Intro

What is Biosecurity? Biosecurity is the implementation of practices that create barriers in order to reduce the risk of the introduction and spread of disease agents

“Bio” = Life  “Security” = Protection

Biosecurity = safety for living things

You, your family, pets, coworkers, patients, wild populations...

Disease transfer

Spread between animals

Zoonotic disease

Spread from animals to humans Biosecurity = prevention!

Infection Control and Prevention

Infectious disease -

Exposure: amount of agent
Vulnerability: animal’s ability to resist
Pathogenicity: agent’s ability to cause disease

Reduce exposure = reduce disease
Captivity (increased exposure + stress) = more vulnerable

Infectious disease can spread by contact with...

Humans (hands, clothing)
Housing (cages)
Supplies (dishes, stethoscope)
Food
Patients (close contact)
Wildlife

https://youtu.be/u0pj3zAFXQA
Disease causing agents (or pathogens) can be spread from animal-to-animal or animal-to-human through a variety of transmission routes.

- **Aerosol** — Droplets containing pathogens travel through the air and are inhaled by another animal or human.

- **Oral** — Ingestion of disease causing agents from contaminated food, water or by licking or chewing contaminated objects in the environment.

- **Direct contact** — Spread of pathogens through contact with open wounds, mucous membranes, or abraded skin contacting an infected animal or its tissues or fluids (e.g., blood, saliva, urine). Inoculation of pathogens can occur from bites or scratches.

- **Reproductive** — A subtype of direct contact that involves pathogens spread by contact with reproductive fluids or tissues. In animals, pathogens may be spread during breeding or between mother and offspring.

- **Fomite** — Spread of pathogens through contact with objects or surfaces contaminated by an infected animal.

- **Vector-borne** — Transfer of a pathogen from an infected animal to another animal or a human by an insect (e.g., flea, tick, mosquito).

- **Zoonoses** — Diseases spread between animals and humans.

Environmental contamination must always be taken into consideration.
Zoonotic Disease: A disease spread between animals and people
  Zooanthroponosis
  Reverse zoonosis
  Human -> Animal
  Anthropozoonosis
  Animal -> Human

Implementation Overview

According to AAHA (American Animal Hospital Association):

Every veterinary practice should have a documented ICPB (Infection Control, Prevention, and Biosecurity) program.

- This applies to Wildlife Rehabilitation facilities as well!

At a minimum this involves:

- A collection of agreed-upon basic infection control practices and accompanying SOPs
- Formal manual incorporating specific staff education and training
- Client/public education
- Surveillance
- Compliance programs

Hierarchy of Controls

Elimination of sources of pathogen exposure involves physically removing (or preventing) the hazard (i.e., pathogen) from entering the facility. Although completely eliminating infected animals from a facility is unlikely to occur, measures can be taken to prevent patients from infecting the general population. While elimination controls are the most effective at reducing hazards, they are often the most difficult to implement.

Engineering controls include measures designed into the facility to remove a hazard at its source or to improve compliance with infection control procedures. These measures can be highly effective but generally have higher initial costs.

Administrative controls include protocols or changes to work practices, policies, or procedures to keep patients or staff separated from a known hazard as well as providing staff with information, training, and supervision for these measures. Administrative controls address the way people work and how animals move through the hospital (traffic flow) when an onsite infectious disease is known or suspected.

Personal protective equipment (PPE) includes the use of special clothing and equipment to protect staff and patients who may be exposed to known or suspected pathogens. PPE places a barrier between staff and an exposure risk (e.g., infected animal, diagnostic specimens) and with appropriate use, helps prevent the spread of...
pathogens between animals and within the practice. The use of PPE is considered a relatively less effective means of controlling exposures because it relies on human factors such as staff compliance and appropriate education and training. Although less effective, lower tiers (e.g., PPE) remain critical for effective infection control and should be used when indicated.

