcrowding, prolonged average length of stay for animals, and associated higher rates of disease [1,3]. Providing education on shelter management through the shelter medicine program has historically helped local organizations improve their organizations. While the shelter medicine program has previously focused on providing medical treatments and providing education on management of the animals, it had not yet focused on the prevention of zoonotic diseases transmission in shelter settings.

The mentor for this project, Dr. Brad Crauer, holds a doctor of veterinary medicine degree from Iowa State University. He has extensive experience working with animal shelter systems in Washington and Kansas. He currently teaches shelter medicine elective coursework to underclassmen at the Kansas State University College of Veterinary Medicine, is the Shelter Medicine Program director, and works on projects related to shelter medicine with senior veterinary students and Master of Public Health students. He has a particular interest in epidemiology in shelter settings, teaching students high quality high volume spay and neuter (HQHVSN) techniques, and closing the gap between private practice veterinary medicine and shelter medicine.

Chapter 2 - Learning Objectives and Project Description

The purpose of this project was to prepare and provide educational materials to animal shelter workers in an effort to help prevent zoonotic disease transmission. Specifically, the project was focused on tailoring these materials to animal shelter workers who worked or volunteered at Kansas animal shelters and those who were partnered with the Shelter Medicine program through the Kansas State University Veterinary Health Center. This project was designed to tackle a specific problem in a specific geographic location while also keeping impacts on the surrounding communities in mind. It was left partially open-ended so that it could be expanded on in the future. It was designed to include a preliminary literature review that would provide opportunities for learning about a variety of zoonotic diseases and determine which ones were considered to be an occupational hazard to animal shelter workers. The project also involved gaining an informal appreciation for what the target audience cared most about, what they already knew, and what kind of changes would be realistic for them to make. Finally, it provided an opportunity to master techniques in written and oral communications.

Learning objectives:

- To understand pathogenesis of common zoonotic diseases and analyze which diseases present an occupational hazard to shelter workers.
- To select zoonotic diseases impacting animal shelters.
- To select zoonotic diseases of concern to animal shelter staff.
- To select the most appropriate communication strategies for delivering zoonotic disease education to animal shelter workers.
- To apply written and oral communication skills while delivering public health information to animal shelter workers.
- To create educational materials intended to teach animal shelter workers how to prevent zoonotic disease transmission.
- To evaluate how risk reduction can be achieved through educational materials.

Project description:

Recent national surveys reveal that a large majority of staff and volunteers in United States animal shelters feel that they would benefit from zoonotic disease

education [3]; however, many did not know where to turn to access the appropriate information. Based on this information, I decided to explore the need for zoonotic disease education for the Shelter Partners that the Shelter Medicine Program works with. Over the course of two weeks, I travelled with the shelter medicine program to eight different animal shelters throughout Kansas (Helping Hands Humane Society in Topeka, KS; T. Russell Reitz Animal Shelter in Manhattan, KS; Cat Tails Feline Rescue, Manhattan, KS; Prairie Paws Animal Shelter, Ottawa, KS, Kansas Humane Society, Wichita, KS; Topeka Community Cat Fix, Topeka, KS, Geary County Animal Shelter, Junction City, KS; and Lawrence Humane Society in Lawrence, KS). I was able to take tours at each of the shelters and gain an overall appreciation

The next step of the project involved researching educational materials that were already available to the public. I found that there was an abundance of primary literature on zoonotic disease transmission from dogs and cats to humans. There were also many scientific review articles that explored risks for zoonotic disease transmission in animal shelter settings. There were informational web pages on official websites, such as the Centers for Disease Control and Prevention (CDC), that outlined some of the most common zoonotic diseases, but an internet searcher would have to know which diseases to search for in order to come across these resources. What seemed to be lacking was user-friendly educational materials that were written for people who would be working with animals on a daily basis. I felt that, through working with my project mentor and through using my public health and veterinary education, we would be able to develop educational resources that addressed the need for zoonotic disease education in Kansas animal shelters.

The core portion of the project involved drafting a document titled “The Animal Shelter’s Guide to Zoonotic Disease Prevention”. The final product was a 16-page document that could be accessed in a virtual PDF format or could be printed out as a booklet and passed out as a training resource. The document was written at approximately an eighth-grade reading level so that it would be easy to understand for workers and volunteers from a variety of educational backgrounds. Reading level of the document was quantified using the Flesch-Kincaid model [29]. The Flesch-Kincaid model is an automated tool that can be used to determine reading level by calculating

average word length and average sentence length in a given document. Themes for prevention were often rephrased or repeated in an effort to reiterate the information so that readers would be more likely to retain what they learned. The main focus of the guide was on zoonotic diseases from cats and dogs but also included some information on zoonotic diseases from exotic pets and livestock. The guide included an introduction that defined the concept of a zoonotic disease and explained why animal shelter workers may be particularly vulnerable to zoonotic diseases. It also included a frequently asked question section that aimed to address some common misconceptions or concerns about zoonotic diseases. The main portion of the document highlighted ten different zoonotic diseases and explained how each could be transmitted and how transmission can be prevented. The individual diseases were chosen based on zoonotic potential of the pathogen that causes the disease, prevalence in the United States, and potential disease severity. Three of the diseases, campylobacteriosis, toxoplasmosis, and salmonellosis, were included so that learners would be aware that they are more likely to experience these diseases through food-borne exposure, although zoonotic exposure from live shelter animals is possible [21, 25, 26]. Two of the diseases, giardiasis and scabies, were included to highlight the concept of human variants versus zoonotic variants. Both of these diseases are more commonly caused by human-specific variants, although infection from zoonotic exposure is possible [15, 17]. At the end of the document, a section of resources for finding additional information was included if learners are interested further exploring these concepts.

As a companion to the 16-page guide, a “continuing education” style presentation was recorded and distributed to local shelters to be used however they saw fit. The presentation was approximately 50 minutes long and could be used as an introduction to zoonotic disease training or could be used as follow up training material for staff members who had previously been trained using the guide. The recorded presentation featured all of the same diseases as the written guide. The presentation included a PowerPoint that mirrored the format of the companion guide. Since the presentation was not live, it included a section of anticipated audience questions that was similar to the frequently asked question section of the guide. The presentation also included a discussion on how preventing zoonotic diseases in a shelter setting can help keep the

entire community healthier because diseases are less likely to be introduced to the public. When local shelter managers were asked by the project mentor, Dr. Crauer, if they would be interested in having a recording to show their staff, many were enthusiastic about receiving the presentation and expressed interest in showing it to their teams at future staff meetings.

The educational materials were delivered to interested shelter managers to distribute to their staff how they see fit. While distributing the educational materials, Dr. Crauer let the shelter managers know that he is available for any follow-up questions they have. The long-term plan for this project is that both the written guide and the recorded presentation will be stored on a campus drive that is accessible to Dr. Crauer. He will have the materials available to distribute to any newly interested shelters or new shelter partners that are added to the Kansas State Shelter Medicine Program. If the shelters are interested in additional education materials, other students could expand the project in the future.

Chapter 3 - Results

During and after taking tours of the shelters, I was also able to have conversations with a variety of shelter workers to gain insight on their values and interest levels. As this project was a non-research activity, a variety of informal discussions took place between myself and the shelter workers, rather than a formal survey-based approach. After speaking with shelter staff members and volunteers, several themes became apparent and helped shape the way the education materials were constructed.

