Transporting Cattle in 2020: Research and Regulation Update

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Take Home Messages

- Young unweaned dairy calves are more prone to transport related stress, morbidity and mortality than are adult cattle.
- Approximately 60% of cull cows have compromised health and advanced age making them more vulnerable to transport stress.
- Cull cows have the greatest probability of becoming lame, non-ambulatory and dying at the end of a long haul (> 400 km) journey compared with other cattle.
- Cull dairy cows with a body condition score of < 2.75, that are < 100 or > 300 days in milk and suffering from digital dermatitis are at higher risk of increased lameness during transport.
- More welfare issues are observed when calves and cows are shipped for > 30 hours.
- Feed withdrawal for up to 30 hours is associated with more indicators of poor welfare than is water withdrawal.
- Animal condition at loading may be more important than provision of a rest in transports exceeding 16 hours.
- Optimal welfare in dairy calves and cows is highly dependent on the animals' condition at loading.

Introduction

Transportation of animals by road continues to be a necessary part of the dairy industry related mainly to the marketing of surplus bull calves and cull cows. However, transportation of young and cull animals has been identified as an important welfare issue needing special consideration (Schwartzkopf-Genswein and Grandin, 2019). Dairy calves and cull dairy cows are among the most vulnerable types of animals regarding fitness for transport when overall condition, health and ability to cope with stress are accounted for.

Heightened public awareness and concern for animal welfare related to transport have increased the need for assessing and developing strategies to minimize potential for poor welfare outcomes. The OIE (The World Organisation for Animal Health, 2008) defines welfare as "how an animal is coping with the conditions in which it lives" and that good welfare "(as indicated by scientific evidence) means the animal is healthy, comfortable, well nourished, safe, able to express innate behaviour, and is not suffering from unpleasant states such as pain, fear, and distress."

Although many studies have documented behavioural and physiological changes in cattle during and after transportation (Schwartzkopf-Genswein and Grandin, 2019), few have assessed very young or old cattle. Behavioural and physiological changes are used as indicators of welfare that can be affected by both animal and non-animal factors. Animal related factors include age, health, body condition, experience, and temperament while non-animal factors include animal management before transport,

handling, loading density, mixing with unfamiliar animals, trailer environment (temperature and humidity, noise and vibration), location within the trailer, transport duration and feed, rest and water intervals (Schwartzkopf-Genswein and Grandin, 2019). Before strategies to improve welfare outcomes during transport can be developed, the impact of each factor indicated above, alone or in combination, need to be better understood for all types of cattle, but more urgently for young calves and cull cows.

The revised Canadian transport regulations (CFIA, 2019) come into effect February 20, 2020, nearly 4 decades after the last regulations were made. The new regulations are science informed, taking into account research studies that provide consistent evidence for areas of improvement. The main changes focus on reducing transport duration, and feed, rest and water intervals. These regulations will play a major role in how cattle transport is conducted in Canada and in animal welfare outcomes.

The objective of this paper is to provide a summary of past and current research relevant to the impacts of transport on Canadian dairy cattle. The following sections will discuss factors contributing to increased susceptibility for poor welfare outcomes during and after transport in unweaned calves and cull cows. In addition, the effects of transport distance; feed, rest and water intervals; and extreme environmental conditions on the same types of animals will be reviewed. Changes to the transport regulations will be outlined with a focus on how they will impact calf and cull cow transport. Finally, recommendations will be given regarding best management practice for these more vulnerable types of cattle. Continued concern and awareness of welfare-conscious transportation practices will improve the health and well-being of dairy cattle while increasing consumer confidence and sustainability of dairy-derived meat products.

▪ Animal Factors Contributing to Poor Welfare

The following section reviews transport studies with emphasis on dairy animals where possible. Recent beef calf and cull cow studies have also been included in this review as they may provide further insight into the impact transport has on young calves and older cows of reduced condition. The major difference between dairy and beef calf studies is the calves' age at time of transport. Beef calves are usually transported at 5–8 months of age and may be weaned a significant number of days before they are transported off farm whereas dairy bull calves are transported as early as 5–30 days of age and are usually not weaned at the time of transport. Most transport studies assessing cull cows do not distinguish between beef and dairy breeds but indicate a cow that is no longer economically viable.

