



Factors influencing the chance of cows being pregnant 30 days after the herd voluntary waiting period

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ABSTRACT

The objective of this study was to study factors affecting a reproductive performance indicator at the cow level adjusted for herd management strategy. Associations between the outcome variable, pregnant or not at the herd voluntary waiting period (VWP) plus 30 d (pregnant at VWP+30), and the predictor variables were analyzed using a multivariable, generalized estimation equations model that adjusted for clustering of the data at the herd level. The statistical analysis was stratified on parity. In total, 132,721 cows were retained for analyses, of which 29,113 (22%) were pregnant at VWP+30 d. Of the nonpregnant cows, 81,483 cows had records of artificial inseminations (AI) and 22,125 cows had no records of AI. The chance of pregnancy was higher for cows of the Swedish Red and for other/cross-breeds compared with Swedish Holstein, for cows from herds with high heat detection efficiency compared with cows from herds with medium and low heat detection efficiency, for cows from herds with long VWP (i.e., >51 d) compared with cows from herds with short VWP (<51 d), and for cows in freestalls compared with cows in tiestalls. The chance for pregnancy was lower for cows with severe problems at claw trimming compared with cows with no problems at trimming (only for second- and higher-parity cows), for cows that had a record of reproduction-related disease, for cows that had a record of any other disease compared with cows without record, for second- and higher-parity cows with records of dystocia compared with cows with no record of dystocia, for first-parity cows in the group with the highest milk yield compared with first-parity cows in the group with the lowest milk yield, for cows of third and higher parity in the group with the lowest milk yield compared with cows in higher yielding groups, for cows bred in summer compared with those bred in winter-spring (not significant for first-parity cows),

and for cows with a twin birth had compared with cows with a single birth. We observed associations of the dose-response type, such that when the milk fat-to-protein ratio increased, the chance for pregnancy decreased, and as the somatic cell count increased, the chance for pregnancy decreased. In conclusion, factors that are known to affect reproductive efficiency also affect the chance of cows being pregnant at the herd VWP plus 30 d.

Key words: reproductive performance, voluntary waiting period (VWP), dairy cow

INTRODUCTION

Reproductive performance in the dairy herd and the dairy cow is partly based on strategy decisions at the herd level; for example, when to serve the cow. These decisions may influence the outcome of individual cows; that is, when and if pregnancy will be achieved. The voluntary waiting period (VWP) is such a managerial decision factor. Reproductive performance in dairy cows is estimated and monitored by various measurements, such as the calving interval, conception rate, and number of inseminations. When monitoring and benchmarking reproductive performance, herd-specific factors such as delaying first service (Wapenaar et al., 2009) by designating a longer VWP may affect, for example, the calving interval. Comparing the calving interval between 2 cows (or the median between 2 herds) that have different VWP would lead to the conclusion that one cow (or herd) performs better than the other if this difference is not accounted for. The commonly used reproductive performance indicators reflect not only the biological reproductive performance of the cow, but also the managerial reproductive performance of the herd because they do not account for differences in VWP.

One way to control for different herd reproductive management strategies and to better reflect the biological reproductive performance of the cow is to use an indicator that controls for reproductive strategy

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decisions at the herd level. We previously investigated a herd reproductive performance indicator that was adjusted for herd VWP: proportion pregnant after the herd VWP plus 30 d (**PV30**) and found that it outperformed many other indicators (Löf et al., 2012). Such an indicator can also facilitate benchmarking between herds with different length of VWP. Many different factors are known to affect reproductive performance in dairy cows (Oltenucu et al., 1990; Butler, 2000; Fourichon et al., 2000; Roxstrom, 2001; Maizon et al., 2004; Windig et al., 2005; Bielfeldt et al., 2006; Garnsworthy et al., 2008; Simensen et al., 2010), but these associations are based on indicators that do not account for strategic decisions and it is not yet known if the same associations apply to PV30. The objective of this study was therefore to investigate factors affecting reproductive performance on the cow level measured with PV30.

MATERIALS AND METHODS

Source of Data

We used precollected data from the Cattle Database at the Swedish Dairy Association (Stockholm, Sweden). This database includes information on milk production from the Swedish Official Milk Recording Scheme at both the cow and herd levels and it combines data on pedigree, disease events, calving dates, inseminations, and pregnancy examinations. All cows that calved between July 1, 2008, and June 30, 2009, and originated from herds that had more than 50 milking cows on average were available for inclusion in the study. Cows also needed to come from herds comprising cows of at least 2 breeds (Swedish Red, Swedish Holstein, or other/crossbreed), the presence of at least 10% of one breed being sufficient for inclusion. Thus, 146,549 cows from 1,431 herds were included. Milk records from the Swedish Official Milk Recording Scheme for the first test-milking after calving was available for each cow, including milk yield (kg), fat percentage, protein percentage, urea concentration (mmol/L), and SCC (cells/mL). Data on how the cows were managed and housed, such as type of milking system and type of housing (pipeline with tiestall, parlors/rotaries with freestall, or automatic/robotic with free tall), feeding system (TMR or not specified), and organically managed (organic or not organic), were also available.

Outcome Variable

The reproductive performance indicator of interest was pregnancy at the herd VWP plus 30 d for each individual cow. The VWP for each of the 1,431 herds was estimated, using survival analysis, as the days

postpartum by which 5% of the cows in the herd-year had received a first insemination. For 10 of the herds, it was not possible to calculate a VWP because there were few records of AI. Those herds were censored and removed from further analysis, which left 145,468 cows from 1,421 herds for further analysis. Conception and day of conception were based on information about inseminations/services, pregnancy checks, and calving dates. If day of conception occurred before the date for VWP+30 d, the cow was recorded as pregnant at VWP+30d (1); otherwise as nonpregnant (0).

Cows that were culled or left the herd before VWP+30 d were censored and removed from further analyses ($n = 9,281$). Censoring was also done for cows where the pregnancy status at VWP+30 d could not be established; for example, because of no pregnancy checks or next calving ($n = 2,943$). Cows with unreasonably short intervals (<20 d) between calving and first AI were also censored ($n = 131$) and cows with no records after calving were censored ($n = 392$). In total, 132,721 cows were retained for analyses, of which 29,113 (22%) were pregnant at VWP+30. Of the nonpregnant cows, 81,483 cows had records of AI and 22,125 cows had no records of AI.

Predictor Variables

Predictor variables are presented in alphabetical order. Breed was divided into 3 categories: Swedish Red (**SRB**), Swedish Holstein (**SH**), and other/crossbreeds.

Records from routine claw trimming that occurred in the interval between 50 d before calving and up to 180 DIM were used to classify claw status. Claw status was divided into 4 different categories: not in database, no problems at trimming, mild problems at trimming, and severe problems at trimming. Severe problems included laminitis-related conditions such as hemorrhages of the sole and the white line, sole ulcers, abscesses in the white line, white line disease, and double sole (Christer Bergsten, Swedish Dairy Association, Stockholm, personal communication).

Records of disease related to reproduction (e.g., cystic ovaries, anestrus, metritis/endometritis, and puerperal paresis) occurring between 10 d before calving up to 120 DIM were classified into 2 groups: no record of disease in one group and at least one record of disease in the other group. Records of disease other than reproduction (e.g., mastitis, ketosis, displaced abomasum, infections), occurring between 10 d before calving up to 120 DIM were classified into 2 groups: no record of disease in one group and at least one record of disease in the other group. Dystocia was defined as a record of a difficult birth, assisted calving, malposition and was classified into 3 categories: yes, no, and no information.

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