High Risk Cows in High Risk Places

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Take Home Messages

- Many cows leave the dairy herd as casualties or forced culls whist in full production: these are a significant economic loss to the herd.
- The rate of loss is variable between herds, indicating that the problem is not inevitable, but preventable.
- The major causes of death and casualty culling in early lactation cows are associated with dystocia, periparturient recumbency, and acute illnesses and injuries to which they are predisposed.
- There are specific cows that are at particular high risk of becoming casualties, forced culls or deaths on farm: these can be identified and treated appropriately to avoid them becoming exposed to potential hazards in high risk places.
- High risk places can be identified on any dairy farm, which predispose high risk cows to injury or disease. If these risks are properly managed, casualties and forced culls can be effectively prevented.

Introduction

One of the major variables of technical efficiency between farms participating in a recent large scale knowledge exchange project in the UK was the forced culling rates, defined as the culling of productive cows during production rather than at the end of their productive lives. Many of these forced culls left the farm dead, having died on the farm, or had to be slaughtered on farm for welfare reasons. These animals had no salvage value, and indeed cost the farmer to legally dispose of them.

The data and anecdotal evidence were further confirmed by a large scale study of culling reasons and the economic costs of culling by Orpin and Esslemont (2010) using data from myhealthyherd.com, a web based health management program which records culling on individual farms and then calculates the economic cost against an achievable target. This study showed

the significant economic cost involved with forced culling, particularly casualty culls and deaths on farm.

The knowledge exchange project highlighted that these deaths and culls particularly involved fresh calved cows, bulling cows and heifers, subordinate cows and those animals that were infirm, immobile or otherwise weakened to the rigours of life on a dairy farm. However, although all dairy farms have high risk cows such as these, not all farms suffer from high forced culling rates: some managed to minimise injury and disease amongst these animals by providing for their needs and ensuring that they were provided with an environment that reduced the risks to their health and wellbeing.

These risks were readily identified, and most can be easily and economically managed so that high risk cows are not exposed to high risk places.

■ The Reasons For Culling

The ideal situation for any dairy herd is to choose to cull cows that are not suitable for the herd, for such reasons as being unproductive, inappropriate, or of the wrong genetics for the aspirations and long term strategy of the herd. In reality, many cows are culled because they are infertile, have chronic or incurable mastitis, are lame or affected with some other condition that brings their productive life to a premature end. Most of these cows are kept in the herd as long as they remain profitable, and in many cases, until they can be replaced by another animal, such as a calving heifer that has been bred specifically as a replacement.

The costs of such culls can be readily calculated as the cost of the replacement plus the cost of any loss of income from the reduced milk yield of a first lactation heifer compared to the mature cow being culled, minus the salvage value of the cow and any reduced feed provision required for the incoming replacement. There are other incidental costs and savings, but in general, the cost of such a cull is minimized by choosing when to cull it. Indeed, on many dairy farms, the culling decision is based on the availability of replacements such that if there is a plentiful supply of high quality heifers coming in to the herd, the culling rates are high. This high turnover helps maintain herd health and genetic improvement. However, the cost of such a replacement policy should never be underestimated.

If a cow has to leave the herd in an emergency, rather than at a time chosen by the availability of a replacement, the costs of culling are very much increased. This is because there is a production gap between the disposal of the emergency cull and the arrival of the replacement. Thus, if a cow becomes sick soon after calving, and has to be culled as an emergency, the cost of the cull is exaggerated by the lost lactation. The loss may be mitigated by recovering some salvage value, and saving on feeding the animal that has

been culled, but the overall cost of the cull is approximately doubled compared to a cull that manages to survive its current lactation.

If a cow dies in early lactation, the cost of the cull is exaggerated even more, as the salvage value is lost, and in many circumstances, there is an added cost for disposal. There is a common saying amongst livestock farmers that “where you have livestock you have dead stock”, but in reality, the rate of deaths and casualties on farms is widely variable, indicating that premature, unplanned death is not an inevitability of dairy farming.

Potential data sets to measure and monitor forced, early lactation culls exist but are rarely analysed and generally do not form part of the routine health and productivity monitoring system of commercial dairies. Such systems are now evolving as a response to the escalating cost of deaths and forced culling on farms, driven by high replacement costs and increased risks.

