

Selective dry cow therapy: Antimicrobial stewardship can offer financial returns in appropriate herds

Amy Vasquez and Sam Rowe



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Partial budget analysis of culture- and algorithm-guided selective dry cow therapy

S. M. Rowe,^{1,2*} D. V. Nycham,³ S. M. Godden,¹ P. J. Gordon,⁴ A. Lago,⁵ A. K. Vasquez,³ E. Royste J. Timmerman,¹ M. J. Thomas,⁶ and R. A. Lynch⁷

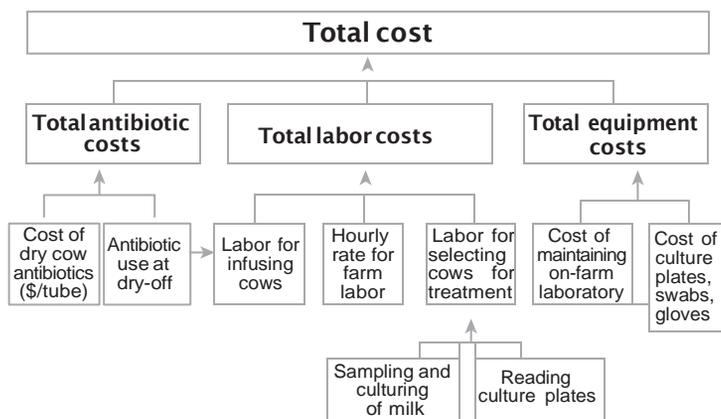
¹Department of Veterinary Population Medicine, University of Minnesota, St. Paul 55108
²Faculty of Science, Sydney School of Veterinary Science, The University of Sydney, Camden, New South Wales 2570, Australia
³Department of Population Medicine and Diagnostic Sciences, College of Veterinary Medicine, Cornell University, Ithaca, NY 14853
⁴Veterinary Diagnostic and Production Animal Medicine, Iowa State University, Ames 50011
⁵DairyExperts, Tulare, CA 93274
⁶Dairy Health & Management Services, Lowville, NY 13367
⁷Pro-Dairy, College of Agriculture and Life Sciences, Cornell University, Ithaca, NY 14853

THE TWO APPROACHES

A recent multi-site clinical trial by our group found that two selective dry cow therapy (SDCT) programs each used 55 percent less antibiotics at dry-off than blanket dry cow therapy (BDCT)

FIGURE 1

Breakdown of costs associated with dry-off



without negatively affecting udder health in the next lactation. The first strategy involved use of microbiological culture to identify and treat any quarter-level infection at dry-off (“culture-guided SDCT”). The second used a computer-

automated data-driven algorithm to select and treat only cows that were “high-risk” for infection at or after dry-off (“algorithm-guided SDCT”). Both strategies require necessary tools: an onsite laboratory with an incubator and consumables such as bacterial growth media, gloves, and inoculation swabs for culture-guided SDCT. Monthly

individual-cow somatic cell counts and mastitis event data is necessary for algorithm-guided SDCT. Additionally, both strategies incur labor costs. Both require a small amount of time at dry-off to sort cows into those that will receive antimicrobial therapy and those that will not. Culture-based SDCT requires additional time prior to dry-off to sort cows and retrieve quarter-level milk samples, and to inoculate and read culture plates. The potential of SDCT to improve antimicrobial stewardship without negative cow or quarter-level impacts are certainly drivers for producers to select either of these strategies. Yet survey data in the U.S. indicates that most producers elect to use BDCT at dry-off. Could the extra labor costs or uncertainty around negative impacts create worry around the economic viability of the practice? Our group aimed to determine the net economic impact of these strategies at the herd level.

MODELING ECONOMIC CONSEQUENCES USING CURRENT INDUSTRY DATA

A partial budget analysis was used to capture herd-level economic impacts of culture and algorithm-guided SDCT over the BDCT approach. We performed these calculations using Monte Carlo simulations within the @Risk software program (@Risk 7.6; Palisade Corporation, Ithaca, N.Y.). Many considerations were made for inputs of these models. First, the findings of our previous study determined that post-fresh udder health was equivalent for the dry cow therapy approaches explored; this was assumed for the first economic models that were investigated. Herd-level components were entered in the model such as costs of medications, labor costs, and cost of the method of SDCT (Figure 1). Each of the herd-level components was represented by a range of values sampled from a distribution characteristic of how the data is presented in the fi These distributions were used because costs may vary by farm, such as extra time required for milk sampling or worker wages. Fixed costs were entered for consumables such as culture plates and sample vials. As most farms use regular DHIA milk-recording, this was assumed to be an already-sunk cost for algorithm-guided protocols. Fifty-thousand iterations were run, with each iteration representing one herd under a set of individual economic and health conditions to capture all of the variability that can occur at the farm level. Examples of individual iterations for blanket, culture-guided, and algorithm-guided protocols are shown in Figure 2.

