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Drug Residue Avoidance and Beef Quality Assurance Practices in Dairy Cattle—Veterinarian Survey Results

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Abstract

As part of an overall educational program, bovine veterinarians' knowledge of dairy beef quality assurance was assessed, with particular emphasis on residue avoidance practices. A survey instrument was developed and sent to all members of the American Association of Bovine Practitioners (AABP) in the member newsletter. Topics included respondent demographics, drug administration practices, record-keeping practices, impression of clients' attitudes and behaviors regarding drug residues, drug information sources, understanding of cull cattle marketing and processing, and interest in Dairy Beef Quality Assurance. Survey respondent demographics were similar to the general AABP membership. Survey results highlighted a need for continued educational efforts for and by veterinarians regarding extra-label drug use, residue avoidance and general knowledge about market dairy beef processing.

Keywords: bovine, dairy, BQA, residue avoidance

Résumé

Dans le cadre d'un programme d'éducation général, les connaissances des vétérinaires bovins sur l'assurance de qualité du bœuf laitier ont été examinées surtout en ce qui a trait aux pratiques pour prévenir les résidus dans le lait. Un questionnaire a été développé et envoyé à tous les membres de l'American Association of Bovine Practitioners (AABP) par l'intermédiaire du bulletin de liaison des membres. Les thèmes incluaient les caractéristiques démographiques des répondants, les pratiques d'administration des drogues, les pratiques d'entrée de données, l'impression sur l'attitude des clients et les comportements concernant les résidus de drogues, les sources d'information sur les drogues, la connaissance de la mise en marché et de la transformation du bétail réformé, et l'intérêt envers l'assurance de qualité du bœuf laitier. Les caractéristiques démographiques des répondants étaient similaires à celle des membres de l'AABP en général. Les résultats du sondage mettaient en évidence un besoin d'éducation continu pour les vétérinaires et par les vétérinaires en ce qui concerne l'emploi non-conforme des drogues, la prévention des résidus, et les connaissances générales sur le marché de la transformation des bovins laitiers.

Introduction

The veterinarian's role in ensuring proper use of pharmaceuticals is in part defined by the Food and Drug Administration Center for Veterinary Medicine (FDA-CVM) and codified in federal law in the Federal Food, Drug and Cosmetic Act.[6] This law holds responsible any individual in the food production system who can be shown to have caused, by act of commission or omission, illegal drug residues in edible animal products. Veterinarians are specifically mentioned as individuals who could be held responsible. The Animal Medicinal Use Clarification Act of 1994 (AMDUCA) further clarifies the veterinarian's role and provides guidance on how drugs are to be used in animals intended for food.[1] Under these laws, producers are required to use prescription and extra-label drugs only under the supervision of a licensed veterinarian, and the attending veterinarian is responsible for ensuring that the client markets cattle free of violative drug residues.

While the FDA-CVM regulates veterinarians and the use of drugs on farms, the United States Department of Agriculture Food Safety and Inspection Service (FSIS) is responsible for ensuring the safety and wholesomeness of the nation's commercial meat products, and oversees drug residue testing at beef slaughter facilities. Overall, the occurrence of violative drug residues in US beef is low, but a study of FSIS residue data in beef from 1991 to 1993 found most (>80%) violative residues in cull cows and bob

veal.[7] In 2005, FSIS reported 670 of 94,570 (0.7%) suspect dairy cattle tested at slaughter had a violative residue, as detected by the Fast Antimicrobial Screening Test (FAST).[18]

Previous pre-harvest food safety initiatives have employed various methods to change dairy producer behavior.[8,9,21,27] Several surveys have examined veterinary drug use among producers.[20,26,29] Veterinarians play an important role in beef quality assurance in market dairy cattle, so the objective of our research was to assess the knowledge, practices and attitudes of bovine veterinarians concerning dairy beef quality assurance (DBQA), with particular emphasis on drug residue avoidance. Results of the survey could be used to develop appropriate and relevant educational interventions.

Materials And Methods

A questionnaire was designed by a team from the University of Minnesota, with extensive input from beef industry professionals and veterinarians from the University of Nebraska, North Dakota State University, Texas A&M University, the FDA-CVM, USDA-Animal and Plant Health Inspection Service and state agencies in North Dakota and Wisconsin. The final questionnaire consisted of two open-ended questions and 25 multiple choice questions that had open-ended/free response options. The survey included questions on respondent demographics (6), treatment strategies (12), client communication (4) and dairy beef quality assurance programs (5). Copies of the survey may be obtained from the corresponding author. The survey was pretested by 49 bovine veterinarians on the first day of the American Association of Bovine Practitioners (AABP) Annual Conference in September 2006 in St. Paul, Minnesota.

