

The Public Health Necessity for Food Regulations I/II *Epidemiology of Transboundary Diseases of Importance in the United States*

AGSC 5540: Food Policies and Regulations

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Week One: Content

- Anthrax; Pseudorabies; Bluetongue; Bovine Spongiform Encephalopathy; Brucellosis
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- Classical Swine Fever; Contagious Bovine Pleuropneumonia (CBPP); Equine Encephalitis; Hendra Virus; Japanese Encephalitis
- Exercise 2
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- Exercise 3
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Anthrax

- Causative agent: *Bacillus anthracis*
- A Gram-positive and spore-forming bacteria
- Can be found as a spore in the **soil worldwide**
- Spores viable for decades in soil
- In the US: Dakotas, northwest Minnesota, Texas, and Nevada
- Common in parts of Africa, Asia, and Middle East
- In Human:
 - Skin
 - Intestine
 - Inhalation
- Animal disease
 - Septicemia and rapid death









Anthrax

- Spores highly infective
- Remain effective during aerosolization
- Low lethal dose
- High mortality
- Person-to-person transmission rare
- Symptoms begin between one day and two months after the infection



Anthrax- Control and Treatment

- <u>Four types in human</u>: Cutaneous (skin); Inhalation; Gastrointestinal; Injection anthrax
- Vaccine for livestock annually to prevent
- Personal Protective Equipment
 - When handling sick animals
- Disinfection:
 - <u>Sporicidal agents</u>: 5% formaldehyde, 2% glutaraldehyde, 10% sodium hydroxide
 - <u>Sterilization</u>: chlorine dioxide, formaldehyde gas, heating to 121°C for at least 30 minutes
- Antibiotics: effective for humans when prescribed early
- Zoonotic Disease





Pseudorabies

- Contagious viral diseases from herpes family
- Primary concern in domesticated **pigs and feral swine**
- primarily spread through direct **animal-to-animal** (nose-to-nose)
- Other mammals
 - Reproductive
 - Nervous system
- Humans are not affected
- Could be a **ubiquitous virus** in some area
- Eradicated in many countries
 - Still occurs in parts of world
- Current **USDA Surveillance** to detect any potential case





Pseudorabies

- Transmission:
 - Direct contact,
 - Reproductive,
 - Aerosol,
 - Ingestion
- Incubation period: 2-6 days
- Common symptoms:
 - Neurological
 - Respiratory issues
 - Itching intensively
 - Stillbirths and abortion
- Morbidity and mortality up to 100%
- Neonates are particularly susceptible to the virus



Pseudorabies

- Considered a **reportable disease**
- Could lead to economic and trade restrictions
- Treatment usually not recommended
- Current control practices:
 - **Depopulation** of the diseased
 - Test and removal of carries
 - Offspring segregation
- Vaccine available in some countries for affected animals



Prevention of Pseudorabies

- **Isolation:** new or returning animals before entry into the herd
- **Disinfect** vehicles, equipment, premises, footwear
- Separation of pigs and feral swine
- USDA extensive surveillance program
 - All 50 states are current free since April 2008 (commercially)
 - Feral swine remain as a reservoir of the pathogen



Bluetongue

- A viral disease
- A Vector-borne disease by *Culicoides* (biting midge)
- Common in **Ruminants** (primarily sheep)
- Currently 24 serotypes worldwide
- Six serotypes isolated in North America
- Distributed world-wide
- Most significant outbreak:
 - Mediterranean 1997-2002



Bluetongue

- Incubation period is 5-10 days
- Symptoms in Sheep
 - Swelling of face
 - Extensive nasal discharge
 - Blue (Cyanotic) tongue
 - Reproductive symptoms
- Cattle, goats
 - Mostly subclinical symptoms;
- Wildlife
 - Hemorrhages (Bleeding internally)
 - Sudden death

Bluetongue is not a significant threat to human health



Bluetongue- management

- Cost cattle industry **\$125B per year**:
 - Lost in trade
 - Animal testing
- No treatment in Animal Industry: Supportive care is only existing treatment
- Prevention:
 - Vector control (Climate change?)
 - Vaccination
- Vaccination challenge:
 - Serotype specific (Climate change?)
 - Adverse effects
- In Humans: low risk of infection, self limiting (Immunocompromised?)





