“A Tale of Two Tusks”

Using MAVEN in an Unusual TB Case and Contact Investigation

Massachusetts Association of Public Health Nurses

May 1, 2014

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Faculty Disclosure

We wish to confirm that we have no financial or commercial interests to disclose.

TB Disease Surveillance

- Immediate reporting
- State and local case manager assignment
- Disease investigation
- Disease management and treatment
- Contact investigation and containment
- Investigation and documentation through an online investigation platform- MAVEN

What do we do…

When the patient is an elephant?

Objectives

- Explore TB in elephants and transmission risk to humans
- Review the surveillance and investigation process for zoonotic diseases; Case report
- Define components of animal and human contact investigation
- Demonstrate shared investigation record using MAVEN
- Discuss shared responsibility in TB surveillance and investigation

Tuberculosis in Elephants

- **Etiology**
  - *Mycobacterium tuberculosis*
- **Epizootiology**
  - Asian and African elephants susceptible
  - Humans are reservoir
  - Chronic, progressive, debilitating disease
- **Transmission and Pathogenesis**
  - Aerosol transmission assumed
  - Transmission from human to elephant or elephant to elephant
  - Diagnosed in captive elephants in US and Europe
  - Not yet found in free-ranging elephants

Tuberculosis in Elephants

- **Clinical**
  - ✓ Signs may be absent
  - ✓ Weight loss, wasting syndrome
  - ✓ Lethargy
  - ✓ Exercise intolerance
  - ✓ Discharge from trunk

Apparent Prevalence in North America 1994-2011

- Overall apparent prevalence approx. 10.6%, 1994-2011
- Annually 1-8 new cases detected through surveillance (Median 3 cases/year)
- Captive elephants in N. America
  - Approx. 274 Asian
  - Approx. 206 African
- Estimated *M. tuberculosis* infections
  - Approx. 16.4% Asian elephants
  - Approx. 2.9% African elephants
- Overall mortality 64/7%; higher in female elephants

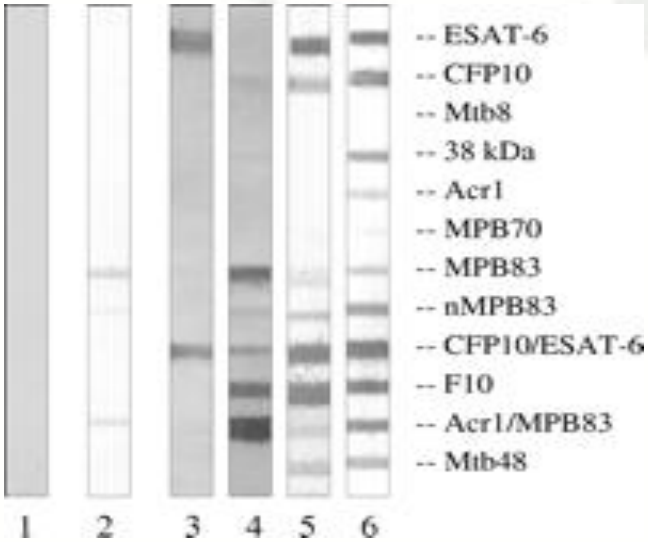
Recent history of TB in Elephants North America

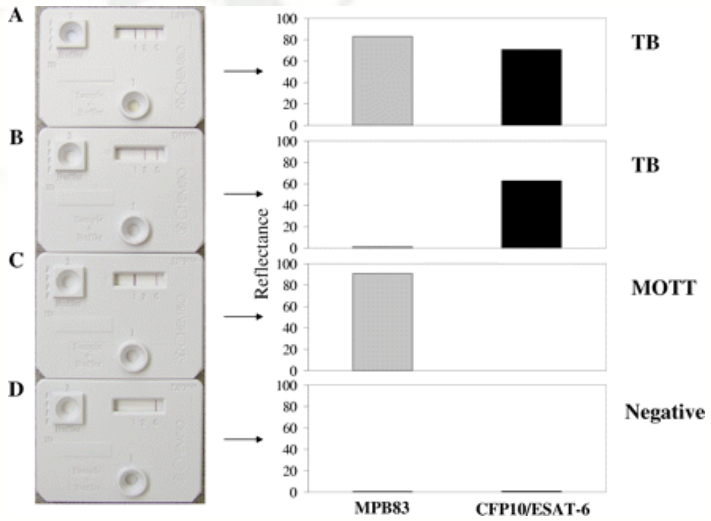
- During the 19th and 20th centuries, *Mycobacterium tuberculosis* in elephants was sporadically reported.
- First reported outbreak of TB in elephants in N. America- Exotic animal farm in Illinois, 1996
- Prompted USDA-APHIS to require annual trunk wash testing of all captive elephants in US, beginning in 1998