The questionnaire was mailed to all 4,540 members of the AABP as an insert in the November/December 2006 issue of the member newsletter. For convenience, the survey was mailed to all members, although only individuals who were currently practicing bovine medicine in the United States were included in the study. The president of the AABP and the chairman of the AABP Committee on Pharmaceutical and Biological Issues each wrote letters encouraging participation. Data were analyzed using SPSS version 15.0.1 (SPSS Inc., Chicago, IL). Simple frequencies were determined for all variables. A sample size calculator was used to determine confidence intervals from response rates.[25] Chi-square tests were performed as applicable for comparisons of binary data, and t-tests for continuous variables. Results for all statistical tests were considered significant at $P<0.05$.

Results and Discussion

Demographic Data

Of all 4,540 AABP members, 2,980 members met the inclusion criteria of being licensed and currently practicing within the United States. The survey was completed by 287 of 2,980 veterinarians (9.6% response rate, 5.5% confidence interval). The median year of graduation from veterinary school was 1985. Forty states were represented, with the highest number of responses from Wisconsin, New York, Minnesota, Pennsylvania and Iowa.

Greater than half of respondents worked in Large Animal Only or Large Animal Predominant practices (26 and 27%, respectively.) The majority of respondents (71%) were owner/partners in their practices, while 21% were full-time associates. The mean practice size was 3.9 veterinarians. Respondents varied by amount of professional time they devoted to dairy practice. Thirty-six percent of respondents reported that they spent less than 25% of their professional time on dairy operations, while 39% spent more than 75% of their time on dairy operations.

There were no significant differences in mean year of graduation or number of survey responses per state between the respondents and the general demographics of the AABP members.[31] Although the survey response rate was relatively low, the respondents were representative of bovine practitioners in the United States who are members of the AABP.

DBQA Injection Practices

To assess behaviors associated with beef quality assurance (BQA), participants were asked what injection sites they used most often when treating clients' cows with antibiotics, vaccines and reproductive drugs (Figure 1). Sixty-seven percent of responding veteri-

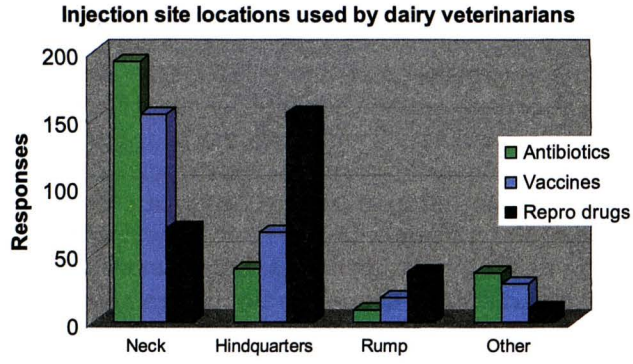

Figure 1. Injection location most commonly used for antibiotics (green bars), vaccines (blue bars) and reproductive drugs (black bars).

narians reported usually giving antibiotics in the neck, while 14% injected into the hindquarters. Fifty-three percent reported using the neck for vaccinations, and 23% reported using the hindquarters (thigh). Twenty-four percent of respondents reported using the neck for injections of reproductive drugs, while 54% reported using the hindquarters. When comparing primary injection site for antibiotic, vaccine and reproductive drugs by chi-square (neck vs. elsewhere), a significant difference was found ($P<0.005$).

Veterinarians as a group give injections in the neck more frequently than dairy producers. A concurrent questionnaire with similar questions about injection sites was administered to dairy producers in the upper Midwest.[13] These dairy producers reported giving 21% of antibiotic injections, 28% of vaccinations and only 5% of reproductive drug injections in the neck. Similar trends were also found in the 1996 National Animal Monitoring System Dairy study,[29] with the minority of dairy producers using the neck for administering injectable drugs to dairy cattle, instead using the hip and hindquarters. It was concluded that the design of dairy cattle facilities was a likely explanation, as cattle tend to be handled from the rear.

