Do Captive Wildlife Put Veterinary Team Members at Risk for Disease?
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The One Health approach to community healthcare is no longer a novel concept. In fact, many physicians and veterinarians have now become familiar with the philosophy that healthy animals in a healthy environment contribute to healthy people and vice-versa. However, the general pet-owning public does not seem as well-versed in the concept and its application to their daily lives and continued good health. Thus, the veterinary practitioner’s role in public health continues to be vital. As our society becomes further and further removed from direct contact with animals and our environment, it is crucial that veterinarians remain vigilant in continuing to educate clients on how live safely, happily, and healthy with their pets.

Key points
All animal orders have their own pathogens that can present a health threat to people. A veterinarian should make an effort to familiarize themselves and their staff with these pathogens and their typical modes of transmission and clinical manifestation in people. Recognizing how to best integrate local public health agencies in a routine veterinary practice setting is good practice for all veterinarians.

Summary
Approximately 75% of all emerging pathogens are zoonotic, and many of them are contagious and infectious. Greater recognition of the importance of safe animal handling is necessary for animals to continue to be a source of happiness and comfort for all of us.

“Take home” points
1. All animals can transmit diseases to their human caretakers – even apparently healthy animals.
2. Most people turn to and trust their veterinarian to guide them on safely living with their pet.
3. Familiarity can breed complacency – just because an animal is commonly kept as a companion animal does not eliminate the zoonotic disease risk that animal presents.
4. Universal precautions and awareness of pathogen modes of transmission are key factors in public health and veterinary practice.
5. It is not recommended that owners kiss their hamsters!

References/suggested reading
http://www.onehealthinitiative.com/
Ebola and Pets: What We Know
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With the growing public concern about Ebola, there are many questions about the disease from consumers as well as medical professionals. Many people first became concerned about pets and Ebola when authorities in Spain announced plans to euthanize the dog belonging to a health worker there who had contracted Ebola after caring for a patient who had recently succumbed to the disease. Ebola virus disease (EVD), formerly known as Ebola hemorrhagic fever, is a severe, often fatal illness in humans, however, little is known about the role of domestic animals in the disease cycle of EVD.

RACE required objectives
1. Review the history of EVD and its growth in West Africa
2. Discuss the different types of EVD and their respective roles in historical outbreaks
3. Discuss the proposed reservoir and typical transmission routes of EVD

It is thought that fruit bats of the Pteropodidae family are natural Ebola virus hosts. The precise manner in which the virus first appears in a human at the start of an outbreak is not always clearly identified. However, researchers believe that the first patient typically becomes infected through close contact with the blood, secretions, organs or other bodily fluids of infected animals such as chimpanzees, gorillas, fruit bats, monkeys, forest antelope and porcupines.

Ebola is spread through direct contact with blood or bodily fluids of a person or animal that is sick with Ebola or through contact with objects (like needles and syringes) that have been contaminated with the virus. Ebola is not spread through the air or by water, or in general, by food. However, Ebola virus may be spread as a result of handling bushmeat (wild animals hunted for food) and contact with infected bats. There is no evidence that mosquitoes or other insects can transmit Ebola virus, however related viruses can infect mosquitoes. Only mammals have shown the ability to become infected with and shed Ebola virus.

Clinical points
Following EVD exposure, the onset of clinical symptoms is generally within 2-21 days with an average of 8 days post-exposure. People are not contagious prior to the onset of clinical symptoms. The disease progresses quickly from fever and other influenza-like symptoms, to diffuse hemorrhage and multi-organ failure. Diagnosis is made with clinical history, then a presumptive test with PCR is performed and confirmed by the CDC if positive. To date, dogs have not been recorded to have any symptoms despite evidence of exposure and presumed infection.

Therapeutic and prognostic points
Aggressive early supportive care including hydration and antibiotics are the cornerstone of therapy. Antivirals appear to have little to no positive effect in people, however ZMapp (three chimeric monoclonal antibodies combined in a biopharmaceutical) has shown promise. Plasma transfusion from convalescing patients is also in experimental use. In countries with developing medical systems, mortality rates approach 80%. In developed countries and with early and aggressive intervention with supportive care, mortality much lower. The current mortality rate in the USA is 20%, while the mortality rate in West Africa is ~75%. Long-term complications based on specific organ damage plague survivors, however survivors are afforded life-long immunity. While swine may show symptoms and succumb to illness, other companion or domestic animals do not seem to show symptoms. Apes, duikers, monkeys and others all succumb to illness similar to that of humans.

“Take home” points
1. Ebola virus disease is a highly infectious, moderately contagious disease.
2. The role of companion animals in the transmission cycle of Ebola virus is not well-characterized, but seems limited.
3. Universal health care precautions can be very effective against the transmission of Ebola virus disease.
4. Cultural traditions in West Africa contribute significantly to the continued transmission of Ebola virus in those countries.
5. Zoonotic diseases, such as Ebola virus, are important issue for veterinarians to continue to educate themselves, their staff and their clients about.

References/suggested reading
2. Olson SH1, Reed P, Cameron KN, Ssebide BJ, Johnson CK, Morse SS, Karesh WB, Mazet JA, Joly DO. Dead or alive: animal sampling during Ebola hemorrhagic fever outbreaks in humans. Emerg Heath Threats J. 2012;5
Feral, or free-roaming, domestic cats are one of the top threats to biodiversity world-wide. In addition, feral cats present a persistent and nearly ubiquitous public health threat. However, these threats seem to go unrecognized by most people, including some veterinarians. Several management strategies are employed to mitigate the severe impact of feral cats on the environment and on the public health. Any discussion of management strategies and search for better methods of control for these cats typically results in very emotional exchanges. The incredible passion on both sides of these discussions makes arriving at a reasonable solution to mitigate the significant and on-going damage from these cats nearly impossible.

**RACE required objectives**

- Define the term feral cat and discuss the source of feral cats.
- Describe several significant public health/safety threats of feral cats
- Describe current management strategies for feral cats

Feral cat populations continue to rise as an effective management strategy for reducing the population and mitigating the impact on sensitive ecology remains elusive. Veterinarians must find a way to continue constructive and professional discourse in search of a better strategy overall.

