Tracking the Cause of Death to Minimize Losses*

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Take Home Messages

- Cow deaths are responsible for about 25% of herd turnover rates.
- Death rates vary by herd and are influenced by herd management and facilities.
- In order to have records to analyze, an effort must be made to accurately determine the cause of death. Often this necessitates a necropsy.
- In this study, injuries were the leading cause of death, followed by "unknown causes", and transition-related disorders.
- Knowledge of the causes of death on the dairies in this study led to management and facility changes that should reduce death rates.

Introduction

Death is one of the major reasons that cows leave dairy herds. The NAHMS (USDA, 2002) survey reported a death rate in the national herd of 4.8%. This rate has increased since BSE was found in the United States in 2003, and it subsequently became illegal to sell down and disabled cattle in 2004. Despite death being a common cause of herd turnover, often the cause of death remains undetermined. The majority of producers expend little effort in trying to determine the most likely cause of death; even fewer dairies routinely have cows that died of unknown causes necropsied. In this study we evaluated a sample of New York dairy herds to determine their death rates, determined when in lactation these cows died, tabulated herd manager comments and necropsy results pertaining to cause of death when apparently accurate records were available, and necropsied cows that did not have a known likely cause of death. The overall objective of the study was to determine if farm management practices or dairy facilities were related to

*Adapted from a paper presented at the 2005 Cornell Nutrition Conference

death rates, and if they could be altered to reduce death rates.

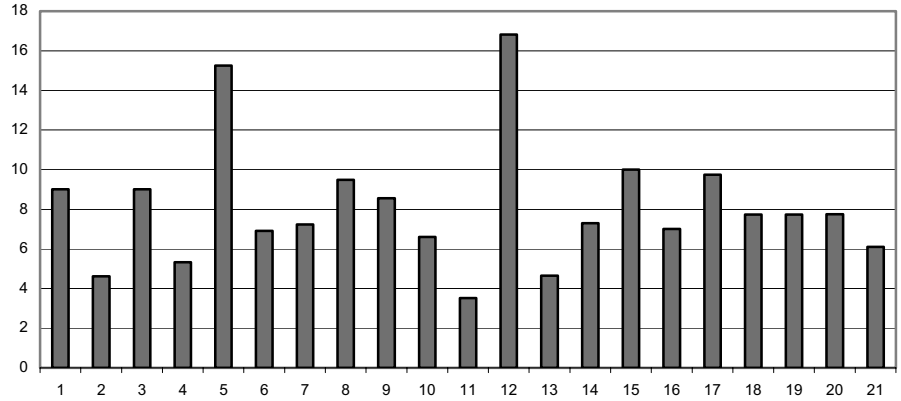

Figure 1. Average annual cow death rates in 21 New York dairy herds.

■ Results - Death Rates In Study Herds

On-farm computerized records were used from approximately 20 New York herds to evaluate death rates. All herds were freestall herds averaging over 300 cows per herd; one herd also used rotational grazing. The average annual death rate (number of lactation > 0 cows that died during the past year / number of cows in the herd) was 8.1%, with a range of 3.5% to 16.8% (Figure 1). Four of the study herds had death rates less than 5.3%, while two were greater than 10%.

Cow deaths were stratified within herd by days in milk (DIM), with DIM intervals of 0-5, 6-50, and > 50 (Figure 2). The time periods were chosen to try to reflect deaths that would be more likely to be associated with calving-related problems (0-5 dim), the transition period (6-50 dim), and later in lactation (> 50 dim). Further stratifications for death events occurring beyond 50 DIM were evaluated, but the results did not differ enough to warrant the additional classifications. Although the calving-related time period was by far the shortest, the six day high-risk period still resulted in an average death loss of 1.2%, with four herds having death losses of less than 0.5%, and four herds at or above 2%. Death rates during the two other time periods evaluated varied substantially across herds, and were influenced primarily by the herd's overall death rate. Deaths occurring during the transition time period (6-50 DIM) ranged from 0.7 to 8.4% of the herd, with a mean of 2.8%. Death rates occurring beyond 50 DIM averaged 4%, with a range from 1.7 to 8.3% of the herd.

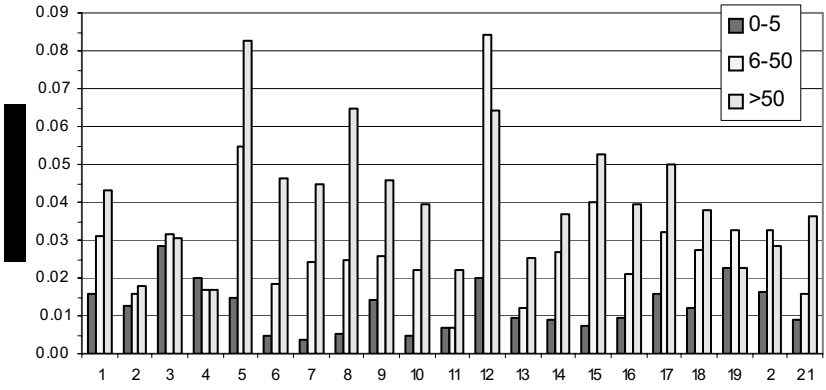

Figure 2. Days in milk when death occurred in 21 New York dairies, as a percent of the adult herd.