Calves

Young calves are more prone to transport related stress, morbidity and mortality than are adult cattle (González, 2012c; Knowles, 1995), likely due to a combination of factors including reduced ability to thermoregulate (Eicher, 2001; Knowles et al., 1997; Knowles, 1999), minimal fat reserves for energy, an immature immune system (Knowles et al., 1997), and reliance on a milk-based diet that may alter metabolism (Schrama et al., 1992), thirst and hunger (compared to calves on solid feed). In addition, young dairy calves (between 1 and 30 days of age) are typically not weaned before marketing and may be transported to veal production units after assembly from several different farms (Wilson et al., 2000), increasing their exposure to pathogens and mixing with unfamiliar animals.

Cull Cows

The culling of cows is a humane and essential practice guaranteeing that the cows are not retained beyond their productive and healthy life, thus ensuring food safety and eliminating the chance that they may become unfit for transport (Rezac et al., 2014). According to the Canadian Dairy Information Centre (CDIC, 2019) the average culling rate for cow herds in 2018 was 31.6%. Although 18% of the culling total was attributed to reproductive and difficult calving issues, an even larger proportion (29.3%) of the total was due to health (mastitis, foot and leg problems, sickness, injury, displaced abomasum, milk fever, arthritis and pneumonia) and age-related issues. While not specifically listed in the CDIC report, cancer eye and poor body condition are common reasons for culling. For example, a U.S. benchmark study of

cull dairy cows arriving at a large slaughter facility found that 9% had one or more health problems (severe lameness, low body condition score (BCS), poor udder condition, prolapse, cancer eye, illness, wounds, active parturition, nervous system disorder, and non-ambulation) that would be considered a welfare problem (Edwards-Callaway et al., 2019). Similarly, Harris et al. (2017) found that 9% of dairy cows were very thin, 43% had some defect (i.e., swollen joint) and 23% were lame. Edwards-Callaway et al. (2019) noted that the majority of compromised conditions documented in those industry surveys would have been present prior to transport. Consequently, advanced age, reduced health and marginal energy reserves are the main reasons why cull cows are more vulnerable to transport stress.

The above findings are consistent with other studies documenting some compromise in cull cow condition prior to transport that could potentially lead to reduced welfare during transportation. For example, Dahl-Pedersen et al. (2018a) reported that close to 75% of cull dairy cows assessed immediately before shipping to market deviated from normal according to at least one clinical measure of compromise. They found that 31% of cows were lame, 20% showed signs of mastitis and 22% had non-severe wounds; however, very few were considered unfit for transport. In a related study, Dahl-Pedersen et al. (2018b) concluded that the clinical condition of cull dairy cows deteriorated during transport based on increased lameness and milk leakage following transport compared with that prior to loading onto the truck. Rezac et al. (2014) also found that the prevalence of gross pathologic lesions in cull cows (87% Holstein) assessed at slaughter was 18.5%, 10% and 10.3% for liver abscesses, ruminal lesions (associated with ruminal acidosis) and lung lesions (associated with bovine respiratory disease), respectively. Therefore, it is not surprising that cull cows can suffer a compromised physical state including weakness, hypothermia, recumbence and death during and after transport (Schwartzkopf-Genswein and Grandin, 2019). These conditions can be exacerbated by the fact that cows are transported long distances (> 400 km) from their farm of origin to processing plants or auction markets where they may be held until a sufficient number of cows are assembled to fill one truck. They may even be resold which means they could remain within the marketing system for an extended period of time, further deteriorating their condition. A recent Canadian study found that cull cows spent 79.6 ± 1.9 hours in the marketing system before being slaughtered (Stojkov and Fraser, 2019). Approximately 43% were in transit for 4–6 days and 4% for 7–9 days, which included delays at auctions or assembly yards. The same study reported a reduction of 0.4 in BCS between the farm and the time of slaughter. Although the prevalence of lameness did not change before compared to after transport, there was a large increase (33%) in milk accumulation and udder inflammation. Collectively, these studies show a clear need for extra vigilance by the producer and transporter to ensure that cull cows are fit for transport and that stressors are minimized as much as possible to avoid negative welfare outcomes.

