Knowledge Transfer – supporting calf health on Irish farms?

Elizabeth A Lane MVB PhD DiplECAR PGCAP, Department of Agriculture, Food and the Marine, Backweston Campus, Co Kildare discusses knowledge transfer in terms of calf health on Irish farms, in a follow-up article to last month's Knowledge Transfer – do the numbers reflect fertility?

Knowledge transfer and innovation in agriculture is prioritised under the current European Rural Development Programme (RDP).[1] The Irish Knowledge Transfer (KT) Programme is funded by the RDP and the National Exchequer. It is run on a facilitated peer-to-peer discussion group model, and is delivered by a network of Department of Agriculture, Food and the Marine (DAFM)-approved faciliators. Animal-health measures, led by veterinary practitioners, are included for five of the six sectors; specifically, dairy, beef, sheep, poultry and equine.

The KT Programme supports the aims of the National Farmed Animal Health Strategy to ensure profitability and sustainability of our farming and processing industries;[2] and DAFM's overall mission to lead the development of a competitive, sustainable and consumer-focused, agri-food sector in a vibrant rural economy.

A number of strands frame the KT Programme; farm health and safety, animal health and management, a breeding plan, grassland management, profitability and financial management, sustainability and farm progression. Participants are obliged to develop an individual farm improvement plan (FIP). The animal-health measures component forms part of the FIP and were developed in collaboration with veterinary staff from DAFM, Animal

Variable	Mean	SEM	Range		N
Herd size (animals in herd)	97	0.8	1	1145	13,635
Smallest herd category	23	0.2	1	42	4,615
Moderate size herd category	71	0.3	43	107	4,489
Largest herd category	197	1.4	108	1,145	4,531
Beef or dairy participant (animals in herd)	97	0.8	1	1145	13,635
1; Beef participant	62	0.6	1	813	9,469
2; Dairy participant	175	1.6	1	1,145	4,141
Number of moves into herd	21.4	0.43	0	1,554	13,635
1st quartile; Lowest number of moves into herd	0.4	0.01	0	1	4,007
2st quartile	3.6	0.03	2	6	3,189
3st quartile	12.6	0.08	7	21	3,038
4st quartile; highest no. of moves into herd	70.6	1.41	22	1,554	3,401
Any move recorded into herd	21.4	0.43	0	1,554	13,635
0; No moves recorded into herd*	0	0	0	0	2,447
1; Any moves into herd	26.0	0.51	1	1,554	11,188
Moves from farm	11.8	0.25	0	732	13,635
0; No moves from another farm*	0	0	0	0	4,649
1; Any moves from another farm	18.0	0.36	1	732	8,986
Moves from mart	9.5	0.29	0	1,129	13,635
0; No moves from a mart*	0	0	0	0	6,180
1; Any moves from a mart	17.4	0.52	1	1,129	7,455
Any late registration recorded by herd	0.1	0.01	0	74	13,635
0; No late registration recorded by herd#	0	0	0	0	13,107
1; Any late calf registration recorded by herd	2.6	0.23	1	74	528
Any lost or stolen animals recorded by herd	0.024	0.006	0	72	13,635
0; No lost or stolen animals recorded by herd^	0	0	0	0	13,445
1; Any lost or stolen animals recorded	1.75	0.38	1	72	190

Table 1: The categorisation of continuous variables for mean herd size, participant type, quartiles of the number of moves into herd, any moves into herd, moves in from mart or farm, record of late calf registration, record of animals being reported lost or stolen, for all cattle herds (n=13,635) enrolled in the KT Programme in June 2016.

** For herds with no moves in to the herd from a mart, farm, or either, the median value, SEM, min and max is zero. The N number indicates the number of herds for whom the number of moves was zero*
 # No late registration was recorded by 13,107 herds
^ No lost or stolen animal was recorded by 13,445 herds

County	No of participants	County	No of participants
Carlow	155	Longford	310
Cavan	340	Louth	144
Clare	484	Mayo	1240
Cork	1602	Meath	288
Donegal	597	Monaghan	364
Dublin	9	Offaly	307
Galway	1626	Roscommon	628
Kerry	748	Sligo	375
Kildare	158	Tipperary	1182
Kilkenny	580	Waterford	164
Laois	287	Westmeath	355
Leitrim	312	Wexford	472
Limerick	749	Wicklow	159
		Total	13,635

Table 2: The number of participants, for whom herd data was available from DAFMs AIM database, in the cattle sector of the KT Programme in each county.

