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A randomised controlled study to assess the effects of an extension programme on the 6 week in-calf rate of seasonal calving, pasture-based dairy herds in New Zealand

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ABSTRACT

The aim of this study was to quantify the effect of participation by New Zealand dairy farmers in a year-long extension programme designed to improve herd reproductive performance. This was estimated by comparing, over two successive years, the proportions of cows becoming pregnant during the first 6 weeks of the seasonal breeding programme (6 week in-calf rate) in herds involved in a full participation group (treatment), with herds in an actively monitored control group or a passively monitored control group. Possible interactions between treatment and various biophysical and socio-demographic factors were also assessed. Multivariable modelling was used to determine the effect of treatment on 6 week in-calf rate, adjusting for design factors (study year and region). It was estimated that the 6 week in-calf rate was 68% (95% confidence interval 65–67%) in the treatment group of farms that participated in the extension programme compared with 66% (95% confidence interval 67–69%) in the actively monitored control group of farms that did not participate in the extension programme ($P = 0.05$); thus the risk difference was 2.0% (95% confidence interval 0.0–3.9%). No significant interactions were found between treatment and region, study year or any of the biophysical and socio-demographic variables on the 6 week in-calf rate ($P > 0.05$). There was no significant difference in the 6 week in-calf rate between the actively and passively monitored control groups ($P = 0.56$). It was concluded that enrolment in the extension programme improved the 6 week in-calf rate, and that the treatment effect was not modified substantially by region, study year or any of the biophysical and socio-demographic variables assessed.

Introduction

The Australasian Pacific Extension Network (APEN) proposes that agricultural extension programmes involve '*working with people in a community to facilitate change in an environment that has social, economic and technical complexity*'[1]. The ultimate measure of the success of such programmes is the transfer and implementation of actions based on knowledge; using this definition, success can be difficult to assess (Hutjens et al., 1980).

Dairy industry extension programmes have evolved to adjust to changes in the complexity and demography of dairy farming, both in New Zealand and internationally (Rivera, 1996). To date, most programmes have been based on principles of farmer participation, adult learning and action learning (Frost, 2000). However, the proportions of participants successfully adopting programme recommendations vary (Bell et al., 2009). Additionally, many farmers do not participate (Jansen et al., 2010a), and thus are often assumed to be 'unwilling' to adopt a change in management behaviour and may be labelled as 'poor performers'. This viewpoint disregards the varied priorities of different farmers and restricts the reach of extension programmes.

Extension programmes have commonly used research-driven, standardised models (Peters et al., 1994b; Lam et al., 2007; Kristensen and Enevoldsen, 2008) using 'top-down' education structured around recommendations from rural professionals, rather than 'bottom-up' (farmer-centric), 'one-on-one' or 'formal structured' models, all of which have been found to have value in farmer extension (Black, 2000).

Most research on the efficacy of extension programmes in the dairy industry has focused on mastitis (Riekerink et al., 2005; Jansen et al., 2010b; Penry et al., 2011). The aim of this study was to quantify the effect of participation in the InCalf reproductive extension programme on herd 6 week in-calf rate using a randomised controlled study design. In a randomised controlled evaluation of dairy extension programmes, Green et al. (2007) evaluated farmer

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compliance to recommended management practices to reduce the herd-level bulk milk tank somatic cell counts. Few studies have formally evaluated extension programmes focused on the improvement of dairy herd reproduction (Varner et al., 1989; Burke and Verkerk, 2010) and none have used a randomised controlled study approach.

The InCalf extension programme was based on findings from data collected on Australian dairy farms from 1996 to 2000, which identified six key risk factors for poor herd reproductive performance: (1) extended period of calving; (2) sub-optimal weights of replacement heifers; (3) inadequate nutrition and low pre-calving body condition; (4) excess negative energy balance in early lactation; (5) poor oestrus detection; and (6) poor artificial insemination practices (Britton et al., 2003; Morton, 2003). Bull management and animal health were subsequently added as further risk factors.

The New Zealand dairy industry adopted a modified InCalf programme in 2007, incorporating data from Xu and Burton (2003), and accounting for the importance of anovulatory anoestrus in New Zealand dairy cows (Burke et al., 2008). A national target of 78% for the 6 week in-calf rate by 2016 was adopted, based on the mean 6 week in-calf rate of the top quartile of herds recorded by Xu and Burton (2003). The InCalf extension programme aimed to provide a framework for key decision makers (KDMs) to make informed and critical decisions about these risk factors in their herd. The programme was delivered using a group-based approach (the InCalf Farmer Action Group) and was based on a four step process (Britton et al., 2003) in which participants were encouraged: (1) to assess their current herd reproductive performance; (2) to identify and prioritise major management areas requiring change to improve herd reproductive performance; (3) to set priorities for actions, and to develop and implement plans for these actions; and (4) to review results, reflect on changes and plan for the following year.

In this study, along with the accompanying study by Brownlie et al. (2015), we evaluated the impact of KDM participation in the InCalf extension programme on herd reproductive performance in either Australia or New Zealand. The New Zealand National Herd Fertility Study has the following aims: (1) to quantify the effect of KDM participation in the InCalf extension programme on 6 week in-calf rate; (2) to assess possible interactions between KDM participation and biophysical and socio-demographic factors on the 6 week in-calf rate; and (3) to evaluate the effect of on-farm monitoring on 6 week in-calf rate.