From 2018 AAHA ICPB Guidelines

- **Elimination**: Removes or prevents entry of the pathogen
- **Engineering Controls**: Hospital design and setup to remove the opportunity for pathogen exposure at the source or improve compliance
- **Administrative Controls**: Work policies and procedures that prevent pathogen exposure
- **PPE**: Personal protective equipment used to prevent pathogen exposure and spread

**Developing a Biosecurity Plan**

1. Assign Staff Role
2. Identify and Develop Protocols/Checklists
3. Perform Initial Assessment
4. Staff Education/Training
5. Client Education
6. Develop and Implement Surveillance Program
7. Establish and Maintain Compliance Evaluation Program

**Assign staff member** (VIP Veterinary Infection Preventionist, ICP Infection Control Practitioner) to oversee and champion the development of and implementation of the program

1. Program development, maintenance, compliance, and evaluation
2. Staff training development and documentation
3. Protocol compliance evaluation
4. A go-to person for reporting infection control concerns, including suspected HAIs (Hospital Acquired Infections)
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Identify and Develop Protocols/Checklists
- Hand hygiene
- Cleaning and disinfection
- Sequence for putting on and removing PPE
- Identifying high-risk patients
- Entering and exiting isolation or dedicated areas for high-risk patients
- Necropsy procedures
- Checklists of key tasks are known to improve compliance throughout the practice workplace

Initial Assessment

Identify strengths and areas for improvement
Tools can assist with this
- AAHA Biosecurity tracker
Examine all key areas of current program
- Hand Hygiene
- Cleaning and Disinfection
- Identification/housing of high-risk patients
- PPE
- Etc...
Identify current risk mitigation
- Presence of written protocols
  - Staff knowledge of and compliance with protocols
Identify areas of the facility on which to focus most immediate attention

Staff Education and Training

All personnel with access to your facility should receive infection control training: During orientation and at least annually
- Tailored to individual job duties
- Emphasize health risks and existing protocols to reduce infection-related hazards. Checklist of required readings
- Meetings with key staff
- Electronic resources to review
- Completion documentation
- Final Assessment

Client Education

Applicable to Wildlife Rehabilitation

We are a resource for public (our clients)

Identify, catalog, and make readily available resources on common infectious and zoonotic diseases
- Basic steps to protect themselves, household members, their pets
- Direct them to helpful resources already available – CDC, DNR
- Some applicable diseases:
  - Rabies
  - West Nile Virus
  - Avian Influenza
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• Baylisascaris
• Distemper
• Other diseases as applicable

Surveillance Program
Develop and implement a surveillance program

Surveillance: the routine collection of information with defined responses

• Provides feedback on effectiveness of infection control program
• Helps to identify areas of weakness
• Provides a warning to allow for an early response to a concern
• Reducing staff/patient illness
• Saving costs
• Saving time
Passive vs Active Surveillance

Passive Surveillance: Using data that is already available
- Disease rates
- Antimicrobial susceptibility patterns
- Trends
- Identify changes that may indicate infection control problem
- Routine recording of animals with specific diagnoses or symptoms
- Centralize available data and analyze

Active Surveillance: Gathering data specifically for infection control
- Fluorescent tagging
- Culturing

Must analyze data to be effective!

Compliance Evaluation Program

Establish and maintain a compliance evaluation program
- Ensure practices align with protocols
- Goals are being met
- Continued improvement occurs
- Audit tool – repeat initial assessment
- Inspection of physical environment
- Review of ICPB practices
- Assessment of workers’ knowledge and application of infection control principles
- Performed regularly
- Establish benchmarks, identify and prioritize needs, and identify resources and timelines to meet benchmarks
- Incorporate other team members into process

Applications

Traffic Flow

Clean → Dirty
Always keep in mind.

Flow of:
- Animals
- People
- Laundry
- Waste

New Intakes

New patients are to be kept in a separate area than other patients
Quarantine period away from other patients
Consider cause of admission as a hint of possible illness
Use diagnostics to rule out infection
Stay knowledgeable about outbreaks
Consider species and risks to facility
Example: Cooper’s Hawks = Mite Protocol

Building Resistance
What we can do:
• Limit stress
• Provide adequate nutrition, housing, enrichment
• Vaccinate when appropriate (Raccoons)
• Prophylactic medications when appropriate

External factors + natural genetic disposition = susceptibility - animal's ability to resist disease

External factors:
• Nutritional
• Environmental
• Pharmacological
• Immunological practices

Arriving at Work
Dedicated Work Clothes/Shoes
Pet cuddles? – not ideal
What did you touch last? Wash hands before starting work.