Health Ireland (AHI), Irish Cattle Breeding Federation (ICBF), Teagasc, the Herd Health Group in University College Dublin (UCD) and private veterinary practitioners with the support of Veterinary Ireland (VI). The participants' veterinary practitioner must complete this component in year one with updates required in years two and three. Cattle participants must complete sections on calf health and biosecurity, with optional sections relating to fertility, parasite control, and lameness (dairy participants only). Furthermore, completing an ICBF Breeding Plan is compulsory for all KT cattle herds, whilst, participation in an AHI CellCheck Farmer Workshop is a requirement for dairy participants.

This is the second in a two-part series of reviews that aims to outline the KT Programme and to evaluate the baseline data used to generate the farm-specific reports for calf health and herd biosecurity for herds enrolled in the KT Programme.

CALF HEALTH

Calf health, or conversely mortality, is an important indicator of welfare on farms. Calf-mortality rates are highly variable between and within countries.[3] Improving calf health requires a multifaceted approach, from national initiatives, to practical on-farm solutions. To ensure farm sustainability and ensure animal longevity, the need to produce, grow, and maintain replacement heifers ready for breeding at 14 to 15 months of age, means we must focus on keeping calves healthy, prevent disease and reduce calf losses. Herd managers and advisers need access to accurate farm-specific data to be positioned to make effective decisions regarding calf health. One of the aims of the KT Programme is to give herd data back to herds.

FARM-SPECIFIC DATA USED FOR THE ANIMAL-HEALTH MEASURES

SOURCES OF DATA FOR THE KT PROGRAMME

Herd-level data pertaining to herd size, numbers of cows in herd, numbers of suckler cows in herd, number of births, number of movements into herd from other farms, number of movements into herd from marts, number of movements recorded from farm to knackery by six months, number of movements recorded to knackery for herd, movements out