A large project involving 843 dairy herds in the North of England involved veterinary practitioners or trained consultants collecting and entering culling data into a central database, including the reason for the cull and whether the cull left the farm at the end of its lactation, as an emergency, or as a death on farm. The data were collected and entered into myhealthyherd.com, a web based health planning tool that includes a system to record and analyze culling data and perform a culling audit. The data is collected and presented in tables as shown in Table 1.

Table 1: Typical culling audit of a 200 cow herd showing the reasons for the overall 26% culling rate: 9 cows died on the farm (4.5% of the herd annually) and 11 cows (5.5%) cows were culled as emergencies. Thus, 20 of the 52 cows culled were sick, deaths or casualties.

	Culling reason	Sold live / end of lactation	Emergency / early lactation	Deaths
?	Fertility	15	N/A	N/A
?	Abortion	3	N/A	N/A
?	Mastitis / udder	8	2	1
?	Lameness	2	3	0
?	Sick / injury	4	4	4
?	Old age	0	N/A	N/A
?	Yield	0	N/A	N/A
?	Notifiable diseases	0	0	0
?	Downer / recumbent cows	N/A	2	2
?	Casualties	N/A	0	2

The data allowed an economic cost to be calculated for each farm and a comparison between farms. This data showed that the participating farms had an overall average (mean) culling rate of 23% per year with the lowest quartile having a culling rate of 10% and the highest quartile having a culling rate of 32%. However, economic evaluations showed that the overall cost of culling was not directly related to the overall culling rate, but the reasons for culling, the stage of lactation when the animal was culled, and the salvage value of the cull. Overall, in this group of dairy herds, over 23% of the culls left the farm as casualties or deaths, equating to an average of 5.3% of the herd. The variation between herds was large.

Figure 1 shows the culling rates of cows in the first 100 days in milk in 500 herds that record milk yields and production data with National Milk Records. The reasons for cull of these animals are not known, but the fact that they left the herd within 100 days of calving implies that their exit was forced. The data shows wide variation between herds, from 0% to over 20% per year. The top 25% of herds cull less than 3% of the herd within 100 days of calving, indicating an achievable target.

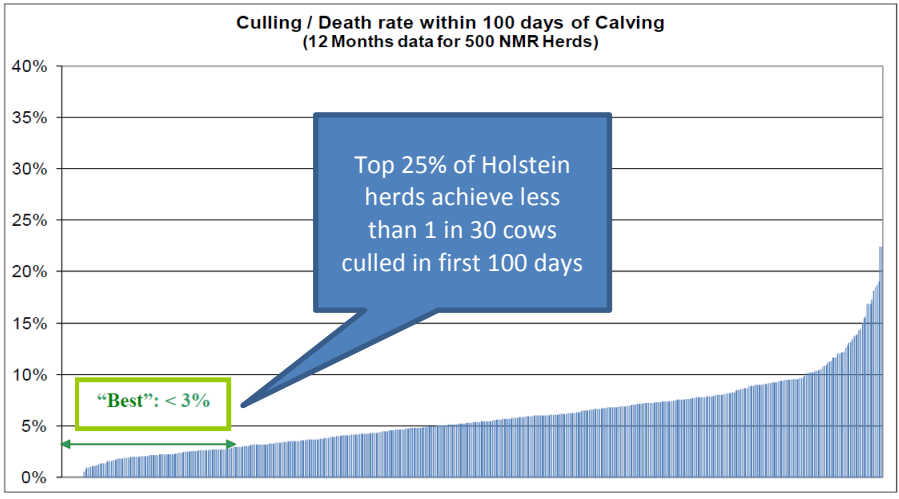

Figure 1: Rates of culling within 100 days of calving of 500 milk recorded herds: most of these cows would have been casualties, injuries or sick cows with poor prognosis.

Further investigations have shown that herds that suffer high rates of emergency culling due to sickness, casualties and deaths and which have limited incoming replacements suffer further losses due to having to retain animals that they would rather cull. Poor quality animals, chronic mastitis cases, and sub-fertile animals are retained in order to keep herd numbers stable, and the long term effect is to reduce the overall quality of the herd.