Approximately 30 animal shelter workers across 8 different facilities offered answers to informal questions about their backgrounds and how they dealt with zoonotic diseases in their shelters. Workers ranged from newer volunteers to shelter managers. Some shelter workers brought up the topic of zoonotic diseases on their own. One shelter in particular had been struggling with a recent ringworm outbreak and the shelter manager and one of the volunteers expressed concern that some of the staff members might get ringworm. Other times, I brought up the topic of zoonotic diseases by asking if they were interested in the topic, if they could ever recall having any zoonotic disease outbreaks at their shelter, or if they would be interested in receiving educational materials about zoonotic diseases. When appropriate, I asked follow-up questions about current prevention methods they used and if they felt they were working well. Through speaking with workers, I was able to identify which aspects of zoonotic disease hazards they felt were most pertinent to address in their own shelters. Workers at one shelter were interested in constructing a separate space to house kittens and add personal protective equipment for the staff to wear to prevent ringworm. In contrast, workers at another shelter said they were not very worried about ringworm because it was not a dangerous infection for humans to have.

Additional information collected through speaking with animal shelter workers was that some individuals expressed a greater concern for the animals that they cared for above their own health and were interested in taking further actions towards preventing disease spread between shelter animals. With this in mind, phrases that would appeal to this type of thinking were included in the oral training presentation.

Introductory statements include mention of workers needing to keep themselves healthy in order to be able to care for the animals, point out the risk for bringing home zoonotic diseases to immunocompromised family members, and mention that many methods used to protect themselves can also protect the animals. Methods that would simultaneously help prevent zoonotic disease spread as well as disease spread between animals, such as proper disposable glove usage, were emphasized and repeated throughout the education materials.

Through these conversations, several themes became apparent. First and foremost, animal shelter workers throughout Eastern Kansas are a diverse group of individuals. The workers' ages, levels of background education, and levels of prior animal handling experience had a wide range. While conclusions cannot be extrapolated from the conversations I had with a small selection of local animal shelter workers, seeing facilities first-hand and directly talking to workers helped me gain a better understanding for what their goals and values were as well as what limitations they might have to work within. For example, I realized that some animals do not have an intake health exam performed by a trained professional, so sick animals that are potentially harboring zoonotic diseases may be more likely to go unnoticed. I also noticed small hazards that could be easily fixed, such as communal food intended for human consumption being left in close proximity to animals. In addition, I gained an appreciation for the diversity of facilities that animal shelter staff must work within. I kept all of this information in mind while selecting the tone and style I used to write the zoonotic disease prevention guide. Through doing this, it was my hope that I would be able to appeal to my audience and make my educational tools more effective.

The themes mentioned above helped craft education materials in a way that would reach most members of the intended audience. The materials had to appeal to a wide variety of different workers. The media format of educational materials had to be an effective mode to communicate information. Recent data revealed that US animal shelter workers may learn better from video-based training as opposed to traditional face-to-face on the job training, so a video presentation version of the training material was provided to workers [27]. Due to the varying levels of experience held by local

shelter workers, the education materials were designed to be written at a manner that was concise and easy to understand [2].

The educational materials were written at approximately an eighth-grade reading level. The number of pages in the guide and length of the recorded presentation were kept to a level where they would not require longer than one hour of learner attention. The materials reported important information without including an abundant amount of complex details that were not crucial to understanding disease prevention. Repetition was used to help learners remember noteworthy concepts [28]. Important themes were intentionally repeated, such as prevention measures that could be used to prevent several different diseases all at once. Overall, the intention was to keep the concepts reasonably easy to understand and retain. It was our hope that by conveying key points about zoonotic disease prevention through effective media formats, shelter workers would be more equipped to protect themselves while at work.

After the project mentor Dr. Crauer informed managers at the local shelters that they would have access to training materials for zoonotic disease prevention, a majority of them expressed that they were excited to use the materials. They were advised that the written guide could be provided to trainees and existing staff and volunteers in digital form and that copies could also be printed out and placed in common areas for staff to periodically review or refer to. A majority of the local managers expressed interest in showing the pre-recorded training presentation during upcoming staff meetings in order to educate existing employees.

Due to the project being recently completed, feedback on the materials has not yet been provided by shelter managers or trainees. Once feedback is provided, this information can be used to totally expand on the project in the future.

Chapter 4 - Discussion

“The Animal Shelter’s Guide to Zoonotic Disease Prevention” booklet, with its accompanying training presentation, filled a gap in existing resources on zoonotic disease prevention that are available to animal shelter workers. Locally, these resources should help combat the spread of zoonotic diseases within Kansas communities. On a larger scale, resources like this could help mitigate disease spread in other areas of the United States or in other countries.

In the future, there is room for follow-up or continuation of the project. It would be helpful to design a feedback mechanism for trainees after they have used the educational materials. A survey that asks learners to rate aspects such as understandability of the materials, level of interest in the topics before/after reviewing the materials, and how realistic they feel preventative measures are would be useful to gauge how helpful the learning materials actually are. Feedback from learners would also help in deciding whether or not the project should be expanded on to include future training materials that cover other diseases or related subjects. Additionally, if the feedback is positive, new learning materials could be created as companions to the existing materials. This could include promoting zoonotic disease prevention using different formats such as large instructional posters to be hung up in common areas for employees. Companion materials, such as educational pamphlets on common zoonotic diseases, could also be made to pass out to new pet owners to encourage them to implement zoonotic disease prevention methods in their homes with their newly adopted pets.

In a future project, the effectiveness of the learning materials could be quantified in a manner that is similar to the learning analysis conducted by Steneroden [2]. A follow-up project of this nature would involve an Institutional Review Board (IBR) approval to conduct research on human subjects and would likely provide valuable insight on how effective educational materials are in training shelter workers. Learners could take a pre-test to analyze their existing knowledge on topics related to zoonotic diseases and prevention. They would then either be told to read the zoonotic disease prevention guide, watch the training video, or both. A post-test could then be conducted

with questions covering the same topics as the first test. Results from the pre- and post-test could be compared to see to what degree learners increased their knowledge base. In order to compare pre- and post-test knowledge, two tests could be given to learners. A large number of learners from different animal shelters would have to be randomly selected to participate in order to minimize inclusion bias. Survey and test questions would need to have prior IBR approval and not include bias. Learners could take a 20-question multiple choice test right before watching a training video and could be given the same test right after the training video concluded. In order to evaluate if there was a significant increase in test score after the training session, mean scores from the first test could be compared to mean scores of the second test by using a two-tailed Student's t-test. To see if information was retained, follow-up tests could be sent out to the same individuals six months after they took the first test. At that time, mean scores from their first pre-test could be compared to their six-month post-test using a two-tailed Student's t-test to see if the scores significantly changed. If six-month post-test scores were statistically higher than the original pre-test scores, then it would be reasonable to believe that workers retained information from their training sessions. If they are not significantly higher, then what?

Additionally, follow up surveys could be sent out to ask which new disease preventative measures had been implemented since training. Survey questions would be designed in a way that would avoid asking leading questions so that results were as accurate as possible. Results from a well-designed survey would help evaluate whether or not the education made shelters more likely to implement policy changes that would help prevent zoonotic disease transmission.

If the current learning materials are found to be successful, different versions for animal shelters in other states could be created. These materials may contain similar information but may also focus on any locally endemic diseases present within the region where the target audience works. Centers for Disease Control and Prevention (CDC) national data and published disease maps could be used to help identify zoonotic diseases that are only endemic in certain areas of the country. Data collected from local health departments would also be useful for disease selection. In the long run, it would be advantageous if these educational materials continued to circulate

through United States animal shelters and helped to decrease the occupational hazards associated with being an animal shelter worker.