Hand Hygiene Easiest and most effective way to prevent the spread of infections

Reduce the number of microorganisms on the hands
• Washing with soap/water (most effective for dirty hands)
• Alcohol-based hand sanitizer (not visibly soiled)

Have hand washing/sanitizer stations readily available in all key areas
When to perform hand hygiene
• Before and after contact with a patient
• After contact with items in the patient’s environment
• Before any aseptic or invasive procedure
• Before putting on and especially after taking off gloves
• After any contact with or any activity involving the body fluids of a patient
• Before eating food or having any hand-to-mouth contact
• After personal body functions, such as using the toilet or blowing one’s nose

PPE
Personal protective equipment (PPE), including dedicated hospital attire, is an important routine infection control tool. Use of PPE reduces the risk of contamination of personal clothing, exposure of skin and mucus membranes of clinic personnel to pathogens, and transmission of pathogens between patients by staff. Use of PPE does not eliminate the need for appropriate environmental controls, such as hazard removal and separation of patient areas from staff rooms

Lab coats: meant to protect clothing from contamination
• Not usually fluid resistant
• To be worn during patient handling
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Removal of gloves is required after:
- Visibly soiled
- Contaminated by bodily fluids
- End of each day

Scrub: similar to lab coats but are worn in place of street clothes
Ideal to have dedicated clothes (and shoes) for work
Launder on site if possible

Non-sterile gowns: provide more coverage than a lab coat
Worn while handling animals with suspected or confirmed illness
Cover torso and arms and fit snugly at the waist
Do not reuse disposable gowns
Launder reusable fabric gowns after each use

Gloves: reduce risk of pathogen transmission by providing a protective barrier to bare hands
Many types
Choose appropriate size
Wash hands after removing gloves
Change gloves (and wash hands) frequently
- 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 are NOT a substitute for proper hand hygiene

Handling gloves: serve as a form of protection from fractious/wild animals
Disinfection considerations

Face protection: prevent exposure of the mucus membranes to infectious materials
Surgical mask
Goggles
Face shield

Respiratory protection: designed to protect the respiratory tract from infectious pathogens transmitted through the air
N95-rated respirator: Fit testing

Footwear: reduce risk of injury from dropped instruments, scratches; protect feet from potentially infectious substances
Closed toe, cleanable footwear, slip resistant Shoe covers

Safety of Facility Personnel

Bites, Puncture, and Scratches: Inherent risk of wildlife rehabilitation
- Appropriate protective gear
- Behavioral signs of stress, fear, or anxiety
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- Make note of particularly aggressive patients and communicate
- Maintain emergency contact information for staff/volunteers
- Seek medical attention when appropriate
  - Immediately wash the wound with soap and water and remove visible debris.
- Consider animal type: Rabies vector, poisonous bites, known infection status, etc.
- Clearly document all injuries

**Sharps**: Injuries from needles or other sharp implements, largely preventable
  - Physical trauma, secondary infection, or drug reactions
  - Proper sharps handling and disposal

**Vaccination**: Considered last line of protection but is advisable for most wildlife staff
  - Consider the severity of the disease, risk of exposure, treatment options, transmissibility of disease, and quality and safety of the vaccine
  - Rabies: recommended for those working with rabies vector species
  - Tetanus: recommended for all in the wildlife field
  - Influenza (human): recommended to prevent spread between humans

**High-risk personnel**: should consult with their physician to identify hazardous situations that should be avoided or handled with altered practices or precautions
  - Pregnancy
  - Immunocompromised individuals

Important to remember that infection control practices of the entire clinic play a critical role in the overall safety of its individual members

**Laboratory Safety**

**Laboratory personnel**: properly trained in specimen handling, testing, and biosafety practices

**Laboratory area**: designated area, separate from treatment and surgery rooms.

  - Dispose of sharps and slides appropriately
  - Dispose of samples appropriately
  - Clean and disinfect area immediately after use
  - Perform hand hygiene
  - Designated Laboratory sink
  - Surfaces that are easily cleaned and disinfected

**Handling of biological specimens**: urine, feces, aspirates, and swabs should be treated as potentially infectious material.

  - Wear proper PPE
  - Carefully fill specimen container (avoid contamination of outer surfaces)
  - Appropriate packaging if being sent out – leak proof containers designed for the specimen placed in a secondary clean, sealed, plastic bag.

