

# William “Bill” Wailes Memorial Lecture- Dairy Cow Death Certificate: Why?

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## Abstract

On-farm death of adult dairy cows is a significant problem for both economic and animal welfare reasons. These losses and their causes are not carefully monitored or evaluated on most dairies leaving producers and veterinarians without the information needed to manage them. The reasons cows die are multiple and complex, necessitating an improved approach to diagnosis, information management and analysis. Here we will discuss a method to get useful information about cow death losses to help manage cow health.

## Introduction

Historical data suggest that dairy cow mortality has ranged between 1 and 5% of rolling herd inventory per year into the 1970s, with typical losses of 2 to 3%. In the last decade however, our investigations and other literature finds a range of mortality in dairy herds across the US between 2 and 15%, with typical losses between 6 and 8%. Clearly some herds do very well in maintaining a very low mortality rate while other herds must have significant health or management problems that lead to numerous bad outcomes. Not only are these losses an economic disaster, they also represent very substantial problems with animal well-being.

Adult cow death loss is an issue that should be very important to producers and veterinarians, but historically the careful tracking of causes of mortality on dairies has not been a high priority. This makes sense when losses are very infrequent and appear to have little to do with the health of the remaining herd. For a herd where 5 to 10% of standing inventory is lost to death each year, accepting death losses as inevitable no longer makes sense. It's important to recognize that if a cow dies or is euthanized due to a problem that could have been better managed, there are risks for other cows in the herd to have a similar outcome. Uncovering the nature of those risks is important for optimizing cow health. The first step for evaluating the impact of death losses on an individual dairy is to look closely at overall death losses and determine if they are high or low.

Rising rates of occurrence across the industry suggests that veterinarians and producers do not have the information required to manage the problem. The purpose of this presentation is to critique the information we have, consider what information we need, and suggest changes in information gathering for dairy herds that would help diminish losses.

### **Problems with our current approach**

Dairy cows are complex animals that go through multiple life stages during their residence on a farm. This is very different than, for example, a beef feedlot where most of the animals are young and growing, somewhat equivalent to dairy heifers. In such populations, infectious respiratory disease is far and away the number one health challenge that predisposes to euthanasia and death.

For adult dairy cows, there is no single predominant life-threatening disease. On an individual dairy, there are times when a unique problem manifests and may lead to a series of illnesses and deaths. Beyond such episodes, however, there is no simple explanation of cow losses. Our studies show that it is relatively easy to find 30 or more different causes of death on dairies. Reviewing on-farm records, most producers list at least 8-10 and up to 20 different causes of death.

We have plenty of records and information on causes of death. Producers, dairy researchers, or veterinarians can go to the records to find out why cows die. Some publications and the national surveys conducted by the USDA National Animal Health Monitoring System (NAHMS) provide summaries of causes of dairy cow death obtained from such records. The question is whether this information is useful for making herd management decisions that improve animal health and decrease herd losses. For several reasons we believe the answer is no. Let's explore the reasons why.

### **Source of information for records**

Almost all record entries are performed by farm personnel with little or no veterinary input. We have been interested in causes of on farm cow death for some time now and have compared veterinary assessment versus producer- attributed cause of death. Not surprisingly we find that producer records are only accurate about half of the time. This is most likely because cause of death can be complicated and is hard to assess without a real investigation.

The best means of assessing the type of disease that kills a cow is to perform a necropsy. The 2007 and 2014 NAHMS dairy studies showed that between 15 and 24% of operations performed some necropsies on dead cows and fewer than 5% of dead cows were examined by necropsy. In other words, little is done to investigate why cows die.

If death losses are very low, then misclassification of cause of death in a percentage of the animals probably makes little difference to a herd manager. But if death losses on an annual basis are high or rising, then it makes sense to employ professional input when analyzing causes. The fact that very few dairy cow deaths are evaluated by necropsy leaves a serious information gap in any analysis of cow mortality.

## **Type of information in records**

Beyond the question of whether the listed cause is accurate, do the descriptors in the records adequately describe why cows died? For example, if records show that some percentage of cows died from “digestive”, how does this categorization help? Would this represent infectious disease, nutritional problems, intestinal accidents, bad surgical outcomes? As another example, if you consider the category of lameness as a cause of death, there are many potential causes of lameness and reasons why a lame cow might be euthanized on farm. If a records’ review showed ‘lameness’ as a leading cause of loss, it would be difficult to institute a specific corrective action that would decrease the numbers in this category. Most of the categories used in dairy records are easy to use, but upon later review they are not useful for defining beneficial management changes that could be made. Often producers will list something like “shot” or “died” or “euthanized” for many of the cows. This type of information is not very useful if you are trying to improve outcomes.

