Animal Welfare Institute

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April 1, 2024

The Honorable Thomas J. Vilsack
Secretary
United States Department of Agriculture
1400 Independence Ave SW
Washington, DC 20250

Dr. Michael Watson
Administrator
Animal and Plant Health Inspection Service
United States Department of Agriculture
4700 River Road
Riverdale, MD 20737

VIA USPS and electronic mail

RE: Petition for Rulemaking

Dear Secretary Vilsack,

Please see the attached petition submitted on behalf of the Animal Welfare Institute (AWI) requesting that the United States Department of Agriculture (USDA) initiate rulemaking under the Animal Health Protection Act to protect animals during domestic transport. Specifically, this petition requests that the USDA and its Animal and Plant Health Inspection Service (APHIS) initiate rulemaking to adopt fitness for transport standards for vulnerable animals transported interstate.

AWI is a nonprofit organization dedicated to reducing animal suffering and promoting the welfare of all animals, including animals in agriculture. AWI seeks to reduce suffering by identifying and promoting policies that improve the welfare of animals on farms, during transport, and at slaughter. In service of its transport objective, AWI works to educate the public about the conditions faced by animals during domestic and international transport and advocates for improvements to achieve humane transport for all farmed animals.

Farmed animals experience significant stress during transport, which is harmful to their health and welfare. They become especially vulnerable as journey durations lengthen, leading to an increased risk of mortality, injury, and infection. Accordingly, the World Organisation for Animal Health (WOAH) has established criteria to assess whether animals are fit to be transported by land. Animals in high-risk groups, such as very young animals and cull animals, all of whom are frequently subject to long journeys, are particularly vulnerable to the harmful impacts of transport.

Current federal regulations provide that the interstate movement of diseased animals is generally prohibited. However, the United States has not adopted the WOAH standards, and currently, there are no enforceable requirements that any animals transported within the United States are fit to undergo those journeys. There is evidence that unfit neonatal and cull animals are shipped interstate on a daily basis. This practice results in the poor health and welfare of vulnerable animals, resulting in greater risk of the dissemination and transmission of pathogens and increased antibiotic use and resistance.

AWI respectfully requests that the USDA initiate a rulemaking to 1) establish fitness standards for travel, 2) require certificates of veterinary inspection for all interstate travel of vulnerable animals, and 3) provide for penalties for violations of the rules.

Thank you for your consideration. Please feel free to contact me should any questions arise at dena@awionline.org or (202) 446-2146.

Sincerely,

Dena Jones

Dena Jones, MS
Director, Farmed Animal Program

PETITION FOR RULEMAKING

TO: Thomas J. Vilsack, Secretary
United States Department of Agriculture
1400 Independence Ave SW
Washington, DC 20250

Dr. Michael Watson, Administrator
Animal and Plant Health Inspection Service
United States Department of Agriculture
4700 River Road
Riverdale, MD 20737

PETITION: To Promulgate Regulations Under the Animal Health Protection Act to Establish Fitness for Transport Standards for Animals Shipped Interstate by Land Within the United States.

SUBMITTED BY: **Animal Welfare Institute**, 900 Pennsylvania Avenue, SE, Washington, DC 20003, (202) 337-2332

DATE: April 1, 2024

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I. INTRODUCTION

This petition is submitted on behalf of the Animal Welfare Institute (AWI) and Animals' Angels and requests that the United States Department of Agriculture (USDA) and its Animal and Plant Health Inspection Service (APHIS) initiate rulemaking to promulgate regulations establishing fitness for travel criteria for neonatal and cull animals transported interstate. For the purpose of this petition, "animal" means livestock as defined by USDA export regulations.[1]

At any given time, significant numbers of animals are being transported around the country, often for extended periods of time. Transport is recognized as one of the most stressful times in a farmed animal's life, and the amount of suffering an animal endures depends primarily on two things: transport conditions (stocking density, provision and condition of bedding, trailer design, duration, weather, etc.) and the animal's health and physical state upon undertaking the journey.

Transport can be a challenging time for healthy and physically fit animals, but challenges are even greater for animals that are young, weak, diseased, or injured. Animals already in a state of poor welfare are less able to cope with the additional challenges associated with transport and often experience further deterioration in condition, resulting in unnecessary suffering or even death. Particularly vulnerable animals, such as neonatal "surplus" calves and cull animals, have less economic value than their "market" counterparts, and thus their welfare during transport is more likely to be overlooked by producers and carriers.

Studies have shown that stress, particularly when prolonged, lowers an animal's ability to resist infection. Consequently, stress during transport and its downstream effects contribute significantly to animal health and welfare problems, food safety issues, and antibiotic resistance. Vulnerable animals that are unfit to travel are more likely to carry, contract, and/or transmit disease. It is therefore imperative that only those animals that are fit to undertake the journey are transported to reduce incidences of morbidity and mortality and minimize the risk of the spread of disease.