**Spill plan**: written plan available that details the response to large or small spills, appropriate for the substances that are handled. Material Safety Data Sheets (MSDS) should be organized and available for all chemicals and help with developing the spill plans.
In-house bacterial and fungal cultures: consider increased risk associated with these procedures, as well as regional regulations for manipulating biohazardous agents
  • Knowledge of laboratory biosafety practices, compliant with BSL-2 (Biosafety level 2) practices
  • Must be done right, in terms of quality and safety
  • Never perform on-site cultures from animals suspected of harboring a BSL-3 pathogen
  • *Yersinia pestis* (plague), *Francisella tularensis* (tularemia), and *Brucella* spp.

**Cleaning and Disinfection**
Minimize spread = limit the course of infectious diseases
Disinfection
Removal/Eradication
Failure to sanitize completely → reinfection/spread

**Choosing a Disinfectant**
- Kill Claims
- Contact Time
- Safety of the Product
  - Surfaces
  - Equipment
  - Human -PPE
  - Patients
- Ease of Use
- Other Questions: Manufacturer provided training? Cost?

**Keep it Clean!**
The easiest and most important principle to implement is keeping things in the facility clean. Yourself!
  - Hand washing
  - Dedicated gear

Patients
  - Daily cleaning
  - Daily change of food & water Equipment

& facilities
  - Detergent – remove organics
  - Disinfectant – remove agents of disease Contact time

Disposal of waste and carcasses

**Cleaning and Disinfection**
Have Material Safety Data Sheets (MSDS) available
Train all applicable personnel on use of disinfectants
Rooms and cages should be cleaned and disinfected regularly
  • Place signage on cages to indicate status “Needs disinfection”
  • Helpful to have color-coded signage (one color for biosecurity related signage)
1. Remove all bedding and organic material
2. “Dry” clean to remove loose organic material
3. “Wet” clean with warm water and detergent
4. Rinse with clean water
5. Allow to dry or manually do so
6. Apply disinfectant
   Consult the label
7. Rinse thoroughly
8. Allow to dry as much as possible before reintroducing animals
9. If known contaminated/high-risk area: a second application of a wide spectrum disinfectant should be considered

### Laundry Collection and Handling

<table>
<thead>
<tr>
<th>Single-use, disposable linens are ideal</th>
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<td>- Costly and produce tremendous waste</td>
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Clinic clothing and linens are laundered on site or sent to commercial laundry facility equipped to handle veterinary/medical laundry

Wear PPE while doing laundry or touching dirty linens Gloves, gown/apron, mask?

Remove large amount of solid debris, feces, blood clots from linens with gloved hand and paper towel Place laundry in designated laundry bin/laundry bag - Not on the floor

Clean laundry bins regularly (ideally after each use)

Laundry bags can be washed along with the linens that they contain

Contaminated laundry from critical areas (Surgery, Isolation): Kept in closed bins with a bag, bag brought to laundry room at end of day or as required

Linens transported via cart should not be moved from dirty to clean

Dedicated clean to dirty flow should be established

Contain wet laundry in a plastic bag and dispose of bag after use

Store in a manner to prevent contamination

Separate cart/bin for clean and dirty laundry

Clean laundry should be stored in cabinet that has doors that can close

Do not store clean laundry in the laundry room

Commercial and home washing machines are sufficient to reduce the amount of most infectious pathogens

- If cold water wash – use appropriate cold water detergent
- Hot washing is usually not enough to disinfect/sterilize ○ 160 degrees F/71 degrees C for 25 min would be required – not capable on most household washing machines
- Heat and drying effects of tumble/hot air drying is critical ○ Accounts for a large proportion of the decrease in bacterial counts
- Laundry not considered clean until completely dry, ideally at highest heat possible
- Infectious laundry should be washed separately ○ Remove as much debris as possible
  - Pre-soak in a bleach solution 10-15 min prior to washing
  - Add bleach to washing machine ○ Tumble dry at highest heat setting possible
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Kitchen

Clean: Wash your hands and surfaces often. Germs that cause food poisoning can survive in many places and spread around your kitchen.
Wash hands for 20 seconds with soap and water before, during, and after preparing food and before eating.
Wash your utensils, cutting boards, and countertops with hot, soapy water. Rinse fresh fruits and vegetables under running water.

