Occupational Infections

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Occupational Setting

- **Institutions**
  - **Military Recruits/Units**
  - **Schools**
  - **CCC**
  - **Prisons**
  - **Cruise Ships**
- **Hospitals**
  - **Tuberculosis**
  - **Hepatitis B**
  - **HIV**
  - **Hepatitis C**
  - **Norovirus**
- **Medical Research**
  - **Aerobiology**
- **Farm/Ranch/Forestry**
  - **Brucellosis**
  - **Anthrax**

Human Infections

Hospital / Medical Research Institutions
First Responders (Lab/Disaster)

Zoonotic/Arthropod-borne Infections

- **Veterinary Medicine**
- **Farm/Ranch/Forestry/Hunters**
- **Medical Research**
- **Military Operations**
- **Adventure Travelers**

Categories of Occupational Exposures

1. Contact with Infected Living Animals
   - Handle infected domestic animals (inhalation or percutaneous exposure)
   - Handle infected chickens or birds
   - Bite or scratch by infected dog or cat
     Bite by skunk, raccoon, bat, fox, other carnivore, or woodchuck
   - Handle infected rodents (inhalation or percutaneous exposure)
   - Bite by rodents
2. Contact with Contaminated Animal Product
   - Handle infected animal carcasses or placental tissues
   - Handle raw goat hair, wool or hides from endemic area

Categories of Occupational Exposures

3. Contact with Tick, fleas, Mites
   - Work in tick infested area in North America
   - Work in building infested with fleas or mites of rodents
   - Work in mite infested area of central, eastern or Southeast Asia
4. Contact with Human or Animal Waste
   - Work or swim in contaminated water (percutaneous exposure)
   - Associate with dogs in endemic area
   - Care for children or animals infected with cryptosporidiosis

Categories of Occupational Exposures

5. Contact with Infected Patient or Blood
- **Handle contaminated needles or surgical instruments**
- **droplet/airborne pathogens**
- **Bloodborne pathogens**

6. Raise Dust Containing the Pathogen
- **Plow, dig or excavate soil in endemic area**
- **Raise dust from bird roosts, chicken coops or bat-inhabited caves in endemic area**
- **Raise dust of excreta from rodents**

1. Contact with Infected Living Animals

Handle infected domestic animals (inhalation or percutaneous exposure)

Animal breeder	**Brucellosis**
Animal caretaker	**Influenza**
Animal scientist	**Hendra & Nipah virus**
Farmer & Rancher	**Leptospirosis**
Farm worker	**Q fever**
Lab animal worker	
Veterinarian	

1. Contact with Infected Living Animals

Handle infected chickens or birds

Animal breeder	**Influenza**
Animal caretaker	**Newcastle disease**
Animal scientist	**Psittacosis**
Lab animal worker	
Poultry farmer	
Poultry handler	
Veterinarian	

1. Contact with Infected Living Animals

Bite or scratch by infected dog or cat

Animal breeder	**Brucellosis**
Animal caretaker	**Cat scratch fever**
Animal scientist	**Capnocytophaga infection**
Farmer & Rancher	**Pasteurellosis**
Farm worker	**Plague**
Lab animal worker	**Rabies**
Veterinarian	**Tularemia**

1. Contact with Infected Living Animals

Bite by skunk, raccoon, bat, fox, other carnivore, or woodchuck

Farmer & Rancher	**Rabies**
Farm worker	
Game warden	
Hunter & Trapper	
Veterinarian	
Wildlife biologist	

1. Contact with Infected Living Animals

Bite by rodents

Farmer & Rancher	**Monkeypox**
Farm worker	**Plague**
Game warden	**Rat bite fever**
Hunter & Trapper	
Veterinarian	
Wildlife biologist	

1. Contact with Infected Living Animals

Handle infected rodents
(inhalation or percutaneous exposure to infected rodent)

Farmer & Rancher	**Arenaviral infection**
Farm worker	**Hantavirus infection**
Game warden	**Lassa fever**
Hunter & Trapper	**Leptospirosis**
Veterinarian	**Lymphocytic choriomeningitis**
Wildlife biologist	**Monkeypox**
	Omsk hemorrhagic fever
	Plague

1. Contact with Infected Living Animals

Handle infected laboratory rats

Lab animal worker	**Hantavirus infection**
Veterinarian	**LCM**
	Rat bite fever

1. Contact with Infected Living Animals

Handle infected macaque monkeys

Lab animal worker	**B-virus infection**
Veterinarian	

2. Contact with Contaminated Animal Product

Handle infected animal carcasses or placental tissues

Animal breeder	**Anthrax**
Animal caretaker	**Brucellosis**
Animal scientist	**Crimean Congo HF**
Butcher	**Glanders**
Farmer & Rancher	**Hendra & Nipah virus**
Farmworker	**Influenza**
Hunter & Trapper	**Leptospirosis**
Lab animal worker	**Newcastle disease**
Meat packer	**Plague**
Slaughterer	**Psittacosis**
Veterinarian	**Q fever**
	Rift valley fever
	Tularemia