**“Take home” points**

1. Feral cats are a source of infectious disease.
2. Feral cats have a significant negative impact on endangered and endemic populations
3. Currently employed management strategies are variably effective at reducing feral cat populations in a reasonable timeframe.
4. Veterinarians should encourage responsible pet ownership, including discouraging the feeding of feral cats.
5. The feeding and maintaining of feral cat colonies is incongruent with a common sense approach to public health.

**References/suggested reading**


Patrick Foley, PhD, Janet E. Foley, DVM, PhD, Julie K. Levy, DVM, PhD, DACVIM, Terry Paik, DVM. Analysis of the impact of trap-neuter-return programs on populations of feral cats. JAVMA December 1, 2005, Vol. 227, No. 11, Pages 1775-1781.


Practitioners and the Flu
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With ~75% of all emerging pathogens zoonotic, a One Health approach to infectious disease evaluation becomes increasingly more prudent. No diseases better demonstrates the validity of One Health than zoonotic influenzas. With seemingly infinite combinations of the key components, hemagglutinin (H) and neuraminidase (N), long-term physiological immunity to influenza seems nearly impossible. It is critical for veterinarians to understand the key features of this virus and how to best respond to emerging influenzas.

RACE required objectives
- Describe the influenza virus molecule and discuss the concepts of antigenic drift, shift and mutation
- Review the history of pandemic influenzas in different species and their impact on society
- Discuss the prominent influenzas and their clinical implications

Key points
Influenza transmission is through aerosolized droplets and other respiratory secretions. Influenza survives in the environment, even under some less favorable conditions. Animals and humans are able to shed influenza prior to the onset of clinical symptoms for up to 72 hours, making biosecurity difficult to perform effectively.

Diagnostic and therapeutic points
Diagnosis can be based on clinical presentation or in conjunction with a variety of diagnostic tests. Supportive care shouldn’t be overlooked in non-food animals. Early supportive care and isolation from cohorts should be definitive. Additionally, personnel should be careful and maintain good hygiene practices to prevent cross-species transmission. Antivirals are sometimes effective in animals, but must be given very early in infection to be effective. Some resistant influenzas do exist. Vaccinate!

Early response to supportive care with less severe fever, decreased respiratory secretions, etc., are generally good prognostic indicators. Treatment in commercial production operations is not possible and all influenza infections in animals should be treated as significant.

“Take home” points
1. Influenza is unpredictable and cross-species transmission does occur.
2. Virus shedding is possible for 48-72 hours prior to the onset of clinical symptoms, so good biosecurity should be practiced when bringing new animals into an existing group.
3. Influenza is not new – it has just evolved.
4. Antivirals are most effective when initiated early in disease onset.
5. Veterinarians and their staff should be vaccinated annually to prevent influenza transmission.

References/suggested reading
http://www.flu.gov/pandemic/history/
Veterinary Practice Ownership and Disaster Response Responsibilities
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Natural disasters can strike anywhere – even your veterinary practice. Whether the greatest threat in your home area is hurricanes or earthquakes, as a practice owner, it behooves you to be aware of the most common threats and the most common issues facing populations following disasters. The most important step a practice owner can take to become more prepared for recovering from any natural disaster is to develop a WRITTEN continuity of operations plan (COOP). This document makes everything easier following the impact of a storm, flood, fire, or other calamity. Whether it is insurance contact information or contingency plans for infectious disease management in a boarding facility, a COOP can be invaluable. Practice owners should also recognize the liability that attaches with maintaining hospitalized or boarded animals during a developing storm. Legal advice for these activities is a must!

Following natural disasters, such as hurricanes or earthquakes, endemic infectious diseases MAY proliferate. Long-term and otherwise routine preventive care such as flea and heartworm prevention, may not be available to owners due to property loss. Thus, these parasites may proliferate. However, if diseases are not present in an area, they may not necessarily show up post-impact, i.e. an earthquake is not an infectious disease source. Loss of public health infrastructure can lead to enhanced transmission of zoonotic diseases. Clinical approaches may need to be tweaked following natural disaster impact.

All disaster response efforts in the US follow a similar structure and veterinary integration occurs in 2 places – public health and agriculture. Veterinarians should join local volunteer efforts to enhance their community’s ability to recover quickly from any disaster.

RACE required objectives

- Describe one critical step in practice preparedness planning
- List the leading cause of mortality following a hurricane
- List 2 infectious diseases of interest following any natural disaster
In recent years the topic of antimicrobial resistance (AMR) has gained great attention. The importance of multidrug-resistant organisms (MDROs) in human health has been an issue for some time, with a similar problem in veterinary medicine more recently identified. The transmission of pathogens between animals and people and proposed interconnectedness of antimicrobial use and AMR in human and animal populations has brought great attention to the importance of antimicrobial stewardship in controlling AMR in these populations. Recently, this attention has begun to focus on small animal veterinary medicine. This talk will review the current concerns of AMR in small animal veterinary medicine and discuss how to set up a clinic infection control antimicrobial stewardship program in clinical practice.

**Antimicrobial resistance**

There is currently great attention on the emerging epidemic of multidrug resistant bacteria because of dramatic increases in infections, limited antimicrobial options and potential public health consequences. These MDROs are not inherently more virulent than antimicrobial susceptible organisms, but treatment options are limited, something that ultimately can worsen the prognosis. The US Centers for Disease Control and Prevention has recently assessed domestic antibiotic resistance threats for people based on: clinical and economic impact, incidence, transmissibility, availability of effective antimicrobials, and barriers to prevention. This assessment included the estimate that each year AMR is responsible for over two million human illnesses and 23,000 deaths. Several pathogens of importance relative to veterinary medicine were included as “serious antibiotic resistance threats”, namely extended spectrum β-lactamase producing Enterobacteriaceae (ESBLs), *Salmonella* spp., and methicillin-resistant *Staphylococcus aureus* (MRSA). As animals and people may share common infection sources or transmit these pathogens to each other, this concern is equally important in the veterinary field, and all of the above-named pathogens can be found in veterinary patients.

