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Infection Prevention and Control Best Practices

For Small Animal Veterinary Clinics

August 2008

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DISCLAIMER

This best practices document is intended to guide clinical practice only and provide assistance for decision-making on infection prevention and control issues. Its use should be flexible to accommodate specific challenges and risks in different facilities and regions while ensuring best practices in infection prevention and control. These practices neither constitute a liability nor discharge from liability. While every effort has been made to ensure accuracy of the contents at the time of publication, neither the authors nor the Canadian Committee on Antibiotic Resistance (CCAR) give any guarantee as to the accuracy of information contained herein, nor accept any liability, with respect to loss, damage, injury or expense, arising from any errors or omission in the contents of this work.

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CANADIAN COMMITTEE ON ANTIBIOTIC RESISTANCE (CCAR)

The Canadian Committee on Antibiotic Resistance (CCAR) was formed in 1998 to co-ordinate Canadian efforts to control the development and spread of antimicrobial resistance. Working together on activities identified in the National Action Plan to Address Antibiotic Resistance, CCAR's main areas of interest are resistance surveillance, infection prevention and control, and optimal antimicrobial use. The Committee provides outreach to the health care and agricultural communities through a variety of activities, including professional seminars, a series of reports and informational documents for specific target audiences, and managing one of the most comprehensive websites on antimicrobial resistance in Canada (www.ccar-ccra.org).

The CCAR also works with various levels of government to develop policy and identify human and financial resources to address resistance. The Public Health Agency of Canada provides considerable financial support through a three-year contract for services which expires in March of 2008. Whenever possible, CCAR leverages these resources to undertake activities and specific projects with those partners dedicated to the same interest in reducing antimicrobial resistance.

PREPARED BY

Maureen E.C. Anderson, Jenny Montgomery, J. Scott Weese, John F. Prescott
Department of Pathobiology, University of Guelph, Guelph, Ontario N1G 2W1

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ISBN #

Summary of

Infection Prevention and Control Best Practices

For Small Animal Veterinary Clinics

This document is designed to provide a complete and readily accessible summary of infection prevention and control best practices for small animal veterinary clinics, and is intended to be understandable to all members of the veterinary practice team. The basic contents and key messages are summarized below, and a more detailed summary is available in Appendix I.

1. Infection prevention and control strategies are designed to **protect patients, owners, veterinary personnel and the community**. All veterinary personnel should play an active role in protecting every person and animal associated with the veterinary clinic.

2. **Every** veterinary clinic, regardless of type or size, should have a **formal infection control program**, a written infection control manual, and an infection control practitioner (ICP) to coordinate the program.

3. Some form of **surveillance** (either passive or active) should be practiced by all veterinary facilities. The keys to passive surveillance are to centralize the available data, and to have a designated ICP who compiles and evaluates the data on a regular basis.

4. **Routine Practices** that are critical to infectious disease prevention and control:
    a. Hand hygiene, including:
        i. Handwashing
        ii. Use of alcohol-based hand sanitizers
    b. Risk reduction strategies, particularly those related to:
        i. Use of personal protective equipment (PPE)
        ii. Cleaning and disinfection
        iii. Laundry
        iv. Waste management
    c. Risk assessment of animals and personnel with regard to:
        i. Disease transmission
        ii. Disease susceptibility
    d. Education
        i. Veterinary personnel
        ii. Animal owners
        iii. Public

5. All **surgical procedures** cause breaks in the normal defensive barriers of the skin or mucous membranes, and therefore carry an inherent risk of surgical site infection (SSI). Good general infection control practices (e.g. hand hygiene, cleaning and disinfection) are important for prevention of SSIs, but there are also specific infection control measures pertaining to surgery that should be considered.

6. Every veterinary clinic should have an **isolation** area for caring for and housing animals with potentially contagious infectious diseases.

7. Proper **wound care** is critical to preventing transmission of bacteria, particularly multidrug-resistant pathogens, between animals, personnel and the environment.

8. **Animals from shelters** and similar facilities should be considered high risk from an infectious disease standpoint and managed appropriately to prevent transmission of disease.

9. **Safety** of personnel and animal owners should always be a priority. Personnel should take all necessary precautions to prevent animal-related injuries (e.g. bites, scratches), and all bite wounds should be taken seriously. Proper sharps handling practices should be emphasized to reduce the risk of needle-stick injuries.

10. **Education** of personnel and clients about zoonotic and infectious disease risks and prevention is crucial.

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For Small Animal Veterinary Clinics

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INTRODUCTION

The Canadian Committee on Antibiotic Resistance (CCAR) has sponsored the development of best practices for infection prevention and control for human healthcare facilities and community health care settings, and recognizes the need for similar information directed towards veterinary clinics. Veterinary facilities face many of the same challenges that human healthcare facilities encounter. Hospital-acquired infections (HAIs) can have devastating effects on the health of veterinary patients, as well as the emotional and financial well-being of their owners. Outbreaks of HAIs can have a significant impact on patients, their owners and veterinary personnel. Additionally, the close contact between most people and their pets allows for transmission of infectious agents between humans and animals, in both directions, and many of the most important HAIs in human hospitals are now emerging in veterinary hospitals. Veterinary clinics can act as reservoirs of human and animal pathogens and play a role in dissemination of infectious agents including antimicrobial-resistant bacteria into the general population, with potential effects on humans and animals. Veterinary personnel also face an inherent risk of zoonotic disease from contact with both healthy and ill animals. All these issues clearly indicate why infection control is an important aspect of veterinary practice. However, the field of veterinary infection control is poorly developed compared to that of infection control in human healthcare, and few resources are currently available to help veterinarians design and implement adequate infection control programs.

PURPOSE

The purpose of this document is to provide veterinary personnel with a succinct guide to principles and practices of infection control relevant to small animal veterinary clinics. This document provides the basic information needed to develop an infection control program and establish basic infection control practices for such a clinic, with specific emphasis on critical aspects such as hand hygiene, and cleaning and disinfection.

SCOPE OF DOCUMENT

This document covers small animal veterinary clinics and is relevant to all personnel that work in association with such clinics, including veterinarians, veterinary technicians and lay staff. For the purposes of this document, 'veterinary personnel' refers to all personnel that work in a veterinary clinic. This includes non-clinical staff, as in many situations these individuals may still have periodic direct or indirect contact with patients and pathogens within a clinic.

GUIDING PRINCIPLES

(Modified from Ontario Ministry of Health and Long Term Care, 2004)

1. Infection prevention and control strategies are designed to protect patients, owners, veterinary personnel and the community.

2. A significant percentage of hospital-associated infections (HAIs) in veterinary clinics can likely be prevented with proper compliance to basic, practical infection control practices.

    - Although poorly quantified, HAIs occur in veterinary clinics and can have a significant impact on animal health. While the proportion of preventable HAIs in veterinary clinics is unknown, it has been estimated at 30-70% of HAIs in human hospitals are preventable (Haley et al. 1985).

3. A systematic approach to infection prevention and control requires all veterinary personnel to play an active role in protecting every person and animal associated with the veterinary clinic, patients or veterinary personnel.

4. Veterinary personnel need to follow infection prevention and control protocols at all times and use critical thinking and problem solving in managing clinical situations.

BASIC PRINCIPLES OF INFECTION PREVENTION AND CONTROL

GENERAL CONCEPTS

Every veterinary clinic, regardless of size and type, should have a documented infection control program. This may range from simply a written collection of basic infection control practices, to a formal infection control manual with specific training, monitoring, surveillance and compliance programs. Lack of a clearly defined infection control program may lead to unnecessary patient morbidity and mortality, and exposure of veterinarians, staff and owners to zoonotic pathogens. Improved infection control is a necessity as veterinary medicine evolves. Advances in veterinary medicine mean that animals are living longer, and owners are often expecting a higher level of care for their pets that is more comparable to what they themselves may receive. There are also more animals at higher risk for infection in general because of more invasive and immunosuppressive therapies. In addition to the desire to achieve "best practice" standards whenever possible, the increasingly litigious nature of society may be one of the driving forces toward improved infection control in veterinary clinics. While the potential liability associated with morbidity and mortality in individual pets is limited, the potential consequences of zoonotic diseases in owners and staff are significant and warrant careful consideration.

Infection prevention and control measures can be broadly divided into three main categories: those that decrease host exposure, decrease host susceptibility and increase host resistance to infectious pathogens.

1. Decreasing **exposure** is the most important aspect of disease control in most situations. If a pathogen does not encounter an individual, then disease cannot occur. The number of organisms to which a host is exposed is also an important factor in determining whether or not colonization or infection (disease) will ensue. Depending on the pathogen, decreasing or preventing exposure may be easy, difficult or impossible.

2. There are many factors that interact to determine whether or not infectious disease will develop in a particular host. In most cases, simple exposure of an animal to an infectious agent does not mean that disease will result. The **susceptibility** of the individual to a particular number of an infectious agent plays an important role. Although difficult to quantify, certain situations may result in increased susceptibility to infection and disease. Many factors causing increased susceptibility are not preventable, but some are, and efforts should be undertaken to address these issues. Factors to consider include judicious use of antimicrobials and other drugs, provision of proper nutrition, adequate pain control, and appropriate management of underlying disease.

3. Measures to actively increase **resistance** of a host are commonly used in veterinary medicine, but these should be considered only the third line of defense, after those meant to decrease exposure and susceptibility. Vaccination is currently the main technique used to increase resistance of animals or humans to infection. However, no vaccine is 100% effective. Therefore, while vaccination is an important part of infection prevention and control, it must not be the only component of an infection control program if the program is to be successful. In addition, many HAI-infections are caused by opportunist microorganisms for which vaccines are unavailable.

RATIONALE FOR ROUTINE PRACTICES – THE CHAIN OF TRANSMISSION

(Modified from Public Health Agency of Canada, 1999)

Transmission of infection during the provision of health care requires three elements: a **source** of infectious microorganisms, a **susceptible host**, and a **means of transmission** for the microorganism. Prevention of infection in animal health care settings should be directed primarily at interrupting the transmission of microorganisms from source to host, because agent and host factors are typically more difficult to control.

SOURCE

Animal sources of infectious microorganisms may be animals which are merely colonized by an infectious agent (meaning the pathogen resides in or on the body, but is not associated with any clinical disease or host response), animals in the pre-clinical (incubation) phase of disease, animals with acute disease, animals with chronic disease caused by persistent infection, and animals that are recovering from clinical disease but are still shedding the infectious agent. People can be an important source of zoonotic pathogens, and like animals they may be colonized or infected. Contamination on a person's clothing or body, particularly the hands, can also be a source of infectious microorganisms. Other potential sources include food, water, and an animal's own indigenous microflora, which may be difficult to control. Inanimate objects, including medical equipment, supplies and drugs, animal bedding, environmental surfaces and waste that have been contaminated can also be important sources. Microorganisms to consider include bacteria, viruses, fungi and parasites. In some cases, vectors such as lice, mosquitoes, flies, ticks, fleas, rodents and other vermin can transmit certain pathogens.

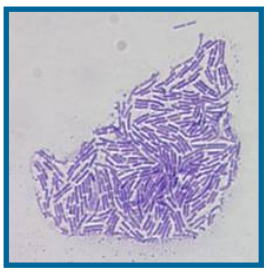
HOST

Decreasing host susceptibility

Decreasing host susceptibility to infection is difficult to achieve in a hospital setting. Regarding patients, the judicious use of antimicrobials, minimizing the use of immunosuppressive agents, avoidance of dietary changes whenever possible, ensuring adequate nutritional intake, adequate pain control, and limiting the use of invasive devices should be considered, as these can all have an impact on host immune function. For hospital personnel, it may not be possible to directly decrease their own susceptibility to infection, but it is important to be aware of those individuals who may have increased susceptibility. These include persons who are immunosuppressed due to disease or medical treatment, or who are being treated with antimicrobial drugs, have open wounds or who are pregnant. Good communication between veterinary personnel, their physicians and clinic administration is important to lessen the risk of zoonotic infection.

Increasing host resistance

Vaccination is currently the main technique used to increase resistance of animals and humans to infection. As noted, no vaccine is 100% effective and there are many infections for which vaccines are unavailable. Factors to consider when developing vaccination recommendations or requirements include the prevalence of a particular disease in the area, risk to healthy and compromised patients, transmissibility of the disease, risk to veterinary personnel, ability to treat the disease, efficacy of vaccination and safety of vaccination. Vaccination can only be maximally effective when it is used in conjunction with other appropriate infection control practices.



TRANSMISSION

Microorganisms are transmitted in animal health care settings by **four main routes**: contact, droplet, air-borne and vector-borne transmission. The same microorganism may be transmitted by more than one route.

1. **Contact transmission** is the most important and frequent mode of transmission of health-care associated infections (HAIs). It can be divided into direct and indirect contact transmission.
    - **Direct contact transmission** involves direct body surface-to-body surface contact resulting in physical transfer of microorganisms from an infected or colonized animal. For example, two dogs in a waiting room that come into direct contact when they sniff each other may transmit pathogens present in their noses or perineal areas; direct contact of a veterinarian's hands with a wound on an animal may result in transmission of opportunistic pathogens from the normal microflora of the person's hands, or infectious organisms present in the animal's wound, to the patient or the veterinarian, respectively.
    - **Indirect contact transmission** is the result of physical transfer of microorganisms from the original animal (or human) source to a new host, without direct contact between the two. This typically involves body surface contact with an inanimate object, environmental surface or the integument of another animal or person that has been transiently contaminated by the original animal (or human) source. For example, handling one animal and then petting another animal without washing one's hands constitutes indirect contact between the two animals.

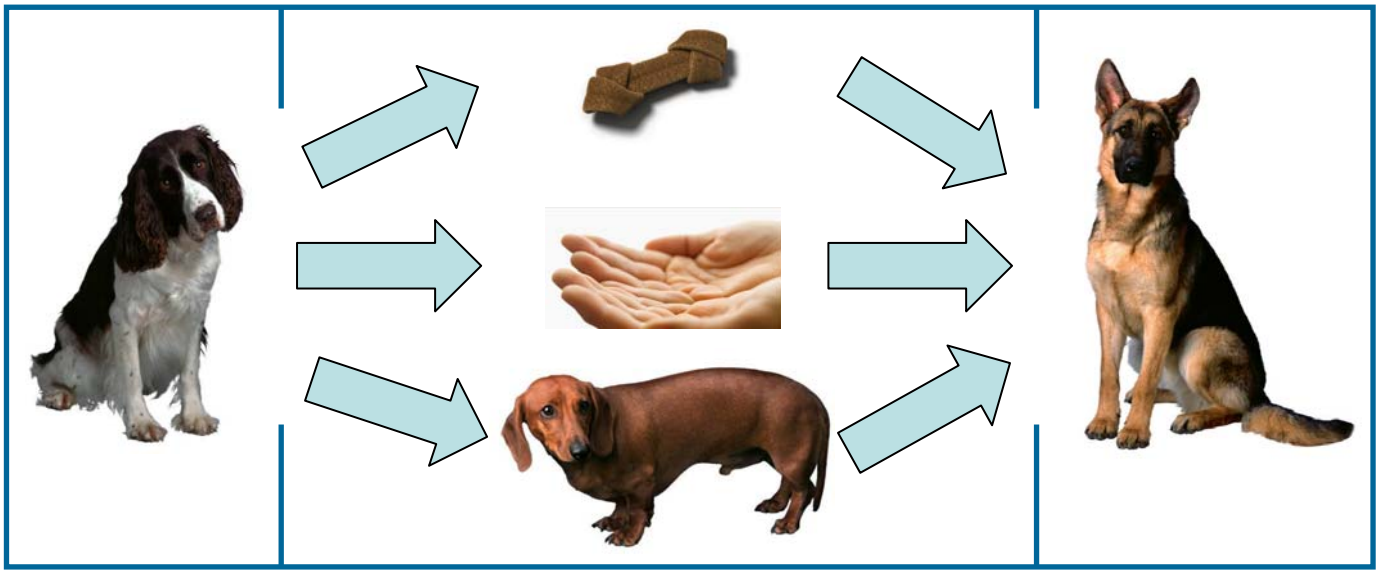
2. **Droplet transmission** is theoretically a form of contact transmission. However, the mechanism of transfer of the pathogen from host to host is quite distinct from either direct or indirect contact transmission. Droplets are generated from the source animal primarily during coughing or sneezing, and during the performance of certain procedures such as suctioning. Transmission occurs when droplets containing microorganisms generated from the source animal are propelled a short distance through the air (usually less than one metre) and deposited on the new host's conjunctiva (i.e. in the eye), nasal mucosa, mouth, or an open wound. For example, a cat with an upper respiratory tract infection can transmit viruses or bacteria to another cat in the waiting room by sneezing on it, particularly if they are face-to-face, even if the animals do not touch each other directly. Because droplets do not remain suspended in the air, special air handling and ventilation are *not* required to prevent droplet transmission; that is, droplet transmission must not be confused with air-borne transmission. Droplets can also contaminate the surrounding environment and lead to indirect contact transmission.

3. **Airborne transmission** occurs by dissemination of either airborne droplet nuclei (5 µm or smaller, about 2-3 times the size of most bacterial pathogens) from partly-evaporated droplets containing microorganisms, or dust particles containing the infectious agent. Microorganisms carried in this manner remain suspended in the air for long periods of time and can be dispersed widely by air currents. They may be inhaled by another host within the same room, or they may reach hosts over a longer distance from the source, depending on environmental factors. Airborne transmission of pathogens in veterinary clinics is very rare.

4. **Vector-borne transmission** occurs when vectors such as mosquitoes, flies, ticks, fleas, rats, and other vermin transmit microorganisms. Some act as simple mechanical vectors, comparable to indirect contact transmission, whereas others acquire and transmit microorganisms by biting. It is important to have control measures in place to reduce or eliminate the presence of such vectors in veterinary clinics.

