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Michael W. Brunt
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Dr. Michael W. Brunt is an animal welfare researcher exploring the human barriers to improving the lives of animals. He completed his BSc in Zoology and MSc in Population Medicine from the University of Guelph. His PhD in Applied Animal Biology from the Animal Welfare Program at the University of British Columbia sought to understand the social licence to use animals for scientific purposes and the role of institutional transparency. Dr Brunt is currently working as a SSHRC Postdoctoral Research Fellow and NSERC Postdoctoral Research Scholar in the Department of Population Medicine at the Ontario Veterinary College. His principal research interests involve improving the lives of animals under human care, understanding public attitudes to animal uses, ethics of animal use, transparency of animal use practices, and the social licence to use animals. His current research focus analyzes how veterinarians and dairy farmers view their role in promoting positive welfare states and if there are constraints to the implementation of positive experiences for animals within the practice of veterinary medicine and industrial agriculture. Additionally, if an inability to influence positive welfare states in animals may be detrimental to the mental wellbeing of veterinarians and caregivers of animals, and vice-versa, if poor mental health for these groups may also interfere with their perceived capacity to intervene on behalf of the animals.

Michael W. Brunt
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The evolving role of a veterinarian in cattle welfare?

Improving cattle welfare

Bovine veterinarians are interacting with cattle on a daily basis and have traditionally improved the welfare of these animals through routine herd health monitoring and the rapid diagnosis and treatment of disease. Over the last decade there has also been a growing interest to mitigate the pain experienced during routine procedures (Winder et al., 2016).

The frequent interactions between veterinarians and farmers allow for trusted, long-term relationship development. These trusted relationships make veterinarians influential members of the farm team who not only guide decisions pertaining to animal health (Swinkels et al., 2015) but also animal welfare (Wolf et al., 2016). However, time is a precious resource, and veterinarians frequently triage how best to influence the lives of cattle.

In addition to diagnosis and treatment of diseases, the improvement of preventative herd management practices (e.g., biosecurity, vaccine protocols, transition cow care, new calf care) offers opportunities to prevent animal suffering. It is important to note that dairy farmers expect veterinarians, with whom they have a trusted relationship, to communicate animal welfare issues (e.g., lameness, hock injuries, and disbudding practices) that are noticed on farm (Croyle et al., 2019).

What is positive welfare?

The scientific comprehension of the lived experiences of animals has profoundly advanced over the last 15 years. Many animals have the capacity for both positive and negative experiences. Rault and colleagues (2020) describe how animal welfare improvement is not just based on what the animal suffers from or lacks, but also on the welfare benefits of providing opportunities for positive experiences. Withholding these opportunities might not necessarily cause suffering, but it denies the potential for positive welfare.

Positive experiences could lead to feelings of enjoyment, pleasure, happiness or contentment through activities such as play, autonomy, social contact, maternal bonds or calm respectful human interactions.

The relaxed demeanor of many cows in a barn with an automatic milking system (AMS) is striking. The agency to decide when to get

milked may decrease stress and anxiety for some animals. Research has been conducted in some areas to ascertain how motivated cattle are to access certain resources that could provide positive experiences. Cows are highly motivated to access and use mechanical rotary brushes (McConnachie et al., 2018) even if this resource is not equally valued by all animals. One of the speakers from the 13th Boehringer Ingelheim Expert Forum presented her research detailing how cattle also readily make use of stationary brushes (Van Os et al., 2021). Growing research has also shown that calves and cows are both highly motivated to access pasture (von Keyserlingk et al., 2017; Whalin et al., 2022) and that cows are highly motivated to reunite with their calf (Wenker et al., 2020). The group housing of calves has also shown to be associated with increase in play behaviour (Duve et al., 2012), cognitive performance (Meagher et al., 2015), and decreased avoidance of new foods (Costa et al., 2014). The understanding of how the engagement in positive experiences impacts cattle is continuing to expand.

What is the veterinarian's role?

We asked veterinarians and veterinary students in Canada how important the role of a veterinarian is to promote practices that influence the experience of dairy cows (Brunt et al., 2023). While all practices discussed were seen as important practices to minimize negative experiences were most important, a balance of positive and negative experiences was less important, and encouragement of positive experiences scored lowest.

Participants were also asked to explain their answer regarding the perceived role of a veterinarian in the promotion of dairy cattle welfare. Four themes were described and centered on: the animal, the producer, the veterinarian, and society. The promotion of positive experiences was also less important than decreasing negative experiences for our participants. Four themes were described to explain this answer and centered on: frameworks to compare positive and negative experiences, impacts on the animal, the participant's view of their role, and the practicality of implementation. Overall, we found modest differences in valuing avoidance of negative vs. promotion of positive welfare. We found no differences in the quantitative analyses between veterinarians and veterinary students. In this study veterinarians were favourably disposed to positive aspects of welfare for dairy cows but may be more focussed on avoidance of negative aspects of welfare.

What do veterinarians think about positive welfare?

We asked the same veterinarians and veterinary students about their attitudes, perceived professional normative values, and perceived ability to promote positive welfare for dairy cows (Brunt et al., 2024). The participants had very favorable attitudes and perceived favorable values in the veterinary community towards positive welfare opportunities for dairy cows. We identified three themes in the answers provided to justify the professional normative values: influences from within the veterinary profession, influences from outside the veterinary profession, and personal views of participants. Our participants were confident that veterinarians could suggest positive welfare opportunities for dairy cows. However, there was uncertainty that the decision to suggest these opportunities to producers was within a veterinarian's control.

Additionally, the participants were not confident that implementation of positive welfare opportunities was under a veterinarian's control. The barriers to veterinarians promoting positive welfare opportunities for dairy cows were centered around three themes: not practical to implement, resistance to change, and concern for the animal. Concerns were raised by participants that many positive welfare opportunities were impractical or expensive to implement on a dairy farm. In this study we established that positive attitudes and positive professional values exist in the veterinary community towards positive welfare for dairy cows, but much uncertainty exists regarding a veterinarian's ability to influence change to current practices.

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Donal Lynch

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Donal Lynch MVB Cert DHH. Qualified as a veterinarian from University College Dublin in 2000. With a keen interest in Irish farming systems and production he went to work as a clinical veterinarian in Tullamore where he is now the owner manager of a 10 vet mixed practice. The bovine farms within the practice are predominantly seasonal grass based systems and are either dairy or beef. Other interest areas within the practice include ovine, equine and companion animal. Donal also runs a hobby farming enterprise with suckler beef cows and breeding ewes.

Providing a service to the clients of the practice and the animals under their care is the key reason for the practice.

Education is another area of interest with Donal being involved in delivering practical farmer training and continuing professional development training for veterinarians. He is one of the organisers of Vet24, the 2024 Irish national veterinary CPD event.

Donal Lynch
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Cow preparation to calving

A cow calving is the culmination of a lifetime of preparation for the event. Our aim as veterinarians is to facilitate the farmer to manage this event and preparation for same to ensure a smooth calving that results in a live healthy calf from a healthy cow in the most welfare friendly manner possible.

This journey begins with the breeding of a suitable maternal replacement heifer be it for the dairy or the beef system. In this we will need to select breeding animals with appropriate maternal traits, these will include docility, pelvic size, ability to eat, production of milk including colostrum of a high quality.

This heifer will then be managed through her life to ensure she achieves an appropriate bodyweight at calving which will require attention to detail in all aspects of her life including disease control and nutrition.

When we come to the last trimester of pregnancy there will be opportunity to effect changes and interventions to enhance the outcome of the calving process.

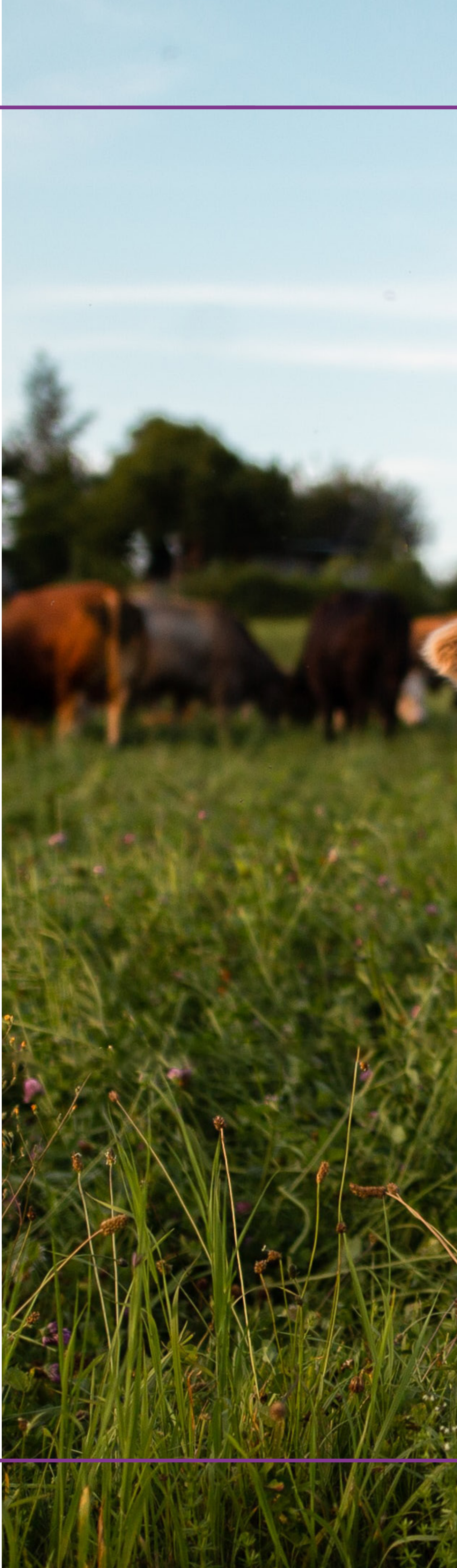
Cow condition is going to be critical where we want a cow fit not fat for calving. A body condition of 3.25 is optimal. Interventions to effect change here need to be made early in the 3rd trimester. If a cow is over conditioned she can be dried off later or restricted somewhat in the early dry period. A beef cow could be weaned later. For the underconditioned cow we need to supplement feed from far out in the dry period, consider early dry off or weaning in the beef cow. However all this being said as we approach the calving we need to supplement a higher energy feed to ensure that we have enough energy and protein in the diet to supply the requirements for the calving process and the constituents of a good quality colostrum. The mineral content of the diet is fundamental at this stage to prevent milk fever and subclinical milk fever from calcium availability deficiency at and around calving. Other mineral are relevant at this time and would include iodine, copper and selenium. The mineral imbalances that are relevant at this time will vary widely in different parts of the world and in different farming systems.