Several mechanisms are known to result and contribute to AMR, including selective pressure with antimicrobial use and movement of plasmids between bacteria. The relationship between antimicrobial development and shortly following development of resistance to the new antimicrobial is clearly documented in human medicine. Currently there is limited understanding of the role of antimicrobial use on AR in non-human species, however several emerging veterinary pathogens (e.g., methicillin-resistant *Staphylococcus pseudintermedius* - MRSP) highlight the likely role of antimicrobial use in animals.

**Hospital–associated infections**

Hospital-associated infections (HAIs) are infections acquired by patients during hospitalization and are an inherent risk in both human and veterinary medicine. In human hospitals, HAIs are a well-recognized contributor to illness and death, with an estimated 5% of US patients developing a HAI, and tens of thousands dying each year. Substantial direct and indirect costs are estimated to result from HAIs. Additionally, according to the Infectious Disease Society of America, approximately 70% of human HAIs in the USA are resistant to at least one antimicrobial. Similar HAI risks have been reported in veterinary medicine. Perhaps most important to this topic is the assumption in human medicine that 10-70% of all HAIs are preventable. A similar preventable fraction is likely in veterinary medicine.

**AMR in veterinary medicine**

Currently, AMR is an emerging issue in veterinary medicine. MDROs are likely to be transmitted from the environment, patients, personnel, owners, and potentially food. A lack of centralized reporting of MDROs and HAIs in veterinary medicine has resulted in difficulties in clearly quantifying AMR occurrence and studying trends and associated factors. However, it is clear that MDROs in veterinary medicine complicate treatment, increase morbidity, mortality, and associated treatments. Transmission between animals and between animals and people is well-described for several MDROs, creating concerns for the health of patients, clinic staff, clients, and public health. It is highly likely that mandated antimicrobial restrictions are soon to come in all sectors of veterinary medicine.

**Roles for antimicrobial stewardship in veterinary medicine**

It has been estimated that 50% of antimicrobials are unnecessarily or inappropriately prescribed in human medicine. Antimicrobial stewardship programs (ASPs) have been developed in human medicine to combat antimicrobial misuse. ASPs will vary with clinic size, AMR patterns, and resources, but overall are designed to:

- Optimize clinical outcome
- Minimize unintended consequences of antimicrobials (e.g., resistance, adverse events)
- Optimize drug use, choice, dosing, duration and route
Such ASPs in human medicine have led to reduced antimicrobial use, increased appropriate use of antimicrobials, and reduced resistance.

**How to set up a clinic antimicrobial stewardship program**

Setting up a clinic ASP need not be overly complicated or time consuming. However, there are several key steps that must be addressed when setting up an ASP. These include:

- Ensure coordination of the program by an individual with interest and expertise;
- Get commitment (“buy-in”) by the clinic staff;
- Develop a formal ASP;
- Establish collaborations with your clinic microbiology laboratory;
- Education of staff;
- Incorporate compliance measures;
- Periodically evaluate and update the program to ensure it meets your needs.

When developing a formal ASP it is often useful to establish categories of antimicrobial prescription/use. For instance, these may include:

1. First-choice drugs (i.e., drugs for which there are no restrictions in use);
2. Restricted drugs (i.e., drugs for which there are specific indications ± consultation with coordinator required before use);
3. Reserve drugs (i.e., drugs that can only be used after permission from the program coordinator).

Such a tiered approach allows one to focus their efforts on those antimicrobials of greatest concern (e.g., public health concerns, MDRO development in patients). The development of the tiers should be based on existing guidelines, local patterns of AMR, and goals of the ASP. Having a close collaboration with your clinic microbiology laboratory can be incredibly valuable in this process as they will be able to provide annual reports summarizing trends in AMR for your practice or region. Such reports should be used to inform prioritization of antimicrobials to target for the ASP and may also assist in guiding initial therapy decisions for some conditions.

Compliance can be one of the largest stumbling blocks in setting up an ASP. Changing clinician practices and ensuring accountability can be time consuming and fraught with logistical complications. Several developed approaches (often used in concert) can assist in incorporating compliance measures with minimal effort.

**Education**

A number of excellent educational tools are available (and currently being developed) to assist in educating veterinary clinicians and staff on the topic of antimicrobial stewardship. For instance the British Small Animal Veterinary Association has developed the “Protect” website ([http://www.bsava.com/Resources/PROTECT](http://www.bsava.com/Resources/PROTECT)). On this site there are a number of education tools aimed at ASP education, development and compliance.

**Clinical guidelines**

It is important to recall and incorporate general clinical guidelines into an ASP. These include:

- Reserving antimicrobials for where there is evidence of bacterial infection and clinical disease (e.g., not when only colonization or for self-limiting infections);
- Consider the antimicrobial, pathogen, site, and patient;
- Utilize cytology when indicated to guide antimicrobial decisions;
- Ideally culture before using antimicrobials;
- When appropriate start with topical medications for superficial skin infections;
- Limit duration of antimicrobials, when indicated;
- Re-evaluate and perform re-checks on patients to ensure you are achieving the desired response;
- Educate clients on the use of antimicrobials (e.g., when they are and are not indicated, following prescription for dose, timing, and duration).

**Pre-prescription approval**

For select antimicrobials of high AMR concerns or consequences (e.g., carbapenems, vancomycin) it is often warranted to require approval from the ASP coordinator before the antimicrobial can be used. The coordinator may require convincing evidence that the specific antimicrobial is warranted, such as documented resistance to all other drug options.