Trunk Wash Technique

Additional Test Methods

- DPP VetTB Assay (Dual Path Platform)
  - Rapid, point of care serologic test
- Multiantigen Print Immunoassay (MAPIA)
  - Follow up test to DPP, evaluates for presence of antibodies to a larger number of MTB antigens than DPP





Current Testing Protocol

- Annual testing of all captive elephants under supervision of licensed veterinarian according to USDA requirements
  - Culture (trunk wash-triple sample)
  - DPP (Rapid serologic test)
- Elephants with a reactive DPP must then have a MAPIA test performed
- Positive findings on one or more of the above tests trigger accelerated testing schedules

Zoonotic Transmission

- **Transmission from elephants back to humans working in close proximity first described in late 1990s**
  - 1996 Exotic animal farm-Illinois, four elephants with TB(3 died)
    - ✓11/22 handlers +PPD, one had smear-, culture+ active TB
    - ✓IS6110 and TBN12 typing confirmed same strain among elephants and handler with active TB
- 1997-2000 Los Angeles Zoo
  - Two Asian elephants, three Rocky Mountain goats and one black rhinoceros diagnosed with *M. tuberculosis*
  - No active human cases, but 55 tuberculin skin test conversions were associated with training elephants and attending an elephant necropsy

Tennessee 2009

Infectious diseases on msnbc

Elephants blamed
outbreak at Tenn.

Three of the eight infected workers weren't in clos

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By Mike Stobbe
Associated Press
updated 2/16/2011 5:50:00 PM ET

ATLANTA — A tuberculosis outbreak am
blamed on one of the pachyderms, even t
the animal.

Elephants can carry TB, and there have b
three of the eight employees who got TB didn't work directly with the elephant, accordin
Wednesday by the Centers for Disease Control and Prevention.

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Elephant Behind TB Outbreak at Tenn. Sanctuary

Published February 18, 2011 | Reuters

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Liz, an African elephant housed at a sanctuary for the animals, was the source of tuberculosis infection among eight workers at the refuge, an author of a report on the 2009 outbreak said on Thursday.

None of the infected employees at the Hohenwald, Tennessee, sanctuary for old, often abused, elephants, became ill. The workers were given preventive therapy, and 54-year-old Liz is in quarantine and undergoing treatment.

Sponsored Links

A report by The Centers for Disease Control and Prevention blamed pressure-washing of elephant barns for the spread of the tuberculosis

RESEARCH

Elephant-to-Human Transmission of Tuberculosis, 2009

Rendi Murphree, Jon V. Warkentin, John R. Dunn, William Schaffner, and Timothy F. Jones

In 2009, the Tennessee Department of Health received reports of 5 tuberculin skin test (TST) conversions among employees of an elephant refuge and isolation of *Mycobacterium tuberculosis* from a resident elephant. To determine the extent of the outbreak and identify risk factors for TST conversion, we conducted a cohort study and onsite assessment. Risk for conversion was increased for elephant caregivers and administrative employees working in the barn housing the *M. tuberculosis*–infected elephant or in offices connected to the barn (risk ratio 20.3, 95% confidence interval 2.8–146.7). Indirect exposure to aerosolized *M. tuberculosis* and delayed or inadequate infection control practices likely contributed to transmission. The following factors are needed to reduce risk for *M. tuberculosis* transmission in the captive elephant industry: increased knowledge about *M. tuberculosis* infection in elephants, improved infection control practices, and specific occupational health programs.

Zoonotic transmission of *Mycobacterium tuberculosis* from elephants to humans working in close proximity was described in the late 1990s. Studies of workers exposed to elephants infected with *M. tuberculosis* have reported a potential for elevated risk among those who have prolonged and close contact with elephants; engage in treatment, medical procedures, or necropsies of elephants; live inside or close to an elephant barn; or participate in cleaning elephant barns or work as groundskeepers (*1*–*3*). public, private, and nonprofit facilities. Among these, ≈12% of Asian and ≈2% of African elephants are thought to be infected with *M. tuberculosis* (*6*,*7*). Recommendations for detection and treatment of tuberculosis (TB) in elephants exist (*8*). However, no standard definition exists for latent TB in elephants, and no sound clinical criteria exist for diagnosing TB in elephants. Elephants are considered exposed to *M. tuberculosis* if they have had contact with an *M. tuberculosis* culture–positive animal. They are thought to have active TB when *M. tuberculosis* is cultured from respiratory secretions obtained from their trunk (trunk wash). However, performing a trunk wash is challenging, and culture of *M. tuberculosis* from these specimens is unreliable (*9*,*10*). Knowledge about effectiveness of human antituberculous medications in elephants is limited (*6*–*8*).