Cow preparation to calving

Hygiene at calving is paramount to reducing neonatal disease but also to reduce maternal infections. There are two major sources of contamination, the environment and the cow herself. The environment needs to be clean, well maintained and most importantly dry. Effort needs to be put in with the cow to reduce the risk of her introducing infection to the calf. This includes parasite control, management of hide contamination and housing environment approaching calving.

There are also a number of interventions that should be considered during this period. Vaccines to prevent neonatal calf diarrhoea, mineral supplements to enhance neonate and maternal health and parasite treatment as required should be considered.

The preparation of the dam in the approach to calving needs to include appropriate handling to facilitate a stress free calving line is fundamental for the cow to be comfortable with human interaction. However when she enters labour she should be afforded a quiet calm secluded area to calve, this will greatly contribute to a smooth stress free calving resulting in the best chance for the calf and the cow.



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Dr. Creutzinger is an assistant professor of dairy science in the Department of Animal and Food Science at the University of Wisconsin-River Falls. There, she teaches dairy production and animal welfare and performs basic and applied research aimed at improving the lives of dairy cattle. Her expertise is in transition dairy cows, non-replacement calves, and animal welfare.

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Designing a maternity pen

Calving is a key component of dairy production. Dairy cows give birth approximately once per year to initiate lactation for milk production. Parturition, or calving, is accompanied by changes in behavior and needs that are different from that of lactating and non-lactating (i.e., dry) cows. As cows approach calving, they have a greater number of transitions between standing and lying (cite), take more steps (cite), and seek isolation by increasing their distance to other cows in their social group and utilizing features in the environment that provide cover (cite). It is hypothesized that the behavior of dairy cattle changes due to physical discomfort of labor and to find a desirable area to give birth.

Figure 1. Cows in a group maternity pen (100 ft2/cow) have a calving blind centered in the middle of the pen, made from road barriers. There was a preference for calving next to the blind (Creutzinger et al., 2021)

Despite the specific behavioral needs at calving, calving pens have been designed with a human-centered approach to facility ease of management and cleaning. We should instead focus on designing calving pens from the cow's perspective. Research from the last 10 years has found that dairy cows have retained the motivation to isolate at calving by using 'blinds' for seclusion and distancing themselves from other cows when possible. For example, cows preferred to calve next to a solid barrier compared to an open area in group calving pens (Figure 1; Creutzinger et al., 2021) and behind a covered area of an individual calving pen that faced a larger group pen (Figure 2; Proudfoot et al., 2014a).

A recently published study investigated using firehose to create a calving blind that was durable and easily cleaned (Figure 3; Olsen et al., 2024) and found that 43% of cows gave birth inside one of the blinds. Cows also physically distance themselves from other cows at calving when given the space. For example, cows with 200 ft2/cow spent more time away from other cows than those

Figure 2. Cows in an individual calving pen with plywood covers on both sides and blocking half of the view to the group maternity pen. Eighty percent of cows gave birth on the side with the plywood cover (Proudfoot et al., 2014.

in pens with 100 ft2/cow as calving approached (Figure 4; Creutzinger et al., 2021). Providing cows with a calving blind and increased space allowance also results in less time walking prior to calving and a shorter labor duration (Creutzinger et al., 2021). Increased space per cow and environmental variation in calving pens that provide opportunities for seclusion have the potential to improve welfare during calving.

While providing a blind in calving pens allows cows to perform motivated behaviors, there are environmental factors that should be considered. One design element to consider is the number of resources per cow in group pens. For example, two studies with the same pen and blind design found that when the cow:blind ratio was 1:1, 52% of cows gave birth in a blind (Rørvang et al., 2018) but when the ratio was two cows per one blind only 10% of cows gave birth in a blind (Jensen and Rørvang, 2018). Further, Proudfoot et al. (2014) found that cows preferred giving birth in a shelter in a group pen but only when housed without a penmate. A recent study found that cows were more likely to calve inside a blind as the number of cows in the pen increased but this may have been influenced by the large blind which allowed two cows to comfortably fit inside at the same time (Olsen et al., 2024). When designing group maternity pens, it is important to provide enough resources per cow to reduce competition over their use.

Location of the maternity pen is another important factor to consider during its design. Two studies have found that cows were more likely to calve inside a calving blind during the day than at night (Olsen et al., 2024; Proudfoot et al., 2014). Both authors hypothesized that cows may have sought additional shelter during the day when there was increased human activity compared to at night. Maternity pens should ideally be in a low-traffic area away from high activity (i.e., the milk parlor). However, if calving pens are placed in a high traffic area, blinds should be utilized for increased seclusion for cows. The installation of cameras to monitor the maternity pen can

Figure 3. Calving blinds were installed in a group maternity pen at the back of the pen. Fire hoses were hung from a metal frame to create full visible separation (left) or partial visible separation (right). Forty-three percent of cows gave birth in a blind. Of the cows who gave birth in a blind, 64% and 36% calved in the full and partial visibility blinds, respectively (Olsen et al., 2024).

Figure 4. Calving blinds were installed in a group maternity pen at the back of the pen. Fire hoses were hung from a metal frame to create full visible separation (left) or partial visible separation (right). Forty-three percent of cows gave birth in a blind. Of the cows who gave birth in a blind, 64% and 36% calved in the full and partial visibility blinds, respectively (Olsen et al., 2024).

also be used to monitor the progression of labor without disturbing the cows.

The key to providing a good maternity pen is to create opportunities for seclusion, provide at least 150 ft2/cow, and place the pen in a quiet area of the barn. Finally, one of the best ways to improve animal welfare is by providing multiple options from which cows can choose. Individual variation in seeking seclusion, the amount of seclusion, and distance from other cows has been repeatedly demonstrated in research. There is no ‘one size fits all’ option for animals in our care. By providing multiple options in the calving pen, the needs of many animals can be accommodated. References

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FARM ANIMAL WELL BEING

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Emma is a postdoctoral researcher at the Department of Animal and Veterinary Sciences at Aarhus University currently working with positive animal welfare and the connections and trade-offs between animal welfare and sustainability. She did her PhD on the welfare implications of prolonging cow-calf contact in the dairy production. Using both behavioural observations and motivational tests based on operant responses, she investigated the maternal behaviours and motivations of dairy cows. In her current work, she utilises the opportunity to combine her skills gained during her PhD with her skills gained during her Master studies in ecology, biodiversity, and evolution. Through her work, Emma aims to better understand the behaviours, needs, and wants of animals based on their ecology, evolution, and motivations.

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Maternal behaviour in cattle

This paper was co-authored by Heather W. Neave (Department of Animal Sciences, Purdue University, USA) and Margit Bak Jensen (Department of Animal and Veterinary Sciences, Aarhus University, Denmark)

Cattle is a gregarious species with precocial offspring, meaning that newborn calves are highly mobile. This increases the risk of mixing of offspring, and cows must therefore be able to recognise their own calf from others to form an exclusive bond and avoid investing resources in unrelated young (Kendrick et al., 1997). Cows are motivated to isolate themselves from the herd before calving, which likely facilitates the opportunity to form the exclusive bond, though the exact motivation for isolation is still unknown (Rørvang et al., 2018).

As the calf grows older, the distance between cow and calf gradually increases and the suckling bout frequency decreases (Vitale et al., 1986). The natural weaning age, i.e., when the calf becomes completely independent of the dam's milk, remains unclear but is estimated to be between six and eleven months (Flower and Weary, 2001; Johnsen et al., 2015).

Dairy production and cow-calf-contact systems

In conventional dairy production, cow and calf are typically separated within hours of calving. The welfare implications of this procedure receive increasing interest (also by consumers; Busch et al., 2017; Hötzel et al., 2017), and as an alternative, cow-calf-contact (CCC) systems are being developed. Cow-calf-contact systems includes any management system where calves are reared with some degree of cow contact. The amount and type of contact provided by these systems varies from full-time contact to highly restricted contact, and from calves being reared by their dam to calves being reared by foster cows (reviewed by Johnsen et al., 2016).

Providing calves with cow contact has multiple benefits, e.g., increased growth and reduced abnormal behaviour of the calf. However, little research has focused on the cows' benefits (reviewed by Beaver et al., 2019; Meagher et al., 2019). Keeping cow and calf together also comes with challenges, namely reduction of saleable milk yield and increased stress at separation

(Flower and Weary, 2003). One solution is to provide only part-time CCC (Bertelsen and Vaarst, 2023), which is suggested to increase amount of saleable milk and better prepare cow and calf for separation. In our studies (Jensen et al., 2024b), we therefore aimed to investigate the maternal motivation in dairy cows and compare the motivational strength between cows with full- and part-time calf contact.

