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Housing, management characteristics, and factors associated with lameness, hock lesion, and hygiene of lactating dairy cattle on Upper Midwest United States dairy farms using automatic milking systems

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ABSTRACT

The objectives of this cross-sectional study were to describe housing and management practices on farms using automatic milking systems (AMS) in 2 states of the upper Midwest and to evaluate the association of various housing and management factors with 3 measures of animal welfare: prevalence of lameness, severe hock lesions, and dirty cows. Fifty-four farms were visited once to collect facility measurements and observations, interview the dairy producer, and score cows for locomotion, hock lesions, and hygiene. Median number of AMS units/farm was 2 (interquartile range = 1; range = 1 to 8). Factors concerning labor were the most commonly cited reason by dairy producers for making the transition to the AMS; additional commonly cited factors were an improvement in lifestyle and human health. Number of cows fetched per AMS, or manually brought to the AMS if not milked voluntarily, was 4.7 ± 2.3 cows/AMS per day (8% of cows) for free traffic flow farms and 3.3 ± 1.8 cows/AMS per day (5% of cows) for guided traffic flow farms. Cow resting surface was significantly associated with prevalence of lameness and severe lameness. Farms with sand-bedded freestalls (17.2%) and bedded packs (17.4%) had significantly lower lameness prevalence (score ≥3 on a 1 to 5 scale, with 1 = normal locomotion) than farms with mattress freestalls (30.5%), waterbeds (25.0%), and mattresses with access to pasture (22.6%). Farms with mattresses and access to pasture had similar lameness prevalence to farms with waterbeds, but were lower than farms with mattresses only. A somewhat similar result was found for severe lameness prevalence (score ≥4 on a 1 to 5 scale, with 1 = normal locomotion); farms with sand-bedded freestalls (2.8%), bedded packs (0.0%), and mattress freestalls with access to pasture (1.5%) had significantly lower prevalence than farms with mattresses (7.1%) or waterbeds (10.8%). Severe hock lesion prevalence (score = 3 on a 1 to 3 scale, with 1 = normal, 3 = swelling) in herds with sand-bedded freestalls, waterbeds, and bedded packs were similar and significantly lower than the prevalence in mattress-based freestalls. Cows housed in sand-bedded freestalls had significantly lower prevalence of dirty cows (score = 3 or 3.5 on a 1 to 5 scale, with 1 = clean) than those housed on mattresses and waterbeds, and had significantly lower prevalence of severely dirty cows (score = 4, 4.5 or 5 on a 1 to 5 scale, with 1 = clean) than all other housing systems except waterbeds, which was similar. Manure removal system (manual, automatic, or slatted floor) was significantly associated with prevalence of severely dirty cows; farms with manual scraping had lower prevalence of severely dirty cows than farms where alley scraping was practiced automatically or slatted floors were used. Dairy producers using AMS appeared to be successful with a variety of facility designs and management practices. Cow resting surface in AMS herds was associated with some animal health and welfare measurements.

Key words: automatic milking, lameness, robotic milking

INTRODUCTION

The first automatic milking systems (**AMS**) were installed in commercial dairy farms in the Netherlands in 1992 (de Koning and van de Vorst, 2002). In AMS, cows come voluntarily to a robotic milking station to be milked without human intervention, with the exception of a small percentage of cows that need to be fetched because they exceed maximum milking intervals as defined by the user. This is different from conventional milking systems, where cows are brought by humans to a milking parlor as a group to be milked typically 2 or 3 times a day. Similar to conventional milking systems, AMS have been used in various types of housing throughout the world, such as pasture-based (Lyons et al., 2013), freestall barns, and bedded pack barns (de

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Jong et al., 2003). However, management and specific housing characteristics could be different in AMS compared with conventional farms.

