California: Bovine TB Free!
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California Bovine TB Status

- **October 1999:** First gained Bovine TB “Free Status”
- **April 2003:** Downgraded to “Mod. Accredited Advanced” (MAA) - bovine TB in 3 dairy herds
- **April 2005:** Regained “Free Status”
- **Sept 2008:** Downgraded to MAA - bovine TB in 3 dairy herds
  - 2009: 4th affected dairy herd
  - 2011-12: 5th, 6th and 7th affected dairy herds
  - 2013: 8th affected dairy herd
- **August 8, 2016:** Regained “Free Status”
Location of the 11 Affected Dairy Herds in California (7 M. bovis strains) 2002-2013

B. McCluskey et al
J Pre Vet Med April 2014
## Cattle TB Testing in CA 2002-2016

<table>
<thead>
<tr>
<th>Fiscal Year (Oct-Sept)</th>
<th># Cattle Tested by Animal Health Officials</th>
<th># Cattle Tested by Private Practitioners</th>
<th>Total # Cattle Tested</th>
<th>Total # Herd Tests</th>
</tr>
</thead>
<tbody>
<tr>
<td>2002-2003</td>
<td>413,211</td>
<td>85,553</td>
<td>498,764</td>
<td>1,919</td>
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<tr>
<td>2003-2004</td>
<td>354,448</td>
<td>135,659</td>
<td>490,107</td>
<td>2,098</td>
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<tr>
<td>2004-2005</td>
<td>55,263</td>
<td>85,030</td>
<td>140,293</td>
<td>1,545</td>
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<tr>
<td>2005-2006</td>
<td>15,835</td>
<td>73,783</td>
<td>89,618</td>
<td>1,175</td>
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<tr>
<td>2006-2007</td>
<td>9,034</td>
<td>84,235</td>
<td>93,269</td>
<td>1,158</td>
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<tr>
<td>2007-2008</td>
<td>219,259</td>
<td>99,271</td>
<td>318,530</td>
<td>2,119</td>
</tr>
<tr>
<td>2008-2009</td>
<td>195,315</td>
<td>117,239</td>
<td>312,554</td>
<td>2,984</td>
</tr>
<tr>
<td>2009-2010</td>
<td>34,685</td>
<td>89,545</td>
<td>124,230</td>
<td>2,114</td>
</tr>
<tr>
<td>2010-2011</td>
<td>60,228</td>
<td>99,878</td>
<td>160,106</td>
<td>1,714</td>
</tr>
<tr>
<td>2011-2012</td>
<td>77,534</td>
<td>91,488</td>
<td>169,022</td>
<td>1,348</td>
</tr>
<tr>
<td>2012-2013</td>
<td>145,473</td>
<td>123,083</td>
<td>268,556</td>
<td>1,518</td>
</tr>
<tr>
<td>2013-2014</td>
<td>70,206</td>
<td>125,636</td>
<td>195,842</td>
<td>1,322</td>
</tr>
<tr>
<td>2014-2015</td>
<td>15,134</td>
<td>108,514</td>
<td>123,648</td>
<td>1,144</td>
</tr>
<tr>
<td>2015-2016</td>
<td>13,549</td>
<td>103,885</td>
<td>117,434</td>
<td>1,331</td>
</tr>
</tbody>
</table>

**Cumulative Total**: 3,101,973 23,489
Since last downgraded in 2008, close to 1.5 million cattle tested, and 8 affected herds managed, to regain TB Free status.
CA Bovine TB Surveillance FY 15-16

A. Slaughter Surveillance
- Four of “top 40” US adult packing plants
- 506 granulomas to NVSL
- # Adults slaughtered in CA = ~800,000
  Rate = 1.26 submissions per 2,000 adults (vs 2.75 two yr ago)
- # “Fat” cattle slaughtered in CA = ~400,000

B. Live Cattle TB Tests
- Private Veterinarians: 103,885 CFTs
  Suspects = 1,100  Response Rate 1.06%
- Regulatory Veterinarians: 13,549 CFTs
  Suspects = 173  Response Rate 1.28%
California Granuloma Submissions for Bovine Tuberculosis Surveillance

Dramatic decrease in granuloma submission rates since plants split samples into formalin/borate and ship to NVSL vs California personnel collecting samples and delivering to CAHFS laboratory.
What Have We Learned?
Evolution

- 1769: About 200 cattle from Baja CA driven to San Diego
- Spanish placed herds in presidios and missions
- 1795: Each soldier awarded two milk cows
- 1840’s Gold rush: American settlers arrive with cattle
- 1857: First commercial dairy
- Early 1900’s: TB program - area testing
- Since mid 1990’s - rely on slaughter surveillance
- Reduce disease spread from high-risk animals