Maternal motivation in cattle

Motivation can be assessed in multiple ways; observing which resource the animal utilises the most in a free or discrete choice test can give an indication of preference (e.g., dairy cows' preference for lying surfaces; Schütz et al., 2020). However, to quantify the animal's motivation, consumer-demand approaches involving operant conditioning are more useful (e.g., dairy cows' motivation to lie down; (Jensen et al., 2004).

In our study (Jensen et al., 2024a), we utilised the maximum price paid (MPP) method, where cows were trained to pass through a weighted gate to reach their calf. The weight on the gate was controlled using pressurised air. Following each successful passing, the weight on the gate increased. If a cow failed to reach her calf in two consecutive tests, we interpreted it as her having reached her maximum price, and she was excluded from further testing. Using this method, we compared the maternal motivation of cows having either full-time (23 h contact/d), part-time (10 h contact/d), or no calf contact (separated from their calf 48 h after calving).

From behavioural observations (Jensen, 2024), we found that part-time cows spent less time nursing and grooming their calf compared to full-time cows. Nevertheless, we found no difference between the treatments on the level of exclusivity (i.e., whether a cow allowed calves other than her own to suckle), nor on the amount of nursing taking place in the inverse parallel position (Figure 1), which has been suggested as a proxy for maternal-filial bond strength (Le Neindre, 1982).

Similarly, in the MPP test, we found no difference in the strength of the maternal motivation between full- and part-time cows, while the MPP of the no-contact

Figure 1. The inverse parallel position. The cow is able to reach the calf's hindquarters during nursing, allowing her to sniff and recognise which calf it is.

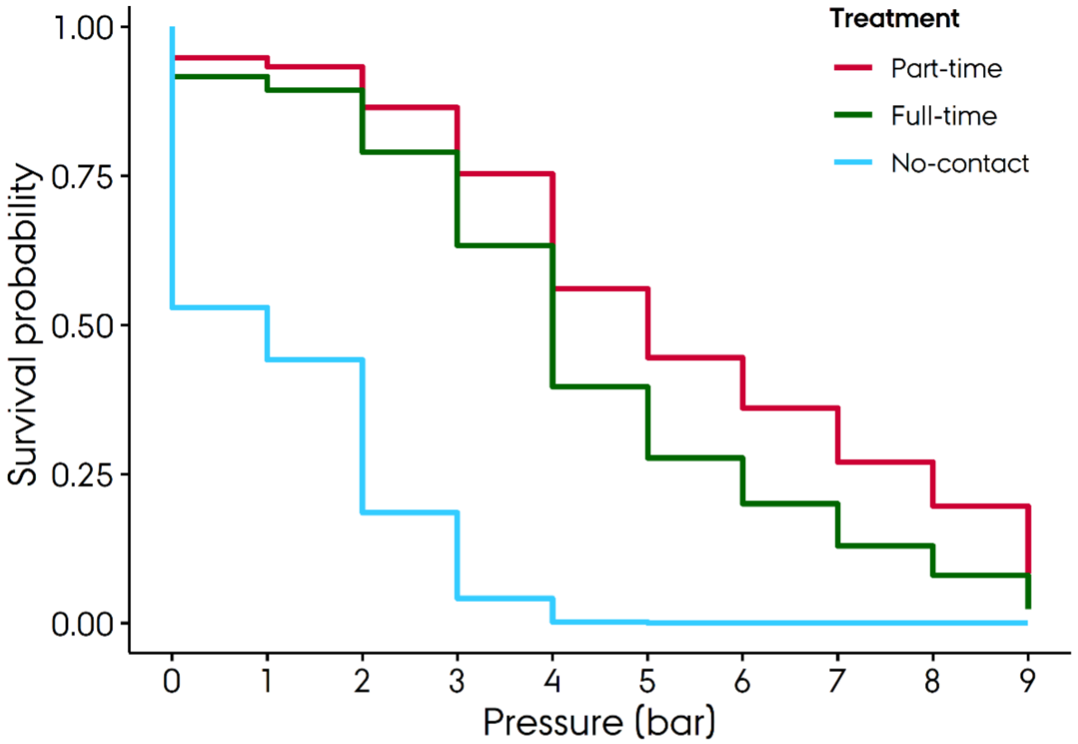

Figure 2. Results from maximum price paid test. The y-axis describes the probability of a cow continuing on to the next price point (measured as resistance on the weighted gate in bar). There was no difference found between cows with full- and part-time calf contact, while cows with no calf contact had low probability of reaching higher prices, interpreted as lower maternal motivation.

cows was significantly lower than the other two treatments (Figure 2). Cows with only 10 h calf contact/d thus appear able to form maternal bonds of similar strength to cows with 23 h calf contact/d.

Welfare implications

As part-time contact may be more feasible for some farmers (Bertelsen and Vaarst, 2023), it is a positive finding that cows with part-time calf contact also formed strong bonds to their calf; access to a highly valued resource is expected to promote positive welfare (Boissy et al., 2007). However, the repeated separations of part-time cow and calf may be stressful, namely due to the strong maternal-filial bond (Roadknight et al., 2022). Indeed, cows with part-time contact were less optimistic in a judgement bias test compared to cows with full-time contact, which suggests a negative emotional stage (Neave et al., 2024b). However, whether this was caused by the repeated separations or other aspects of the treatment requires more research.

Additionally, whether part-time contact better prepared cow and calf for separation is unclear. In the first two days following complete weaning and separation, vocalisation rates did not differ between part- and full-time cows and calves (Bertelsen and Jensen, 2023; Neave et al., 2024a); however, other behavioural signs of separation stress in the first 48 h after separation were reduced in part-time cows (Neave et al., 2024a).

In conclusion, dairy cows housed with either full- and part-time calf contact both form strong bonds to their calf. This result supports the use of part-time systems as a compromise between early separation and full-time CCC. However, more research on the welfare implications of part-time contact is needed, both during the rearing period and following separation.

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FARM
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Laurent graduated from the National Veterinary School of Lyon (France) in 1993 and worked for 7 years in several veterinary practices in France, mainly on large animals. He joined Boehringer Ingelheim France in 2001 as a Technical Services Veterinarian providing scientific support to both Cattle and Companion animals products. In 2006, he moved to the Boehringer headquarters in Ingelheim, Germany to become responsible for the global technical support of the dairy cattle portfolio, with a special focus on mastitis therapy (UbrolexinÒ, MamyzinÒ, UbrostarÒ) and inflammation and pain (MetacamÒ).

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What analgesia for the calving cow?

Calving is a critical time for the health and welfare of the cow. An uneventful calving is a prerequisite for optimal development of the calf and to ensure good fertility in the subsequent breeding period. In contrast difficult labours requiring assistance for calf delivery, or dystocia, is known to decrease calf viability, to reduce milk yield and fertility in the cow (Mee, 2008; Barrier and Haskell, 2011) and to increase the risk of culling (Tenhagen et al., 2007). Additionally, losses are thought to increase with the degree of calving difficulty (Barrier and Haskell, 2011). Immediate effects may include vaginal or uterine tears, bleeding, or death of the cow. Post-partum effects include retained placenta, metritis, milk fever, and down cows.

Calving is painful for the dam

Labor is a potentially stressful and painful event, due to the uterine contractions that promote expulsion of the fetus, and inflammation of the uterine tract. (Mainau and Manteca, 2011).

During labor, neurotransmitters such as prostaglandins contribute to the sensitization of oxytocin receptors in the myometrium and the activation of nociceptive fibers, thus supporting the physiological role of pain.

Dystocia, and subsequent assisted calving, is recognised as being a painful condition. Assistance can vary from a farmer giving a quick pull, to a veterinary surgeon being required to carry out a caesarean section. The more severe the level of calving difficulty, the more assistance required and subsequent compromise on health and welfare.

Higher levels of haptoglobin concentration have been observed 5 days postpartum in animals with dystocia due to uterine torsion compared to animals with natural parturition (Schönfelder, 2005). Likewise, dry matter intake for cows that experienced dystocia has been observed to be lower 48 hours after calf delivery compared to unassisted cows (Proudfoot, 2009). Finally, cows requiring assistance have been found to spend significantly less time self-grooming than dams delivering naturally, which can be indicative of greater pain (Barrier, 2012). This may be due to local tissue damage and inflammation caused by a prolonged or severe assisted extraction.

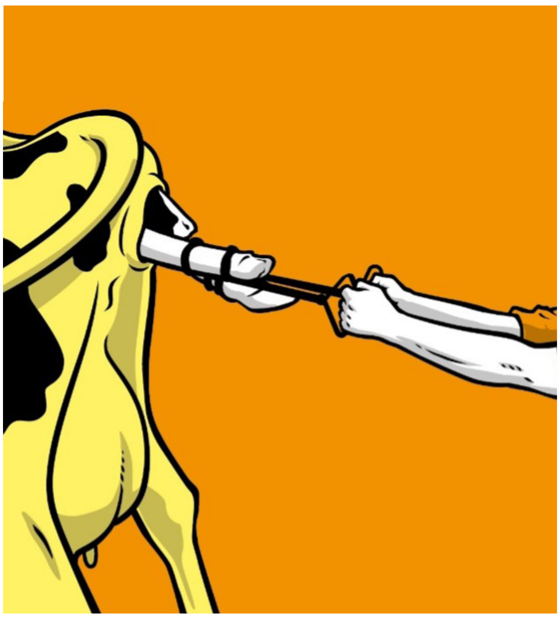
How to control labour pain?

The use of analgesics during labor is still questioned because of conflicting reports as to their benefits in controlling pain, their ability to maintain productive functions, their tocolytic effects, and the potential inhibition of uterine contractions that may prolong labor (Mota-Rojas et al., 2022).

Opioids and non-steroidal anti-inflammatory drugs (NSAIDs) have been shown to indirectly inhibit myometrial contractions by decreasing oxytocin secretion, while local analgesics decrease the number of contractions, although its intensity increases, improving maternal performance (Mota-Rojas et al., 2022).