II. INTERESTS OF THE PETITIONERS, ANIMAL WELFARE INSTITUTE AND ANIMALS' ANGELS

A. Animal Welfare Institute

The Animal Welfare Institute (AWI) is a Washington, DC-based nonprofit founded in 1951. Since its creation, AWI has been dedicated to reducing animal suffering caused by people. AWI seeks better treatment of animals everywhere—in the laboratory, on the farm, in commerce, at home, and in the wild. This work includes efforts to improve the welfare of animals used in agriculture. In furtherance of its mission to alleviate animal suffering, AWI promotes higher-welfare farming systems and works to raise awareness about the cruel realities of conventional, industrial animal agriculture.

As part of AWI's mission to seek better treatment of animals everywhere, the organization advocates on behalf of farmed animals during transport. AWI educates its members and the public about the realities of the conditions animals face during transport both domestically and internationally by monitoring morbidity (illness) and mortality on international shipments of animals by sea, monitoring enforcement of the Twenty-Eight Hour Law, conducting in-depth research on animal transport, and publishing and regularly updating its reports *Legal Protections for Farm Animals*

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[1] See definition of Livestock in Title 91 Exportation of Live Animals "Livestock. Horses, cattle (including American bison), captive cervids, sheep, swine, and goats, regardless of intended use." 9 C.F.R. § 91.1

During Transport[2] and *A Review: The Twenty-Eight Hour Law and Its Enforcement*.[3] AWI also advocates for improved enforcement of laws and the expansion of protections for animals during transport via regulation, legislation, and voluntary industry standards. For example, in 2011 AWI and the World Society for the Protection of Animals petitioned the USDA to adopt fitness for travel standards for animals shipped by sea internationally, except to Canada and Mexico.[4] After several, highly publicized incidents of high mortality of pregnant dairy heifers being shipped to Europe, the USDA eventually promulgated the rule as requested.[5]

B. Animals' Angels

Animals' Angels Inc. is a Maryland-based nonprofit organization focused on improving conditions for farmed animals. Animals' Angels works primarily in the field—conducting hands-on research and investigations, with the goal of reporting observations, documenting conditions, and exposing animal cruelty.

Animals' Angels shares results of investigations and documentation of cruelty with law enforcement and government agencies to ensure accountability for violations of animal protection laws. Investigations are also shared with auction and slaughter plant management and trucking companies to encourage the improvement of animal handing practices during transportation, at auction, and at slaughter. In addition, Animals' Angels engages with the media and the public to promote awareness of serious issues affecting farmed animals every day.

III. REQUESTED ACTION

United States citizens have the right to petition their government to add, amend, or repeal regulations under the Right to Petition Government Clause of the First Amendment of the United States Constitution,[6] the Administrative Procedure Act,[7] and USDA regulations.[8] Under this authority, the petitioners submit this petition for rulemaking to the Secretary of the Department of Agriculture (Secretary). Petitioners request that the Secretary uses their authority under the Animal Health Protection Act to promulgate regulations ensuring only fit animals are transported to protect public health and domestic commerce of the United States as well as the health and welfare of animals transported within the United States, and to ensure that animals arrive at their destination in a safe, healthy condition.

IV. LEGAL BACKGROUND

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[2] ANIMAL WELFARE INST., LEGAL PROTECTIONS FOR FARM ANIMALS DURING TRANSPORT (Apr. 2021) https://awionline.org/sites/default/files/uploads/documents/21LegalProtectionsTransport.pdf.
[3] ANIMAL WELFARE INST., A REVIEW: THE TWENTY-EIGHT HOUR LAW AND ITS ENFORCEMENT (June 2022) https://awionline.org/sites/default/files/uploads/documents/22-Twenty-Eight-Hour-Law-Report.pdf.
[4] ANIMAL WELFARE INST. & WORLD SOCIETY FOR THE PROTECTION OF ANIMALS, PETITION TO THE USDA TO AMEND THE INSPECTION AND HANDLING OF LIVESTOCK FOR EXPORTATION REGULATIONS TO INCLUDE FITNESS FOR TRANSPORT REQUIREMENTS (Feb. 18, 2011) https://awionline.org/sites/default/files/uploads/legacy-uploads/documents/PetitiontoUSDAonanimalexportsfinal-1298047206-document-36635.pdf.
[5] Exportation of Live Animals, Hatching Eggs, and Animal Germplasm From the United States, 81 Fed. Reg. 2967 (Jan. 20, 2016) (codified at 9 C.F.R. §91); *Groups Urge Suspension of US, Russia Livestock Trade*, MEAT + POULTRY, (Sep.19, 2011), https://www.meatpoultry.com/articles/7922-groups-urge-suspension-of-us-russia-livestock-trade.
[6] U.S. CONST. amend. I.
[7] 5 U.S.C. § 553(e).
[8] 7 C.F.R. § 1.28.