**Post-prescription review, computer-based decision support, and established best practice guidelines**

Additional approaches can be helpful. Post-prescription review involves the ASP coordinator periodically retrospectively reviewing the antimicrobial decision choices for a subset of the patients. During review, attention is placed on de-escalation, dose, and pathogen-antimicrobial mismatch. Recently, a number of computer-based decision support tools and established best practice guidelines have become readily available. These tools and guidelines can greatly assist in guiding antimicrobial decisions for select conditions. The following are some examples of established tools and guidelines:
• Antimicrobial use for superficial pyoderma (dogs):
• In development: respiratory tract infections; septicemia: visit the International Society for Companion Animal Infectious Diseases (ISCAID) website for more information: http://www.iscaid.org/

References
Surveillance is an important tool for identifying and responding to changes in disease frequency and epidemiology, including outbreaks. It allows for the detection of hospital-associated infections (HAIs) and zoonotic agents and for monitoring disease prevention and control practices. As such, it is an integral component of an infection control program. Surveillance programs have played a critical role in disease prevention and control in the human and food/production animal health sectors. Yet, companion animals have not historically been a part of national or local surveillance efforts, and there currently is limited use of surveillance in the small animal clinical setting. However, recent appreciation of the importance of companion animals as sentinels for emerging zoonotic diseases and the utility of surveillance data for studying and responding to changes in the epidemiology of infectious and non-infectious disease has resulted in new initiatives in this field. Significant efforts are being made by companion animal practices to incorporate surveillance systems into their infection control programs. A surveillance program does not need to be complicated, expensive or take an excessive amount of staff time. However, key areas should be addressed ahead of time to ensure the program that is developed meets the needs of the clinic. The following serves to provide program suggestions and highlight areas to address to ensure a surveillance program is tailored to meet your needs and those of your clients and patients.

What is surveillance?
Surveillance is a system based on continuous information recording, making it possible to monitor the health status of a given population and the risk factors to which it is exposed. Further, it is a system used to detect pathological processes as they appear and study their development in time and space with the objective of taking appropriate measures to control them (surveillance = monitoring, data collection + action). This does not mean that data are continually collected on a daily basis, but that the system is permanently in place (and not of limited duration).

Why do we need surveillance in clinical practice?
Hospital-associated infections (HAI) are infections acquired by patients during hospitalization and a well-recognized contributor to illness and death in human hospitals. In human hospitals, an estimated 5% of US patients developing a HAI, and tens of thousands die each year. Substantial direct and indirect costs are estimated to result from HAIs (e.g., in the US $28-45 billion in direct costs annually). While there are limited data for these estimates in veterinary medicine, similar HAI risks have been reported, such as HAIs in 16% of ICU patients.1

A recent study reported that 82% of veterinary teaching hospitals documented one or more outbreaks of hospital-acquired infections during the preceding 5 years.2 Surveillance programs allow for early recognition of HAIs and outbreaks, as well as provide important information for better understanding and responding to local disease occurrence (e.g., tracking cases of antibiotic resistant infections, enteric pathogens, reportable pathogens). Surveillance helps to define the typical (baseline) for disease frequency in a given practice, so that changes in this frequency can be accurately interpreted and logical decisions can be made regarding control and prevention methods. In addition, it allows for the evaluation of compliance with infection control procedures.

Current examples of surveillance in small animal practice
A few recently developed national/regional surveillance systems for small animal practices help to illustrate the utility and design of such programs.

**Companion animal parasite council (USA)**
Maps depicting the relative prevalence of tick-borne pathogens, intestinal parasites and heartworm are provided for the United States. Data are derived from results of testing performed by IDEXX Laboratories and ANTECH Diagnostics.

**Worms and germs map**
[http://www.wormsandgermsmap.com](http://www.wormsandgermsmap.com)
Disease cases are logged by participating veterinary clinic staff, and cases are then mapped in real time. Established case definitions are used to ensure reliability in case recognition and mapping. Diseases are plotted to the first three digits of the postal or zip code. It is an initiative of Dr. Scott Weese (University of Guelph), also coordinator of the companion Worms and Germs Blog ([http://www.wormsandgermsblog.com](http://www.wormsandgermsblog.com)).

**CICADA survey (United Kingdom)**
[http://uk.cicadasurvey.com/](http://uk.cicadasurvey.com/)
Provided free of charge to registered practices in the UK, CICADA shows up-to-date reported disease trends in companion animals, including recent outbreaks and current hot spots. Data are provided by participating small animal clinics through periodic mandatory web-based surveys.

Steps to setting up a clinic surveillance system
To be effective, there are a number of areas that need to be considered when establishing a surveillance system. The following questions must be carefully considered.

1. Who will set-up and monitor the system? Ideally a single person will frequently monitor data to increase the likelihood of recognizing a trend or related cases.
2. How are cases identified and defined? Here a standard case definition is imperative. A case definition must be well-thought out and consistently used.
3. What type of system will be used (see below) and what data will be collected? A number of factors may play a role in this decision such as cost, pathogens of interest, what is acceptable to those taking part in data collection and analysis, ability to alter the system to adapt to change (scalable), reliability in detecting disease, speed at which information can be obtained, number of high-risk cases routinely housed in or seen at a facility.
4. How often will data be formally analyzed and reported?
5. Who will receive reports?
6. What are the triggers for initiating further analysis/surveillance or responding with infection control and prevention practices?
7. Are there areas that need to be addressed regarding owners’ approval for collection of samples used solely for the purpose of surveillance and how results from such tests will be provided to clients?

A working group should be identified to define objectives and address the above areas. The surveillance plan that is developed should be documented in writing and become part of the clinic’s infection control plan.

What type of surveillance will be used?
Early in the planning stages, it is important to determine the type of surveillance that is indicated and/or acceptable. There are three main types of surveillance; active, passive and syndromic.

Active surveillance
Involves collection of data specifically for infection control purposes (e.g., laboratory samples taken specifically for purpose of surveillance). One may elect to only collect from a subset of patients (e.g., high-risk, certain days of the week).

Example
Active methicillin-resistant *Staphylococcus aureus* (MRSA) surveillance is used at some large animal clinics, with nasal swabs collected from horses on admission, every 7 days in hospital, and on discharge. Swabs are screened for MRSA using enrichment media. Molecular typing is performed on MRSA-positive isolates. A classification scheme, such as listed below, is then utilized to determine the most likely source of positive isolates.

- Community-associated (CA): detected at admission
- Community onset-hospital associated (CO-HA): detected at admission from a horse who was admitted to the same hospital within the previous 12 weeks
- Hospital-associated (HA): first sample negative and MRSA detected on subsequent sample

**Advantages**
Ensures all animals of interest are included; data may be available earlier than if relying on passive or syndromic methods (able to identify asymptomatic shedders); data typically high quality.