2. Contact with Contaminated Animal Product

Handle raw goat hair, wool or hides from endemic area

Grader & Sorter	**Anthrax**
Freight handler	
Packer	
Drum head Importer	

3. Contact with Tick, fleas, Mites

Work in tick infested area in North America

Farmer & Rancher	**Babesiosis**
Farmworker	**Colorado tick fever**
Forester	**Ehrlichiosis**
Groundskeeper	**Lyme disease**
Highway maintenance	**Powassan virus encephalitis**
Hunter & Trapper	**Relapsing fever**
Landscaper	**RMSF**
Logging worker	**STARI**
Rail track maintenance	**Tick paralysis**
	Tularemia

3. Contact with Tick, fleas, Mites

Work in building infested with fleas or mites of rodents

Building cleaning worker
Pest control worker

Murine typhus
Plague
Rickettsialpox

3. Contact with Tick, fleas, Mites

Work in mite infested area of central, eastern or Southeast Asia

Hunter & Trapper
Laborer

Scrub typhus

4. Contact with Human or Animal Waste

Care for children or primates infected with hepatitis A

Child care worker	**Hepatitis A**
Lab animal worker	
Veterinarian	

4. Contact with Human or Animal Waste

Work or swim in contaminated water (percutaneous exposure)

Farm worker	**Leptospirosis**
Farmer & Rancher	**Melioidosis**
Sewer worker	**Naegleriasis**
	Schistosomiasis

4. Contact with Human or Animal Waste

Associate with dogs in endemic area

Farmer & Rancher
Farm worker

Echinococcosis

4. Contact with Human or Animal Waste

Care for children or animals infected with cryptosporidiosis

Animal handler (cattle)
Child care worker

Cryptosporidiosis

5. Contact with Infected Patient or Blood

Handle contaminated needles or surgical instruments

Dental worker
Embalmer
Healthcare worker

AIDS
Crimean-Congo HF
Ebola -Marburg
Hepatitis B
Hepatitis C
Lassa fever

5. Contact with Infected Patient or Blood

Droplet/airborne pathogens

Healthcare worker caring for sick patients

Adenovirus
Arenavirus infection
Crimean-Congo HF
Diphtheria
Ebola -Marburg
Influenza
Lassa fever
Measles
Meningococcus
Monkeypox
Mumps
Mycoplasma infection
Parvorvirus
Pertussis
Rubella
SARS
Tuberculosis
Varicella

5. Contact with Infected Patient or Blood

Bloodborne pathogens

Healthcare worker
caring for sick patients
infection

AIDS
Arenavirus

Crimean-Congo HF
Ebola -Marburg
Hepatitis B
Hepatitis C
Lassa fever
West Nile virus infection

6. Raise Dust Containing the Pathogen

Raise dust from bird roosts, chicken coops or bat-inhabited caves in endemic area

Bridge painter
Construction worker
Demolition worker
Farmer & Rancher
Farmworker
Gardener
Heating & AC worker
Roofer

Histoplasmosis

6. Raise Dust Containing the Pathogen

Raise dust of excreta from rodents

Building cleaning worker
Construction worker
Dockworker
Farmer & Rancher
Farm worker
Game warden
Granary worker
Groundskeeper
Heating & AC worker
Hunter & Trapper
Pest control worker
Repair worker
Wildlife biologist

Arenaviral infection
Hantavirus infection
Lassa fever
Leptospirosis
LCM
Rat bite fever

6. Raise Dust Containing the Pathogen

Plow, dig or excavate soil in endemic area

Archeologist
Demolition worker
Farmer & Rancher
Farmworker

Coccidioidomycosis
Paracoccidioidomycosis

Newly Emerging Diseases

- Avian Influenza
- Influenza pandemics
- SARS
- MDR Tuberculosis
- MRSA
- MDR C. difficile
- ESBL-producing gram negatives
  - Carbapenem-resistant Klebsiella pneumoniae (KPC)
  - Colistin-resistant Acinetobacter baumannii and Pseudomonas aeruginosa

Medical Surveillance in Biomedical Research

- Occupational Immunization
  - Hepatitis B
  - Rabies
  - Rubeola
  - Select Agents
- Biological Surveillance
  - Immune response
  - PPD / QuantiFERON Test
- Prophylaxis
  - Bloodborne Pathogens
  - Simian Retroviruses
  - B virus
  - Select agents (bioterrorism agents)
- Post-Exposure Evaluation

Travel-Associated Diseases

Routine Vaccination
Required Travel Vaccinations
- **Yellow Fever**
- **Meningococcal (Haaj)**

Recommended Travel Vaccinations
- **Hepatitis A**
- **Typhoid Fever**
- **Hepatitis B**
- **Japanese Encephalitis**
- **Rabies**
- **Meningococcal**

Malaria
Traveler's Diarrhea

Bioterrorism / "Select Agents"