BSE- Bovine Spongiform Encephalopathy

Commonly known as Mad Cow Disease

- Caused by **prions** (infectious protein particles)
- Cattle and humans are susceptible
- A neurological disease that could be fatal
- **Transmitted** by:
 - Consumption of scrapie-infected feed
 - Spontaneous mutation
- Distribution is worldwide



Symptoms of BSE

- In Cattle
 - Incubation period is 2-8 years
 - Initial signs are mild and subtle
 - At final stages
 - tremors
 - loss of balance
 - death
- In Humans
 - Unknown incubation period (many years to many decades)
 - Neurological signs
 - Depression and schizophrenia-like symptoms
 - Could lead to death





BSE Management

- Very resistant infectious agent (sanitization very difficult)
- Currently no effective treatment or vaccine
- Prevention:
 - surveillance program and testing
 - Restriction in trade
 - Animal feed regulation (bone meals and mammalian products)
- Outbreak in 2001-2002 in United Kingdom: cost the industry 3.7 billion Euro

Brucellosis

• Caused by bacteria (several species)

(Genus Brucella e.g. B. melitensis, B. abortus, B. suis, and B. canis)

- Highly infectious (N95 or KN95 mask during farm visits?)
- Easily aerosolized
- Transmission:
 - Ingestion
 - Inhalation
 - Direct contact
- Signs in animal:
 - Reproductive complications
- Signs in humans:
 - Cyclic fever and
 - Flu-like symptoms





Brucellosis- Treatment & Prevention

- Treatment: long-term antibiotics (Problem: Diversity of causative agents)
- Prevention:
 - Vaccination of calves
 - Minimizing exposure to wildlife
 - Segregation of infected animals
 - Disinfection of environment
- No vaccine available for human
- Main infection source for human:
- Contaminated milk, cheese, and ice-creams
- Handling farm animals (glove, goggle, secondary outfit +mask?)
- Hunting Activities

Exercise 1

- What are the common Sporicidal agents and Sterilization methods for control of Anthrax?
- What is the incubation period of Pseudorabies and common symptoms in Animals?
- What is the incubation period for Bluetongue diseases and main symptoms in sheep?
- What are the BSE symptoms in Cattle and Human?
- What are some of the Brucellosis signs in human and strategies to prevent the disease in animal population?
- What is the causative agent for each disease? (Bacterial, Viral, or prions) Anthrax; Pseudorabies; Bluetongue; Bovine Spongiform Encephalopathy; Brucellosis

Classical Swine Fever

- Viral Disease, highly contagious
- Disturbed worldwide
- Spread through:
 - Ingestion of virus
 - Direct contact
 - Aerosol
 - Insects (vector-bone disease)
- Feeding swine **untreated food wastes** containing infected pork scraps can cause infection
- (By Product, Animal Food Regulation, FSMA)



Classical Swine Fever

- Incubation period is 2-14 days
- Clinical signs variable depending on:
 - Strain of virus
 - Susceptibility and genetic makeup of the pig
- Signs very similar to many swine diseases
- Signs could be Acute to asymptomatic
- Main symptoms:
 - fever,
 - weakness
 - anorexia
 - purplish discoloration of skin of ears, inner thighs
 - Could cause death





Classical Swine Fever

- Not a zoonotic diseases
- Could cause 100% mortality in swine herds
- Could cause **import/export restrictions** and economical losses
- Controlled by:
 - Quarantine
 - Slaughter
 - Vaccine in endemic area

Was eradicated from the U.S. in 1978



Contagious Bovine Pleuropneumonia (CBPP)

- Bacterial diseases
- Mainly a concern in Cattle
- Also a concern in **Buffalo**, **bison**, **yak**, **water buffalo**
- Transmission by:
 - Aerosol in close contact
 - Transplacental
 - Direct contact
 - Saliva
 - Urine
 - fetal fluids
- Eradication had been successful in UK and Australia



