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# Effect of different scenarios for selective dry-cow therapy on udder health, antimicrobial usage, and economics

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## ABSTRACT

The goal of dry-cow therapy (DCT) is to reduce the prevalence of intramammary infections (IMI) by eliminating existing IMI at drying off and preventing new IMI from occurring during the dry period. Due to public health concerns, however, preventive use of antimicrobials has become questionable. In this study, we evaluated the effects of 8 scenarios for selecting animals for DCT, taking into account variation in parity and cow-level somatic cell count (SCC) at drying off. The aim of this study was to evaluate udder health, antimicrobial usage, and economics at the herd level when using different scenarios for selecting cows for DCT. To enable calculation and comparison of the effects of different scenarios to select cows for DCT in an "average" herd, we created an example herd, with a virtual herd size of 100 dairy cows to be calving during a year. Udder health, antimicrobial usage, and economics were evaluated during the dry period and the first 100 d in lactation, the period during which the greatest effect of DCT is expected. This leads to an estimated 13,551 cow-days at risk during a year in a 100-cow dairy herd. In addition to a blanket DCT (BDCT) scenario, we developed 7 scenarios to select cows for DCT based on SCC. The scenarios covered a range of possible approaches to select low-SCC cows for DCT, all based on cow-level SCC thresholds on the last milk recording before drying off. The incidence rate of clinical mastitis in the example herd varied from 11.6 to 14.5 cases of clinical mastitis per 10,000 cow-days at risk in the different scenarios, and the prevalence of subclinical mastitis varied from 38.8% in scenario 1 (BDCT) to 48.3% in scenario 8. Total antimicrobial usage for DCT and clinical mastitis treatment varied over the scenarios from 1.27 (scenario 8) to 3.15 animal daily dosages (BDCT), leading to a maximum reduction in antimicrobial usage of 60% for scenario 8 compared with BDCT. The total costs for each of the scenarios showed little variation, varying from €4,893 for scenario 5 to €5,383 for scenario 8. The effect of selective DCT compared with BDCT on udder health, antimicrobial usage, and economics is influenced by the SCC criteria used to select cows for DCT. Scenario 2 resulted in the lowest increases in clinical and subclinical mastitis compared with BDCT. The greatest reduction in antimicrobial usage was achieved under scenario 8. From an economic perspective, lowest costs were achieved with scenario 5. Drying off dairy cows with antimicrobials has an effect on udder health, antimicrobial usage, and economics.
**Key words:** mastitis, antimicrobial reduction, dry-cow therapy, economics

## INTRODUCTION

Since the 1970s, the 5 Points Mastitis Control Plan has been used successfully to manage and control contagious mastitis (Dodd et al., 1969). One of the points recommended is the use of dry-cow therapy (**DCT**) to reduce the level of IMI by eliminating IMI present at drying off and preventing new IMI from developing during the dry period (Neave et al., 1969). A study in the 1990s showed that the use of dry-cow antimicrobials reduced clinical mastitis (**CM**) compared with untreated controls (Schukken et al., 1993). In that study, however, a within-cow comparison on the effect of DCT was performed without separating uninfected and infected cows (Schukken et al., 1993). Bradley and Green (2000) showed that approximately 50% of quarters with CM due to environmental pathogens in the first 100 DIM were infected with the causative pathogen during the dry period, even though they were treated with dry-cow antimicrobials. Thus, DCT has consequences for udder health during both the dry period and lactation. In the United States and Canada, uptake of blanket dry cow therapy (**BDCT**) by dairy herds is estimated

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at 72 and 88% respectively (USDA, 2008; Dufour et al., 2012). In the Netherlands, approximately 90% of all dairy cows were treated with dry-cow antimicrobials in the period from 2005 to 2010 (Lam et al., 2013). In the United Kingdom, DCT use is estimated to be even higher, with 99% of dairy cows treated at drying off (Berry and Hillerton, 2002). In 2013, antimicrobial use for DCT counted for 49% of the total antimicrobial use in the Dutch dairy industry (SDa, 2014).

