TB in Elephants: Human Health Considerations

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State Public Health Veterinarian
Virginia Department of Health
Background

• Maryland Department of Health and Mental Hygiene (DHMH) contacted Virginia Department of Health (VDH) in April 2011 to alert VDH about a circus coming to Virginia

• DHMH had been responding to concerns raised by an animal welfare group about a circus elephant with TB
April 4, 2011

Officer Jackson
Animal Control Program
Bureau of Environmental Health
301 Stockholm Street
Baltimore, MD 21230
VIA FAXMILE (410-396-7332)

Re: Urgent: Tuberculosis-Positive Elephant in Baltimore with Ringling

Dear Officer Jackson:

April 6, 2011

Dr. Guy Hohenhaus
State Veterinarian
Maryland Department of Agriculture
Office of Marketing, Animal Industries and Consumer Services
50 Harry S. Truman Pkwy.
Annapolis, MD 21401
VIA FAXMILE 410-841-5999 AND ELECTRONIC MAIL (Hohenhaus@mda.state.md.us)

Re: Urgent: Tuberculosis-Positive Elephant in Baltimore

Dear Dr. Hohenhaus:
TB in elephants called 'a gray area'

Animal-rights group says elephant with positive TB test is a danger

By Laura Vozzella, The Baltimore Sun
7:59 p.m. EDT, April 6, 2011

An animal-rights group contends that an elephant .....poses a health risk to the public because she has tested positive for tuberculosis...
April 12, 2011

Dr. Richard L. Wilkes
State Veterinarian
Virginia Department of Agriculture & Consumer Services
Division of Animal and Food Industry Services
P.O. Box 1163
Richmond, VA 23218
VIA ELECTRONIC MAIL (richard.wilkes@vdacs.virginia.gov) &
FACSIMILE (804-371-2380)

Re: Urgent: TB-Positive Elephant Scheduled to Enter Virginia

Dear Dr. Wilkes:

I am writing to inform you that Karen, an elephant used by the Ringling Bros. and Barnum & Bailey Circus (Ringling) unit scheduled to perform in Fairfax, Virginia from April 14 to 24, recently tested positive for a form of tuberculosis (TB) that is highly transmissible to humans. Because of this, as shown in the attached correspondence that PETA recently obtained, the State of Tennessee prohibited Ringling from bringing Karen into the state for the circus’ January performance dates in Nashville. In the interest of public health, Virginia should not permit Karen’s entry into the state.
Background-Medical

- Asian elephant, 42 years old, imported from Thailand in 1969
- December 2010: trunk wash negative, serologic antibody assay positive
  - Prophylactic treatment initiated
- March 2011: Trunk wash negative for ~4 weeks
Public health vs Occupational Health

• Public health
  – Consider…“minimizing or eliminating contact with the public that would result in exposure by contact or aerosol transmission.”

• Occupational Health
  – Precautions for trunk wash procedure
  – Precautions for animals under enhanced surveillance
  – Precautions for workers during necropsy
  – Annual testing
Public health considerations

• Guidelines for the Control of Tuberculosis in Elephants, USAHA (2008)
• Literature review
• Outreach to experts and partners
• Medical records
• Activity review
VDH Conclusion and Response

- Karen poses no risk of tuberculosis infection to spectators attending circus performances
- Written communication with animal advocacy group
- Preparation for media inquiries
- Communication with the next state this elephant would be entering (West Virginia)
TB in Elephants

• *Mycobacterium tuberculosis* (TB) is the predominant disease causing organism

• Individual case reports in 1800s and early 1900s

• Particular focus on cases since mid-1990s with death of 2 circus elephants

• USDA mandated testing initiated in 1997
TB in Elephants

• ~450 captive elephants in the US

• Of captive US elephants, higher incidence of Asian than African elephants culture positive
  – Likely due to the Asian elephants’ closer association with people

• Exposure to the aerosol of an infected person or other animal
TB in Elephants

• **Clinical signs**
  – Often absent
  – Chronic weight loss
  – Inappetence
  – Exercise intolerance

• **Diagnosis**
  – Trunk wash culture
  – Ancillary testing limited
TB in Elephants

• Treatment regimens may include:
  – Isoniazid
  – Rifampin
  – Ethambutol
  – Pyrazinamide
  – Enrofloxacin

• Routes include oral, rectal, injectable
TB in Elephants

• Human health concerns
  – Occupational vs general public health
  – Close, prolonged contact and other work related duties thought to be risk factors
  – Instances of work related exposure documented
  – One study has documented both work related impact and assessed risk to general public
Occupational Health Studies

*Mycobacterium tuberculosis* Infection as a Zoonotic Disease: Transmission between Humans and Elephants