CBPP

- Incubation period is 20-123 days
- Respiratory signs
 - Cough
 - Broad stance
- Morbidity could be as high 100% in a herd
- Mortality could range from 10 to 70%
- Vaccine available in endemic counties
- Human are immune, not a zoonotic disease





Equine Encephalitis Viruses

- Three viruses:
 - Eastern (EEE)
 - Western (WEE)
 - Venezuelan (VEE)
- Transmitted by mosquitoes (vector-borne disease)
- Birds could be asymptomatic carrier
- Clinical signs in human and Equids (Horses, mules, donkeys)
 - No to mild signs to
 - Flu-like illness
 - Encephalitis in small proportions
 - Can also infect a wide range of animals including: mammals, birds, reptiles, and amphibians

Equine Encephalitis Viruses

- The viruses are **very unstable** in environment
- Supportive care is the only current treatment
- Vaccine are available for Equine
- Vaccine for human very expensive primarily for:
 - Researchers
 - Public health workers with enhanced exposure
 - Travel Clinics for International Travel



Hendra Virus

- Viral disease consider as emerging (first observed in Australia)
- Natural infections had been **reported only** in:
 - Horses
 - Humans
- Current transmission by:
 - Fruit bats
 - Bodily fluids and urine of those infected
- Clinical signs in Horses
 - Sudden respiratory signs
 - Nasal discharge
 - Fever
 - Encephalitis
 - Sudden death
- Clinical signs in Humans
 - Flu-like illness
 - respiratory complications
 - Highly fatal in human, could be as high as 2 in 3 cases

Hendra Virus

- Little is known about pathogen
- Highest level of security (**biosafety level 4**) needed for studying the pathogen
- Could cause high mortality in humans
- Currently no treatment option is available

(Great topic for term paper)



Japanese Encephalitis

- Viral infection
- Vector-borne diseases
- Species of concern:
 - Humans
 - Pigs
 - Other domesticated animals
- Endemic in many Asian countries
- Supportive care is currently the only treatment option
- Vaccines available and effective for Prevention: human, horses, and swine



Japanese Encephalitis

- Incubation period is typically 6-10 days
- Clinical signs in Horses
 - Fever and
 - Neurologic complications
- Swine
 - Stillbirths
- Humans
 - Fever
 - Headache
 - Could be fatal

Just like many infections disease: No treatment available but prevention by vaccines (Measles, polio etc., No to **antivacers**) (Great topic for term paper)



Exercise 2

- What is the incubation period of Classical Swine Fever and what are the diseases symptoms?
- What CBPP stands for and what are the transmission routes of the dieses?
- What are the three Equine Encephalitis Viruses and what are the signs in human and equine?
- Among the pathogens we studies today, which one is considered an emerging pathogen than require highest level of biosecurity for researcher intent to study the pathogen?
- What is the incubation period of Japanese Encephalitis and what are the main symptoms in human, horses, and swine?
- What is the causative agent for each disease? (Bacterial, Viral, or prions)

Classical Swine Fever; Contagious Bovine Pleuropneumonia (CBPP); Equine Encephalitis; Hendra Virus; Japanese Encephalitis

Lumpy Skin Disease

- Viral infection in cattle
- Transmitted by mosquitoes and biting fli
- Endemic in sub-Saharan Africa
- Hyperendemic in rainy season (Why?)
- Causes severe economic losses
- Could lead to secondary infections





Lumpy Skin Disease

- Incubation period is typically 2-5 weeks
- Common symptoms:
 - Fever
 - Abortions
 - Decreased milk production
 - Nodules typically appear 10 days later
- Mortality rates could range as low as 2 to 85% of herd
- Vaccination with **attenuated virus** available for livestock (need refrigeration)



Q Fever

- Bacterial diseases caused by *Coxiella burnetii* (pasteurization indicator)
- Transmission by:
 - Aerosol
 - Direct contact
 - Ingestion
 - Ticks
 - Raw milk (Cow-share program?)
- Clinical signs in sheep, cattle and goats
 - Can be **asymptomatic**
 - abortions possible
- Clinical sign in humans
 - Flu-like pneumonia