Separate: Don’t cross-contaminate
Raw meat, poultry, seafood, and eggs can spread germs to ready-to-eat foods—unless you keep them separate.
Use separate cutting boards and plates for raw meat, poultry, and seafood.
Bottom shelf is coldest and preferred meat location.
If possible: a separate refrigerator for meat and produce would be preferred.
If possible: do not store carcasses, medications/vaccines, or human food/medications in patient food refrigerator/freezer.

Cook: When cooked eggs are served the egg white should be firm and not be left at room temperature for more than 30 min. Refrigerate unused portions.

Chill: Refrigerate promptly
Bacteria can multiply rapidly if left at room temperature or in the “Danger Zone” between 40°F and 140°F.
Never leave perishable food out for more than 2 hours (or 1 hour if it’s hotter than 90°F outside).
Keep your refrigerator below 40°F and know when to throw food out
Refrigerate perishable food within 2 hours. (If outdoor temperature is above 90°F, refrigerate within 1 hour.)
Thaw frozen food safely in the refrigerator, in cold water, or in the microwave. Never thaw foods on the counter, because bacteria multiply quickly in the parts of the food that reach room temperature. Refrigerate fruits, vegetables, milk, eggs, and meats within 2 hours. (Refrigerate within 1 hour if the temperature outside is above 90°F.)
Divide warm foods into several clean, shallow containers so they will chill faster.
Store raw meat on the bottom shelf away from fresh produce and ready-to-eat food. Throw out foods left unrefrigerated for over 2 hours.

Mortalities

A fact of life in raptor rehabilitation
Non-infectious and infectious disease
Unexpected illness/death
Suspicious for infectious +/- reportable disease

Necropsy
Ideal: all mortalities
Practical: unexpected, suspicious
Veterinarian or diagnostic lab

Diagnostic lab
Set up arrangement prior
To lab ASAP
Refrigerate
DO NOT freeze
Waste Management – Carcass Disposal

Biomedical waste is a potential source of both zoonotic and non-zoonotic infectious pathogens
- Sharps, Tissues, Highly contaminated materials, Carcasses

Disposal requirements are dependent on local area regulations
- Leak-proof container with bag that can be discarded
- Empty waste bins at the end of the day
- Store carcasses and waste separately from food/medication storage

Examples

Infection Identified:

Implement quarantine protocol
- Separate equipment dedicated to that space
- Foot bath/designated shoes/shoe covers
- Hand sanitizer readily available
- Trash in closed bag
- Double bag trash to remove from room
- Wash laundry separate at the end of each day
- Disinfect surfaces frequently
- Consider flow – perform treatments last
- Designated staff – limit traffic

Avian Pox
- Limit traffic
- Insect Control
- Disinfectant choice – Viral Spectrum
- Dedicated supplies/instruments
- Infectious while lesions active
  - Knowledge of Incubation and infectious period

Sally Splash Salmonella
- Proper PPE
- Knowledge of risks
- Communication of incident and outbreak
Application Principles

- Limit access to patient areas
  - Human
  - Special cases
  - Wildlife
- Separate new and sick patients
- Don’t share disease with other facilities
- Monitor for disease
- Report sick patients
- Always wear appropriate PPE
- Hand Hygiene

Simplified Development of a Biosecurity Plan:
1. **Risk assessment**: helps to determine the areas or factors are most likely to lead to the spread of infectious agents.
2. **Risk management**: A preventive plan is developed and implemented.
3. **Communication**: all members of the organization, volunteers, and other visitors are informed of the plan to ensure cooperation and adherence.

Helpful tips:
- Don’t get bogged down
- Start with small changes
- Plan to make small adjustments to program continually over years
- Communication is key
- Everyone has a role in biosecurity

Recommended Resources


**CDC (Centers for Disease Control and Prevention)**: [https://www.cdc.gov/](https://www.cdc.gov/)

A large portion of this presentation was adapted from AAHA guidelines and the Ontario Animal Health Network IPC Best Practices

Center for Food Security and Public Health http://www.cfsph.iastate.edu/Zoonoses/index.php