We describe an outbreak of *M. tuberculosis* infection among employees of an elephant refuge. We also present findings of the ensuing epidemiologic and environmental investigation conducted to identify work practices and facility characteristics that probably contributed to zoonotic transmission.

Outbreak

In July 2009, routine screening detected conversion of tuberculin skin test (TST) results from negative to positive among caregivers at a nonprofit elephant refuge in south-central Tennessee, USA. In addition, records review

Emerging Infectious Diseases • www.cdc.gov/eid • Vol. 17, No. 3, March 2011

Population at Risk

- Workers with prolonged AND close contact to elephants infected with TB have potential for elevated risk of infection.
  - Treatment, medical procedures
  - Necropsy
  - Live in or close to elephant barn
  - Cleaning barns or working as groundskeepers

Recommendations

- Improved methods for diagnosis are needed
- Develop evidence-based guidelines for Infection Control Practices
- Need for occupational health/TB awareness among elephant caretakers
- Reduce aerosol-generating practices

Case Report

- **August 23, 2010: Epidemiology Program received a call from DAR reporting a possible case of TB in a 36 year-old elephant at the Southwick Zoo in Mendon**
  - Elephant died on 7/29/10
  - + MAPIA test 3/10 while in FL (triggered accelerated trunk wash cultures)
  - +AFB in trunk wash culture collected 7/21/10
  - Limited necropsy performed-multiple biopsy specimens sent for testing at Tufts and NVSL
  - Granulomas grossly visible in lung tissue at necropsy
  - Animal buried on site

Initial Investigation/Findings

- Dondi
  - ✓ 36 year-old female Asian Elephant
- Privately owned
  - ✓ Owned by same couple since coming to US
  - ✓ Adopted from Thailand 34 years prior
- Spent summers in Mendon at Southwick Zoo and winters in Florida

Initial Investigation/Findings

- Southwick veterinarian reported that Dondi had been deteriorating for a couple weeks prior to death
  - ✓Dental infections
  - ✓Colitis
  - ✓*NO* overt respiratory symptoms or discharge from trunk

Animal Contact Investigation Findings

- Dondi's owners/caretakers had reportedly not allowed her to have contact with other elephants during her lifetime in the US
  - ✓Confirmed by veterinarian in FL and MA
  - ✓May have been housed in separate enclosure, but same building (at Southwick Zoo) as elephant that died of TB in 2007 (after returning to Texas).

Human Contact Investigation

- Initial investigation identified several potential contacts:
  - ✓ 2 veterinarians (MA and FL)
  - ✓ 3-4 Primary caretakers at Southwick Zoo (2 of whom had left MA)
  - ✓ 4 other individuals present at necropsy
- Contact information to the TB Program for intensive follow up

Human Contact Investigation

Based on the concentric circle decision was made to test

- Owners
- Handlers
- Zoo Owner
- Veterinarians

Human Contact Investigation

- 11 people identified
- 10 people tested
- 10 people negative
- 1 low priority (tested by primary care physician)
- 1 recently completed Chemotherapy and radiation for cancer -CXR was recommended

Interstate Collaboration

- Animal's owner lived out of state
- Request sent to Pennsylvania Health Department
- 2 people identified
- 2 people tested
- 2 negative

Interstate Collaboration

- Veterinarian lived in Florida
- Request sent to Florida Health Department to contact
- Veterinarian tested by Primary care physician
- Negative TST

Community Concerns - Children

- Child reportedly fed the elephant regularly over the past six months.
- Kids often came to the zoo and requested to feed the elephant (not done on a regular basis).

- 1 child was allowed to feed 1 apple to the elephant on 2 separate occasions (contact estimated less than 5 minutes)
- Local pediatrics office received multiple calls regarding potential exposure.