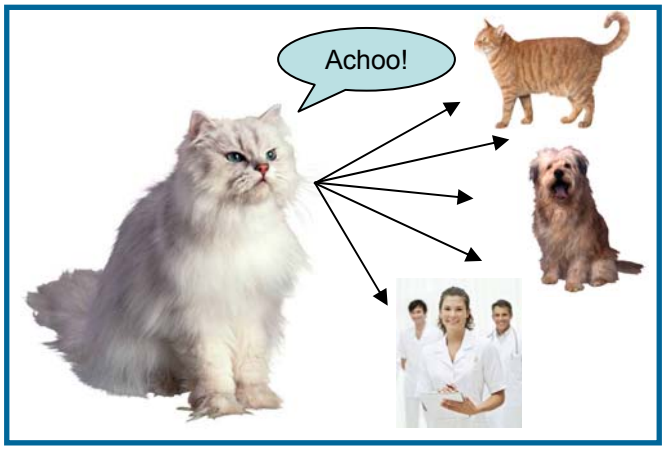
FIGURE 1: HOW MICROORGANISMS ARE TRANSMITTED

Indirect Contact

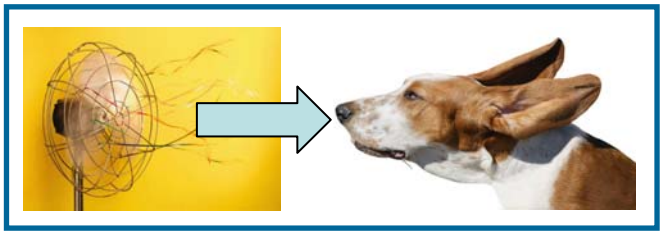


Direct Contact

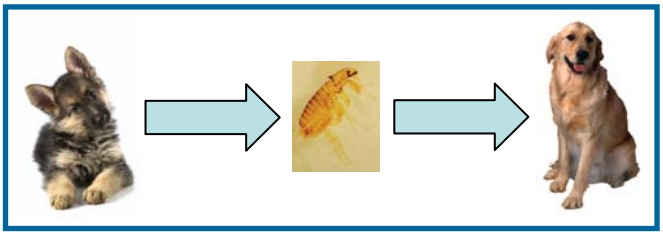
Droplet (<1 metre)



Airborne (>1 metre)



Vectorborne



HIERARCHY OF INFECTION CONTROL MEASURES

(Modified from British Columbia Centre for Disease Control, 2004)

The coordinated efforts of occupational health and safety groups and building engineers have created a framework in human medicine that includes **three levels of infection control**: engineering controls, administrative controls and personal protective measures. These levels of control can easily be applied to veterinary practices as well.

1. **Engineering controls** are built into the design of a facility (e.g. room design, sink placement, Heating Ventilation and Air Conditioning [HVAC] systems). It is important for infection prevention and control professionals to be involved in the design and planning of new facilities. They can also help to plan and design improvements which may be incorporated into an existing facility. Engineering controls include logical design of clinics to facilitate use of routine infection control measures such as hand washing, proper cleaning, and separation of animals of different species and different infectious disease risks. All new building or renovation plans need to be evaluated from an infection control perspective.

2. **Administrative controls** include protocols for hand hygiene, immunization of animals and staff, protocols for managing animals and staff during an infectious disease outbreak, and protocols for caring for animals with zoonotic infections.

3. **Personal protective equipment (PPE)**, although very important, is the least desirable way to control infectious hazards because it does not eliminate them - it merely contains the hazard. Nonetheless, the inherent risk of exposure to microbial pathogens in veterinary clinics means that proper use of PPE is a critical component of a complete infection control program. Effective use of PPE is dependent on appropriate education and compliance of all staff. Personal protective equipment should be considered a last line of defense for hazards that cannot be overcome with other preventative measures.

THE INFECTION CONTROL PROGRAM

Every veterinary clinic, regardless of type or size, should have a formal infection control program that is coordinated by one specific person. This **infection control practitioner (ICP)** should develop protocols, ensure that protocols are being followed, act as a resource for infection control questions, ensure proper training of new staff, direct and interpret surveillance and communicate with staff regarding infection control issues.

This is <u>not</u> necessarily a cumbersome or time-consuming job, as many may think! The day-to-day responsibilities are typically minimal. It is also a not a position that needs to be filled by an expert in infection control or someone with specific training, although that would certainly be desirable. In human hospitals, ICPs are typically nurses with specialized infection control training, who perform the day-to-day infection control duties and work under an infection control head, who is typically a physician with training in one or more of infection control, infectious diseases, microbiology and/or public health. These individuals are rarely available in veterinary medicine, but that does not mean that an effective program cannot be established. Either veterinary technicians or veterinarians would be appropriate in veterinary clinics. Formal training would be ideal but is not readily available, and **the key requirement for the position is an interest in infection control**. Ideally, over time, the ICP will advance his or her skills through formal and informal continuing education.

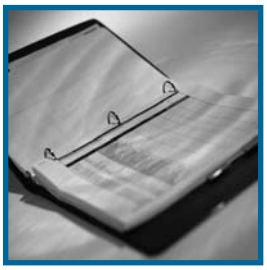
In veterinary clinics, the ICP should be the central infection control resource. Among other duties, he or she should:

- Help facilitate development of a written infection control manual
- Direct and document training of new staff (particularly lay staff)
- Perform formal or informal quality control evaluation of infection control practice compliance (e.g. observing cleaning and disinfection practices, hand hygiene)
- Be the person designated to receive information about and record incidents of suspected hospital-associated infections.

A **written infection control manual** is a critical part of the infection control program. Written documentation can clearly explain infection control practices, ensure that new staff members are properly informed and raise awareness about infection control. Furthermore, written documentation may be important legally in the event of hospital-associated, or more concerningly, zoonotic infections. A written manual demonstrates a level of awareness and effort towards infection control and could be a critical measure to reduce liability risks by demonstrating use of some degree of due diligence.

<u>Every</u> veterinary clinic, regardless of type or size, should have a
FORMAL INFECTION CONTROL PROGRAM,
a written infection control manual *that describes the program,*
and an infection control practitioner (ICP) *to coordinate the program*

Support of hospital administration is also crucial to an effective infection control program. If practice owners and managers are unwilling to provide the ICP with adequate time, resources and support, the infection control program will fail. Hospital administration needs to ensure that all veterinary personnel understand and accept the importance of an infection control program, and intervene when required if issues (e.g. poor compliance) arise.



SURVEILLANCE

Surveillance is a key component of any infection control program. Effective infection control is impossible without surveillance, and some form of surveillance should be practiced by all veterinary facilities. **Many clinical aspects of surveillance are easy, inexpensive and can be readily incorporated into day-to-day veterinary practice.**

PASSIVE SURVEILLANCE

In the absence of an ongoing infectious disease outbreak, **passive infectious disease surveillance is likely adequate for most clinics**. Passive surveillance is practical, cost-effective and can be performed in any clinic. It involves analysis of data that are already available (e.g. bacterial culture and susceptibility results, results of other kinds of infectious disease testing) to determine elements such as endemic disease rates, antimicrobial susceptibility patterns and trends, and changes in disease patterns. An example of passive surveillance would be monitoring the surgical site infection (SSI) rate following all surgical procedures and specific surgical procedures (e.g. spays, neuters). Monitoring of bacterial culture and susceptibility testing can provide information regarding possible outbreaks of hospital associated infections (HAIs), as well as information to guide empirical antimicrobial therapy. Routine recording of animals with specific syndromes such as vomiting, diarrhea, coughing or sneezing is another simple means of providing information that can help in the prevention and early detection of outbreaks, and can help to identify index cases should a hospital outbreak occur.

Post-discharge surveillance is more problematic, but is very important for conditions such as SSIs, as many such infections do not develop until after the animal is discharged from the hospital. Post-discharge surveillance can consist of direct examination of the patient during a recheck appointment, evaluation of readmission data or simple telephone or mail contact with owners.

The keys to passive surveillance are to **centralize the available data**, and to have a designated infection control practitioner (ICP) who is responsible for compiling *and evaluating* this data on a regular basis. **Simply collecting the data or even entering it in a spreadsheet is of no value unless someone looks at it.** This is particularly important in large clinics or hospitals where multiple veterinarians may have patients with similar infections but do not communicate this to others, and therefore the start of an outbreak can be missed. If an outbreak is identified, then a plan can be formulated and implemented in order to stop the spread of disease. This plan may or may not include additional active surveillance to identify additional cases.

> The keys to passive surveillance are
> to centralize the available data, and
> to have a designated ICP who compiles and evaluates the data
> on a regular basis.

ACTIVE SURVEILLANCE

Active surveillance involves gathering data specifically for infection control purposes. As a result, it is usually more expensive and time consuming but usually provides the highest quality data. This is rarely needed in most veterinary clinics and is typically reserved for large facilities with increased infection control threats and personnel available to direct such testing, or during a specific outbreak investigation. An example of active surveillance is collection of nasal and rectal swabs from all animals being admitted to a hospital, whether or not they have signs of infection, to screen for methicillin-resistant *Staphylococcus aureus*.

ROUTINE PRACTICES

Routine Practices are a way of thinking and of acting that forms the foundation for limiting the transmission of microorganisms in all health care settings. It is the standard of care for all patients/clients/residents.
– Rick Wray, Hospital for Sick Children, Toronto, Canada

Routine practices include:

- **Hand hygiene**
- **Risk reduction strategies** through use of personal protective equipment (PPE), cleaning and disinfection of the environment and equipment, laundry management, waste management, safe sharps handling, patient placement, and healthy workplace practices
- **Risk assessment** related to animal clinical signs, including screening for syndromes that might indicate the presence of infectious disease (e.g. fever, coughing/sneezing, diarrhea, abnormal excretions/secretions), and use of risk assessment to guide control practices
- **Education** of veterinary personnel and owners

HAND HYGIENE

(Modified from Ontario Provincial Infectious Disease Advisory Committee, 2008)

Hand hygiene is the responsibility of all individuals involved in health care. Effective hand hygiene kills or removes microorganisms on the skin while maintaining hand health and skin integrity (i.e. prevents chapping and cracking of skin). Sterilization of the hands is not the goal of routine hand hygiene - the objective is to reduce the number of microorganisms on the hands, particularly the number of microorganisms that are part of the transient microflora of the skin, as these include the majority of opportunistic pathogens on the hands. These transient microbes may be picked up by contact with a patient, another person, contaminated equipment, or the environment. There are **two methods** of removing/killing microorganisms on hands: washing with **soap and running water** or using an **alcohol-based hand sanitizer**.

Hand hygiene is the single most important way to prevent infections in the healthcare setting.

ALCOHOL-BASED HAND SANITIZERS

Alcohol-based hand sanitizers/rubs are, with some exceptions, the **preferred method** for decontaminating hands that are not visibly soiled. They have superior ability to kill microorganisms on the skin than even hand washing with antibacterial soap, can quickly be applied, are less likely to cause skin damage, and can be made readily available at almost any point of care. Use of **non-alcohol-based waterless hand sanitizers** in healthcare settings is **not recommended**.

Alcohol-based hand sanitizers should contain **70-90% alcohol**. Use of products containing **emollients** helps to reduce skin damage which can otherwise occur with frequent use of hand sanitizers. Products containing alcohol and chlorhexidine are also available. Chlorhexidine provides some residual antimicrobial action on the hands after use, but it is unclear whether or not these combinations provide any true benefit in clinical settings. They may be more useful as alternatives to traditional surgical scrubbing techniques (see Surgery section on page 40).

Alcohol-based hand sanitizers are **not effective against certain pathogens**, including **bacterial spores** (e.g. clostridial spores) and ***Cryptosporidium* spp**. Nonetheless, alcohol-based hand sanitizers may be useful even if alcohol-resistant pathogens like *Clostridium difficile* are present. The improved hand hygiene compliance seen with alcohol-based hand sanitizers and their efficacy against other pathogens are important aspects of infection control Routine use of these products has not resulted in detectable increases in *C. difficile* infection rates in human hospitals. However, if hands are potentially contaminated by one of these organisms, hand washing with soap and running water should be performed if possible. Although even antimicrobial soaps are similarly ineffective against these pathogens directly, the physical process and mechanical action of hand washing can decrease the number of these organisms on the hands. Alcohol is also not as effective against **non-enveloped viruses** (e.g. canine parvovirus, feline panleukopenia virus) as it is against most other microbes. As for clostridial pathogens, hand washing with soap and running water is likely more effective, and should be used whenever possible when these pathogens are involved.

Technique:

1. Remove all hand and arm jewelery.
2. Ensure hands are visibly clean (if soiled, follow hand washing steps).
3. Apply between 1 to 2 full pumps or a 2-3 cm diameter pool of the product onto one palm.
4. Spread the product over all surfaces of hands, concentrating on finger tips, between fingers, back of the hands, and base of the thumbs. These are the most commonly missed areas.
5. Rub hands until product is **dry**. This will take a **minimum of 15 to 20 seconds** if sufficient product is used.
    - Hands must be fully dry before touching the patient or patient's environment/equipment for the hand rub to be effective, and to eliminate the rare risk of flammability in the presence of an oxygen-enriched environment, as may occur in the presence of gas anesthetic machines.

HAND WASHING

Most transient bacteria present on the hands are removed during the mechanical action of washing, rinsing and drying hands. Hand washing with soap and running water must be performed when hands are visibly soiled. If running water is not available, use moistened towelettes to remove all visible dirt and debris, followed by an alcohol-based hand rub.

Bar soaps are not acceptable in veterinary practice settings because of the potential for indirect transmission of pathogens from one person to another. Instead, liquid or foam soap should be used

- Soap should be dispensed in a disposable pump dispenser
- Soap containers should not be refilled without being disinfected, since there is a risk of contamination
- **Antibacterial soaps should be used in critical care areas** such as ICU, and in other areas where invasive procedures are performed

Technique:

1. Remove all hand and arm jewelery.
2. Wet hands with warm (not hot) water. Hot water is hard on the skin, and will lead to dryness and additional skin damage.
3. Apply liquid or foam soap.
4. Vigorously lather all surfaces of hands for a **minimum of 15 seconds**. This is the minimum amount of time required for mechanical removal of transient bacteria. Pay particular attention to finger tips, between fingers, backs of the hands and base of the thumbs. These are the most commonly missed areas. A simple way many people time their hand-washing is by singing "Happy Birthday".
5. Using a rubbing motion, thoroughly rinse soap from hands under warm running water. Residual soap can lead to dryness and cracking of skin.
6. Dry hands thoroughly by blotting hands gently with a paper towel. Rubbing vigorously with paper towels can damage the skin.
7. Turn off taps with paper towel to avoid recontamination of your hands
    - NOTE: If air hand dryers are used, hands-free taps are necessary, as turning taps off without using paper towel as described will result in recontamination of hands after washing.

WHEN HAND HYGIENE SHOULD BE PERFORMED

- Before and after contact with a patient
    - Especially before performing invasive procedures
- Before and after contact with items in the patient's environment
- After any contact with or any activity involving the body fluids of a patient
- Before putting on and especially after taking off gloves
- Before eating food
- After personal body functions, such as using the toilet or blowing one's nose

FACTORS THAT INFLUENCE THE EFFECTIVENESS OF HAND HYGIENE

- **Condition of the skin**: Intact skin is easier to clean than skin that is chapped, cracked, cut, abraded or otherwise inflamed. Intact skin is the first line of defense against bacteria.
- **Finger nails**: Natural nails more than 3-4 mm long are difficult to clean, can pierce gloves and harbour more microorganisms than short nails. **Artificial nails or nail enhancements** (including nail polish) should **not** be worn by anyone involved directly in patient care, as they have been implicated in the transfer of microorganisms in human medicine.
- **Jewelery**: Jewelery is very hard to clean, and physically protects bacteria and viruses from the antiseptic action of alcohol-based hand sanitizers and the mechanical cleaning action of soap and running water. Rings and bracelets should not be worn during patient contact. Rings, in particular, increase the number of microorganisms present on hands and increase the risk of tears in gloves.

Intact skin is the first line of defense against bacteria.



SKIN CARE

Careful attention to skin care is an essential part of the hand hygiene program. Products used for hygiene should be "hand-friendly" – for example, alcohol-based hand sanitizers containing emollients are available, which can help reduce the drying effect of the alcohol. If skin integrity is an issue, the individual should consult his or her physician. Skin lotions can help maintain the health and integrity of the skin, but it is important to use a skin lotion that does not interfere with glove integrity. Petroleum-based lotion formulations can weaken latex gloves and increase permeability. Lotions that contain petroleum or other oil emollients should only be used at the end of the work day. If lotions are used during the work day, select a water-based product.

It is reassuring to the client to see clinic personnel performing hand hygiene,
and it increases client awareness of the importance of hand hygiene.
Practices may wish to reinforce this by providing alcohol-based hand sanitizers in the waiting room.

PERSONAL PROTECTIVE EQUIPMENT (PPE)

Personal protective equipment (PPE) is an important routine infection control tool. PPE use is designed to reduce the risk of contamination of personal clothing, reduce exposure of skin and mucous membranes of veterinary personnel to pathogens, and reduce transmission of pathogens between patients by veterinary personnel. Some form of PPE must be worn in all clinical situations, including any contact with animals and their environment. **Tables 1 and 2 summarize infectious disease control precautions by disease condition and agent, and recommended personal protective equipment for routine veterinary procedures, respectively.** These recommendations must always be tempered by professional judgment, while still bearing in mind the basic principles of infectious disease control, as every situation is unique in terms of the specific clinic, animal, personnel, procedures and suspected infectious disease.

Use of personal protective equipment does not eliminate the need for appropriate environmental engineering controls, such as hazard removal and separation of patient areas from staff rooms.

Personal protective outerwear is used to protect veterinary personnel and to reduce the risk of pathogen transmission by clothing to patients, owners, veterinary personnel and the public. Protective outerwear should be worm whenever there may be contact with an animal or when working in the clinical environment (including cleaning).

Street clothes should always be covered by protective outerwear, such as a lab coat, when working in the clinic.

LAB COATS

Lab coats are meant to protect clothing from contamination, but generally they are not fluid resistant, so they should not be used in situations where splashing or soaking with potentially infectious liquids is anticipated. These garments should be changed promptly whenever they become visibly soiled or contaminated with body fluids, and at the end of each day. **Lab coats worn in the clinic should not be worn outside of the work environment.** Lab coats worn when handling patients with potentially infectious diseases should be laundered after *each* use, because it is almost impossible to remove, store/hang and reuse a contaminated lab coat without contaminating hands, clothing or the environment.

SCRUBS

Scrubs are often worn in veterinary clinics as a form of basic personal protective equipment. They have the advantage of being durable and easy to clean, and their use prevents contamination and soiling of the street clothes that personnel wear outside the clinic. Clinic scrubs should not be worn outside the clinic. They should not be taken home by personnel to be washed, rather they should be washed on-site, with other clinic laundry. Scrubs should be washed at the end of each day and whenever they become visibly soiled.

Protective outerwear, including scrubs, should not be worn outside the clinic.

Designated scrubs should always be worn during surgery – these scrubs should not be worn during other procedures or when handling patients. Scrubs worn for surgery should be covered with a lab coat outside of the surgical suite.

