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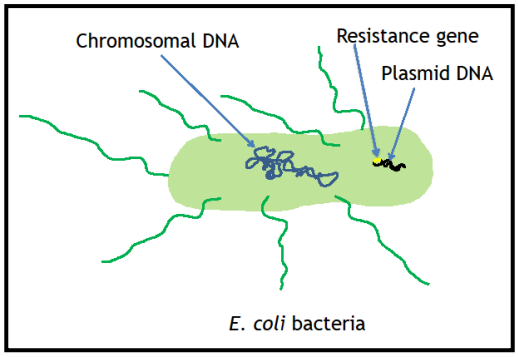
New Antibiotic Resistance Gene in Washington Dairy Cattle

By Dr. Margaret Davis



Background

E coli bacteria are normally found in feces and environments of dairy cattle and calves, so monitoring *E coli* is a good way to learn about antibiotic resistance on dairies. A new gene, called $bla_{CTX\text{-}M}$ for resistance to ceftiofur was first detected in Washington State in 2011 (Table 1). Previously, the earliest detection of *E coli* with $bla_{CTX\text{-}M}$ in U.S. cattle was reported by Ohio State in 2009 from fecal samples collected from dairy cattle. In the early 2000's these bacteria were prevalent in human infections in Canada, and the first human infection was reported in Washington State in 2001-2002.

Table 1. Results of $bla_{CMY\text{-}2}$ and $bla_{CTX\text{-}M}$ PCR of *E. coli* from cattle feces in the Pacific Northwest.

Year	Total number of isolated bacteria tested	Number of farms	% $bla_{CMY\text{-}2}$ positive (95% CI)	% $bla_{CTX\text{-}M}$ positive (95% CI)
2002-2003	94	6	88.2 (79.5 – 93.7)	0 (0 – 3.9)
2008	64	4	70.3 (57.4 – 81.9)	0 (0 – 7.1)
2011	93	2	65.6 (55.5 -74.9)	10.8 (5.6 – 19.4)
2012*	787	30	31.1 (27.9 – 34.5)	12.4 (10.2 – 15.0)

* In 2012, bacteria were collected without using antibiotics to select for resistant ones, as was done for the previous years. So we can't conclude that the prevalence of $bla_{CMY\text{-}2}$ went down between 2011 and 2012.

Our Research

In 2012, fecal samples from an average of 39 calves on each of 30 dairy farms in Washington State were collected and information about the farms and management practices gathered.

- Total number of fecals samples? Number of isolates?
- A gene that causes resistance to ceftiofur and ampicillin-clavulanic acid (called $bla_{CMY\text{-}2}$) was present in > 90% of the fecal samples from 25/30 farms.
- The new gene ($bla_{CTX\text{-}M}$) was present in > 90% of fecal samples from 9/30 farms.
    - 28/30 farms had *some* $bla_{CTX\text{-}M}$

From a survey of management factors, some potential risk factors emerged that were associated with a high prevalence of the new resistance factor *bla*$_{CTX-M}$:

1. Herd size: Larger herds had higher prevalence.

2. Fly control: The use of residual fly sprays for insect control was associated with lower prevalence.

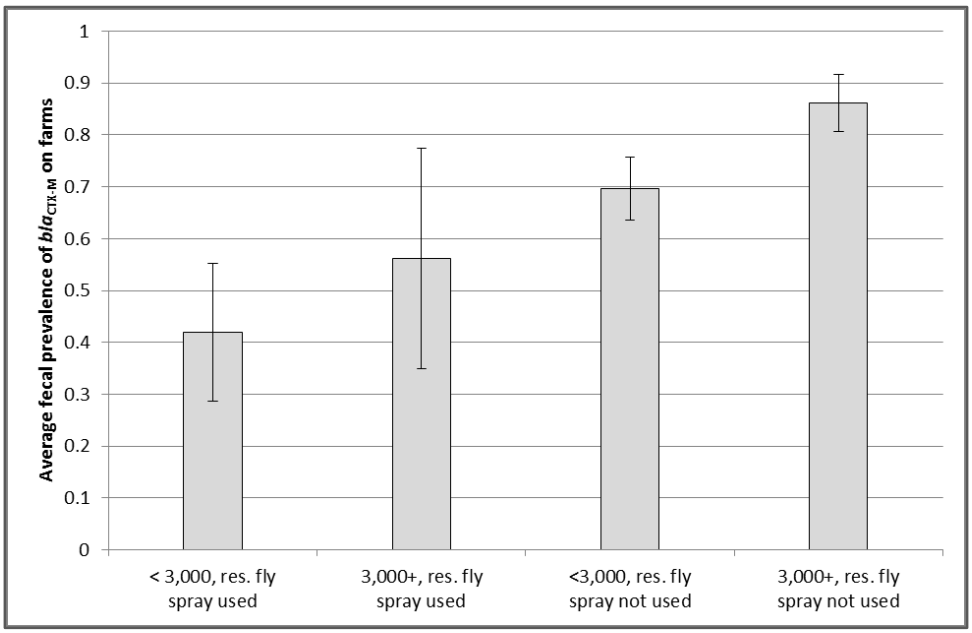


Table 2. Herd size and use of residual sprays for fly control. The prevalence of bacteria from calves with the new resistance factor, *bla*$_{CTX-M}$, according to the herd size in terms of number of adult cows and whether the farms used residual fly sprays for fly control.

