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Effects of reduced intramammary antimicrobial use during the dry period on udder health in Dutch dairy herds

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ABSTRACT

Dry cow therapy (DCT) in the Netherlands changed from mainly blanket to selective antimicrobial DCT. This transition was supported by a national guideline, with the individual somatic cell count (SCC) at the last milk recording before dry-off as the main selection criterion for antimicrobial DCT. The aim of this retrospective observational study is to evaluate the SCC dynamics during the dry period at the herd and individual dry period level following the national transition from mainly blanket to selective antimicrobial DCT. At the herd level, we used 2 data sets to evaluate the SCC dynamics during the dry period: (1) a national data set containing 3,493 herds with data available from 2011 through 2015 and (2) a veterinary practice data set containing 280 herds with data available from 2013 through 2015. The herd level analysis was carried out using key performance indicators provided via milk recording (CRV, Arnhem, the Netherlands): the percentage of cows that developed a new intramammary infection (IMI) during the dry period and the percentage of cows cured of an IMI during the dry period. The effect of DCT at individual dry period level was analyzed with a mixed-effects logistic regression model based on 4,404 dry periods from 2,638 cows in 20 herds within the veterinary practice data set. For these 20 herds, individual SCC data from milk recordings and individual cow DCT were available from 2013 through 2015. No significant changes were observed to the SCC dynamics during the dry period at the herd level. The percentage of cows that developed a new IMI during the dry period ranged between 16 and 18%, and the percentage of cows cured from an IMI during the dry period ranged between 74 and 76%. At the individual dry period level, a low SCC at the first milk recording following a dry period was associated with the use of intramammary antimicrobial DCT with or without the concurrent use of an intramammary teat sealer [odds ratio (OR) = 2.16 and OR = 2.07, respectively], the use of DCT with an intramammary teat sealer only (OR = 1.35), and a low SCC at the last milk recording before dry-off (OR = 1.78). This study demonstrates that the selection of cows for DCT without antimicrobials based on SCC thresholds at the last milk recording is possible without significant changes to udder health and reduced the use of antimicrobials.

Key words: antimicrobial, dairy cow, dry period, selective dry cow therapy, udder health

INTRODUCTION

Udder health management is important in the maintenance of a healthy and profitable dairy herd (Middleton et al., 2014). Dry cow therapy (**DCT**) with intramammary antimicrobials has long been recommended as an essential part of udder health management on dairy farms (Dodd et al., 1969). The goal of DCT is to treat any existing IMI at dry-off and to prevent the occurrence of a new IMI during the dry period. For this reason, the advice has been to treat all cows with an intramammary antimicrobial at dry-off, irrespective of the presence or absence of an IMI (blanket dry cow therapy, **BDCT**; Dodd et al., 1969; Eberhart, 1986; Dingwell et al., 2003). In contrast, many Nordic countries have refrained from using BDCT and have been successfully using selective dry cow therapy (**SDCT**) since the 1970s or earlier (Osteras et al., 1999; Ekman and Osteras, 2003; Osteras and Solverod, 2009). With SDCT, only those cows most likely to have an IMI at dry-off are treated with intramammary antimicrobials. Several cow level variables such as SCC, bacteriological culture, and clinical mastitis history are considered when selecting cows likely to have an IMI at dry-off

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(Torres et al., 2008; Cameron et al., 2015; Kiesner et al., 2016).

To reduce the development of antimicrobial resistance, there has been an increasing worldwide interest in the prudent use of antimicrobials and in a reduction in the use of antimicrobials in general (WHO, 2015; OIE, 2016; Goff et al., 2017). Since 2008, the Dutch government, together with livestock and veterinary associations, has taken a proactive role in the reduction of antimicrobial use in livestock species (Speksnijder et al., 2015). As a result, there has been a mandatory reduction in the use of antimicrobials in Dutch livestock: 20% by 2011, 50% by 2013, and 70% by 2015 in relation to their use in 2009. One way these drastic reductions were achieved is the ban, in effect since November 2012, on the preventive use of antimicrobials in Dutch livestock. As a result, Dutch dairy farmers have been forced to use SDCT rather than BDCT. In January 2014, the Royal Dutch Veterinary Association provided a guideline, "The use of antimicrobials at dry-off in dairy cattle," to support veterinarians in advising dairy farmers in the practice of SDCT (KNMvD, 2014). Individual SCC from a composite milk sample taken at the last milk recording before dry-off became the main selection criterion for the use of antimicrobials at dry-off (see Appendix for details). The SCC thresholds used in the guideline were based on the results of a deterministic modeling study by Scherpenzeel et al. (2016a) and were expected to result in an optimal tradeoff between reduced use of antimicrobials associated with udder health (DCT and mastitis therapy) versus minimal increased risk of new IMI after the dry period.

Legitimate concerns have been raised by farmers and veterinarians about the negative effect of the potential increase in both clinical and subclinical mastitis associated with SDCT and its consequential effect on animal welfare and production. Therefore, the aim of this study is to evaluate the SCC dynamics during the dry period at herd and individual dry period level following the aforementioned national transition from mainly BDCT to SDCT in the Netherlands. Furthermore, this study describes the reduction in the use of antimicrobials associated with udder health during the transition from BDCT to SDCT. We used a multilevel approach, applying a gradually more detailed analysis. First, we analyzed herd level SCC information before and after the dry period in a national data set. Second, we analyzed the sales figures of intramammary products and herd level SCC information before and after the dry period in a data set from a single veterinary practice. Third, we analyzed herd level SCC information before and after the dry period and most importantly individual DCT and associated individual SCC before and after the dry period in a subset of the veterinary practice data set.

MATERIALS AND METHODS

Antimicrobial Use Associated with Udder Health

Veterinary Practice Level. The University Farm Animal Practice serves around 330 dairy cattle herds, comprising about 27,500 cows in total. All antimicrobial drugs used on these herds were distributed solely by the veterinary practice. We extracted the number of total annual sales of intramammary products (dry cow antimicrobials, mastitis antimicrobials, and teat sealers) to these herds from the practice's management software system (Viva 1.0, Corilus Veterinary BV, Houten, the Netherlands).

Herd Level. We calculated the mean animal-defined daily dose (**DDDA**) for overall antimicrobial and intramammary antimicrobials (DCT and mastitis therapy) use from 2013 through 2015 for a subset of 20 herds. These 20 herds were a convenience sample based on the availability of data for the analysis of individual DCT and the associated SCC dynamics during the dry period. No other selection criteria were applied. To calculate the DDDA, we followed standard operating procedures of the Netherlands Veterinary Medicines Authority as described by Gonggrijp et al. (2016).

SCC Dynamics During the Dry Period

We used an elevated SCC as an indicator for the presence of an IMI (Schukken et al., 2003; Vissio et al., 2014). In line with the thresholds for elevated SCC used in Dutch national milk recording, primiparous cows with an SCC $\geq$150,000 cells/mL and multiparous cows with an SCC $\geq$250,000 cells/mL were classified as infected (de Haas et al., 2008). In this study, we investigated dry period SCC dynamics using key performance indicators provided via milk recording (CRV, Arnhem, the Netherlands). The key performance indicators used were the mean percentage of cows with a new IMI at the first milk recording following a dry period (percent new IMI) and the mean percentage of cows cured of an IMI during the dry period (percent cured IMI). A new IMI was defined as a change in SCC from below the threshold at the last milk recording before calving to an SCC equal to or greater than the threshold at the first milk recording after calving. A cured IMI was defined as a change in SCC from equal to or greater than the threshold at the last milk recording before calving to an SCC below the threshold at the first milk recording after calving.