0576 Optimization of reproductive management programs using lift chart analysis and cost-sensitive evaluation of classification errors.
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The common practice on most commercial dairy farms is to inseminate all cows that are eligible for breeding, while ignoring (or absorbing) the costs associated with semen and labor directed toward lowly fertile cows that are unlikely to conceive. Modern analytical methods, such as machine learning algorithms, can be applied to cow-specific explanatory variables for the purpose of computing the probabilities of success or failure associated with upcoming insemination events. Lift chart analysis can identify subsets of high fertility cows that are likely to conceive and are therefore appropriate targets for insemination (e.g., with conventional AI semen or expensive gender-enhanced semen), as well as subsets of low fertility cows that are unlikely to conceive and should therefore be passed over at that point in time. While such a strategy might be economically viable, the management, environmental, and financial conditions on one farm might differ widely from conditions on the next, and hence the reproductive management recommendations derived from such a tool may be suboptimal for specific farms. When coupled with cost-sensitive evaluation of misclassified and correctly classified insemination events, it can be potentially powerful tool for optimizing the reproductive management of individual farms. In the present study, lift chart analysis and cost-sensitive evaluation were applied to a data set consisting of 54,806 insemination events of primiparous Holstein cows (as experimental unit) on 26 Wisconsin farms, as well as a data set with 17,197 insemination events of primiparous Holstein cows on three Wisconsin farms, where the latter had more detailed information regarding health events of individual cows. In the first data set, the gains in profit associated with limiting inseminations to subsets of 79 to 97% of the most fertile eligible cows ranged from $0.44 to $2.18 per eligible cow, depending on days in milk at breeding and milk yield relative to contemporaries. In the second data set, the strategy of inseminating only a subset consisting of 59% of the most fertile cows conferred a gain in profit of $5.21 per eligible cow. These results suggest that, when used with a powerful classification algorithm, lift chart analysis and cost-sensitive evaluation of correctly classified and misclassified insemination events can enhance the performance and profitability of reproductive management programs on commercial dairy farms. Note: In machine learning methods, *P*-value is not a criteria of decision-making as it is in classic statistics.

Key Words: machine learning, reproductive management, cost-sensitive

0577 The cost of clinical mastitis in the first 30 d of lactation: an economic assessment tool.
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Mastitis results in considerable economic losses for dairy producers and is most commonly diagnosed in early lactation. The objective of this study was to create a tool to estimate the predicted economic impact of clinical mastitis occurring during the first 30 d of lactation for a representative North American dairy. A deterministic partial budget model was created in spreadsheet software to estimate the projected direct and indirect costs per case of clinical mastitis occurring during the first 30 d of lactation in a typical dairy. The cost calculator was built by adapting published estimates from recent peer reviewed literature covering mastitis incidence, pathogen prevalence, recurrence risk, culling effects, reproductive effects, and milk production effects to estimate the value of projected future production, culling, death, and reproductive losses. Herd specific data including milk price, reproductive performance, lactational culling risk, diagnostic costs, treatment protocol costs, replacement costs, market cow prices, feed costs, labor costs, and veterinary costs are input to allow full customization of the projection model. The average case of clinical mastitis resulted in a net economic loss of $458, including $135 in direct costs and $323 in indirect costs. Direct costs included diagnostics ($3), therapeutics ($42), discarded milk ($20), veterinary service ($15), labor ($30), and death loss ($26). Indirect costs included future milk production loss ($135), future culling and replacement loss ($162), future reproductive loss ($21), and ongoing monitoring costs ($5). Accurate decision-making regarding mastitis control relies on understanding all of the economic impacts of clinical mastitis, especially the longer-term indirect costs that represent 71% of the total costs per case of mastitis. Future milk production loss represents 29% of total costs, and future culling and replacement loss represents 35% of the total costs of a case of clinical mastitis. In contrast to older estimates, these values represent the current dairy economic climate, including milk price ($0.48/kg), feed price ($0.286/kg DM), replacement costs ($2000), and use the latest estimates on the production and culling effects of clinical mastitis. This economic model is designed to be customizable for specific dairy producers and their herd characteristics to better aid them in developing mastitis control strategies.

Key Words: mastitis, economics, transition