■ Casualties And Deaths In Early Lactation

During the UK BSE crisis between 1996 and 2006, any bovine over 24 months old that either died on farm or had to be slaughtered on farm, had to be reported to the authorities who collected the animal and tested its brain for BSE as part of a national active surveillance programme. The reasons for death or emergency slaughter were collected at the time of the notification and the data pooled. Analysis of six months' data for the year 2006 shows that over 25% of the 106,000 deaths and casualty slaughterings were due to calving injuries or downer cows: and this is generally confirmed by anecdotal enquiries on farms with high emergency culling rates. The single most important reason for premature death is dystocia and perinatal recumbency, often associated with sickness or injury. The downer cow is typically a periparturient animal or in very early lactation, as this particular animal is at high risk of the causes of recumbency.

■ Diagnosis And Prognosis Of The Downer Cow

The cow that is unable to rise unaided, or unable to stand and move freely is not able to cope with normal productive functions within a dairy herd and becomes a burden to the herd as well as a major welfare issue. The recumbent cow requires constant attention, intensive nursing and skilled, dedicated workers to care for its needs. Such resources are often unavailable on modern commercial dairies, and the poor prognosis of these animals means that they most commonly become a casualty cull.

Downer cows can be divided into four groups according to their cause:

- Traumatic
- Neurological
- Metabolic
- Toxic

Traumatic

Traumatic recumbency is the most common cause of downer cow syndrome: these are cows that have suffered some sort of injury, or have become confined or entangled in a situation that prevents them from rising to their feet. Most of the traumas involved are skeletal, although direct damage to the motor nerves that supply key muscle groups that are required to provide the herculean power required to raise some 500 kg of cow to its feet, is not uncommon.

Injuries to the pelvic skeleton and limbs are the most common cause of traumatic recumbency, particularly in periparturient females and those in estrus. The pelvic frame of the modern dairy cow is not tolerant of excessive abduction, and dislocation of the hip joint, or fracture of the proximal femur is often a consequence of “doing the splits”. Lateral dislocation of the knee can also occur, with rupture of the medial collateral ligaments. These cases carry a very poor prognosis, and although heroic attempts at correcting dislocated hip joints can be attempted, they rarely bring a complete cure with the return of such mobility to allow a normal productive life.

Other direct traumas to the musculature of the hind limb can occur, mostly as a consequence of slips and trips. Because of the way that cows normally rise to the standing position, damage to the hind limbs is much more likely to result in recumbency than damage to the front limbs. The musculature of the hind limb is poorly developed in dairy cows, which seem to be much more predisposed to hind limb trauma than beef breeds.

Neurological

Traumatic injuries to the lower spine which cause dysfunction of the lower part of the spinal cord or spinal nerves are not uncommon and create a more difficult diagnostic challenge for veterinarians. Disruption of the nerves supplying the pelvic limb causes a recumbency that can be difficult to define by neurological examination of a large animal that is reluctant to move or be moved. Even if there is no neurological disruption, the pain of spinal injury can be enough to prevent a cow rising. Careful observation and examination of the spine, looking for abnormal swelling, heat and pain may make deep injuries evident, but the prognosis of these cases is difficult to determine, other than by administering effective analgesia and monitoring progression or regression over time.

Direct trauma to the lumbosacral plexus can occur, particularly as a result of dystocia. The close proximity of the nerves in this complex to the pelvic canal makes then particularly vulnerable to pressure and trauma while oversized calves become trapped or are pulled through the pelvic cavity. Such trauma may be unilateral or bilateral, and may result in a severe, temporary or long term partial or total paralysis of one or both hind limbs.

Pain, particularly of the limbs, can cause cows to be recumbent. Severe foot lameness involving hind limbs or all four feet can be a direct cause of recumbency. It is known that cows suffering chronic pain, such as from a foot lesion, have lower pain thresholds for other sources of pain, and so are less inclined to subject themselves to the risk of pain, avoiding it by remaining recumbent.

Central neurological dysfunction is not uncommon; sporadic cases of listeriosis or botulism can cause recumbency. These conditions generally involve other neurological signs and can be diagnosed by careful examination.

