A matched case control study of farm managment practices as risk factors for bulk tank milk inhibitory substance grades in New Zealand dairy herds

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Summary
The contrast of management practices between 102 case farms with an inhibitory substance (IS) grade and 122 matched control farms without a grade in June/July 2001 showed that IS-grades were more likely when blanket dry-cow-treatment (DCT) was used, several individuals applied DCT drugs and when drying-off was extended to the extent that dry-periods were too short. Case farmers apparently had major difficulties to manage mobs of freshly calved cows, cows of which colostrums was collected separately for sale, and cows treated with antibacterial drugs. Multi-factorial analysis of the data was constrained by missing values. However, a matched analysis was statistically more powerful than ordinary logistic regression despite smaller number of observations.

Introduction
Ninety percent of the dairy herds in New Zealand follow a strictly seasonal calving pattern. Considerable food safety concerns were raised after the rate of inhibitory substance (IS) grades of bulk tank milk (BTM) had increased two-fold in June-July 2001, the start of the lactation season 2001/02. Statistics of the pharmaceutical industry indicated that sales of drugs for dry cow treatment (DCT) had been 40% higher in 2001 than in the previous year.

Objectives
This study was commissioned jointly by the pharmaceutical and the dairy industry to investigate possible herd management practices causing the increase of inhibitory substance grades in bulk tank milk. The study aimed to contrast management practices of farms with an inhibitory substance grade (IS-grade) to those of farms without an IS-grade in June/July 2001. The study also compared changes in management from the preceding season 2000/01 to the current season 2001/02 between cases and controls.

Material and Methods
All 133 farms with an IS-grade (cases) and 133 matched control farms without an IS-grade (controls) were targeted for an interview by a professional dairy farm advisor. Controls were matched for (i) BTM pickup date (i.e. date of shipment and testing); (ii) date (± 3 days) of the first BTM consignment in the milking season 2001/02 (i.e. lactation stage); and (iii) herd size approximated by BTM consignment volume at pickup date.

The data were analysed in four ways; (i) simple odds ratios were calculated for the association between case-control status and all variables individually; (ii) the McNemar test was used to compare variable responses of the year 2001 to 2000 within each group, case and control. Subsequently, variables significant at $p < 0.05$ in the first analysis were subjected to a (iii) matched and a (iv) non-matched multi-factorial logistic regression analysis. Missing values restricted the use of hierarchical multi-factorial modelling: about 40% farms were lost when 50% of the variables had been included in a full model. As a solution, variables with the most complete information were included at the start; then consistently non-significant variables were removed as more covariates were included in the models. The same process was repeated with a matched (conditional) and a non-matched modelling approach.

Table 1: Comparison of matched and non-matched multifactorial logistic model results

Variable	OR	95% Confidence interval	p
1. Non – matched analysis: n = 191 farms			
DCT applied to all cows in the herd	1.45	0.78 – 2.67	0.241
Milk from AB-treated cows fed to calves	0.46	0.24 – 0.87	0.018
AB-treated cows milked separately	2.13	0.97 – 4.68	0.059
Duration for lactational mastitis therapy varied sometimes	0.52	0.28 – 0.99	0.047
Number of persons administering DCT	1.24	0.82 – 1.90	0.311
2. Matched analysis: n = 69 farm pairs			
DCT applied to all cows in the herd	2.34	0.95 – 5.79	0.065
Milk from AB-treated cows fed to calves	0.33	0.14 – 0.79	0.013
AB-treated cows milked separately	3.39	1.08 – 10.67	0.037
Duration for lactational mastitis therapy varied sometimes	0.40	0.17 – 0.96	0.040
Number of persons administering DCT	1.98	1.12 – 3.47	0.018

Results

Thirty-one cases and 11 controls did not agree to be interviewed, thus, 102 cases and 122 controls were evaluated. Case and control herds were of similar size and production level. A matched analysis provided more statistical power than a non-matched analysis despite loss of farms when matched pairs were incomplete (Table 1).

Overall, the bi-variate and/or multi-variate comparisons suggested that case farmers used more blanket dry-cow treatment (DCT), involved more staff handling DCT drugs, dried cows off 1.2 weeks later and therefore had shorter dry periods than control farmers (Figure). Case farmers stated more frequently than control farmers that they changed to permanent DCT records between seasons and that they kept white boards or sheets in the shed for recording.

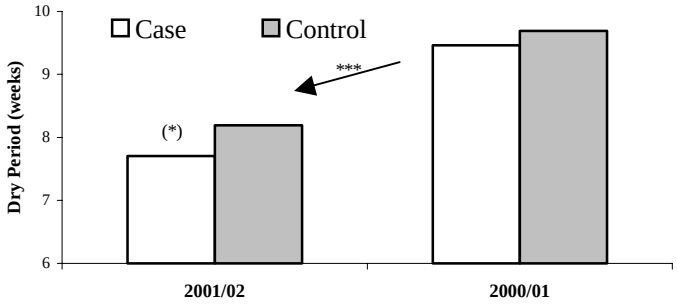
Both cases and controls milked cows twice as long once-a-day before dry-off compared to the previous season, but this did apparently not alter the IS-risk. There were no differences in the type of drugs used for DCT or for the treatment of mastitis,

but cases used more tubes for the treatment of mastitis occurring during the dry period. Cases culled cows for mastitis to a lower extent, reported lower incidences of clinical mastitis during the dry period and during subsequent lactation. Control farmers marketing colostrum sold smaller colostrum quantities than cases and cases tended to use marking systems that accounted for the number of days after calving to a lesser extent than controls.

Discussion

A time of major risk was when cows were dried-off. Another area of risk was mastitis occurring during the dry period. There was a great discrepancy between records presented during the interview (9-14% farmers) and the statement of farmers about the availability of permanent records (90-100% farmers). Thus cow marking and record keeping will be other major discussion topics for future extension activities, especially in view of the apparent difficulty to simultaneously manage a number of different mobs within the large sized New Zealand dairy herds (DCT- or mastitis-treated, colostrum, post-colostrum, whole milk, different pasture blocks, etc.). While the reasons for IS-grades were similar to those reported by Edmondson (1), New Zealand farmers are challenged by the large number of mobs that need to be managed separately due to large herd sizes (mean of 427 herds = 276, range 50 – 1150 milking cows and heifers).

Figure 1: Herd level dry periods of case and control farms during the season with increased inhibitory substance grades (2001/02) and the preceding season (2000/01).



References

1. Edmondson, P. Avoidance of medicines residues in milk. In Practice, May 2003, 278-283.