NSAIDs are a class of drugs with anti-pyretic, anti-inflammatory and analgesic properties. They may play a therapeutic role in alleviating the impact of the inflammation and pain associated with parturition. However, despite their relatively common use by veterinary surgeons, only a few published studies have specifically focused on the benefits of NSAID therapy around parturition or to manage pain associated with assisted calving.

NSAIDs work through inhibiting the enzyme cyclooxygenase (COX), which has two main isoforms (COX-1 and COX-2) that modulate the inflammatory response. The selectivity of the NSAIDs has been associated with both benefits and complications for dams. In dairy cows, for example, administering NSAIDs of the inhibitor of COX-1 type produced adverse effects such as retained placenta, metritis, and culling, because COX-1 is constitutive and participates in diverse physiological functions. In contrast, preferential inhibitors of COX-2 have been related to benefits for the health and productivity of calving cows (Trimboli et al., 2020).



Which NSAID?

Flunixin

A number of studies have been carried out on the routine use of NSAIDs around calving with various outcomes. The effect of flunixin treatment after calving was evaluated by Shwartz et al. (2009) in 26 cows. None of the cows was recorded as having dystocia. Flunixin meglumine was administered daily for the first 3 days of lactation beginning at parturition. Flunixin did not improve production during the first 35 days in milk (DIM), and dry matter intake was reduced from 1 to 7 DIM. The authors concluded that, overall, flunixin treatment had no significant benefit.

In another study on over 1200 dairy cows (Duffield et al., 2009), flunixin meglumine was administered (fixed dose of 1.25 g for cows and 1.1 g for heifers) approximately 2 hours following calving with a repeat injection approximately 24 hours later. No significant effect of treatment was found on the risk of subsequent hypocalcaemia, displaced abomasum, clinical ketosis or mastitis, nor was there any difference in milk production, serum metabolic parameters or acute-phase proteins between the treatment groups. However, cows treated with flunixin showed a significant increase in both the risk of retained placenta and the risk of developing metritis.

Flunixin meglumine has also been shown to have a harmful effect on fetal viability. Newby et al. (2017) studied 34 Holstein cows treated with flunixin and 38 with a placebo, before and after calving. The results showed that the offspring of the animals treated with the flunixin 24 hours before parturition had higher mortality rates and an increased probability of placental retention and fever, coupled with lower milk production and a higher risk of metritis development.

On the other hand, in the paper from Giammarco,et al. (2018), multiparous cows having received a single injection of flunixin meglumine within 12 hours after calving had a significantly lower incidence of retained placenta than did control. Furthermore, a greater percentage of flunixin-treated cows were pregnant at the first insemination but no differences in overall milk yield, milk composition and dry matter intake were found.

More recently, a study assessed the effects of a single transdermal administration of flunixin meglumine in early postpartum cows (Schmitt et al., 2023). Regardless of parity, flunixin-treated cows were significantly less likely to abduct their tail from their body and show an arched back on the day after treatment, indicative of a reduced pain.

Ketoprofen

In contrast, in a large-scale study on 447 cows and heifers evaluating the benefit of treatment with ketoprofen after calving (including in cows with dystocia), animals treated with ketoprofen showed a reduced risk of retained placenta (Richards et al., 2009). Ketoprofen was given immediately after calving and again 24 hours later. There was no impact on other measures of uterine or reproductive health, post-partum disease, milk production or fertility.

Gladden et al. (2021) investigated the behavioural effects of ketoprofen administration in the immediate post-partum period on cows experiencing both assisted and unassisted parturition. Cows treated with ketoprofen spent less time in lateral recumbency, independent of assistance status. Additionally, cows treated with ketoprofen spent more time with the head rested when in sternal recumbency – a behaviour associated with comfortable resting.

Carprofen

One study assessed the postcalving effect of carprofen in cows administered within 6 hours after calving (Stilwell et al. 2014). Production data (milk yield and fertility) of cows treated with carprofen or a placebo were compared. Total lactation yields at 305 d in milk were higher in the primiparous cows treated with carprofen. Fewer cows were pregnant at 220 days postpartum in the treated group as the use of carprofen

	FLUNIXIN MEGLUMINE	KETOPROFEN	MELOXICAM	CARPROFEN
Impact on milk yield	**No** *Shwartz, 2009, Giammarco 2018* **or decrease** *Newby, 2017*	**No** *Richards, 2009*	**No** *Mainau, 2014, Newby, 2013* **or increase** *Swartz, 2018 Shock; 2018 Carpenter, 2016*	**No** *Giammarco 2018* **increase** *in heifers Stilwell 2014*
Increased risk of retained placenta	**Yes** *+++ Duffield, 2009* **No** *Giammarco 2018*	**No** *Richards, 2009*	**No** *Newby, 2014*	**No** *Stilwell, 2014*
Effect on SCC			**Decrease** *Shock; 2018*	
Effect on appetite or feed intake	**No** *Giammarco 2018* **or decrease** *Shwartz, 2009*		**No** *Newby, 2014*	**No** *Giammarco 2018* **or slightly** *Stilwell, 2014*
Impact on culling risk	***Decrease*** *Giammarco 2018*		**No** *Carpenter, 2016* **or decrease** *Shock; 2018*	**Decrease** *Giammarco 2018*
Effect on metritis development	**No** *Schmitt 2023* **or increase** *Newby, 2017, Duffield 2009*		**No** *Newby, 2014*	
Reproduction performance		**No** *Richards, 2009*		**Decreased** *Stilwell 2014*
Effect on cow comfort	**Positive** *Schmitt 2023*	**Positive** *Gladden 2020*	**Positive** *Swartz 2018*	
Effect on cow activity			**Increased** *(heifers) Mainau, 2014*	**Increased** *Stilwell 2014*
Effect on postpartum disease*	**No** *Duffield, 2009*	**No** *Richards, 2009*	**No** *Swartz 2018*	**No** *Stilwell 2014*
Impact on viability of the offspring	**Increased stillbirth x5** *Newby, 2017*			

* LDA, milk fever, mastitis, metritis, ketosis.. TABLE. Reported effects of various NSAIDs when administered around parturition

increased the time from calving to conception. No significant differences were observed in the time of placental expulsion or incidence of clinical disease over the 3 days postpartum, but more animals from the carprofen group were observed eating during the first hours after calving.

However, a single injection of carprofen to multiparous cows within 12 hours after parturition could positively influence both pregnancy and culling rates (Giammarco,et al., 2018): a greater percentage of carprofen-treated cows were pregnant at the first insemination than in control, and cows in the carprofen group showed a lower culling rate. No differences in overall milk yield, milk composition and dry matter intake were found.

Meloxicam

The effect of meloxicam in cows that were either unassisted or had an easy, manually assisted delivery was investigated by Mainau et al. (2014). Treatment was randomly administered within 12 hours of calving to 30 heifers and 30 cows from a commercial dairy farm in Spain. There was no effect of treatment on milk yield. Despite the limited number of animals, the heifers given meloxicam showed greater activity than the placebo animals in the days after calving. Another study investigated the effect of meloxicam in dairy cows following an assisted calving (Newby et al., 2013). 42 dairy cows and 61 heifers received either Metacam® 20mg/ml at 0.5 mg/kg or a placebo 24 hours following calving. There was no difference associated with treatment in DMI, milk production, or metabolic indicators. However, although the treatment was administered rather late after calving, meloxicam-treated cows spent more time feeding and had more frequent visits to the feed bunk in the 24 hours following the injection.

In a study of 237 dairy cows, oral administration of meloxicam (1 mg/kg) before or after calving had no effect on the health of dams, but increased milk production by 6.8 kg/day in eutocic cows (Swartz et al., 2018). Regardless of the time of administration, dystocic cattle that received meloxicam were less active than dystocic controls.

Similarly, Carpenter and al. (2016) found that whole-lactation (305d) milk and protein yields were greater in cows having received oral meloxicam 12 to 36 hours after parturition and Shock et al. (2018) published that a single treatment with oral meloxicam to recently calved cows was associated with an increase in milk production for the first three tests following parturition, a modest reduction in SCC at first test, and a reduction in the risk of leaving the herd through death or culling within the first 60 days following parturition. Overall, meloxicam treatment has been shown to have potential beneficial effects on milk production and cow health when administered within 1 h after calving without particular side effects (Trimboli et al., 2020).

To specifically investigate the effects of meloxicam on the risk of retained fetal membranes, a study was carried out at a large commercial dairy farm in Canada (Newby et al., 2014). 235 cows and primiparous heifers received 0.5 mg/kg of Metacam® on the day of calving, while 227 animals were left untreated. No impact of treatment on the incidence of retained fetal membranes between meloxicam-treated and untreated animals was detected and there was no difference between the 2 groups in the incidence of periparturient diseases following calving.

Pain associated with C-section

Following a caesarean section, cows experience post-surgical pain due to the cutting of the skin, muscle and other tissues. It is an acute somatic pain that is sharp, stinging and highly localised at the site of injury. In contrast, visceral pain occurs due to manipulation of the uterus and other viscera, the distension thereof, and the traction needed to extract the foetus from the cow's abdominal cavity. It follows inflammation of the tissues and is reported as being more diffuse, dull and poorly localised. Finally, there may also be underlying postpartum pain in the reproductive tract in patients who have undergone emergency C-sections. This may be due to failed attempts at a vaginal delivery and the additional pressure exerted during any attempted manual extractions.