▪ Non-Animal Factors Contributing to Poor Welfare

The transport process has the potential to impose significant challenges for cattle including physical and psychological stress, injury and even death (Schwartzkopf-Genswein and Grandin, 2019). The conditions of transport can vary substantially according to its duration, when the animals had last been rested, fed and watered, and the environmental conditions under which the transportation takes place. Although there are several other factors (driver experience, trailer compartment, animal handling, road conditions, loading density, and regulations) that can affect the quality of the transport, only the factors previously listed will be covered in this paper. The effects of these factors on animal welfare outcomes are not mutually exclusive, and multiple stressors can have an additive effect imposing even greater challenges for the cattle.

Transport Duration

The total amount of time (duration) that an animal is on a truck has been referred to as the transport continuum. This continuum comprises several events including loading, waiting to depart after loading, driving and stationary periods, waiting to off-load and any experienced delays in between (Schwartzkopf-Genswein and Grandin, 2019). A transport survey conducted by our research group found that cattle (all types) shipped within and outside of Alberta took on average 15.9 hours, and up to 45 hours to reach their

final destination (Gonzàlez et al., 2012a). However, only 1% of the cattle tracked in that study were classified as cull with no distinction based on breed or gender. An Ontario study reported average shipping times of 4.6 hours and up to 68.3 hours for all cattle types shipped to slaughter with no specific mention of young calves or cull animals (Warren et al., 2010). A recent study assessing cull dairy cow conditions at slaughter found that approximately 16% of cattle were transported 1,100 km (approximately 11 hours in transit based on a driving speed of 100 km/ hour not including other events within the transport continuum) from farm to abattoir (Stojkov and Fraser, 2017).

Numerous research studies have shown a strong association between increased transport duration and decreased animal welfare (Schwartzkopf-Genswein and Grandin, 2019). This is mainly due to the length of time animals are without feed, water and rest, which have obvious effects on weight loss (shrink), dehydration, hunger, fatigue and stress. The most significant weight loss occurs within the first 12 hours of transport resulting from the elimination of urine and feces as well as water through breathing and evaporation (Barnes et al., 2004; Coffey et al., 2001). Any weight loss occurring after that point in time is believed to be more detrimental to welfare since it is associated with mobilization of the animal's energy reserves. As stated earlier, dairy calves and cull dairy cows would be most affected by this stage of shrink because of their already low fat reserves compared with other cattle types.

Our previous studies showed that cull cows were at higher risk of poor welfare when transported > 400 km based on having the greatest likelihood of becoming lame, non-ambulatory or dying in transit compared with other cattle types (calves, feeders and fats; González et al., 2012c). Journeys > 400 km also caused greater shrink in cull cows compared with that in fat cattle transported the same distance (González et al., 2012b). A recent Danish study assessing cull cows transported an average of 187 minutes (ranging between 32 and 510 minutes) found that one-fifth of them became lame or got more lame during transport (Dahl-Pedersen et al., 2019b). There was also a significant increase in the proportion of lame cows after transport (41%) compared with before transport (31%). The risk factors associated with the increased lameness following transport included low BCS (< 2.75), early or late lactation (< 100 or > 300 days in milk (DIM)), digital dermatitis in the hind feet and pelvic asymmetry. The same study reported increased milk leakage (1% vs. 17%) and wounds (22% vs. 34%) before and after transport, respectively. Animals that were < 100 DIM and transported > 100 km were more likely to be observed with milk leakage. The authors concluded that even transports as short as 8 hours can affect welfare outcomes in cull dairy cows.

Transport durations exceeding 30 hours significantly increased the chance of cattle becoming lame, non-ambulatory or dying, regardless of breed or age (González et al., 2012d). Cattle losing 8% of their body weight also had an increased risk of death (González et al., 2012b). In addition, several studies showed that journeys > 24 hours increased physiological indicators of fatigue, dehydration and mobilization of energy reserves (Tarrant et al., 1992; Warriss et al., 1995) leading the authors to conclude that time on the truck should not exceed 1 day. The most recent National Animal Health Monitoring System (NAHMS) survey of the U.S. dairy industry reported 37% of farms sent their cows directly to slaughter, which reduced transport duration as well as the total time required to get to the abattoir (USDA, 2014). For example, 50% of slaughter-direct cows were transported < 80 km, 38% were transported between 80 and 400 km and 11% were transported > 400 km. On the other hand, 78% of non-direct (auction) cows travelled < 80 km and 22% were transported between 80 and 400 km. Following the trip to the auction, most of these cows would be transported to an abattoir. The survey indicated that cows were shipped an average of 6.7 hours, with maximum durations being > 24 hours. Edwards-Callaway et al. (2019) cautioned that the transport durations reported in that study only represented the final leg of the cow's journey, not any prior transports, and therefore are likely an underestimation of their actual transport continuum. Most studies assessing the effects of transport duration on young calves looked at the combined effect of transport duration, and feed, water and rest intervals; these will be discussed in the following section.