**Disadvantages**
Expensive; requires staff time to collect samples.

Environmental surveillance
(A form of active surveillance), is sometimes used in hospitals. This form of surveillance typically involves culturing the clinic environment. Environmental contamination in veterinary clinics is common. A recent study found zoonotic pathogens could be isolated from common environmental surfaces in a large proportion of community veterinary clinics. Given the profound contamination present, the utility of routine culture-based environmental surveillance in the small animal clinic setting is of questionable use. Environmental cultures could be considered in the context of an outbreak investigation, with assistance of relevant experts for proper design and interpretation. Rather, a more general approach to the assessment of cleaning/disinfection through environmental tagging has been proposed. This method involves the placement of a fluorescent dye on locations of interest, followed by UV light visualisation after cleaning should have been completed. Detection of the dye after cleaning suggests areas were missed or inadequately cleaned. Using this method, Weese et al. documented significant differences in the prevalence of successful
cleaning by general location \( (P<0.0001) \) and surface type \( (P<0.0001) \), leading to the identification of inadequacies in protocols and practices, which could be remedied. This technique is an efficient, low cost tool that can be useful in establishing baseline cleaning rates, identifying deficiencies in protocols, and evaluating the effects of interventions and education of personnel.

**Passive surveillance**

Involves the use of data that are already available (e.g., medical records, diagnostic laboratory samples submitted for other purposes).

**Example**

Passive surveillance may be used to monitor post-operative surgical site infections (SSIs) by reviewing case records and client communication for surgical patients at discrete time points after the procedure. Standard definitions can be used to classify reports as SSI,\(^7\) such as:

Superficial incisional SSI: infection occurs within 30 days after the procedure, involves only skin and subcutaneous tissue of the incision and patient has at least one of the following:
- Purulent drainage from the superficial incision;
- Organisms isolated from an aseptically-obtained culture;
- Superficial incision that is deliberately opened and is culture-positive or not cultured and patient has at least one of the following signs or symptoms: pain or tenderness; localized swelling; redness; or heat.

*Similar definitions are available for deep incisional and organ/space SSIs.\(^7\)*

**Advantages**

Data have been collected for other means, so are available and possibly minimal effort (although considerable time can be spent cleaning and analyzing these data).

**Disadvantages**

Only as good as the data that are collected for clinical purposes; may not be effective means of detecting problems particularly if follow-up is not uniform for all cases; potential biases must be considered (e.g., more apt to culture infections that do not resolve with empirical therapy, thereby overestimating the proportion of multi-drug resistant infections).

Note: SSI surveillance should be considered by clinical practices. A recent prevalence study found that SSIs were the most common human healthcare-associated infection, accounting for 31% of all HAI's among hospitalized patients.\(^8\) Additionally, recent work at a veterinary teaching hospital\(^9\) identified SSIs in 3.0% of animals undergoing surgical procedures. Many (35%) SSIs were only identified through active follow-up and were not in the medical record. SSIs were most common following orthopedic surgeries and procedures with an implant. Methicillin-resistant staphylococci were most commonly identified, with methicillin-resistant *Staphylococcus pseudintermedius* accounting for the majority of SSIs. These types of findings highlight the utility of a surveillance system, as they provide a benchmark for SSIs and information that should be monitored and addressed with an infection control program.

**Syndromic surveillance**

Involves detection of readily identifiable syndromes (e.g., coughing, diarrhea), not specific diseases. Syndromic surveillance is an easy tool for identification of certain high-risk cases and can be applied by veterinary and lay staff. The use of syndromic surveillance for nosocomial illness (e.g., onset of vomiting/diarrhea during hospitalization) may be a simple, effective tool if there is high staff compliance.

**Example**

A recent report\(^10\) describes the use of syndromic surveillance to identify and halt the nosocomial transmission of canine parainfluenza in a veterinary teaching hospital. Veterinary kennel staff quickly alerted infection control personnel of two fully vaccinated dogs that had recently been hospitalized in the same ward at the clinic and were now presenting with cough and fever. Infection control was able to act quickly, ensuring the presenting cases were placed in isolation and appropriate personal protective equipment was used, suspected contacts in the ward were identified and quarantined, appropriate patient testing and follow-up was performed, and monitoring of hospitalized patients for signs of respiratory disease or fever of unknown origin was increased. Canine parainfluenza infection was diagnosed through identification of seroconversion of all tested dogs. A total of four hospital-associated cases were identified (all occurring through first generation transmission; infectious agent from the index case to the first group of secondary cases) before clinical illness was apparent; no within-hospital second generation transmission was observed. This example supports the utility of syndromic surveillance with prompt infection control measures as an integral part of an infection control program.

**Advantages**

Allows for quick, easy characterization; all staff can participate in case identification.

**Disadvantages**

Broadly defined groups may not permit accurate identification of clusters/outbreaks; many suffer from high false positive or false negative identifications.
Selected references


What’s New with Pet-Associated Zoonotic Diseases: MRSA, MRDOs, and MORE

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Although pet ownership has many established health benefits, pets can also be a source of disease for pet owners and veterinary clinic staff. These pet-associated zoonotic disease risks are highest amongst young children, the elderly, pregnant women, and those with an impaired or weakened immune system (immunocompromised, immunodeficient). The proportion of households in the United States with at least one higher-risk person is very high (estimated to be over 50%) and many have pets. Veterinary staff are in a key position to provide recommendations to clients and veterinary staff to promote safe pet ownership practices. However, the area of pet-associated zoonotic diseases is frequently changing as new pathogens are identified or emerging into new locations and our understanding of the role pets in zoonotic disease (and related epidemiology) is improved through research and novel methodologies.

The veterinary clinic environment can also be a source of pet-associated disease. It is perhaps not overly surprising that individuals that work with animals are at increased risk from infectious diseases. During their careers, approximately two-thirds of veterinarians report a major animal-related injury resulting in lost work or hospitalization.¹ In two US-based studies, 28-47% of veterinarians reported having contracted a zoonotic infection during the course of their veterinary work of which ~45% were medically confirmed; zoonoses most frequently reported included dermatophytosis, bartonellosis, and cat and dog bite infections.²,³

This talk covers several important zoonotic diseases, highlighting new information regarding their incidence, risk factors for human or pet illness, and similar insights into their epidemiology.