Ten of the herds in the study routinely recorded their best estimate of the cause of death and had a portion of animals dying for unknown reasons necropsied. These reasons were tabulated using the codes in Table 1 that most appropriately matched the recorded cause of death. Injuries were coded as the primary cause of death (20%), followed by deaths from unknown reasons (16%), calving-related problems (18% mean, 12% median), transition-related problems (9.8%), mastitis (9.4%), and gastrointestinal reasons (8.9%).

Herds representing over 12,000 cows were contacted in June, 2005 concerning the necropsy aspect of this study. Herd owners or managers were asked to contact us for a free necropsy of any cow that died of unknown reasons. Examples of known causes of death that were provided included the following: a) a cow that had been treated for acute mastitis and did not respond to therapy, and b) a cow that was observed becoming severely injured. Although we were prepared for the phone to ring incessantly, only 25 necropsy requests were received; of these, we were only available for 19 of the necropsies. Although at first the response seemed very poor, in retrospect it agreed exactly with the percentage of unknown or unclear deaths coded in Table 1 (12,000 cows x 8.1% annual death rate x 2/12 of a year x 15.7% unknown/unclear death codes = 25 deaths). More calls probably would have been received if producers were less confident in their suspected cause of death. Causes of death in the necropsy study included hardware, lung abscesses, fatty liver, ruptured aneurysm, and other causes (Table 2).

Table 1. Recorded causes of death in 10 New York dairies.

Dairy	1	2	3	4	5	6	10	12	18	22	Average (Median)
Herd death rate, %	9.0	4.6	9.0	5.3	15.3	6.9	6.6	16.8	7.7	6.1	8.7 (8)
Recorded cause of death											
Calving-related (usually < 6 DIM)	13.7	26.9	31.3	50.0	14.8	11.1	9.5	10.9	6.2	5.6	18 (12)
Transition-related (usually 6-50 DIM)	6.8	23.1	14.5	0	6.6	4.4	4.8	38.2	0	0	9.8 (6.7)
Injury (including scraper deaths)	24.7	3.8	20.5	12.5	21.3	17.8	29.8	13.6	30.8	22.5	20 (21)
Unknown or unclear	13.7	23.1	6.0	12.5	24.6	17.8	20.2	12.7	4.6	21.3	16 (16)
Gastrointestinal (includes RDA, Salmonella, enteritis)	16.4	3.8	8.4	12.5	6.6	13.3	10.7	0	10.8	6.7	8.9
Mastitis	6.8	11.5	9.6	6.3	9.8	15.6	8.3	.9	12.3	12.4	9.4
Pneumonia	2.7	0	3.6	6.3	0	2.2	2.4	9.1	0	4.5	3.1
Lung abscess	1.4	3.8	0	0	1.6	2.2	0	1.8	10.8	9.0	3.1
Hardware and heart problems	5.5	3.8	1.2	0	1.6	0	3.6	4.5	10.8	3.4	3.4
Lameness, including Super Footrot	0	0	0	0	6.6	8.9	0	2.7	1.5	3.4	2.3
Ruptured aneurysm/artery	1.4	0	0	0	3.3	2.2	0	2.7	4.6	1.1	1.5
Ulcer	6.8	0	2.4	0	3.3	2.2	0	0	4.6	5.6	2.5
Lymphosarcoma/cancer	0	0	0	0	0	2.2	4.8	0	1.5	3.4	1.2
Hemorrhagic Bowel Syndrome	0	0	0	0	0	0	4.8	2.7	0	0	.7
Drown (oral fluids)	0	0	2.4	0	0	0	1.2	0	0	0	.4
Clostridium	0	0	0	0	0	0	0	0	1.5	1.1	.3

■ Discussion - Death Rates In Study Herds

DairyMetrics (2008), a herd evaluation and benchmarking program available from DRMS, reported death rates of approximately 7% during 2005 for similarly sized herds in New York and nationally. Death accounted for 25% of the herd turnover rate in the herds in this study (~ 8% death rate/~32% herd turnover rate). This was greater than the proportion obtained from DairyMetrics for 195 similarly sized New York herds (19%), or that of 10,600 similarly sized herds nationally (20.6%).