Education Challenges

- Family and zoo staff regarding TB prevention and control
- Transmission (not well understood from animal source to humans)
- Other state partners
- Community members

Secondary challenges

Challenges from media and animal rights groups

Human Challenges

- Dondi was viewed a member of the family
- Assistance needed to support family through grieving process while also performing disease and contact investigation

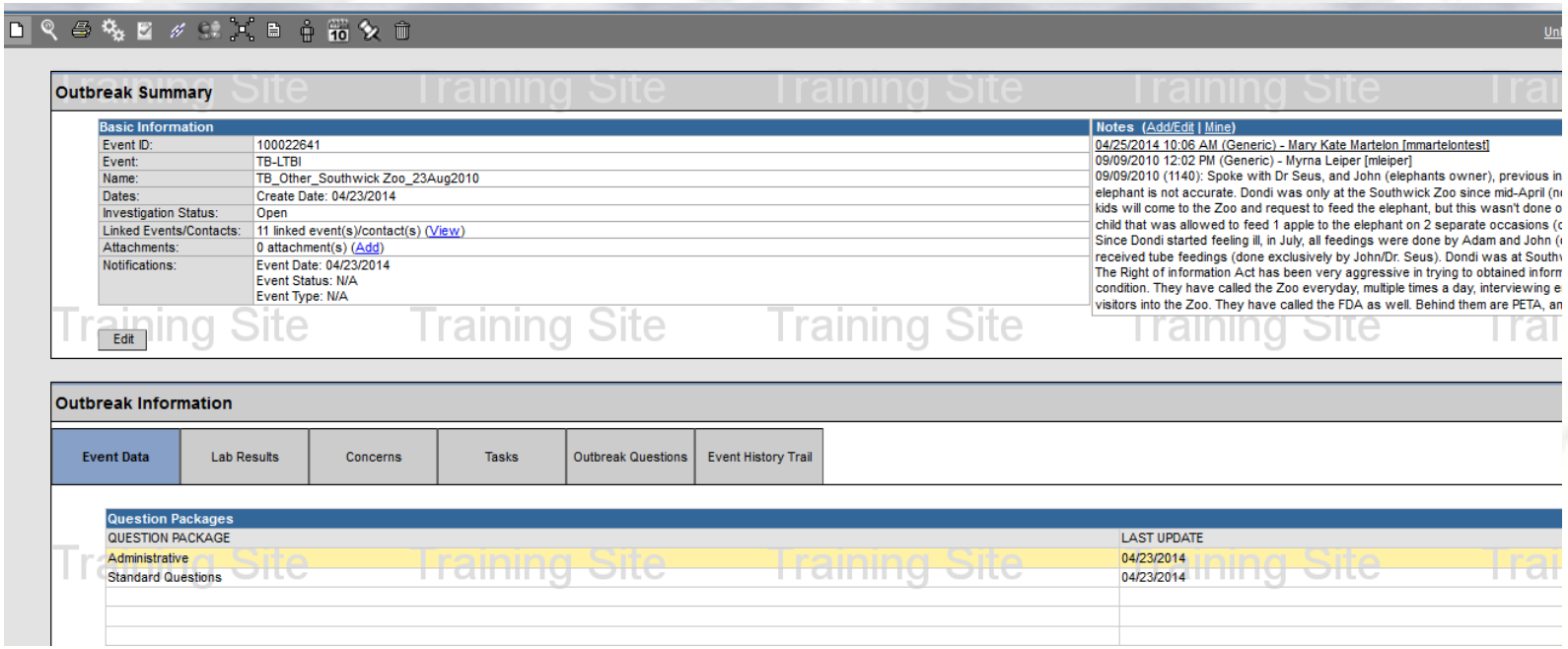
TB Program Challenges

How to craft a record for an elephant in a person based data system? Must be able to:

- Attach needed information in a central repository
- Handle various information sources
- Be used as shared communications tool by all people working on case
- Provide a place to link and follow human contacts in an organized way