The Animal Health Protection Act (AHPA), passed in 2002 and codified as Title 7, U.S.C. Section 8301 et seq., is the federal statutory framework for animal health legislation. The intent of the act is: to ensure the prevention, detection, and eradication of diseases in animals in order to protect 1) the health of animals, 2) the health and welfare of the people of the United States, 3) the economic interests of the livestock and related industries, 4) the environment, and 5) interstate commerce and foreign commerce. Congress's findings specifically note that the health of animals is affected by the methods by which they are transported in interstate and foreign commerce.[9] The Act enables the Secretary of Agriculture to "prohibit or restrict the movement in interstate commerce of any animal, article, or means of conveyance if the Secretary determines that the prohibition or restriction is necessary to prevent the introduction or dissemination of any pest or disease of livestock."[10]

APHIS has promulgated regulations related to monitoring the health status of animals transported interstate.[11] While 9 C.F.R. section 71.3 provides that the interstate movement of diseased animals or poultry is generally prohibited, there is currently no general requirement that animals be fit for transport. This chapter's regulations require certain species of animals moved interstate to be individually identified and accompanied by a certificate of veterinary inspection (CVI)[12] completed by an accredited veterinarian, APHIS representative, or State or Tribal representative.[13] The CVI typically requires the veterinarian to attest that the animals are free of evidence of infectious or contagious disease, such as brucellosis, tuberculosis, or scrapie.[14] For certain species transported to or from specific locations, or those being sent directly to slaughter, no documentation of health status is required.[15]

By contrast, federal export regulations state, "All livestock intended for export by air or sea must receive a visual health inspection from an APHIS veterinarian within 48 hours prior to embarkation, unless the importing country specifies otherwise. The purpose of the inspection is to determine whether the livestock are sound, healthy, and fit to travel."[16] The regulation then lists eight categories of animals that are unfit to travel. These categories are taken directly from the World Organisation for Animal Health (WOAH) code chapter applicable to animals transported by sea.[17] However, no part of the WOAH code chapter applicable to transport of animals by land has been incorporated into the U.S. domestic or international transport regulations.

Equines bound for slaughter are the only animals whose fitness prior to transport domestically is addressed by federal regulation. Along with other documentary requirements, the owner or shipper of an equine traveling to slaughter must make a statement of fitness to travel at the time of loading

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[9] 7 U.S.C. § 8301.
[10] 7 U.S.C. § 8305(1).
[11] 9 CFR § 70-89.
[12] Individual states issue a certificate of veterinary inspection (CVI). The federal code refers to Interstate Certificate of Veterinary Inspection (ICVI). In practice the USDA uses CVI and ICVI interchangeably, as both contain the same information. This petition will refer to CVIs.
[13] 9 C.F.R. § 86.5
[14] 9 C.F.R. § 86.1
[15] 9 C.F.R § 86.5
[16] 9 C.F.R. § 91.7
[17] World Organization for Animal Health [WOAH], *Terrestrial Animal Health Code, Chapter 7.2, Transport of Animals by Sea* (2008).

which indicates that the equine is able to bear weight on all four limbs, able to walk unassisted, not blind in both eyes, older than 6 months of age, and not likely to give birth during the trip.[18]

While many states require animals imported into the state to be accompanied by a CVI, as with federal regulation, those transported directly to slaughter are exempt.[19]

V. FACTUAL BACKGROUND

Here the petition outlines the basic facts related to the road transport of farmed animals within the U.S. beginning with a discussion of the total number of animals subject to interstate transport based on available data. It then discusses what it means for an animal to be fit for transport based on scientific literature, industry standard, and international regulatory standards. Details of transport stress and how it affects an animal's immune function are also reviewed. Two categories of animals—cull animals and neonatal calves, both of which are particularly vulnerable and at risk of being transported while unfit—are described, including the marketing channels through which these animals pass as well as the number transported within the U.S. based on limited available data.

A. Number of Farmed Animals Transported by Road within the United States

The transport of farmed animals has increased steadily over the past several decades, as the animal agriculture industries have moved toward greater consolidation, vertical integration, and separation between stages of production.[20] As a result, farmed animals are now routinely transported for a variety of purposes, most notably breeding, backgrounding, grazing, feeding, marketing, and slaughter. Smaller numbers of animals are also transported for less common purposes, including exhibition, competition, laboratory research, and for importation or exportation from the United States.[21]

According to the USDA's National Agricultural Statistics Service (NASS), 54.4 million calves and cattle, 182 million pigs and hogs, and 1.4 million sheep and lambs were marketed in 2022.[22] For that year, NASS reported on-farm slaughter for cattle, calves, hogs, and sheep combined as just 292,000 animals.[23] This means that a very small percentage of animals are raised and slaughtered at only one location—the vast majority of animals are transported at least once during their lives.