Beef Quality Assurance guidelines indicate the neck should be used for all subcutaneous (SC) or intramuscular (IM) injections in an attempt to reduce the prevalence of injection site blemishes in whole muscle cuts of beef, such as the round, sirloin and chuck.[2] Through educational efforts and financial incentives, the prevalence of injection site lesions in fed cattle in the United States decreased significantly through the 1990s.[22] However, the prevalence of injection-site lesions in outside round muscles of market dairy cows was reported in one study as approximately 49% .[24] This results in producer losses of nearly $70 per cull cow due to product defects such as bruises, injection site lesions and condemnations.[23] Veterinarians can help reduce this loss by demonstrating safe injection techniques for different handling facilities, and adopting a policy to only use the neck for injections that are more likely to cause lesions, such as large volumes (>5 mL), or with drugs or vaccines known to cause inflammation.

Extra-Label Drug Use

Survey participants were asked about extra-label use of specific drugs in dairy cattle. Forty percent of veterinarians reported personally injecting the non-steroidal anti-inflammatory drug flunixin meglumine intramuscularly, which differs from the labeled intravenous (IV) route of administration. Sixty-six percent of respondents also reported dispensing flunixin meglumine to clients for IM administration in dairy cows. Veterinarians who prescribed IM flunixin were asked to state withdrawal times they recommended. Answers for milk withholding times ranged from 0 to 30 days with a mean of 2.9 days. Meat withholding times ranged from 0 to 30 days, with a mean of 10.7 days.

The Food Animal Residue Avoidance Database (FARAD) holds the position that flunixin should not be given IM or SC because of injection site lesions and prolonged tissue clearance.[10,14] FARAD recommends a 30-day withdrawal for meat if a single injection has been given, but extends the time to 60 days if there were multiple IM flunixin injections. A conservative milk withdrawal of 72 hours is also recommended.[28] A recent press release from the FDA-CVM discusses the occurrence of violative residues in dairy cattle that resulted from IM flunixin use for convenience purposes, and stresses this is not an allowed reason for extra-label use.[4] Flunixin was second only to penicillin in detected drug residue violations by the FSIS in 2005,[18] although the FAST screening assay used to identify potential residue violations by bacterial growth inhibition does not specifically detect non-steroidal anti-inflammatory drugs such as flunixin meglumine, and the compound is only detected in secondary testing.[3]

Twenty-eight percent of respondents reported using florfenicol in dairy cows, which is an extra-label use. As long as the requirements of AMDUCA are met, a veterinarian is legally allowed to prescribe florfenicol for use in dairy cows. Recent FSIS surveillance has not detected violative residues of florfenicol in tissues from either dairy or beef cattle.[18]

Record-Keeping, Communications and Violative Residue Avoidance

Respondents were asked how often they felt that dairy producers' lack of compliance with drug use instructions could potentially cause a violative residue (Figure 2). Forty-three percent chose "a few times a year", 24% "yearly" and 12.5% "never". When asked about the major reasons for non-compliance by clients in their practices (Table 1), the most frequently chosen answers were client perceptions of low risk of being found in violation (55%) and lack of understanding of residue avoidance practices (53%). Respondents also cited pressure to remove a sick cow from the farm (35%), lack of treatment records (27%), lack of time to carry out less convenient treatments (26%) and poor communication between veterinarian and producer (18%). A Pennsylvania risk assessment-based study identified a lack of adequate farm treatment records as being the highest area of risk for antibiotic residues, followed by lack of understanding how to judiciously use antibiotics and suboptimal relationships between veterinarians and their clients.[27]

Sixty-three percent of respondents reported they did not routinely advise clients to test cull cows for res-

idues before marketing. One study found significantly more farms with milk residue violations were not routinely using an antibiotic testing kit than were farms that had no residue violations,[15] indicating that more widespread use of such tests may be a valuable aid in determining when an animal has cleared meat withdrawal times.

Sixty-two percent of responding veterinarians stated they asked their clients to keep written treatment records. However, 45% of respondents said they never looked at clients' written treatment records (Figure 3). Numerous surveys have pointed out a great need for more consistent record-keeping of drug treatments in dairy cattle.[20,26] In a recent nationwide study of farms with more than 200 cows, 42% of farms did not keep complete written treatment records.[20] A study which included large and small dairy farms in Pennsylvania found 50% of dairy producers did not consistently keep written treatment records.[26] Keeping adequate treatment records is required by law in order to ship milk[30] and to market beef.[5] Veterinary involvement in overseeing treatment records, particularly when a prescription or extra-label drug is used, is a crucial step.

