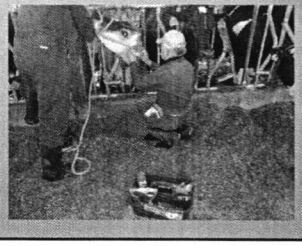
Wisconsin Bovine Tuberculosis Updates

Elisabeth Patton
TB summit
November 2019

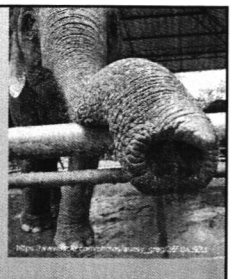
TB, one year and counting updates

- Bovine TB background
- Where did we start?
- What have we done?
- What's next?



Mycobacterium species

- *M. tuberculosis*
  - #1 human infection worldwide
    - known to infect zoo animals
- *M. bovis*
  - Wide host range
    - infects most mammals / very infectious

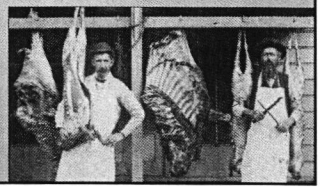


Bovine TB: US History

- 1600s TB imported with European cattle
- 1882 Koch discovers tubercle bacillus (*M. bovis*)
- 1900s TB leading cause of death in people in US
  - Est. 20-30% of human TB cases are *M. bovis*

Bovine TB: US History

- 1910 Milk pasteurization, meat inspection begins
- 1917 National eradication program begins
  - ~5% of all US cattle infected with TB
  - 1922 mandatory
- 1918 Cost to industry
  - est. $40 Million



Bovine TB: US Eradication Program

- 1920 Skin test standardized to caudal fold test
- 1935 Prevalence reduced to 3% in US cattle
- 1950s Surveillance method: 'down the road'
  - Prevalence. 0.1%
- 1960s Surveillance now slaughter inspection

USDA

Bovine TB: Transmission

- Inhalation
  - Aerosol from other infected animals
- Ingestion
  - Unpasteurized milk, contaminated feed/food

Bovine TB: Clinical Signs in Cattle

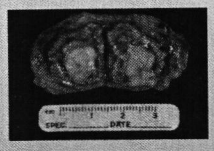
- Most cattle appear healthy
  - can be asymptomatic for years, yet infectious
- Long incubation period
- Advanced infections
  - Loss in body condition
  - Lymphadenopathy, intermittent fever (rare)
  - Chronic cough, nasal discharge (rare)

Bovine TB: Necropsy

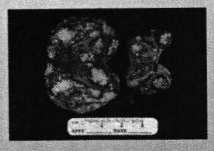
- Gross lesions may be subtle

Bovine TB : Bovine Necropsy

Tracheal-Bronchial l.n.



Medial Retropharyngeal l.n.