Although the relationship between antimicrobial use and the development of antimicrobial resistance in bacteria is complex and unclear (Oliver et al., 2011), correlation between veterinary antimicrobial use and antimicrobial resistance in animal pathogens is likely (Chantziaras et al., 2014). Global concern about antimicrobial resistance propagates prudent and restricted use of antimicrobials, including DCT, in the dairy industry (Oliver et al., 2011). Therefore, in the Netherlands, preventive use of antimicrobials in DCT is no longer allowed and selective dry-cow therapy (**SDCT**) was introduced in 2013 as an alternative for BDCT. To correctly select cows for curative use of antimicrobials in DCT, IMI at drying off need to be identified. This identification can be based on different criteria, such as SCC, bacteriological culture, and CM history (Torres et al., 2008; Rajala-Schultz et al., 2011). Herd-level parameters, such as bulk milk SCC can also be taken into account. Application of a SDCT regimen, based on withholding DCT from multiparous cows with SCC <250,000 cells/mL and primiparous cows with SCC <150,000 cells/mL at the last milk recording before drying off, has been evaluated (Scherpenzeel et al., 2014). This approach significantly increased the incidence rate of CM (**IRCM**) and subclinical mastitis (**SCM**) and had potential consequences for animal welfare and economics but resulted in a substantial decrease in antimicrobial usage.

Farmers' decision-making on DCT is based not only on the description of the udder health situation in terms of disease (e.g., incidence of CM or SCM) but also in monetary terms (e.g., economic losses; Hogeveen et al., 2011). Earlier work showed that SDCT is attractive from an economic point of view (Huijps and Hogeveen, 2007). In that study, however, the probability of treatment for SDCT depended on the sensitivity and specificity of the selection procedure: with a high sensitivity of selection, infected cows are more likely to be treated; with a high specificity, uninfected cows are less likely to be treated. It was assumed that the right animals, those who have not developed IMI, were selected and not treated with antimicrobials at drying off but the authors did not describe how to select those animals. Given the variety in possible approaches for selecting cows for DCT when implementing SDCT in practice, and the consequences of that for udder health and economics, selection criteria need further attention. Therefore, in this study, we evaluated the effects of 8 scenarios for selecting animals for DCT, taking into account variation in parity and cow-level SCC at drying off. The aim of this study was to evaluate udder health, antimicrobial usage, and economics at the herd level when using different scenarios for selecting cows for DCT.

## MATERIALS AND METHODS

### Field Data

A field trial was carried out between June 2011 and March 2012 in the Netherlands. In total, 1,657 lactating cows [657 primiparous cows (40%) and 1,000 multiparous cows (60%)] from 97 herds were dried off in the study and were followed from drying off until 100 DIM. Bulk milk SCC of the participating herds varied from 41,000 to 387,000 cells/mL, with an average of 184,000 cells/mL. The effect of SDCT was evaluated using a split-udder design in which 2 lateral quarters of each cow were treated with antimicrobials and the 2 contralateral quarters remained as untreated controls. All cows enrolled had a low SCC at the last milk recording before drying off. Low SCC was defined as <150,000 cells/mL for cows at the end of their first lactation and <250,000 cells/mL for older cows, thresholds used in the Dutch national milk recording for indicating an elevated SCC (de Haas et al., 2008). A more detailed description of this field trial can be found in Scherpenzeel et al. (2014).

### Age Groups

Because different age groups have different characteristics with regard to the dry period and udder health, cows in first and later lactations were judged separately. The youngest group is the group of animals after their first calving. In this study, this group was referred to as heifers (group **H**). At the end of the first lactation, these animals are dried off. Mastitis in the first dry period, and 100 DIM after (the second) calving is related to the dry-cow treatment at the end of the first lactation. This group of animals, until they were 100 DIM, was referred to as first dry period (**FDP**) animals. Multiparous cows are animals that have calved at least twice. Cows that were dried off for the second or later time were referred to as multi dry period (**MDP**) animals during their dry period and the first 100 DIM of the subsequent lactation. As such, terminology related to parity was considered as parity at drying off.