Emerging Diseases and related issues

Mark Irwin*

Presentation one - 23.11.2010
Zoo Preparedness - Introduction, import of planning (prevention & response)

Defining "emerging disease" as a disease that is increasing in prevalence and is new, or new in its character/ presentation. Mark also defined in simple language the other components of such disease.

- Re-emerging Disease: A disease that is increasing in prevalence and has occurred in the past.
- Disease Outbreak: Documented episode/occurrence of a disease in a specific time/place, often used with "epidemic" to imply excessive occurrence.
- Epidemic / Epizootic: Occurrence of a disease in excess of what would be considered normal for a given situation. and
- Pandemic / panzootic : Disease epidemic that spans a broad geographical area. I.e. distribution across multiple-continents. E.g. Swine flu

Causes of Emerging Diseases include the following :

- Changing world: Changing health concerns
- Human activities: such as Population growth, Urbanization, Sanitation challenges, Technology
- Environmental changes, such as Climate change including Vector distribution and stressors
- Globalization – including travel and movement of goods
- Interaction which includes i) human beings (zookeepers, veterinarians, farmers, etc.); ii) domestic animals and both *in situ* and *ex situ* wildlife.

Why should zoos care?, he asked as a rhetorical question. There are many reasons, such as i) the very mission of conservation itself, e.g. the impacts of disease in both field and captive facilities, as well as zoos educational role; ii. In parks with wildlife at risk, the "One Health" concept, iii) Seventy to seventy-five percent of emerging diseases are of animal origin. Animal keeper and vets, handing animals as they do, are at higher risk; iv. Zoos bring people, diverse exotic wildlife and native wildlife together in the same place and as public attractions, perception can impact as much as reality.

Vulnerabilities of emerging diseases : i. Visitors, staff and animal health … it is crucial to be prepared to protect them, ii. vulnerabilities must be identified and risk assessment done, and iii. all of this should be incorporated into planning.

Dr. Mark Irwin presenting his introductory talk on emerging diseases

The threat is in the normal things that one uses daily in running an animal facility,
Staff practices (domestic animals, hygiene, etc.)
Site specific – seasonal variations, Endemic disease & emerging diseases, Seasonal variations, Topographical.
E.g. pools of standing water, Waste handling system, Water supply, Climate changes & weather episodes.
Cautionary actions must be taken so as to prevent the disease from occurring in one's facility with various plans and strategies:

Prevention Plan
Work to prevent the disease: i. Identify risks & vulnerabilities, ii. Previous disease in zoo (re-emerging), iii. Local wildlife disease, iv. Serious disease, v. Exotic or other emerging/ re-emerging disease, vi. Develop comprehensive Bio-security & preventative medicine programs, vii. Staff training plan – prevention procedures, viii. Surveillance & monitoring, ix. Acquisitions & dispositions
Preventative Medicine Plan:
i.General medical program – includes emerging disease threats & bio-security, ii. To be evolved by veterinarian in consultation with stakeholders and advisors, E.g. Vaccination protocols, quarantine procedures
Biosecurity Plan: Prevent the introduction and spread of disease into and within the facility is CRITICAL. Biosecurity will be explained in detail in another session.
Surveillance plan: In a surveillance plan you i. Establish contacts and resources, ii. Develop relationships with colleges, NGOs, government departments, etc. and iii. conduct sample collecting such as zoos' animal collections, local wildlife and public health departments.

Response Plan – Your response should be that you are prepared to manage a disease outbreak when it does happen
Crisis response – you need a decision-making team, and a list of resources and contact information for advisors and resources.

- Anticipated resources required : i. Quarantine & other facility needs, ii Equipment & supplies and iii. Financial resources
- Staff Training – i. essential for both prevention and response, e.g. identification, technique and compliance. ii. 75% of emerging diseases are of animal origin, iii. Preventative measures training includes PPE Personal protective equipment and understanding & compliance, iv. Strong lines of communication critical.
- Facilities - Facilities required are i. Quarantine and ii. Staff set up for compliance with routine finishes with quarantine, ventilation, waste, foot traffic flow and tool use and sharing.
- Equipment – needs a maintenance schedule so that it is always ready, availability in crisis situation, and back-ups in case of breakage.