Chapter 5 - Competencies

Student Attainment of MPH Foundational Competencies

Table 5.1 Summary of MPH Foundational Competencies

Number and Competency		Description
7	Assess population needs, assets and capacities that affect communities' health	Population needs and assets were assessed and taken into consideration when writing the "The Animal Shelter's Guide to Zoonotic Disease Prevention" document and while recording the training session.
16	Apply principles of leadership, governance and management, which include creating a vision, empowering others, fostering collaboration and guiding decision making	Principles of leadership (creating a vision, empowering others, fostering collaboration, and guiding decision making) were applied when presenting educational materials to local animal shelters and working with them to implement the materials in their training regimens.
18	Select communication strategies for different audiences and sectors	Communication strategies for the written guide and the recorded training session were selected based on the diverse intended audience.
19	Communicate audience-appropriate public health content, both in writing and through oral presentation	Audience appropriate content was selected for the written guide and the recorded training session.
22	Apply systems thinking tools to a public health issue	A systems thinking approach was taken when analyzing how an animal shelter system works and interacts with surrounding community systems. This information was used to guide the construction of the written guide and the recorded training session.

Competency #7: Assess population needs, assets and capacities that affect communities' health

Population needs within the shelter systems and their surrounding communities were assessed and taken into consideration when drafting the document, while

recording the companion presentation, and when offering the educational materials to shelter managers. In general, the target “populations” consisted of shelter volunteers, foster partners, fulltime shelter workers, and the shelter management teams. Members of the surrounding community can also be considered to be part of the population as they interact with the shelter, shelter animals, and shelter workers. The population in this case was the target audience for the educational materials. Many members of the population were aware that zoonotic diseases presented a risk in general but were not educated on who was particularly at risk, how to identify risks, or best prevention methods. The population also consisted of people with varying levels of education and animal experience. The educational materials were crafted in a way that addressed the population’s need for an easy to understand training document.

The Kansas shelter partners also tended to have limited superfluous assets available to their population. The format of the education materials was chosen with population assets in mind. A booklet that was available in both a digital and printable format was important to accommodate shelters that may not have access to the machinery required to make and distribute hard copies of training materials. Time and space were also assets that seemed to be limited for the target population, so a pre-recorded presentation was ideal to allow members of the population to view at their leisure when they had access to the time and space to do so. Along with this theme, since time was a limited but valuable resource to this community, it was important that the educational materials be concise without an extreme amount of detail.

Competency # 16: Apply principles of leadership, governance and management, which include creating a vision, empowering others, fostering collaboration and guiding decision making

Although I did not become integrated as part of an animal shelter team during this experience, I was able to take on a leadership role by creating a vision for zoonotic disease education implementation in a shelter system. I worked with members of the shelter management teams to gain a sense for what their needs and wants were in regard to volunteer/worker education. I then used that information and rapport to create educational materials that aimed to empower shelter managers to be able to better train

their workers. This in turn allowed workers to better protect themselves against zoonotic diseases. Additionally, a secondary goal for the project was to empower shelter management teams with the information they needed to eventually make changes to their system that would improve zoonotic disease prevention and keep their team members safe. The project itself was in collaboration with the Shelter Medicine Program/VHC and their shelter partners. By exploring a new avenue of teamwork between these entities, the collaborative efforts between the groups were strengthened.

Competency # 18: Select communication strategies for different audiences and sectors

The essence of this project centered around selecting communication strategies for a selection of audiences. The educational materials had to be easily understandable and accessible to shelter workers or volunteers with varying levels of education. The scope of this project had to encompass communication methods that could simultaneously catch the attention of those with less than a high school education as well as those who have had a post-secondary education and years of experience in the field. For this reason, emphasis was placed on writing the booklet in a conversational tone and at approximately an eighth-grade reading level. The document was also purposely concise. We chose to focus on a core set of concepts and omitted complicated details that may be easily forgotten or would distract from the core concepts.

The materials had to be acceptable resources for those who may have had no previous exposure to the concept of zoonotic disease. The document and the presentation start out with a general definition of a zoonotic disease and many of the frequently asked questions cover concepts that are key to understanding prevention methods suggested in the rest of the document/presentation. While many have no experience with these topics, some shelter workers have been in the field long enough to have heard of certain zoonotic diseases and may even have a general idea of what some common prevention methods are. They have also likely seen media coverage on certain zoonotic threats and may have heard some common misconceptions about the diseases. This is why it was important to also address common concerns about certain

zoonotic diseases. While they might not be in the top ten most likely zoonotic diseases to get from a cat or dog in a shelter, diseases like Giardia and Toxoplasmosis were included in the document because most people have heard of them and are likely worried about getting them from infected shelter pets.

While speaking with shelter workers, many expressed that they were much more worried about the health of the animals they worked with than they were about their own health. This information was kept in mind while creating the document and recording the presentation. Many prevention methods, such as proper disposable glove usage when dealing with cats that have ringworm, simultaneously help prevent the transmission of ringworm between shelter cats and prevent zoonotic transmission of ringworm. Many of these ideas were highlighted in the document because it appealed to the worker's desire to protect the animals while also empowering them to keep themselves healthy.

Competency #19: Communicate audience-appropriate public health content, both in writing and through oral presentation

Targeted writing strategies were used while writing the zoonotic disease prevention guide to effectively communicate zoonotic disease identification and prevention strategies to a mixed group of animal shelter workers. As mentioned previously, the document was written in a manner that is concise and easily understandable. The format was intended to be clean and logically organized to minimize confusion. Follow up resources were intentionally included to give enthusiastic audience members an avenue to further explore the concepts.

Targeted presentation strategies were used while making the presentation and recording the zoonotic disease prevention training session. The PowerPoint presentation was intended to look professional, have an appropriate amount of information on each slide, and flow in a logical manner. Additionally, a selection of images was intentionally chosen to be inserted into certain slides only if they positively contributed to the concept being highlighted. The accompanying audio was intended to be professional yet conversational and approachable. The audio also intentionally included statements that the audience could easily relate to.

Competency # 22: Apply systems thinking tools to a public health issue

The systems thinking approach was used in strategizing for the development of the zoonotic disease prevention guide as well as the recorded training session. From a broad perspective, animal shelter workers can be identified as being at an increased risk for contracting zoonotic diseases. Shelter workers are in close contact with dense populations of animals on a regular basis and may even work or volunteer with more than one organization, further increasing their potential exposure. Additionally, examining how shelter workers interact with their surrounding community was important for identifying risk and communicating that possible risk to the audience. This was showcased in the frequently asked question section of the document and recorded presentation. Shelter workers interact with members of the public through intake and adoptions and they also go home to their friends and family in the community. If shelter workers contract a communicable zoonotic disease such as ringworm, it is possible for them to spread it to community members. This would in turn impact other public health systems within the community such as community health centers who may have to see these people as patients. This concept was communicated to the audience by explaining that some diseases are communicable and that certain community or family members are increasingly susceptible to catching a disease from them if the person is immunocompromised.

Student Attainment of MPH Emphasis Area Competencies

Table 5.2 Summary of MPH Emphasis Area Competencies

MPH Emphasis Area: Infectious Diseases and Zoonoses		
Number and Competency		Description
1	Pathogens/Pathogenic Mechanisms	A literature review of common zoonotic pathogens in an animal shelter setting was conducted for this project. Pathogenic mechanisms were studied in order to better understand the diseases and make recommendations for how to prevent transmission.

2	Host Response to Pathogens/Immunology	Host response to zoonotic disease had to be taken into consideration when conducting a literature review for the project as well as when drafting the training guide. Special attention was paid to describing possible symptoms of disease in human and animal patients and how immunocompromised individuals may respond differently.
3	Environmental/Ecological Influences	Environmental influences within an animal shelter such as animal population density, building size/capability, endemic disease present within the local region, and human-animal interaction had to be kept in mind when deciding which zoonotic diseases to include in the educational materials.
4	Disease Surveillance	Disease surveillance principals were briefly highlighted in portions of the written document that discussed identifying sick animals and identifying possible signs of zoonotic disease in shelter workers.
5	Disease Vectors	Disease vectors play an important role in several of the zoonotic disease that were showcased in the project. Sections in the written document and recorded presentation include mention of how disease vectors play a role in zoonotic disease transmission.