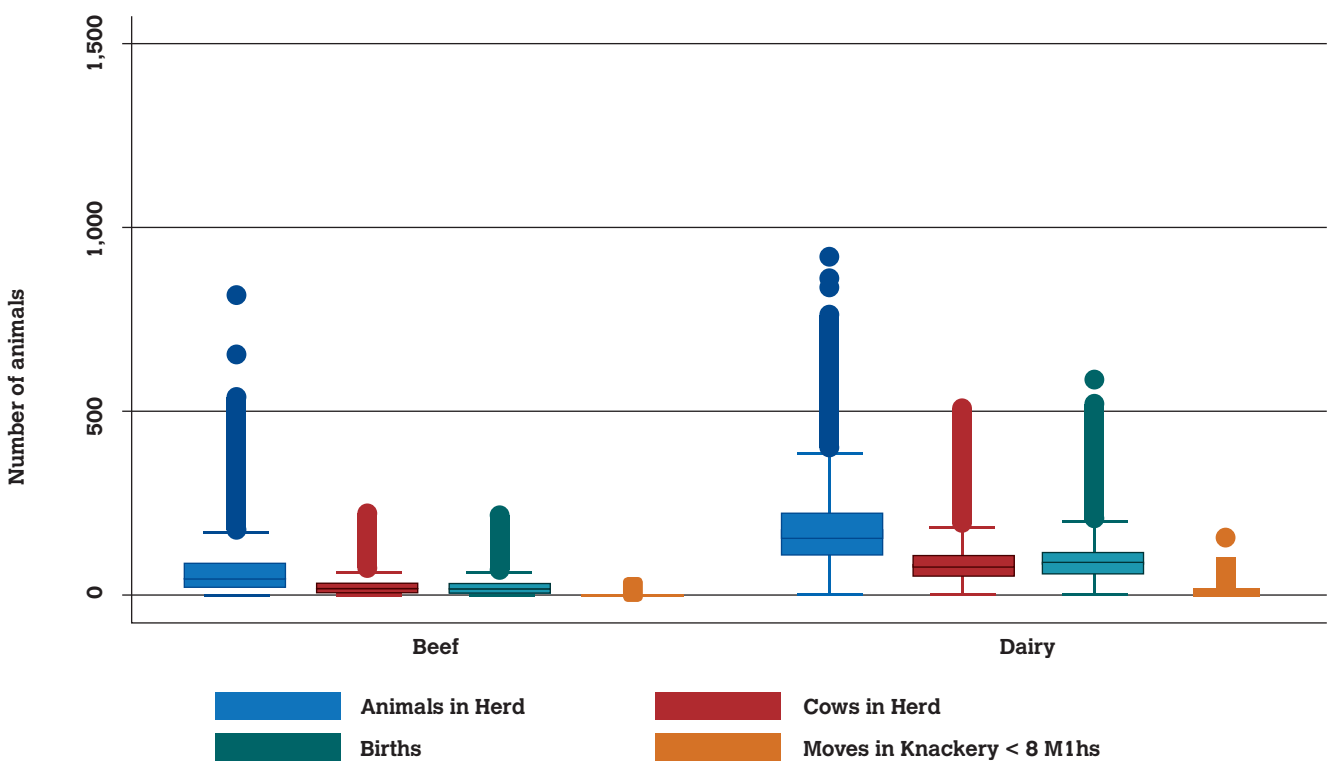


Figure 1: Box and whisker plots representing the numbers of animals, cows, births and movements to knackery for animals less than six months old for beef and dairy participants enrolled at the start of the KT Programme.

	Odds ratio	Std. err.	P-value	Confidence interval	
Region: North East	Referent				
North West	0.72	0.06	0.001	0.62	0.84
South East	0.73	0.06	0.001	0.62	0.85
South West	0.70	0.06	0.001	0.60	0.82
Farm to farm movements	Referent				
Any farm to farm movement	1.40	0.10	0.001	1.22	1.61
All moves	Referent				
2nd quartile	0.99	0.08	0.881	0.85	1.15
3rd quartile	1.09	0.09	0.314	0.92	1.28
Highest number of moves in	1.55	0.13	0.001	1.32	1.83
Registration – any late registration	1.73	0.18	0.001	1.40	2.13

Table 3: Multivariable logistic regression model for the association between selected potential risk factors and the proportion of herds that were classified as having a high six-month herd calf mortality rate (six-month MR >10%). The odds ratios (OR), Standard error (Std. Err.) the p-value and the 95% confidence intervals are presented. Variables for herd size, moves in through a mart, a herd record of lost or stolen animal reports were removed from the model as non-significant.

of herd to factory, to export, number of late calf registrations recorded by the herd, the number of animals reported as lost or stolen, the calf mortality index, and cumulative welfare index were sourced from the DAFM's Animal Information Movement System (AIMS) database for herds enrolled in the KT Programme.

DATA MANAGEMENT AND STATISTICAL ANALYSIS

Categorisations used for all independent variables are presented in Table 1. Herd-calf mortality rate was described in terms of a single-binary outcome variable: 15% of poorest performing herds, based on calf-mortality index, and calculated by the birth to death by six month's ratio, were assigned a score of one, while all other herds were assigned a score of zero. A multivariable-logistic regression analysis was utilised to determine the effect of selected herd-level factors on the outcome variable; a high or normal herd-calf mortality rate.

THE HERDS

A total of 9,876 beef and 4,268 dairy participants enrolled in the KT Programme in 2016. Baseline data were available for 9,494 beef participants and [4,166] dairy participants from the AIMS database (see Table 2).

The mean (± SEM) herd size was 62 (± 0.6) animals in 9,469 herds, and 175 (± 1.6) animals in 4,141 herds, for beef and dairy participants, respectively (see Table 1), and represented by box and whisker plots in Figure 1. Beef participants had 20 (± 0.3) cows, with 20 (± 0.2) births recorded in 2015, while dairy participants had 88 (± 0.8) cows and 93 (± 0.9) births in 2015, the year before they enrolled in the KT programme. Animal numbers were based on animals present in the herd on December 31, 2015.