The administration of flunixin meglumine to cows after caesarean section was associated with a higher probability of retained placenta (Waelchli et al., 1999). No adverse effects were reported with pre-emptive administration of meloxicam (Barrier et al., 2014). In the study by Maufre et al., meloxicam administration before caesarean section had no effect on the incidence of retained placenta. The pregnancy rate was higher in treated than in control and a survival analysis showed that the median calving interval was 35 days shorter in the meloxicam group. Moreover, cows treated with meloxicam spent significantly more time lying in the first 16 hours following surgery than cows that received placebo (Barrier et al., 2014). They also had more bouts of lying in the first 24 hours after surgery. Although some studies have suggested that increased lying and an increased number of postural changes could be associated with higher pain levels, longer lying times may actually reflect improved rest and comfort in the postpartum cow, as motivation to rest is likely to be high during the postpartum period.

Conclusion

Inflammation and pain are commonly seen in cattle after calving. Based on the studies reported above, short-term treatment of cows at calving with NSAIDs is likely to be of value in improving the health and welfare of cattle and can therefore be recommended.

Although available data is sometimes conflicting and seem to show a limited benefit in terms of fertility and milk production in early lactation, NSAIDs have a positive impact on cattle well-being immediately postpartum. Cows which have had an assisted calving receiving NSAIDs will have reduced pain, be more comfortable, and therefore will be more likely to display their natural behaviours (feeding time, rumination time, lying time), therefore reducing the likelihood of post-partum disease including ketosis and left displaced abomasum.

By allowing a faster return to normal production state, adding a safe and effective NSAID into post calving farm protocols should improve welfare and subsequent health of the cow and therefore benefit both dairy herds and producers.

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How to best assist the calving cow

What is an assisted calving anyways?

Dystocia is the term used to describe prolonged or difficult calvings (Mee, 2008); however, these births may or may not be assisted by a human. It is more accurate to describe what occurs on farm when people get involved as an assisted calving. A dystotic calving may go unassisted, while dams who are assisted at calving may have delivered the calf themselves without problem – the human decision-making process is distinct from what might occur without human intervention.

For example, many producers will choose to assist a calving when they recognize the calf is in posterior presentation, when progress is slower than expected, or if a staff shift change is impending. In contrast, an unassisted calf may be born covered in meconium, indicating fetal stress, or a dam may go through a protracted delivery without ever being observed by humans, particularly in extensive calving systems.

Understanding the impacts of assisted calving and the best ways to mitigate them is critical to cow well-being.

What is the cost?

Assisted calvings are a cause of important financial losses for cattle herds. The negative impacts of assisted calving in dairy cattle have been well reviewed by Mee (2008). Economic losses for dairy cattle in the United States (US) related to assisted calvings were estimated at $28.53 for heifers and $10.00 for cows (Dematawena and Berger, 1997). In Australia, the overall cost for the red meat industries was appraised at almost $98M per year (Shepard et al., 2022).

For beef cattle, previous calculations estimate $5.50 per cow based on aggregated national data in the US. However, in a recent economic analysis using over 13,000 individual-level historical records from seven cow-calf operations in western Canada, it was estimated that heifers assisted at calving cost an average of $227.43 CAD per calving and assisted cows cost $67.06 CAD (Lucio et al, 2024a). Even unassisted heifers were not profitable, costing an estimate $76.11 CAD per calving. Only cows unassisted at calving were profitable, bringing an estimated average profit of $120.12 CAD per calving.

The main drivers of economic losses associated with assisted calving were the high culling and mortality risk among the affected cows and calves (Lucio et al, 2024a). The odds of being culled or dying prior to the next calving season was 2.3 and 1.4 times higher for assisted heifers and cows, respectively, compared to their unassisted counterparts. Furthermore, in this population, calves that were assisted at calving were almost 7 times more likely to die prior to weaning compared to unassisted calves. Calves that do not survive until weaning do not bring any revenue to the operation. These losses represent the extreme end of the impacts of assisted calving and do not fully encompass the impacts on animal well-being, health, and productivity.

When should we assist in calving?

It is commonly recommended to intervene with calving in a timely fashion in order reduce the risk of negative outcomes for both the cow and the calf (Nix et al., 1998; Mee, 2004; Lombard et al., 2007). According to normal calving times for Holstein cows, calving should be assisted 65 min after feet or 70 min after the amniotic sac have been observed (Schuenemann et al., 2011). However, without constant observation, which is rarely feasible in the field, the precise timing of progression of calving is often impossible to know.

In western Canada, approximately 71 and 82% of cow-calf producers checked cows and heifers, respectively, 3 or more times during the day, but these numbers drop substantially at night (Pearson et al., 2019). For heifers, almost 3 out of 4 producers reported that they will assist heifers within 90min of seeing the amniotic sac or feet or when progression seems to have halted, while for cows, this number drops to about 3 out of 5 producers (Pearson et al., 2019).

Early intervention at calving (i.e. 15 min after both front feet were observed) did not reduce the risk of stillbirth in dairy cows but did improve calf vigour compared to unassisted calvings and those that were assisted later (i.e. 1 hour after both feet were observed) (Villettaz Robichaud, et al., 2017).

There is opportunity to reduce negative impacts of assisted calvings and improve the well-being of cows and their calves by coaching producers about timely assistance at calving.

How hard do we really pull?

The amount of effort applied to extract a calf during a calving is most commonly assessed using broad, subjective categories. We usually score calving ease as an easy pull (e.g., one person pulling using obstetrical chains), a difficult pull (e.g., two or more people pulling using chains, or the application of a calf jack), or a surgical intervention (i.e., a Caesarian section). However, these categories are often inconsistently defined and based on individual decision-making. For example, an individual working alone may decide to use a calf jack for what would otherwise be considered an easy pull.

Quantifying the actual force applied during various types of calvings can help us better understand the effort applied to deliver a calf. A study used obstetrical chains modified to include a tension sensor and data logger determined the amount of force applied during calving (Pearson et al., 2020). During manual assistance (i.e., one or two people pulling on obstetrical chains), the peak force applied to the calf averaged 95.5 kg. In contrast, during mechanical deliveries (i.e., when using a calf jack) this average peak was 188.6 kg. The median overall force applied to the calves for the entire duration of extraction was over 178 kg min for manual assistance and 380 kg min for mechanical assistance. For context, the typical mechanical delivery would be akin to having a 380 kg animal sit on you for 1 min or a 190 kg animal sit on you for 2 min or a 76 kg animal sit on you for 5 min. This study demonstrated the impressive amount of force that can be applied even to relatively routine calvings on farm, which should be considered when making post-parturient decisions for the cow.

Can we treat the pain?

When asked, most western Canadian beef producers agree that assisted calving and C-sections are painful (Moggy et al., 2017). This belief seems to correspond with a steady increase in the use of non-steroidal anti-inflammatory drugs (NSAID) for post-parturient beef cows in the region (Murray et al., 2015; Moggy et al., 2017; Pearson et al., 2019a).

Minimal scientific evidence exists to support or refute the use of an NSAID after an assisted calving in beef cattle, but there is growing evidence in dairy cattle. In one study that explored the use of meloxicam (Metacam®, Boehringer Ingelheim, Ingelheim, Germany) in beef dams and calves after assisted calving, there were no statistically significant effects on the dams in terms of post-calving behaviour, serum haptoglobin, or vulvar surface temperature (Lucio, et al., 2024b). Given to beef heifers prior to C-sections, meloxicam had no effect on the incidence of retained fetal membranes (RFM) but was associated with higher proportions of cows subsequently getting pregnant (Mauffré et al., 2021).

Dairy cows that received meloxicam 6 to 24 hours after calving demonstrated more feeding behaviour (Newby et al., 2012) and higher activity (Mainau et al., 2014) compared to placebo-treated cows. Similarly, dairy cows showed more behaviours associated with comfort post-partum when given ketoprofen after an assisted calving (Glassen et al., 2021). When given an oral meloxicam formulation (Alberta Veterinary Laboratories Ltd., Alberta, Canada) after calving, dairy cows produced more milk, had lower odds of subclinical mastitis, and were less likely to die or be culled (Shock et al., 2018). Administering meloxicam prior to calving resulted in dystotic dams being less active than placebo-treated dams, the relevance of which is uncertain (Swartz et al., 2018). However, the eutotic dams in that study given meloxicam pre-calving produced more milk than the placebo-treated dams.

Some studies have described an increased risk of RFM associated with the use of flunixin meglumine following C-section (Waelchli et al., 1999) or calving (Newby et al., 2016) in dairy cows. Further, pre-calving treatment with flunixin was associated with increased risk of stillbirth (Newby et al., 2016). In contrast, administration of ketoprofen was associated a decreased risk of RFM in dairy cows (Richards et al., 2009), and meloxicam administered within 1 hour of calving was not associated with the risk of RFM or any other peri-parturient diseases (Newby et al., 2014).

It is likely that the timing of administration, type of calving, and drug of choice have an impact on the subsequent effectiveness of NSAID in cows after calving.

So, what should we do?

Appreciating the forces of extraction and pain experienced by cows assisted at calving as well as the negative impacts and associated economic losses should help motivate efforts to prevent dystocia, assist in a timely fashion, and implement strategies to improve post-parturient cow care.

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Clinical scoring systems in the newborn calf

Significance of clinical scores in veterinary medicine

Calf mortality rates across European countries exhibit a range, documented from 3.87% to 7% [1-2], with the highest vulnerability observed within the first four weeks of life. Principal causes of perinatal mortality encompass dystocia, anoxia, and trauma stemming from dystocia, alongside less frequent occurrences of intrauterine death and premature placental expulsion [3]. Notably, pneumonia and diarrhea emerge as predominant factors contributing to neonatal mortality [4-5]. Nevertheless, calf mortality typically arises from a blend of dam-related factors, infective agents, and suboptimal management practices.