Competency # 1: Pathogens/Pathogenic Mechanisms

A literature review of common zoonotic pathogens in an animal shelter setting was conducted for this project. Through this process, pathogenic mechanisms for each of the diseases were studied in order to better make recommendations for how to prevent transmission. It was especially important to understand disease propensity for

being zoonotic. A literature search, combined with knowledge from previous coursework, helped determine which diseases should be included in the education materials. It became important to differentiate between the potential for zoonosis vs the probability for zoonosis by separating out rare case reports from large studies that revealed disease patterns.

Competency # 2: Host Response to Pathogens/Immunology

Host response to zoonotic disease had to be taken into consideration when conducting a literature review for the project as well as when drafting the training guide. Special attention was paid to describing possible symptoms of disease in human and animal patients in the training guide. The guide mentions that certain diseases will not cause a significant immune response in infected animals, meaning they would not be showing symptoms, and explains that humans may be more sensitive to a given disease and will develop symptoms. Additionally, sections of the guide and presentation included mention that immunocompromised individuals may respond to zoonotic diseases differently than individuals with strong immune systems. It was important to consider the possibility that some shelter workers would be immunocompromised as well as the possibility that shelter workers have contact with immunocompromised family, friends, or other members of the community.

Competency # 3: Environmental/Ecological Influences

Environmental influences within an animal shelter such as animal population density, building size/capability, endemic disease present within the local region, and human-animal interaction had to be kept in mind when deciding which zoonotic diseases should be included in the educational materials. An overall understanding of environmental and ecological influence on disease pathogenesis was also important to understanding the multifaceted nature of zoonotic disease transmission.

Competency # 4: Disease Surveillance

Disease surveillance principals were highlighted in portions of the written document that discussed identifying sick animals and identifying possible signs of

zoonotic disease in shelter workers. Both education materials carefully explained that and worker who had potentially been exposed to a zoonotic disease or is showing symptoms should alert their team and seek advice from their personal physician. Similarly, they were encouraged to seek veterinary advice when shelter animals start to exhibit symptoms of disease.

Competency # 5: Disease Vectors

Disease vectors play an important role in several of the zoonotic disease that were showcased in the project. Specific disease vectors were mentioned in certain sections of the document/presentation such as tapeworm, leptospirosis, and rabies. Knowledge of disease vectors was important for knowing when contact with certain species of wildlife made shelter animals more likely to be carrying a zoonotic disease. Additionally, it helped explain why vectors make some diseases, such as tapeworms, that are spread through the ingestion of fleas, less likely to be transmitted to humans.

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References

- [1] Weese, J. S., Peregrine, A. S., & Armstrong, J. (2002). *Occupational health and safety in small animal veterinary practice: Part I--nonparasitic zoonotic diseases*. The Canadian veterinary journal = La revue veterinaire canadienne.
<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC339409/>.

- [2] Steneroden, K. K., Hill, A. E., & Salman, M. D. (2011). *Zoonotic Disease Awareness in Animal Shelter Workers and Volunteers and the Effect of Training*. Wiley Online Library. https://onlinelibrary.wiley.com/doi/pdf/10.1111/j.1863-2378.2011.01389.x?casa_token=uSxIWgQI-88AAAAA%3ATXJHcjCi8uNyctCV_ZAKQCLdplARsJiFcwn9-qgXYH5Vydmf5KiUIS81iB5JGVNcGS0u9QRED1mU-0o.

- [3] Steneroden, K. K., Hill, A. E., & Salman, M. D. (2010). *A needs-assessment and demographic survey of infection-control and disease awareness in western US animal shelters*. Preventive Veterinary Medicine.
https://www.sciencedirect.com/science/article/pii/S0167587710003016?casa_token=6FXydCwh704AAAAA%3ALpCdbZ1EgegTheNoliBKNLSQVFh4ibB3tAaJjEGurjty231noDRhJ0zUb7W9XVr_M0usGMfXz_Y.

- [4] Babbit, J. (2010). *Operational Guide for Animal Care and Control Agencies: Companion Animal Zoonotic Diseases*. American Humane Association.
<https://americanhumane.org/app/uploads/2016/08/op-guide-zoonoticdiseases.pdf> .

- [5] Centers for Disease Control and Prevention. (2017). *Zoonotic Diseases*. Centers for Disease Control (CDC). <https://www.cdc.gov/onehealth/basics/zoonotic-diseases.html>.

- [6] Iorio, R., Cafarchia, C., Capelli, G., Fasciocco, D., Otranto, D., & Giangaspero, A. (2007). *Dermatophytoses in cats and humans in central Italy: epidemiological aspects*. New Zealand Veterinary Journal.
https://onlinelibrary.wiley.com/doi/pdf/10.1111/j.1439-0507.2007.01385.x?casa_token=-PpBGTgicPMAAAAAA%3ALGisa-

H2kWRa4q1_M8uqJ_kqBIDVSRMSGcwCMo4USODOw-
gyEiwqYumzIRRuGSDriCMhIfVn7IGvTkQ.