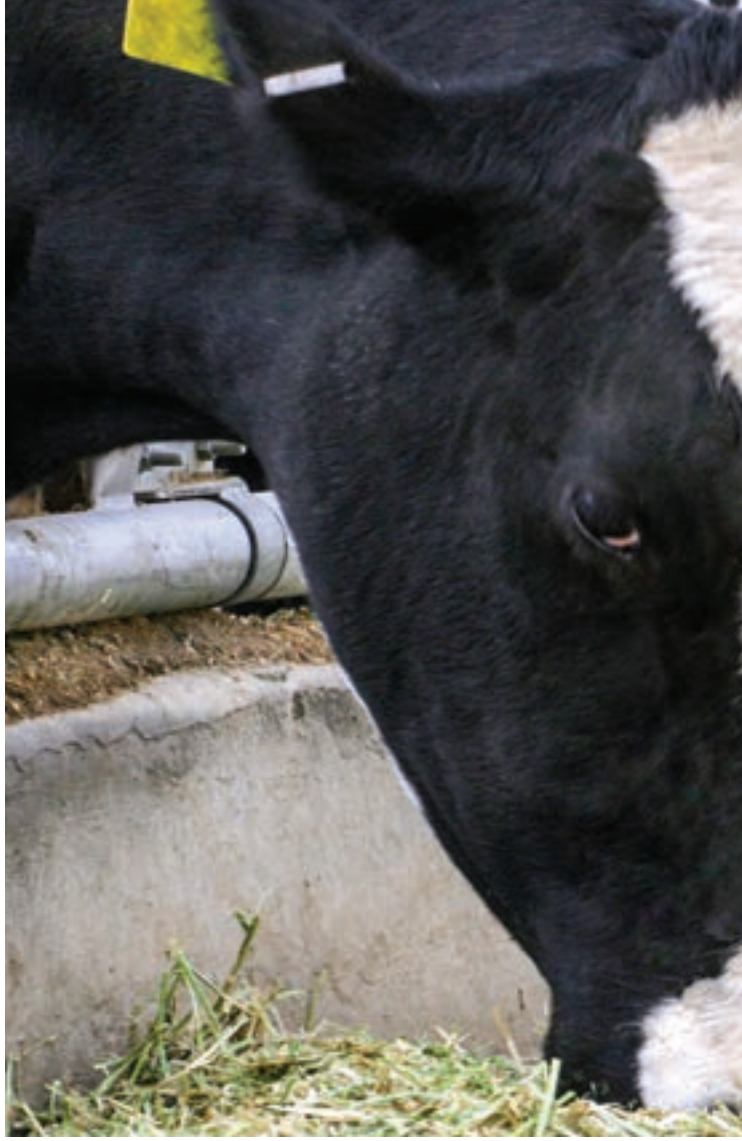
CALF HEALTH IN THE KT HERDS

The mean calf-mortality index (birth to recorded dead by 6 months ratio) was 0.50 (± 0.001) for all herds. The mean calf mortality index was 0.44 (± 0.001) for beef participant herds, while dairy particpant herds recorded a calf mortality index of 0.63 (± 0.001). The calf-mortality rate was highly variable among participant herds, and ranged from 0 to 0.3, for the 1st to 99th percentile, for all participant herds.

Overall, 15.3% (± 0.003) herds were categorised having recorded a high calf-mortality rate, with a calf mortality index of > 10% by six months of age. Some 15.1% (± 0.004) of beef and 15.6% (± 0.005) of dairy participant herds were considered to be high calf-mortality herds.

EVALUATION OF CALF HEALTH IN HERDS CONDUCTED AS PART OF THE KT PROGRAMME

A multivariable logistic regression model was developed to assess the risk of herd being classified having a high calf mortality rate (>10%; Table 3). There was an effect of region on the proportion of herds classified as high mortality herds. Herds in the North East were higher risk of high mortality classification compared with all other regions. If any farm to farm movements were recorded into the herd, the herd was 1.4 times (confidence interval; CI; 1.22 to 1.61) increased liklihood of being categorised a high calf mortality herd (Table 3). A herd record of animal movement through a mart into the herd was not associated with increased risk of high calf mortality classification. When examining the influence of magnitude of movements, herds that recorded the highest number of moves in (4th quartile, number of moves in ranging between 22 to 1,554 moves in) were of increased risk of high calf mortality classification. The herds with a high number of recorded movements in were 1.55 (CI 1.32 to 1.83) times more likely to be classified as high calf mortality herds, compared with the referent herds, which only had one or no recorded movement into the herd in the previous year (see Table 3). Herds that had even a single, late calf registration (4% of herds) were 73% more likely to be classified as a high mortality herd (CI 1.4 to 2.13). Herd size, the effect of moves through a mart, and history of the herd reporting lost or stolen animals were excluded from the multivariable logistic regression model as non-significant when controlling for all factors.



DISCUSSION

An average calf mortality rate of 5%, by six months of age, recorded among all KT cattle sector participants compares favorably with those reported elsewhere in France (10% dairy herds; 7.6% beef herds),4 the UK (14% dairy herds),[5] Italy (>17%),[6] the US (8%, perinatal losses only),7 Norway (7.9%),[8] and Malta and Gozo (6% and 9% respectively).[9] Although some countries report consistently good calf-survival rates; for example, Sweden (2.6% and 4%).[10,11]