Feed and Water Deprivation

Currently, transport trailers used to haul livestock in North America are not equipped to provide animals with access to feed and water while they are on board. Consequently, when cattle are confined within the truck, they are subject to periods of feed and water deprivation dictated by the length of time they are transported. Although cattle could gain access to feed and water once they are off-loaded, it does not always mean they do (many auctions do not provide feed, but all provide water) which can further exacerbate any negative effects. In contrast, some European trailers (Pezzaioli, Carrrozzeria Pezzaioli Ltd., Monticharai, Italy) have been designed such that cattle can eat and drink during their journey. Until similar trailer designs are available for use in Canada, the effects of feed and water deprivation will remain an important factor in the welfare of all transported cattle.

The main effects of feed and water withdrawal, regardless of cattle type, are weight loss and the potential for hunger, dehydration and stress that can increase as the time between feeding or drinking opportunities increases. Feed withdrawal for 12, 24, 48, and 96 hours reduced live weight in beef calves by 6, 8, 12, and 14%, respectively (Schwartzkopf-Genswein and Grandin, 2019). In the case of young calves, some studies have shown that long journeys resulted in the mobilization of energy reserves (Mormède et al., 1982; Nielsen et al., 2011; Bernardini et al., 2012; Fisher et al., 2014) and low blood sugar (hypoglycemia) (Bernardini et al., 2012; Nielsen et al., 2011; Fisher et al., 2014). Feed and water deprivation can also alter normal patterns of feed consumption and digestion. For example, rumination was reduced and almost disappeared within 24 hours of feed and water removal from sheep (Welch and Smith, 1968). It has also been speculated that restricting access to feed and water reduces the fermentation capacity of the rumen for 5 days or more (Hutcheson and Cole, 1986). Collectively, these studies suggest that calves could be at greater risk of hunger, fatigue, weakness and injury during transportation as a result of restricted feed and water access.

Interestingly, numerous studies in young calves reported no signs of dehydration following prolonged periods of transport-associated water deprivation. For example, dairy calves ranging in age from 5 to 21 days that were transported and fasted between 18 and 30 hours showed no signs of dehydration (Kent and Ewbank, 1986; Todd et al., 2000; Fisher et al., 2014). This is particularly intriguing given that they consumed a milk-based diet before transport. More research needs to be conducted regarding these findings so the outcomes can be better understood.

Overall, feed withdrawal for up to 30 hours appears to result in more indicators of poor welfare than does water withdrawal. We are still not sure what level of energy mobilization can affect welfare outcomes. In addition, few studies have assessed feed and water withdrawal on cull cows.

Rest Intervals

Long-haul transport causes muscle damage (indicator of muscle exertion and fatigue) in young calves (Grigor et al., 2001; Bernardini et al., 2012; Fisher et al., 2014). This is a result of increased physical effort required to maintain balance during braking, cornering and accelerating over long periods of time. Although no studies have been conducted assessing fatigue in cull cows, it is very likely that they experience similar or even more severe effects because of increased health issues such as lameness, known to worsen over the course of a journey. Furthermore, cows are typically under loaded in trailer compartments compared with calves or feeder cattle (González et al., 2012d) (especially in the nose and top back compartment, known as the doghouse) due to axle weight restrictions, which may add further challenges to maintaining balance.

A rest period provided to cattle in the middle of a long journey allows them to lie down and consume feed and water, mitigating negative outcomes such as fatigue, hunger and dehydration. The need for the provision of a rest has been supported by studies showing young dairy calves (less than 30 days of age) increase lying time on the truck with increasing time in transit (Cockram and Spence, 2012) and they experience fewer losses of balance and trampling following a longer (12 hours) compared with a shorter

(1 hour) rest (Grigor et al., 2001). Edwards-Callaway et al. (2019) noted that cull dairy cows typically transported between 7 and 24 hours to slaughter would rarely stand for that length of time given the choice; unfortunately, the ability to lie down and rest on a truck is extremely limited. One study concluded that cows deprived of the chance to feed and rest for as little as 3 hours will select rest over feed (Metz, 1985).

