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The epidemiology of culling and mortality of New Zealand dairy cows

A thesis presented in partial fulfilment of the requirements for the degree of

PhD
in
Veterinary Epidemiology

at Massey University, Manawatu, New Zealand

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2018

Abstract

Culling of dairy cattle for non-production causes and on-farm mortality have adverse consequences for farm profitability and animal welfare. Farmers face increasing pressures to improve farm profit and to answer concerns from the public and consumers about the welfare of their animals and ethics of their management systems. Farmers in New Zealand need new information to both develop control programs to reduce losses that arise from non-production culling and mortality, and to promote and defend their farming system. Our main aims were to define the current and past trends in the incidence of culling and mortality in New Zealand dairy cows, and investigate their associated risk factors. Our secondary aims were to review the incidence of culling and mortality in dairy cattle in other modern dairy industries against which the findings from New Zealand studies could be compared, to evaluate any limitations for analysis of electronic database records of culling and mortality of New Zealand cows, and, to estimate the financial consequences for herd owners of reduced incidence of non-production culling and mortality. We found no trend over the last two decades in the incidence of culling of dairy cows, either internationally or nationally, whereas, over the same period, the incidence of mortality in cows has increased internationally, but not in New Zealand. Additionally, we identified several disorders especially common in the period immediately following calving associated with increased rates of culling and mortality; that electronic database records of cows that had been culled or died were suitable for analysis when they came from a large population, but could be biased from individual herds; and that farm profits were increased when the incidence of culling and mortality was reduced. These findings provide new information to support New Zealand dairy farmers to develop their own performance targets and control programs to reduce the incidence of mortality and non-production culling of cows.

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Preface and Acknowledgements

The background to this Thesis is a research partnership project between the New Zealand dairy industry, represented by DairyNZ, and the Ministry of Business, Innovation and Employment, named "Pillars of a Competitive and Responsible Dairy System: Improved Longevity and Reproductive Performance" [Anonymous, 2017a,b]. One aim of this project is to investigate " The prevalence of, and reasons for, premature mortality and health-related productivity losses in NZ dairy systems and how these are affected by farm management and nutrition, thereby improving the life of farmed animals and both the efficiency and sustainability of the industry." This partnership has two major components or 'pillars', namely cow fertility, and cow lifetime productivity, and it is the second of these that the work described in this Thesis contributes to. The PhD which this Thesis represents has been funded by this partnership, and is one of more than 10 programs to train emerging scientists and post-graduate students.

This Thesis is based on publications. The structure of the Thesis is centered around six chapters which describe separate studies, and these are surrounded by two chapters that firstly introduce, and then finally discuss the gathered findings. Each of these six study chapters were written originally in the style and format of a manuscript required for submission for publication in a peer-reviewed journal. An abstract and section for acknowledgements are included in each chapter as they would be submitted in a manuscript. The differences between a submitted manuscript and the format of each study chapter in this Thesis are that the tables and figures are placed within the body of the text rather than at the end, an interpretive summary has not be included as required by some publishers, a single bibliography is placed at the end of the Thesis rather than accompanying each chapter, and the spelling has been maintained as US English.

My first and deepest thanks go to my wife and greatest supporter, Jane. Jane has encouraged me daily, chided me when I have become distracted, and reminded me of why we set out on this path together. I have taken much time and energy out of our marriage and applied it to my PhD, and now look forward to redirecting that back to ourselves. I also thank my family and my friends who have shown interest in my work, and provided balance and welcome alternative activities. If you have caught some of my passion for lifelong-learning, and I know some have, then I am also encouraged.