Participants were asked to cite methods they used to communicate with clients about the use of animal health products. The majority used in-person communication (96%), written instructions (74%) and telephone calls (64%). Veterinarians also used a practice newsletter (29%), practice meetings (28%), email (8%), fax (5%) or websites (3%). One means to improve compliance with labeled instructions and ensure proper use of pharmaceuticals in dairy cattle is to increase use of written diagnostic and treatment protocols on farms. Developing such protocols creates an opportunity for veterinarians to discuss proper drug use and educate dairy producers about withdrawal times, antibiotic resistance and disease-prevention practices.

Veterinary Knowledge about Market Pricing and Drug Residue Testing in Beef

In order to assess veterinarian knowledge about cull dairy cow beef marketing and production, survey respondents were asked a series of questions about

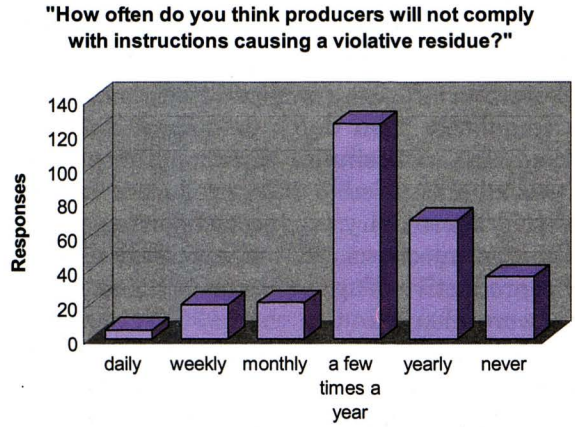

Figure 2. Survey respondents' opinions on the frequency of noncompliance with treatment instructions by dairy clients.

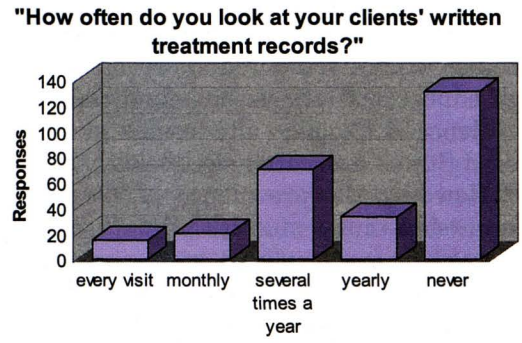

Figure 3. Frequency veterinarians indicated they reviewed dairy clients' written treatment records.

Table 1. Veterinarian opinions for non-compliance with drug use instructions in dairy clients.

	No. responses	(%)
Client perceives low risk of being found in violation	158	55.1
Lack of understanding of residue avoidance practices	151	52.6
Pressure to quickly remove cow from farm	101	35.2
Lack of treatment records	77	26.8
Lack of time to carry out less convenient treatments	75	26.1
Poor communication btw producer and employees	70	24.5
Poor communication btw veterinarian and employees	52	18.1
Inadequate cattle handling facilities	50	17.4
Lack of facilities/labor to manage unproductive cow	28	9.8
Other	23	8.0

price factors, beef markets and drug residue testing (Table 2). Participants were asked to select factors they believed affected the price producers received for culled dairy cows. Ninety percent chose health of animal and 84% selected weight as relevant factors, while foot and leg problems were selected by 57%, quality of meat selected by 52% and approximately 40% of respondents chose age, breed and hide blemishes as price-determining factors.

Little research has been published to describe relevant factors that cattle buyers take into account for cull dairy cattle. A single study primarily describing beef-type cull cows found cattle health and visible knots or lumps had large negative effects on price received. Additionally, dairy-type animals were sold at a significantly lower price than beef-type cows.[16] It is hypothesized that due to the industry-wide ban on non-ambulatory cattle, foot and leg problems would also result in discounts; this could not be substantiated with any published studies.

When asked to select from a list of potential food products made from cull dairy cattle beef, the most commonly selected uses were processed meat (88%), grocery store (88%), fast-food restaurants (83%) and pet food (67%). Although the mean quality grade for cull dairy cattle is cutter/canner,[23] dairy cow beef is also used for higher-quality food markets such as chain steak houses and mail-order steaks.

When asked to select from a list of drugs routinely tested for in beef, 52% of respondents believed penicillin was routinely tested, while fewer than half of respondents believed tetracycline (37%), sulfadimethoxine (36%), or gentamicin (43%) were routinely tested. Forty-four percent of respondents indicated they didn't know what drug residues were tested. With the current FAST protocol in use to detect bacterial growth inhibition, violative levels of all antimicrobials can be detected. Suspect samples are additionally tested for non-steroidal anti-inflammatory drugs.[3] No survey respondents were able to correctly identify this point,

Table 2. Veterinary knowledge about cull cattle marketing, drug residue testing.