THE RESULTS

In the situation of BDCT, the largest cost is antibiotics. Although costs decline for medications in the SDCT strategies, farms will experience increases in total labor costs and equipment costs.

The @Risk program generated a net herd impact distribution histogram for the 50,000 iterations associated with culture-guided SDCT (Figure 3, page 10) indicating that there is variation in the money saved per cow-dry-off across

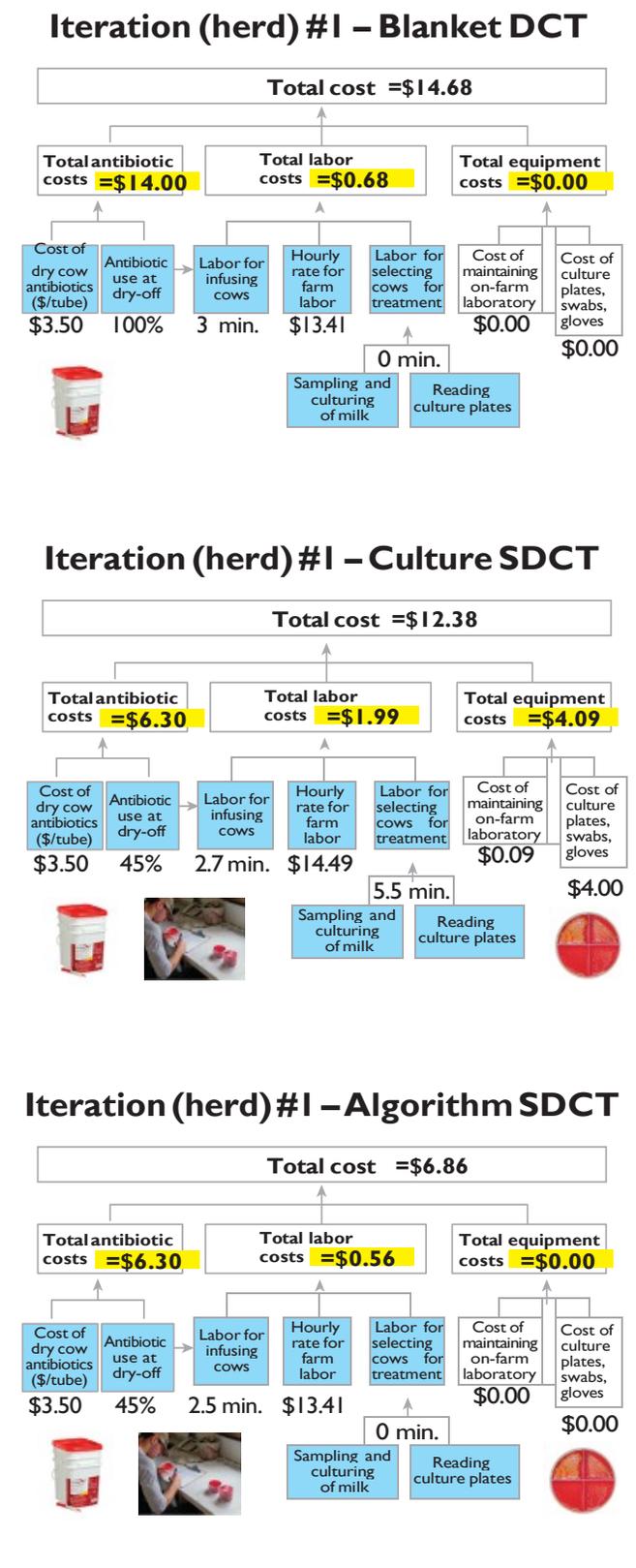
the herds. The average economic savings (the peak of the curve) for a herd using culture-guided therapy over BDCT was \$2.14 per cow-dry-off. Three-quarters of the herds experienced a positive economic impact (greater than \$0) whereas in 25 percent of farms, the strategy was not economical (less than \$0). For algorithm-guided SDCT, 100 percent of iterations found that it was a profitable alternative to BDCT with an average net of \$7.83 per cow dry-off (Figure 4, page 10). For 1,000 cows dried off per year, this amounts to over \$7,500. When we further investigated what inputs were responsible for one farm achieving higher net values than another, we found two major contributors: the cost of the antibiotic tubes and the proportion of quarters treated at dry off. In the culture-guided program, the latter will be driven by the number of positive cultures whereas in the algorithm-guided program, it will be driven by the number of cows above the thresholds for somatic cell count and mastitis cases.

WHAT IF UDDER HEALTH DECLINES?