Bovine TB : Cervid

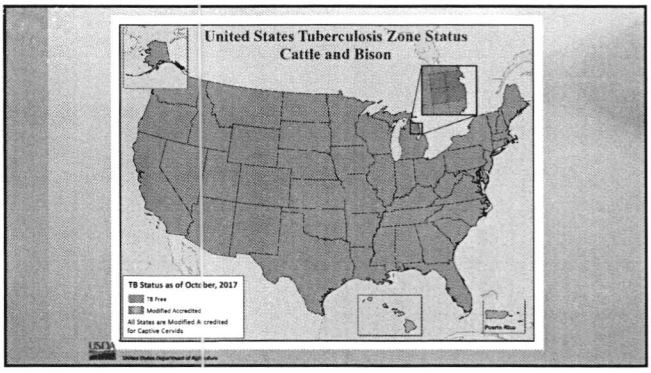
Ribcage

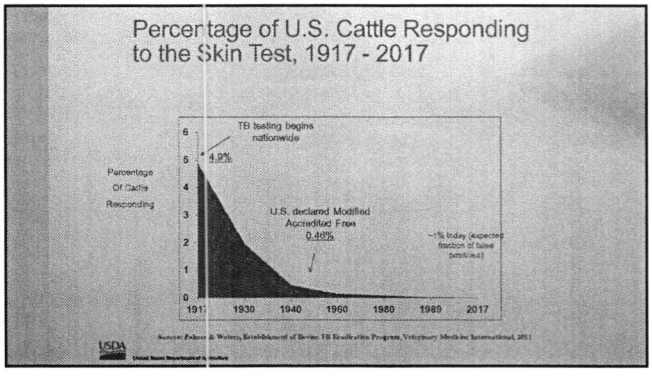
Surface of lung

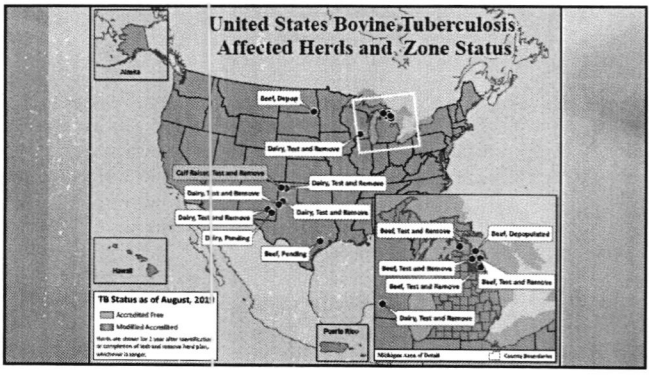
http://www.michigan.gov/dnr/0,4570,7-153-10370_12150-263062--,00.html

Bovine TB: Zoonotic

- Primary reservoir - cattle or wildlife
- People exposed
  - Raw milk or raw milk products
  - Rarely inhalation
- Human to human transmission rare
  - Recent case reported in US
- Infected people transmit infection to cattle
  - Recent cases reported in US
- Wildlife reservoirs vary
  - WTD MI
  - European Badger UK


United States Tuberculosis Zone Status
Cattle and Bison
TB Status as of October, 2017
TB Free
Modified Accredited
All States are Modified Accredited for Captive Cervids
Puerto Rico
USDA


Percentage of U.S. Cattle Responding to the Skin Test, 1917 - 2017
TB testing begins nationwide
4.9%
Percentage Of Cattle Responding
U.S. declared Modified Accredited Free
0.46%
~1% today (suspected fraction of false positives)
6
5
4
3
2
1
0
1917
1930
1940
1960
1980
1989
2017
USDA

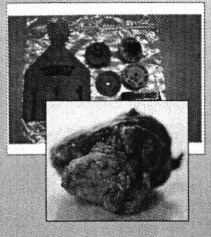

United States Bovine Tuberculosis
Affected Herds and Zone Status
Alaska
Hawaii
Puerto Rico
Beef, Depop
Dairy, Test and Remove
Calf Raising, Test and Remove
Dairy, Test and Remove
Dairy, Test and Remove
Dairy, Test and Remove
Dairy, Test and Remove
Dairy, Pending
Beef, Pending
Beef, Test and Remove
Beef, Depopulated
Beef, Test and Remove
Beef, Test and Remove
Beef, Test and Remove
Beef, Test and Remove
Dairy, Test and Remove
TB Status as of August, 2017
Accredited Free
Modified Accredited
Michigan Area of Detail
County Boundaries

Hurdles to US TB Eradication

- Pockets of wildlife infection
- Undetermined sources of infection (New WGSs?, human transmission?)
- Annual introduction from Mexican feeders & "ropers", and undocumented movement of Mexican origin "ropers" from state to state
- Non-uniform detection at slaughter plants
- Poor animal ID/Traceability/correlation at slaughter
- Changes in cattle production: larger herds, heifer raisers, recipient suppliers
- Decreased regulatory budgets (Indemnity changes?)