Death rate can be influenced by producer attitude and management philosophy. Some producers try to expand their herd by keeping or trying to save cows that could have been sold for beef. Others will much more aggressively sell an animal that does not appear to have a very good prognosis. Both types of philosophy were about equally represented in this study, without any consistent differences in death rates between the two types of management styles.

Management in the study herds was considered to be at or above average for similarly sized herds across the industry. Evidence of this is seen in the pregnancy rates of the study herds, which averaged 19.5%. Stone (1999) found an average pregnancy rate of 15% in a survey of 90,000 cows in 170 northeast herds in 1999. Pregnancy rate is generally a good proxy of a dairy's cow management level since it involves both cow health and proper implementation of a reproductive program to achieve success. Also interesting is that three of the five herds with the lowest death rates also had the most aggressive foot trimming programs, with overgrown toes rarely observed. This may be more of a sign of management in general as opposed to an effect from better feet (e.g. fewer injuries), since one of the herds had a very low injury rate, one was average, and the third did not have adequately described death reasons to be part of Table 1.

Low death rates are possible, as evidenced by the survey data in Figure 1. However, it is difficult for a dairy to achieve a death rate of less than 4%. Interestingly, the herd with the lowest death rate in Table 1 (4.6%, herd 2) also had a dramatically lower injury-induced death rate than the other herds (3.8% versus nearly 20%), while the herd with the second lowest death rate in Table 1 (5.3%, herd 4) had the next lowest injury-induced death rate (12.5%). Injuries were found to be the leading cause of death in a year-long study involving a 1,400 cow Colorado dairy (Severidt et al., 2006), averaging essentially the same as in this study (21% of deaths). Herd 2 was a three year old facility that utilized sand for the stall surface. Traction throughout the barn would be expected to be good both because of the newer concrete and alley surface covering with sand. Producers and consultants should look for "high risk" injury areas on dairies and implement facility renovations to reduce this primary cause of death rates. Examples of renovations would include the

installation of grooved or relatively soft rubber, regrooving or resurfacing of concrete, application of lime to slippery surfaces, switching to sand bedding, improvements in stall design, and the removal of equipment or structures that can injure cows when passing (e.g. pipe or bolts from gates extending into alleyways). Ice-covered concrete, whether around water troughs or throughout the facility, must also be considered and dealt with. One of the study dairies lost five cows in one day due to injuries that had occurred from ice around water troughs. We need to remember that a cow is exposed to a hazard (slippery floor, incorrect stall design, crowd gate with an electric wire in a large group of cattle, etc.) on a continuous basis, and the best way for long term improvement is to eliminate the hazard.

Herd 12 had the highest death rate (16.8%), with 10.5% of the herd dying by 50 DIM, and 38% of the deaths coded as a transition problem (e.g. fatty liver). Herd 12 was a 2x herd that fed a one-group TMR and did not use BST. Cows managed like this are at a much higher risk of becoming over-conditioned, and thus being more prone to freshening problems and metabolic disorders. Additionally, the dairy had been feeding a relatively higher energy far-off dry and prefresh ration, which could both further impair intakes post-freshening. Cook and Nordlund (20041) found an increase in metabolic disorders and deaths in herds that have excessive pen moves during the immediate pre- and post-freshening time periods. Producers and consultants should always be thinking of ways to improve the transition cow program since it is of such importance to the overall performance of the dairy.

A major cause of death was of the “unknown/unclear” category. Producers and veterinarians do not necropsy enough animals. The main reason for this probably is the prioritization of time, with the dead animal probably rightly being at the bottom of the list. Cost is another factor; a thorough field necropsy takes about 30 minutes to an hour, depending on the amount of help and whether or not the carcass must be sewn back together.

Two examples of where valuable information was obtained from the necropsies described in Table 2 were with those deaths caused by hardware and ruptured aneurysms. Hardware was not suspected in any of the three cows that died of hardware. Two of the three animals had magnets. The animals were from three different dairies. Both of the wires that were found were similarly sized (~.5mm x 60mm). Two of the hardware deaths were acute where the wire had either lacerated an artery or caused a myocardial disturbance; the third was a more classical hardware case, with severe purulent pericarditis. Both of the wires that were found were magnetic, yet had not become attached to the magnets. Hardware should be managed with the same risk-reduction approach discussed with injuries. On and off-farm risks should be considered. For example, when considering feed and forage suppliers: Are magnets present in equipment used in the mixing and augering

processes? Are feed trucks ever used to haul waste or scraps? How careful of avoiding wire/metal are farms that you may buy forages from? When considering on-farm risks: Are wires, nails, needles and other metal wastes disposed of properly? Is there any chance they can end up in the field and be picked up by harvesting equipment? Are steel-belted radial tires used to cover bunker silos? Is chicken wire used to keep cows away from the curtains, and are they eating it? Are magnets given to cattle when they have an adequately developed reticulum (probably any time after about 4 months of age, although I have seen dairies successfully give them to 2 month old calves). Are magnets becoming heavily contaminated with metal shale, rendering them ineffective? Are powerful, properly maintained magnets present on harvesting and feeding equipment? Several of the dairies in the study purchased much more powerful magnets because of the hardware deaths observed in the study. The magnets were placed in the unloading chute of the feed truck, and have captured a vast amount more metal than the magnets that originally came with the feed truck. A possible source of these magnets is Magnetic Products, Highland MI, 1-800-544-5930.