	No. responses	(%)
What factors do you believe affect the price producers receive for culled dairy cows?		
Health of animal	257	89.5
Weight	241	84.0
Foot/leg problems	164	57.1
Quality of meat	150	52.3
Age	122	42.5
Breed	119	41.5
Hide blemishes	116	40.4
How do you think meat from culled dairy cattle in the United States is used?		
Processed meat (hot dogs, cold cuts)	252	87.8
Grocery store	252	87.8
Fast food restaurants	238	82.9
Pet food	192	66.9
School lunch programs	146	50.9
Chain restaurants	145	50.5
Charity food programs	109	38.0
Foreign export	86	30.0
Locally owned restaurants	73	25.4
Mail order steaks	38	13.2
Which antibiotic/anti-inflammatory residues are routinely tested for in cattle used for beef?		
Penicillin	148	51.6
Gentamicin	122	42.5
Tetracycline	105	36.6
Sulfadimethoxine	102	35.5
Enrofloxacin	91	31.7
Flunixin meglumine	90	31.4
Ceftiofur	82	28.6
Phenylbutazone	72	25.1
Amikacin	51	17.8
I don't know what is routinely tested for	129	44.1

which demonstrates a need for further education about drug residue testing methods at slaughter.

Veterinary Sources of Information, Educational Methods

Respondents were asked to select their top three sources for information about the use of animal health products (Figure 4). The most frequent choices for obtaining product information were pharmaceutical company representatives (74%), educational seminars (70%) and product labels (51%). The working relationship between pharmaceutical companies and veterinarians lends itself to an opportunity for veterinary education about judicious and legal drug use in dairy cattle.

Participants were asked how they most often determined withholding times for antibiotics used in an extra-label manner (Figure 5). Forty-five percent reported they consulted FARAD, while 23% said they calculated a withholding time based on published data, 13% consulted other veterinarians in their practice, 4% consulted university or extension veterinarians and 10% used other methods. As of May 5, 2008, FARAD's hotline and website service was again available with temporary funding to support the service through September 2008, and there was ongoing work to include sustained multi-year funding in the Farm Bill. During 2007, FARAD lost funding for a period and had to close its hotline, although the database and website services were maintained.[11] Considering its widespread use among the veterinary community, the loss of FARAD would be a serious detriment to the knowledge base for the practicing veterinarian using extra-label drug treatments.

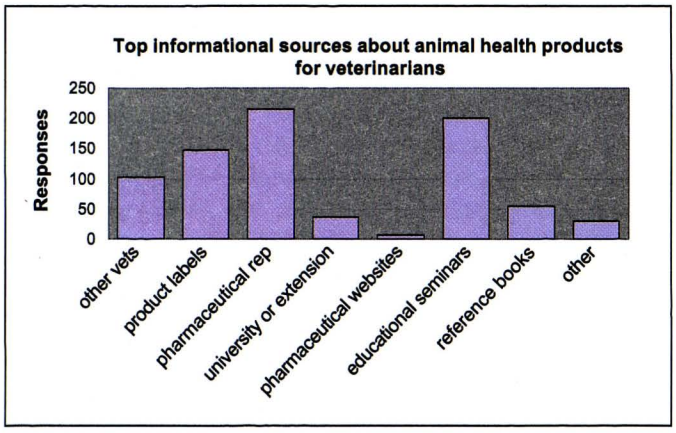

Figure 4. Resources used by veterinarians for information about animal health products.

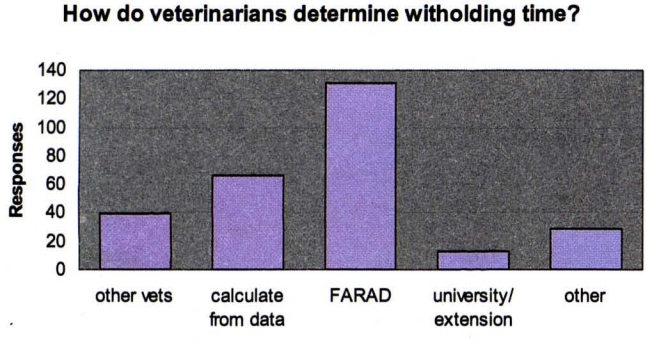

Figure 5. Informational sources most commonly used by veterinarians to determine meat and milk withholding time for extra-label drugs.

