

Value of Arrival Metaphylaxis in the U.S. Fed Cattle Industry

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Introduction:

Use of antimicrobials¹ in livestock production is facing intense public scrutiny. Major restaurants, food service companies, food processors, and supermarkets have pledged to reduce the use of antimicrobials in meat production (Pew Trust, 2016). Federal and international organizations have expressed growing concerns that use of shared-class² antimicrobials in livestock production may be linked to increased health risks and antimicrobial resistance in humans (Center of Disease Control, 2013; World Health Organization, 2012). These concerns, in part, have prompted state and federal legislators to increase regulation and veterinary oversight of shared-class antimicrobials in animal production (American Veterinary Medical Association, 2009; Food and Drug Administration (FDA) (FDA 2012, 2013).

Metaphylaxis³ is an animal health management practice in which FDA approved antimicrobials are administered to a group of high health-risk animals, generally via injection, to eliminate or minimize incidence of an acute onset of a disease outbreak. While all antimicrobials are regulated by the FDA in the U.S., current policy debates include whether to further regulate antimicrobials used for metaphylaxis. Livestock producers are concerned that restricting or removing such a widely used production technology would be detrimental to animal health and result in substantial animal deaths, reduced animal welfare, increased production risk, and reduced profitability.

¹ “Antimicrobial drugs include all drugs that work against a variety of microorganisms, such as bacteria, viruses, fungi, and parasites. An antibiotic drug is effective against bacteria. All antibiotics are antimicrobials, but not all antimicrobials are antibiotics.” (FDA 2018).

² Shared-class antimicrobials are used to treat disease in both human and animals.

³ Metaphylaxis is used in cattle to reduce the risk or impacts of an outbreak of bovine respiratory disease (BRD), the most common cause of morbidity and mortality in beef cattle production affecting 97% of feedlots, 16% of cattle, and costing the beef industry an estimated \$6 billion annually (Griffin, 1997; U.S. Department of Agriculture, 2013). Metaphylaxis is used by 59% of U.S. feedlots selectively on 20.5% of cattle placed on feed across all cattle placement weights (U.S. Department of Agriculture, 2013).

The purpose of the research summarized here was to estimate the value of metaphylactic use in U.S. cattle feeding and determine economic impacts on consumers and producers if its use were eliminated.

Procedures:

To accomplish the objective, a cattle feeding net return simulation model was developed to determine how use of metaphylaxis impacts net return distributions. Net return distributions for high health risk cattle were compared across three different animal placement weight categories (550, 700, and 850 lbs.) and two health treatments (metaphylaxis and no metaphylaxis). The cattle feeding simulation estimated changes in net returns distributions and translated these into short-run producer and consumer surplus changes with and without the use of metaphylaxis in treatment of high health-risk cattle. Producer and consumer impacts were estimated using a multi-market partial equilibrium model that allows for changes in the feedlot industry to be transmitted from beef to pork, lamb, and poultry final consumers through a series of market linkages, including international trade.

Key Findings:

Use of metaphylaxis is most profitable when administered to high health-risk cattle having lighter placement weight. On average, high health-risk 550-lb. placements lose \$104.46 per head; 700-lb. high health-risk cattle placements lose \$99.26 per head; and 850-lb. high health-risk cattle placements lose \$63.36 per head when not treated with metaphylaxis relative to treated cattle. Greater uncertainty in net returns is associated with no metaphylaxis and lighter placement weights (see Figure 1).

The feedlot data used in this research was collected from ten large Midwestern feedlots which are representative of traditional large scale production feedlots. These feedlots, on average, used metaphylaxis as a health management protocol on 87% of 550-625 lbs. placements; 23% of 626-775 lbs. placements; 4% of 776-925 lbs. placements, and 26% of all cattle placed. These estimates are higher than those reported by NAHMS surveys of cattle feeders of 68%, 18%, 3%, and 20%, for each of the three placement weight categories and overall cattle treatment, respectively.

The value, metaphylactic application rates, and number of cattle placed on feed in a given year in each weight class were used to calculate the cumulative value of metaphylaxis to the U.S. cattle feeding industry. If metaphylaxis were eliminated, and cattle producers did not substitute into other health management practices, net returns to the cattle feeding sector would decline by \$532.18 million to \$679.56 million annually if the metaphylactic application rates were similar to NAHMS or our sample feedlot data, respectively. These translate to a reduction of 0.92% or 1.17% in industry gross revenue for NAHMS and our sample feedlot data, respectively (see Table 1).



Short-run societal market impacts of removing metaphylaxis were also quantified. Table 2 presents societal economic surplus estimates of a complete removal of metaphylaxis using both the NAHMS survey data and proprietary feedlot data with the associated 0.92% and 1.17% losses in net returns to the cattle feeding industry. Feedlots ultimately pass costs downstream to feeder cattle producers resulting in large losses in the feeder cattle sector. Feedlots would lose from \$925 million to \$1,180 million and feeder cattle producers would lose \$1,061 million to \$1,354 million in producer surplus in a single year if metaphylaxis was eliminated. Higher beef retail prices induce consumers to substitute into other meat products leading to relatively larger gains for pork and smaller gains for poultry and lamb consumers and relatively larger gains for poultry and smaller gains for poultry and pork producers.