NASS also estimates the number of pigs, hogs, cattle, and calves transported interstate annually. These "inshipments" include all animals entering a state for feeding or breeding, but exclude animals brought in for immediate slaughter.[24] According to the 2022 report, NASS estimated more than 21 million cattle and calf inshipments[25] and 62 million hog and pig inshipments.[26] According to these

[18] 9 C.F.R. § 88.4(a)(3)(vii).
[19] *E.g.* ARIZ. ADMIN. CODE. §3-2-606, CAL. CODE REGS. tit. 3, §830.3; MICH. COMP. LAWS §287.719; NM CODE R. §21.32.4.8; 4 TEX. ADMIN. CODE § 51.2; WIS. ADMIN. CODE ATCP §10.06.
[20] Monica Engebretson, *North America*, in LONG DISTANCE TRANSPORT AND WELFARE OF FARM ANIMALS 219 (M. Appleby, V. Cussen, L. Garcés, L. Lambert & J. Turner, eds., 2008).
[21] Based on AWI's analysis of state veterinary inspection and federal import/export records.
[22] NATIONAL AGRICULTURAL STATISTICS SERVICE, USDA, NO. 0748-0318, MEAT ANIMALS PRODUCTION, DISPOSITION, AND INCOME: 2022 SUMMARY 8, 15 (Apr. 2023); NATIONAL AGRICULTURAL STATISTICS SERVICE, USDA, NO. 1949-1611 SHEEP AND GOATS 9 (Jan. 2023).
[23] NATIONAL AGRICULTURAL STATISTICS SERVICE, USDA, NO. 0499-0544, LIVESTOCK SLAUGHTER: 2022 SUMMARY 8 (Apr. 2023).
[24] NASS, NO. 0748-0318, *supra* note 22.
[25] *Id*. at 8.
[26] *Id*. at 14.

reports, the number of cattle, calves, hogs, and pigs shipped interstate increased almost four-fold in the past 60 years, from approximately 23 million animals in 1970[27] to 83 million in 2022.

The most recent comprehensive report on interstate animal transport was authored by the USDA's Economic Research Service (ERS) in 2003.[28] This report describes interstate movements of cattle, sheep, and pigs by assessing patterns in the shipping of these species. The researchers combined information contained in certificates of veterinary inspection and/or import permits for the year 2001 from 29 states to track the movement of animals.[29] The data excluded animals transported for slaughter, however, since most states do not require permits or veterinary certificates for animals being sent directly to slaughter.[30] The ERS estimated that, at the time of their study, 57% of all cattle, 27% of all pigs, and 34% of all sheep will be shipped across state lines at least once during their lifetimes.[31]

B. Defining Fitness

"Fitness for transport" is fundamentally defined in terms of animal health and welfare. Transport is generally understood to carry the risk of compromising welfare as assessed by the Five Freedoms framework: freedom from hunger and thirst; discomfort; pain, injury or disease; fear and distress; and freedom to express normal behavior.[32] An animal is considered fit if their physical condition is such that transportation will not cause suffering, i.e., "prolonged or severe negative/unpleasant affective states," or a significant decline in their health status.[33] In other words, although transport generally poses a risk to animal health and welfare, particularly if the journey is very long, this risk can be substantially decreased with appropriately selected and enforced "fitness for transport" requirements.[34] Because transporting animals carries the risk of disseminating disease from one region to another, ensuring that animals are fit for transport, i.e., not sick or weak, is also important for protecting public health and the health of a region's animal populations.

Even though it is generally agreed that ensuring animals are fit for transport is the most important factor in ensuring welfare, there is no uniform definition of what exactly constitutes fitness. At a minimum, the principle underlying fitness criteria is that an animal is unfit if the journey will result in suffering or death. Most guidelines promulgated by governmental bodies and industry groups agree that blind, non-ambulatory, severely injured, or heavily pregnant animals cannot complete the journey without significant or unnecessary suffering.[35] The European Union, like WOAH, also

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[27] STATISTICAL REPORTING SERVICE, USDA, MEAT ANIMALS FARM PRODUCTION, DISPOSITION, AND INCOME, BY STATES: 1969-1970 6, 14 (Apr. 1971).
[28] Dennis A. Shields & Kenneth H. Mathews, Jr., USDA ECONOMIC RESEARCH SERVICE, LDP-M-108-01, INTERSTATE LIVESTOCK MOVEMENTS (June 2003).
[29] *Id*. at 12 ("Animals in these States represented about two-thirds of the U.S. cattle inventory, 80 percent of the hog inventory, and half of the sheep inventory" [at the time of the research]).
[30] *Id*.
[31] *Id*. at 2.
[32] Mellor, D.J. (2016) Updating Animal Welfare Thinking: Moving beyond the "Five Freedoms" towards "A Life Worth Living, *Animals (Basel),* 6(3):21. https://doi.org/10.3390/ani6030021
[33] Cockram, M.S. (2019) Fitness of animals for transport to slaughter. *Can Veterinary. J.* 60(4):423-429.
[34] Temple Grandin, *Welfare During Transport of Livestock and Poultry*, in IMPROVING ANIMAL WELFARE: A PRACTICAL APPROACH (3d ed. 2021) ("The most important factor for the welfare of animals during transport is to put an animal that is fit for transport on the truck…").
[35] Grandin, T. (2016) Transport Fitness of Cull Sows and Boars: A Comparison of Different Guidelines on Fitness for Transport, *Animals (Basel)*, 6(12), 77. https://doi.org/10.3390/ani6120077; *Transportation and Fitness-to-Travel*

defines very young neonates as unfit for transport.[36] Determining whether an animal is fit also requires consideration of the journey itself; an animal may be fit to undertake a short journey in fine weather with a lower stocking density, but not a long journey in high temperatures with a higher stocking density.