A prompt identification of poor health newborn calves is essential for the rapid and efficient intervention, and it is hence a crucial objective in the modern dairy industry; a valuable tool is represented by the application of clinical scores, which aids farmers, technicians and veterinarians, to assess and categorize clinical conditions objectively, thereby enhancing data reliability and eliminating bias.

Disease-oriented scores for the newborn calf

While various diarrhea scoring systems exist, primarily focusing on fecal consistency, they have limitations in treatment establishment, particularly regarding correction of acidosis and electrolyte imbalances. The literature suggests to combine multiple clinical scores, such as fecal consistency, dehydration status, and vigor assessments, to obtain a precise understanding of the calf's condition. Fecal scoring should be combined with clinical scoring to differentiate between mild and severe diarrhea cases, streamlining the use of additional diagnostic tools for most critical cases.

For diagnosing respiratory disease, selecting the most suitable scoring system depends on available resources and objectives. The Wisconsin score [6] is highlighted for its simplicity, but may pose challenges for inexperienced operators due to its subdivision of clinical signs. A two-level approach could beadopted, using a simple initial respiratory score followed by detailed evaluation using the WI score for unwell calves. Complementing clinical scores with lung ultrasonography further improve accuracy and diagnosis refinement.

Newborn calf viability scores

Differently from the previous scores, which are diagnosis-specific, the viability scores are not aimed at assessing a disease, but rather to identify those calves at risk for survival soon after birth, and also those that survive but are at higher risk for reduced pre-weaning health and performances. Unlike in small animals, conducting blood samples for investigating acid-base balances and other parameters in newborn large animals is feasible without significant effort; nevertheless, an appropriate scoring system is more cost-effective, quick and feasible to implement, as it doesn't require sampling or specific equipment. Numerous modified scores have been developed by researchers aiming to categorize the vitality of calves.

The APGAR score was firstly designed with the purpose of early detection of poor-viability newborn babies, and several studies have tried to adapt it to the bovine species [3,7-8], combining the 5 APGAR parameters (appearance, pulse, grimace, activity, respiration) with some other behavioral parameters (time to reach sternal recumbency, time to stand up, time to suck). The higher the score, the better the viability of the calf.

Recently, a VIGOR Score has been proposed [9]. This takes into account 10 parameters subdivided in 5 VIGOR categories:

V – visual appearance of meconium staining, tongue/head;

I – initiation of calf movement;

G – general responsiveness, like head shake in response to straw in nasal cavity, tongue pinch, eye reflex;

O – oxygenation, measured through mucous membrane color, length of tongue;

R – heart rate, respiratory rate.

Each parameter is rated 0, 1, 2, or 3, except for eye reflex, length of tongue, heart and respiratory rate which are rated 0, 1, and 2. A score of 3 (or 2) corresponds to normal, and decreasing points indicate decreasing responsiveness. The sum of individual scores gives a result that can vary from 0 to 26, and based on final score, the authors proposed a subdivision of calves into five groups: 26-27= excellent vitality, 23–25= very good vitality, 21-22= good vitality, 18-20=marginal vitality, and <17 poor vitality. Calves with marginal or poor vitality require immediate support and intervention.

Future directions

Despite several attempts to devise a scoring system for newborn calf vitality, these index-based scores have struggled to gain traction among cattle producers and veterinarians outside of research contexts; the complexity of these scores and the absence of clear intervention recommendations likely contribute to their limited adoption.

Further efforts are necessary to validate a practical tool that can be readily and accurately utilized on farms; in the future, the combined use of automatic detection systems and artificial intelligence algorithms could be helpful in continuous monitoring of the calves at birth, in order to identify calves at risk, and thus limit the assessment of clinical scores only to few critical subjects.

CALF 911
CALF VIGOR SCORING

BCRC
BEEF CATTLE RESEARCH COUNCIL

VISUAL APPEARANCE

V	Yellow Staining (Meconium)	Normal: no staining 3	Slight: around anal/ tail head area 2	Moderate: extending over body 1	Severe: fully covered 0
	Tongue/Head	Normal: no swelling, tongue 3	Tongue protruding but not swollen 2	Tongue protruding and swollen 1	Head and tongue swollen, tongue 0

INITIATION OF MOVEMENT

I	Calf Movement	Standing/ walking 0-30 min. 3	Attempts to stand 30 min. - 1.5 hr. 2	Sitting upright (Sternal) 1.5 hr. - 3 hr. 1	On side, no efforts to rise > 3 hr. 0

GENERAL RESPONSIVENESS

G	Suckling Reflex	Strong 3	Medium 2	Weak 1	No response 0
	Head Shake (in response to straw in nose)	Shakes head vigorously 3	Moves head away 2	Twitches or flinches 1	Does not respond 0
	Tongue Pinch	Actively withdraws tongue 3	Attempts to withdraw 2	Twitches tongue 1	Does not respond 0
	Eye Reflex (after touching eyeball)		Actively blinks and closes eye 2	Slow to blink 1	Does not respond 0

OXYGENATION

O	Mucous Membrane Colour	Bright pink 3	Light pink 2	Brick red 1	White/blue 0

RATES

R	Heart Rate (bpm= beats per minute)	Normal: 90-160 bpm 2	Rapid/irregular: >160 bpm 1	Slow/absent: <90 bpm 0
	(To measure heart rate, put your hand on the calf's chest. Take pulse for 15 seconds and multiply by four.)			
	Respiration (rrpm= respiratory rate per minute)	Normal: 40-70– rrpm 2	Slow: <40 rrpm 1	Fast: >70 rrpm 0

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Impacts on the calf of a difficult birth process

The early life of an animal, before birth and in the early postnatal period, has an important 'programming' effect on future development. This concept originated in human medicine but has since been considered in farm animal development too (e.g. Arnott et al., 2012; Sinclair et al., 2016;). Studies have shown that prenatal nutrition, in particular, but also pain and stress in the mother, can lead to epigenetic alterations in the pathways that influence muscularity, fatness, appetite, mammary gland development, and fertility (Sinclair et al., 2016; Wathes, 2022). There are also some data that suggest impacts on welfare-related traits such as behaviour, immune function, and stress reactivity (Arnott et al., 2012; Sinclair et al., 2016). For example, in pigs experience of prenatal stress resulted in a greater behavioural response to an acutely painful event (tail docking) in early postnatal life (Rutherford et al., 2009).

Most studies have focused on prenatal events. However, recent data suggest that stressors encountered early in the postnatal life of the animal, such as pain, may also have long term effects on animal development. For example, one study suggested that early pain exposure in ewe lambs (tail docking without anaesthetic) led to increased pain sensitivity when they gave birth themselves as adults (Clark et al., 2014). A review of painful procedures in farm animals concluded that there was preliminary evidence for alterations in the animal's developmental trajectory induced by early pain exposure, as seen in rodents (Adcock, 2021). The possibility that a similar impact may be seen through pain associated with a difficult birth process has also been suggested by Arnott et al. (2012). It is possible, therefore, that the process of birth, and early life events, as well as stressful events experienced in utero, can have impacts on future growth, development and productivity in dairy calves.

A difficult or prolonged birth process is a significant risk factor for calf mortality. Calving difficulty or dystocia is consistently found to be related to high calf mortality occurring within 24 hours of birth, with mortality increasing with the severity of the dystocia (Lombard et al., 2007). Neonates may die during the birth process, as a consequence of asphyxia, resulting in hypoxia, hypercapnia and acidosis (Nowak et al., 2022), and/or damage and trauma suffered during delivery. Neonates can suffer a range of injuries, particularly involving haemorrhage around the brain and spinal cord, subcutaneous oedema or rupture of the liver. By extrapolating findings from studies of central nervous system haemorrhages carried out in humans (Moussouttas et al., 2006; Schwedt et al., 2006), neonatal calves with these injuries are likely to experience severe pain. In addition, calves are at risk of traumatic injury and fracture during assisted delivery, particularly with mechanical calf pullers.

The immediate consequences of a difficult delivery are low vigour and calves that are slow to stand and suck (Barrier et al., 2011), have an impaired ability to ingest colostrum and hence immunoglobulins, and an impaired ability to thermoregulate. Newborn calves born after assistance are more likely to be recumbent and have reduced behavioural responses indicative of good welfare, such as play, in the early neonatal period (Barrier et al., 2013; Gladden et al., 2019). These calves also have elevated circulating cortisol compared to calves born more easily (Barrier et al., 2013; Kovacs et al., 2021), and an elevated heart rate for at least the first 5 days after birth (Nowak et al., 2022). As some of the behavioural impacts of a difficult delivery (most notably play) can be reversed by provision of non-steroidal anti-inflammatory drugs immediately after birth (Gladden et al., 2019), this suggests that early experience of pain may be an important factor influencing calf development.

Most studies of the impact of dystocia in dairy cattle have focused on the immediate postnatal period and survival in the calf, or on longer-term impacts on maternal productivity and health, with few studies considering the consequences for the dystocic calf which does survive. However, there are data which suggest that assisted heifer calves that survive the neonatal period have a higher probability of mortality than unassisted heifers by weaning, by 120 days of age and by first service (Barrier et al., 2013; Henderson et al., 2011).

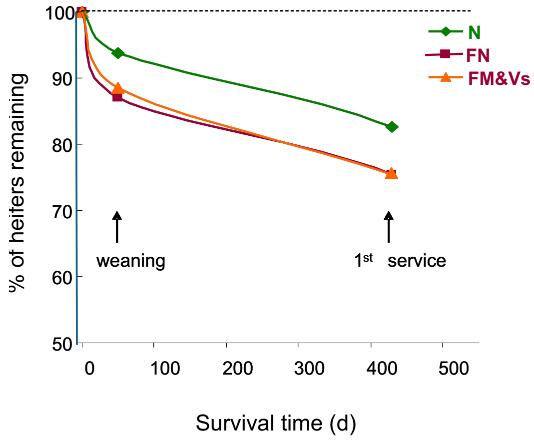

Figure 1.