Ninety percent of respondents said they were either "very familiar" or "somewhat familiar" with Beef Quality Assurance or Dairy Beef Quality Assurance practices (Table 3). Considering the predominant injection practices and on-farm recommendations that respondents reported, the results of this survey suggest there may be a disconnect between knowledge about BQA and on-farm practices. These programs require giving all injections in the neck, keeping adequate treatment records and using pharmaceuticals judiciously.[2]

Seventy-two percent of respondents stated they were interested in learning more about BQA/DBQA recommendations. The types of programs most likely to get good participation were home study with printed materials (34%), local/regional meeting sponsored by a pharmaceutical company (30%), computer CD (30%), on-line program (27%), televised recording (27%), program during AABP annual meeting (23%) and program during state veterinary association meeting (21%). It appears a wide variety of sources can be employed in order to raise veterinary awareness about BQA. Currently available is a comprehensive online educational source that was designed for use in the western states,[17] and efforts are ongoing both at the national and state levels to target beef quality messages for veterinary audiences.

Conclusions

Although veterinary drug residues in beef occur infrequently in the United States, the results of this survey demonstrate a need for targeting educational efforts at drug residue prevention in cull dairy cattle. A veterinarian's influence on drug residue occurrence in dairy cattle beef is mainly indirect. In one study, veterinarians were found to be directly responsible for only 4% of drug residue violations in beef.[7] Considering a large proportion of residue violations are from over-the-counter drugs,[18] it is likely most violative residues occur without a veterinarian's knowledge or input. However, veterinarians have been repeatedly cited as an important source of information for dairy producers about animal health products.[12,13,19,32]

Table 3. Educational methods.

	No. responses	(%)
How familiar are you with BQA/DBQA practices?		
Very familiar	103	35.9
Somewhat familiar	154	53.7
Not familiar	17	5.9
Have not heard of DBQA/BQA	4	1.4
What type of program would you most likely participate in? (check top 3)		
Home study with printed materials	97	33.8
Meeting sponsored by pharmaceutical company	87	30.3
Computer CD	85	29.9
On-line program	72	26.8
Videotape or DVD	76	26.5
Program during AABP annual meeting	65	22.6
Program during state veterinary association meeting	59	20.6
Meeting with veterinary college or extension	41	14.3
Producer sponsored educational program	28	9.8
Satellite TV program	7	2.4

The important role veterinarians play on dairy farms in drug residue avoidance and as promoters of quality assurance cannot be overstated. Veterinarians should continually review their own indications and withdrawal times for all extra-label drugs, and consider the means of communication that will work best to ensure violative residues are avoided. Development of consistent on-farm protocols for common disease recognition and treatment is an important step, along with overseeing complete written treatment records. As a profession, we will continue to review our dairy beef quality assurance knowledge and practices to promote judicious drug use and food safety and quality.

Acknowledgements

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References

1. Animal Medicinal Drug Use Clarification Act of 1994 (AMDUCA). http://www.fda.gov/cvm/amducatoc.htm Accessed 10/17/2007

2. Beef Quality Assurance. http://www.bqa.org/codeBQAGuidelines.aspx Accessed 10/20/2007

3. Dey BP, Thaker NH, Bright SA, Thaler AM: Fast antimicrobial screen test (FAST): improved screen test for detecting antimicrobial residues in meat tissue. *JAOAC Int* 88:447-454, 2005.

4. FDA Reminds Veterinarians on the Correct Use of Flunixin Meglumine. http://www.fda.gov/cvm/CVM_Updates/FlunixinGlumine.htm Accessed 10/19/2007

5. FDA/ORA CPG 7125.37 Proper Drug Use and Residue Avoidance by Non-Veterinarians. http://www.fda.gov/ora/compliance_ref/cpg/cpgvet/cpg615-200.html Accessed 10/19/2007

6. Federal Food, Drug, and Cosmetic Act Table of Contents. http://www.fda.gov/opacom/laws/fdcact/fdctoc.htm Accessed 10/17/2007

7. Gibbons SN, Kaneene JB, Lloyd JW: Patterns of chemical residues detected in US beef carcasses between 1991 and 1993. *J Am Vet Med Assoc* 209:589-593, 1996.

8. Gibbons-Burgener SN, Kaneene JB, Lloyd JW, Erskine RJ: Influence of the Milk and Dairy Beef Quality Assurance Program on dairy farm drug management practices. *J Am Vet Med Assoc* 216:1960-1964, 2000.

9. Gibbons-Burgener SN, Kaneene JB, Lloyd JW, Erskine RJ: Evaluation of certification in the Milk and Dairy Beef Quality Assurance Program and associated factors on the risk of having violative antibiotic residues in milk from dairy farms in Michigan. *Am J Vet Res* 60:1312-1316, 1999.