We have studied causes of death and most commonly we find that the causes listed are so generic and non-informative that it is easy to conclude that nothing can be done to change the outcomes. But this is not true. For the dairies we have studied, it seems that only a small percentage of deaths were truly unavoidable. The remainder can be evaluated and good information can be obtained that can help a producer take steps that decrease such losses in the future. But this requires investigation of losses in a manner that provides information about prevention strategies.

### **How should we approach information about cause of death?**

Necropsy examination is the single best way to determine accurately the specific reason an animal died. There are probably numerous reasons necropsy is not more commonly used. Included are time and availability of the herd veterinarian, limited focus by producers on cause of death, and the hassle of getting necropsy done. Performing necropsy on farm is not terribly complicated and yields excellent information. We have developed a website that walks through the process, describes the tools needed, describes what normal tissues look like, and discusses disposal of carcasses. This site is at <https://www.cvmb.colostate.edu/ilm/proinfo/necropsy/notes/INDEX.HTML>

Most dairies have someone on farm who can work with the veterinarian and learn to do necropsies when the veterinarian is not available. This process encourages more communication with the veterinarian and can stimulate interest in animal health. Photos can be taken by cell phone and sent to the veterinarian for discussion. Learning to take tissue samples for further evaluation is also relatively easy.

It would be ideal if all animals that die on farm are investigated thoroughly. This ideal would be hard to achieve, and our investigations show that it’s not necessary to perform necropsy on every single death. Accidents that lead to euthanasia, and cows with prolonged illness and substantial diagnostic workup probably do not warrant a necropsy unless there are specific lingering questions. On the other hand, cows that die without much warning, or cases where the outcome was expected to be very different certainly warrant a necropsy. We estimate that a producer can have a very good understanding of cow mortality on their operation with about a 50% necropsy rate.

Necropsy can define the proximate cause of death in most cases. Necropsy is a critical element to the investigation of death, but we have found that this is not sufficient to inform well directed management changes. Something more is needed.

### **Information beyond necropsy**

Necropsy might determine that a cow died from infection in the abdomen, called peritonitis. The way dairy records are commonly used, this would be listed in the record as “digestive”. It would be hard to remember whether the cow had preceding bowel infection leading to perforation, or perhaps had a ruptured uterus, or perhaps a surgery went poorly, or perhaps there was an abdominal wound from some type of accident.

To understand the reason a cow died from a particular disease you need more information. Was the disease identified properly? Was it treated properly? Did the cow respond as predicted? Were other disease problems also identified? Was the problem associated with a particular risk on the farm?

Asking the question “why?” a problem occurred is more important than just identifying the problem itself via necropsy. The best time to gather this information is right after the cow is dead. Otherwise critical information like where the cow was located, who had last seen the cow, who had treated the cow, whether appropriate procedures were followed, whether the cow had preceding health problems that contributed to the death, are all lost to memory.

Dairy records currently contain descriptors of disease but don’t provide information about why the problem occurred. This means that later review of records does not provide the information needed to change things in the future. If several cows died from different disease problems, but in each case the problem was poor disease identification, or improper treatment of the disease, then records need to identify ‘failure of disease recognition and treatment’ for corrective actions to be taken. Numerous different dairy cow health problems have common roots that can be managed for improvement.

Most dairy producers, dairy workers, and veterinarians are good investigators and problem solvers. Understanding the cause of death requires a thought process that asks the question “why” that outcome occurred. If death loss on farm is taken seriously, if a good investigation is done, and if people focus on asking why a cow died, good explanations can be achieved in almost all cases to a degree that decisions can be made about how to decrease the likelihood of similar problems in the future.

### **Capturing the information in records**

The final step to creating useful information about cow death losses is to create a system that captures it in a way that it can be evaluated and reviewed. The human medical community dealt with this problem many years ago as they tried to monitor causes of death in human populations. Their efforts developed Death Certificates that have been used for well over a century. These documents combine information about a proximate cause of death, commonly including autopsy information or results of diagnostic testing. They also include historical information about the characteristics of the individual to help determine the underlying cause of the death.

We have adapted this method for use on dairies. The person evaluating the death can enter information and walk through a process of investigation that helps them determine the most likely reason the cow got sick with a problem resulting in death. The process is relatively simple but relies on collecting information that is most easily assembled near the time of death. The death certificate form establishes who the cow was and some details about her life in the herd. It asks about previous health problems and treatments. These types of details provide a reasonable assessment that the investigator can use to formulate ideas about why this cow developed the problem that either killed her or led to the decision to euthanize.

The idea behind the death certificate is not that there is 100% certainty about cause of death, because that would be unrealistic. Rather, it prompts the dairy worker and/or the herd veterinarian to become more aware of the specific risks and likely problems that end up with a bad outcome. Some of the requested information comes from dairy records, while other information comes from the people working with the cows. A copy of the dairy cow death certificate is provided below.