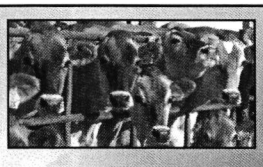
USDA United States Department of Agriculture

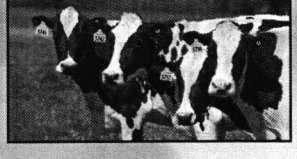
Identification important in confirming TB cases



USDA United States Department of Agriculture

Official ID

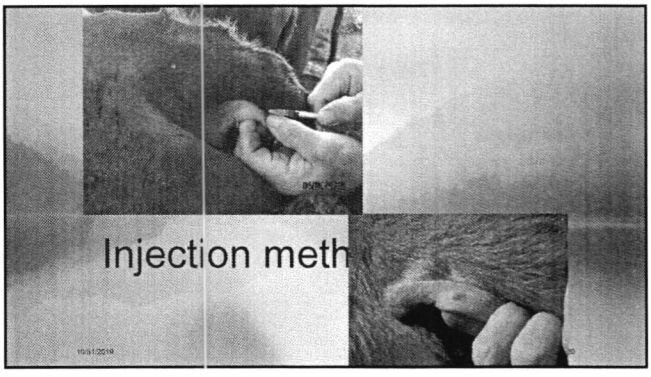




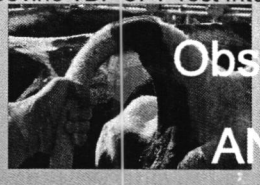
TB Testing n Cattle

- **Caudal fold tuberculin test (CFT)**
  - Screening test for bovine TB
  - Purified protein derivative of bovine tuberculin- intradermal injection in the caudal tail fold

- **Comparative cervical tuberculin test (CCT)**
  - Confirmatory test for bovine TB
  - Purified protein derivatives of bovine and avian tuberculin- intradermal injection in the neck



Bovine TB: CFT Test Interpretation



Observe

AND

Palpate

Bovine TB: Follow up Testing

- Follow up tests for CFT test responder
  - Comparative Cervical Tuberculin (CCT) Test
  - Gamma Interferon (GI) Blood Test
    - Not currently approved in US
      - Evaluation in progress
      - Test performance issues
- Follow up tests performed only by regulatory veterinarian
  - Currently only CCT

CCT Test

HERD OWNER - LAST NAME FIRST NAME INITIAL

DUTCHER, MICHAEL / USDA, APHIS,VS-WISCONSIN

ROUTE - STREET - ROAD
1111 DENING WAY / SUITE 100

POST OFFICE STATE (Including Zip Code)
MADISON WI 53717

COUNTY TOWNSHIP SECTION HERD NO.
Dane

REASON FOR CFT OR SCT

AREA	1	HERD RETEST	4
HERD(RE) ACCREDIT	2	TRACING RES KILL	5
MILK ORDINANCE	3	TRACING REACTORS	6
SALE - SHOW	4	TRACING EXPOSED	7
IMPORTED	5	OTHER	10 X