Hospital-associated infections

Hospital-associated infections (HAIs) are those infections believed to be acquired during hospitalization. Recently, there has been increased awareness and interest in the incidence and importance of HAIs in veterinary medicine. Of noted importance is that some veterinary HAIs (e.g., methicillin-resistant Staphylococcus aureus (MRSA), Salmonella) are zoonotic – potentially transmitted to staff or pet owners resulting in human illness. Further, as veterinary medicine advances, there may be parallel increases in HAI risk through the use of more invasive procedures, more use of invasive devices (e.g., urinary catheters, intravenous catheters), more immunosuppressant therapies, and a greater intensity of critical care management. Patients that might not have survived their underlying disease in the past may now be alive, but highly susceptible to infection and able to transmit zoonotic HAIs. Based on the reported veterinary HA-outbreaks or supposition from the human literature, several important zoonotic pathogens responsible for HAIs (including MDROs) are identifiable: S. aureus and S. pseudintermedius, Salmonella spp. and Escherichia coli.

Staphylococci

S. pseudintermedius and S. aureus are often carried on the skin and in the gastrointestinal tracts of dogs and people (respectively). The emergence of methicillin-resistance in these species, denoted as MRSP and MRSA, has had profound implications for zoonotic transmission and prevention/control. Methicillin-resistance is mediated by the mecA gene, expression of which results in production of an altered penicillin-binding protein. This altered protein has a low affinity for β-lactam antimicrobials (penicillins, cephalosporins, and carbapenems), rendering strains resistant to these antimicrobials. Additionally, resistance to other classes of antimicrobials is frequently observed: lincosamides (clindamycin), fluoroquinolones, macrolides (erythromycin), tetracyclines, trimethoprim-sulfonamides.⁴

MRSA is an important pathogen in people and to a lesser extent, MRSA has also been noted in veterinary patients. Prior antimicrobial use, prior hospitalization, and ownership by veterinary or human health-care workers/students and longer hospitalization (> 3 days) have been associated with MRSA colonization or infection in dogs.⁵,⁶ Furthermore, the use of fluoroquinolones and cephalosporins has been linked to the emergence of MRSA in people and may play a role in veterinary species. It is important to note that an abnormally high proportion of veterinarians are colonized with MRSA as compared to the general public. As such, they may serve as a source for HAIs in their patients if infection control practices (notably hand hygiene) are not observed. This also likely indicates deficiencies in standard infection control and hygiene practices that allow for transmission of MRSA between veterinary personnel and animals. For instance Anderson, et al. found that veterinary personnel who reported washing their hands after handling horses believed to have infectious diseases had one-third the risk of colonization with MRSA than those that did not report this practice.⁸

MRSP has rapidly spread globally in canine populations, often with high levels of antimicrobial resistance, something that is of tremendous concern as S. pseudintermedius is the leading opportunistic pathogen in dogs (and to a lesser degree cats). In one study, more than 90% of MRSP isolates were also resistant to four additional antimicrobial classes.⁷ Recent prior hospitalization and β-lactam antimicrobial administration have been associated with MRSP infections, suggesting nosocomial transmission may be a factor in MRSP disease. Although apparently a rare occurrence, MRSP is zoonotic with severe disease occurring in some individuals.
Colonization on the other hand appears more commonplace, noted in veterinary healthcare workers and evidence of transmission within households (to people and other animals) in which one or more dogs with an MRSP infection has been diagnosed.

**Escherichia coli**

*E. coli* is a common component of the commensal gastrointestinal microflora of pets and people and is an important pathogen in both species. Many community and hospitalized small animals shed MDR *E. coli* in their feces. A number of factors have been associated with dogs shedding or acquiring MDR *E. coli* during hospitalization, including duration of hospitalization (>3 days) and treatment with antimicrobials shortly before or while hospitalized (cephalosporins, metronidazole). Of particular concern, is the ability for some strains of *E. coli* to produce β-lactamase, notably the extended spectrum β-lactamases (ESBLs) producers, which provide resistance to a broad range of β-lactam antimicrobials, including third generation cephalosporins. Furthermore, ESBLs are conferred resistance to additional antimicrobial classes through genetic linkage with resistance mechanisms. The role of pets in the transmission of ESBL-producing *E. coli* is currently unclear. One study reported a six-fold greater risk for colonization with ESBL-producing *E. coli* than people who do not own pets.

**Salmonella**

From the perspective of pet-associated disease, salmonellosis is most commonly associated with contact with select species. Reptiles, amphibians, rodents, exotic species (e.g., hedgehogs), and young poultry (e.g., chicks) have been implicated in a number of nationwide and internationally human salmonellosis outbreaks. In these outbreaks, the elevated risk for particular groups is highlighted as children accounted for a high proportion of cases (35%-70%), with high rates of hospitalization (26%-35%); occasionally cases resulted in death of the child. The risks from reptiles and amphibians are particularly well documented. These species are estimated to be responsible for 11% of salmonellosis cases among persons less than 21 yrs of age. In one study, 17% of state-reported reptile-associated salmonellosis cases were documented in children ≤1 year of age, emphasizing the potential for reptile-associated *Salmonella* to be readily transmitted without direct reptile contact. Additionally, *Salmonella* has been identified as a source of sporadic illness and hospital-associated outbreaks in small animal hospitals. As most infected dogs and cats with salmonellosis are subclinical, there is a high risk for inadvertent hospital-wide environmental contamination and nosocomial transmission. Reported factors leading to an increased risk of *Salmonella* shedding in small animals include consumption of raw meat diets, exposure to livestock, and receiving a probiotic in the previous 30 days. As with *E. coli*, ESBL-producing strains are a concern for antimicrobial resistance and have been identified in small animals, posing an important zoonotic risk.