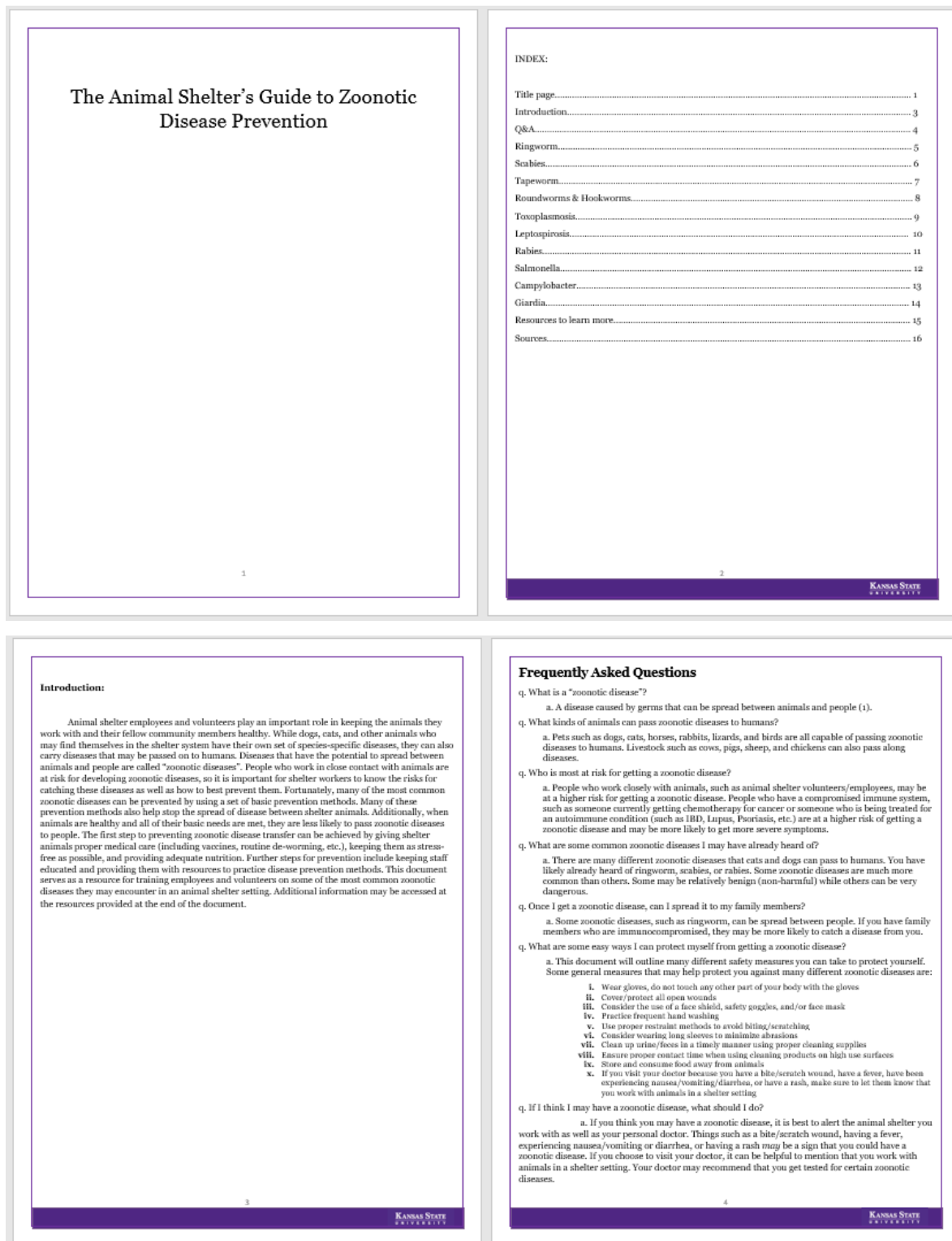
- [7] Centers for Disease Control and Prevention. (2020). *Burden of Fungal Diseases in the United States*. Centers for Disease Control and Prevention.
<https://www.cdc.gov/fungal/cdc-and-fungal/burden.html>.
- [8] Centers for Disease Control and Prevention. (2021). *How Ringworm Spreads*. Centers for Disease Control and Prevention.
<https://www.cdc.gov/fungal/diseases/ringworm/sources.html>.
- [9] Centers for Disease Control and Prevention. (2020). *Rabies*. Centers for Disease Control and Prevention. <https://www.cdc.gov/rabies/index.html>.
- [10] Centers for Disease Control and Prevention. (2010). *SCABIES*. Centers for Disease Control and Prevention.
<https://www.cdc.gov/parasites/scabies/index.html>.
- [11] Lappin, MR., Elston, T., Evans, L., Glaser, C., Jarboe, L., Karczmar, P., Lund, C., Ray, M. (2019). *2019 AAFP Feline Zoonoses Guidelines*. SAGE Journals.
<https://journals.sagepub.com/doi/full/10.1177/1098612X19880436>.
- [12] Centers for Disease Control and Prevention. (2020). *Human rabies*. Centers for Disease Control and Prevention.
https://www.cdc.gov/rabies/location/usa/surveillance/human_rabies.html.
- [13] Ben-Harari, R. \$, & Connoly, M. P. (2018). *High burden and low awareness of toxoplasmosis in the United States*. Taylor & Francis Clinical Features.
<https://www.tandfonline.com/doi/abs/10.1080/00325481.2019.1568792>.

- [14] Sukthana, Y. (2006). *Toxoplasmosis: beyond animals to humans*. Trends in Parasitology.
https://www.sciencedirect.com/science/article/pii/S1471492206000237?casa_token=I3zusrMGX6oAAAAA%3ATIZJKEAbQofqo92vNGaJN-6oJtELhitGCKBBz3pjeISyElmk1QWV0GHJpnETPiGNtj-_vwZtTs8.
- [15] R.C. Thompson. (2004). The zoonotic significance and molecular epidemiology of Giardia and giardiasis. *Veterinary Parasitology*.
<https://www.sciencedirect.com/science/article/abs/pii/S0304401704004005?via%3DiHub>.
- [16] Jiang, P., Zhang, X., Liu, R. D., Wang, Z. Q., & Cui, J. (2017). *A Human Case of Zoonotic Dog Tapeworm, Dipylidium caninum (Eucestoda: Dilepididae), in China*. The Korean journal of parasitology.
<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5365269/>.
- [17] Owusu-Edusei, K., Chesson, H., & Thomas, L. (2009). *The Economic Burden of Pediculosis Pubis and Scabies: Sexually Transmitted Diseases*. Journal of American Sexually Transmitted Diseases Association. .
https://journals.lww.com/stdjournal/FullText/2009/05000/The_Economic_Burden_of_Pediculosis_Pubis_and.6.aspx.
- [18] Dandan, I. (2019) *What is the prevalence of hydatid disease (echinococcosis) in the US?* Medscape. <https://www.medscape.com/answers/178648-69087/what-is-the-prevalence-of-hydatid-disease-echinococcosis-in-the-us>.
- [19] Sun Huh, M. D. (2021). *Toxocariasis*. Medscape.
<https://emedicine.medscape.com/article/229855-overview#:~:text=In%20the%20United%20States%2C%20about,passed%20from%20animals%20to%20humans>.

- [20] Centers for Disease Control and Prevention. (2020). *Cutaneous Larva Migrans - Chapter 4 - 2020 Yellow Book*. Centers for Disease Control and Prevention. <https://wwwnc.cdc.gov/travel/yellowbook/2020/travel-related-infectious-diseases/cutaneous-larva-migrans>.
- [21] Jones, J. L., Parise, M. E., & Fiore, A. E. (2014). *Neglected parasitic infections in the United States: toxoplasmosis*. The American journal of tropical medicine and hygiene. <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4015566/#:~:text=Toxoplasma%20gondii%20infects%20an%20estimated,year%20in%20the%20United%20States>.
- [22] Centers for Disease Control and Prevention. (2015). *Leptospirosis*. Centers for Disease Control and Prevention. <https://www.cdc.gov/leptospirosis/infection/index.html>.
- [23] Levett, P. N. (2004). *Leptospirosis: A forgotten zoonosis?* Clinical and Applied Immunology Reviews. https://www.sciencedirect.com/science/article/pii/S1529104904000492?casa_token=n=nvuGcfbKC6QAAAAA%3AorNME7fmHmMjWjUemBEIVqA4o3wFW5uqh49_Zq4kRrbjnahwoXJRFDOI4vX6QMS23odlFEobTdQ.
- [24] Miotto, B. A., Guilloux, A. G. A., Tozzi, B. F., Moreno, L. Z., Hora, A. S. da, Dias, R. A., Heinemann, M. B., Moreno, A. M., Filho, A. F. de S., Lilenbaum, W., & Hagiwara, M. K. (2018). *Prospective study of canine LEPTOSPIROSIS in shelter and stray Dog populations: Identification of chronic carriers and different Leptospira species INFECTING DOGS*. PLOS ONE. <https://journals.plos.org/plosone/article?id=10.1371%2Fjournal.pone.0200384>.
- [25] Centers for Disease Control and Prevention. (2021). *Salmonella*. Centers for Disease Control and Prevention. <https://www.cdc.gov/salmonella/index.html>.