This petition specifically requests that USDA prohibit the transport of neonatal and cull animals that are 1) sick, injured, weak, disabled, or fatigued, 2) have an unhealed navel, or 3) have a body condition that would result in poor welfare because of the expected climatic conditions. These three criteria are particularly relevant to vulnerable animals and are drawn directly from the WOAH code chapter on the transport of animals by land.

Generally, veterinary science considers the following animal-based measures, or outcomes, as indicators of poor welfare during transport: percentage of animals dead on arrival, percentage of animals experiencing sickness (morbidity within 30 days after arrival), percentage of animals arriving nonambulatory, presence of surface and deep bruises on animals, and percentage of animals with surface hide damage.[37]

Employees at federally inspected slaughter plants track the numbers of animals who were condemned because they were dead on arrival, euthanized on arrival, or died while in lairage.[38] Although animals transported to slaughter while unfit may still be processed without being condemned, and animals that were fit to travel may be condemned for reasons unrelated to fitness, antemortem condemnation is an important measure of welfare during transport. In a processing plant, the presence of a dead or non-ambulatory animal (absent misadventure on the road) is a strong indicator that they were unfit for transport.[39] Death during transit or in lairage just prior to slaughter is a serious animal welfare issue, a potential indicator of disease, and an economic loss for the industry.[40]

C. Transport Stress

When evaluating an animal's fitness for transport, one key consideration is their ability to tolerate the stress associated with transport. Transport stress is considered a type of chronic (rather than acute) stress because it encompasses events that occur immediately pre-transport (e.g., food withdrawal), during transport (including loading, unloading, and time at auctions or collections centers), and post-

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Recommendations for Cattle, AMERICAN ASSOCIATION OF BOVINE PRACTITIONERS (Aug. 2019), https://www.aabp.org/Resources/AABP_Guidelines/transportationguidelines-2019.pdf; Transport Quality Assurance, *Version 8 TQA Handbook*, NATIONAL PORK BOARD (2023); C.R.C c. 296 Health of Animals Regulations: Part XII Transport of Animals s. 136 (2022) (Can.).

[36] Annex 1, EU Council Regulation (EC) No 1/2005 of 22 December 2004 on the protection of animals during transport and related operations and amending Directives 64/432/EEC and 93/119/EC and Regulation (EC) No 1255/97 (exemption for transports under 100km); World Organization for Animal Health [WOAH], *Terrestrial Animal Health Code, Chapter 7.3, Transport of Animals by Land* (2011).

[37] Temple Grandin, *Welfare During Transport of Livestock and Poultry*, in IMPROVING ANIMAL WELFARE: A PRACTICAL APPROACH 242 (3d ed. 2021)

[38] FSIS Directive 6100.1, Ante-Mortem Livestock Inspection (USDA 2020) https://www.fsis.usda.gov/sites/default/files/media_file/2020-07/6100.1.pdf.

[39] Romero, M.H. et al. (2022) Field Trial of Factors Associated with the Presence of Dead and Non-ambulatory Pigs During Transport Across Three Colombian Slaughterhouses, *Frontiers in Veterinary Sci.* 9:790570. https://doi.org/10.3389/fvets.2022.790570; Sutherland, M.A. et al. (2008) Health of non-ambulatory, non-injured pigs at processing *Livestock Sci.* 116:237–245. https://doi.org/10.1016/j.livsci.2007.10.009

[40] Peterson, E. et al. (2017) Use of Temperature, Humidity, and Slaughter Condemnation Data to Predict Increases in Transport Losses in Three Classes of Swine and Resulting Foregone Revenue. *Frontiers in Veterinary Sci.,* 4:67. https://doi.org/10.3389/fvets.2017.00067

transport (restraint, new diet, adapting to the new environment). Transport stress encompasses psychological stress, physiologic stress, and physical stress.[41] As described in more detail below, potential stressors include dehydration/thirst, food deprivation/hunger, fatigue, mixing with unfamiliar animals, and exposure to highly variable or extreme weather conditions.

Even short journeys have been shown to induce significant stress.[42] Stress is measured through various physiologic parameters, including cortisol release. Increases in circulating cortisol have been noted in nearly all transport studies in which cortisol levels were measured.[43] For pigs, some have suggested, based on salivary cortisol levels, that transportation is "the most stressful event" these animals experience during their lifetimes.[44]

1. Impact of Transport Stress on Immune Function

It is well accepted that transport-associated stress temporarily decreases immune system function and increases vulnerability to opportunistic infections.[45] The immunosuppressive effect of stress results from several different mechanisms. In response to stress, the hypothalamic-pituitary-adrenal (HPA) axis is activated, leading to release of the glucocorticoid hormone, cortisol.[46] Increased cortisol levels result in decreased antibody concentrations, potentially by suppressing antibody production and/or increasing breakdown (catabolism) of antibody proteins.[47] Elevated cortisol levels also inhibit the functioning of neutrophils, crucial cells of the immune system that engulf and destroy invading microorganisms.[48] Transport stress in particular seems to affect neutrophil function during the post-