Discussion:

Previous impact assessments on the removal of antimicrobials in U.S. livestock production have primarily focused on removal of the larger relative proportion of antimicrobials in feed and water⁴ for hogs, broilers, and cattle rather than antimicrobials used in metaphylaxis. Our producer and consumer surplus estimates are larger in comparison to studies that estimated short-run economic impacts of bans in feed and water antimicrobials. These net returns and social surplus impacts are valuable to producers, animal health consultants, and policy makers, which will allow them to make more informed decisions surrounding metaphylaxis use.

The full article summarized here is available at: http://www.waeonline.org/UserFiles/file/JARE432_v1.pdf

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⁴ Antimicrobials used in feed and water are sometimes referred to as "sub-therapeutic" and/or "growth promoting".

Tables and Figures:**Table 1. U.S. Cattle Feeding Industry Annual Net Return Impact of Removal of Metaphylaxis for High Health-Risk Cattle, 2015**

Data Source	Metaphylaxis Industry Net Return Value (million \$)	Value of Metaphylaxis as Percentage of Industry Gross Revenue ^b (%)
NAHMS ^a	532.18	0.92
Feedlot Data	679.56	1.17

^a National Animal Health Monitoring System

^b Total fed cattle industry is valued at \$57.93 billion (\$1.48 / lb. * 39,109.36 / lbs.)

Table 2. Short-Run (1 Year) Producer and Consumer Surplus Estimates of Removal of Metaphylaxis for High Health-Risk Cattle, 2015

Surplus Measure	NAHMS ^a	Feedlot Data
	(million \$)	(million \$)
Producer Surplus		
Beef		
Retail	377.45*	476.70*
Wholesale	-206.97*	-267.45*
Fed Cattle	-924.86*	-1179.85*
Feeder Cattle	-1060.78*	-1354.22*
<i>Total Beef Producer Surplus</i>	<i>-1809.52*</i>	<i>-2322.44*</i>
Total Meat Producer Surplus	-772.53*	-996.66*
Total Meat Consumer Surplus	-1074.23*	-1370.51*

Note: * indicates significance at p-value < 0.05

^a National Animal Health Monitoring Survey



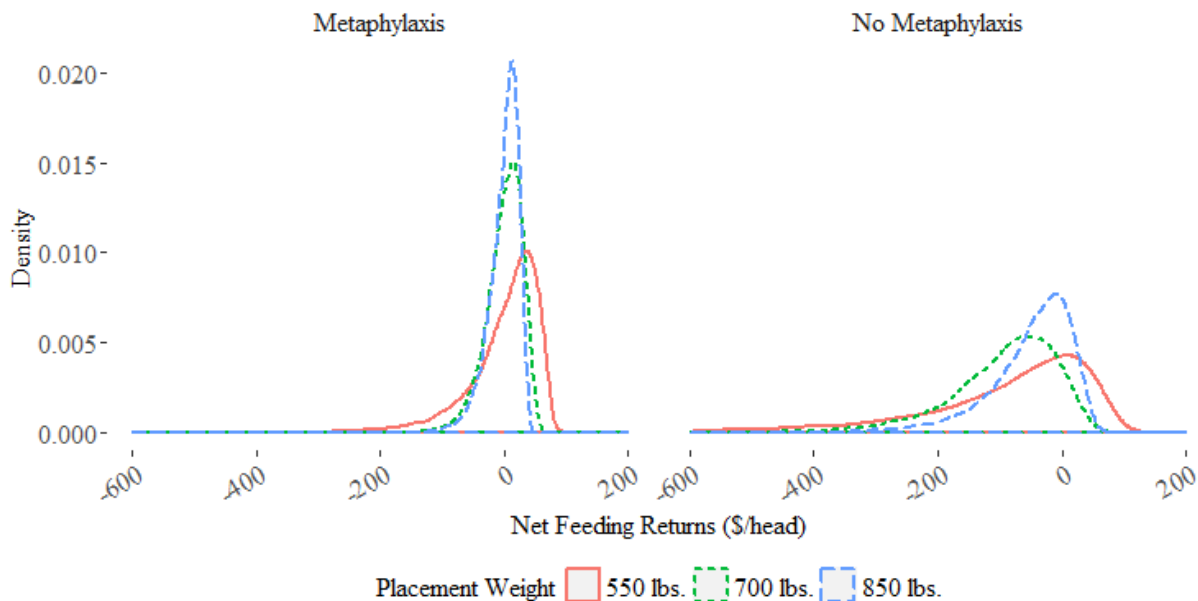


Figure 1. Simulated Net Return Distributions for High Health-Risk Cattle at Different Placement Weights with and without Metaphylaxis

Note: 550 lb. high health-risk cattle lose \$104.46 per head; 700 lb. high health-risk cattle lose \$99.26 per head; and 850 lb. high health-risk cattle lose \$63.36 per head when not treated with metaphylaxis relative to treated cattle. Typical cattle feeding returns over a comparable period across all cattle placement weights were -\$43.39/head (Focus on Feedlot, 2017).

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