Q Fever

- Highly infectious bacteria
- Aerosols could travel ½ mile by wind
- Often **self-limiting disease** in human and animals
- Antibiotic required in case of complications (human and animals)
- Vaccines for human in some countries
- Prevention in human:
 - Consumption of pasteurized milk
 - Limited exposure to diseased animals

Rinderpest

- A contagious viral disease
- Primarily in cattle and domestic buffalo
- **Transmission** by
 - Direct or close contact with virus
 - Ingestion of contaminated food
 - Contaminated equipment
- Common in East Africa and less common in Asia
- Vaccine offers life-long immunity for various species
- Not a zoonotic diseases



Rinderpest

- Incubation period is typically 3-15 days
- Diseases had 4 forms:
 - (1) <u>Classical</u>: Common signs are fever, diarrhea, nasal discharge
 - (2) <u>Peracute</u>: Mostly occurs in <u>young animals</u> and is rapidly fatal
 - (3) <u>Subacute</u>: Mild signs with <u>low mortality</u>
 - (4) <u>Atypical</u>: Irregular fever mild diarrhea



Sheep and Goat Pox

- Viral Disease
- The dominant Pox disease of domestic animals
- Infection could **limit trade** of livestock and product
- Common in: Africa, Asia, and India
- Could lead to secondary infections
- Not a human pathogen
- Vaccines for animals available in endemic area



Sheep and Goat Pox

- Incubation period is 4-13 days
- Common clinical symptoms:
 - Fever
 - Difficulty breathing
 - Skin lesions that may take up to 6 weeks to heal
- Mortality could be 50% in susceptible herds
- Mortality could 100% in the young





Exercise 3

- What is the incubation period of Lumpy Skin Disease and what are the diseases symptoms?
- What microorganism is causing Q Fever in human and animals?
- What is the incubation period of Rinderpest and what are the four forms of the disease?
- What are the common clinical symptoms of Sheep and Goat Pox?
- What is the causative agent for each disease? (Bacterial, Viral, or prions)
- Lumpy Skin Disease; Q fever; Rinderpest; Sheep and Goat Pox

Disease Occurrence Level of disease

- **Sporadic** refers to a disease that occurs infrequently and irregularly.
- Endemic refers to the <u>constant presence</u> and/or usual prevalence of a disease or infectious agent in an animal or human population within a geographic area.
- Hyperendemic refers to persistent, high levels of disease occurrence.
- **Epidemic** refers to an <u>increase</u>, often sudden, in the number of cases of a disease above what is normally expected in that population in that area.
- **Outbreak** carries the same definition of epidemic, but is often used for a more <u>limited geographic</u> area.
- **Pandemic** refers to an epidemic that has spread over several countries or continents, usually affecting a large number of people.

Exercise 4

For each of the following situations, identify whether it reflects:

A. Sporadic disease

- **B. Endemic disease**
- C. Hyperendemic disease

D. Pandemic disease

E. Epidemic disease

1. 22 cases of Salmonellosis occurred within 3 weeks among residents of a particular neighborhood (usually 0 or 1 per year)

2. ____Average annual incidence was 364 cases of pulmonary tuberculosis per 100,000 population in one area, compared with national average of 134 cases per 100,000 population

3. ____ Over 20 million people worldwide died from influenza in 1918–1919

4. _____ Single case of Aspergillosis was diagnosed in a community

5. ____About 60 cases of listeriosis are usually reported in this region per week, slightly less than the national average

Additional Resources and References:

Centers for Disease Control and Prevention:

https://www.cdc.gov/csels/dsepd/ss1978/index.html

Photo courtesy and source:

http://www.cfsph.iastate.edu/Animal Response/English/p df/S8 SPN ADE Pathogens Shortversion.pdf

Food and Agriculture Organization of the United Nation:

http://www.fao.org/emergencies/emergencytypes/transboundary-animal-diseases/en/ Principles of Epidemiology in Public Health Practice

Third Edition

An Introduction to Applied Epidemiology and Biostatistics

> October 2006 Updated May 201



U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICE: Genters for Disease Control and Prevention (CDC) Office of Workforce and Career Development Atlanta, GA 30333



Thank you