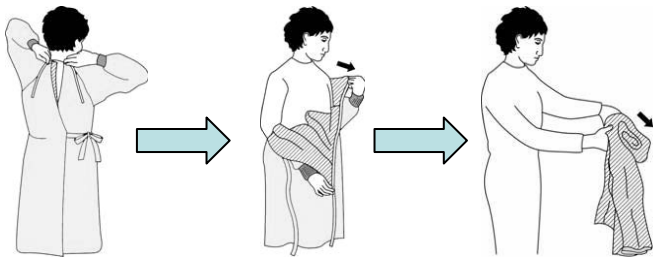
NON-STERILE GOWNS

Gowns provide more coverage for barrier protection than lab coats, and are typically used for handling animals with suspected or confirmed infectious diseases, that are housed in isolation. Permeable gowns can be used for general care of patients in isolation. Impermeable (i.e. waterproof) gowns should be used to provide greater protection when splashes or large quantities of body fluids are present or anticipated. Disposable gowns should not be reused, and reusable fabric gowns should be laundered after *each* use, because **hanging/storing and reusing contaminated gowns inevitably leads to contamination of hands, clothing or the environment**. Gloves should be worn whenever gowns are worn. Gowns (and gloves) should be removed and placed in the trash or laundry bin before leaving the animal's environment, and hands should be washed immediately afterwards.

Personnel should learn to remove gowns properly, in such a way as to avoid contaminating themselves and the environment (**Figure 2**). The outer (contaminated) surface of a gown should only be touched with gloves.

1. After unfastening or breaking the ties, peel the gown from the shoulders and arms by pulling on the chest surface while hands are still gloved.
2. Ball up the gown for disposal while keeping the contaminated surface on the inside.
3. Remove gloves and wash hands.
4. If body fluids soaked through the gown, promptly remove the contaminated underlying clothing and wash the skin.

FIGURE 2: HOW TO REMOVE A GOWN



These diagrams are available to download from the CDC website http://www.cdc.gov/ncidod/dhqp/ppe.html

All gowns should be used only once, then discarded or laundered.

GLOVES

Gloves reduce the risk of pathogen transmission by providing barrier protection. They should be worn when contact with blood, body fluids, secretions, excretions and mucous membranes is possible. Gloves should also be worn when cleaning cages and environmental surfaces, as well as when doing laundry if gross contamination of items is present.

- Gloves should be removed promptly after use, avoiding contact between skin and the outer glove surface.
- Gloved hands should not be used to touch surfaces that will be touched by people with non-gloved hands.
- Care should be taken to avoid contamination of personal item such as telephones, pens and pagers.
- Hands should be washed or an alcohol-based hand sanitizer should be used immediately after glove removal. It is a common misconception that using disposable gloves negates the need for hand hygiene. **Gloves do not provide complete protection against hand contamination, therefore hand hygiene immediately after removing gloves is essential.**
- Disposable gloves should **not** be washed and reused.

Gloves are NOT a substitute for proper hand hygiene.

Change gloves and perform hand hygiene when:

- Moving from contaminated areas to clean areas on the same animal
- Moving from dirty to clean procedures on the same animal
- After contact with large amounts of blood and/or body fluids
- Between individual animals

Gloves come in a variety of materials. The choice of glove material depends on their intended use. Latex gloves are commonly used, but if latex allergies are a concern, acceptable alternatives include nitrile or vinyl gloves. Latex gloves will decompose and lose their integrity when exposed to many chemicals. If exposure to chemicals such as disinfectants is expected (e.g. when cleaning and disinfecting cages), disposable nitrile gloves or heavier, reusable rubber gloves (e.g. common dishwashing gloves) can be used. Reusable gloves must also be disinfected at the end of each task.

FACE PROTECTION

Face protection prevents exposure of the mucous membranes of the eyes, nose and mouth to infectious materials. Face protection typically includes a nose-and-mouth mask (e.g. surgical mask) and goggles, or a full face shield, which should be used whenever exposure to splashes or sprays is likely to occur, including dental procedures, nebulization, and wound lavage.

RESPIRATORY PROTECTION

Respiratory protection is designed to protect the respiratory tract from zoonotic infectious diseases transmitted through the air. **The need for this type of protection is limited in veterinary medicine** because there are few relevant airborne or aerosol zoonotic pathogens in companion animals, in most regions. The N95 rated disposable particulate respirator is a mask that is inexpensive, readily available, easy to use and provides adequate respiratory protection in most situations. However, people need to be fit-tested to ensure proper placement and fitting of N95 masks. Special N95 masks are required for people with beards. Surgical masks are not a replacement for N95 masks.

FOOTWEAR

Closed toed footwear must be worn at all times to reduce the risk of injury from dropped equipment (e.g. scalpels, needles), scratches from being stepped on by dogs, and to protect the feet from contact with potentially infectious substances (e.g. feces, discharges and other body fluids).

Designated footwear or disposable shoe covers are required in areas where infectious materials are expected to be present on the floor, in order to prevent their spread to other areas. This is particularly important in veterinary clinics because patients, and sometimes the personnel working with them, often have very close contact with the floor, unlike human hospitals. **Designated footwear or disposable shoe covers may be required** for patients with infectious diseases that are kept on the floor (e.g. in a large dog run) or that may contaminate the floor around their kennel (e.g. an animal with severe diarrhea). Such footwear must be removed as the person leaves the contaminated area, and should be immediately disposed of in the garbage (if disposable), or left at the entrance of the contaminated area on the “dirty” side.

In veterinary clinics, it is important to
prevent the spread of infectious materials present on the floor,
as patients and personnel often have very close contact with the floor.

TABLE 1: INFECTIOUS DISEASE CONTROL PRECAUTIONS BY DISEASE CONDITION AND AGENT

Disease Condition	Agent Name	Disease Name	Zoonotic Risk	Bite/Scratch Concern	Environmental Contamination	Arthropod Vector	PPE Protocol			
							Gloves 	Gown[a] 	Mask[b] 	Other
Upper Respiratory Tract Infection	*Bordetella bronchiseptica*	Bordetellosis	+		+		+	+		
	Canine influenza virus	Influenza			+		+	+		
	Feline calicivirus	Calicivirus			+		+	+		
	Feline herpesvirus 1	FVR			+		+	+		
Lower Respiratory Tract Infection	*Bordetella bronchiseptica*	Bordetellosis	+		+		+	+		
	Francisella tularensis	Tularemia	+	+	+	+	+	+	+	
	Pasteurella multocida	Pasteurellosis								P
	Canine influenza virus	Influenza			+	+	+	+		
	Canine parainfluenza virus	Parainfluenza			+		+	+		
Diarrhea	*Campylobacter jejuni*	Campylobacteriosis*	+		+		+	+		S
	Clostridium difficile	*C. difficile* diarrhea	+		+		+	+		S
	Cryptosporidium spp.	Cryptosporidiosis*	+		+		+	+		S
	Escherichia coli	*E. coli* diarrhea	+		+		+	+		S
	Giardia spp.	Giardiosis*	+		+		+	+		S
	Salmonella spp.	Salmonellosis*	+		+		+	+		S
	Toxoplasma gondii	Toxoplasmosis	+		+		+	+		S
	Canine parvovirus	Parvo			+		+	+		S
	Feline panleukopenia virus	Panleukopenia			+		+	+		S
Neurological Signs	*Listeria monocytogenes*	Listeriosis	+		+		+	+	+	C, E
	Canine distemper virus	Distemper			+		+	+		
	Rabies virus	Rabies*	+	+			+	+	+	C, E
Skin Condition / External Parasites	MRSA	MRSA pyoderma	+	+	+		+	+		C
	MRSP	MRSP pyoderma	?		?		+	+		C
	Fleas	Fleas	+		+		+	+		
	Lice	Pediculosis			+		+	+		
	Mites	Mange	+		+		+	+		
	Ticks	Ticks	+		+		+			L

Disease Condition	Agent Name	Disease Name	Zoonotic Risk	Bite/Scratch Concern	Environmental Contamination	Arthropod Vector	PPE Protocol			
							Gloves 	Gown[a] 	Mask[b] 	Other
Skin Condition / External Parasites (continued)	*Microsporum spp.* *Trichophyton spp.*	Dermatophytosis, Ringworm	+		+		+	+		
	Sporothrix schenkii	Sporotrichosis	+	+			+			F, S, L
Wounds and Abscesses	MRSA	MRSA	+	+	+		+	+		C
	MRSP	MRSP	?		?		+	+		C
	Pasteurella multocida	Pasteurellosis	+							P
	VRE	VRE	+		+		+	+		C, S
	Other MDR bacteria	Other MDR bacteria	+				+	+		C
Fever of Unknown Origin / Non-Specific Clinical Signs	*Bartonella* spp.	Cat Scratch Disease	+	+		+				B
	Borrelia burgdorferi	Lyme Disease	+			+				B
	Brucella canis	Brucellosis*	+				+	+	+	
	Chlamydophila psittaci	Psittacosis	+		+		+	+	+	C, E
	Coxiella burnetti	Q fever	+		+		+	+	+	C, E
	Francisella tularensis	Tularemia*	+			+	+	+	+	C, E
	Leishmania spp.	Leishmaniasis	+			+				B
	Leptospira spp.	Leptospirosis	+		+		+	+		C, S
	Rickettsia rickettsii	RMSF	+			+				B
	Toxoplasma gondii	Toxoplasmosis	+		+					F
	Canine distemper virus	Distemper			+		+	+		
	Canine adenovirus 2	Adenovirus			+		+	+		
	Feline leukemia virus	Feline leukemia			+		+	+		
	FIV	FIV			+[c]					
	Rabies virus	Rabies*	+	+			+	+	+	C, E
	West Nile virus	West Nile fever				+				P
Intestinal Worms	*Ancylostoma spp.*	Hookworm	+		+					F
	Dipylidium caninum	Tapeworm	+			+[d]				P
	Echinococcus spp.	Hydatid disease	+		+		+	+		S
	Taenia spp.	Tapeworm			+					F
	Toxocara spp.	Roundworm	+		+					F

+ Risk exists/PPE required; ? Unknown risk

FIV – feline immunodeficiency virus; **FVR** – feline viral rhinotracheitis; **MDR** – multidrug-resistant; **MRSA** – methicillin-resistant *Staphylococcus aureus*; **MRSP** – methicillin-resistant *Staphylocooccus pseudintermedius*; **PPE** – personal protective equipment; **RMSF** – rocky mountain spotted fever; **VRE** – vancomycin-resistant *Enterococcus spp.*

[a]Disposable gown or dedicated lab coat; [b]Mask covering the nose and mouth (e.g. surgical mask); [c]Environmental contamination by blood; [d]Transmission by ingestion of fleas

B = Prevent direct contact with blood; **C** = Cover broken skin; **E** = Eye protection recommended; **F** = Prevent direct contact with feces and transfer of fecal contamination; **L** = Lab coat (non-dedicated) recommended; **P** = Standard PPE only, according to procedure; **S** = Shoe covers recommended if there is possible fecal contamination (or urine contamination for leptospirosis) of the floor in the area where the animal is being kept

*Notifiable disease in people in Canada. In Canada, any animal suspected of being infected with rabies must be reported immediately to the Canadian Food Inspection Agency (CFIA)(see Appendix III on page 68 for more information)

TABLE 2: RECOMMENDED PERSONAL PROTECTIVE EQUIPMENT FOR ROUTINE VETERINARY PROCEDURES

Procedure	Disposal Gloves	Sterile Gloves	Gown / Dedicated Lab Coat	Face Protection[a]	Other/Comment
Bandage change	+				
Crushing pills					Mask[c]
Dental procedures	+		+	+	
Digital rectal palpation	+				
Draining sterile seroma/hematoma		+			
Expressing anal glands	+				
Fine needle aspirate					
Handling soiled laundry	+		+		
Handling stool samples	+				
Handling urine samples	+[b]				
Injections: intramuscular and subcutaneous					
Intranasal *Bordetella* vaccination	+				
Intravenous catheter placement					
Lancing abscess	+		+	(+)	
Obstetrical procedures: cats		+	+	+	Q-fever risk
Obstetrical procedures: dogs		+			
Oral antimicrobial administration	+[c]				
Oral examination	+				
Urinary catheter placement		+			
Venipuncture					
Wound cleaning/debridement		+			
Wound lavage/flushing	+		+	(+)	
Wound suturing		+			

+ PPE recommended; (+) PPE recommended if splash risk is present

[a]Face shield or protective glasses and face mask; [b]If urinary tract infection is suspected, gloves are recommended; [c]Indicated in individuals with sensitivity to the drug

CLEANING AND DISINFECTION

Cleaning and disinfection are two separate tasks. **Cleaning** involves the removal of visible organic matter with soap or detergent, whereas **disinfection** involves the application of a chemical or other procedure in order to kill the remaining microbes that cannot be adequately removed by cleaning. Cleaning is essential because the survival time of many infectious agents outside the host is prolonged by the presence of organic matter, and organic matter also decreases the effectiveness of disinfectants. Depending on the level of disinfection used, disinfection kills or prevents the growth of many or most pathogens.

Equipment should be cleaned and disinfected according to its intended use, the manufacturer's recommendations, and practice policy. Equipment must be cleaned before sterilization or disinfection. Surfaces where animals are housed, examined, or treated should be made of non-porous, sealed, easy-to-clean materials to facilitate cleaning and disinfection and minimize infection transmission.

Personnel whose duties include cleaning and disinfection of equipment and different hospital areas should be trained regarding how to safely handle and use the products available in the clinic. In Canada, Material Safety Data Sheets (MSDS) must be readily accessible for all the applicable chemical products.

CLEANING

Cleaning entails the removal of all forms of organic matter (e.g. feces, urine, blood, food, dirt etc.) from a surface. Recommended cleaning procedures for common environmental surfaces are shown in **Table 3**.

- Ensure all areas are well ventilated during cleaning.
- After cleaning, allow all surfaces to dry completely.

Cleaning must always be done before a disinfectant is used.

Removing loose, dry debris from surfaces:

- Avoid generating airborne dust that may contain pathogens by:
  - using a vacuum cleaner equipped with a HEPA filter
    - The filter helps to prevent aerosolization of pathogens such as ringworm. For this reason, vacuums without HEPA filters should not be used for cleaning in patient-contact areas.
  - lightly spraying surfaces with water prior to mopping or sweeping
  - using an electrostatic wipe (e.g. Swiffer™ cloth)
  - using a wet mop
- Exposure to aerosols generated by brushes during cleaning can be minimized by taking certain precautions, such as wearing a face mask and containing spatter if the brush or surface is damp. A surgical nose-and-mouth mask will provide some protection against droplet spatter, but not against finer particles and dry dust that can become suspended in the air. A properly-fitted N95 face mask can provide this level of protection (see Respiratory Protection on page 23).

Removing sticky, wet or dried-on organic material from surfaces:

- This kind of debris should be removed using a detergent or soap and a brush or cloth, as necessary.
- During cleaning, it is the mechanical action and surfactant properties of the soap that are important, not necessarily its antimicrobial activity.
- Avoid the use of pressure washers, particularly those that produce more that 120 psi of pressure. This amount of pressure may cause aerosolization of pathogens, and pressure washing may even damage surfaces, thus making them harder to disinfect properly. A home garden hose sprayer usually produces less than 120 psi of pressure, and would therefore be relatively safe to use in a small animal kennel area.

***Gloves should be worn when cleaning and disinfecting, and hands should be washed after finishing any cleaning activity.**

DISINFECTION

Disinfection can only be maximally effective if it is preceded by thorough cleaning. Some pathogens (e.g. clostridial spores) are highly resistant to disinfection, therefore cleaning in these cases is particularly crucial in order to mechanically remove the organisms.

- Ensure all areas are well ventilated during disinfection
- *Gloves should be worn when handling disinfectants, but latex gloves will decompose and lose their integrity when exposed to many chemicals. For small jobs, disposable nitrile gloves should be used instead. For large jobs, heavier rubber gloves (e.g. common dishwashing gloves) can be used, but reusable gloves of this type must also be disinfected at the end of each task.
- Use of protective eye goggles is also recommended when handling disinfectants due to the splash risk.
- Always apply the selected disinfectant according to the product label, with particular attention to:
    - appropriate dilution
    - required contact time
- If patients or personnel may have direct skin contact with the surface, or if the disinfectant used may damage a particular surface, the disinfectant may need to be rinsed off with clean water after an appropriate amount of time has elapsed.
- After disinfection, allow all surfaces to dry completely.

TABLE 3: RECOMMENDED CLEANING PROCEDURES FOR COMMON ENVIRONMENTAL SURFACES

Surface / Object	Procedures	Special Considerations
Horizontal surfaces with low patient contact (e.g. front desk, records area)	1. Clean regularly with detergent, e.g. bi-weekly 2. Clean and disinfect promptly if visibly soiled with feces, urine or body fluids	
Horizontal surfaces with high patient contact (e.g. exam tables, scale, kennels)	1. Clean and disinfect between all patients. Surface should be cleaned of visible debris then a disinfectant should be applied. Adequate contact time should be provided, as per label directions. 2. Provide enhanced disinfection after contact with high-risk patients (i.e. diarrheic). Higher level disinfection (i.e. bleach, oxidizing agent) should be used if lower level disinfectants are used routinely	See Tables 5 and 6 for selection of appropriate cleaning & disinfectant products Electrostatic wipes (i.e. Swiffer™ cloths) can be used to remove loose fur and dust
Vertical surfaces (e.g. walls, doors, windows including blinds/ curtains)	1. Clean regularly with a detergent, e.g. monthly 2. Clean and disinfect if visibly soiled with feces, urine or body fluids	
Hard floors (e.g. tile, wood, sealed cement)	1. Clean daily with a detergent. Disinfect regularly, e.g. weekly 2. Clean and disinfect after potentially infectious patients 3. Clean and disinfect if visibly soiled with feces, urine or body fluids	
Carpets/upholstery	1. Vacuum regularly, e.g. monthly **Note:** Do not vacuum if there may have been contact with an animal shedding an infectious pathogen (i.e. ringworm), unless the vacuum is equipped with a HEPA filter 2. Shampoo or steam clean if necessary to remove visible dirt and debris	See Tables 5 and 6 for selection of appropriate cleaning & disinfectant products Cleaning is especially important for these surfaces as they are difficult or impossible to disinfect

SINGLE-USE VS REUSABLE EQUIPMENT

Single-use equipment (e.g. hypodermic needles) should not be re-sterilized or disinfected for re-use. Such items should be properly disposed of immediately after initial use. In veterinary medicine, some equipment that is considered single-use in human healthcare is reused because the cost of some items makes it impractical to discard them after a single use (see Disinfection of Anesthetic Equipment on page 41). There is little to no objective information on how to disinfect or resterilize such equipment, and how often this can be done without compromising the integrity of item. The level of disinfection required should be evaluated as for multi-use equipment (below). Items should be carefully inspected prior to each use, and replaced if there is evidence of damage that may impair the function of the equipment or subsequent cleaning and disinfection.