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[41] Carroll, J. A., & Forsberg, N. E. (2007) Influence of stress and nutrition on cattle immunity. *The Veterinary Clinics of North America: Food Animal Practice*, 23(1):105–149. https://doi.org/10.1016/j.cvfa.2007.01.003

[42] Pascual-Alonso, M. et al. (2017) Thermophysiological, haematological, biochemical and behavioural stress responses of sheep transported on road. *J. of Animal Physiology and Animal Nutrition*, 101(3):541–551. https://doi.org/10.1111/jpn.12455

[43] Earley, B. (2017) Invited review: Relationship between cattle transport, immunity and respiratory disease. *Animals,* 11(3): 486–492. https://doi.org/10.1017/S1751731116001622

[44] Schwartzkopf-Genswein, K.S. et al. (2012) Road transport of cattle, swine and poultry in North America and its impact on animal welfare, carcass and meat quality: A review. *Meat Sci*., 92(3):227–243. https://doi.org/10.1016/j.meatsci.2012.04.010; Geverink, N. A. et al. (1998) Effects of regular moving and handling on the behavioral and physiological responses of pigs to preslaughter treatment and consequences for subsequent meat quality. *J. of Animal Sci.*, 76(8):2080–2085. https://doi.org/10.2527/1998.7682080x

[45] Hulbert, L. E., & Moisá, S. J. (2016) Stress, immunity, and the management of calves. *J. of Dairy Sci*., 99(4):3199–3216. https://doi.org/10.3168/jds.2015-10198; Cortese, V. (2009) Neonatal Immunology. *The Veterinary Clinics of North America: Food Animal Practice*, 25(1):221–227. https://doi.org/10.1016/j.cvfa.2008.10.0033168/jds.2015-10198; Cusack P. (2023) Evaluation of practices used to reduce the incidence of bovine respiratory disease in Australian feedlots (to November 2021). *Australian Veterinary J.*, 101(6):230–247. https://doi.org/10.1111/avj.13239; Roadknight, N. et al. (2021a) Invited review: The welfare of young calves transported by road. *J. of Dairy Sci.* 104(6):6343–6357. https://doi.org/10.3168/jds.2020-19346; Earley, B. et al. (2012) The effect of transport by road and sea on physiology, immunity and behaviour of beef cattle. *Research in Veterinary Sci*., 92(3):531–541. https://doi.org/10.1016/j.rvsc.2011.04.002; Mormede, P. et al. (1982) Effect of transportation on blood serum composition, disease incidence, and production traits in young calves. Influence of the journey duration. *Annals of Veterinary Research* (Fr.) 13(4):369–384. https://hal.science/hal-00901393; James A. Roth, *Cortisol as Mediator of Stress-Associated Immunosuppression in Cattle*, *in* ANIMAL STRESS 225–243 (G.P. Moberg ed., 1985); Murata, H. & Hirose, H. (1991) Effect of transportation stress on bovine lymphocyte and neutrophil functions. *Japan Agricultural Research Quarterly*, 25(1):61–64; Carroll & Forsberg (2007), *supra* note 41.

[46] Roth, J. A., & Kaeberle, M. L. (1982) Effect of glucocorticoids on the bovine immune system. *J. of the American Veterinary Med. Ass'n.*, 180(8):894–901.

[47] *Id*.

[48] *Id*.; Roth (1985), *supra* note 45.

transport period.[49] Even relatively short periods of transport (up to four hours) have been documented to result in impaired functioning of other immune cells, including lymphocytes and macrophages in the lungs of livestock.[50]

Stress also decreases production of immune cells (specifically suppressing lymphocyte blastogenesis), which appears to be at least partially brought about by elevated cortisol levels.[51] In addition, stress decreases levels of certain cytokines involved in generating an immune response (specifically suppressing production of interferon IFN-ɣ), potentially by a cortisol-independent mechanism.[52] Research has found numerous extra-adrenal mechanisms of stress-induced immunosuppression, including via the central nervous system.[53]

While transport stress potentially affects all transported animals to a certain degree, those who are in good condition and fit to travel are better able to cope with transport stressors. Animals who are unfit for transport because of illness or injury often experience considerable chronic stress prior to transport, meaning they are already immunosuppressed prior to being impacted by transport stress.[54] Periparturient livestock, transport of whom is restricted in WOAH code chapters on transport of animals by land and by sea, have naturally-occurring immunosuppression due to the rate and extent of tissue mobilization during the periparturient period, reduction in neutrophil and lymphocyte function, and increases in circulating glucocorticoids during birth.[55] WOAH's prohibition on the transport of animals "whose body condition would result in poor welfare because of the expected climatic conditions" has implications for immunocompetence, as both heat stress and cold stress suppress immune response in a range of species through multiple mechanisms.[56]

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[49] Hulbert & Moisá (2016), *supra* note 45.

[50] Murata & Hirose (1991), *supra* note 45.

[51] Roth (1985), *supra* note 45; Earley et al. (2012), *supra* note 45.