Materials and methods

Overview of the study

The New Zealand National Herd Fertility Study was undertaken in dairy herds from four regions of New Zealand (Waikato and Taranaki in the North Island; North and South Canterbury in the South Island; Fig. 1). These regions were chosen to represent a diverse cross-section of the dairy industry. A coordinating veterinary practice was located within each region. The study sampling frame consisted of all dairy clients of these practices. One person was identified as the KDM in each herd. Where the herd fulfilled eligibility criteria and the KDM agreed to participate, the herd was randomly allocated to one of three groups: (1) KDM and farm staff participation in the InCalf extension programme (InCalf Farmer Action Group), with on-farm monitoring (treatment group; $n = 73$); (2) on-farm monitoring without KDM or farm staff participation in the extension programme (actively monitored control group or 'control' group; $n = 73$); and (3) passive data collection only through the national dairy database (passively monitored control group; $n = 22$).

The passively monitored control group was included to allow evaluation of effects of on-farm monitoring, the so-called 'Hawthorne effect' (Holden, 2001). Herd reproductive performance in the other two groups was measured using mandatory strategically timed pregnancy diagnoses during 2009–2010 and 2010–2011. Pregnancy diagnosis was timed to ensure that conceptions occurring within the first 42 days of the mating period could be diagnosed precisely. The proportion of cows pregnant in the first 42 days of the mating period (6 week in-calf rate) was used as the key measure of herd reproductive performance.

Once enrolled, access to herd data from the New Zealand Dairy Core Database (Livestock Improvement Corporation) was granted by each KDM. The data included herd, cow and lactation level information. Herd level socio-demographic and biophysical data were collected using annual questionnaires. The first of which was completed at the start (i.e. May/June 2009) of the study by trained interviewers (Brownlie et al., 2011).

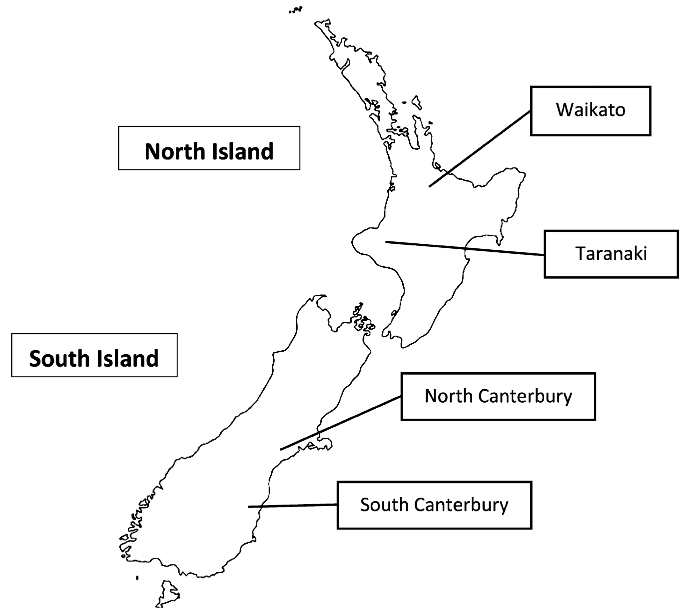

Fig. 1. Map of the regions contributing herds to the New Zealand National Herd Fertility Study.

Sample size calculations

A priori one tailed sample size calculations were performed using Win EpiScope 2.0 (Thrusfield et al., 2001) based on detecting a difference in the 6 week in-calf rate in the treatment group relative to the actively monitored control group. No account was taken of clustering of herd years within herd. Based on this, 60 herds were required in each group over 2 years to have 80% power for detecting a significant difference at the 5% level if the true effect of treatment was a 10% increase in 6 week in-calf rate in each year.

Herd selection

Criteria for herd selection have been described previously (Brownlie et al., 2011). Eligible herds were required to be predominantly spring calving (i.e. > 90% of calvings annually occurred between 1 June and 30 November) and the herd's KDM was to be likely to remain unchanged for the 2 years of the study. The KDM must have been considered by the regional coordinating veterinarian as being likely to comply with the study protocol and data recording requirements. Within each region, all eligible KDMs were invited to an introductory meeting at the commencement of the study, when the study protocol and allocation to groups were described. Those who agreed to participate were randomly allocated to groups.

Allocation to groups

To minimise bias due to differences in prior herd reproductive performance between groups, within each region, herds were ranked on the estimated 6 week in-calf rate in the year preceding the study (1 June 2008 to 31 May 2009). This estimate was derived by the dairy herd testing service providers (LIC and CRVAmbreed), using an industry agreed algorithm (which was part of the InCalf Fertility Focus Report). The algorithm derives an estimate of the 6 week in-calf rate based on calving dates and insemination data. Once ranked within each region, herds were blocked into groups of two or three adjacently ranked herds. Within three regions, 18 blocks were created so that 18 herds could be allocated to participate in an InCalf Farmer Action Group and the same number of herds could be allocated to the actively monitored control group. Where there were further eligible herds in a region, blocks of three herds (rather than two) were created.

Within blocks with three herds, one herd was randomly allocated to each of the three groups. In blocks of two herds, one was randomly allocated to the treatment group, with the remaining herd allocated to the actively monitored control group. Within North Canterbury, an additional 19th block was created to avoid creating a passive control group of two herds. Allocations were performed using computer-generated random numbers.