- [26] Centers for Disease Control and Prevention. (2019). *Information for Health Professionals*. Centers for Disease Control and Prevention.
<https://www.cdc.gov/campylobacter/technical.html#:~:text=Active%20surveillance%20throug%20the%20Foodborne,from%20Campylobacter%20infection%20every%20year.>
- [27] Howard, V. J., & Digennaro Reed , F. D. (2015). *An evaluation of training procedures for animal shelter volunteers*. Journal of Organizational Behavioral Management.
[https://www.tandfonline.com/doi/abs/10.1080/01608061.2015.1093052.](https://www.tandfonline.com/doi/abs/10.1080/01608061.2015.1093052)
- [28] Saville, K. (2011). *Strategies for using repetition as a powerful teaching tool* . SAGE Journals.
[https://journals.sagepub.com/doi/full/10.1177/0027432111414432?casa_token=EWlu9Qdzn7IAAAAA%3A5obN0LAXIcvyS1NuCxnX2eU_GyTvFRWzxZIEck99oMVD6t7C3zrT55LrYIK-IMDYwpktRGtK6U9UPQ.](https://journals.sagepub.com/doi/full/10.1177/0027432111414432?casa_token=EWlu9Qdzn7IAAAAA%3A5obN0LAXIcvyS1NuCxnX2eU_GyTvFRWzxZIEck99oMVD6t7C3zrT55LrYIK-IMDYwpktRGtK6U9UPQ)
- [29] Kincaid, J., Fishburne, R., Rogers, R., Chissom, B. (1975). *Derivation of new readability formulas (Automated Readability Index, Fog Count and Flesch Reading Ease Formula) for Navy enlisted personnel*. Research Branch Report 8-75, Millington, TN: Naval Technical Training, U. S. Naval Air Station, Memphis, TN.
<https://apps.dtic.mil/sti/pdfs/ADA006655.pdf>
- [30] Ambrose, M., Kucharski, A., Formenty, P., Muyembe-Tamfum, J., Rimo, A., & Lloyd-Smith, J. (2019). *Quantifying transmission of emerging zoonoses: Using mathematical models to maximize the value of surveillance data*. bioRxiv.
[https://www.biorxiv.org/content/10.1101/677021v1.](https://www.biorxiv.org/content/10.1101/677021v1)

Appendix I: Training booklet entitled “The Animal Shelter’s Guide to Zoonotic Disease Prevention”



Zoonotic diseases:

1. Ringworm:

How is it spread?

Ringworm is the common term for a rash that can form on the skin due to a fungal infection. Contrary to its name, it is not actually a worm at all. The scientific name for ringworm is *Dermatophytosis* because the disease comes from microscopic fungal organisms known as *Dermatophytes*. Ringworm can be spread by touching an animal that has the fungus on their skin or fur. It can also be spread by touching a contaminated surface such as a cage floor, counter, or bedding. It is possible for you to spread ringworm to other parts of your body, to other people, or to other animals (2). Ringworm can linger in the environment and can be very difficult to get rid of. There are ways to protect yourself and the animals you work with from ringworm.

How is it prevented?

- Wear gloves when handling animals
- Wear scrubs, long sleeves, or other clothing that act as a barrier between the animal and your skin and can be easily changed if worn while handling an infected animal
- Avoid kissing and hugging animals
- Disinfect areas that animals have touched or brushed up against

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2. Sarcoptic mange (scabies):

How is it spread?

Scabies are a microscopic burrowing mite, so they cannot be seen with the naked eye. The most common types of scabies that may be encountered by an animal shelter worker are variants of *Sarcoptes scabiei*. There are many different species of this mite that can be found on humans and other mammals such as dogs and cats. Sometimes, the type of scabies that is usually found on dogs can infect humans. These mites usually cause a mild to moderate rash or skin irritation. If a shelter dog is infected with scabies, it is possible for you to catch scabies by touching the dog or its bedding (3).

How is it prevented?

- Wear gloves when handling animals or their bedding
- Wear scrubs, long sleeves, or other clothing that act as a barrier between the animal and your skin and can be easily changed if worn while handling an infected animal
- Avoid kissing and hugging animals
- Wash bedding and grooming utensils in hot water +/- a disinfectant

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3. Tapeworm

How is it spread?

Tapeworms are a type of parasitic flatworm that can be found in the gastrointestinal system of animals or humans. Dogs can have many different types of tapeworm. Some of these can be zoonotic. The first, *Dipylidium caninum*, has larva that live inside of fleas. When a dog is grooming themselves and eats a flea, the dog can become infected with the tapeworm. While it is rare for humans to get this kind of tapeworm, young children that play with or kiss dogs and accidentally ingest a flea are at risk for getting a tapeworm (4).

The second type of tapeworm that a dog may have is an *Echinococcus* species of tapeworm. This type of tapeworm is zoonotic and can be very dangerous to a human who becomes infected. The most common way this type of tapeworm is spread in an animal shelter setting would be if animal feces containing the eggs was accidentally ingested. When animal shelters regularly treat animals for fleas and test/treat them for tapeworms, it becomes much less likely that shelter workers could get tapeworms from the animals. Humans who have a tapeworm may experience stomach aches, diarrhea, or unexplained weight loss.

How is it prevented?

- Wear gloves when handling animals or cleaning their feces
- Make sure animal feces are quickly cleaned up
- Wash hands with warm water and soap after cleaning or handling animal feces
- Avoid kissing animals or allowing them to lick you
- Do not eat food or store food near where animals are housed
- Do not share food with animals

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4. Roundworms & Hookworms

How is it spread?

Most puppies and some adult dogs have gastrointestinal parasite infections. Some of these parasites can also infect humans and may cause an upset stomach, diarrhea, and other related symptoms. The risk of humans getting these parasites can be reduced if animals are put on a deworming protocol. In a shelter setting, humans may be infected with intestinal parasites such as roundworm (*Toxocara canis*) through fecal contamination, so caution must be taken when cleaning up feces. Additionally, it is possible for hookworm larva (*Ancylostoma caninum*) to enter a human body by penetrating the skin. This happens most commonly through the feet, so it is important to not walk barefoot around areas where animals go to the bathroom.

How is it prevented?

- Wear gloves when handling animals or cleaning their feces
- Make sure animal feces are quickly cleaned up
- Wash hands with warm water and soap after cleaning or handling animal feces
- Avoid kissing animals or allowing them to lick you
- Always wear shoes when working with animals

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5. Toxoplasmosis

How is it spread?

Toxoplasmosis is a disease that you may have heard of people getting after cleaning cat litter boxes. *Toxoplasma gondii* is the microscopic parasite that is responsible for this disease and is very commonly found in cats but can also be found in dogs, rodents, and even birds. Toxoplasma can be transmitted through animal feces, through raw or undercooked meat, and can be passed from pregnant women to their babies. As mentioned, this parasite can be passed from cats to humans through cat feces; however, it is actually more common for humans to get this disease from eating undercooked meat such as chicken or pork (5). In a shelter setting, it is still important to practice good hygiene when handling litter boxes.

How is it prevented?

- Avoid feeding potentially contaminated food to shelter cats such as raw meat or allowing them to hunt wild prey
- Make sure litter boxes are cleaned frequently
- Wear gloves and use proper hand hygiene while cleaning litter boxes
- Consider avoiding litter box cleaning duties if pregnant

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6. Leptospirosis

How is it spread?

Leptospirosis is a disease that is caused by *Leptospira* bacteria. The bacteria is commonly found in the urine of infected wildlife such as wild rodents, deer, and raccoons and can be passed to dogs (6). There is currently a vaccination against leptospirosis for dogs but many dogs have not been vaccinated. This *Leptospira* bacteria is found in high concentrations in the urine of infected dogs so it is especially important for humans to take caution when cleaning up urine. Due to the risk of leptospirosis, you should treat urine messes in the same way you treat fecal messes. Getting leptospirosis from a dog is fairly rare but can be serious and cause symptoms such as fever, muscle aches, and chills (7).

How is it prevented?

- Assume all urine is possibly contaminated
- Wear gloves
- Consider the use of safety goggles or a face shield to prevent urine from splashing onto your face
- Do not let urine puddle sit around for extended periods of time and clean frequently urinated on areas several times per day
- Avoid the use of standing bodies of water such as pools for shelter animal recreation

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7. Rabies

How is it spread?