Anthrax (Bacillus anthracis)
Pneumonic plague (Yersinia pestis)
Tularemia (Francisella tularensis)
Smallpox (Variola major)/ Monkey Pox / Vaccinia
Botulinum exotoxin (Clostridium botulinum

Infection Hazards to Laboratory Animals Handlers

Common Vaccinations
- **Tetanus**
- **Rabies (if indicated)**
- **MMR (non-human primate work)**
- **Vaccinia (Smallpox, Monkey Pox, Vaccinia-Chimeric Vaccine Research)**

Others Vaccinations for specific research protocols
- **Anthrax**
- **Yellow Fever**
- **Japanese B Encephalitis**
- **Influenzae (Avian Flu, Swine Flu, SARS)**
- **BCG**

Bite Wounds

- **Domesticated and laboratory animals commonly transmit Eikenella corrodens and Pasteurella multocida with bites**
- **Pig bites are the worst for secondary wound infections**
- **Augmentin 875 mg BID x 10 days (if allergic to PCN, use Levaquin)**

Simian “B Virus”

Cercopithecine herpesvirus 1

Endemic in macaque monkeys

Ocular, oral - genital secretions, CNS tissues, CSF fluid are infectious

Route of Exposures for Animal Care Takers

- **Bites, scratches**
- **Secretions thrown into the eye or mucous membranes**
- **Open wounds from handling dirty cages**
- **Note: Exposure to peripheral blood has NOT been reported to associated with human infection**

Simian “B Virus”

Flu-like symptoms which progresses to encephalitis (usually fatal if untreated in humans)

Incubation period 2 days to *5* weeks

Rarely see herpetic lesions at exposure site

Recurrent encephalitis reported in 25 survivors

Simian "B Virus"

Post-exposure prophylaxis as per USPHS
Immediate cleansing / irrigation
Viral wound culture (**AFTER** cleansing / irrigation)
Valacyclovir (Valtrex) 1000mg /Day for 14 days
Herpes B titers baseline and in 2-4 weeks and in 3 months if symptomatic
Send specimens to B Virus Lab at Georgia State University

Simian Immunodeficiency Virus (SIV)

HIV-like retrovirus of NHP

Causes an asymptomatic infections in humans

Limited human studies suggests that SIV infection does NOT result in an AIDS-like syndrome

Simian Immunodeficiency Virus (SIV)

- **Post-exposure prophylaxis utilizes USPHS HIV PEP Protocol**
  - **Atripla daily for 28 days (if not pregnant)**
  - **Truvada daily and Kaletra BID for 28 days**
- **Initial and follow-up laboratory tests during therapy (25% failure to complete PEP)**
- **SIV sero-surveillance at 0, 6 weeks, 3 months and 6 months**

Laboratory-Acquired Infections 1930's - 1940's

The first studies of the occupational hazards to bacterial, fungal and rickettsial agents in laboratories were published in the 1930's and 1940's.

Laboratory-Acquired Infections 1950 - 1975

- Laboratory works were shown to have higher rates of Brucellosis, Q fever, typhoid fever, viral hepatitis and tuberculosis compared to the general population.
- 20% of cases were attributed to documented accidents (mouth pipetting and needle sticks) and exposure to infectious aerosols was considered to be the plausible but unconfirmed source of infection in the remaining

Laboratory-Acquired Infections 1970's - 1980's

- There was a marked decline in bacterial and rickettsial infections and with a lesser decline in Viruses and fungi.
- At the same time there was growing attention focused on laboratory exposure to Hepatitis B virus and WV.
- In the 1990's, attention focused on laboratory exposure to recombinant DNA, chimeric virus development using vaccinia virus, and carcinogenic material/tissues)

Laboratory-Acquired Infections 2000 - Present

Attention has focused on laboratory exposure to disease agents without current effective treatments

"SELECT AGENTS" (e.g. ricin, hemorrhagic viruses)

MDR Bacteria (TBc, C. difficile, ESBL, MRSA)

MDR Viruses (HIV, Avian Flu, SARS)

Prions (?)

Nanoparticles (?)

Top Ten Laboratory-Acquired Infections 1979-2004

Total of 1, 141 laboratory-associated infections in literature review

Mycobacterium tuberculosis	**199 cases**
Arboviruses	**192**
Coxiella burnetti	**177**
Hantavirus	**155**
Brucella	**143**
Hepatitis B	82
Shigella spp.	66
Salmonella spp.	64
Hepatitis C	32
Neiserria meningitidis	**31**

Bold indicates via aerosol transmission

Laboratory-Acquired Vaccinia Infections

The Center for Disease Control (CDC) reported 5 cases of occupational exposure to orthopox virus that resulted in hospitalization in the April 18th, 2008 edition of the MMWR (Vol. 57, No. 15). Their investigation of the cases identified four preventable causes for these significant occupationally-related orthopox infections:

1. **The employee's refusal to receive vaccination;**
2. **The laboratory failure to vaccinate their employees;**
3. **Failure to revaccinate individuals with inadequate response to an initial vaccinia vaccination; and**
4. **Failure to re-vaccinate (booster) exposed employees at 10 years.**

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