Assisted calves also have an increase in disease risks or require more non-routine health treatments (Barrier et al., 2013), which may be because of lower transfer of immunoglobulins in these calves (Sutter et al., 2023). Surviving assisted calves had a similar growth rates and fertility to unassisted calves (Barrier et al., 2013), although this may be due to the mortality of the more badly affected animals. In addition, birth difficulty was associated with reduced first lactation milk production and tended to reduce predicted lifetime production (Heinrichs and Heinrichs, 2011). The data tentatively suggest that early pain experience in the calf through a difficult delivery can set in motion a series of events that lead to a compromised cow. Many of these issues are compound and improvements in calf welfare, such as ensuring adequate colostrum and treating pain, may also have significant production benefits for the cow in the future.

Figure 2.

Practical applications

Difficult deliveries can clearly have long term effects on the health and welfare of the offspring, in addition to impacts on the mother, the need for labour inputs and effects on staff morale of delivering dead neonates. Thus, measures to reduce and prevent dystocia will be very beneficial. Management to prevent dystocia, such as attention to maternal nutrition, provision of a quiet, stress-free birth environment and careful sire selection particularly for first-time mothers, are measures that should reduce birth difficulty in the short-term. Genetic selection to reduce birth problems may also provide a longer-term solution to preventing difficult deliveries. Finally, the sympathetic management of any cases of dystocia that do arise, by taking care when using traction and providing additional support to the neonate, including use of pain relief, to ensure a good mother-young bond and adequate intakes of colostrum, may reduce the impact of the difficult delivery for the calf.

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George Tomas Stilwell took his degree in veterinary medicine by the Lisbon University in 1986. He worked as a practitioner from 1986 to 2000. He is currently an Associate Professor and head of the CIISA's Animal Behaviour and Welfare Research Lab. He is also responsible for the Farm Animal Veterinary Hospital and Ambulatory Clinic Service. Between 2018 and 2019 he was Locum Senior Veterinarian in Dairy Cattle Health by invitation of Massey University (New Zealand). George's research activity focuses primarily on ruminant health, behaviour and welfare. His PhD project was on pain assessment and management in cattle. He was the national coordinator of projects such as AWIN – Animal Welfare Indicators and WelfaRuminant, BovINE, and ANICARE. Since 2007 George has acted as an invited expert in several European Food Safety Authority (EFSA) working groups on dairy and beef cattle health and welfare. George is an EBVS-recognized Diplomate at the European College in Bovine Health Management since 2005 and a founding member of the Portuguese Buiatric Association. He is a full member of the Welfare Quality Network®, and an expert visitor in Clinical Sciences – Food-producing animals, for the European Association of Establishments for Veterinary Education (EAEVE).

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Special care for the dystocia calf

As a result of difficult births or dystocia, a considerable number of calves are either born dead or die within 48 hours of birth. Calves born alive after severe dystocia have greater odds of treatment for respiratory disease (OR = 1.7), digestive disease (OR = 1.3), and overall mortality (OR = 6.7) (Lombard et al., 2007). Dystocia requiring forced extraction, compared with unassisted calving, is 4.22 times more likely to result in calf death within the first 21 days of life. Even calves having mild dystocia are less likely to survive to 30 days than calves born unassisted. However, some of the calves that are born alive could be saved if diagnosed and treated on time by simple interventions.

Dystocia interferes with newborns' vitality by being associated with reduced body temperature, decreased blood pH and plasma cortisol concentrations, and increased blood glucose. Additionally, it can be associated with pain due to trauma or prolonged compression.

The consequences of dystocia are not limited to the immediate post-calving period. All these alterations lead to weakness, impaired temperature regulation and slow to stand and suckle. All these negatively affect the absorption of colostral immunoglobulins, leading to immuno-depressed calves. In suckler herds, it may also prevent the calf from following the dam.

Therefore, the ability for dystocia to negatively influence calf immediate and late survival occurs via multiple mechanisms. In this talk, we will address three of the most common effects of dystocia in calves – hypoxia-anoxia, acidosis and trauma/pain. Although not necessarily a direct consequence of dystocia, neonatal maladjustment syndrome entails the same risks to survival.

Hypoxia

Foetus hypoxia for 3 to 4 minutes during calving is physiological, and can even be considered useful as hypercapnia stimulates the respiratory centres. However, if a progressive degree of hypoxia or anoxia takes place it can have serious and prolonged deleterious effects or even cause foetal death.

Prolonged hypoxia has two negative effects: affects surfactant-producing pneumocytes and causes vasoconstriction of pulmonary vessels leading to alveolar and interstitial oedema and further reducing gas exchange; and leads to several systems' insufficiency and especially of the CNS (ischemic encephalopathy). Additionally, oxygen deprivation induces foetal acidosis affecting vital organs functionality thus originating a weak calf.

Depression, low vitality score and meconium staining of the foetal fluids are indicators of prolonged intrauterine hypoxia.

Hypoxic calves should have their airways cleared, breathing should be stimulated and oxygen should be provided. Forced insufflation of the lung should be attempted.

Figure 1. Meconium-stained calf after a difficult parturition.

Acidosis

Calves suffering from dystocia should be assumed to have a higher-than-average level of respiratory and metabolic acidosis. Acidosis makes calves weak and depressed.

Respiratory acidosis results from premature rupture of the umbilical vessels or impaired respiration after birth. If hypoxia is severe and prolonged, tissues will derive energy from anaerobic glycolysis, resulting in the production of lactic acid, and inducing a state of metabolic acidosis. Evidence shows that dystocia calves are more acidotic, take longer to achieve a normal pH, and have a greater risk of mortality. Dystocia-induced respiratory acidosis has been associated with decreased absorption of IgG from colostrum.

Treatment for respiratory acidosis is the same as for hypoxia. As for metabolic acidosis, treatment should include IV administration of bicarbonate. Treatment strategies will be discussed at the talk.

Trauma

Dystocia or forced parturition can cause severe trauma to both the dam and calf. In the newborn, the most common lesions are broken vertebrae, ribs or limbs. Also, neuropathies due to hyperextension nerves during incorrect forced traction. A study has shown that up to 40% of veterinary-assisted deliveries may result in rib fractures and up to 10% in vertebral fractures, although many will go undiagnosed. It has been shown that rib fractures leading to trachea collapse and stenosis may occur during difficult delivery of calves. Rib fractures may be involved in lung disease in older calves (e.g. lung contusion or pneumonia).

Limb fractures are especially common when excessive force is exerted, especially in disproportion-origin dystocia. The most common fractures include the metacarpus and metatarsus (approximately 50%), tibia (approximately 12%), radius and ulna (approximately 7%), and humerus (<5%). The use of mechanical extractors is very often associated with such fractures.

Examination of calves after forceful delivery should be exhaustive to detect even small trauma. Handling of these animals should be extra-careful as causing pain will reduce vitality, colostrum intake and IgG absorption. For example, avoid hanging a calf over a gate by its back legs as this can worsen nerve damage, or avoid energetic massaging the rib cage as fractured ribs are very painful.

Figure 2. Broken ribs in calf that died 24 hours after forceful delivery.

Dummy-calves

Compression and hypoxia during labour play a crucial role for calves: it stimulates widespread noradrenergic activation within the brain. Compression of the thorax during labour may activate a yet undescribed neuroinhibitory reflex that counterbalances the labour-related stimuli that promote neuroactivation via locus coeruleus-noradrenergic pathways. Once compression is over, these and other neuroactivators, as well as environment stressors induce postnatal consciousness associated with marked activity that is essential for precocious species survival. Simulating the compression followed by releasing it after 20 minutes, has shown to stimulate awareness and activity in newborn calves with maladjustment syndrome (dummy-calves). The method will be described in this talk.

In summary, practitioners and farmers should treat every calf that was exposed to (even mild) dystocia as a seriously compromised calf.

Figure 3. Thoracic squeeze in a Blonde d'Aquitaine dummy calf.