[52] Earley et al. (2012), *supra* note 45; Vogt, A. et al. (2023) Fecal cortisol metabolites reflect transport stress in 3-month-old dairy calves pre- and postweaning: A pilot study. *J. of Dairy Sci*., 106(3):2124–2136. https://doi.org/10.3168/jds.2022-22341

[53] Mari S. Golub & M. Eric Gershwin, *Stress-Induced Immunomodulation: What Is It, If It Is?*, *in* ANIMAL STRESS 177-192 (G.P. Moberg ed., 1985).

[54] Ley, S. J. et al. (1994) Effect of chronic pain associated with lameness on plasma cortisol concentrations in sheep: a field study. *Res. in Veterinary Sci.*, 57(3):332–335. https://doi.org/10.1016/0034-5288(94)90126-0; Bustamante, H. A. et al. (2015) Stress and pain response after oligofructose induced-lameness in dairy heifers. *J. of Veterinary Sci.*, 16(4):405–411. https://doi.org/10.4142/jvs.2015.16.4.405

[55] Ingvartsen, K. L., & Moyes, K. M. (2015) Factors contributing to immunosuppression in the dairy cow during the periparturient period. *The Japanese J. of Veterinary Research*, 63(1):S15–S24; Ster, C. et al. (2012) Effect of postcalving serum nonesterified fatty acids concentration on the functionality of bovine immune cells. *J. of Dairy Sci.*, 95(2):708–717. https://doi.org/10.3168/jds.2011-4695; Aleri, J. W. et al. (2016) Periparturient immunosuppression and strategies to improve dairy cow health during the periparturient period. *Res. in Veterinary Sci.*, 108:8–17. https://doi.org/10.1016/j.rvsc.2016.07.007; Theodorou, G. et al. (2007) Short communication: study of immune parameters in three Greek dairy sheep breeds during the periparturient period. *J. of Dairy Sci.*, 90(12):5567–5571. https://doi.org/10.3168/jds.2007-024; Cai, T. Q. et al. (1994) Association between neutrophil functions and periparturient disorders in cows. *American J. of Veterinary Res.*, 55(7):934–943.

[56] Sun, Y. et al. (2018) Protective effects of zymosan on heat stress-induced immunosuppression and apoptosis in dairy cows and peripheral blood mononuclear cells. *Cell Stress & Chaperones*, 23(5):1069–1078. https://doi.org/10.1007/s12192-018-0916-z; Carroll, J. A. et al. (2012) Influence of environmental temperature on the physiological, endocrine, and immune responses in livestock exposed to a provocative immune challenge. *Domestic Animal Endocrinology*, 43(2):146–153. https://doi.org/10.1016/j.domaniend.2011.12.008; Carroll, J. A. et al. (2001) Impact of environmental temperature on response of neonatal pigs to an endotoxin

This petition focuses particularly on two specific groups of animals that are most likely to be transported when unfit: cull animals and neonatal (under 4 weeks) animals, specifically "surplus" or "replacement" dairy calves.

D. Cull Animals

1. Market

Cull animals are removed from a producing herd and sent to slaughter due to age, illness, or other infirmity typically affecting productivity. Cull cattle include dairy cows, who are typically culled due to health problems, low milk production, or fertility issues, and beef cattle, who are culled due to health problems or poor growth under the feedlot system.[57] Cull pigs are typically breeding sows who are culled due to fertility issues and lameness, and breeding boars, who are culled due to reproductive problems and obesity.[58] Sheep and goats used for breeding are also culled.

Cull sows and boars and "non-conforming" hogs are typically sold in a secondary marketing channel separate from "market hogs" that meet qualifications set by major packers. Cull pigs are sold through auction markets or through specialized dealers. It is common for cull sows to be transported to intermediate locations or "collection points" where they can stay for up to several days to be sorted or resold before they are sent to slaughter. Cull pigs are usually transported at least twice and, as discussed below, can spend considerable time in the marketing channel before they arrive at the slaughterhouse.[59]

Most dairy producers in the U.S. remove around 28% of their herd annually to maintain profitable rates of milk production.[60] Some of these animals will be sold to other dairies in order to reduce excess productivity and cut costs at the dairy of origin. Our concern here, though, is with those removed from the herd and sent to slaughter.

As with cull breeding pigs, the market for cull dairy cows has many variations and complexities. Some cows are transported directly to slaughter plants, while many others pass through one or more auction markets or dealer facilities before making the journey to slaughter.[61] The 2014 National Animal Health Monitoring System (NAHMS) survey on dairy production in the U.S. reported that 58.3% of cows removed from a herd were sent to a market or auction, while 33.5% were sent directly

challenge. *American J. Veterinary Res.*, 62(4):561–566. https://doi.org/10.2460/ajvr.2001.62.561; Regnier, J. A., & Kelley, K. W. (1981) Heat- and cold-stress suppresses in vivo and in vitro cellular immune responses of chickens. *American J. of Veterinary Res.*, 42(2):294–299.