Our research group has conducted two studies assessing the effects of different lengths of rest stop following 15 hours of transport under Canadian commercial conditions in newly weaned beef calves (Marti et al., 2017) and following 12 and 36 hours of transport in conditioned beef calves (Melendez et al., 2020). The studies looked at weight loss, indicators of stress, muscle damage, hunger and dehydration, and behaviour after off-loading. The first study found that rest periods ≥ 10 hours did not prevent short- and long-term stress after transport in newly weaned calves. The second study found that 36 hours of transport (compared with 12) had greater effects on the calves (weaned and vaccinated) including lower weight, average daily gain and intake, and increased shrink, inflammation and fat metabolism. Surprisingly, there were no effects on any indicators of welfare measured among calves given 0, 4, 8, or 12 hours of rest with the exception of fat metabolism, which was greater in calves provided no rest (no food). The study concluded that preconditioning (implying good calf condition) may have more impact on calf welfare than a rest period on journeys exceeding a total (combined time before and after rest period) of 16 hours. A study conducted at a commercial rest stop site in Canada reported that in the first hour after off-loading, cattle (all types) transported an average of 30 hours were observed to eat more frequently than rest, however, after the first hour they were observed to rest (lie down) more than eat (Ross et al., 2016). These studies help to provide guidance regarding optimal lengths of rest (relative to the distance transported) as well as which aspect of the rest is more important than others.

In order to fully understand the value of rest periods on dairy cattle welfare, all factors including loading and unloading, mixing with other animals, novel feed and water, and quality and accessibility of the feed, water and rest areas must be considered. More research assessing the effects of rest periods on newly weaned calves, unweaned calves, and cull cows is urgently needed.

Environmental Conditions

Unlike some European trailers, transport vehicles in Canada are not climate controlled (Schwartzkopf-Genswein and Grandin, 2019). Instead, temperature and humidity (microclimate) within the trailer is managed using passive air flow via perforations of varying sizes, dimensions and patterns along the sides and roof of the trailer. Therefore, extreme cold or hot environmental conditions can have direct impact on the trailer microclimate as well as the cattle held within them (Schwartzkopf-Genswein and Grandin, 2019). A survey conducted by our research group found that temperature extremes of -42°C and +45°C were recorded over an 18-month period when cattle were transported within and outside of Alberta (González et al., 2012a). Although cattle are homoeothermic (ability to adapt temperature change) a period of acclimation (days or even weeks) is needed for them to adjust because metabolic changes associated with acclimation take time. Consequently, abrupt changes in ambient temperature could have greater negative impacts (heat or cold stress) on cattle than consistently hot or cold conditions. This is even more critical for young calves because they have limited ability to thermoregulate. In addition, dairy calves and cull cows are usually housed indoors or with shelter such that exposure to extreme temperatures is minimized. Therefore, dairy cattle are more likely to experience abrupt changes in temperature when they are transported because their ability to adapt to high or low temperatures within a trailer is limited.

Cattle cope with heat and cold stress by adjusting their behavioural and physiological responses. In the case of heat stress, cattle respond by panting, sweating, seeking shade, and increasing respiration rate and peripheral blood flow (West, 2003). Likewise, cattle experiencing cold stress shiver to maintain their core body temperature and may seek shelter away from drafts. This increases their energy demand, further depleting energy reserves in cattle that are already feed and water deprived. Some or all of these coping strategies can be restricted during transportation making it more difficult for the animal to dissipate

or reserve heat, particularly if they are very young or very old (Grandin, 2001).

Trailer microclimate can vary substantially based on air temperature, humidity, loading density, use of bedding, airflow, and animal respiration, sweat, and excretions (Schwartzkopf-Genswein and Grandin, 2019). Although the effects of trailer microclimate have not been well studied in unweaned calves and cull dairy cows, there is some evidence that it can negatively impact animal welfare if too high or too low. For example, death in commercial cattle (all types) transported > 400 km increased significantly when ambient temperatures went below -15ºC while the probability of becoming non-ambulatory increased when temperatures rose above 30ºC (González et al., 2012d). In addition, ambient temperature during the summer had a greater impact on trailer microclimate than did loading density (Goldhawk et al., 2014).