- Four elephants from an exotic animal farm diagnosed with TB infection between 1994-6.
- Documented 11/22 handlers (6 elephant and 5 tiger) PPD positive with 3 converters in screenings from 1996-7
- One handler with active TB
- Molecular analysis of elephant and human isolates considered identical
- Elephant necropsy attendance, training, cleaning barn
- No mention of infection control or respiratory plan

Occupational Health Studies

Human Exposure following *Mycobacterium tuberculosis*
Infection of Multiple Animal Species in a Metropolitan Zoo

- TB identified in 6 animals (2 elephants, 3 goats and 1 rhino)
- Genotyping evidence strongly suggested transmission from one species to another
- 307/336 zoo employees underwent skin testing
- 55/307 with positive result; no active cases found
- Attending one elephant’s necropsy training elephants were risk factors for conversion
- Authors stressed importance of adhering to strict infection control measures during medical procedures

Occupational Health Studies

Elephant-to-Human Transmission of Tuberculosis, 2009

- Skin test (TST) conversions detected in elephant sanctuary workers July 2009
- Culture positive elephant detected December 2008
- 46/57 current and former sanctuary employees interviewed
- 9 TST conversions documented between and 8/9 converted during 2009 and spent ≥4 hours in quarantine barn
- Risk factors included working in quarantine area or sharing airspace with that area
- Need for consistent infection control training and decreasing aerosol generating cleaning methods

Routine trunk wash detected TB in one elephant; led to increased testing and 2 other infections detected

In total, 118 human contacts evaluated with both employees, zoo volunteers and members of the general public (special event attendees) evaluated

Found 6 converters of 29 close contacts tested

Found one casual contact (zoo volunteer) positive

Authors conclude continuing annual TB screening, fit tested N-95 when in elephant barn or in contact with a potentially infectious elephant
TB Guideline Development

• Original guidelines developed by the United States Animal Health Association and used by USDA Animal Care
• Development of guidelines initiated in mid-1990s
• Debate within the elephant care community in regard to guidelines
• Process initiated by USDA Animal Care to encourage stakeholders in elephant care to write new guidelines
Stakeholder Group Guidelines

- Process began in 2011
- Draft guidelines produced and distributed in 2015
- Multiple sections including diagnostics, testing requirements, trunk wash technique, treatment, FAQs sheets and human health considerations

Image courtesy of Maryland Zoo
Stakeholder Group Guidelines

• Occupational health section
  – Human to human transmission
  – Elephant to elephant transmission
  – Occupational vs Public Health Considerations

Image courtesy of Maryland Zoo
Occupational vs Public Health Considerations

• TB transmitted through close prolonged contact with a person or animal shedding the organism

• Interspecies transmission more likely occupational health risk

• No specific definition of prolonged contact
  – Several hours or more likely necessary
Occupational Health Recommendations

• Facilities that house elephants should develop and occupational health program

• Occupational health protocols should take into consideration:
  – Species of elephants maintained at the facility
  – Health and diagnostic testing history of those elephants
  – The kind of contact members of the general public may have with elephants
Occupational Health Recommendations

• Routine (annual) tuberculosis screening of employees who work with elephants

• Employees with acid-fast positive sputum smears. These individuals should not work directly with elephants until it is determined whether their lab findings represent infection with an organism of the *M. tuberculosis* complex

• Routine education of staff in zoonotic disease prevention
Occupational Health Recommendations

• Education of staff on diagnostic tests or clinical symptoms consistent with active human tuberculosis infection

• Infection control and routine hygiene and sanitation practices including guidelines to reduce direct and indirect aerosol transmission of TB

• Training of employees in the use of PPE
Research Opportunities

• Additional information the time between when an elephant first initiates treatment and cessation of TB bacteria shedding

• Epidemiologic data of zoo employees

• Definition of “exposure”
  – Elephant to elephant
  – Human ↔ elephant
Additional References


• Elephant Tuberculosis – A view from the inside available at http://epi.ufl.edu/onehealth/elephant-tuberculosis-a-view-from-the-inside/

• International Elephant Foundation, https://elephantconservation.org/


• Recommendations for the Diagnosis, Treatment and Management of Tuberculosis (*Mycobacteria tuberculosis*) in Elephants in Human Care available at http://www.aazv.org/?page=ElephantMTBRecs

Additional References


• Transmission of Mycobacterium tuberculosis from an Asian elephant (Elephas maximus) to a chimpanzee (Pan troglodytes) and humans in an Australian zoo, Stephens, et al, Epidemiol. Infect, doi:10.1017/S095026881300068X


• Tuberculosis: an emerging zoonosis, NSW Public Health Bulletin, Vol. 24(1) 2013
Thank you