This process promotes much more interaction between the veterinarian and the workers on the farm who deal with animal health. In our experience having workers become more involved with health processes and communication about health events leads to much more knowledge and information about how to keep cows healthy. Commonly the process of doing a necropsy and pursuing answers generates worker questions about disease identification and treatment and can positively influence health care.

Some producers might argue that filling out a death certificate takes time, which is true. After a very few cases this process is relatively fast, and *the important point is that investigating cause of death in individuals is helpful in getting information that can be used to improve health of the herd*. It seems that many producers have the mindset that there is not much value in performing an investigation of death. After all, there is nothing that can be done to help an animal after it is dead. While this is true for that individual, investigating cause of death is one of the few, and arguably the single most powerful way to assess outcome of prior treatment, management, and decision-making. Knowing why a cow died and thinking through the chain of events that led to that loss is a powerful means to critique the risks that occur daily on the operation.

Once the underlying cause of death has been established we use an alphanumeric coding system that includes eight letters so that it can fit in modern computerized dairy record systems. This system identifies a target area for preventive interventions, distinguishes euthanasia from death by natural causes, identifies whether a death certificate was filled out, lists the disease that was the proximate cause of death, and describes the underlying causative problem. The coding system is presented below.

Using this coding system does not require that a necropsy is performed, but in many cases it emphasizes why a necropsy would be useful. The code makes it easy to determine how many cows died for specific reasons while providing much more information than current records. Again, this heightens awareness of specific risks on the dairy that can produce bad outcomes. It is important to note that these are simply codes that we have developed over time, but any of them can be changed or adapted for an individual farm or veterinarian

The first 2 letters in the code represent a specific disease problem or problem area that can be managed for improved outcomes. Such problem areas include calving trauma, injury due to human error, transition cow problems, and so on. If a records' review shows numerous cows that died due to these 'problem areas', then decisions can be made to help minimize that cause of disease and death.

For the proximate and underlying causes of death, which identify the specific problems found by testing, necropsy or inquiry, we have established 38 different 2 letter codes. Therefore the diagnosis of death can be far more specific than the current record systems that abbreviate a term for an organ system, such as 'resp' or digestive'.

We laminate the sheets with the coding key and have them available on farm with the certificates of death to make the process of coding very easy. We have made these forms available on our Integrated Livestock Management website so that you can download them or print them out easily. The ILM webpage is at <https://www.cvmbs.colostate.edu/ilm/> and the site containing the Certificate of Death, the Mortality Record coding system and a necropsy data collection form is at: <https://www.cvmbs.colostate.edu/ilm/projects/mortality.html>

We maintain the Certificates of Death in a hard copy filing system so they can be reviewed later. The coding system makes searching for information from computerized records simple. We recommend that producers review mortality records with their veterinarian on a routine basis, as they would any other indicator of herd performance and herd problems so that improvements can be made in an ongoing fashion.

Figure 1: Dairy Certificate of Death with Cause-of-Death Statement

  		<b>Craig McConnel &amp; Franklyn Garry</b>	
CERTIFICATE OF DEATH: <b>Final Mortality Code</b> _____			
1. Dairy	2. Animal ID/Tag	3. Date of birth (M/D/Y)	4. Date of death (M/D/Y)
5. BCS	6. Lactation Number	7. Lactation status <input type="checkbox"/> Lactating <input type="checkbox"/> Dry	8. Days in milk or Days dry
9. Fresh Date (M/D/Y)	10. <input type="checkbox"/> Aborted this lactation DCC at abortion:	11. Pregnancy status <input type="checkbox"/> Open <input type="checkbox"/> Pregnant	12. Days carrying calf
13. Calving ease score	14. Pen number	15. Location at time of death	16. <input type="checkbox"/> Down prior to death Days down: _____
17. Manner of death  <input type="checkbox"/> Unassisted  <input type="checkbox"/> Euthanasia	18. Was a necropsy performed? <input type="checkbox"/> yes <input type="checkbox"/> no  Relevant findings:		19. Were adjunct diagnostics performed?  <input type="checkbox"/> yes: _____  <input type="checkbox"/> no
20. CAUSE OF DEATH. Part I. Enter the <u>chain of events</u> --diseases, injuries, or complications--that directly caused the death. DO NOT ABBREVIATE. Enter only one cause on a line. Add additional lines if necessary.			Approximate interval: Onset to death
IMMEDIATE CAUSE (Final disease or condition resulting in death) →			
a. _____ Due to (or as a consequence of):			_____
Sequentially list conditions, if any, leading to the cause listed on line 'a'. Enter the <b>UNDERLYING CAUSE</b> (disease or injury that initiated the events resulting in death) on line 'd'.			
b. _____ Due to (or as a consequence of):			_____
c. _____ Due to (or as a consequence of):			_____
d. _____			_____
PART II. Enter <u>other significant issues or conditions contributing to death</u> that are not outlined in Part I.			
21. Did injury play a role in death?  <input type="checkbox"/> yes <input type="checkbox"/> no	22. Date of injury (M/D/Y)	23. Location of injury on body	
24. Place on farm the injury occurred	25. Describe how the injury occurred		