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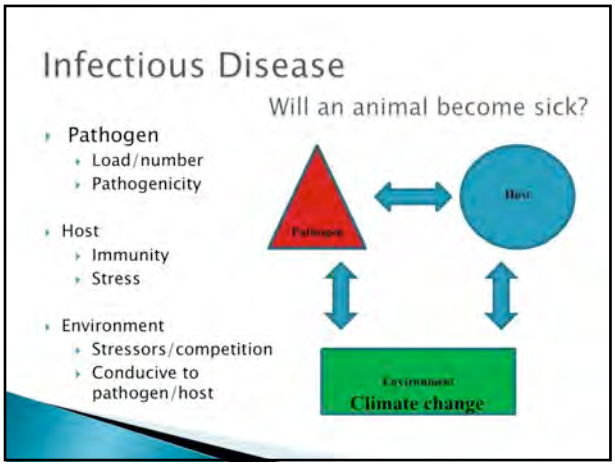
- Supplies – in quantity and of good quality. Supplies should be adequate for likely crisis situations (e.g. dust mask won't work for flu outbreak) and a Maintenance schedule (up-to-date drugs, latex items (gloves, coveralls, booties). For Pathology exams need a room with equipment (scalpel, forceps, work table, scissors, etc.; it should be cleaning and disinfection friendly, should be able to decontaminate equipment and personnel, set up for handling and storage of samples and biological waste.
- Finances - Budget should be available for surveillance & testing of Necropsy of deaths, unusual deaths, equipment and supplies (PPE & emergency supplies) and time and resources for staff training.
- Communication plan: i. Media, partnerships, colleagues, scientific community, etc., ii. Regulation & reporting: e.g., Government and other local, regional, national, international regulatory bodies, Association Accreditation standards and NGOs, Colleges, governments, OIE, etc.
- Communication includes: Reporting responsibilities & stakeholders, e.g. i. Government, public media, faith-based groups, victims/victims families, medical personnel, local & broad community, etc., ii. Goal: Improve coordination & outcome, iii. Key Points: 3-10 points, iv. Public, v. Build trust, vi. Use only credible sources and check information for accuracy/completeness, vii. Announce early if public behavior is a factor, viii. Clear, open and candid, ix. Consider context: public's beliefs, culture, knowledge, x. Minimize public anxiety and confusion (can call on WHO resources)

<u>Presentation Two - 24 November 2010</u>
Emerging Disease: Crisis Planning
Mark gave his second presentation by narrating a scenario to give an example of emerging disease. You were hiking in the Adirondack Mountains of NY, yesterday. Today you find a little black round thing, the size of a sesame seed attached to your leg. Red rash … somewhat shaped like a "bullseye" target.

Lyme Disease is a bacteria that is caused by tick
Organism: *Borrelia Burgdorferi* (Bacteria)
Spread: Bite of deer tick vector. (Host: white-tailed deer, white-footed mouse.
Signs & Symptoms: Acute and chronic. Red rash, flu-like, stiffness. Chronic - joint pain, skin, heart, nervous.
Diagnosis: Blood test
Treatment: Antibiotics
Prognosis: Good with early treatment
Prevention: Tick removal and avoidance

Another example but on a bigger scale is *Opossom*.



Infectious Disease-Will an animal become sick? We can say it is a combination of many factors when an animal becomes sick. He narrowed down into three factors: Pathogen, host and environment
Pathogen
Load/number, Pathogenicity
Host
Immunity, Stress
Environment
Stressors/competition, Conducive to pathogen/host

Emerging Disease & Climate Change
Climate change:
- Pathogen
  New selection pressures
  E.g. Temperature may favour the Pathogens to grow in more number, Change in precipitation, host species
  New distributions
  E.g. Expanding north, south, in elevation, etc.
  New vectors & vector distribution
  New combinations of host & environment in which to interact
  Stressed hosts = increased pathogen susceptibility

- Host
  New stressors & susceptibility
  Competition from new/other species
  Environmental
  Exposure to new diseases
  Weather & climate
  Habitat change (both gradual & catastrophic)
  Food availability
  Exposure to new diseases

Why do we need to be concerned about this? He summarized it into two categories.
1. Health concern - "One Health"
Human / Domestic Animal / Wildlife
www.onehealthinitiative.com
2. Financial cost
Potentially crippling to economies
E.g. SARS, Avian flu, etc.