The mean herd mortality rate reported for the KT herd participants also compares positively with those reported in other pasture-based dairy systems such as New Zealand,[12] where perinatal mortality rate (death by 24 hours) was 5.7% (ranging from 2.2-8.6% on individual farms) and postnatal losses (24h to 13 weeks) were 4.1 %, varying from 3.6-4.6% on individual farms. Calf mortality rate varied among farms; and individual farm calf mortality rate ranged between 0 and 30% (1st to 99th percentile) in the current study. Such variation in calf mortality among farms has been reported in a number of studies.[5,6,12] Many studies that have reported calf mortality rates were conducted on small number of herds,[5,6,10,11,12] with research investigators visiting the farms during the course of the study. It would be expected that this should optimise data precision. The source of data for the KT Programme is a national database, similar to the aforementioned French,[4] US,[7] Norweigian,[8] and Maltese[9] studies. There is a concern, as with all national databases,

that full disclosure may not have been made for all farms. The non-disclosure rate of calf losses is currently unknown on Irish farms. While all herd owners are required to register all births, whether born alive or not, we should consider tabulating the number of non-productive animals (cows not calved more than two years, and heifers not calved by more than three years) within the herd to estimate possible non-disclosed births. Further improvements should result from compulsory participation in HerdPlus, the ICBF national fertility recording programme. The capture of herd-breeding data should contribute to more efficient and accurate data capture on farm.

Interestingly, herd type or size did not influence calf mortality rate in the current study. When all factors were controlled, herd type and size was eliminated from the model. Essentially region, the number of movements into the herd and a record of late registrations were more associated with risk of herd being classified as a high-mortality herd, and herd type and size was removed from the model. The difference in region is unexplained, and herd size was not different compared with other regions. It will be necessary to conduct further analysis to determine if mean calving timing differed. Perhaps a higher proportion of autumn or dual season calving herds may have exerted an influence; as research performed elsewhere has reported an increased risk of perinatal mortality in winter born calves compared with summer born.[8,13] Studies have reported an influence of herd size with increased calf mortality reported in large herds.[8,12] There is a need to examine the influence of expanding herds on calf mortality outcomes. This study was limited to data gathered during a single year of entry into the KT Programme. The accumulation of data over a number of years will allow us to assess the effect of herd expansion on calf mortality rates.

There is evidence to suggest that high numbers of movements into herds were negatively associated with the calf mortality outcome. Herds with the highest number of moves into the herd were 55% (CI 32 to 83 %) more likely to be categorised as high calf-mortality herds. Farm-to-farm moves were associated with greater risk of high calf mortality herd, while history of mart movement did not influence increased risk of a negative outcome. Understanding the nature of the movement, the age and class of animal moved may throw light on this difference. Torsein et al reported an increased risk of high-calf mortality in herds purchasing 10 or more animals,[14] while a more recent study of the same group alludes to the complex nature calf health and the influence of cow management, milk yield, and biosecurity risks.[15]

A history of any late registration exerted the biggest influence on risk of herd classification as a high calf-mortality herd (OR 1.73; CI 1.40 to 2.13). This is of interest to policymakers, as a history of late calf registration is one of the criterion used, in addition, to calf mortality, to rank herds

for farm welfare assessment visits. This gives credence to the current ranking system for welfare visits.

OPPORTUNITIES OF THE KT PROGRAMME

The KT Programme aims to support the herd health conversation between the farms' own veterinary practitioner and the herd owner. It is the first step towards to a complete herd-health plan. The programme draws data from different sources to benefit the participants and aims to give farm data back to farms to support effective decision-making by farm managers and by advisers. Future work will extend to analysing trends in data over a number of years and monitoring change in response to recommendations. The role out of new initiatives are often associated with teething difficulties, despite this, it is crucial that the programme progresses over time and avoids the delays in programme delivery that occurred in year one.

CONCLUSIONS

An average herd-calf mortality rate of 5% compares favourably to that reported in other European countries and elsewhere. However, considerable variation in calf mortality has been demonstrated among farms in this study. Evidently some farms are confronting serious calf health issues, despite this, 90% of farms report calf-survival rates similar to elsewhere. An evaluation of data collected throughout the programme will allow for year-on-year assessment to understand factors contributing to consistently good outcomes.

The KT Programme is an opportunity to develop individualised herd-health plan for cattle herds. It enables farm specific data to be given to the farms own veterinary practitioner. It will support effective decision making, and allow for discussions with the herdowner on their business plans for their particular farm. Mandatory participation in HerdPlus and participation in a CellCheck Farmer Workshop for dairy herds should contribute to an increase in fertility recording and perhaps as a consequence calf registration data quality will improve. The aim is to improve the animal-health measures with each iteration of the Farm Improvement Plan to support effective appraisal and decision-making, with the ultimate goal to deliver a complete herd-health plan.

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CONFLICT OF INTEREST STATEMENT

The author of this paper does not have a financial or personal relationship with other people or organisations that could inappropriately influence or bias the content of the paper.

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