10. Haskell SR, Gehring R, Payne MA, *et al*: Update on FARAD food animal drug withholding recommendations. *J Am Vet Med Assoc* 223:1277-1278, 2003.

11. Kahler SC: FARAD Funding: the long and short of it. *J Am Vet Med Assoc* 232:492-493, 2008.

12. Kaneene JB, Ahl AS: Drug residues in dairy cattle industry: epidemiological evaluation of factors influencing their occurrence. *J Dairy Sci* 70:2176-2180, 1987.

13. Knust B, Nelson L, Schott L: Drug residue avoidance and beef quality assurance in dairy cattle-- producer survey results. Unpublished Data, 2007.

14. KuKanich B, Gehring R, Webb AI, Craigmill AL, Riviere JE: FARAD Digest: Effect of formulation and route of administration on tissue residues and withdrawal times. *J Am Vet Med Assoc* 227:1574, 2005.

15. McEwen SA, Black WD, Meek AH: Antibiotic residue prevention methods, farm management, and occurrence of antibiotic residues in milk. *J Dairy Sci* 74:2128-2137, 1991.
16. Mintert J, Blair J, Schroeder T, Brazle F: Analysis of factors affecting cow auction price differentials. *Southern J Ag Economics* 22:23-30, 1990.
17. Moore DA, Kirk JH, Klingborg DJ, *et al*: Dairy beef: maximizing quality and profits--a consistent food safety message. *J Dairy Sci* 87:183-190, 2004.
18. 2005 National Residue Data. http://www.fsis.usda.gov/Science/2005_Red_Book/index.asp Accessed 10/18/2007
19. Payne M, Bruhn CM, Reed B, Scearce A, O'Donnell J: On-farm quality assurance programs: a survey of producer and industry leader opinions. *J Dairy Sci* 82:2224-2230, 1999.
20. Pfizer Animal Health: United States injectable antibiotic usage in dairy herds, 2006.
21. Raymond MJ, Wohrle RD, Call DR: Assessment and promotion of judicious antibiotic use on dairy farms in Washington State. *J Dairy Sci* 89:3228-3240, 2006.
22. Roeber DL, Cannell RC, Belk KE, Scanga JA, Cowman GL, Smith GC: Incidence of injection-site lesions in beef top sirloin butts. *J Anim Sci* 79:2615-2618, 2001.
23. Roeber DL, Mies PD, Smith CD, *et al*: National market cow and bull beef quality audit-1999: a survey of producer-related defects in market cows and bulls. *J Anim Sci* 79:658-665, 2001.
24. Roeber DL, Cannell RC, Wailes WR, *et al*: Frequencies of injection-site lesions in muscles from rounds of dairy and beef cow carcasses. *J Dairy Sci* 85:532-536, 2002.
25. Sample Size Calculator. http://www.surveysystem.com/sscalc.htm Accessed 10/19/2007.
26. Sawant AA, Sordillo LM, Jayarao BM: A survey on antibiotic usage in dairy herds in Pennsylvania. *J Dairy Sci* 88:2991-2999, 2005.
27. Sischo WM, Kiernan NE, Burns CM, Byler LI: Implementing a quality assurance program using a risk assessment tool on dairy operations. *J Dairy Sci* 80:777-787, 1997.
28. Smith GW, Davis JL, Tell LA, Webb AI, Riviere JE: Extralabel use of nonsteroidal anti-inflammatory drugs in cattle. *J Am Vet Med Assoc* 232:697-701, 2008.
29. USDA - APHIS - Animal Health Monitoring & Surveillance - NAHMS - Dairy. http://www.aphis.usda.gov/vs/ceah/ncahs/nahms/dairy/ Accessed 10/18/2007
30. US FDA/CFSAN - Grade "A" Pasteurized Milk Ordinance (2003 Revision): Table of Contents. http://www.cfsan.fda.gov/~ear/pmo03toc.html Accessed 10/19/2007
31.VanDyke L: AABP 2006 Membership Data Spreadsheet. Accessed January 2007.
32. Zwald AG, Ruegg PL, Kaneene JB, *et al*: Management practices and reported antimicrobial usage on conventional and organic dairy farms. *J Dairy Sci* 87:191-201, 2004.