Metabolic

Hypocalcaemia, known commonly as milk fever, has traditionally been the first on the list of differential diagnosis for the downer cow. The acute drop in blood calcium at or around calving due to the failure in calcium mobilization starves the muscles of calcium necessary for their function. Classical milk fever is now uncommon, mainly due to a better understanding of calcium dynamics and the use of dietary cation anion balanced diets in dairy cows prior to parturition.

Subclinical hypocalcaemia is now more common, which may result in prolonged recumbency, which responds poorly to the traditional parenteral injection of calcium salts but can be controlled by slow release oral calcium boluses. Blood calcium estimations are now cheap and easy to perform and make diagnosis of hypocalcaemia straightforward.

Hypophosphatemia is also uncommon, and the diagnosis of the “bright sitter” can no longer assume to involve phosphorus deficiency. Subacute ruminal acidosis and a subsequent metabolic acidosis can alter the calcium balance in the cow, creating recumbency in cows that can be at any stage of pregnancy or lactation. Indeed, a sudden change in diet can induce recumbency due to metabolic disturbance at any stage, and so a diagnosis of hypocalcaemia or hypophosphatemia should not be discarded simply because the cow is not periparturient.

Toxic

Now one of the most common causes of recumbency that creates a diagnostic challenge is toxemia caused by disease or metabolic dysfunction. Endotoxemia subsequent to *E. coli* mastitis is one of the most common causes of periparturient recumbency that is commonly confused with hypocalcaemia. These cows may be recumbent for many days after the inflammation in the udder resolves, as systemic endotoxins and their effects outlast the local clinical signs. There is some suggestion that some specific endotoxins are neurotoxic, causing a specific paralysis: many of these cows appear bright and well, yet are unable to rise from recumbency.

Other systemic infections can cause recumbency, and post mortem examination often discloses the most severe infections such as peritonitis that have existed in the cow without being specifically diagnosed. The cow seems

particularly resilient to infections, and can hide specific clinical signs from the most attentive veterinary surgeon.

■ High Risk Cows

While the periparturient cow is at particularly high risk of all the causes of recumbency and the diseases and conditions that predispose to recumbency, other cows can also be at high risk. Individual animals or groups of animals may be at particularly high risk of trauma and injury leading to recumbency with a poor prognosis because of their social order, their behaviour, their hormonal state, their inability to cope with the environment that they are required to live in, or a chronic debility that makes life in a commercial dairy herd challenging.

- Heifers – new heifers introduced into the herd are often bullied, or suffer metabolic stresses due to improper feeding.
- Cattle in estrus – bulling behaviour predisposes cows to injury, particularly slipping and tripping if the environment is unsuitable to cater for their hyperactivity.
- Subordinate cows – those low in the pecking order, or newly introduced into an established group have sometimes violent interactions with more dominant cows, leading to injuries, slips and trips and severe injuries that may result in recumbency or debility.
- Old and infirm – any cow that is already debilitated by its age or physical condition is predisposed to injury if the environment is not suitable. Lameness is a particular debility that predisposes cows to further injury: in particular, chronic pain from lameness lesions is known to lower the pain threshold of the individual, so that affected cows make extraordinary efforts to avoid further trauma, and unfortunately, often predispose themselves to further injury.

Every dairy herd will contain high risk cows – they are an inevitability of modern dairy farm husbandry. However, some herds will have more than others, and even within herds, there will be times when the proportion of high risk cows in the herd is higher than at other times, such as in seasonal calving herds, or herds with a high culling rate and a high proportion of heifers.

The presence of high risk cows is not necessarily associated with a high incidence of deaths and casualty culls: the risk to these animals can be minimized by proper husbandry and the provision of an environment that caters for their needs.

■ High Risk Places

The environment provided for a cow should always minimize the risk to its health and wellbeing, allowing it to express normal behaviour and physiological function without risk of injury or disease.

The modern, well designed and well managed dairy farm can provide an excellent environment for dairy cows, but there can also be significant challenges to high risk cows where the environment creates high risks:

- Inoculation points – areas where high pathogenic challenges can overcome the resilience of the high risk cow to infections
- Slippage areas – where slippery surfaces make normal locomotion or stability at rest difficult
- High traffic areas – where cows are unable to plot their passage and become crowded or congested
    - Feeding areas
    - Collection and handling areas
    - Entry and dispersal areas
- Trauma and injury points, where structures cause direct injury or trauma
    - Damaged surfaces or rough concrete that traumatize feet
    - Cubicle / free-stall structures and design causing discomfort or direct injury
    - Neglected or damaged equipment such as automatic scrapers, feeders, handling squeezes etc.