Producers and transporters can employ various strategies to moderate cold environmental conditions including the use of bedding and boarding. Bedding provides insulation for calves and cows during cold weather and its use is required on journeys over 12 hours (CFIA, 2019). One study showed that young dairy calves increased the time they spent lying down when bedding was provided compared with when it was not (Jongman and Butler, 2014) suggesting bedding also increases calf comfort. Boarding is the use of solid pieces of plastic, fiberglass or plywood to block (either fully or partially) perforations within the trailer walls. Boards are used during cold weather to reduce air exchange between the outside (colder air) and inside of the trailer resulting in warmer trailer microclimates. A study assessing the effects of winter transport on cull beef cows found that boarding increased ventilation when trailers were in transit but decreased ventilation (increasing internal temperature and humidity) during stationary periods (Goldhawk et al., 2015).

Strategies to reduce heat stress include reducing stationary periods, transporting during the coolest rather the hottest part of the day, and parking in shade (Schwartzkopf-Genswein and Grandin, 2019). Future studies need to assess the effects of provision of water on trailers in reducing heat stress.

▪ Transport Regulations

As of February 20, 2020, the amendments to the Transportation of Animals requirements under the Health of Animals Regulations (CFIA, 2019) will take effect. The last changes to the regulations were made over 40 years ago in 1977.

The most significant changes for cattle include a reduction in the maximum allowable transport duration from 48 to 36 hours (with no rest stop) before they must be unloaded for food, water and rest, and an increase in the mandatory rest stop time from 5 to 8 hours (CFIA, 2019). An exception to this is for unweaned calves that cannot be transported for more than 12 hours before having a mandatory rest of 8 hours (CFIA, 2019). Another major difference between the old and new regulations is that transport duration includes the time required to load and unload the cattle since this is also time that the animals must remain on the truck without feed, water or rest.

The regulations also define animal fitness for travel. A compromised animal refers to “an animal with reduced capacity to withstand transportation but where local transportation with special provisions will not lead to undue suffering” (CFIA, 2019). Unfit cattle refer to “animals with reduced capacity to withstand transportation and where there is a high risk that transportation will lead to undue suffering” (CFIA, 2019). Unfit cattle may only be transported for veterinary treatment or diagnosis. Examples of unfit cattle include downer animals, and cattle with cancer eye or bone fracture. Currently there is little financial disincentive for farmers to stop shipping compromised dairy cows because slaughter plants stand to get significant financial returns if these animals survive their journey to the plant (Edwards-Callaway et al., 2019). Consequently, shipping compromised cull cows to slaughter remains common despite being a substantial welfare problem.

The current revisions to the transport regulations were based on several years of consultation with veterinarians, producers, livestock transporters, scientists and the public. The main goal of the revisions

was “to improve the well-being of animals during the entire transportation process, keeping in mind Canada's geographic size and the time required to travel between locations” (CFIA, 2019). The current amendments took into consideration several factors including public concern for lengthy transport durations, limited feed, rest and water intervals, incorporation of current research and increased pressure for compliance with international standards such as the OIE. Currently, the EU regulations specify a maximum of 14 hours of transport before a required 8-hour rest (European Commission, 2005) while the U.S. specifies a maximum of 28 hours (USDA, 1997) with no mention of a feed, water and rest period. Future changes to the transport regulations need to remain science-based rather than emotion-based to ensure animal welfare and not political pressure is the main consideration.

▪ Conclusions

Unweaned dairy calves and cull dairy cows have unique challenges regarding transportation because of their reduced condition, health and ability to cope with stress. Consequently, producers and transporters must be more vigilant about how these cattle are managed throughout the transport process so poor welfare outcomes are minimized. This requires that producers have access to science-based information regarding the welfare impacts of relevant transport related factors (i.e., animal type, transport duration, environment, regulations). The studies outlined above provide evidence that calf and cow welfare can be improved by ensuring the animals are in good condition at loading. In addition, longer duration transports with restricted access to feed, water and rest, and under extreme environmental conditions, increase indicators of reduced welfare. At this time little is known regarding what level of indicators represent a true welfare concern. This is one reason why animal outcome measures such as morbidity and mortality will remain important. Continued assessment of combined animal and non-animal factors will be necessary to further guide animal management aligned with industry and societal demands. It is important that research rather than emotion continues to drive any regulation changes going forward.

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