Pathogens:
Bacteria : Viruses, Fungi, Parasites, Protozoa, Other (Prion)

How the situation is handled?
Prevention?
How the disease is spread / Transmission
Treatment
Threat level
Linger in environment?

Exposure
Fomite: Inanimate object that can transfer pathogen. E.g. Brush, footwear, blanket, etc.

Either direct or indirect:
- Direct: contact with a disease carrying animal
- Indirect: contact with objects, materials that have been in contact with disease carrying animal.

Eg. Contaminated fomites.

Transmission
Ingestion: Food and water
Inhalation: Moisture particles from ill animal breathing/ sneezing can become aerosolized or spread on dust particles. Most likely in small, closed environment with poor ventilation.
Contact with skin, mucous membrane, wound. Pathogen can enter into body to cause disease.

Injection: Bite of fleas, ticks, lice, mosquitoes or other insects. Injection by other means - needles, injuries etc.

Control and Prevention
Cleanliness and Personal hygiene
  Wash hands with soap and water
Wear protection as needed when working around animals, with feces, raw meat, dead animals, etc. (gloves, masks, etc.)
  Wash and cook food well
Regular health exams and monitoring
  Fecal Examinations, TB testing, Vaccination
Knowledge:
  Relevant animal diseases and transmission
  Public Education

Emerging and re-emerging diseases are 70% vector-borne or zoonotic.

Wildlife Conservation Society (WCS) has published a document 'The Deadly Dozen'
Diseases expected to have greater impact due to climate change: Avian Flu, Plague, Babesia, Cholera, Intestinal & external parasites, Ebola, Lyme Disease, Tuberculosis, Sleeping Sickness, Rift Valley Fever, Red Tides, Yellow Fever

Influenza
Many different strains – mutates quickly and can adapt / move between species
Avian strain H5N1 – highly deadly to domestic & wild birds
Potential to mutate into human-spread strain
Pandemic concern
Widely spread through domestic poultry
  Food supply safe? (Staff, zoo, etc.?)

Avian Influenza
Organism: Avian Influenza Virus
Spread: Secretions from infected birds, equipment, people. Not common infection of people
Signs & Symptoms: Conjunctivitis, potential to lead to flu-like symptoms.
Diagnosis: Clinical symptoms in birds and virus isolation
Treatment: Supportive
Prognosis: Strain dependent. Usually not severe in people. In birds, morbidity and mortality can reach 100%
Prevention: Depopulation of bird flocks.

Influenza
Wild birds can spread. Increase risk with climate change through:
  Distribution and movements of wild birds
  Greater interaction of domestic and wild populations
Quickly mutating virus
  Difficult to vaccinate for
Potential for other strains and species involvement
  Swine flu pandemic

Parasites
External & internal parasites
  Many can be spread between domestics, wildlife & people.
  Temperatures & precipitation changes
  Changes in species interaction
  Exposure & transmission opportunities through intense weather episodes

Plague
Bacterium, *Yersinia pestis*
Spread by rodents - fleas
Changes in rodent distribution
  Temperature & precipitation
  Global transportation /shipping

Rift Valley Fever
Rift Valley Fever Virus
Africa & middle East
Abortions & death in hoofstock
Can be fatal in humans
  Butchering infected animals
Wildlife factor in spread?