3. Any recent animal movement onto the farm was associated with higher prevalence.

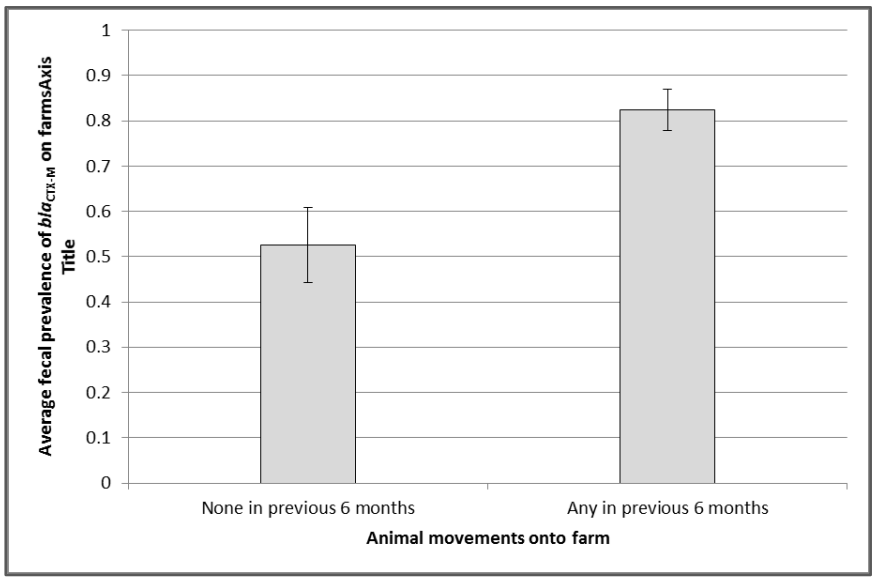


Table 3. Animal movement onto the farm. The prevalence of bacteria from calves with the new resistance factor, *bla*$_{CTX-M}$, according to whether or not animals were moved onto the farm in the previous 6 months. Animal movements included purchase of bulls or cows, and bringing heifers back on to the farm after being raised elsewhere.

4. Frequency of adding new bedding to calf hutches: On large herds with less than weekly addition of new bedding had higher prevalence.

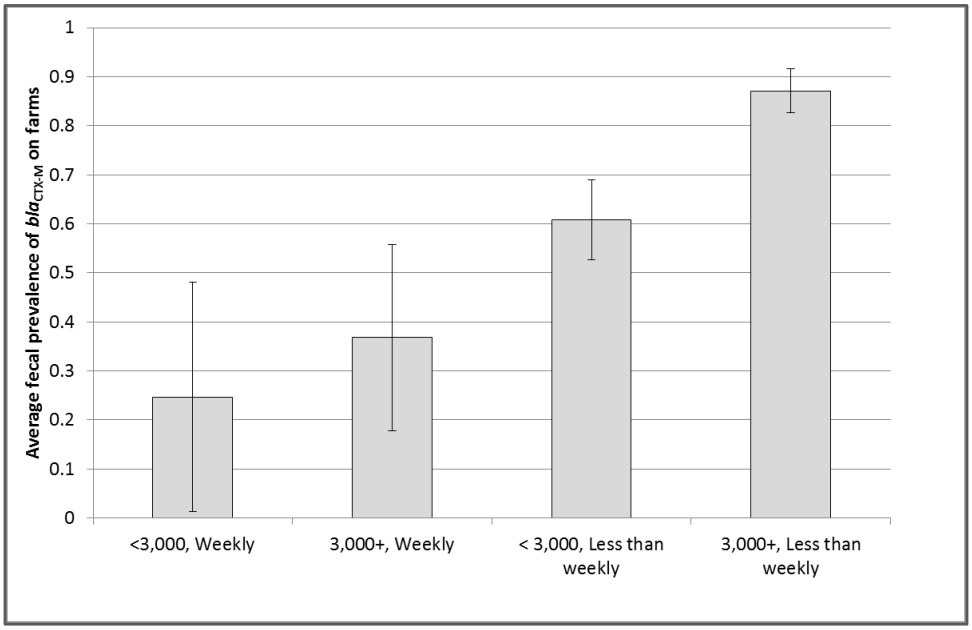


Table 4. Herd size, and frequency that new bedding is added to calf hutches.
The prevalence of bacteria from calves with the new resistance factor, bla_{CTX-M}, according to the herd size in terms of number of adult cows and how frequently new bedding was added to the calf hutches.

Conclusion

This novel resistance factor rapidly became widespread globally. Although antibiotic use may promote the emergence of new resistance factors, allowing for dissemination of the bacteria is also important. Biosecurity measures like fly control, limiting animal movement and hutch management may help to prevent dissemination of bla_{CTX-M} in the *E. coli* of cattle

References

Moland ES, Black JA, Hossain A, Hanson ND, Thomson KS, Pottumarthy S. Discovery of CTX-M-like extended-spectrum beta-lactamases in Escherichia coli isolates from five US States. Antimicrob Agents Chemother. 2003 Jul; 47(7):2382-3.

Mollenkopf, D. F., M. F. Weeman, J. B. Daniels, M. J. Abley, J. L. Mathews, W. A. Gebreyes, and T. E. Wittum. 2012. Variable within- and between-herd diversity of CTX-M cephalosporinase-bearing Escherichia coli isolates from dairy cattle. Appl Environ Microbiol **78:**4552-4560.

Wittum, T. E., D. F. Mollenkopf, J. B. Daniels, A. E. Parkinson, J. L. Mathews, P. R. Fry, M. J. Abley, and W. A. Gebreyes. 2010. CTX-M-type extended-spectrum beta-lactamases present in Escherichia coli from the feces of cattle in Ohio, United States. Foodborne Pathog Dis **7:**1575-1579.