Photo courtesy of the Jack Mason Museum of West Marin History
Continuing Evolution Needed

- Sporadic cases continued, dairies got bigger, cattle moved long distance in trucks (state borders less relevant)

→ Time to re-evaluate strategy

- Federal Order in 2009

- Improved diagnostics (sort of 😊)

- Whole genome sequencing

- Degree of spread in a herd varied

→ Changed understanding of risk factors, pathogen, host and management

- Not all TB alike so program must be more flexible
7 in Central Valley
4 in Chino milk shed
The 4 affected dairies in Chino in 2009-2011 were located very close together, but they were caused by 3 different *M. bovis* strains. Without DNA typing, we would have assumed this was one outbreak.
Dairy Demolition and Building Houses in Southern California
For Sale: Calves, Sheep, Pigs, Goats in Southern California
Old Dairy Facility Being Used to House Dairy Replacements, Beef Cattle and Mexican Steers in Southern California
Dairy in Southern California
Cumulative Incidence of *M. bovis* Disease in People by County, 2006–2013

3-4% of human TB in California are *M. bovis* vs. 1.6% in the US overall. CA reports about half of the confirmed human *M. bovis* cases nationwide.
Percentage of Human TB Cases Attributable to \textit{M. bovis} by County in California, 2003–2014

- Of 58 counties in California, 52 had human TB cases.
- Of those 52 counties, \textit{M. bovis} TB in humans occurred in 35 counties.
- Average of 83.8 cases/year (range 73–101), or \(~4\%\) of human TB cases, attributable to \textit{M. bovis}.
- Nationally, \textit{M. bovis} accounts for 1-2\% of all human TB cases\textsuperscript{1}, or less than 230 TB cases/year\textsuperscript{2}.

\textbf{Legend}

- Dark Blue: > 6\%
- Medium Blue: 3.1 – 6\%
- Light Blue: 0.1 – 3\%
- Gray: No \textit{M. bovis} cases
- White: No TB cases recorded

\textsuperscript{1} Hlavsa et al. (2008) Human tuberculosis due to \textit{Mycobacterium bovis} in the United States.
\textsuperscript{2} CDC Division of Tuberculosis Elimination (2011); http://www.cdc.gov/tb/publications/factsheets/general/mbovis.pdf
California borders a Mexican “non-accredited” dairy region (Tijuana, Ensenada, Tecate, and Mexicali milk sheds)
TB Case Rates Attributable to *M. bovis* and *M. tuberculosis* in People in California 2003-2014

Total cases of TB in people in California 2003-2014 = 23,774

Attributed to *M. bovis* = 1,006
Attributed to *M. TB* = 22,768

Source Data: California Department of Public Health, Tuberculosis Control Branch, 2015;
M. bovis Cases in People in California

- *M. bovis*: A persistent cause of human TB
- Unlike *M. tuberculosis*, *M. bovis* cases in people have **not** declined
- Proportion of TB cases attributable to *M. bovis* has **increased**
- Distribution of *M. bovis* cases similar to *M. tuberculosis*, but more concentrated in Southern California
- *M. bovis* disproportionately affects young children over age 1
- *M. bovis* disease (like *M. tuberculosis*) is more commonly identified among those born outside the US
- Mexico is most common country of origin for those with *M. bovis*
- Distribution of human *M. bovis* cases does not correlate with California dairy locations
- Unpasteurized soft fresh cheeses from Mexico often consumed
**M. bovis** Cases in People cont.

- More likely than *M. tuberculosis* to cause extra-pulmonary disease
- More common in the immunocompromised
- Harder to treat, requires longer therapy owing to PZA resistance
- Associated with higher mortality than *M. tuberculosis*

**CA TB Elimination Plan 2016-2020:** DOES NOT INCLUDE *M. bovis*  
(the focus is on latent TB)

- Specific actions to prevent *M. bovis* in people are needed!
- Efforts should focus on binational families and immunosuppressed
- Efforts that limit raw dairy consumption and actions to reduce *M. bovis* in cattle in Mexico
- New surveillance efforts can provide interventions for people
Take-home Messages

1. New *M. bovis* strains continue in US cattle with no definitive source
2. Need active surveillance of adult and fed cattle
3. Need individual cattle identification
4. Need rapid accurate tests to detect infection
5. Genotyping is helping to determine disease relationships
6. Over 50% of US *M. bovis* cases in people occur in California
7. Mitigate the risk of introducing disease from many potential sources
8. One-Health approach is clearly needed