## MORTALITY CODES

### **Mortality Alphanumeric Code: letters 1-8**

- 1-2) Category related to target area for intervention
- 3) Euthanized versus Death by natural causes (E/D)
- 4) Death certificate (Y/N)
- 5-6) Immediate/proximate disease related to cause-of-death
- 7-8) Underlying or intermediate disease process or causative factor if known

### **Death Themes & Categories**

- Specific disease process as a stand-alone problem  
**DZ:** Specific disease such as HBS, metritis, etc.
- Traumatic injury  
**IC:** Injury related to calving trauma  
**IJ:** Injury such as spinal, stifle or hip damage  
**HE:** Trauma due to human error
- Multifactorial failures linked to transition period  
**TN:** Multifactorial transition/early lactation disease or negative energy balance issues
- Feed management  
**FD:** Feeding error
- Miscellaneous events not conducive to prevention  
**MS:** Miscellaneous
- Undetermined  
**UN:** Undetermined

**Disease codes    Immediate/Intermediate/Underlying Disease or Causative Factors**

AB	Abomasitis
BK	Back injury
BL	Bloat
BO	Bleed out/hemorrhage
CA	Cancer
CH	Choke
CC	Concrete flooring
CE	Cancer eye
CL	Clostridial leg
CN	Congenital defect
CT	Cecal torsion
DA	Left displaced abomasum
DI	Diarrhea/Infectious gastrointestinal disease
DW	Down cow
DY	Dystocia
ED	Edema
FL	Fatty liver
FR	Footrot
FS	Freestall/facility issues
FW	Footwart
HB	Hemorrhagic bowel syndrome
HP	Hip displacement
HW	Hardware disease (TRP)
HT	Heart pathology
IC	Ice
IN	Indigestion
JN	Johnes disease
KE	Ketosis
LG	Leg injury
LI	Listeria
LM	Generic lameness--needs attributed to specific causative factor
LV	Liver abscesses
MA	Mastitis
MC	Malignant catarrhal fever
ME	Metritis
MF	Milk fever/Metabolic
MV	Mesenteric root volvulus
PA	Parlor issues
PE	Peritonitis
PN	Pneumonia
RD	Right displaced abomasum

RN	Renal disease/failure
RP	Retained placenta
SA	Sole abscess
SE	Septicemia
SH	Shoulder injury
SJ	Septic joint
ST	Stifle injury
UI	Udder injury
UL	Perforated gastrointestinal ulcer
UT	Uterine tear
VT	Vaginal trauma

**Example 1: Hemorrhagic bowel syndrome sudden death**

**DZDYHBxx**

DZ = Specific disease to target for intervention D = Died of natural causes

Y = Death certificate completed with necropsy findings

HB = Hemorrhagic Bowel Syndrome as the immediate cause of death xx = No relevant underlying or intermediate disease processes

**Example 2: Failure to treat/heal lameness due to a chronic sole abscess**

**DZENLMSA**

DZ = Lameness failure related to hoof care E = Euthanized

N = No death certificate completed

LM/37 = Generic lameness as the immediate cause of euthanasia SA/47 = Sole abscess as the disease process underlying the lameness

**Example 3: Severe calving trauma leading to euthanasia**

**ICEYVTDY**

IC = Injury related to calving trauma E = Euthanized

Y = Death certificate completed with necropsy findings VT = Vaginal trauma as the immediate cause of death DY/45 = Dystocia as the underlying cause of death

**Example 4: Back injury leading to euthanasia**

**IJEYBKFS**

IJ = Traumatic injury E = Euthanized

Y = Death certificate completed detailing sequence of events underlying the injury BK = Back injury affecting the spinal cord

FS = Injury related to freestall issues

Example 5: Early postpartum death related to multiple diseases

**TNDYSEDA**

TN = Multifactorial transition cow/early lactation disease problems D = Died of natural causes  
Y = Death certificate completed with necropsy findings and history of disease SE = Septicemia  
as the immediate cause of death

DA/32 = Displaced abomasum representing an intermediate disease process

Example 6: Late lactation death due to choking on foreign material

**MSDYCHxx**

MS = Miscellaneous event D = Died of natural causes

Y = Death certificate completed with necropsy findings CH = Choke

xx = No relevant underlying or intermediate disease process

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