Concrete provides a potential for a high risk environment on any dairy farm, and particularly in the areas of high risk such as high traffic areas. Slippery concrete is a particular hazard for high risk cows, made considerably worse if it is sloping, smooth, or smeared with fecal contamination. Conversely, rough or damaged concrete is highly damaging to cows' feet, creating more high risk cows as well as directly causing lameness.

■ Identifying High Risk Places – Tracking The "Unlucky Cow"

A simple and methodical system to identify high risk places for high risk cows on a dairy farm is to physically follow the pathway of the "unlucky cow". The unlucky cow may be the fresh calved heifer that has had a prolonged, painful, calving and joins the herd feeling frail and fearful, confronted by unfamiliar surroundings and fellow cows intent on maintaining their social position. This unlucky cow has to cope with the physiological and metabolic changes

associated with lactation as well as the social upheaval of moving into what can be an inhospitable environment.

Following the passage of the unlucky cow from the calving area to her first milking experience and then into the feeding and rest areas will demonstrate specific high risk places such as:

- Heavily contaminated pre-calving accommodation that provides a high risk inoculation point for mastitis
- Confined or inappropriate calving boxes and pens: heifers in particular have higher rates of dystocia if calved alone, segregated from their fellow animals
- Poor calving box surfaces such as slippery concrete or a contaminated environment leading to environmental mastitis
- Inappropriate transitional feeding and husbandry predisposing to metabolic upsets and displaced abomasum
- Slippery or tortuous passages from calving areas to milking parlors and feeding points
- Poor surfaces in collecting yards, parlor entrances and exits (particularly where there is congestion or acute turns.
- Poor cubicle / free-stall design and husbandry reducing lying times, predisposing to environmental inoculation, or causing direct trauma or injury
- Insufficient or inadequate feeding areas, limiting feed access, reducing forage intakes or predisposing to bullying at the feeder
- Slippery surfaces such as smooth, sloping or smeared concrete, particularly in areas where stable mobility is required such as corners and congestion points and where there are unavoidable social interactions.
- Inadequate or poorly designed handling and treatment areas such as foot baths, foot trimming areas, AI holding pens (where there may be several cows in estrus and showing hyperactivity) etc.

In most situations, any high risk places can be readily identified and the risk to the “unlucky cow” reduced. Simple structural alterations can often be the remedy, but where the inherent design or structure of the environment cannot be readily corrected, strategic changes may have to be considered to avoid high risk cows living in high risk places.

Examples Of Separating High Risk Cows From High Risk Places:

- Provide fresh calved cows the very best accommodation possible, using less than adequate housing and accommodation for low risk cows such as late lactation and early dry cows.
- Groove concrete areas that are slippery, sloping, smooth or smeared.
- Lay suitable rubber matting in high traffic areas, congestion points, or turning zones or where there are damaged concrete surfaces that cows cannot avoid.
- Provide any cow that has had a prolonged or traumatic calving with special care, including analgesia until they are fit and strong enough to face the rigors of daily life in a dairy herd.
- Allow adequate feed space so that even the most reluctant, subordinate cows can feed at any time without fear or injury.
- Separate cows in estrus and provide them with areas where their behaviour is not a threat to themselves or their fellow cows.

Conclusion

Casualty culls can be a major economic loss for dairy farms, as well as a concerning welfare issue. Deaths, fatal disease and irreparable injuries are not an inevitable part of modern dairying and many farms have very low rates of casualty culls.

The highest risk animals in the herd can be identified, and managed to avoid the risk of the causes of casualty culling.

High risk places within the farm can be identified and modified economically and effectively to reduce the risks of death, disease and injury.

An annual culling audit will demonstrate the current rate of casualty culls and the economic costs of these culls, as well as monitoring progress and the economic benefits once high risk cows and high risk places have been properly managed.

Reference

Orpin, P.G. and R.J. Esslemont. 2010. Culling and wastage in dairy herds: An update on incidence and economic impact in dairy herds in the UK. Cattle Practice. 18: 163-172.

NOTES