Yellow Fever
Virus
Vector: mosquitoes
Distribution changes of vector
Recent outbreaks have impacted South American wild primate populations

Your deer have a persistent, chronic cough. Some seem to have laboured breathing…
Tuberculosis
Bovine, avian, human …
Zoonotic
Often present in wildlife populations
Unpasteurized milk consumption
Distribution changes & changes in wildlife/domestic interactions concerns
  Organism: *Mycobacterium* species (Bacteria) (human, bovine, avian)
  Spread: Airborne / inhalation
  Signs & Symptoms: Fever, chills, respiratory – chronic cough. (Acute or Chronic)
  Diagnosis: Intra-dermal test (follow up 3 days)
  Treatment: Antibiotics
  Prognosis: Good, unless disease is advanced
  Prevention: Masks, screening, quarantine

Disease?
Particular concern for female workers
- pregnancy (birth-defect) threat
Onset of flu-like symptoms
Definitive host: felines

Toxoplasmosis
Organism: *Toxoplasma gondii* (Parasite)
Spread: Raw meat, cat feces, unwashed fruit
Signs & Symptoms: None, flu-like, birth defects.
Diagnosis: Blood test
Treatment: Some medications
Prognosis: Very good – death depending on health status
Prevention: Hygiene (food, cat)

You find your horse dead. It has blood coming from its nose and eyes.
Anthrax
Organism: *Bacillus anthracis* (Bacteria)
Spread: Spores from diseased animal
Signs & Symptoms: Flu-like, pustules (1), respiratory (2), bleeding vomit/diarrhea (3), shock, death. (3 forms)
Diagnosis: Blood culture and other
Treatment: Antibiotics
Prognosis: Depends on when it is diagnosed
Prevention: Don't necropsy suspect! Spores are highly resistant
Emerging zoonotic disease of South Asia
Causes serious disease and death in people
Inflammation of the brain (encephalitis)
1999 outbreak on swine farm in Malaysia
12 outbreaks since (incl. India & Bangladesh)

Nipah Virus
Organism: Nipah virus (*Paramyxoviridae*)
Spread: body fluids or tissue (swine, fruit contaminated by fruit bat urine)
Signs & Symptoms: asymptomatic to death. Headaches, myalgia, vomiting, sore throat, dizziness, respiratory

Diagnosis: Virus isolation tests/ DNA (ELISA, PCR)
Treatment: Symptomatic
Prognosis: Good after acute encephalitis. 20% have lingering problems. Some report 45-75% fatal
Prevention: Biosecurity & food hygiene. Culling ill & quarantine.

Leishmaniasis
Organism: parasite
Spread: Sand fly bite. Particular issues of late in Afghanistan
Signs & Symptoms: disfiguring skin sores
Diagnosis: often clinical based, on presenting signs
Treatment: Painful injections of sodium stibogluconate repeatedly
Prognosis: Injections can cure parasite
Prevention: Biosecurity & food hygiene. Culling ill & quarantine.

Salmonella
Organism: *Salmonella* species (Bacteria)
Spread: Feces. Some animals can be chronic carriers Farm animals, wild animals, esp. reptiles, etc.
Signs & Symptoms: Fever, diarrhea, abdominal cramps. Can spread and become fatal
Diagnosis: Fecal culture, blood test, etc.
Treatment: Antibiotics
Prognosis: Good with early treatment. Can develop into Reiter's Syndrome – chronic irritation (joints, urination, etc.)
Prevention: Hygiene and proper food preparation (meat, eggs, milk)

Ebola
Ebola hemorrhagic fever virus (similar to marburg fever virus
Highly lethal to humans, gorillas & chimpanzees
No cure
Outbreaks seem related to changes in rainfall/dry seasons

Cholera
Bacterium *Vibrio cholerae*
Spread through contaminated water in small organisms
Haiti – infrastructure, flooding, etc.
Temperature dependent

Red Tide
Harmful algal bloom – dinoflagellate species (phytoplankton)
Neurotoxin
Worldwide concern of mass aquatic animal deaths (incl. seabirds, penguins, etc.)
Human deaths & marine mammal stranding
Marine or aquatic ecosystems

Sleeping sickness
Trypanosomiasis, protozoan
Zoonotic
Tsetse fly vector – distribution changes?
Sub-Saharan Africa
300 000 new cases/year
40 000 deaths / year
The day after cleaning out an old storage barn, staff members develop a fever, and muscle aches. The attic was very dirty with old musty clothes and mouse droppings.