DATE INJECTED

CFT OR SCT	COMPARATIVE CERVICAL
07/06/2011	07/06/2011

ACTIVE OF SUSPECT SUSPECTS ☐ YES ☒ NO

CC TEST RESULTS

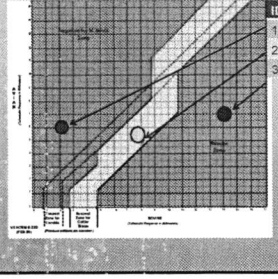
NRS	MID	MLA	AVIA.
1	1	1	3

TUBERCULIN	SERIAL NO.	LICEN
AVIAN	10BAI11CO	
MAMMALIAN	3:BAI13C1	

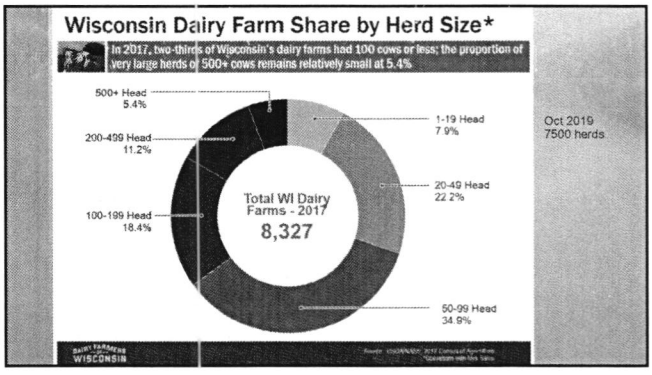
ANIMAL NUMBER	OFFICIAL IDENTIFICATION NUMBER	OTHER IDENTIFICATION	AGE	BREED	SEX	AVIAN PPD (UPPER) SKIN THICKNESS Millimeters Normal	Millimeters 72 Hours	Millimeters Increase	BOVINE PPD (LOWER) SKIN THICKNESS Millimeters Normal	Millimeters 72 Hours	Millimeters Increase	PREVIOUS CFT OR SCT RESPONSE	CLASSIFICATION (CC TEST) (N S R)
1	3:AAA1210	T-1569 B.400D/E-.4	5Y 0M	NO	F	10.0	16.0	6.0	12.0	14.0	2.0		N
2	3:AAA1211	T-1671 B.100D/E-.4	5Y 0M	NO	F	10.0	15.0	5.0	12.0	20.0	8.0		S
3	3:AAA1212	T-1A-8 B.400D/E-.4	5Y 10M	NO	F	10.0	17.0	7.0	12.0	26.0	14.0		R
4													
5													

10/31/2019

CCT Scatter Gram



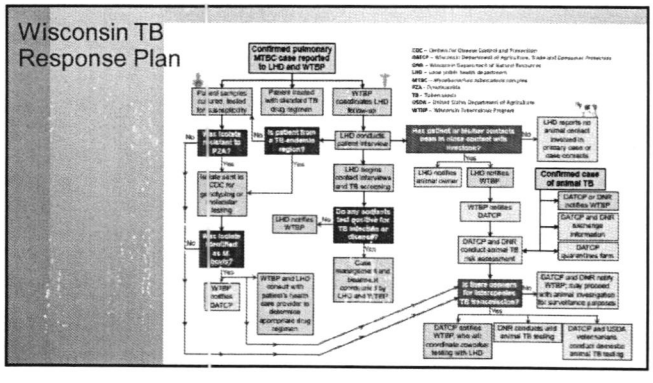
ID	Change in size
1	6/2
2	5/8
3	7/14

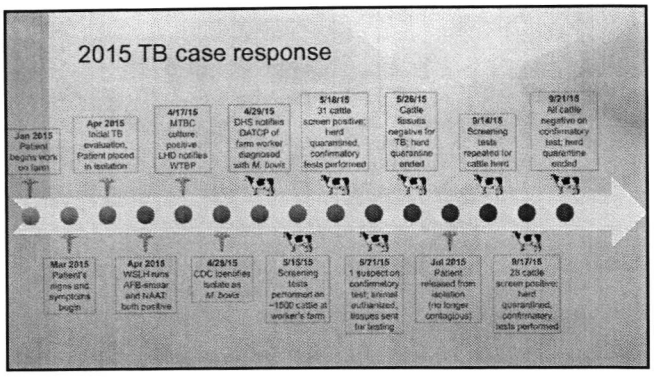


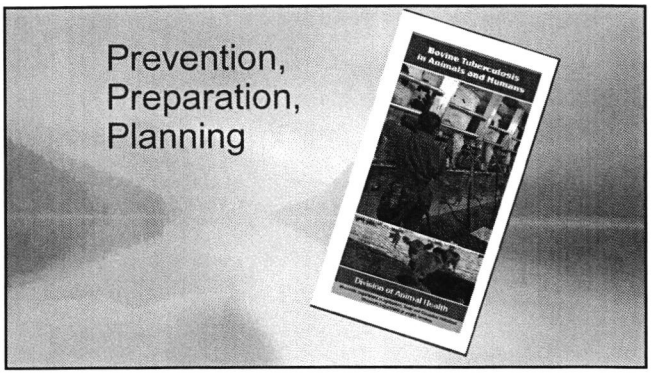
Wisconsin Monthly Dairy Farms Statistics

