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A survey of United States dairy hoof care professionals on costs associated with treatment of foot disorders

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ABSTRACT

The objective of this study was to collect information regarding hoof care professionals' billing practices and to gather their opinions about foot disorders and the value of their prevention. Responses were gathered from veterinarians ($n = 18$) and hoof trimmers ($n = 116$) through both online and paper survey platforms. Because of the limited number of respondents, veterinarian responses were not further analyzed. Of the 6 foot disorders included in the survey, the treatment cost per case was greatest for toe ulcers (mean \pm standard deviation; $\$20.2 \pm 8.5$), sole ulcers ($\19.7 ± 8.6), white line disease ($\$19.5 \pm 8.1$), and thin soles ($\18.1 ± 8.1), and least for infectious disorders (foot rot and digital dermatitis; $\$8.0 \pm 7.6$ and $\$7.5 \pm 9.6$, respectively). Of the disorders, digital dermatitis represented most of the foot disorder cases treated by respondents over the past year ($43.9 \pm 20.4\%$), whereas toe ulcers and thin soles represented the least (5.3 ± 4.1 and $5.3 \pm 5.7\%$, respectively). Respondents that served mostly large herds (>500 lactating cows) reported a lower prevalence of digital dermatitis (31.6 ± 4.2 vs. 44.4 ± 3.4 and $46.7 \pm 3.2\%$ in small and medium herds, respectively) and a higher prevalence of sole ulcers (23.1 ± 3.0 vs. 13.4 ± 2.4 and $13.3 \pm 2.3\%$ in small and medium herds, respectively). Region of the United States (Northeast, Midwest, or other) also influenced foot disorder prevalence; respondents from the Northeast reported more sole ulcers than respondents from other regions (22.1 ± 2.3 vs. $12.4 \pm 3.3\%$). When respondents were asked which disorder was associated with the greatest total cost per case to the producer (treatment and labor costs plus the reduction in milk yield, reduced reproductive performance, and so on), hoof trimmers ranked digital dermatitis as having the greatest total cost per case and thin soles as having the least total cost per case.

Finally, respondents indicated that the most important benefits of reducing foot disorders were enhanced animal welfare and increased milk production, whereas the least important benefit was reduced veterinary and hoof trimmer fees. Results from this survey can be used to improve the accuracy of foot disorder cost estimates and contribute to better decision-making regarding both foot disorder treatment and prevention.

Key words: lameness, hoof health, disease treatment costs, animal health economics

INTRODUCTION

Lameness is a clinical sign, expressed as irregular gait or posture, associated with any painful disorder of the locomotor system (Van Nuffel et al., 2015). In dairy cattle, the main cause of lameness is foot disorders (Van Nuffel et al., 2015). The most common foot disorders found in United States dairy herds are digital dermatitis, sole ulcer, white line disease, foot rot, toe ulcer, and thin sole (Bicalho et al., 2007; Sanders et al., 2009; DeFrain et al., 2013).

Each case of a foot disorder results in an expense for the dairy producer. Foot disorder expenses include direct expenditures in the form of treatment (i.e., outside labor, producer labor, and therapeutics) and indirect losses (i.e., nonsaleable milk, reduced milk production, reduced reproductive performance, increased risk of culling and death, increased risk of foot disorder recurrence, increased risk of other diseases, and reduced animal welfare; Dolecheck and Bewley, 2018). The total cost per case of a foot disorder depends on the type of disorder and other cow and farm specific factors (e.g., cow age, DIM at occurrence, market prices). Dolecheck and Bewley (2018) summarized previous studies that have estimated the cost of non-disorder-specific lameness, as well as specific foot disorders. Most recently, Charfeddine and Pérez-Cabal (2017) estimated the cost per case of sole ulcer, white line disease, and digital dermatitis in Spanish dairy herds, finding that sole ulcers were the most expensive ($\$232$ to $\$622$ /case)

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whereas digital dermatitis was the least expensive (\$53 to \$402/case).