While my family and friends have supported my life away from my workplace, my supervisors have initiated, encouraged, and enabled this Thesis to be completed, and each have contributed to the main chapters of this thesis. Professor Cord Heuer (Massey University), my Main Supervisor, has been my strongest supporter. Cord has contributed technical advice and wise counsel towards each chapter of the Thesis, and additionally assisted in reviewing articles for Chapter Two. I have especially appreciated Cord's broad and higher-level perspectives which have helped me keep my direction. Adjunct Professor, Tim Carpenter, Massey University (retired) also contributed his technical and writing skills into each chapter. I valued Tim's sage advice and keen sense of humor. Dr Scott McDougall (Cognosco, Anexa-FVC, Morrinsville), has played a part in this PhD from even before I became involved. Scott supervised Tom Brownlie, who collected the data for his PhD in 2009 and 2010, that I have now used in Chapters Three and Five of this Thesis, and provided input into the wider dairy industry partnership project that this PhD is a part of. Scott was also my previous manager at Cognosco in Morrinsville, and stirred my interest in veterinary epidemiology and encouraged me to apply for the PhD studentship for this project. I am grateful to Scott for his enduring influence on my career. Finally, Dr Claire Phyn (DairyNZ) has not only overseen my relationship with my study funders and championed our achievements, but also helped me appreciate the broad range of work contributing to the Pillars project and has tried to train my scientific writing style (will this task ever be complete?).

Several other university academics have made important technical and writing contributions to specific chapters in this Thesis, and will be co-authors on the published manuscripts. Dr Peter Thomsen, Aarhus University, Denmark, co-reviewed scientific articles for the Literature Review (Chapter Two)

and contributed to writing the manuscript. His expertise in the subject area and in authoring reviews was greatly appreciated. Professors Henk Hogeveen, Wageningen University, and Mirjam Nielen, Utrecht University, both in the Netherlands, hosted me for three months and provided their expertise in animal health economics to enable me to complete Chapter Seven. Professor Mark Stevenson, University of Melbourne, assisted in preparation of Chapter Four, and in particular, the section on spatial analysis. I have also collaborated with Massey University academics on two chapters of this Thesis: Dr Carolyn Gates who wrote a software routine to efficiently create a data set to analyse trends of culling and mortality in the New Zealand dairy herds over two decades for Chapter Four, and Professor Nicolas Lopez-Villalobos, who advised on the mathematical modeling used in Chapter Seven.

Much of the data on which this Thesis is based was collected because of the work of dairy farmers and veterinary technicians. I owe a debt of gratitude to the farmers who gave of their time in to provide data for two field studies because they supported the study goals and wanted to give back to the dairy industry. I also greatly appreciate the efforts of the technicians who gathered and managed the data which I have analyzed. I also want to specifically thank Dr Tom Brownlie (LIC, New Zealand), who gathered and managed the data I analyzed in Chapters Three and Five, for his own PhD thesis.

I have also received assistance from several database software experts who helped me wrangle large data sets into a form that could be analysed. Andy Taylor (AE Software, Tauranga) worked on the data sets I used in Chapters Three, Five and Six; and Simon Verschaffelt and Richard Gilbert (Massey University) helped prepare the large data set in Chapter Four to be analysed. I am very grateful for their help.

I have relied heavily on Open Source software to complete the analyses and prepare this Thesis. My first thanks go to those who have developed and maintain the statistical software ‘R’ (R Foundation, Vienna, Austria), and the many add-on packages that I have used. The more significant software package contributors are acknowledged in the Bibliography. In particular, I have done all my work using the ‘R’ interface ‘R Studio’ (Boston, MA), and produced reports, manuscripts and this Thesis using the add-on package ‘knitr’, ‘rmarkdown’ and ‘bookdown’. This has been a ‘learning process’ for

me, often challenging, but ultimately rewarding. My further thanks go to those who have developed and maintained the LaTex typographic software 'MikTex', which I used to print this Thesis.

Finally, I acknowledge and thank my PhD examiners, Ian Dohoo, John Morton, and Richard Laven, for the time and effort given by each to reviewing this Thesis and attending my examination. I appreciate their valuable insights, suggestions, and the discussions we had (and will hopefully continue to have in the future). I believe this Thesis is stronger for their input.