**Leptospira**

Leptospirosis is an important re-emerging zoonosis in dogs. Dogs with leptospirosis can serve as a source of this pathogen for clinic staff. Although such events do not appear to be common, simple steps can be taken to further reduce this risk. In order to be effective, infection control practices should be implemented as soon as leptospirosis is considered a reasonable differential. Since test results are often negative during the acute phase of disease or test results may be delayed, it is prudent to consider all dogs with acute renal or hepatic disease, or where there is a reasonable possibility of leptospirosis, as leptospirosis suspects until an alternative diagnosis has been made. Treatment with an appropriate antimicrobial (i.e. intravenous ampicillin or, if tolerated, oral doxycycline) should be started or continued if the animal is being treated at the time of admission. Precautions should be taken, including PPE (gloves, gowns, booties if potential contamination of floor, face protection if urine splashing is a risk) and reduced movement of the animal, until appropriate antimicrobial therapy has been given for at least 48 hours. Thereafter the risk of shedding viable *Leptospira* in the urine is greatly reduced. As a contaminated hair coat can be a risk for transmission, consider bathing leptospirosis suspects with a chlorhexidine-containing shampoo followed by hot air drying after 48 hours of appropriate antimicrobials have been administered.

**Capnocytophaga canimorsus and Pasteurella multocida**

These organisms are common commensals in the oral cavity of dogs and cats. Transmission generally occurs through the bite of an infected or colonized animal or contact with saliva (such as by licking) on mucous membranes or an open wound. In patients at high risk, severe wound infections, sepsis, disseminated intravascular coagulation or death can occur. Patients with no spleen, older adults and people with alcohol dependence are at particularly increased risk for infection with Capnocytophaga canimorsus.

**Cryptosporidium species and Giardia duodenalis**

In people, subclinical or self-limiting diarrhea is generally observed with cryptosporidiosis and giardiasis, with weight loss and chronic diarrhea in high-risk patients. For cryptosporidiosis, symptoms may vary with the species or genotype of infection. Although most *Giardia* assemblages are species-specific, several are found in both animals and people with documented zoonotic transmission. Several pet species may harbor zoonotic *Cryptosporidium* and *Giardia*, including dogs and cats, which can pass the organisms in feces.
References


Pet ownership is common in North America, with over 50% of US households owning cats or dogs, and other companion species also reported. Although pet ownership has many established health benefits, pets can also be a source of disease for pet owners. The disease risks associated with pet ownership are believed to be highest amongst young children, the elderly, pregnant women, and those with an impaired or weakened immune system (immunocompromised, immunodeficient). Estimates suggest the proportion of individuals with some degree of immunodeficiency is high. As such, animals are frequently a part of households with one or more individuals who have some degree of immunodeficiency. Pet ownership and contact recommendations are established for high-risk groups and can reduce the risk of pet-associated disease. Veterinary staff are in a key position to provide these recommendations to clients and promote safe pet ownership practices. Encouraging and safeguarding client disclosure of immunocompromising conditions is critical for effectively providing this service. This topic has recently been reviewed, with publications directed toward the veterinary and human health communities.

Health benefits of animal ownership
The mental and physical benefits of pet ownership and contact are well documented. The emotional bond between owners and pets can be as important to the owner as human relationships and provide similar psychological benefits. Numerous health benefits including reduction in distress, anxiety, loneliness, and depression are associated with animal interaction. Ownership of some animal species (e.g., dogs) increases exercise and thus directly improves physical health. Children brought up with companion animals have better social skills, self-esteem, and empathy than children without pets. In adults and the elderly, studies have documented an association between pets and reduced risk of cardiovascular disease, higher survival rates from myocardial infarction, and improved psychological and physical well-being among the elderly. Health benefits are also well documented in individuals who are immunocompromised. Such individuals may spend considerable time alone, and thus are especially vulnerable to mental and physical illness. Among individuals infected with HIV, domestic animals are often perceived as family members, serve as sources of support and affection, and protect against loneliness.

Immunocompromising conditions
People may be immunocompromised for various reasons. It is important to remember that people are not simply immunocompromised or not; there is a degree to which people are immunocompromised and this varies between and within conditions. Primary immunodeficiencies are those that result from genetic causes, while acquired immunodeficiencies result from non-genetic causes. Although both are important, acquired immunodeficiencies are much more common causes of immune dysfunction. Acquired immunodeficiencies include: 1) transplants (bone marrow and solid organ), 2) infectious diseases [e.g., human immunodeficiency virus (HIV) infection], 3) metabolic diseases (e.g., diabetes mellitus, renal disease), 4) splenectomy, 5) cancers, 6) drugs (e.g., high doses of steroids, chemotherapeutics), and 7) physiologic factors (e.g., malnutrition, extremes of age, and pregnancy). It is estimated that up to 20% of the United States population has some degree of immunosuppression, with similar statistics likely applying to most developed countries.

Health risks of animal ownership
Despite the established benefits of pet ownership and interaction, companion animals are a potential source of numerous human diseases. As a general rule, immunocompromised people are more likely to get sick from something that would not hurt an immunocompetent person, and are more likely to develop serious illness or complications from something that would only cause mild disease in others. For example:

- Individuals infected with HIV are at 20-100 times greater risk of Salmonella bacteremia than those without HIV infection.
- *Capnocytophaga canimorsus* is a member of the normal oral bacterial flora of dogs and cats. Alcoholics, asplenic individuals and immunocompromised individuals are at risk for severe (often deadly) *C. canimorsus* infection following dog/cat licks or bites.
- Individuals with hematologic malignancies are twice as likely to be infected with Campylobacter than those without cancer and illness is more likely to be severe and prolonged in these individuals.
- *Bordetella bronchiseptica* can cause severe illness in immunocompromised individuals.

The veterinary clinic environment can also be a source of pet-associated disease. It is perhaps not overly surprising that individuals that work with animals are at increased risk from infectious diseases.
Pet ownership and practices by immunocompromised individuals

Studies indicate that pet ownership practices by immunocompromised individuals are very similar to that of the general population, with 50–60% of surveyed groups with cancer, HIV infection and transplant recipients owning pets. Furthermore, the distribution of species owned mirrors that of the general population, with dogs and/or cats being the most common pets, but other species (e.g., birds, pocket pets, reptiles/amphibians) also reported. High-risk pets (those believed to pose the greatest health risk due to an elevated frequency of pathogen colonization and/or shedding), including dogs/cats < 6 months of age, exotic species, rodents, and reptiles/amphibians, are often owned by immunocompromised individuals. A study among households with children diagnosed with cancer, noted that over 70% of households that obtained a new pet following diagnosis, acquired a high-risk pet. Pet husbandry practices that increase zoonotic disease risk have been frequently documented among immunocompromised individuals. In one study, high-risk foods (i.e. raw eggs, raw meat, or raw animal product treats) were fed to dogs in 21% of households with children diagnosed with cancer. Furthermore, infection control practices among pet owners who are immunocompromised appear to be no more stringent than those practiced by lower-risk individuals.