One limitation of current foot disorder cost estimates is that many of the expenditures and losses that contribute to the cost per case are not easily defined. For example, treatment expenditures are often based on the author's opinion (Guard, 2008; Bruijn et al., 2010) or outdated values (Cha et al., 2010). In reality, these costs depend on the type of foot disorder, the severity of the condition, the treatment used, and the person treating the case (i.e., producer, hoof trimmer, or veterinarian). The best estimate of these costs would come from those that charge the producer for them (i.e., hoof trimmers and veterinarians). Recently, Charfeddine and Pérez-Cabal (2017) conducted a survey of Spanish hoof trimmers to define the costs charged to producers to treat a case of sole ulcer, white line disease, or digital dermatitis; however, no similar estimates are available for the United States dairy industry.

Our study aimed to collect and summarize information on foot disorder treatment costs charged by hoof trimmers and veterinarians to dairy producers. The resulting values could be used to improve foot disorder cost estimates, therefore improving decisions about foot disorder treatment and prevention. Additional insight was provided into hoof trimmers' general billing practices and views on the prevalence and total cost of different foot disorders and the value of their prevention.

MATERIALS AND METHODS

Survey Development

A survey was drafted with the goal of defining treatment costs for foot disorders as charged to producers by hoof trimmers and veterinarians. The drafted survey was reviewed by industry veterinarians ($n = 2$), academic veterinarians ($n = 5$), academic professionals ($n = 7$), and animal science graduate students ($n = 10$) to collect feedback on content and organization. Based on collected feedback, revisions were made before the survey was sent to potential respondents. The final survey questions are included in Appendix Figure A1. The revised survey was also reviewed by the University of Kentucky Institutional Review Board and found exempt from human subject protection regulations as described in the US Department of Health and Human Services Federal Policy for Protection of Human Subjects 45CFR46.101(b).

Demographic information elicited by the survey included profession (veterinarian, hoof trimmer, or other), the location of practice (country or states served, if within the United States), herd sizes served, and the mean number of dairy cows trimmed per week (broken

out into preventive and treatment trimmings). Respondents selecting other for their profession were removed from the survey results because they were outside of the target audience. General practice questions were formulated to evaluate the rate charged by hoof trimmers and veterinarians to come to a farm and conduct either preventive or treatment trimmings. These questions included (1) asking respondents if they charged a visit, daily, or set-up fee and, if so, how much; (2) the on-farm rate (\$/h or \$/cow) charged for preventive trimming; and (3) the mean number of cows trimmed per hour.

Condition-specific foot disorder questions focused on 6 disorders: digital dermatitis, foot rot, sole ulcer, thin sole, toe ulcer, and white line disease. These disorders were chosen based on their expected prevalence and feedback from those who reviewed the first version of the survey. All disorders were defined within the survey according to industry standards (Zinpro, 2014; Appendix Figure A2). Condition-specific questions included the total amount charged to the producer for treatment of each disorder along with the percent of the total cost attributed to labor and the percent of the total cost attributed to supplies. Additionally, respondents were asked to estimate the amount of time spent to treat a case of each disorder, the percent of lameness cases treated in the past year attributed to each disorder, and milk withhold recommendations following treatment. Retrospectively, the question about milk withhold recommendations was removed from the study results because of US regulations restricting hoof trimmers from prescribing antibiotics.

Finally, respondents were asked to answer 2 rank order questions. First, they were asked to rank the 6 foot disorders based on their opinion of the total cost per case to the producer (treatment and labor costs plus the reduction in milk yield, reduced reproductive performance, and so on) from most expensive (1) to least expensive (6). Second, they were asked to rank the importance to producers of 8 potential benefits (identified by the authors) of reducing dairy cow lameness from most important (1) to least important (8). The potential benefits included decreased incidence of other diseases (not lameness), enhanced animal welfare, increased milk production, increased reproductive performance, increased cow longevity, reduced drug and supply costs, reduced producer labor costs, and reduced veterinary and hoof trimmer fees.

Survey Distribution

The target audience for the survey was veterinarians and hoof trimmers; therefore, the American Association of Bovine Practitioners (**AABP**) and the Hoof Trim-

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