

The impact of future technological advancements on current bovine respiratory disease management practices

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In the United States, total beef production has been driven by technologic advancements. Adoption of multiple technologies has allowed the US cow herd to produce record-setting levels of protein for consumers.² Specifically, from 1955 to 2004, pounds of beef per beef cow increased from 137 lb to 250 lb (62 kg to 113 kg), respectively, despite beef cow numbers remaining relatively consistent.¹ Because of these improvements in beef production, the US and its trade partners enjoy a highly sought-after product at a reasonable price. Likewise, technology in various forms (e.g. management practices, vaccines, antimicrobials) has provided valuable tools for the prevention, control, and treatment of bovine respiratory disease (BRD).⁴ Although these products have improved overall BRD management and are responsible for part of the improvement in beef production efficiency, their availability has also altered marketing practices associated with elevated BRD risk. The risk of morbidity and mortality associated with BRD has not declined despite research that has identified numerous risk factors, built knowledge around the contributing viral and bacterial pathogens, and expanded vaccine and antimicrobial options.^{3,4} In other words, the incidence of BRD is the result of a multi-segmented industry with market forces that tend to run counter balanced to management designed to reduce BRD risk. These forces expose calves to multiple risk factors which reduce the efficacy of BRD prevention, control, and treatment modalities.

Proper preconditioning programs (weaning, castration, immunization, parasite control, and nutrition) reduce the incidence of BRD in the post-weaning phase of production.^{3,4} However, the financial incentive to follow those practices (or perhaps the economic penalty for not doing so) is not sufficient for widespread adoption and annual sustainment. Conversely, preconditioning efforts that reduce BRD risk may be overwhelmed by the production and marketing systems (that assist with elevated efficiency) that increase the likelihood for BRD. Forces driving those marketing systems – global markets, perceptions by the consumer about how beef is produced, and demographics of the consumer – will

likely necessitate continued changes in beef production to meet new opportunities for marketing beef.² Therefore, to maintain current beef production efficiency and manage consumer perception, it is necessary to augment BRD management with additional tools that avoid the ongoing repetition of conventional management practices while expecting different results.

Predicting and diagnosing BRD is challenged by the bovine's ability to conceal clinical signs of disease.^{5,6} Technology aimed at predicting BRD development at the individual-animal level could provide value by optimizing current BRD control programs that leverage antimicrobial metaphylaxis. In parallel, timely diagnosis of BRD within both the preweaning and postweaning phases of production could provide an opportunity to improve treatment outcomes, individual animal performance, and animal welfare all while supporting judicious antimicrobial use.

As mentioned above, the beef production industry has multiple biologic and pharmacologic tools to manage BRD. The advent of technologies that improve the prediction and diagnosis of BRD may provide greater opportunity for both antimicrobial and non-antimicrobial products to find a place in BRD control and treatment. For example, the application of immunostimulants and non-steroidal anti-inflammatory drugs (NSAIDs) have shown limited efficacy when utilized in a stand-alone manner or with antimicrobials (i.e. ancillary therapy) in conventional BRD diagnosis settings. However, there may be subpopulations that would find greater value in immunostimulant and/or NSAID therapy if BRD was diagnosed in a timelier manner. That said, in general, we foresee application of the same BRD prevention, control, and treatment products that are currently available today; however, we envision that their utilization and subsequent efficacy may be optimized by applying them within an ecosystem that increases the likelihood of an earlier diagnosis and a successful outcome.

An extremely important topic that can be affected by implementing new technologies as described above is the

impact on the human workforce. We would be remiss if our industry and profession did not learn from the precision agriculture space. Technology in that area has provided the row-crop industry with the ability to optimize yield while reducing costs and sustaining land resources. Although those technologies still require people, labor is made more efficient with technologic advancement. In contrast, the availability of labor is one of the rate-limiting steps in bovine production systems. Our early experiences have exposed 2 schools of thought among those engaged in beef production. First, is the perception that technologic advancements are a means of decreasing the need for labor due to the challenge of identifying and retaining a skilled labor force. Second, is the implementation of technologies designed to assist in activities previously performed exclusively by people. The latter may be perceived by some employees as a threat to their employment. A more realistic approach to that conundrum is that there will continue to be an ongoing need for labor; however, the skill sets previously demanded to adequately perform a given job may be modified and become less rigorous, thereby increasing the available labor pool. Additionally, with the onset of new technologies, employers may be able to reallocate existing labor and improve overall efficiency. Ultimately, people cannot be separated from the role of technology in animal health care. People must apply the technology, and in many cases respond to the actionable data provided by the respective technology.

New technologies have aided the animal-based food and fiber industries to efficiently produce safe and valuable products for the human population. We strongly support appropriate use of currently available technologies designed

to prevent, control, and treat BRD (e.g. vaccines, antimicrobials) as well as the ongoing implementation of management practices designed to reduce BRD risk (e.g. preconditioning strategies). However, we look forward to the application of new developments that optimize BRD prediction and diagnostic accuracy. These new tools may provide opportunities to maximize the efficacy of current prevention, control, and treatment modalities while also fostering in new opportunities to leverage non-antimicrobial options. The overall objectives being to maximize the producer's bottom line and the animal's wellbeing while satisfying consumer demand.

References

1. Elam TE, Preston RL. Fifty years of pharmaceutical technology and its impact on the beef we provide to consumers. Available at: <http://www.beeftechnologies.com/>, 2004.
2. Drouillard JS. Current situation and future trends for beef production in the United States of America - A review. *Asian-Australasian J Anim Sci* 2018;31:1007-1016.
3. Hilton WM. BRD in 2014: Where have we been, where are we now, and where do we want to go? *Anim Health Res Rev* 2014;15:120-122.
4. Smith RA, Step DL, Woolums AR. Bovine respiratory disease: Looking back and looking forward, what do we see? *Vet Clin North Am Food Anim Pract* 2020;36:239-251.
5. Timsit E, Dendukuri N, Schiller I, et al. Diagnostic accuracy of clinical illness for bovine respiratory disease (BRD) diagnosis in beef cattle placed in feedlots: A systematic literature review and hierarchical Bayesian latent-class meta-analysis. *Prev Vet Med* 2016;135:67-73.
6. White BJ, Renter DG. Bayesian estimation of the performance of using clinical observations and harvest lung lesions for diagnosing bovine respiratory disease in post-weaned beef calves. *J Vet Diagn Invest* 2009;21:446-453.

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