Zoonotic disease education

Despite an increased risk for pet-associated disease, it appears a minority of high-risk pet-owners receive education on ways to prevent zoonotic infections. Among households with children recently diagnosed with cancer, only 32% of respondents recalled having received zoonotic disease information from any source (including physicians and veterinarians). This proportion is similar to that recalled by the general population. The limited recall of zoonotic disease education by immunocompromised individuals is concerning and an area in which veterinarians and their staff can make significant contributions.

Guidelines to reduce pet-associated health risks

The risk of disease transmission between pets and people is a function of pet and human-related factors. These factors include animal species, diet, age, opportunity for exposure (hospitalization, level of confinement), immunosuppression, and personal hygiene. By targeting these factors, we can dramatically reduce the disease risks facing immunocompromised individuals.

Being immunocompromised is not a contraindication to having a pet. However, individuals who are immunocompromised, and households with such individuals, should be more cautious than other pet owners of ensuring their pets remain healthy and following precautions to reduce transmission of pathogens from pets. Pet contact guidelines can be categorized into 1) personal hygiene, 2) types and ages of animals and 3) pet health and husbandry practices (Table). These guidelines are general; several recently published resources should be consulted for targeted information for specific human and veterinary medical conditions. Clients that have specific questions about the risk to household members should be encouraged to consult with their physician.

The prevention methods above apply equally to clinic members who may be at increased risk for pet-associated infections. In addition, such individuals should discuss any necessary work restrictions and precautions with their physician. In general, high-risk individuals who work in small animal hospitals should avoid handling patients with suspected or known infectious diseases. Such individuals should strictly follow infection control principles, including hand hygiene and use of personal protective equipment. Based on the level of immunosuppression, routine glove-use may be considered when handling all animals, however strict hand hygiene (washing with soap and water or use of alcohol-based hand sanitizer) after every patient contact and immediately after removing gloves is critical. Gloves should always be worn when having contact with animal fluids or feces. Prevention of animal bites, scratches, or sharps injuries is important. Training for all staff on pet-associated zoonotic disease risks and prevention within and outside the veterinary clinic should be required and documented. Staff knowledge on this topic should be periodically assessed.

Knowledge of client’s immune status: promoting and safeguarding client disclosure

Given the increased pet-associated disease risk for immunocompromised individuals, it is important for veterinary staff to be aware of these conditions and provide targeted education and recommendations to those clients. It appears, however, that most veterinarians are not aware of their clients’ immune status (only 66% in one study), making such targeted efforts difficult. Techniques that utilize passive (e.g., pamphlets, signs) and active (intake questionnaire) formats can be effective in encouraging client’s to disclose the immune status of individuals in their household. Brochures and posters are available from a number of sources (e.g., the Centers for Disease Control and Prevention Healthy Pets - Healthy People, Pets are Wonderful Support, Worms and Germs Blog – Ontario Veterinary College). Some advocate utilizing intake questionnaires to obtain information for the client’s household, such as asking if there are any children less than 5 years of age, people with immune problems, or women who may be or are planning to become pregnant.

Veterinary clinic staff must recognize, however, that such client personal health information may be considered confidential and protected under privacy laws. The greatest concerns focus on how this information is secured and provided to other individuals (e.g., clinic staff, other veterinary clinics). As such, veterinary clinics need to decide how such information is recorded, if at all. If information is recorded, it is best to ensure clients are aware (and provide written consent) to why the information is requested, how
the information will be used and, if included in the patient’s record, may be transmitted to other veterinary clinics as part of the patient’s record. This consent should be reviewed with the client on a regular basis.

Table: Pet contact guidelines for households with immunocompromised individuals

Personal hygiene
- Wash hands after handling animals or their environment; supervise hand-washing for children < 5 yrs
- Avoid contact with pets’ feces and animal-derived pet treats
- Promptly wash bites and scratches from animals; do not allow pets to lick open wounds or broken skin
- Have someone who is not immunocompromised clean litter boxes/cages/aquariums (if that is not possible wear gloves); do not dispose of aquarium water in sinks used for food preparation or bathtubs

Types and ages of animals
- Avoid contact with dogs and cats < 6 months of age or strays
- Avoid contact with animals with diarrhea
- Avoid contact with young farm animals (e.g., petting zoos)
- Avoid contact with reptiles, amphibians, rodents, and baby poultry (chicks and ducklings) and anything that has been in contact with these animals; preferably these animals should not be kept in the households of immunocompromised individuals
- Reptiles, amphibians, rodents, and baby poultry should not be permitted to roam freely through a home or living area and should be kept out of kitchens and food-preparation areas
- Exercise caution when playing with dogs and especially cats to limit scratches; keep pets’ nails short
- When acquiring a new pet, seek mature animals from established vendors
- Avoid contact with exotic pets and non-human primates
- When visiting other households with pets, take the same precautions with those pets

Pet health and husbandry
- Spay/neuter any pets to help decrease roaming tendencies and behavioral issues
- Keep cats indoors; change litter boxes daily; keep cats away from kitchens or other areas where food preparation and eating occur
- Keep dogs confined when possible; walk on leash to prevent hunting and eating garbage or feces
- Feed only canned or dried commercial food or well-cooked home-prepared food; any dairy products should be pasteurized
- Prohibit access to non-potable water, such as surface water or toilet bowls
- Routine preventative care, including steps to control and prevent ecto- and endoparasites (e.g., ticks, worms) as indicated by the area
- Clean bird cage linings daily; wear disposable gloves (+/- surgical mask) when handling; dampen cage litter with water (mist) to decrease generation of dust
- Clean small rodent cages frequently
- Regularly (e.g., weekly) launder pet bedding
- Seek veterinary care at first sign of illness in an animal

Selected references
1 American Veterinary Medical Association, Pet ownership and demographics sourcebook. American Veterinary Medical Association, Schaumburg, IL (2007).