Rupture of an artery, probably from an aneurysm, was responsible for two of the deaths in Table 2. Additionally, it was listed as a cause of death in half of the herds in Table 2, responsible for the death of 0.5% of one of the herds. Undoubtedly ruptured vessels were responsible for some deaths receiving a different code. The cause of this problem is not known, although insufficient copper levels have been shown to result in decreased levels of lysyl oxidase. This enzyme is involved in the formation of collagen and elastin, integral components of arterial vessels (NRC, 2001). Copper levels have been fed well above NRC recommendations in several of the herds, yet the problem has persisted. Liver copper levels have been normal when tested in animals that died of the problem. One theory is that copper levels may be insufficient at some point in the animal's life, resulting in a defective artery that ruptures later in life. Additional research needs to be done to clearly elucidate the cause of this problem.

Interestingly, mastitis was responsible for less than 10% of the deaths described in Table 1. Most probably mastitis was the cause of a much higher percentage of the sold cattle. The relatively low death rate due to mastitis may be due to a combination of proper vaccination, early recognition, and aggressive therapy.

The percentage of cows coded as having died from pneumonia, lung abscesses, ulcers, and lymphosarcoma varied considerably across herds, probably due to both a difference in the actual prevalence of the disorder, and in the ability of the dairy to recognize the disease or condition. Lameness was coded infrequently as a cause of death on most dairies, although it was responsible for 9% of the deaths on one dairy.

Table 2. Causes of death in cows that were necropsied on New York dairies.

Fresh cow	Peritonitis	Perforated bowel, probably calving related
Fresh heifer	Exsanguinated	Ruptured uterine/vaginal artery in an over-conditioned heifer with a difficult calving
Fresh cow	Unclear, possible MF	1 dim, history of milk fever
3 wk fresh cow	Fatty liver	
2 wk fresh cow	Lung abscess, fatty liver	Single, 8x3 cm lung abscess; very pale liver
5 wk fresh cow	Enteritis	Antemortem enteritis diagnosis; very fluid small and large intestinal contents
Prefresh heifer	Pneumonia	
2 wk fresh cow	Lung abscess	Multifocal, 3-15 cm lung abscesses
Midlact cow	Liver abscess	20x4 cm liver abscess
Prefresh heifer	Hardware	Myocardial damage, no infection, magnet
Midlact cow	Hardware	Exsanguinated into reticulum, magnet
Prefresh heifer	Hardware	Severe purulent pericarditis, no magnet
Dry cow	Abdominal aneurysm	Probably ovarian artery rupture/aneurysm
Early lact cow	Thoracic aneurysm	
Late lact cow	Abdominal hemorrhage	Hematoma (6x15 cm) in mesentery of spiral colon, possible heart lymphosarcoma lesions
Fresh cow	Asphyxiated	Died immediately after pumping oral fluids; ground alfalfa from drench in bronchi
Midlact cow	Heat stress? Mastitis	Fans off on a hot summer night in a tunnel ventilated barn
Mid and late lact cows		Both too autolyzed

A likely cause of death was found in 16 of the 19 cases presented in Table 2; a fairly likely cause in one (milk fever), and nothing in two of the cases because they were very autolyzed. This is a relatively high “success rate”. The reasons for this were probably three-fold, and include the type of animal necropsied, the degree of decomposition, and the time committed to the necropsy. Producers called concerning animals that had acutely died, and which they generally had no idea what had caused the death. A lower success rate may have been obtained with some of the injuries, especially if they involved the vertebra. Necropsies were a priority, and hence many of the animals had very recently died. The likelihood of determining the cause of death lessens as decomposition progresses. Finally, very thorough

necropsies were conducted that took more time to complete; many of the lesions were found simply because an effort was made to inspect all abdominal and thoracic organs.

Conclusion

The death of cows on dairy farms represents a significant economic loss for producers. The majority of deaths resulted from complications associated with injuries, calving, the transition period, or were undetermined. Producers and veterinarians should try to determine the cause of death with the objective being that future deaths could be reduced by changing some aspect of management or of the dairy facility. Producers regrooved concrete, installed magnets on the discharge chute of feed trucks, improved their management of tires on top of bunker silos, re-evaluated their trace mineral supplements, and revamped their nutrition and management programs of their dry cows due to a better knowledge of the reasons causing the deaths of cows on their dairies.

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