Abstract

Risk factors for initial respiratory disease in United States' feedlots based on producer-collected daily morbidity counts

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The incidence of initial respiratory disease was followed for 12 weeks in 122 pens of feedlot cattle, based on producer-collected daily morbidity counts. Weekly incidence density was calculated based on the number of new cases and the population at risk. Incidence density was greatest in the first week after arrival and decreased in following weeks. Weekly incidence rate varied between pens and over time from 0 to 27.7 cases per 100 animal weeks at risk. A negative binomial model controlling for multiple events within pens and over time was used to model effects on the number of new cases. Mixed gender groups, cattle from multiple sources and increasing distance shipped were associated with increased risk for initial respiratory morbidity. Heavier entry weight was associated with decreased morbidity risk. These factors may be useful in categorizing groups of calves into risk groups for targeted purchase and management decision making.

VETERINARY PERSPECTIVE

SRP® vaccine stopped a Salmonella outbreak in a Vermont dairy herd

Seven to eight years ago, several of Dr. Kent Henderson's clients began experiencing severe outbreaks of salmonellosis caused by *Salmonella* Typhimurium. In herds with the worst cases, clients were losing large numbers of high-producing cows. Henderson's primary prevention and control program, in addition to increased hygiene on the dairy farm, was vaccination with an autogenous bacterin cultured and produced from the bacteria found on the farm. Production and delivery of autogenous bacterins took considerable time and their use often produced mixed results for Henderson's practice.

When AgriLabs introduced the new *Salmonella* Newport Bacterial Extract vaccine (SRP vaccine) in 2004, Henderson and his associates were excited about the opportunities it afforded them and their clients. Henderson said, "We believed that the SRP vaccine's unique mode of action might provide cross protection against multiple serotypes of salmonella. We were hoping this was going to be a tremendous advantage in our salmonella prevention programs. So we discontinued the use of autogenous vaccines and relied solely on the SRP vaccine with most of our clients."

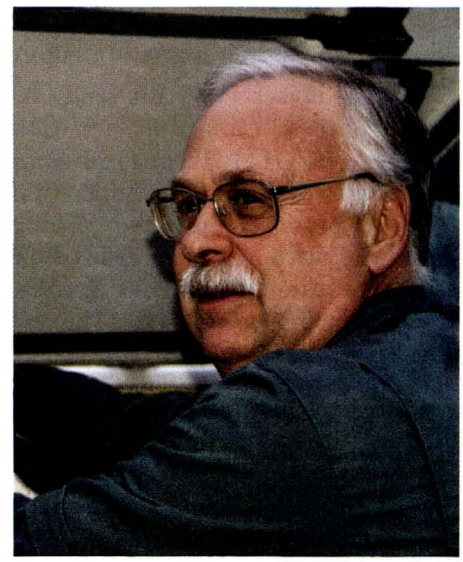
"On a Sunday afternoon in April of 2006, I received a call from one of my clients who had not been vaccinating with SRP. She had five critically ill cows in her herd of 500 milk cows. These fresh-sick animals had high fevers and all five animals were suffering with watery, "lemonade-like" diarrhea, typical in salmonella infections. Plus, the fecal discharge had a unique odor, characteristic of salmonellosis."

In an effort to prevent a salmonellosis outbreak in the entire herd, Dr. Henderson vaccinated 300 of the 500 cows in the herd that afternoon, exhausting the supply of SRP vaccine he had on hand, and completed vaccinating the herd the next day. Henderson said, "I had heard from other veterinarians that, in addition to prevention, SRP vaccine can help treat animals suffering from salmonella infection. So, in addition to fluid and NSAID therapy, I elected to vaccinate the five critically ill, possibly terminal, animals that afternoon. Three of the five showed dramatic signs of improvement within 18 hours of vaccination and all five survived and went back into production. We revaccinated the entire herd with SRP vaccine per label instructions and had only two additional mild cases of salmonella in the herd."

The laboratory at Cornell University identified the cause of infection to be the C_1 strain of *Salmonella* Infantis which is normally considered to be an avian strain of the bacteria. Dr. Henderson is not sure if wild birds were the vector or if the bacteria were brought to the dairy by a farm worker who picked them up at poultry facilities on the premises.

Since the outbreak, the producer has made a concerted effort to clean up the premises. Dr. Henderson feels that the clean up, together with the SRP vaccination program, has prevented further salmonella problems in both the cows and baby calves in this herd. Henderson sums it up this way, "Our client was pleased with our rapid response and the overall outcome our intervention and the SRP vaccination program has had on her dairy."

For more information about this case study or SRP vaccination programs, please call your AgriLabs representative or AgriLabs technical services at 800-542-8916.



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SRP® Technology

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