Multi-use equipment must be properly cleaned and disinfected between each patient. There are three categories of multi-use equipment used on patients: **critical**, **semi-critical** and **non-critical**. Each category defines how instruments must be cleaned and disinfected to prevent transmission of infectious agents. In human healthcare, these categories are defined as per **Table 4**.

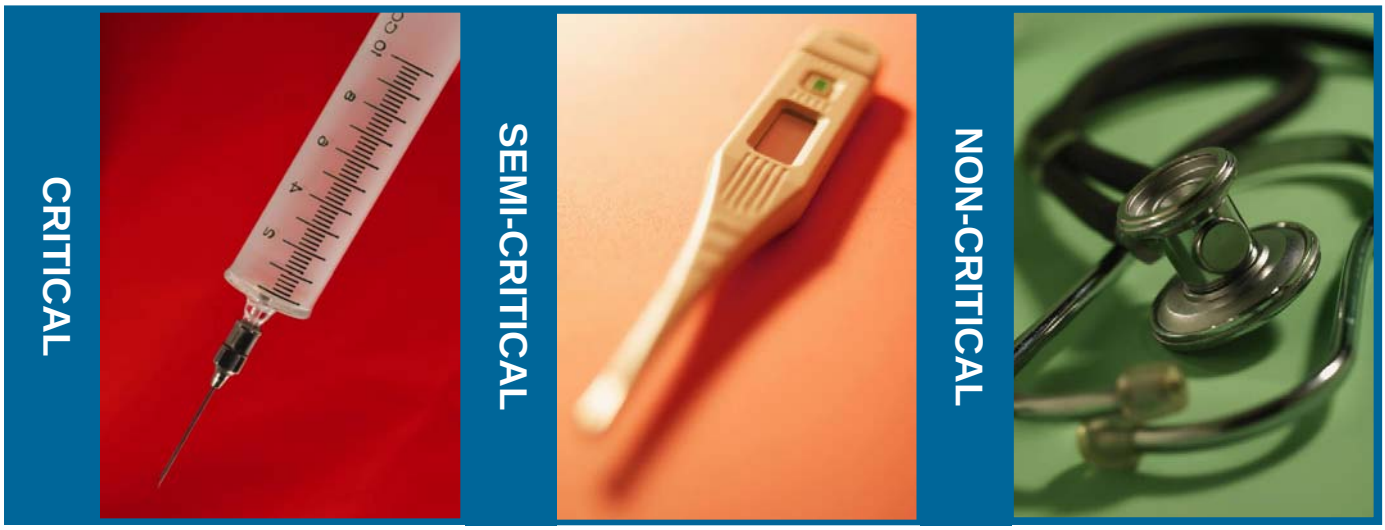
TABLE 4: SPAULDING'S (1970) CLASSIFICATION OF MEDICAL EQUIPMENT/DEVICES AND REQUIRED LEVELS OF PROCESSING AND REPROCESSING

Classification	Definition	Level of Processing/ Reprocessing
Critical equipment/device (e.g. surgical instruments)	Equipment/device that enters sterile tissues, including the vascular system	Cleaning followed by sterilization
Semi-critical equipment/device (e.g. endoscopes, thermometers)	Equipment/device that comes in contact with non-intact skin or mucous membranes but does not penetrate them	Cleaning followed by High Level Disinfection (as a minimum), sterilization is preferred
Non-critical equipment/device (e.g. stethoscope)	Equipment/device that touches only intact skin and not mucous membranes, or does not directly touch the patient	Cleaning followed by Low Level Disinfection, in some cases, cleaning alone is acceptable

See **Tables 5 and 6** for selection of disinfectants.

In veterinary medicine, exceptions to the level of processing required are typically made for some pieces of semi-critical equipment that come in contact with tissues or mucous membranes which are normally considered non-sterile, such as those of the upper respiratory or gastrointestinal tracts. If a transmissible infectious disease is not suspected in the patient, and the subsequent patient is not significantly immunocompromised, thorough cleaning and low level disinfection is likely adequate in these cases. However, if an infectious disease is suspected or the subsequent patient is immunocompromised, then cleaning and high level disinfection or sterilization are recommended in order to prevent disease transmission. For example, a rectal thermometer should undergo cleaning and low level disinfection between every patient, but if used on a diarrheic animal it should undergo high-level disinfection or be discarded and replaced.

FIGURE 3: SPAULDING CLASSIFICATION OF MEDICAL EQUIPMENT



Food and water bowls of patients with infectious diseases should be cleaned and disinfected separately, but careful selection of the disinfectant used is required because only some disinfectants are approved for use on surfaces that come in contact with food. Otherwise disposable dishes can be considered for these animals. Cleaning alone (with regular dish soap) is adequate for food and water bowls from other patients. Toys, litter boxes, and other miscellaneous items should be cleaned and disinfected between patients, or discarded if they are not amenable to proper cleaning and disinfection. Gloves should be worn when handling items from patients carrying zoonotic pathogens or any items that are visibly soiled. Litter boxes should be cleaned out at least daily, and completely emptied and disinfected between patients. Ideally, litter boxes should not be handled by pregnant women, however if daily cleaning and disinfection are performed properly, the risks are minimized.

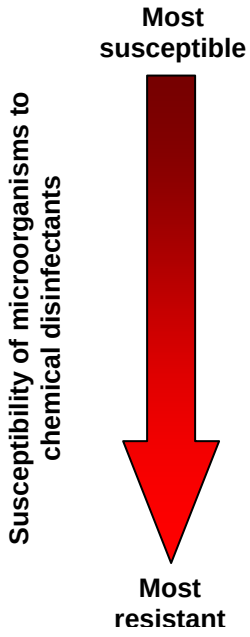
DISINFECTANT SELECTION

There is no "standard" disinfection program that can be used in all veterinary clinics, as clinic environment, surfaces, caseload, general practices and other factors influence disinfectant choices. Selection of a disinfectant for a particular purpose should take into account the product's spectrum of activity, susceptibility to inactivation by organic matter, potential pathogens in the environment, compatibility with soaps and detergents, toxicity for personnel and animals, contact time required, residual activity, corrosiveness, environmental effects and cost (**Tables 5 and 6**).

TABLE 5: CHARACTERISTICS OF SELECTED DISINFECTANTS (Modified from Linton et al 1987 and Block 2001)

Disinfectant Category	Activity in Presence of Organic Matter	Advantages	Disadvantages	Precautions	Comments
Alcohols: Ethyl alcohol Isopropyl alcohol	Rapidly inactivated	Fast-acting No residue Relatively non-toxic	Rapid evaporation	Flammable	Not appropriate for environmental disinfection Primarily used as antiseptics
Aldehydes: Fomaldehyde Glutaraldehyde	Good	Broad spectrum Relatively non-corrosive	Highly toxic	Irritant Carcinogenic Requires ventilation	Used as an aqueous solution or as a gas (fumigation)
Alkalis: Ammonia			Unpleasant odour Irritating	Do not mix with bleach	Not recommended for general use
Biguanides: Chlorhexidine	Rapidly inactivated	Non-toxic	Incompatible with anionic detergents		Not appropriate for environmental disinfection Primarily used as antiseptics
Halogens: Hypochlorites (Bleach)	Rapidly inactivated	Broad spectrum, including spores Inexpensive Can be used on food preparation surfaces	Inactivated by cationic soaps/detergents and sunlight Frequent application required	Corrosive Irritant Mixing with other chemicals may produce toxic gas	Used to disinfect clean environmental surfaces Only commonly available sporicidal disinfectant
Oxidizing Agents	Good	Broad spectrum Environmentally friendly	Breakdown with time	Corrosive	Excellent choice for environmental disinfection
Phenols	Good	Broad spectrum Non-corrosive Stable in storage	Toxic to cats Unpleasant odour Incompatible with cationic and nonionic detergents	Irritant	Some residual activity after drying
Quaternary Ammonium Compounds (QACs)	Moderate	Stable in storage Non-irritating to skin Low toxicity Can be used on food preparation surfaces Effective at high temperatures and pH	Incompatible with anionic detergents		Commonly used primary environmental disinfectant Some residual activity after drying

TABLE 6: ANTIMICROBIAL SPECTRUM OF SELECTED DISINFECTANTS (Modified from Linton et al. 1987 and Block 2001)



Agent	Alcohols	Aldehydes	Alkalis: Ammonia	Biguanides: Chlorhexidine	Halogens: Hypochlorite (Bleach)	Oxidizing Agents	Phenols	Quaternary Ammonium Compounds
Mycoplasmas	++	++	++	++	++	++	++	+
Gram-positive bacteria	++	++	+	++	++	++	++	++
Gram-negative bacteria	++	++	+	+	++	++	++	+
Pseudomonads	++	++	+	±	++	++	++	±
Enveloped viruses	+	++	+	++	++	++	++	+
Chlamydiae	±	+	+	±	+	+	±	-
Non-enveloped viruses	-	+	±	-	++	+	±*	-
Fungal spores	±	+	+	±	+	±	+	±
Acid-fast bacteria	+	++	+	-	+	±	++	-
Bacterial spores	-	+	±	-	++	+	-	-
Coccidia	-	-	+	-	-	-	+	-

++ Highly effective; + Effective; ± Limited activity; - No activity

Examples of microorganisms from each category:
Mycoplasmas: *Mycoplasma canis*, *Mycoplasma felis*; **Gram-positive bacteria**: *Staphylococcus* spp, *Streptococcus* spp; **Gram-negative bacteria**: *Bordetella bronchiseptica*, *Salmonella* spp; **Pseudomonads**: *Pseudomonas aeruginosa*; **Enveloped viruses**: influenza virus, herpesvirus; **Chlamydiae**: *Chlamydophila psittaci*; **Non-enveloped viruses**: feline panleukopenia virus, canine parvovirus; **Fungal spores**: *Blastomyces dermatitidis*, *Sporothrix schenckii*; **Acid-fast bacteria**: *Mycobacterium avium*; **Bacterial spores**: *Clostridium difficile*, *Clostridium perfringens*; **Coccidia**: *Cryptosporidium parvum*, *Isospora* spp, *Toxoplasma gondii*

*In general, phenols are not effective against non-enveloped viruses, but they have been found to be effective against rotaviruses. They have been recommended for use on horse farms to help control equine rotaviral disease in foals. However, efficacy against small animal parvoviruses has not been demonstrated.

COLD STERILIZATION

"Cold sterilization" is used to sterilize items through immersion in a sterilizing solution. Because of the toxicity of some cold sterile solutions, the time required to achieve sterilization using these chemicals, and the availability of autoclaves for sterilization, there is **minimal indication for the use of cold sterilization**. Its main indication is for sterilization of items that cannot tolerate steam sterilization, such as endoscopes.

Although cold sterilization can be an effective means of sterilizing instruments, **misuse can result in ineffective sterilization**. Potential problems include the use of inappropriate solutions, improper preparation of solutions (i.e. inadequate concentration), inadequate contact time, inadequate replacement/refreshment of solution, or inadequate removal of organic debris from equipment prior to immersion in solution. Commonly used disinfectants such as alcohol, iodophors, phenolics and most quaternary ammonium compounds are **not** effective sterilants and therefore are not acceptable for use on items intended to be used in surgical or other invasive procedures. Of the chemical sterilants, only **glutaraldehyde** and **stabilized hydrogen peroxide-based compounds** are effective at sterilizing instruments, and then only if the solutions are prepared and maintained properly, and allowed adequate contact time.

Prolonged contact time (e.g. 10 hours) is required for sterilization using these solutions. Therefore, cold sterilization is not a means for rapid sterilization of surgical instruments that have been inadvertently contaminated during surgery or for surgical instruments that will be used frequently on different patients throughout the day. In some veterinary clinics, disinfectant solutions of other kinds in which a set of instruments is routinely kept are frequently referred to as "cold sterile." Such misuse of this term should be avoided, as instruments kept in disinfectant solutions other than glutaraldehyde or high-level sterilants should **not** be used for surgical or other invasive procedures.

Instruments must be cleaned to remove all visible organic debris (including blood) before placing them in a clean, fresh cold sterilant solution in order for the procedure to be effective. Most chemical sterilants come in solutions consisting of two parts that, when combined, form what is referred to as an "activated" solution. Refer to the product's label for the shelf life of the activated solution. Cold sterilant must be rinsed off all instruments using sterile saline or water before they are used, as some of these compounds (particularly glutaraldehyde) can be irritating to tissues. As with all other chemicals used in a veterinary clinic, Material Safety Data Sheets (MSDS) for these products must be readily available to all personnel who work with them and around them.

Disinfectant solutions in which a set of instruments is routinely kept are often referred to as "cold sterile."
Such misuse of this term should be avoided, as such instruments are rarely, if ever, truly sterile.

MAINTENANCE OF ENDOSCOPES

Proper cleaning and maintenance of endoscopes are important to prolonging the useful life of the instrument, but cleaning and disinfection are also important from an infectious disease control aspect. Endoscopes are semi-critical equipment, and as such require high level disinfection when used in humans. In veterinary medicine, high level disinfection is required prior to use in relatively sterile areas (e.g. urinary tract), but thorough low level disinfections is considered adequate for use in non-sterile areas (e.g. gastrointestinal tract, upper respiratory tract) if a transmissible infectious disease was not suspected in the previous patient and the subsequent patient is not significantly immunocompromised. Manufacturers typically provide detailed reprocessing (cleaning and disinfection) instructions for their instruments, which should be readily available as a reference for staff members responsible for the care of endoscopes. If the endoscope was purchased second hand and the reprocessing instructions were not provided, it is important to contact the manufacturer to obtain a copy. Some general guidelines regarding endoscope maintenance include:

- **Endoscopes must be meticulously cleaned immediately after every use.** Endoscopes typically have several moving or detachable parts and small channels in which moisture, debris and discharge can become trapped. Cleaning must be performed as soon as possible in order to prevent debris from drying onto surfaces, as this can make the debris considerably harder to remove. Prior cleaning is crucial to effective disinfection.
- **All instrument and suction channels must be thoroughly cleaned after each use**, even if the channels were not used during the procedure. Failure to clean these channels is a common error which can result in accumulation of debris, bacteria and biofilms within the instrument. Not only does this pose risk of disease transmission to subsequent patients, but it can also confound sample collection and culture.
- **Rinsing and drying** of the endoscope are also critical to proper maintenance. Failure to rinse off detergents or disinfectants can lead to significant irritation of the tissues of the next patient.
- Chemical sterilants (e.g. glutaraldehyde) are typically used for high-level disinfection or sterilization of endoscopes, as most cannot be steam-sterilized (autoclaved). Consult the manufacturer's instructions regarding what methods can be safely used for any particular endoscope. If a chemical sterilant is used, **a timer should be used to measure the exact contact time** – too short a time may result in an inadequate microbial killing, while too long a time may result in damage to the instrument.

MAINTENANCE OF CLIPPERS

Use of good-quality clippers and maintenance of clipper blades are of great importance. Improper clipper use or maintenance can result in skin trauma, with subsequent risk for infection, or transmission of opportunistic pathogens between patients.

Following routine use of clippers on areas of unbroken skin and non-infectious animals, **basic cleaning with a stiff brush** to remove visible dirt and hair from the blade is likely adequate. More thorough cleaning and disinfection of the blade, as described below, should be done periodically as well, depending on how often the clippers are used.

Clippers should be thoroughly cleaned and disinfected after every use on an animal with a potentially transmissible infection (e.g. an animal with diarrhea), on any area where the skin or hair is significantly contaminated with feces, urine, blood or other body fluids, and before *and* after use on an area where the skin is broken (especially if there is evidence of skin infection). First, a stiff brush should be used to remove visible dirt and hair from the blade, and a soapy, wet cloth used to remove any visible debris from the body of the clippers. The clipper blades can then be sterilized using a chemical sterilant (e.g. glutaraldehyde) or by autoclaving. The body of the clippers can be sterilized using hydrogen peroxide vapour or ethylene oxide (if available). Otherwise, after removing all visible debris, thorough manual wiping with a cloth wetted with a standard disinfectant solution should be performed, paying particular attention to the small crevices of the device and allowing for adequate contact time with the disinfectant. Refer to the clipper's instruction manual to determine what degree of contact with liquid the clippers can safely withstand.

LAUNDRY

(Modified from Canadian Committee on Antibiotic Resistance, 2007)

Although single-use, disposable items are ideal from an infectious disease control aspect, such items can also produce tremendous waste. Laundry is therefore a very important component of infectious disease control in the clinic setting. Although soiled linens are a potential source of microorganisms, with appropriate hygienic handling, storage and processing of clean and soiled linens, the risk of disease transmission from these items can be reduced to an almost negligible level.

Linens and special clothing used in veterinary clinics (e.g. cage blankets, towels, surgical drapes, surgical gowns, scrubs, lab coats) can be an important means of transporting pathogens from one area to another within the clinic, and to areas outside the clinic. As a result, **clinic clothing (e.g. scrubs, lab coats) should always be washed on-site or sent to a commercial laundry facility** that is equipped to handle laundry from medical/veterinary facilities. This helps to prevent transmission of pathogens to family members, family pets and the general population. Personnel should change into clinic clothes at the beginning of their shift and back into street clothes at the end of their shift. Clinics should have appropriate laundry facilities or laundry services to accommodate the need to change clothing daily, or more frequently if required.

Microbial numbers on soiled linens (e.g. towels, blankets) and clothing are significantly reduced by dilution and during the mechanical action of washing and rinsing. Linens used in veterinary clinics should be laundered together using detergent, and dried in a hot air dryer to promote killing of microorganisms.

Linens contaminated with gross organic material must be pre-cleaned by hand to remove such material prior to laundering. It is not possible to adequately clean laundry by machine when gross organic material is present, and laundering such items can lead to contamination of other laundered items.

COLLECTION AND HANDLING

Except for linens potentially contaminated with infectious agents (see below), all used linens can be handled in the same way. Heavily soiled linens should be rolled or folded to contain the heaviest contamination in the centre of the bundle, without contaminating personal clothing or the environment. Large amounts of solid debris, feces or blood clots should be removed from linen with a gloved hand and disposable tissue or paper towel, which are then immediately placed in the garbage. Excrement should not be removed by spraying with water or shaking as this may result in contamination of the surrounding area and personal clothing.