Rabies is a deadly virus that can infect animals and be spread to humans through bite wounds. Rabies comes from a family of viruses, known as *Rhabdoviridae*, that are commonly carried by mammals. In the United States, populations of wildlife such as bats, raccoons, and skunks carry rabies (8). Some feral cat populations also have rabies and can be dangerous to work with (9). It is important that you know if there are any animals in your shelter who have not had a rabies vaccine yet. It is especially important to avoid being bitten or scratched by an animal who came in as a stray or has an unknown vaccination status. If you are ever bitten or scratched by an animal, it is important to seek medical attention. If bitten by a potentially rabid animal, your doctor will likely want to give prophylactic treatment to prevent you from getting rabies. If unnoticed or untreated, rabies can develop from bite wounds, affect the nervous system, and cause death.

How is it prevented?

- Wear thick bite proof gloves when handling feral animals
- Be aware of potentially aggressive animals who may bite
- Use appropriate restraint methods when handling animals who may bite
- Report all bites as soon as possible and seek medical attention

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8. Salmonella

How is it spread?

Salmonella is a bacteria that can be spread from animals to people through fecal contamination or undercooked meat. Humans exposed to *Salmonella* may develop diarrhea, fever, and stomach cramps (10). In an animal shelter setting, outdoor cats who have caught birds or rodents that have salmonella can become infected and spread it to humans by shedding the bacterial in their feces (11). Additionally, dogs who have been fed a raw diet are more likely to be shedding salmonella and to pass it on to humans (11). Exotic pets such as hedgehogs, snakes, lizards, and turtles also frequently carry *Salmonella*.

How is it prevented?

- Wear gloves when handling animals or cleaning their feces
- Make sure litter boxes are cleaned frequently
- Wash hands with warm water and soap after cleaning or handling animal feces
- Avoid kissing animals or allowing them to lick you
- Do not store or eat food around animals
- Wash hands immediately after handling exotic pets

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9. Campylobacter

How is it spread?

Campylobacter species of bacteria can spread from animals to people through fecal contamination, undercooked meat, or unpasteurized milk. Humans exposed to campylobacter bacteria may develop bloody diarrhea, fever, and stomach cramps (12). Animals often carry *Campylobacter* and do not become sick from it; however, humans are very sensitive to the bacteria and often become sick. In a shelter setting, any animal could be shedding this bacteria but it is especially common for kittens and puppies (13). Humans who come in contact with feces from infected animals are likely to become sick.

How is it prevented?

- Wear gloves when handling animals or cleaning their feces
- Make sure animal feces are quickly cleaned up
- Wash hands with warm water and soap after cleaning or handling animal feces
- Avoid kissing animals or allowing them to lick you

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10. Giardia

How is it spread?

Giardia is a microscopic parasite that infects the intestines of humans, dogs, cats, livestock, and some other exotic pets. Many humans who become infected experience diarrhea, gas, stomach pain, and can quickly become dehydrated. Most pets who have *Giardia* do not show symptoms (14). Dogs, cats, and humans can all carry different variants of *Giardia*. *Giardia* is spread through feces and can contaminate water sources. Most commonly, when humans become ill from *Giardia* it is because it was transmitted to them from another human through unclean surfaces, poor hand hygiene, or contaminated food and water. Like most zoonotic diseases, *Giardia* is still being actively researched. According to the most recent studies, it is possible for humans to get *Giardia* from dogs, cats, and livestock; however, it is much more common to get it from other humans (14). Still, it is important to take measures to prevent animal to human transmission of *Giardia* because it continues to be a possible risk.

How is it prevented?

- Always drink clean water from a trusted water source. Trusted water sources include bottled water, filtered water, and water from clean faucets that are supplied with city water or tested well water.
- Never drink from a container that has been in contact with shelter animals
- Lessen transmission between animals by not allowing them to share water bowls or come in contact with each other's feces
- Wear gloves when handling animals or cleaning their feces
- Make sure animal feces are quickly cleaned up
- Wash hands with warm water and soap after cleaning or handling animal feces

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Additional resources:

To learn more about these diseases and how to prevent them, please visit the resources listed below:

CDC.gov

The official CDC website contains general information about zoonotic diseases. It also has an individual page for each of the diseases outlined in this document.

Sheltervet.org

This website contains the Association of Shelter Veterinarians' official guidelines for standards of care in animal shelters. It includes protocols for controlling zoonotic diseases in shelter animals.

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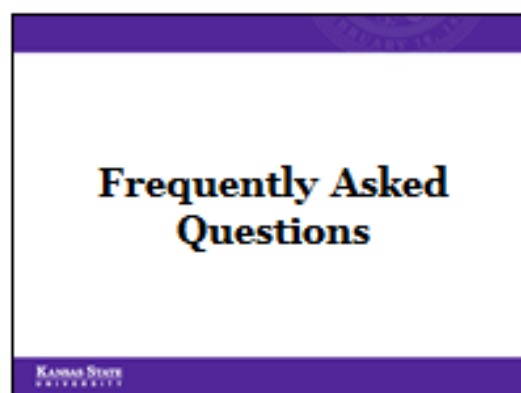
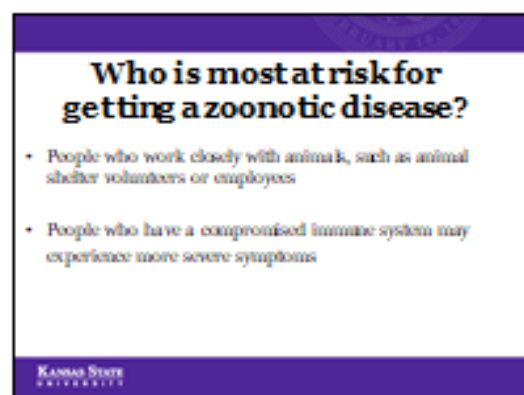
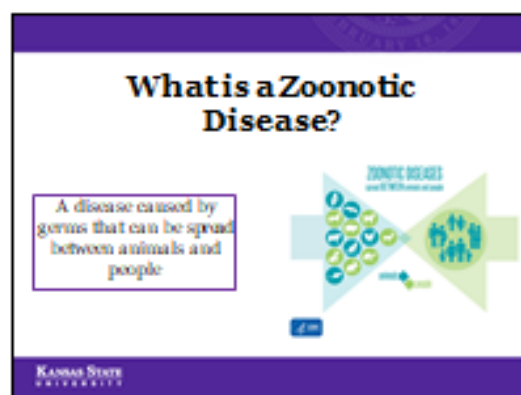
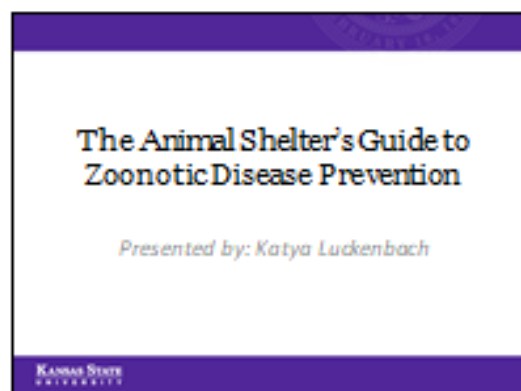
Sources:

- [1] Centers for Disease Control and Prevention. (2017). Zoonotic Diseases. Centers for Disease Control and Prevention. <https://www.cdc.gov/od/ohrt/basis/zoonotic-diseases.html>.
- [2] Wiese, J. S., Peregrine, A. S., & Armstrong, J. (2002). Occupational health and safety in small animal veterinary practice: Part I—zoonotic diseases. The Canadian veterinary journal / La revue vétérinaire canadienne. <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC1330409/>.
- [3] Wiese, J. S., Peregrine, A. S., & Armstrong, J. (2002). Occupational health and safety in small animal veterinary practice: Part II—parasitic zoonotic diseases. The Canadian veterinary journal = La revue vétérinaire canadienne. <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC1330623/>.
- [4] Jiang, P., Zhang, X., Lin, R. D., Wang, Z. Q., & Cui, J. (2017). A Human Case of Zoonotic Dog Tapeworm, *Dipylidium caninum* (Eucestoda: Dipylididae), in China. The Korean journal of parasitology. <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC555699/>.
- [5] Sukhuma, Y. (2006). Zoonotic diseases: beyond animals to humans. Trends in Parasitology. <https://www.sciencedirect.com/science/article/pii/S1367402206000227?ssai=1&md5=323181606AAAAA%3ATTZBKELABQd6q9zrNGaJN-6aJELdGCB3p9d8yElm3aQWVvGBHJnETPKZJ%3A-v6Z2T58>.
- [6] Miotto, B. A., Galloux, A. G. A., Threl, B. F., Moreno, L. J., Hote, A. S. da, Dias, R. A., Higashimura, M. K. (2018). Prospective study of canine leptospirosis in shelter and stray dog populations: identification of chronic carriers and different *Leptospira* species infecting dogs. PLOS ONE. <https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0200384>.
- [7] Centers for Disease Control and Prevention. (2017). Leptospirosis Signs and Symptoms. Centers for Disease Control and Prevention. <https://www.cdc.gov/leptospirosis/symptoms/index.html>.
- [8] Centers for Disease Control and Prevention. (2020). Rabies. Centers for Disease Control and Prevention. <https://www.cdc.gov/rabies/index.html>.
- [9] Leppin, MR., Elston, T., Evans, L., Glaser, C., Jarboe, L., Karcmar, P., Lujad, C., Ray, M. (2010). 2010 AAEP Feline Zoonoses Guidelines. SAGE Journals. <https://journals.sagepub.com/doi/full/10.1177/10986423103880436>.
- [10] Centers for Disease Control and Prevention. (2021). Salmonella Homepage. Centers for Disease Control and Prevention. <https://www.cdc.gov/salmonella/index.html>.
- [11] Leonard, E. K., Pearl, D. L., Finley, R. L., Janssen, N., Peregrine, A. S., Reid-Smith, R. J., & Wiese, J. S. (2012). Evaluation of Pet-Related Management Factors and the Risk of *Salmonella* spp. Carriage in Pet Dogs from Volunteer Households in Ontario (2005–2006). Wiley Online Library. https://onlinelibrary.wiley.com/doi/pdf/10.1111/j.1365-2275.2009.02105.x?casa_token=yvXT7onPvU7uAAA%3A_TAcMUJ4TU1x8_gKAR7DSKaNo8Z_Yu3pooTCVS5TV4S8qTUT7KaoXhWxlykqv5dq7n1C3HEB3MDk.
- [12] Centers for Disease Control and Prevention. (2010). Campylobacter Questions and Answers. Centers for Disease Control and Prevention. <https://www.cdc.gov/campylobacter/faq.html>.
- [13] F. Acha. (2018). Campylobacteriosis in dogs and cats: a review. New Zealand Veterinary Journal. <https://www.tandfonline.com/doi/full/10.1080/00480169.2018.1477568>.
- [14] R.C. Thompson. (2004). The zoonotic significance and molecular epidemiology of *Giardia* and *giardiasis*. Veterinary Parasitology. <https://www.sciencedirect.com/science/article/abs/pii/S0304401704004005?via=ihI3Dihub>.

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Appendix II: Pre-Recorded Zoonotic Disease Prevention Training Session



Once I get a zoonotic disease, can I spread it to my family members?

- Some zoonotic diseases, such as ringworm, can be spread between people.
- If you have family members who are immunocompromised, they may be more likely to catch a disease from you.

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What are some ways I can protect myself from getting a zoonotic disease?

- Use proper restraint tools and methods when handling animals to avoid biting or scratching



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What are some ways I can protect myself from getting a zoonotic disease?

- Wear gloves
- Put on and take off gloves properly
- Do not touch any other part of your body with the gloves



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What are some ways I can protect myself from getting a zoonotic disease?

- Clean up urine/feces in a timely manner using proper cleaning supplies
- Ensure proper contact time when using cleaning products on high use surfaces
- Store and consume food away from animals

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What are some ways I can protect myself from getting a zoonotic disease?

- Cover/protect all open wounds
- Consider the use of a face shield, safety goggles, and/or face mask
- Practice frequent hand washing
- Consider wearing long sleeves to minimize abrasions

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What are some ways I can protect myself from getting a zoonotic disease?

- If you visit your doctor because you have a bite or scratch wound, have a fever, have been experiencing nausea/vomiting/diarrhea, or have a rash, make sure to let them know that you work with animals in a shelter setting

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If I think I may have a zoonotic disease, what should I do?

- Alert the animal shelter you work with
- Alert your personal doctor

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Sarcoptic mange

- Also known as "Scabies"
- Microscopic mite that can cause an itchy rash
- Rare but possible to catch from animals



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Zoonotic Diseases

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Tapeworm

- A gastrointestinal parasite, can cause stomach aches, diarrhea, or unexplained weight loss
- Multiple types of tapeworms
- Fecal/oral contamination

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Ringworm

- A circular shaped rash that can form on the skin due to a fungal infection (dermatophytosis)
- Spread through direct touch of an infected animal or by touching contaminated surfaces



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Roundworms & Hookworms

- Gastrointestinal parasites that can cause abdominal pain or diarrhea
- Effective deworming protocols for shelter animals can help prevent zoonotic infection

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Toxoplasmosis

- Can be dangerous for pregnant women
- Can be transmitted through cat feces but is more commonly transmitted through undercooked meat



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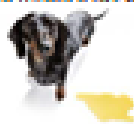
Salmonella

- A bacteria that is spread through fecal/oral contamination or undercooked meat
- May cause diarrhea, fever, or stomach cramps in humans
- Outdoor cats and exotic pets are most likely to be carriers

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Leptospirosis

- Bacterial diseases that is commonly spread from wildlife to domestic pets through urine
- Can cause flu-like symptoms in humans
- Treat all urine messes the same way you would treat fecal messes!



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Campylobacter

- A bacteria that is spread through fecal/oral contamination, undercooked meat, or unpasteurized milk
- May cause bloody diarrhea, fever, or stomach cramps in humans
- Animals who carry campylobacter are often asymptomatic but humans are much more sensitive to it

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Rabies

- A deadly virus that can be spread to humans through bite wounds
- Wildlife such as bats, raccoons, and skunks carry rabies
- Very important to make sure all shelter animals are vaccinated
- Always report all bite wounds

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Giardia

- A microscopic parasite that can cause diarrhea, gas, and abdominal pain
- Many variations of species specific Giardia
- Giardia can be zoonotic, but most commonly when humans get giardia it is because they caught human specific giardia from another person

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You can help make your shelter a safer place!

- Preventing zoonotic diseases helps keep you and your coworkers safe
- It also helps prevent disease spread between animals, which keeps the animals healthy and makes them more adoptable

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• *Amegon* instructions

- 1. [Amegon](#) is a broad-spectrum disinfectant that kills bacteria, viruses, and fungi. It is used to disinfect surfaces that have been contaminated with these organisms.
- 2. [Amegon](#) is used to disinfect surfaces that have been contaminated with these organisms.
- 3. [Amegon](#) is used to disinfect surfaces that have been contaminated with these organisms.
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Additional Resources:



[CDC.gov](https://www.cdc.gov)



[ShelterVet.org](https://www.sheltervet.org)



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- Public Health Department at Kansas State University College of Veterinary Medicine
- Shelter Medicine Program at Kansas State University College of Veterinary Medicine

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Keywords

- 1. [Amegon](#) is a broad-spectrum disinfectant that kills bacteria, viruses, and fungi. It is used to disinfect surfaces that have been contaminated with these organisms.
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