Hantavirus
Organism: Hantavirus (Virus)
Spread: Rodent feces and urine
Signs & Symptoms: fever, aches, respiratory, poor kidney function.
Diagnosis: Serology and other
Treatment: Supportive
Prognosis: Depends on infection (good – death 6-15%)
Prevention: Hygiene, mask & gloves if working in rodent areas
Dengue fever & heamorrhagic fevers
chytridiomycosis

Babesia
Vector – tick
Domestic and wild animal concern
Emerging as greater risk in humans
Can increase susceptibility to other disease
E.g. large die-offs of lions in Africa in conjunction with canine distemper

Many Others:
SARS – Severe Acute Respiratory Syndrome
Chandipura
Hemorrhagic fevers
Crimean-Congo hemmorrhagic fever
Dengue Fever
Kyasanur forest disease
Tick borne, viral hemorrhagic fever endemic in South Asia
Similar to yellow fever and dengue fever
"monkey disease"

Emerging Diseases: Defense
Commonalities
Biosecurity
Vector control
Wildlife/feral animal control
Sanitation / Hygiene
Surveillance & monitoring
Communication

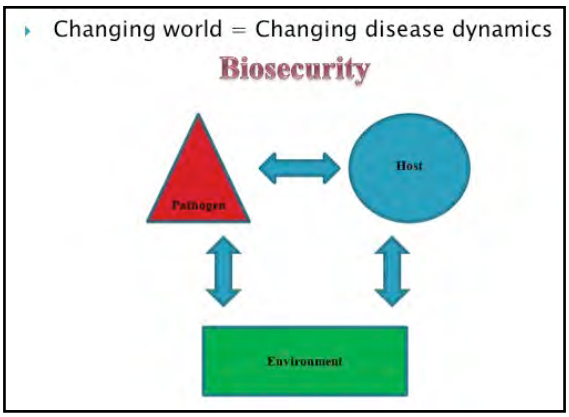
Remember: Prevention
Cleanliness and Personal hygiene
  Wash hands with soap and water
Wear protection as needed when working around animals, with feces, raw meat, dead animals, etc. (gloves, masks, etc.)
  Wash and cook food well
Regular health exams and monitoring
  Fecal Examinations
  TB testing
  Vaccination
Knowledge:
  Relevant animal diseases and transmission
  Public Education

Summary
• The occurrence of disease is a consequence of factors relating to the pathogen, host & environment.
• Environmental change from climate change and other factors impacts all.
• There are numerous emerging diseases but common principles of prevention prevail
• It is important to understand the pathogen, its unique characteristics and mode of transmission to most effectively manage the disease.

<u>Third presentation</u>
Emerging Disease Preparedness: Biosecurity
Changing world = Changing disease dynamics

Biosecurity:
• Those precautions taken to control infectious disease and minimize the risk of its introduction to an animal population.
• Essential component of disease prevention and facility health planning.

Disinfection – application of a chemical that kills 100% of labeled organisms (US)



Sanitize – killing up to 99.999% of organisms listed (may not include viruses & fungi)
Effective contact time & dilution are essential
Follow label
Chlorine broadcast (ammonia mix)

Developing a Biosecurity plan:
Identification of risks- E.g. Avian influenza risk
Identification of vulnerabilities- E.g. Staff maintain poultry at home.
Development of disease management plan- E.g. Uniforms stay at zoo, etc. Coordinate with government agency to monitor wild & collection birds.
Prevention
Outbreak
Implementation facility-wide- Staff training program, etc.

SPIDER:
Set goals
Plan
Implement
Document
Evaluate
Re-adjust

SPIDER entered the zoo field as a framework for animal enrichment programs but has value for other situations.