BAGGING AND CONTAINMENT

- Linens should be handled with a minimum of agitation and shaking.
- Always place soiled linens directly in a hamper or bag designated for dirty laundry.
- Never place soiled linens on the floor.
- Laundry bags should be tied securely and not over-filled.
- Carts and hampers should be cleaned after each use.
- Laundry bags should be washed after each use. They can be washed in the same cycle as the linens they contain.

TRANSPORT

Linen transported by cart should be moved in such a way that the risk of cross-contamination is minimized (e.g. avoid moving the cart from potentially contaminated areas (runs/kennel area) to cleaner areas (prep room, surgery).

Clean linen should be transported and stored in a manner that prevents contamination. If laundry carts are used, separate carts should be used for clean and dirty linens.

WASHING AND DRYING

- Use of normal machine washing with a commercial laundry detergent and machine drying are sufficient to greatly reduce the numbers of most significant infectious pathogens from most soiled linens.
- If laundry is washed in cold water, an appropriate cold-water detergent must be used according to label directions.
- It should **not** be assumed that hot water washing will disinfect or sterilize items. High temperature (> 71.1ºC) washing can significantly reduce bacterial numbers, but standard household washing machines do not typically reach this temperature, even if the hot water setting is used.
- The heat and drying effects of tumble drying are a critical step in the laundering process, and account for a large proportion of the decrease in bacterial counts achieved. Therefore, laundry should not be considered clean until it has also been dried completely, ideally using the highest heat possible.
    - Line-drying linens outdoors may have the advantage of also exposing the surface of the fabrics to ultraviolet (UV) light, if they are hung to dry in the sun. However, it would be difficult to expose all surfaces to sunlight, and thick fabrics, items made of multiple fabric layers and those containing seams may protect bacteria from UV exposure. Also, the antimicrobial action of the high heat of tumble drying is lost if linens are line-dried, therefore tumble drying is recommended, especially for any materials that may have been contaminated with a transmissible infectious pathogen.

Laundry should not be considered clean until it has also been dried.

LAUNDRY FROM INFECTIOUS CASES

- Laundry from potentially infectious cases should be treated separately from other laundry.
- Linens should be collected in a separate linen bag and washed and dried separately.
- For linens with gross contamination of a potentially infectious nature (e.g. feces from a diarrheic animal, discharge from an infected wound, urine from an animal with a urinary tract infection), as much organic material as possible should be removed by hand (using gloves and disposable tissue or paper towel, as described above). The items should then be pre-soaked in bleach solution (9 parts water:1 part household bleach) for 10-15 minutes prior to machine washing.
- Bleach should also be added to the household detergent in the washing machine as per label instructions.

PROTECTION OF PERSONNEL

Personnel need to protect themselves from potential transmission of pathogens from soiled linens by wearing appropriate personal protective equipment (e.g. gloves, gown, apron) when handling soiled linens. **Personnel should wash their hands** whenever gloves are changed or removed, or if they come in contact with soiled linens while not wearing gloves. Hand hygiene stations should be available in laundry area.

COMMERCIAL LAUNDRY FACILITIES

A company which specializes handling laundry from medical/veterinary facilities should be used if it is not possible for laundry to be cleaned on-site. Adequate separation of clean and dirty laundry in the transport truck is essential to ensure that there is no opportunity for mixing or cross-contamination of clean and dirty linens.

WASTE MANAGEMENT

Veterinary biomedical waste is a potential source of both zoonotic and non-zoonotic infectious pathogens. Therefore, it is important to handle all such waste appropriately. In Canada, biomedical waste is defined and regulated at the provincial/territorial and municipal levels (usually by the Department/Ministry of the Environment). Biomedical waste typically includes sharps, tissues (anatomic waste), highly contaminated (e.g. blood-soaked) materials, and dead animals. National guidelines for biomedical waste management have been published through the Canadian Council of Ministers of the Environment (CCME), and are available at http://www.ccme.ca/assets/pdf/pn_1060_e.pdf. However, individual provinces and territories may have more stringent regulations. Details are usually readily available through provincial and municipal web sites, or through provincial veterinary associations. Small clinics in rural areas, where biomedical waste disposal services are not be readily available, may be able to make arrangements with a local human hospital or other healthcare institution to have their waste disposed of with that of the human facility.

Although it is beyond the scope of these guidelines to describe veterinary biomedical waste management in detail, the following basic information may be helpful:

- **Used sharps** are considered *biomedical waste* and should be disposed of in accordance with regulations from municipal and provincial/territorial authorities. Use approved, puncture-resistant sharps disposal containers to remove, store and dispose of used sharps such as needles, blades, razors and other items capable of causing punctures.
- **Non-anatomical waste saturated or dripping with blood** (e.g. blood-soaked lap sponges and gauze) are also best disposed of as *biomedical waste*.
- **Liquid waste** such as chest fluid, abdominal fluid, irrigating solutions, suctioned fluids, excretions and secretions usually may be poured carefully down a *toilet or any drain connected to a sanitary sewer* or septic tank. Provincial and territorial regulations may dictate the maximum volume of blood or body fluids that is permitted to be poured into the sanitary sewer. If there is likely to be splashes or sprays during this disposal process, appropriate personal protective equipment should be worn.
- **All other waste**, such as general office waste and non-sharp medical equipment, may be disposed of in the regular waste stream, and requires no special treatment other than containment during disposal and removal. Waste should be contained in a leak-proof container or bag that can be discarded with the waste (e.g. a plastic garbage bag).

Urine and feces are not considered biomedical waste, nor is **disposable equipment that has come in contact with an infectious animal** (e.g. examination gloves, gowns, bandage materials that are not saturated with blood). Nonetheless, some of these materials may pose a risk to clinic personnel, patients and waste disposal personnel in terms of their potential to transmit infectious pathogens. Therefore, additional **precautions should be taken to minimize contamination of the clinic environment and the risks to people and animals from potentially infectious waste**. These may include double-bagging of materials from isolation areas, and keeping waste cans covered to prevent access by curious animals and to prevent spillage if a waste can is knocked over. If contamination of the inside of a waste can occurs (e.g. due to a tear in a garbage bag), the container should be thoroughly disinfected after emptying.

Precautions should be taken to minimize contamination of the clinic environment and the risks to people and animals from potentially infectious waste.

SURGERY

All surgical procedures cause breaks in the normal defensive barriers of the skin or mucous membranes. These breaks are therefore accompanied by an inherent risk of surgical site infection (SSI). Surgical site infections can occur sporadically or as part of an outbreak, and can have devastating outcomes in some situations. Good general infection control practices (e.g. hand hygiene, cleaning and disinfection) are important for prevention of SSIs. Specific measures pertaining to surgery include maintenance of the surgical environment, use of appropriate personal protective equipment and hand hygiene, disinfection and sterilization of anesthetic equipment and surgical instruments, appropriate use if peri-operative antimicrobials, and surgical site care before, during and after the procedure. Many of the recommendations below are already considered minimum practice standards in Canada. Actual requirements may vary somewhat by province. Veterinarians should contact their provincial veterinary association for details about the specific regulations in their area.

SURGICAL ENVIRONMENT

Having a well designed and maintained surgical area or suite is very important. In order to keep the surgical environment as clean as possible, this area should be separated from personnel and animal traffic, and be easy to thoroughly clean and disinfect. **A surgical area should only be used for surgical procedures**, and should not be used for non-surgical procedures between surgeries. Entrance to the area should be restricted at all times to minimize traffic in the room. The number of people in the surgical area has been identified as a risk factor for SSI in small animals, so only essential personnel should be allowed in the area during any surgical procedure. All personnel participating in the procedure, including those performing surgical nursing duties, must be trained in operating room procedures.

A surgical area should only be used for surgical procedures.

PERSONNEL CONSIDERATIONS

PERSONAL PROTECTIVE EQUIPMENT

All personnel in the surgical area should wear designated surgical scrubs, a surgery cap or hair bonnet, and a nose-and-mouth mask when surgery is underway, regardless of whether or not they are directly involved in the procedure itself. **Scrubs worn in surgery should not be worn when handling or treating other patients**, and at a minimum should be covered with a lab coat when outside the surgery area (see Personal Protective Equipment under Routine Procedures). Personnel directly involved in the procedure should also wear a sterile gown and sterile gloves.

HAND HYGIENE

A surgical hand scrub should be performed before putting on a sterile gown and sterile gloves. Various surgical scrub techniques have been described. Most commonly, a **structured five-minute surgical scrub with antibacterial soap** is used:

- Remove all hand and arm jewelry
- A pick or file should be used to clean all dirt out from underneath the fingernails.
- If hands or arms are visibly dirty, they should initially be washed with soap and water as per standard hand hygiene protocols.
- Hands and forearms are then lathered with antibacterial soap. Scrubbing with a bristled sponge proceeds proximally from the fingertips to the forearms, just below the elbow. Additional details can be found in a surgical reference book.
- A sterile towel must be used to dry the hands before donning a gown and gloves.

Application of **commercial alcohol-chlorhexidine combinations** can be used as a replacement for traditional surgical scrubbing. This approach has been shown to be equally effective at removing bacteria, and is less time consuming and irritating to the skin, particularly if a surgical hand scrub is required multiple times in a day. If such a commercial combination is used, hands must be thoroughly washed and fingernails carefully cleaned initially. It is also critical to follow the label directions regarding the amount of product to use and how to apply it.

EQUIPMENT CONSIDERATIONS

STERILIZATION OF INSTRUMENTS

Complete sterilization of surgical instruments and any items that might come in contact with the surgical field is a crucial procedure. Poor sterilization or inappropriate handling of instruments after sterilization can result in contamination of sterile tissues during surgery. Steam sterilization (i.e. autoclaving) is most commonly used in veterinary clinics. Quality control testing of autoclaves should be performed regularly and documented:

- **Sterility indicator strips** should be placed in every surgical pack. External autoclave indicator tape is not a reliable indicator of the sterility of a pack's internal contents.
- **Biological sterility indicators** should be used periodically. These indicators contain bacterial spores, which are the most resistant form of bacteria. After being autoclaved, the indicator is submitted for testing to ensure that all of the spores have been killed by the sterilization process. In human healthcare facilities it is recommended that these indicators are used daily, or at least weekly. Weekly or bi-weekly use is likely adequate in most veterinary clinics, depending on how heavily the autoclave is used. A biological sterility indicator should also be used in the next cycle anytime the autoclave has been moved, repaired, or if there has been any other indication of sterilization failure.

Quality control testing of autoclaves should be performed regularly.

Flash sterilization should not be used unless absolutely necessary for emergencies only. Flash sterilization should never be used for surgical implants. Countertop "cold sterile" disinfectant solutions should not be used for any surgical instruments or implants, as these solutions typically do not achieve true sterilization of the instruments they contain (see Cold Sterilization on page 35).

DISINFECTION OF ANESTHETIC EQUIPMENT

Endotracheal tubes: In human medicine, endotracheal (ET) tubes are typically considered single-use devices, but reuse of ET tubes has become more common with the rising costs of healthcare. These tubes can be effectively re-sterilized between patients using glutaraldehyde or ethylene oxide gas, although the physical integrity of the cuffs in particular can be compromised by repeated sterilization with these methods. These tubes are considered semi-critical equipment, and as such should be subjected to high-level disinfection or sterilization. In veterinary medicine, it is impractical to discard ET tubes after a single use, but glutaraldehyde or ethylene oxide gas sterilization may not be readily available. Evidence-based guidelines for reuse of ET tubes in veterinary medicine are not available. Nonetheless, **at an absolute minimum**, ET tubes must be thoroughly cleaned (inside and outside) with hot water and detergent immediately after use to prevent any discharge or debris from drying and forming a biofilm on the device. Tubes should then be soaked in a solution of a quaternary ammonium compound (QAC), rinsed thoroughly and dried prior to being reused. It is important to test the integrity of the cuff before every use to ensure the device has not been compromised by repeated exposure to the disinfectant.

Anesthetic gas tubing and rebreathing bags: Although the tubing connecting the anesthetic machine to the patient's endotracheal tube should not come in direct contact with the patient, moisture and condensation often accumulate in the tubes and may contain microorganisms from the animal's airway. In human medicine, this equipment is also typically single-use. As for ET tubes, evidence-based guidelines for reuse of this equipment in veterinary medicine are not available. **At a minimum**, gas tubing should routinely be washed thoroughly with hot water and detergent and hung to dry at the end of the day's procedures, or more often if they are heavily used. If there is visible discharge in the tubing, or if the animal has a known or suspected respiratory tract infection, the tubing should be washed with hot water and detergent, soaked in a solution of a QAC, rinsed with water and dried prior to being reused. Rebreathing bags should be cleaned/disinfected as for the associated gas tubing, as they also come in contact with the expired air from the patient.

If an animal has a known or suspected transmissible respiratory tract infection, filters are available which can be placed between the ET tube and the rest of the anesthetic circuit in order to help protect the equipment from contamination.

PERI-OPERATIVE ANTIMICROBIALS

Administration of peri-operative (i.e. before, during and after surgery) antimicrobials is an important and complex issue. The goal of peri-operative antimicrobial therapy is to reduce the risk of post-operative infection, while minimizing the negative impact on the patient's natural microflora and the risk of antimicrobial-associated complications such as diarrhea.

There is currently very little objective information about the need for antimicrobials for specific veterinary procedures, as well as the optimal choice of drug(s), timing and dosages. **Antimicrobials are indicated in clean-contaminated, contaminated and dirty procedures.** *The need for antimicrobial prophylaxis in clean procedures is unclear.* In human medicine, antimicrobials are not typically recommended for clean procedures such as arthroscopy, however there are conflicting opinions. Regardless, it is unclear whether recommendations from human medicine should be directly extrapolated to veterinary procedures, because there are obvious differences in post-operative incision care and patient environment for animals, which may increase the risk of infection. The need for peri-operative antimicrobial therapy for different procedures, particularly clean procedures, requires further research. Concerns with this practice that currently exist include inappropriate timing of administration (i.e. too far in advance of surgery or starting after surgery), excessive duration of therapy, inadequate dosing and inappropriate drug choice.

If peri-operative antimicrobials are used, they should be administered so that therapeutic levels are present at the surgical site at the time of first incision. This typically requires parenteral (i.e. not oral) administration of an antimicrobial approximately one hour before surgery. If the surgical time is longer than two half-lives of the drug(s), then an additional dose should be given during the surgery. In human medicine, it has been shown that starting antimicrobial therapy after surgery is no more effective than not using antimicrobials at all. Typically, antimicrobials are not needed after surgery since the highest-risk time for contamination of the surgical site (i.e. during the surgery itself) is already passed.

Starting antimicrobial therapy after surgery is no more effective than not using antimicrobials at all.

SURGICAL SITE MANAGEMENT

PRE-OPERATIVE CARE

Pre-operative management of the surgical site may be very important, but there has been very little research in this area in veterinary medicine. The goal of pre-operative surgical site management is to eliminate potential pathogens without creating a physical environment that may increase bacterial colonization or infection post-operatively.

If the patient's hair coat is visibly dirty, bathing the animal before surgery is reasonable if there is adequate time for the hair coat to dry before the procedure. In humans, it has been suggested that any method of hair removal can be associated with higher SSI rates, but obviously this cannot be avoided for the vast majority of procedures in veterinary medicine. Shaving the surgical site the night before has been associated with higher SSI rates in humans, therefore **clipping (not shaving) of the surgical site should only be performed right before surgery**. Care must be taken to avoid damaging the skin during this procedure, as abrasions provide sites for invasion and proliferation of opportunistic bacteria. Use of good quality, well-maintained clippers and blades helps to reduce the risk of skin abrasions. If skin lesions around the surgical site are noted before or after surgery, the finding should be recorded and investigated, to determine whether equipment maintenance and/or personnel training need to be improved. **Animals should not be clipped in the surgery area/suite itself**. A "prep" area outside of surgery area should ideally be used for this and any other pre-operative procedures.

Clipping (not shaving) of the surgical site should be performed right before surgery.

Skin preparation after clipping is also important. Typical practices include thoroughly cleaning and scrubbing the site with antibacterial soap, followed by application of alcohol, and finally application of a chlorhexidine or iodine solution. Potential problems that need to be avoided include:

- Failure to prepare a large enough area of skin
- Inadequate initial cleaning with soap and water
- Contamination of preparation solutions
- Inadequate contact time with the antiseptic
- Contamination of the area during or after preparation due to improper technique

If skin preparation solutions (e.g. antibacterial soap and water, alcohol, chlorhexidine, iodine) are kept in refillable containers, these containers must be disinfected when empty before being refilled. Contamination of these solutions with bacteria that are resistant to their respective antimicrobial actions can occur. Refilling the containers without disinfecting them can allow these resistant contaminants to accumulate. An outbreak of catheter site infections was reported in a small animal clinic that was associated with contaminated skin preparation solutions.

POST-OPERATIVE CARE

Post-operatively, a surgical incision site is highly susceptible to opportunistic infection from the bacteria of the patient's own microflora, from the environment or from hospital personnel. Contact with the surgical incision, particularly with bare hands, should be avoided. Covering or bandaging incisions for a minimum of 24 to 48 hours after surgery has been recommended in humans; this is also a reasonable recommendation in small animals in most situations. **Bandage changes should be performed using aseptic technique**. Pet owners and handlers should be instructed on how to manage an animal with an incision, and the signs for which to look that may indicate the development of a SSI. There is no objective information about the need to cover surgical incisions for more that 48 hours in veterinary or human medicine, but arguments can be made for both sides. **Preventing the animal from licking, scratching or otherwise traumatizing the surgical site is critical.** Damaging to the healing incision or the skin around it can result in the deposition of opportunistic pathogens, and make it easier for bacteria to grow in the area.

PATIENT CARE AND HANDLING

ISOLATION FACILITIES

Every veterinary clinic should have a dedicated isolation area for caring for and housing animals with potentially contagious infectious diseases. The size and structure of the isolation facility varies with aspects such as clinic size, types of animal species treated and diseases that are endemic to the area. A proper isolation area should allow for complete physical separation of potentially infectious cases, and have areas for performing routine procedures such as bandage changes, thereby reducing the risk of direct or indirect infection of other hospitalized animals or clinic personnel. Ideally, **isolation facilities should be in a low traffic location within the clinic**.