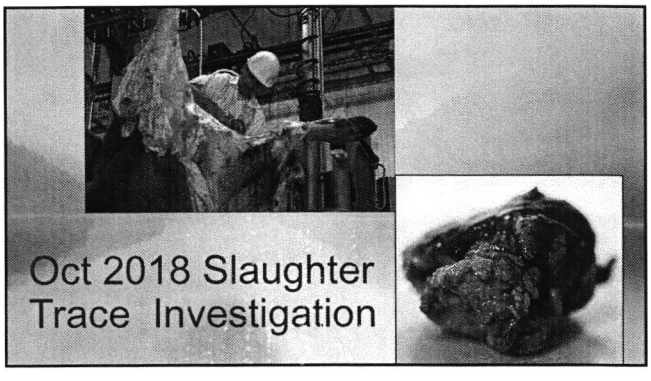
Number of Licensed Dairy Herds: 7,476 herds (October 1, 2019)
Number of Dairy Cows: 1,267,000 dairy cows (September 2019)
Average Number of Cows Per Dairy Farm: 169 dairy cows (September 2019)
Total Monthly Milk Production: 2.52 billion pounds (September 2019)
Monthly Milk Production Per Cow: 1,985 pounds or 231 gallons
Daily Milk Production Per Cow: 66 pounds or 7.7 gallons

Source: Wisconsin Agricultural Statistics Service (WASS)

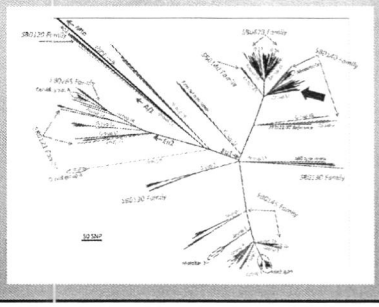


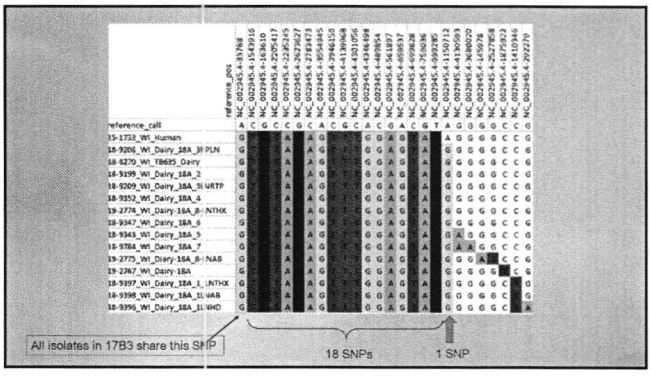

2015 TB case response
Jan 2015
Patient begins work on farm
Mar 2015
Patient's signs and symptoms begin
Apr 2015
Initial TB evaluation. Patient placed in isolation
Apr 2015
WSLH runs AFB-smear and NAAT both positive
4/17/15
MTBC culture positive LHD notifies WTBP
4/29/15
CDC identifies isolate as M. bovis
4/29/15
DHS notifies DATCP of farm worker diagnosed with M. bovis
5/15/15
Screening tests performed on ~1500 cattle at worker's farm
5/18/15
31 cattle screen positive; herd quarantined, confirmatory tests performed
5/21/15
1 suspect on confirmatory test; animal euthanized, tissues sent for testing
5/26/15
Cattle tissues negative for TB; herd quarantine ended
Jul 2015
Patient released from isolation (no longer contagious)
9/14/15
Screening tests repeated for cattle herd
9/17/15
23 cattle screen positive; herd quarantined, confirmatory tests performed
9/21/15
All cattle negative on confirmatory test; herd quarantine ended


Prevention, Preparation, Planning
Bovine Tuberculosis in Animals and Humans
Division of Animal Health