SPIDER – Setting goals:
Minimize the risk of disease introduction and spread
Quick, effective management when a disease crisis does occur
Program should acknowledge that specific disease situations will vary.
- Disease prevention vs. disease control
- Eradication vs. management

SPIDER - Planning:
Assess risks & vulnerabilities
Identify program's leadership team & their individual roles
- Establish communication lines
- Determine decision making process

Facilities
Biological breaks between
- Areas of the zoo
  - Formal quarantine area
  - Program animals vs. main collection
- Animals & visitors
  - Animals & staff
  - Staff & home
- Visitor
  - Animal contact – direct / indirect
  - Hand-washing stations
- Staff hygiene facilities (uniforms)

Policies & Standard Operating Procedures (SOPs)
Animal care SOPs
- Develop with biosecurity in mind
- E.g. Quarantine last
- E.g. High risk areas /activities last (compartmentalize)
- E.g. divide staff to areas to create biological zones
  - Disinfectant protocols

Visitor contact (direct & indirect) E.g. hand washing
Outreach animals – separate zone
Staff hygiene/sanitation
- E.g. uniforms stay at zoo

Staff Training
Best practices
Compliance
Instruct, mentor, check for understanding, and then follow-up periodically

Animal food & water
Source
- Safe? Reliable?

Back-up available?
- Quality check
- Do staff know what to look for?
- Will they?
- Monitoring / testing required?
- System for rotating supplies
- Traceable / trackable in the case of an outbreak?
- Documentation
- E.g. Public donation & DOT

Wild & feral animals
Identification of specific disease threats
E.g. feral cats – toxplasma
Endemic wildlife diseases
Pest control measures
Safe – animal collection, visitors, staff?
Humane? Public scrutiny?
Prevent access & contamination (urine/feces)
Plan for dealing with healthy, ill and dead wildlife on site.
Disease monitoring plan for cases of concern

Surveillance & Monitoring
Essential for early identification of disease
Routine:
- General health monitoring of collection
- Necropsy of dead
- Investigate unusual mortalities
- Record & assess mortality & morbidity

Report unusual or serious cases to regulatory bodies
Partner with other institutions to share resources
- Institutions of higher education
- NGOs
- Government (Public health)

Communications
Internally
Between all departments
- Critical step between keeper (front line) and director/veterinarian/curator (How?)

To professionals
Government & regulatory bodies
Other facilities
Scientific publications

To public
When does the public need to be notified?
Who decides and who relays the information?
Carefully consider the instution's obligations to public safety and consequences

Other considerations:
Documentation
How, who, why, etc.?
Finances
Specific disease situations
May require unique protocol for diseases of particular significance (danger or prevalence)

SPIDER - Implementing:
Keeper & staff training
Compliance?
Routine disease surveillance
Regular meetings
Risk assessment
Documentation, evaluation, re-adjusting

SPIDER - Documenting:
Internal records
Daily Keeper Reports (DKR), pest control records, yearly summaries, etc.
Medical: baseline values
Regulatory bodies
Government
Associations
Partners

• "If it wasn't documented, it didn't happen."

SPIDER - Evaluating:
Regularly scheduled
Refer to documentation – analyze as needed
Include representatives from each relevant dept.
What worked? What didn't?

SPIDER – Re-Adjust:
Make necessary changes
Plan to gather any missing information

Summary
An effective biosecurity program will minimize the introduction and spread of disease. It needs to include plans for disease outbreak.
An organized, structured approach should be used when developing the plan.
Implementation must be facility-wide.

Presentation Four-26.11.2010
Zookeeper Training for Disease Preparedness

Keeper Training
Can your keepers:
Identify signs of illness?
Communicate their observations effectively to zoo leaders?
Identify and minimize biosecurity threats such as the transfer of pathogens within the zoo or into/out of the zoo?
Precisely comply with biosecurity & quarantine protocols?
Provide adequate, safe & humane assistance to veterinary staff through animal restraint, handling & training in the case of a disease outbreak?

Zookeeper Training
Keepers:
Daily, intimate contact with animals
Eyes, ears, hands for managers & veterinary staff on the daily basis
Frequently moving between animal, staff & visitor areas.
Often have animals at home
Diverse responsibilities & training

Duties:
Basic:
Observation
Cleaning
Feeding & Water
Intermediate:
Enrichment
Documentation & records
Treatments
Training
Advanced:
Public demonstrations
Regional participation
(e.g. Studbook keepers, workshops)
Keeper exchanges
Assist in research
An educated, interested and motivated keeper is CRITICAL!