FARM ANIMAL WELL BEING

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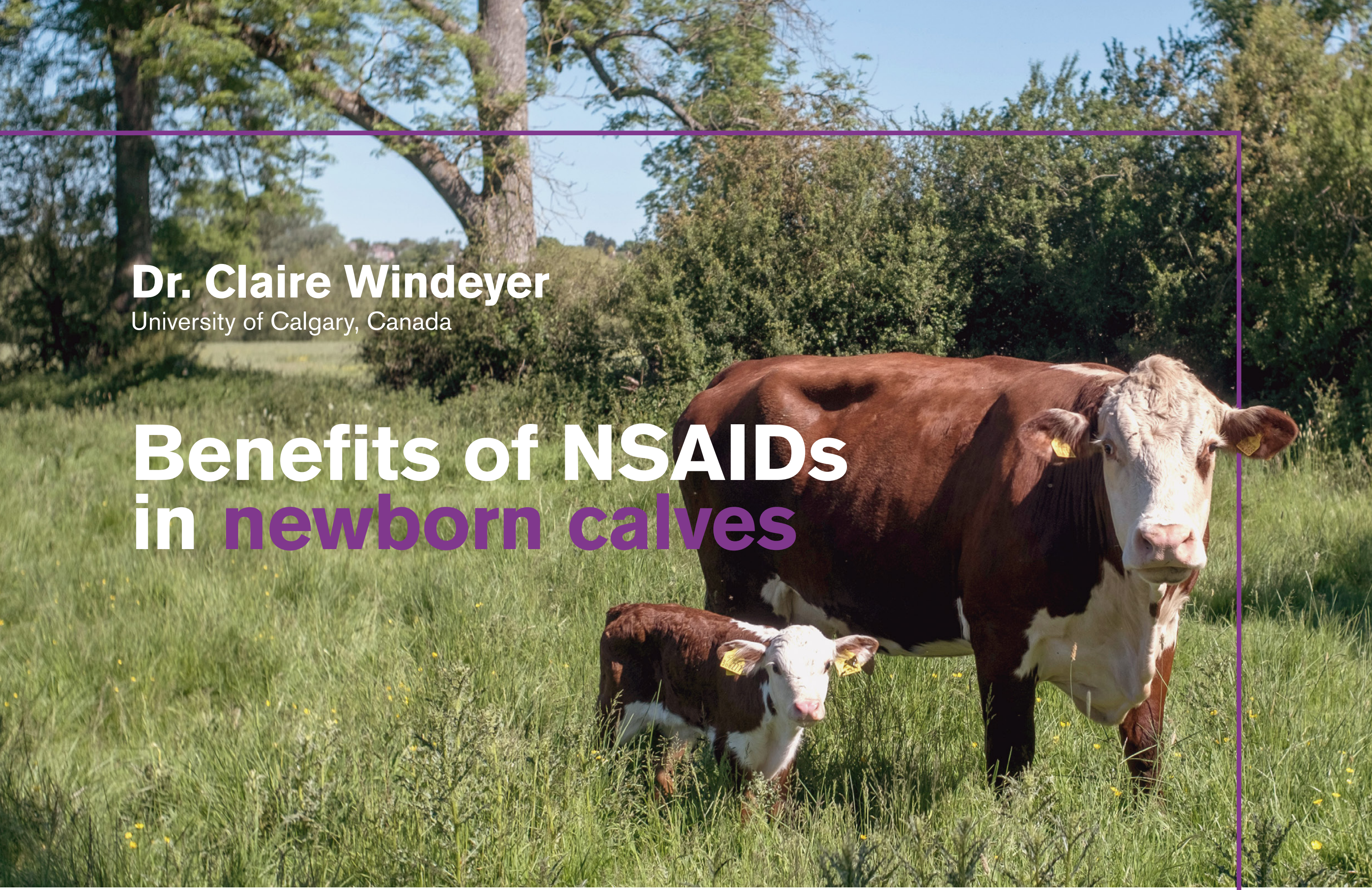
Dr. Claire Windeyer is an associate professor at the University of Calgary Faculty of Veterinary Medicine. She completed her BSc (Animal Science), DVM (Food Animal Stream), and DVSc (Ruminant Health Management) at the University of Guelph. She teaches epidemiology, health management, and bovine medicine and surgery in the DVM program and advanced beef health management in the graduate program.

Her research interests include peri-parturient care of the calf and cow, evidence-based management strategies to improve disease control and animal welfare by examining pre-weaning calf management practices, understanding how producer perceptions influence on-farm health management decision-making, and effective, integrated knowledge mobilization.

She received the 2023 Zoetis Outstanding Achievement in Graduate Supervision Award and the 2021 Canadian Veterinary Medical Association Merck Veterinary Award. Claire was raised in Nova Scotia and now lives with her husband Bruce, 7 horses, 2 dogs, 2 cats, and a small chicken flock on an acreage near Dogpound, Alberta, Canada.



Dr. Claire Windeyer
University of Calgary, Canada

Benefits of NSAIDs in newborn calves

The Challenge.

The riskiest time in a calf's life is the moments during and immediately after birth. Many Canadian beef producers report that mortality of preweaning calves is a major concern for their herd (Murray et al, 2015a). In beef calves, 1 in 4 preweaning deaths are attributable to perinatal issues (USDA, 2015). In dairy cattle, 5.6% of calves die within 48 hours of birth (i.e. stillbirths) and 5.4% of preweaning mortality is due to calving problems (USDA, 2016; USDA, 2018). The incidence of calving assistance in cow-calf herds in North America is about 5%, with heifers requiring more assistance (9.4-13.5%) than cows (3.2-3.8 %) (Pearson et al. 2019; USDA, 2020). However, 96% of beef producers report having to assist at least one calving during a given calving season (Pearson et al., 2019a). Globally, 1.5 to 13.7% of dairy cows and heifers reportedly experience assisted calving (Mee, 2008).

Properly caring for newborn calves compromised by dystocia remains an important issue for individual calf health and well-being, and for herd management and productivity of cattle herds worldwide.

Acid-Base Disturbances.

Calves that experience a difficult calving often have a severe mixed metabolic and respiratory acidosis, but all newborn calves are affected to varying degrees (Homerosky et al., 2017a). Although the best means of correcting this acidemia in the field are still being debated, prompt and effective ventilation is undoubtably important to address the respiratory component of the acidemia and is essential for the survival of the neonate. The metabolic acidosis from poor perfusion during dystocia can likely be mitigated through volume expansion (via colostrum consumption or fluid therapy) and/or improved circulation (via physical stimulation of the calf and thermoregulatory assistance).

Subclinical Trauma.

In addition to causing these acid-base disturbances, dystocia can be a traumatic and painful time in a calf's life. Calves born of a difficult assist had significantly higher serum concentrations of creatine kinase and aspartate aminotransferase at 24 hours after birth compared to unassisted calves or even calves born of an easy assist (Pearson et al., 2019b). These biomarkers are suggestive of tissue trauma, even though none of the calves in this study were diagnosed with any overt signs of trauma.

A study of dairy calves investigating vaccination against Bovine Respiratory Disease inadvertently found that 6% of calves had evidence of undiagnosed rib fractures, and this was associated with assistance at calving (Ollivet et al., 2018). Greater signs of trauma were seen in stillborn dairy calves assisted at delivery than unassisted stillbirths (Barrier et al., 2013a). Dairy calves assisted at calving also had 4 times higher salivary cortisol levels compared to their unassisted peers (Barrier et al., 2013b), indicating greater levels of perinatal stress.

It is likely that prevalence of subclinical trauma is underestimated in calves assisted at birth, which may be an unrecognized source of suffering in neonatal calves.

Other Consequences of An Assisted Birth.

Assisted calving is associated with higher risk of morbidity and mortality, poor calf vigour, and decreased odds of acquiring adequate transfer of passive immunity (TPI). Beef calves in western Canada assisted at calving had 7 times higher odds of dying and had 60% higher odds of being treated for disease prior to weaning compared to unassisted deliveries (Lucio et al., 2024). Similarly, dairy calves assisted at calving were more likely to be treated or to die before weaning than calves that had a normal birth (Barrier et al., 2013b).

More calves that were a difficult assist had a weak suckle reflex and abnormal mucous membrane colour (Pearson, JM, et al. 2019b), parameters that are indicative of compromise in a newborn calf (Homerosky et al., 2017a). Dairy calves also had lower vigour when assisted at calving compared to unassisted calves (Barrier et al., 2012; Murray et al., 2016). Beef calves assisted at delivery had 4 to 11 times higher odds of failing to consume colostrum within 4 hours of birth, compared to calves that were not assisted at delivery (Homerosky et al., 2017b). These types of calves also had 7 to 26 times higher odds of having serum immunoglobulin G concentrations <24 g/L, meaning they had inadequate TPI (Pearson, JM, et al., 2019b). The economic cost of each case of failed TPI has been previously estimated €60-80 (Raboisson, D, et al., 2016).

Given these consequences, strategies to mitigate the negative impacts of assisted birth are critical for ensuring calf well-being.

Pain Mitigation.

Dystocia is perceived by producers to be a painful event (Moggy et al., 2017) and increasing numbers of beef producers in Canada report using a non-steroidal anti-inflammatory drug (NSAID) for both the cow and calf after an assisted calving (Murray et al., 2015a; Moggy et al., 2017; Pearson et al., 2019a).

The use of meloxicam (Metacam®, Boehringer Ingelheim, Ingelheim, Germany) in beef calves after an assisted calving has been assessed on cow-calf operations in western Canada. In a small, randomized control trial, calves treated with meloxicam had significantly greater average daily gain from birth to one week of age compared to calves treated with placebo (Pearson et al., 2019c). However, in a large, randomized field study, no statistically significant differences in physiological indicators of pain and inflammation, calf behaviour, or TPI were detected between placebo and meloxicam-treated calves (Pearson et al., 2019d). Interestingly, producers in the latter study, blind to treatment group, were able to identify the meloxicam-treated group, subjectively indicating “they mother up better” or “the calves just look better” or “they are ready to be moved out of the barn sooner”. This observation led to a study of behavioural responses to meloxicam treatment of the cow and calf after calving, and it was shown that calves treated with meloxicam were more active, specifically playing more, in the 24hr after birth (Lucio et al., 2024), supporting the producers’ observations.

The impact of NSAIDs on the pain and inflammation associated with birth has been investigated more extensively in dairy calves. When ketoprofen was given to dairy calves, either unassisted or delivered with mild to moderate assistance calves, these calves spent less time laying in lateral recumbency and more time playing compared to calves who were given placebo (Gladden et al., 2019), despite no discernible impact on cortisol, lactate, CK, or TPI (Gladden et al., 2018). Calves treated with meloxicam showed more improvement in vigour compared to placebo-treated calves (Murray et al., 2016). They also had better weekly health scores from birth to 6-8 weeks (Murray et al., 2015b; Murray et al., 2016), greater milk intake (Murray et al., 2016), and higher weight gain during the first week of life (Murray et al., 2015b) than untreated calves.

Conclusions.

There is increasing awareness that birth is a potentially painful event for calves and that it may have many negative consequences, particularly when the calving is difficult. In addition to the immediate post-natal activities of ensuring the calf survives via resuscitation, correction of acid-base disturbances, and provision of assistance with colostrum consumption, the consideration of pain mitigation is warranted. There is a growing body of evidence that supports the use of NSAIDs after calving to improve calf well-being and care.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