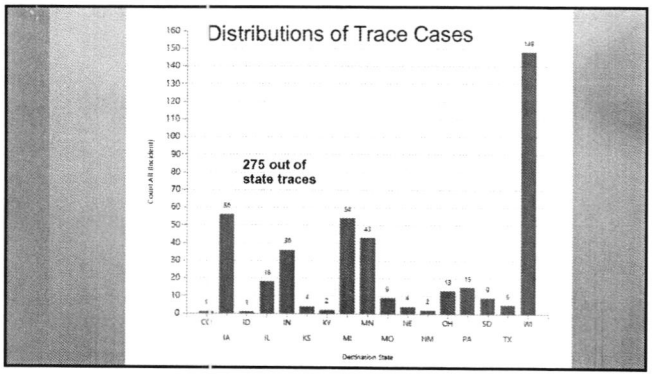

Oct 2018 Slaughter Trace Investigation

M. bovis Phylogentic Tree





Distributions of Trace Cases



Trace Herd Investigations

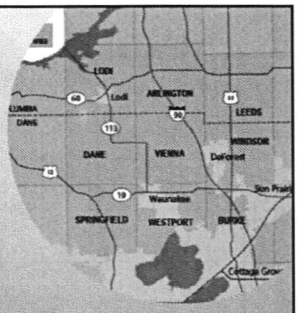
- Contact herds
- Contact trace in/trace out herds
  - Sales Records from Dealers/Markets
- Process
  - Complete Epidemiology form
    - Breeding animals
    - Feeder Animals
  - Determine next steps
    - Herd quarantine
    - Herd testing
    - Restricted movement to slaughter
    - Herd plan

Wildlife Sampling

Department of Natural Resources
Wildlife Services

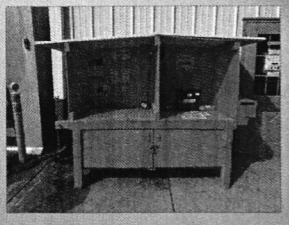
Surveillance in White-tailed Deer

- Notification 3 weeks prior to hunting season
- Deer samples from 9 townships surrounding positive dairy farm
- Low deer density/habitat in comparison to the remainder of the counties
- 232 white-tailed deer tested for bovine tuberculosis (bTB) from the fall 2018 hunting season



Surveillance in White-tailed Deer

- Used existing system in place for CWD head sampling collection
- Staffed for opening weekend
- 4 locations in the 9 township area
- Collected heads taken to DNR CWD processing center for sample collection



Surveillance in White-tailed Deer

- Samples collected: Medial Retropharyngeal, Parotid, and Submandibular lymph nodes.
- Pooled geographically in groups of 5-6 animals for culture submission
- Half of samples from each animal kept frozen in house for follow-up should culture identify a positive pool
- Worked closely with our partners at DATCP, the Wisconsin Department of Health Services (DHS) and the U.S. Department of Agriculture (USDA) to develop surveillance plan
- Plan to continue for minimum of 3 years.

Wildlife Sampling

- Wildlife Services
  - Trapping mesocarnivores
    - Raccoons, opossums
    - DATCP/USDA VS sampling
    - USGS laboratory
    - Collecting lymph nodes 2019, 2020

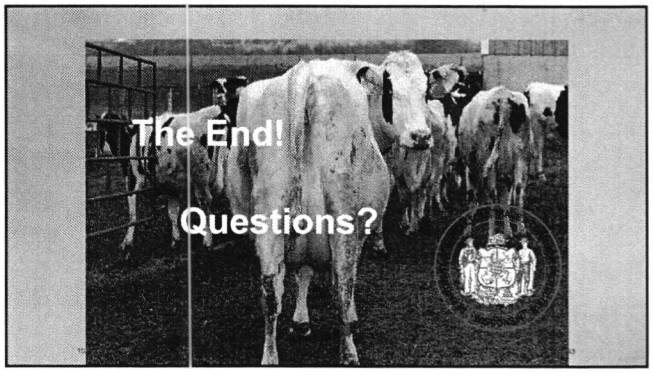
Photo from wikipedia

Lessons Learned

- One Health
  - Human WGS prevented a lot of testing
    - Trace backs- source of infection
  - Established communication plan with other agencies
    - Public Health
    - Department of Natural Resources
  - Proactive Human Health Programs needed
    - Producer driven

Lessons Learned

- Trace Investigations
  - Official Identification Needed
    - Farm of origin
    - Recorded at points of concentration
- Unified message to producers/practitioners
  - Joint public meetings with USDA/Public Health/DNR


The End!
Questions?