Though previous research by our group found no impact on udder health consequences when comparing SDCT methods to BDCT, there continues to be the “what if?” question. For instance, earlier SDCT studies did fi increases in risk of mastitis and/or worsened milk quality. It should be noted that many of

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FIGURE 2
Examples of one iteration for each dry cow treatment strategy



HERD MANAGEMENT

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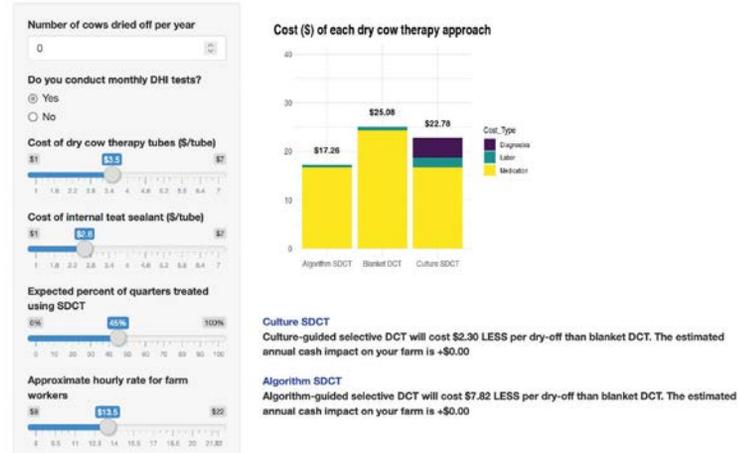
these studies were performed on herds that did not use internal teat sealant or that had a higher incidence of *Staph aureus*. Regardless, an objective of our group was also to investigate how a decline in udder health after switching to a SDCT strategy would affect the net herd economic impact. Using the same Monte Carlo simulation models, we were able to include a variable that introduced a cost (based on replacement costs, treatments, milk loss, etc.) for increases in mastitis of one, two or five percent for each herd. The question here was, if mastitis does increase as a result of implementing SDCT, will the farm still experience economic returns? As in the previous situation, antibiotic tubes were the largest contributing expense; perhaps the savings would exceed the costs incurred for mastitis cases.

The results of this sensitivity analysis were as follows: at a one percent increase in mastitis, if a culture-guided SDCT program is used, the average farm must be treating 40 percent or fewer quarters to experience a net benefit. For algorithm-guided, the farm must be treating 60 percent or fewer quarters. At a two percent increase in mastitis,

FIGURE 5
Online cost calculator

Selective Dry Cow Therapy Cost Calculator

Enter your information below to compare the cost of dry cow therapy strategies in your herd



20 percent of quarters or less must be treated to result in net positive returns in a culture-guided program, while 40 percent of quarters or less must be treated in the algorithm-guided program. Finally, at a five percent increase in mastitis, none of the programs will have positive returns. In summary, as risk for mastitis increases on a farm after SDCT implementation, it becomes less economical to continue to the program.

APPLYING THIS KNOWLEDGE

How can one predict what will happen on an individual farm? We highly encourage discussion with the farm's veterinarian to determine candidacy for successful implementation, which will include considerations such as dry-off procedures and techniques, current milk quality parameters, presence of contagious pathogens in the herd, and availability/acquisition of necessary

tools. To determine what dry cow therapy method might be most cost-effective, our team has developed a tool where producers can enter their treatment and labor costs, current practices, and expected level of treatment to generate values for comparison: Selective Dry Cow Therapy Cost Calculator - Dairy Know (umn.edu): dairyknow.umn.edu/research/udder-health/selective-dry-cow-therapy-cost-calculator. (Figure 5) ■

Amy Vasquez (amy.vasquez@danone.com) is on the Milk Quality and Animal Care team at Danone North America and in previous roles has dedicated much time to extension/research regarding selective treatment protocols. Sam Rowe (samue.rowe@sydney.edu.au) is a senior lecturer in ruminant medicine at The University of Sydney and has conducted research and extension in mastitis management in the United States and Australia.

FIGURE 3
Culture-guided SDCT net herd impact (\$/cow-dry-off)

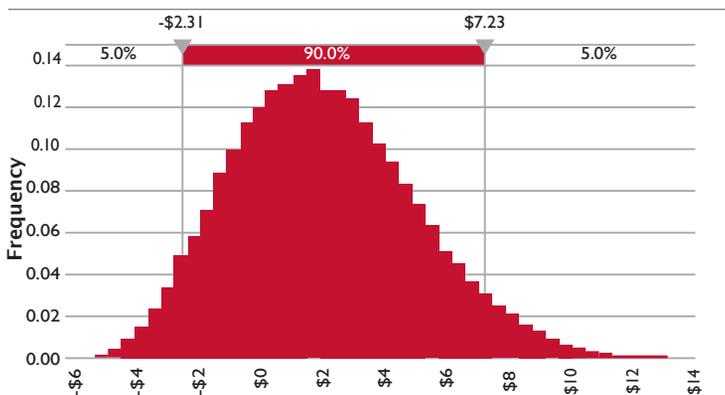


FIGURE 4
Algorithm-guided SDCT net herd impact (\$/cow-dry-off)