Every veterinary clinic should have an isolation area for caring for and housing animals with potentially contagious infectious diseases.

If an isolation area was not included in the original physical design of the clinic, a potential alternative in some cases may be to convert an examination room into a dedicated isolation room. The room selected should be in the area of the lowest human and animal traffic possible. The room should be easy to clean and disinfect and emptied of all non-essential equipment. This type of room conversion can be difficult to do effectively depending on the design and layout of the clinic and the room itself. The feasibility of using such a room for isolation of infectious animals must be assessed on a facility-by-facility basis.

Ventilation should be designed such that movement of air from the isolation room to other areas of the clinic is prevented (i.e. the room should be vented to the outdoors). If this is not readily possible, a HEPA air filtration system should be used for the air leaving the isolation room.

Only the equipment and materials needed for the care and treatment of the *individual* animal should be kept in the isolation room. This may include items such as a designated stethoscope, thermometer, grooming supplies, leash, and muzzle. Supplies of items that will be used on subsequent isolation patients (e.g. packages of bandage material, boxes of needles and syringes) should not be kept in the isolation area. **All items entering an occupied isolation area should be considered infectious** and disposed of or disinfected after discharge of the patient. *Items should not be removed from the room except for disposal.* Use of disposable articles can minimize the need to take soiled items out of the isolation room.

When the isolation room is in use by an animal with a potentially contagious infectious disease:

- **Prominent signage** should indicate that the animal may be infectious and should outline any additional precautions that need to be taken in addition to routine isolation protocols.
- **Access to the isolation room should be limited** to the minimum number of essential personnel necessary to provide appropriate patient care.

PERSONAL PROTECTIVE EQUIPMENT AND WASTE IN ISOLATION

All personnel entering an isolation area housing a potentially infectious animal, regardless of whether they plan on having direct contact with the animal, must wear appropriate personal protective clothing. At a minimum, this consists of a clean lab coat or similar item of outerwear that is only worn in the isolation area and disposable examination gloves. Depending on the diagnosis and the mode of transmission of the disease, shoe covers, masks and eye protection may be required when handling an animal in isolation.

- Gloves should be discarded after a single use. Hands must be washed immediately after gloves are removed.
- Similarly, gowns should be discarded (if disposable) after a single use. Reusable gowns and lab coats used in isolation should be laundered after a single use. Storing/hanging and reusing a contaminated gown or lab coat inevitably leads to contamination of hands, clothing and the environment. Therefore, when removed, these items should immediately be placed in the isolation room garbage or laundry bag.
- Eye/nose/mouth protection may be re-used with the same animal if they are not visibly soiled and can be consistently removed without contamination of the inside of the eye wear/mask or the immediate environment. Nose and mouth masks should only be reused by the same person. If the eyewear or mask becomes contaminated with body fluids such as urine or feces, it should be replaced with a clean article. **Designated personal protective equipment must remain in the isolation room.**

Contaminated items and waste alike should be bagged prior to being removed from the isolation area. Articles should then immediately be either discarded or taken to the appropriate area for additional cleaning and disinfection. **Waste from an isolation room should be treated as potentially infectious.**

PATIENTS IN ISOLATION

Dogs that are housed in isolation should not be walked nor allowed to urinate or defecate in public areas or areas used by other animals. If a dedicated area for walking is not available and the dog needs to be taken out of the primary isolation area to urinate and defecate, a separate run should be designated for *each* dog in isolation (i.e. if there is more than one animal in isolation, they cannot all use the same run). The run selected should be as far as possible from runs being used by other animals. The dog should be moved **directly** to the run by personnel wearing appropriate personal protective clothing. Moving the animal through other areas of the clinic should be avoided as much as possible. **Carrying the dog or transporting it on a gurney** is ideal in order to minimize the risk of contamination of the floor and clinic environment. The designated run should be prominently labeled and disinfected daily.

If a patient being housed in isolation absolutely must be taken elsewhere in the clinic for essential procedures such as radiographs or surgery, *if at all possible* this should be done the end of the day, or during a time where there is the least animal and personnel movement in the clinic.

- Appropriate personal protective equipment should be worn by all personnel involved with the procedure.
- Other animals should be kept out of the procedure area.
- The procedure area should be thoroughly cleaned and disinfected as soon as the procedure is completed.

FOOTBATHS AND FOOTMATS

Footbaths or footmats are used to decrease (but do not eliminate) microbiological contamination of footwear. Footbaths are shallow containers containing a disinfectant solution. Footmats are spongy commercial mats covered with a durable, easy-to-clean material that can be saturated with disinfectant. Footmats can increase compliance because they are easier to use, but they are more expensive and more difficult to maintain than footbaths.

Data regarding the need for and efficacy of footbaths and footmats are very limited, and there is essentially no information relating to small animal clinics specifically. It has been shown that footbaths can reduce bacterial contamination of footwear in large animal clinic settings. Although other sources of contamination have been shown to be more significant in infection transmission, footwear and floor surfaces cannot be overlooked in an infection control program in a small animal clinic, because patients so often have extensive direct contact with the floor. Possible problems with footbath or footmat use must also be considered. Footbath or footmat use is almost invariably accompanied by spillage of disinfectant solution; this can create a slipping hazard on smooth floor surfaces, which are typically present in small animal clinics. Certain disinfectants can also damage floor surfaces with prolonged contact.

Footbaths or footmats should be considered when personnel will be walking on a surface that could potentially be more contaminated than the general floor environment, and where spread of this contamination might pose a risk to patients or personnel. The most likely area where footbaths or footmats could be useful would be at the exit of an animal housing area (e.g. dog run) that contains a potentially infectious case, and where clinic personnel will be walking in and out of the potentially contaminated area. The need for routine use of footbaths or footmats in isolation areas where animals are confined in cages is questionable. If footbaths or footmats are used, selection of an appropriate disinfectant is important. The disinfectant should be effective against the specific pathogen(s) of concern, stable in solution, and effective with a relatively short contact time (see Tables 5 and 6). Oxidizing agents such as accelerated/stabilized hydrogen peroxide and peroxygen disinfectants are ideal. The solution should be changed daily, or sooner if gross contamination of the bath/mat occurs.

Maintaining proper concentrations of active disinfectants in footbaths and footmats is essential for proper performance.

WOUNDS AND BANDAGES

Wound infections can be caused by many bacterial pathogens, some of which can be transmitted between animals or between animals and people. One example is methicillin-resistant *Staphylococcus aureus* (MRSA), which can infect both people and animals, but there are a variety of other pathogens that are of concern. This includes both multidrug resistant (e.g. *S. aureus*, *S. pseudintermedius*, enterococci) and susceptible bacteria. Wounds provide a prime site for invasion of opportunistic bacteria such as these. Even wounds that are not known to be infected should be protected from contamination by veterinary personnel and from the environment to reduce the risk of secondary infection.

- Sterile gloves should be worn for debridement, treatment and bandaging of deep wounds and those involving vital structures. Clean, non-sterile examination gloves are adequate for these procedures if the wound is more superficial.
- **Bandages must be kept dry** to prevent bacterial strike-though. This means keeping the outside of the bandage as dry as possible, and also including sufficient absorbent material in the bandage itself to prevent discharge from the wound from soaking through the bandage. If the outside of a bandage appears wet, it should be changed.
- **Used bandage materials should be considered infectious**. Such materials should be placed directly in the garbage and not on the floor, examination table or any other surface. The risk of contamination and spread of any pathogen is likely higher for wounds with a large amount of discharge.
- Wound treatments and bandage changes should be performed in an area that is easily disinfected (e.g. on an examination table). Wound irrigation and lavage should be performed in such a way that the fluid used is contained (e.g. in a sink or tub, or with disposable absorbent material). Bandages should NOT be changed in the kennel/ward area where there is a higher risk of cross-contamination of other patients.
- Hands should be washed thoroughly after changing a bandage. Equipment used for bandage changes (e.g. bandage scissors) should be disinfected between uses.

Wound infections can be caused by many bacterial pathogens,
some of which can be transmitted between animals or between animals and people.
Wounds provide a prime site for invasion of opportunistic bacteria.

Animals with known MRSA or multi-resistant bacterial wound infections are likely to be colonized with these pathogens at other body sites as well (e.g. nose, rectum, intestinal tract), and should therefore be handled with contact precautions and housed in isolation.

FEEDING OF RAW MEAT

Raw meat-based diets for cats and dogs often contain a variety of enteropathogens, including *Salmonella spp*, *Campylobacter spp*, *Clostridium difficile*, *Clostridium perfringens*, extended spectrum beta-lactamase (ESBL) Enterobacteriacea, and enterohemorrhagic strains of *Escherichia coli* such as O157:H7. It has also been shown that animals fed raw meat diets may shed higher levels of *Salmonella* and ESBL Enterobacteriacea in their feces. Raw meat diets and feces from animals fed these diets may pose a risk to hospitalized animals and clinic personnel, and may contaminate the hospital environment. Therefore, **a policy against the feeding of raw meat to hospitalized animals should be in place**. Clients who do not wish to have their animal fed a commercial kibble diet could consider cooking the pet's normal diet for the duration of the hospitalization period. However, if it is the opinion of the attending veterinarian that changing an animal's diet from a raw meat diet would adversely affect the animal's health, then the following guidelines should be followed:

- Animals regularly fed raw meat should be housed in isolation and considered infectious. All protocols for handling isolated animals should apply.
- Raw meat should be kept frozen until the day before feeding. It should be thawed in the refrigerator on the bottom shelf in a sealed container.
- Any uneaten meat should be promptly discarded in such a way that it will not attract nor be accessible to insects, vermin or other animals. Significant bacterial growth can occur in any meat that is left out at room temperature, even for a short period of time.
- Any items that come in contact with raw meat (e.g. bowls, storage containers) should be cleaned and disinfected immediately after use.
- Hand hygiene should be strongly emphasized after handling raw meat or any items that have been in contact with raw meat.

It should be clinic policy not to feed raw meat to hospitalized animals.

ADMISSION OF ANIMALS FROM SHELTERS

Humane societies, animal shelters and similar facilities typically contain transient, stressed populations of animals, large numbers of young animals, sick animals and animals with unknown health and vaccination status. As such, they should be **considered high risk from an infectious disease standpoint**. Animals admitted from these facilities should be subjected to a high degree of scrutiny. Recommended practices include:

- All animals from such facilities should be examined immediately upon arrival. They should not be allowed to come in contact with other animals in the waiting/reception area.
- If there is an ongoing outbreak of an infectious disease at an animal shelter, admission of animals from the facility for elective procedures should be restricted (i.e. admission for emergencies only). Otherwise, all animals from the facility should be admitted directly to isolation.
- Animals from these facilities should be housed separately from other patients, if possible. Use of a separate ward, separate area of a ward or leaving empty cages between those animals and other patients can be used, depending on the degree of separation required for the diseases of primary concern.

For elective procedures (e.g. spay, neuter):

- All dogs, cats and ferrets must have been vaccinated against rabies at least 2 weeks prior to presentation if they are more than 14 weeks old.
- All dogs and cats must have received other routine vaccinations (as needed according to geographic region) at least twice if they are more than 14 weeks old, with the most recent vaccine administered at least 2 weeks prior to presentation.
- All animals must have been dewormed with a broad spectrum anthelmintic at least 7-10 days prior to admission.
- Animals with abnormalities including, but not limited to, fever, oculonasal discharge, coughing/sneezing, diarrhea and potentially infectious skin conditions should not be admitted for elective procedures.
- Depending on the geographic region and time of year, flea treatment prior to admission may also be required.

SAFETY OF CLINIC PERSONNEL

BITES AND SCRATCHES

Bites and scratches are an inherent risk in veterinary medicine and a common cause of occupational injury and illness. In a survey of veterinarians from the USA, approximately two-thirds had sustained a major animal-related injury at one time. Bites and scratches accounted for just over one-third of these injuries. Up to 60% of dog bites and 80% of cat bites require medical attention. Approximately 3% to 18% of dog bites and 20% to 50% of cat bites become infected. Most dog and cat bite wound infections are caused by a mixture of aerobic and anaerobic bacteria.

In general, veterinary personnel should be able to recognize behaviour in animals and situations that are associated with an increased tendency for an animal to bite. Professional judgment must be exercised to guide bite prevention practices. Personnel should take all necessary precautions to prevent animal-related injuries in the clinic. These may include physical restraint or chemical restraint (sedation or anesthesia) of an animal. Appropriate equipment (e.g. different sizes of muzzles, bite-resistant gloves, catch pole, cat bags) should be readily available. Such equipment should also be as easy to clean as possible. Experienced veterinary personnel rather than owners should restrain animals for procedures whenever possible. Personnel must always be aware of changes in their patients' behaviour which may precede attempts to bite. **Veterinary personnel should not let client perceptions or attitudes prevent them from using appropriate bite-prevention measures** (e.g. muzzling).

If anyone is bitten or scratched by an animal:

- Immediately wash the wound thoroughly with plenty of soap and water.
- Report the incident to the local public health unit.
    - If a bite occurred, the rabies vaccination status of the animal must be noted
- Seek medical attention as soon as possible for any bite that:
    - is on a hand or is over a joint
    - is over a prosthetic device or an implant
    - is in the genital area
    - is over a tendon sheath, such as bite on the wrist or the ankle
    - causes a large amount of tissue damage (e.g. a deep tear or tissue "flap")

Medical attention should also be sought for any bite (particularly from a cat) sustained by a person with any of the following conditions:

- Compromised immune system (e.g. HIV/AIDS, transplant or chemotherapy patients)
- Chronic swelling (edema) in the area that was bitten
- If the person has had his or her spleen removed
- Liver disease, diabetes, lupus or other chronic systemic disease

If the bitten area becomes increasingly painful or swollen, if the wound develops a discharge, or if the person develops a fever or swollen lymph nodes, consult a physician as soon as possible.

A physician will decide (in some cases in consultation with public health personnel) if antimicrobial therapy, tetanus vaccination, rabies vaccination, or any additional treatment (e.g. lavage, debridement, sutures) are necessary. Most bite wounds are not sutured in order to promote drainage and reduce the risk of infection.

Emergency contact information (i.e. physician, public health department) should be clearly posted in the clinic.

All bites or scratches should be reported to the clinic infection control practitioner (ICP) and the injury documented. Bites and scratches should not be considered "part of the job" and summarily dismissed. Even seemingly small, innocuous injuries can develop severe complications. Regular review of injuries is useful to identify trends in behaviour that may be associated with injuries and to develop protocols to reduce the risk of injuries. Documentation is also important for employees in the event that serious health problems subsequently develop.

All animal bites should be reported to the local public health unit due to the risk of rabies exposure.

SHARPS

Injuries from needles and other sharp implements are common in veterinary medicine but are largely preventable. Although there is not the level of risk of bloodborne pathogen exposure in veterinary practice as there is in human medicine, serious outcomes can result following needlestick or other sharps injuries, including significant trauma, secondary infection and drug reaction (i.e. toxic, allergic, idiosyncratic).

Proper sharps handling practices are a practical yet effective way of reducing workplace injuries in veterinary clinics. Use appropriate barriers (e.g. closed toed shoes) and safe work practices when using sharp instruments and devices (e.g. needles, scalpels, etc.), after procedures and when cleaning used instruments.

- Never remove needle caps by mouth.
- Do not bend or manipulate needles in any way.
- Do not pass uncapped needles to another person.
- Ensure proper animal restraint to reduce inadvertent needlestick injuries from animal movement.
- Do not recap needles by hand. If recapping is required, use the “one-handed scoop” technique (see below), forceps or a needle cap holder.
- **Ensure that approved point-of-use sharps disposal containers are located everywhere needles are handled.** These containers are puncture-resistant, leak-proof, and prevent removal (both accidental and intentional) of discarded sharps.
- Always dispose of sharps immediately in an approved sharps disposal container.
- **Never dispose of needles or other sharps into anything other than an approved sharps container**, even if they are capped or otherwise contained. This reduces the risk of accidental injury to veterinary personnel, patients, clients and non-veterinary personnel (e.g. waste disposal personnel).

The most important precaution for preventing needle-stick injuries is to **avoid recapping needles**. Recapping needles causes more injuries than it prevents. When it is absolutely necessary to recap needles as part of a medical procedure or protocol:

- Use a mechanical device such as forceps or hemostats to replace the cap on the needle.
- Alternatively, the needle can be recapped using the “one-handed scoop" technique:
    - Place the cap on a flat horizontal surface.
    - Holding the syringe with the attached needle, or the needle hub alone (when unattached), scoop up the cap with the needle by sliding the needle tip inside, without touching the cap with one’s other hand.
    - Once the point of the needle is covered, tighten the cap by pushing it against an object, or by pulling the base of the needle cap onto the hub of the needle *with the same hand holding the syringe*.

Recapping needles causes more injuries than it prevents.

After injecting live vaccines or aspirating body fluids or tissue, the used syringe should be placed in a sharps container with the needle attached. Following most other veterinary procedures, the needle and syringe may be separated for disposal of the needle in the sharps container. This is most safely accomplished by using the needle removal device on an approved sharps container, which allows the needle to drop directly into the container without being handled or touched.

SHARPS SAFETY FOR CLIENTS

Periodically, owners may be required to treat their animals at home with injectable medications (i.e. insulin, subcutaneous fluids). In these situations, it is the responsibility of the attending veterinarian to:

- Provide (and document) training on how to handle sharps, including injection and disposal practices.
- Provide an approved sharps container or give clients clear instructions regarding how to obtain one.
- Ensure that the client is able to safely handle and dispose of sharps.
- Advise clients that the sharps container should be returned to the clinic for disposal when 3/4 full, and exchanged for a new container (if necessary).

Used sharps are considered biomedical waste in veterinary practices. Dispose of used sharps containers in accordance with regulations from municipal and/or provincial/territorial authorities.

DIAGNOSTIC SPECIMEN HANDLING

Urine from animals with suspected urinary tract disease, and all feces, aspirates, and swabs should be treated as potentially infectious material. Protective outerwear (e.g. lab coat) and disposable gloves should be worn when handling these specimens. Gloves should be discarded and hands washed immediately after handling these items. Care should be taken to avoiding touching clean items (e.g., microscopes, telephones, food) while handling specimens or before glove removal. A separate refrigerator should be used for diagnostic specimens, which should be cleaned on a regular basis.

A designated area of the clinic should be used for specimen processing. This should be separate from treatment and surgery areas so as to decrease the risk of contamination of these areas. After processing a specimen, materials should be disposed of or stored properly and promptly.