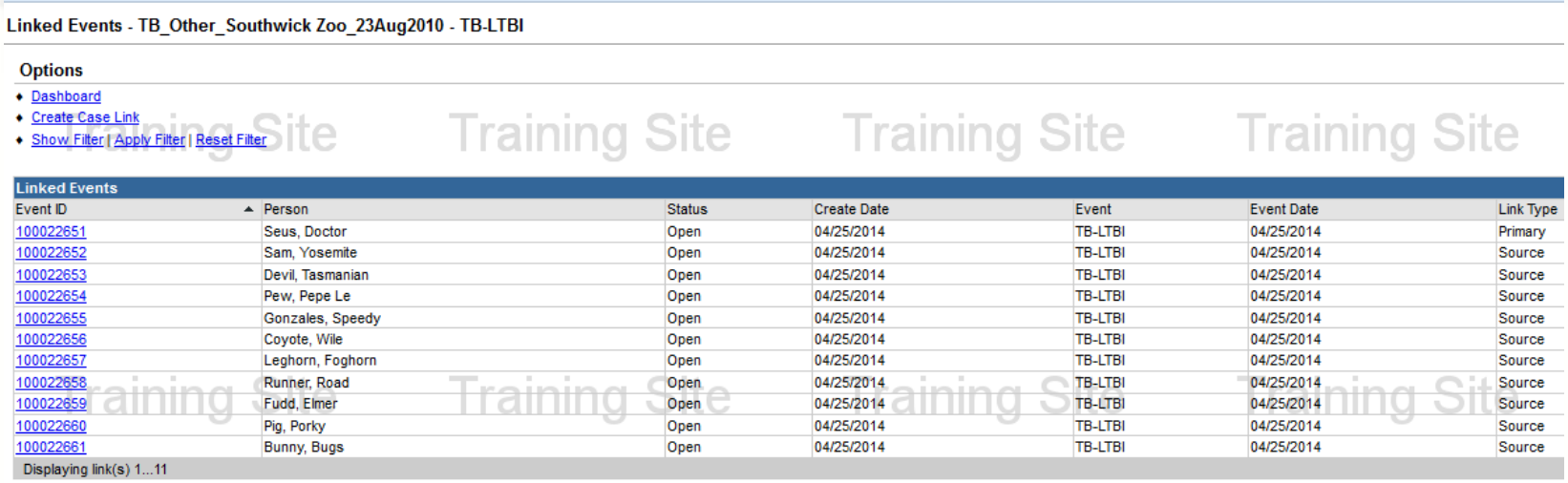
MAVEN Outbreak Module

- Advantages:
  - ✓ Part of a system already in use
  - ✓ Ability to share records and deposit all info related to case



MAVEN Outbreak Module Cont.

- Advantages Cont.:
  - ✓ Ability to link human contacts to “source”
  - ✓ Ability to view all linked cases in one location



Linked Events - TB_Other_Southwick Zoo_23Aug2010 - TB-LTBI

Options

- Dashboard
- Create Case Link
- Show Filter | Apply Filter | Reset Filter

Linked Events

Event ID	Person	Status	Create Date	Event	Event Date	Link Type
100022651	Seus, Doctor	Open	04/25/2014	TB-LTBI	04/25/2014	Primary
100022652	Sam, Yosemite	Open	04/25/2014	TB-LTBI	04/25/2014	Source
100022653	Devil, Tasmanian	Open	04/25/2014	TB-LTBI	04/25/2014	Source
100022654	Pew, Pepe Le	Open	04/25/2014	TB-LTBI	04/25/2014	Source
100022655	Gonzales, Speedy	Open	04/25/2014	TB-LTBI	04/25/2014	Source
100022656	Coyote, Wile	Open	04/25/2014	TB-LTBI	04/25/2014	Source
100022657	Leghorn, Foghorn	Open	04/25/2014	TB-LTBI	04/25/2014	Source
100022658	Runner, Road	Open	04/25/2014	TB-LTBI	04/25/2014	Source
100022659	Fudd, Elmer	Open	04/25/2014	TB-LTBI	04/25/2014	Source
100022660	Pig, Porky	Open	04/25/2014	TB-LTBI	04/25/2014	Source
100022661	Bunny, Bugs	Open	04/25/2014	TB-LTBI	04/25/2014	Source

Displaying link(s) 1...11

- Disadvantages:
  - ✓ No jurisdiction for an outbreak/cluster event
  - ✓ Cluster/Outbreak events are not included in any workflows

Lessons Learned

- Increasing incidence of TB in elephants
- Interspecies transmission of TB
- Collaboration between TB Prevention and Control with Zoonotic Epidemiologist and Veterinarian
- Using MAVEN as a shared repository for information
- Use of outbreak model in MAVEN for tracking of human contact/animal case
- Use of outbreak model for tracking clusters, airline exposures and other non-traditional cases of TB

Questions

Resources

- Guidelines for the Control of Tuberculosis in Elephants 2010 (USAHA) 8 November 2010

  http://www/aphis.usda.gov/animal_welfare/index.shtml

- Proceedings from USDA-APHIS Animal Welfare Conference on Tuberculosis in Elephants, April 2011- Kansas City, MO
  - http://www.aphis.usda.gov/animal_welfare/pg.php?pg=Tuberculosis_in_Elephants
- Elephant to Human Transmission of Tuberculosis-2009
  - www.cdc.gov/eid Vol. 17, No. 3, March 2011
- Human Exposure following Mycobacterium tuberculosis Infection of Multiple Animal Species in a Metropolitan Zoo
  - www.cdc.gov/eid Vol. 8, No. 11, November 2002

Thank you!