In recent years, a growing number of dairy farmers in North America have implemented AMS for a variety of reasons, including improved quality of life, issues associated with hired labor, and improved quality of management of the dairy herd (de Jong et al., 2003). Most of the research with AMS has been conducted in Europe (Klaas et al., 2003; Hogeveen et al., 2004; Bach et al., 2007) and more recently in Canada (King et al., 2016; Westin et al., 2016). Limited information exists about housing, management practices, and reasons for AMS installation on dairy farms in the United States. Based on field observations and a limited number of studies, both free (where cows have unrestricted access to the feeding area, lying area, and AMS unit) and guided flow (where cows must visit areas of the barn in sequence, such as from lying area to the AMS unit to the feeding area, using a combination of preselection and one-way gates) cow traffic patterns have been successfully used in AMS. The housing design with AMS might be different to conventional milking barns, and hence worth researching.

Measures of animal welfare, such as prevalence of lameness, hock lesions, and dirty cows, have not been extensively investigated in AMS farms in the United States. In addition, limited research has been conducted to evaluate the association of these measurements with various housing and farm management factors in AMS. Borderas et al. (2008) found lameness prevalence to be associated with lower milking frequency in AMS. Lameness is a very costly disease, ranging in cost from about $120 to over $300 per case, depending on the type of lesion (Cha et al., 2010). A recent study in Canada (King et al., 2016) assessed lameness in AMS herds and found lameness and severe lameness prevalence of 26 and 2.2%, respectively.

The objective of our cross-sectional study was to describe housing and management practices on farms using AMS in 2 states in the upper Midwest. In addition, we investigated associations between some housing and management characteristics and the prevalence of some measures of animal welfare, namely lameness, severe hock lesion, and dirty cows, which had not been previously studied in this region of the United States.

MATERIALS AND METHODS

Farms and Data Collection

Fifty-four dairy farms in the Midwest (Minnesota and Wisconsin) using AMS were visited between June and September 2012 to collect on farm data for this observational study. At the time of study enrollment, it was estimated (based on AMS dealer information) that these farms represented the majority (>85%) of farms using AMS in these 2 states. Farms in the current study had installed Lely Astronaut (Lely Industries N.V., Maassluis, the Netherlands) or DeLaval VMS (Delaval International AB., Tumba, Sweden) AMS.

During farm visits, data were recorded by research personnel on current barn design, including number of AMS units per farm and per pen, whether the barns were built new or retrofitted, number of freestalls per pen (when applicable), type of manure-removal system used for the barn alleys, cow resting surface, free or guided flow cow traffic, ventilation system, length (m) of the exit lane from the AMS and depth of open area (m) in front of the AMS entrance, the presence and location of a footbath, and barn lighting practices. Barn lighting practices were recorded to learn whether cows would have light at all times of day as they entered the AMS area or not, and whether lighting protocols were similar to conventional herds. In addition, milk production per cow (kg/d) was obtained from the AMS software at each farm (yearly average for year of visit, collected remotely).

Farm managers were interviewed in-person by research personnel during the farm visit to collect information on overall herd management practices, labor, adaptation of the cows to the AMS, fetching routine and number of cows fetched per day (average for the previous month), number of AMS calls per day (average for the previous month), and experience with equipment failures and repairs (average for the previous year). One question was about the reason for installing AMS and another was about perceived factors for success with AMS. The questionnaire had 43 open-ended or short answer questions (such as “please describe feeding management protocols” or “on average, how many cows do you fetch per AMS per day”).

Lameness Prevalence

A minimum of 30% of cows in all pens as a representative sample of the herd (Endres et al., 2014) were scored for locomotion by a single trained observer using a 5-point scoring method (Flower and Weary, 2006), where 1 = normal, 2 = imperfect locomotion, 3 = lame, and 4 and 5 = severely lame. Cow identification was recorded by the observer to avoid scoring the same cow more than once; cows were scored by the observer as they walked in the freestall alleys for a minimum of 6 strides without impediment, and approximately every 3rd cow was scored. Locomotion score data were used