- Specimen processing areas should be cleaned and disinfected immediately after use.
- Samples from animals with suspected or known infectious diseases should be disposed of as infectious waste.
- Leak-proof plastic containers should be used for specimen storage in a designated refrigerator which does not contain food, vaccines or medications of any kind.
    - Contamination of the outside of sample containers should be avoided. If the outside of a container becomes contaminated, it should be cleaned and disinfected prior to storage.
- Sharps such as microscope slides and glass pipettes should be disposed of in approved sharps containers.

DENTAL PROCEDURES

Dental procedures often entail a significant risk of splash exposure involving saliva, blood, and bacteria-laden debris. Procedures such as ultrasonic scaling can result in aerosolization of large numbers of bacteria. There is also potential for personnel to sustain cuts and abrasions from dental equipment or teeth during dental procedures. To reduce the risk of transmission of harmful bacteria from the animal's mouth to veterinary personnel, the person performing the procedure and anyone in the immediate vicinity should wear:

- Protective outerwear (e.g. designated lab coat, designated scrubs)
- Disposable gloves
- Surgical (i.e. nose and mouth) mask
- Protective eye glasses/goggles, or a full face shield

Dental procedures should be performed in a contained area away from other patients, personnel and high traffic areas. Procedure such as bandage changes, wound care or placement of invasive devices (e.g. intravenous catheters, urinary catheters) should never be performed in close proximity to a dental procedure due to the risk of contamination by aerosolized bacteria.

NECROPSIES

Necropsies are high risk procedures because of potential contact with infectious body fluids, aerosols, and contaminated sharps. Non-essential persons should not be present during necropsy procedures in order to minimize exposure of personnel to these hazards. Personnel involved in or present at necropsies should wear:

- Protective outerwear (e.g. designated lab coat, designated scrubs)
- Disposable gloves
- Protective eye glasses/goggles, or a full face shield

In addition, when opening the body cavities of larger animals or for any other heavy cutting, cut-proof gloves which can be washed in the laundry should be used to prevent accidental injury from necropsy blades. Additional precautions for respiratory protection (including environmental controls and face masks) should be employed if power equipment is used, since these instruments increase the amount of potentially infected material that becomes aerosolized.

It is recommended that in-clinic necropsies **not** be conducted on any animal suspected of being infected with a pathogen requiring biosafety precautions above level 2 (e.g. *Chlamydophila psittaci*, *Coxiella burnetti*, *Francisella tularensis*, rabies virus). Instead the entire body should be submitted to an approved diagnostic laboratory. Ensure that all requirements for shipment of biological samples are met (these can usually be provided by the laboratory in question), including providing notification of any suspected infectious disease in order to protect laboratory personnel. Material Safety Data Sheets (MSDS) for human pathogens, including many zoonotic pathogens, are available on the Public Health Agency of Canada (PHAC) website at http://www.phac-aspc.gc.ca/msds-ftss/index-eng.php. These sheets list the recommended precautions for handling these pathogens and potentially infectious materials as safely as possible. For more information on risk group classification of infectious agents, visit the American Biological Safety Association website, http://www.absa.org/riskgroups/index.html. Information on the requirements for the different containment levels needed to handle infectious pathogens can be found in the Laboratory Biosafety Guidelines (2004 edition) which are also available on the PHAC website at http://www.phac-aspc.gc.ca/publicat/lbg-ldmbl-04/index-eng.php.

VACCINATION OF PERSONNEL

Vaccination should be considered a final line of protection but is important for certain diseases. Decisions regarding vaccination policies should consider the risk of exposure, the severity of disease, whether the disease is treatable, the transmissibility of disease, as well as the quality and safety of the vaccine.

Rabies: Rabies vaccination is indicated for anyone who has a greater than average risk of exposure to the virus. **All veterinary personnel that might have contact with animals should therefore be vaccinated against rabies**, except in areas that have been formally declared rabies-free (e.g. Hawaii). This includes lay staff that might have periodic animal contact, such as front office staff. Even animals that are kept indoors can be exposed to rabies by bats, and the disease may not be suspected on initial admission. Rabies vaccines for humans are generally considered safe and highly effective. In areas where rabies is endemic, rabies titres should be checked every 1-2 years to ensure that protective immunity is maintained, with re-vaccination provided as required. For additional information on rabies vaccination in people, see the Canadian Immunization Guide, 7th edition (2006) (http://www.phac-aspc.gc.ca/publicat/cig-gci/p04-rabi-rage-eng.php) or the Centers for Disease Control and Prevention (CDC) rabies website (http://www.cdc.gov/rabies/exposure/preexposure.html).

Tetanus: Although bites and scratches are very low risk for tetanus infection, cuts and scratches from other objects or soil contamination of puncture wounds are still a risk. Therefore, tetanus vaccination is indicated in veterinary personnel. Boosters are generally administered every 10 years.

Influenza: Human influenza is a common and highly transmissible disease, even though it is not transmissible to companion animals. Infected veterinary personnel can rapidly infect their colleagues and veterinary clinics could act as sources of community infection if infected employees are present. It is reasonable for veterinary clinics to recommend annual influenza vaccination of all personnel (as per the recommendations of the Canadian National Advisory Committee on Immunization (NACI)), and to ensure that personnel have time to visit their physician or a vaccination clinic for this purpose. Employees should also be encouraged to stay home if they are ill.

TRAINING AND EDUCATION OF PERSONNEL

Personnel training and education are essential components of an effective infection control program. All personnel, including temporary lay personnel, kennel staff, students and volunteers, should receive education and training about injury prevention and infection control during their initial orientation and periodically thereafter. Additional training should be provided as recommendations change or if problems with infection control practices are identified. Training should emphasize awareness of the hazards associated with individual work duties, and prevention of zoonotic disease exposure. Staff participation in training should be documented by the infection control practitioner (ICP). A list of additional electronic and print resources that may be useful for training purposes can be found under References.

All personnel should receive education and training about injury prevention and infection control.

CLIENT EDUCATION

Client education is the responsibility of the entire practice team. By helping clients understand infectious and zoonotic disease risks and the basic steps they can take to protect themselves and their animals, they can live happier and healthier lives with their pets.

Discussion of zoonotic disease risks should be a routine part of new pet examinations and new client visits. Client education must also occur when the veterinarian has a reasonable suspicion of a potentially infectious disease, and particularly if the disease is zoonotic. Notification of the owner to this effect must be documented in the patient's medical record. This documentation may also be very important legally, should an animal's infection result in human illness.

Client education is the responsibility of the entire practice team.

Items to discuss, information to provide to the client in print form, and/or information to document in the medical record may include:

- What disease is suspected or has been diagnosed
- How the disease is confirmed, if necessary
- How the disease is transmitted
- Risks to members of the household
- Risks to other in-contact individuals (e.g. elderly grandparents who live elsewhere)
- Risks to in-contact pets
- Symptoms in humans
- Clinical signs in animals
- How to prevent disease transmission from the pet to people and to other pets
- How the disease is treated in animals
- Public health enforcement issues such as quarantine, submission of tissues to labs, etc.
- Circumstances under which the client should seek medical attention, if applicable

CLIENT VISITATION

Given the strong bond between owners and their pets, it is understandable when clients wish to visit their hospitalized pets. However, animals carrying transmissible infectious pathogens pose a potential risk to other animals at the clinic and at the owner's home, as well as to the clinic employees, the owner and other household members. **As a policy, clients should not be allowed to visit animals that are considered potentially infectious.** Under extenuating circumstances, such as an animal whose condition is imminently life-threatening, owners may be allowed to visit their animal, but the use of proper personal protective equipment should be demonstrated to the clients and all infection control procedures should be followed, as for clinic personnel involved in the animal's care.

As a policy, clients should not be allowed to visit hospitalized animals carrying any suspected infectious disease.

CLINIC PETS

It is currently common for veterinary clinics to have resident animals. From an infection control perspective, these animals pose a potential risk for disease transmission, and from the health perspective of the clinic pet itself. Clinic animals that have free access within the clinic could be sources of pathogen transmission. Uncontrolled access to waiting room areas could result in a large number of contacts, with the corresponding potential for pathogen transmission. Although there are no objective data quantifying the risks to patients, people or clinic animals themselves, the theoretical risks and lack of a real need for clinic pets indicates a need for consideration of the cost-benefit of keeping clinic pets. Based on the potential risks, it is recommended that veterinary clinics do not keep such animals, and every attempt should be made to adopt out any existing pets.

From an infection control standpoint, veterinary clinics should never have a resident "clinic pet."

While suboptimal from an infection control standpoint, if a clinic has a clinic pet, the following recommendations should be considered. The clinic pet should not have access to any patient treatment areas, patient housing areas, examination rooms, isolation, surgery or the patient waiting area. It should not be allowed to wander freely through the kennel/ward areas where it could cross-contaminate kennels. The animal should have a dedicated food and water bowl, litter box, toys, etc. The pet must also receive regular health checks and have an appropriate vaccination, deworming and external parasite control program. Clinic pets, particularly cats, should not be allowed to have unsupervised outdoor access because of the higher risk of exposure to (and subsequent shedding of) pathogens such as *Salmonella* and *Toxoplasma* from hunting birds and rodents.

VECTOR CONTROL

Some important pathogens can be transmitted by wild rodents (e.g. mice, rats) or insect vectors (e.g. fleas, ticks, mosquitoes, houseflies). A few of these pests can be true carriers of certain diseases, meaning they can be infected by or incubate particular pathogens, but many of them can also be non-specific mechanical vectors that simply move microbes from one area or surface to another. Pest management is an important aspect of effective prevention and control of infectious disease transmission. Pest management practices include:

- Examination of animals upon arrival for ectoparasites such as fleas, and treatment with an adulticidal antiparasitic medication prior to admission if ectoparasites are detected.
- Storing food and garbage in metal or thick plastic containers with tight-fitting lids.
- Prompt disposal of food waste and other material (e.g. feces) that may attract rodents or insects.
- Sealing potential pest points-of-entry into buildings. Common methods include the use of caulk, steel wool or mesh wire under doors and around pipes.
- Installation and maintenance of window screens to prevent entry of insects into buildings.
- Elimination of potential rodent nesting sites (e.g. clutter).
- Removal of standing water (e.g. empty cans, clogged gutters) outside buildings that can otherwise serve as breeding grounds for mosquitoes.

Additional measures may be warranted for the control of specific pests. Consultation with a pest control expert is recommended if a particular infestation is present, or for additional guidance and information.



CLINIC DESIGN

Clinic design is critical to effectively implementing infection control measures. Unfortunately, infection control has not always been considered when designing clinics. Commonly encountered problems include:

- High animal and personnel movement in areas where procedures are performed
- Use of flooring and kennel surfaces that are difficult or impossible to disinfect
- Inadequate (or absent) isolation facilities
- Lack of a separate area to examine or treat animals with potentially infectious diseases
- Lack of sinks in all examination rooms and treatment areas
- Lack of a separate area for diagnostic specimen processing
- Lack of a separate area for staff to store personal items and eat

In established clinics, correcting these deficiencies can be difficult or impossible, and often expensive. However, practical and cost-effective measures can often be undertaken to improve infection control within an existing facility. For example:

- Place alcohol-based hand sanitizers in patient contact areas wherever sink access is inadequate.
- Provide separate refrigerators for diagnostic specimens, vaccines and medications, and food for human consumption.
- Alter personnel and animal movement patterns to reduce direct and indirect contact of relatively healthy patients with sick patients.

Designated staff areas should be set aside for eating, drinking and breaks.
These activities should not occur in any area where animals or diagnostic specimens may be present.

Infection control issues should be considered when designing new clinics or when undertaking renovation or expansion of existing clinics. An architect with experience designing veterinary clinics should be used, and infection control considerations should be emphasized. Consultation or review of preliminary plans by a veterinary infection control expert is also useful. However, critical assessment of plans with an infection control mindset can readily be performed by any veterinarian. Special emphasis should be given to issues such as:

- Number and placement of sinks – a sink should be present in every examination and procedure room.
- Overall clinic flow from “clean to dirty”, with isolation areas well removed from other animal housing or procedure areas.
- Use of sealed flooring materials that are amenable to frequent cleaning and disinfection.
- Separation of animal procedure areas from areas where specimens (i.e. stool) are processed.
- Provision of a dedicated “personnel-only” space for breaks, food storage and consumption, and storage of personal items.

REPORTABLE DISEASES

Certain diseases are immediately reportable to regulatory bodies, often at the time the disease is suspected but still not diagnosed. These diseases vary between countries and tend to focus on exotic pathogens and those of significant zoonotic concern (e.g. rabies). Every veterinary clinic should have a list of reportable diseases prominently displayed in an area easily accessible to clinic personnel. The clinic’s Infection Control Manual should clearly state the required reporting procedures, including contact numbers for the appropriate animal health and/or public health authorities.

See Appendix III on page 68 for case management of rabies suspects.

APPENDICES

APPENDIX I: Detailed Summary of
Infection Prevention and Control Best Practices
For Small Animal Veterinary Clinics

Below is a detailed summary of the contents and key messages of this document. This summary can be used for review, and as an infectious disease control checklist, in addition to the clinic audit tool in Appendix II (page 62).

11. Infection prevention and control strategies are designed to **protect patients, owners, veterinary personnel and the community**. All veterinary personnel should play an active role in protecting every person and animal associated with the veterinary clinic.

12. **Decreasing exposure** to microorganisms is the most important aspect of disease control in most situations.

13. Every veterinary clinic, regardless of type or size, should have a **formal infection control program**, a written infection control manual that describes the program, and an infection control practitioner (ICP) to coordinate the program.

14. Some form of **surveillance** (either passive or active) should be practiced by all veterinary facilities. The keys to passive surveillance are to centralize the available data, and to have a designated ICP who compiles and evaluates the data on a regular basis.

15. **Routine Practices** that are critical to infectious disease prevention and control:
    a. Hand hygiene, including:
        i. Handwashing
        ii. Use of alcohol-based hand sanitizers
    b. Risk reduction strategies, particularly those related to:
        i. Use of personal protective equipment (PPE)
        ii. Cleaning and disinfection
        iii. Laundry
        iv. Waste management
    c. Risk assessment of animals and personnel with regard to:
        i. Disease transmission
        ii. Disease susceptibility
    d. Education
        i. Veterinary personnel
        ii. Animal owners
        iii. Public

16. **Hand hygiene** is the single most important way to prevent infections in the healthcare setting. Intact skin is the first line of defense against bacteria. Hand hygiene of some kind should be performed:
    a. Before and after contact with a patient (especially before performing invasive procedures)
    b. Before and after contact with items in the patient's environment
    c. After any contact with or any activity involving the body fluids of a patient
    d. Before putting on and especially after taking off gloves

17. **Personal protective equipment (PPE)** is used to protect veterinary personnel and to reduce the risk of pathogen transmission by clothing to patients, owners, veterinary personnel and the public.
    a. Street clothes should always be covered by protective outerwear, such as a lab coat, when working in the clinic.
    b. Protective outerwear, including scrubs, should not be worn outside the clinic.
    c. Lab coats and gowns worn when handling patients with potentially infectious diseases should be laundered after *each* use.

d. **Gloves** should be worn when contact with blood, body fluids, secretions, excretions and mucous membranes is possible, as well as when cleaning environmental surfaces and when doing laundry if gross contamination of items is present.
    i. Gloved hands should not be used to touch surfaces that will be touched by people with non-gloved hands.
    ii. Gloves should be removed promptly after use and **hand hygiene** performed immediately.
    iii. Gloves are NOT a substitute for proper hand hygiene.
e. Face protection should be used whenever exposure to splashes or sprays is likely to occur.
f. Designated footwear or disposable shoe covers may be required for some patients with infectious diseases. In veterinary clinics, it is important to prevent the spread of infectious materials present on the floor, as patients and personnel often have very close contact with the floor.

18. **Cleaning** involves the removal of visible organic matter with soap or detergent, whereas **disinfection** involves the application of a chemical or other procedure in order to kill the remaining microorganisms.
    a. Cleaning must always be done before a disinfectant is used.
    b. Gloves should be worn when cleaning and disinfecting, and hands should be washed after finishing any cleaning activity.
    c. **Selection of a disinfectant** for a particular purpose should take into account the product's spectrum of activity, susceptibility to inactivation by organic matter, potential pathogens in the environment, compatibility with soaps and detergents, toxicity for personnel and animals, contact time required, residual activity, corrosiveness, environmental effects and cost.
    d. Multi-use equipment must be properly cleaned and disinfected between each patient. There are three categories of multi-use equipment used on patients: critical, semi-critical and non-critical.
        i. Disinfectant solutions in which a set of instruments is routinely kept are often referred to as "cold sterile," but such instruments are rarely, if ever, truly sterile. The main indication for cold (chemical) sterilization is for items that cannot tolerate steam sterilization, such as endoscopes.

19. **Laundry** is also an important component of a complete infectious disease control program.
    a. Linens used in veterinary clinics should be laundered together using detergent, and dried in a hot air dryer to promote killing of microorganisms.
        i. Laundry from potentially infectious cases should be treated separately from other laundry, including use of bleach in the wash cycle.
        ii. Linens contaminated with gross organic material must be pre-cleaned by hand to remove such material prior to laundering.
        iii. Laundry should not be considered clean until it has also been dried.
    b. Clinic clothing (e.g. scrubs, lab coats) should always be laundered on-site or sent to a commercial laundry facility that is equipped to handle laundry from medical/veterinary facilities.
    c. Always place soiled linens directly in a hamper or bag designated for dirty laundry.
    d. Clean linens should be transported and stored in a manner that prevents contamination.
    e. Personnel should wear appropriate personal protective equipment (e.g. gloves, lab coat) when handling soiled linens, and perform hand hygiene when the task is complete.

20. Veterinary clinic waste is a potential source of both zoonotic and non-zoonotic infectious pathogens. Therefore, it is important to handle all such waste appropriately.
    a. **Biomedical waste** typically includes sharps, tissues (anatomic waste), highly contaminated (e.g. blood-soaked) materials, and dead animals.
    b. All waste should be contained in a leak-proof container or bag that can be discarded with the waste.
    c. Additional precautions should be taken to minimize contamination of the clinic environment and the risks to people and animals from potentially **infectious waste** (e.g. body fluids of and disposable equipment that has come in contact with an infectious animal).