Keeper Training: Mentorship
Mentorship IS training:E.g. Improved compliance & success with protocols & prescribed treatments
Improved Operations and Animal Health: E.g. Increased & earlier detection of health concerns. Observation / training.
Animal Welfare & Health Monitoring: E.g. Anticipation & Proactive thinking
Communication & Reporting: Accuracy
Compliance
Efficiency: E.g. "Conservation is a team effort"
Morale
Productivity: E.g. Open effective communication

Keeper Training: Compliance
A keeper that understands the reasons behind policies & wants to excel:
Less supervision with greater compliance
More likely to identify early signs of disease & effectively communicate it to their supervisor
Precisely follows directions for prevention and during an outbreak

Keeper Training: Mentorship
Relationship-based
Trust, Questions go both ways?, Develop before crisis occurs
Effective learning
Visual & experiential teaching/learning
Vs. reading or telling
Mutual understanding of objectives, expectations & outcomes
Culture of Learning & Teamwork
Provide material to review / read
Encourage questions and ask questions
Do you know why…?
Have you seen this before…?
Can you identify the problem here?
What do you think I am going to do and why?
Encourage participation, E.g. Meetings, training sessions,…
Informal
When learning opportunities arise
Individually or small group
Conversation
Relationship building
Preparation for crisis
Formal
Planned, structured
Institutionally coordinated (team)
Workshops, Keeper exchange, Guest speakers/experts
Partnerships w/ other facilities, Role play scenarios, Drills

Observation & Reporting
Best practices
Active & Purposeful
Learned skill
"An elk is ill"
Characterize
History & duration, Signs & symptoms
Why is it Important?
Preparation & prioritization, Scheduling, Logistics
i.e. Does the keeper identify "observation" as an important responsibility for which they should budget some time and a skill to practice?

Keeper Training: Disease Preparedness
Actively promote hygiene & sanitation policies
Hand washing, Attire & equipment, Prevent cross contamination between exhibits / areas of the zoo or workplace & home
Leaders are de facto role models

Mentorship: Biosecurity
Quarantine
Teach basic principles & explain why
Establish & use Foot baths, separate tools, boots, etc.
May require demonstration / practice
Direction without understanding often has poor compliance
Concepts of disease spread, subclinical disease and carriers may not be appreciated

PPE
Personal Protective Equipment

Proper use & maintenance
Discuss, demonstrate & practice
Different levels of protection depending on disease & risk
Google fog…
Commercial products
Soap/dish detergent
Create film on googles
Dry, Buff

Keeper Training: Communication
Between co-workers, public, managers
Record keeping
Discern what is important
Details
Ask questions – both ways?
Intimidation factor
Ok to be wrong with mutual respect
Drills / Scenarios

Keeper Training: Chemical Safety
Drug / Hospital safety
Proper use of chemicals & equipment
Effective, Safe
Use of PPE
Biological threat
Drugs, disinfectants, cleaning agents, etc.
Institutional policies – Examples:
Explain/illustrate, Check/test for understanding,
Practice: drills, scenarios

Keeper Training: Visitor Interaction
Prevent spread of disease to visitors
Tools & equipment out of public areas
Proper cleaning of public areas
Hand washing following any animal interactions
Hygiene
Communication with visitor
Clear understanding of what is appropriate and what is not.

Keeper Training: Animal Handling
Professional Guidance
Visitor friendly
Calm, in control
Control emotions
Plan & coordinate
Objectives & methods
Diagnostics, treatments, etc.
Minimize Psychological Stress
Explain the consequences
Rough handling methods
Fear / anxiety
Socially inappropriate groupings
Animal Husbandry Training (Operant conditioning)
Outthought, not Outfought

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www.onehealthinitiative.org (One Health Initiative)
www.oie.org (World Organisation for Animal Health
Search: WAHID: up-to-date disease prevalence & monitoring information
www.cdc.org (Center for Disease Control)
www.aazv.org (American Assoc. of Zoo Veterinarians)
https://izvf.portal.isis.org/default.aspx (Int'l Zoo Vet Forum, ISIS)
www.wcs.org (Wildlife Conservation Society)
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