

1 Correlation between Quinolone-Resistant Commensal *E. coli* in Dairy Calves and Enrofloxacin
2 Use

3 Lisa P. Jones^a, William Sisco, Thomas E. Besser, and Margaret A. Davis^a

4 The use of enrofloxacin in food-producing animals can result in rapid development of
5 resistant bacterial populations, including bacterial pathogens. Prior to 2008, the use of
6 fluoroquinolones in cattle was limited to non-dairy animals after which the use of enrofloxacin
7 for respiratory disease was approved for dairy heifers younger than 20 months of age. We
8 hypothesized that retrospective testing would detect an increase in the prevalence of resistance to
9 quinolone antibiotics (nalidixic acid and ciprofloxacin) among dairy calf *E. coli* populations after
10 the approval of enrofloxacin use in dairy heifer calves.

11 *E. coli* isolates for this study were drawn from previous studies in dairy cattle. For all studies
12 prior to 2012, fecal samples were collected from individual animals and plated onto various
13 types of media; for the current study we restricted the comparison to isolates from non-selective
14 media. *E. coli* were tested for antibiotic resistance using a standard disk diffusion method. All
15 pre-2012 isolates were tested for nalidixic acid resistance and a subset were tested for
16 ciprofloxacin resistance. 2012 samples were obtained from 30 farms and were plated onto
17 MacConkey agar supplemented with ciprofloxacin to determine prevalence of ciprofloxacin-
18 resistant *E. coli*.

19 On one large dairy farm sampled in 2006-2008 and in 2011, the prevalence of nalidixic acid-
20 resistant (Nal-R) *E. coli* from calves increased from 1.3 % in 2006 to 47.9 % in 2011 ($P < 0.01$).
21 On the same farm, prevalence of Nal-R *E. coli* from adult dairy cows increased from 0 % in 2008
22 to 16.9 % in 2011. Among those Nal-R *E. coli* in 2011 the prevalence of ciprofloxacin resistance

23 was 53.6%. In 2012, the prevalence of *E. coli* growth from samples plated directly to
24 ciprofloxacin-supplemented media ranged from 0 to 0.86 among 30 farms. The median of this
25 prevalence was .62 among farms that reported enrofloxacin use compared to .34 among those
26 that did not (Wilcoxin one-way $P=0.06$).

27 These data support the hypothesis that quinolone resistance among *E. coli* from dairy animals
28 increased after the approval of enrofloxacin use in dairy heifers. While our observations were
29 confined to commensal *E. coli* populations, the same selective process may be taking place in
30 pathogenic bacterial populations present on dairies, including *Salmonella enterica* and
31 *Campylobacter* spp.

32

33 This work was funded by the USDA National Institute of Food and Agriculture Award No.
34 2010-51110-21131.