21. All surgical procedures cause breaks in the normal defensive barriers of the skin or mucous membranes, and therefore carry an inherent risk of surgical site infection (SSI). Good general infection control practices (e.g. hand hygiene, cleaning and disinfection) are important for prevention of SSIs, but there are also specific infection control measures pertaining to surgery that should be considered.
    a. A surgical area should only be used for surgical procedures.
    b. All personnel in the surgical area should wear **designated surgical scrubs**, a surgery cap or hair bonnet, and a nose-and-mouth mask when surgery is underway.
        i. Scrubs worn in surgery should not be worn when handling or treating other patients, and should be covered with a lab coat outside of the surgical suite.
    c. Steam sterilization (i.e. **autoclaving**) is most commonly used in veterinary clinics for sterilization of surgical instuments. Quality control testing of autoclaves should be performed regularly.
    d. At a minimum, **anesthetic equipment**, including endotracheal (ET) tubes, must be thoroughly cleaned (inside and outside) with hot water and detergent immediately after use to prevent any discharge or debris from drying and forming a biofilm on the device. Additional disinfection may be required for certain pieces of equipment or under particular circumstances.
    e. **Peri-operative antimicrobials** are indicated in clean-contaminated, contaminated and dirty procedures. The need for antimicrobial prophylaxis in clean procedures is unclear.
        i. If peri-operative antimicrobials are used, they should be administered so that therapeutic levels are present at the surgical site at the time of first incision. Starting antimicrobial therapy after surgery is no more effective than not using antimicrobials at all.
    f. Clipping (not shaving) of the surgical site should only be performed right before surgery. Use of good quality, well-maintained clippers and blades helps to reduce the risk of skin abrasions which can provide sites for invasion and proliferation of opportunistic bacteria.
    g. Refillable containers in which skin preparation solutions (e.g. antibacterial soap and water, alcohol, chlorhexidine, iodine) are kept must be disinfected when empty before being refilled, as contamination of these solutions with bacteria that are resistant to their respective antimicrobial actions can occur.
    h. Contact with a surgical incision post-operatively, particularly with bare hands, should be avoided.
        i. Bandage changes should be performed using aseptic technique.
        ii. Pet owners and handlers should be instructed on how to manage an animal with an incision, and the signs for which to look that may indicate the development of a SSI.

22. Every veterinary clinic should have an isolation area for caring for and housing animals with potentially contagious infectious diseases.
    a. Only the equipment and materials needed for the care and treatment of the *individual* animal should be kept in the isolation room. All items entering an occupied isolation area should be considered infectious and disposed of or disinfected after discharge of the patient.
    b. Access to the isolation room should be limited to the minimum number of essential personnel.
    c. All personnel entering an isolation area, regardless of whether they plan on having direct contact with the animal, must wear appropriate personal protective clothing.
        i. Designated personal protective equipment must remain in the isolation room.
    d. All waste from an isolation room should be treated as potentially infectious.
    e. Dogs that are housed in isolation should not be walked nor allowed to urinate or defecate in public areas or areas used by other animals.

23. As a policy, clients should not be allowed to visit hospitalized animals carrying any suspected infectious disease.

24. Footwear and floor surfaces cannot be overlooked in an infection control program in a small animal clinic, because patients so often have extensive direct contact with the floor.
    a. Footbaths or footmats should be considered when personnel will be walking on a surface that could potentially be more contaminated than the general floor environment, and where spread of this contamination might pose a risk to patients or personnel. Maintaining proper concentrations of active disinfectants in footbaths and footmats is essential for proper performance.

25. Wound infections can be caused by many bacterial pathogens, some of which can be transmitted between animals or between animals and people. Wounds provide a prime site for invasion of opportunistic bacteria.
    a. Sterile gloves should be worn for debridement, treatment and bandaging of deep wounds and those involving vital structures. Clean, non-sterile gloves are adequate for more superficial wounds.
    b. Bandages must be kept dry to prevent bacterial strike-though.
    c. Used bandage materials should be considered infectious.
    d. Wound treatments and bandage changes should be performed in an area that is easily disinfected.
    e. Hands should be washed thoroughly after changing a bandage, and equipment used for bandage changes should be disinfected between uses.
    f. Animals with known multi-resistant bacterial wound infections are likely to be colonized with these pathogens at other body sites as well (e.g. nose, rectum, intestinal tract), and should therefore be handled with contact precautions and housed in isolation.

26. It should be clinic policy not to feed **raw meat** to hospitalized animals.

27. **Animals from shelters** and similar facilities should be considered high risk from an infectious disease standpoint. All animals from such facilities should be examined immediately upon arrival without coming in contact with other animals in the waiting/reception area. Animals from these facilities should be housed separately from other patients, if possible.
    a. For elective procedures (e.g. spay, neuter), all animals should be appropriately vaccinated for their age and treated for relevant intestinal parasites and ectoparasites. Animals with clinical signs compatible with an infectious disease should not be admitted for elective procedures.

28. Personnel should take all necessary precautions to prevent animal-related injuries (e.g. bites, scratches) in the clinic, including physical or chemical restraint of an animal, if necessary. Experienced veterinary personnel rather than owners should restrain animals for procedures whenever possible.
    a. If anyone is bitten or scratched by an animal:
        i. Immediately wash the wound thoroughly with plenty of soap and water.
        ii. Report the incident to the local public health unit (due to risk of rabies exposure).
        iii. Seek medical attention for bite wounds in certain locations on the body, and for any bite wound in certain persons, such as immunocompromised individuals.

29. Proper sharps handling practices are a practical yet effective way of reducing workplace injuries in veterinary clinics.
    a. The most important precaution for preventing needle-stick injuries is to **avoid recapping needles**.
    b. Ensure that approved point-of-use sharps disposal containers are located everywhere needles are handled. Never dispose of needles or other sharps into anything other than an approved sharps container
    c. If owners are required to treat their animals at home with injectable medications, ensure that the client is able to safely handle and dispose of sharps.

30. Urine from animals with suspected urinary tract disease, and all feces, aspirates, and swabs should be treated as potentially infectious material.
    a. Protective outerwear (e.g. lab coat) and disposable gloves should be worn when handling these specimens.
    b. Avoiding touching clean items (e.g., microscopes, telephones, food) while handling specimens or before glove removal.
    c. A separate refrigerator should be used to store diagnostic specimens, which should be cleaned on a regular basis.
    d. A designated area of the clinic should be used for specimen processing.

31. Persons performing **dental procedures**, and anyone in the immediate vicinity, should wear appropriate protective outerwear (e.g. designated lab coat), disposable gloves, a surgical (i.e. nose and mouth) mask and protective eye glasses/goggles, or a full face shield.
    a. Dental procedures should be performed in a contained area away from other patients, personnel and high traffic areas.

32. Personnel involved in or present at necropsies should wear appropriate protective outerwear (e.g. designated lab coat), disposable gloves, protective eye glasses/goggles, or a full face shield.
    a. It is recommended that in-clinic necropsies **not** be conducted on any animal suspected of being infected with a pathogen requiring biosafety precautions above level 2. Instead the entire body should be submitted to an approved diagnostic laboratory. Ensure that all requirements for shipment of biological samples are met, including providing notification of any suspected infectious disease in order to protect laboratory personnel.

33. **All veterinary personnel that might have contact with animals should be vaccinated against rabies**, except in areas that have been formally declared rabies-free. This includes lay staff that might have periodic animal contact, such as front office staff.

34. All personnel should receive **education and training** about injury prevention and infection control, including temporary lay personnel, kennel staff, students and volunteers.

35. **Client education** is the responsibility of the entire practice team.
    a. Discussion of zoonotic and infectious disease risks should be a routine part of new pet examinations and new client visits.
    b. Client education must also occur when the veterinarian has a reasonable suspicion of a potentially infectious disease, and particularly if the disease is zoonotic.
36. From an infection control standpoint, veterinary clinics should never have a resident "clinic pet."

37. **Pest management** is an important aspect of effective prevention and control of infectious disease transmission, including Examination of animals upon arrival for ectoparasites, proper storage of food and waste, sealing potential pest points-of-entry into buildings, elimination of potential rodent nesting sites, and removal of standing water outside buildings.

38. Infection control issues should be considered when **designing** new clinics or when undertaking **renovation** or **expansion** of existing clinics.
    a. Designated staff areas should be set aside for eating, drinking and breaks. These activities should not occur in any area where animals or diagnostic specimens may be present.

39. Every veterinary clinic should have a list of reportable diseases prominently displayed in an area easily accessible to clinic personnel. The clinic's Infection Control Manual should clearly state the required reporting procedures, including contact numbers for the appropriate animal health and/or public health authorities.



APPENDIX II: INFECTIOUS DISEASE CONTROL AUDIT FOR SMALL ANIMAL VETERINARY CLINICS

Areas / Items	Fully Implemented	Partly Implemented	Not Implemented	Not Applicable	Comments
Clinic design:					
Designated isolation area					
Designated diagnostic specimen handling area					
Designated staff “break” area					
Clinic “flow” (clean to dirty)					
Protective equipment available:					
Gloves:					
Household rubber, reusable					
Latex or other, disposable					
Masks:					
Nose and mouth (e.g. surgical) masks					
N95 masks, including fit testing					
Gowns					
Lab coats					
Goggles/eye protection					
Written policies for dress code:					
No jewellery (rings or bracelets)					
No nail enhancements					
Hand hygiene:					
Alcohol-based hand sanitizer stations available					

Areas / Items	Fully Implemented	Partly Implemented	Not Implemented	Not Applicable	Comments
Signage for alcohol-based hand sanitizers with instructions					
Signage for hand washing with instructions					
Staff can identify when to use hand hygiene:					
Before and after patient care					
Before aseptic practices					
Before putting on and after taking off gloves					
After contact with body fluids or mucous membranes					
After contact with contaminated equipment					
After personal body functions (i.e. sneezing, coughing)					
Before eating					
Cleaning and disinfecting procedures:					
Written protocols and procedures for cleaning provided					
Written protocols and procedures for cleaning followed					
Approved and appropriate detergents are available					
Appropriate disinfectant products with a DIN number are available for patient-contact surfaces					
Approved and appropriate disinfectant products are available for equipment and instruments					
Cleaning and disinfection protocol for clippers					
Disinfection / sterilization of medical devices:					
Proper cold sterilization technique is used (i.e. product concentration, contact time, equipment properly cleaned before sterilized)					

Areas / Items	Fully Implemented	Partly Implemented	Not Implemented	Not Applicable	Comments
Cold sterilization solution is changed regularly					
Manufacturer's instructions are followed					
Process for cleaning semi-critical and critical devices including written protocol for: disassembly sorting and soaking physical removal of organic material rinsing drying physical inspection wrapping					
Laundry:					
Laundry is performed on site or by or a commercial service					
Laundry is dried at high temperatures (65-70^{o}C)					
Infectious laundry is pre-soaked in bleach solution					
Soiled laundry is transported in a clean manner					
Clean laundry is segregated from soiled laundry					
Hand hygiene is available in laundry area					
Education is provided regarding protective practices					
Sharps handling:					
Approved puncture-resistant, labeled containers used					
Containers not more than 3/4 filled					
Containers are accessible in all required areas					
Sharps are disposed immediately after use					

Areas / Items	Fully Implemented	Partly Implemented	Not Implemented	Not Applicable	Comments
Waste segregation:					
Clear guidelines regarding waste that is:					
Biohazardous					
Non-biohazardous					
Vector control:					
Rodent control is apparent:					
Food debris and clutter eliminated					
Points of entry for rodents are sealed					
No standing water outside clinic					
Windows are screened					
Documentation of staff immunization:					
Rabies					
Tetanus					
Influenza					
Examination rooms:					
Hand washing sinks with soap available in all rooms					
Exam rooms only have essential supplies					
Policies enforced for cleaning exam rooms between patients and at the end of the day					
Enhanced cleaning/disinfection protocol in place for cleaning rooms where an infectious case may have been					
Written procedures for potential exposure of staff to zoonotic pathogens					

Areas / Items	Fully Implemented	Partly Implemented	Not Implemented	Not Applicable	Comments
Separate fridges for food, vaccines and medications, and diagnostic specimens					
Protocol development and staff training:					
Documented annual staff training and updating on infection prevention and control measures					
Documented annual staff training on use of personal protective equipment					
Infection control program:					
Infection control practitioner (ICP) is designated in the clinic to oversee the infection control program					
Surveillance (active or passive) in place					
Surgical site infections are reported to ICP					
All new staff are provided with a copy of the infection control protocols and a signature confirming receipt and understanding is obtained					
A list of reportable diseases is readily available in the clinic					
Contact numbers for the appropriate veterinary (CFIA in Canada) and public health (regional public health unit) are readily available in the clinic					
Autoclave:					
Quality control sterility indicators are included in each autoclaved pack					
Biological indicators are periodically used to ensure adequate sterilization and results are recorded in a log					
All autoclaved packs are marked with date of autoclaving					

Areas / Items	Fully Implemented	Partly Implemented	Not Implemented	Not Applicable	Comments
Isolation area:					
Dedicated Isolation area for animals with infectious diseases is available and clearly marked					
Room vented to outside, or exhaust air HEPA filtered					
Equipment and PPE stay in the Isolation area					
Signage available and appropriate					
Footbaths or footmats available					
Miscellaneous:					
No clinic pets					
Policy not to feed patients raw meat					
Printed materials for clients on zoonotic diseases available					
Written policy on admitting animals from shelters					
A list of syndromes of potentially infectious diseases (i.e. acute diarrhea, acute upper respiratory tract infection) is provided to front office staff, who are required to contact a veterinarian when an appointment is made to determine whether special infection control practices are required prior to the animal entering the clinic					

Suggestion for use of the audit tool: The designated Infection Control Practitioner (ICP) can use the above audit tool annually (or more frequently) to document improvements in "score" over time, and to identify changes needed to be addressed in the next 3, 6 , 9 or 12 months. Improvements can be incremental. Ask different people in the practice to carry out the audit, and compare results at a practice quality control meeting – they may be surprising!

APPENDIX III: MANAGEMENT OF RABIES SUSPECTS

Animals with acute neurological disease are commonly encountered in companion animal practice. Although in most areas it is rare for these animals to have rabies, rabies must be considered in many situations due to the potential devastating consequences of human exposure to the rabies virus. It is important to err on the side of caution when determining whether to declare an animal a "rabies suspect." A history of rabies vaccination should not be used to rule out the possibility of rabies. If an animal is suspected of having rabies, the following must be carried out by the attending veterinarian:

1. Notify the owner that rabies is being considered. The owner should be told about the potential for zoonotic transmission, that the animal will be tested for rabies if it dies/is euthanized and rabies is still considered a possible diagnosis, and that the owner should make a list of individuals that have been in contact with the animal recently. The owner should be asked whether the animal has bitten anyone in the past 10 days. This information should be documented in the medical record.
2. Notify the clinic's Infection Control Practitioner or equivalent.
3. Notify the local animal health and public health authorities. In Canada, these are the district office of the Canadian Food Inspection Agency (CFIA), and the local provincial or municipal public health unit.
4. The animal must be placed under strict isolation with a clear warning sign that the animal is not to be handled unless otherwise directed by the attending veterinarian. **Entry into isolation and treatment of the patient should be limited to the minimum number of personnel necessary.**
5. A clear "Rabies Suspect" sheet must be placed on the cage door. The names of all personnel coming into contact with the animal must be recorded on this sheet.
6. If additional diagnostics or treatments are required, all staff must be informed that the animal is a rabies suspect. Personnel should not be forced to handle the animal if they do not wish to do so.
7. Invasive procedures and procedures likely to result in contact with bodily fluids should be avoided.
8. Anyone handling the animal must wear protective barrier clothing including gloves, gown and face protection. Ensure that any areas of broken skin are securely protected by a bandage or other clothing.
9. Rabid animals can have very unpredictable behavior, therefore additional precautions such as the use of catch poles and heavy gloves should be employed to reduce the risk of bite injury occurring.
10. Do not euthanize the animal unless it is in extremis, or authorized to do so by the owner and the appropriate authorities.
11. If an individual is exposed through a bite or potential salivary contamination of a wound or mucous membrane,
    a. IMMEDIATELY and THOROUGHLY wash the wound/area with copious amounts of soap and water for at least ten minutes. Small wounds should be allowed to bleed to help flush the virus from the tissues.
    b. The wound should then be disinfected using a compound of proven lethal effect for rabies virus (e.g. 0.1% benzalkoniumchloride, 43.70% ethanol, tincture of thimerosal, tincture of iodine up to 0.01% aqueous solution of iodine).
    c. The individual must then immediately seek medical attention in order to receive post-exposure prophylaxis as soon as possible.
    d. All bites should also be reported to the local public health unit.
12. If rabies is ultimately confirmed, public health personnel will determine need for rabies post-exposure prophylaxis for each individual who had contact with the animal, depending on the circumstances for each.

Local and national requirements regarding potential rabies cases may vary, however every veterinary clinic must be aware of proper procedure in its area, which should be prominently displayed for clinic staff, and include current contact information for the appropriate authorities.

In Canada, any animal that dies or is euthanized within ten days of biting a person must be submitted to the Canadian Food Inspection Agency (CFIA) for rabies testing. If any animal has physical contact with a potentially rabid animal, including any and all bats, the CFIA must be notified of the case immediately. The local CFIA inspector will then advise those involved regarding quarantine times and revaccination requirements.

APPENDIX IV: CORE COMPETENCIES IN INFECTION PREVENTION AND CONTROL FOR VETERINARY CLINIC PERSONNEL (adapted from CHICA-Canada)

All staff members of a veterinary clinic should know and understand the infection control responsibilities within the expected scope of their job activities. Staff members should not be allowed to work outside of these activities until they understand and have been appropriately trained in the infection control protocols pertaining to their added job activities.

Area of Competency	**Detailed Core Competency**
Critical assessment skills	Critical assessment skills related to exposure to infectious agents, awareness of zoonotic infections, and use of infectious disease specific protocols
Basic rationale for routine practices	Understands basic microbiology and how infections can be transmitted in veterinary clinic settings
Personal safety	Knows how to appropriately manage sharps, and body fluids.
	Understands the role of vaccines in preventing rabies, tetanus and influenza
Routine practices	Understands the importance of hand hygiene
	Understands the activities of Routine Practices
	Demonstrates appropriate use of Personal Protective Equipment (PPE)
Additional precautions	Understands need for additional precautions depending on disease conditions and agents
Cleaning, disinfection, sterilization; waste management	Maintains a safe and clean environment
	Understands importance of using PPE when sorting laundry
	Recognizes that re-useable equipment that has been in direct contact with an animal should be cleaned and reprocessed before use in the care of another animal
	Appreciates the differences between clean, disinfected (low, medium, and high-level) and sterile items
	Knows the difference between regular, potentially infectious and biomedical wastes

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