[57] Edwards-Callaway, L. N. et al. (2019) Culling Decisions and Dairy Cattle Welfare During Transport to Slaughter in the United States. *Frontiers in Veterinary Sci.* 5:343. https://doi.org/10.3389/fvets.2018.00343

[58] Grandin (2016), *supra* note 35.

[59] Dan Sutherland, THE MARKETING JOURNEY OF CULL SOWS AND SECONDARY MARKET PIGS, SWINE HEALTH INFORMATION CENTER, (June 21, 2017) https://www.swinehealth.org/the-marketing-journey; Blair, B., & Lowe, J. (2019) Describing the Cull Sow Market Network in the US: A Pilot Project, *Preventive Veterinary Med.*, 162:107–109. https://doi.org/10.1016/j.prevetmed.2018.11.005

[60] Edwards-Callaway et al. (2019), *supra* note 57.

[61] Cockram, M.S. (2021) Invited review: The welfare of cull dairy cows. *Applied Animal Sci*., 37(3):334-352. https://doi.org/10.15232/aas.2021-02145

to a packer or slaughter plant. Only 7.3% were sent to another dairy.[62] As of 2019, about 10% of the beef produced in the U.S. came from culled dairy cows.[63]

2. Numbers of Cull Animals Shipped Annually

There is no official or unofficial data available on the number of unfit cull animals transported interstate within the U.S. What we do know is that 3.05 million cull dairy cows were slaughtered at federally inspected establishments in 2022.[64] Additionally, 3.07 million cull sows and 293,000 cull boars were slaughtered in federally inspected establishments in 2022.[65] As explained below, because these animals are often suffering numerous health issues due to their time in production, the likelihood of suffering poor welfare outcomes (death, significant pain, becoming nonambulatory) increases in an already stressful situation. The science is clear that cull animals are the most at risk for being transported while unfit, and peer-reviewed research indicates that cull animals within North American marketing channels are often unfit for transport.[66] This is unsurprising, as they have no legal protection and there are no disincentives for producers to stop transporting unfit animals.

3. Journey Distance and Duration

Cull animals often spend significantly longer in marketing channels and transport than their "market" counterparts. Specific information on journey distance and duration is usually difficult to capture for these populations because they are sold and resold through auction markets, changing owners throughout the process.

In regard to cull cattle, different parts of the supply chain track cow movement differently, so the entire distance and duration of the journey is not captured by any one system.[67] One of the few sources of information on the transport of cull dairy cattle is the 2014 NAHMS dairy survey. It noted that 30% of dairy operations send cows directly to slaughter across state lines and that 11% of dairy cattle shipments travel more than 250 miles from a dairy to a packer or slaughter plant.[68] Auction or live market were the destination for 58% of cull cows, and although the survey reported that the majority of those cows travel for less than 250 miles, it did not track the distances traveled to slaughter after the first marketing destination. It reported that 22% of those sent to live markets travel 50-250 miles on just the first leg of their journey.[69] Because specialized slaughterhouses are required

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[62] NATIONAL AGRICULTURAL STATISTICS SERVICE, USDA, NO. 696.0218, DAIRY 2014: HEALTH AND MANAGEMENT PRACTICES ON U.S. DAIRY OPERATIONS 216 (Feb. 2018) (Hereinafter DAIRY 2014: HEALTH AND MANAGEMENT) https://www.aphis.usda.gov/animal_health/nahms/dairy/downloads/dairy14/Dairy14_dr_PartIII.pdf
[63] Moreira, L. C. et al. (2021) Beef production from cull dairy cows: a review from culling to consumption. *J. of Animal Sci*., 99(7):skab192. https://doi.org/10.1093/jas/skab192
[64] NATIONAL AGRICULTURAL STATISTICS SERVICE, USDA, NO. 0499-0544, LIVESTOCK SLAUGHTER: 2022 SUMMARY 17 (Apr. 2023).
[65] *Id*.
[66] Thodberg, K. et al. (2019) Transportation of Cull Sows–Deterioration of Clinical Condition From Departure and Until Arrival at the Slaughter Plant. *Front Vet Sci.,* 18(6):28. https://doi.org/10.3389/fvets.2019.00028; Grandin, *supra* note 34, at 242; McGee M. et al. (2016) An assessment of swine marketed through buying stations and development of fitness for transport guidelines. *J. Animal Sci.* 94(2):9. https://doi.org/10.2527/msasas2016-019; Vogel, K. D. et al. (2018) An Intercontinental survey of commercial abattoirs: Preliminary data on the prevalence of advanced preslaughter health and welfare conditions in mature cows. *The Bovine Practitioner*, 52(2):109–119. https://doi.org/10.21423/bovine-vol52no2p109-119
[67] Schwartzkopf-Genswein et al. (2012), *supra* note 44; Edwards-Callaway et al. (2019), *supra* note 57.
[68] DAIRY 2014: HEALTH AND MANAGEMENT, *supra* note 62, at 20-26.
[69] *Id*.

for handling animals of this size, cull dairy cattle often face a second extended journey (>250mi) after they are purchased at the live animal market, with the transport vehicle potentially making multiple stops to pick up additional cull cattle before arriving at the slaughterhouse.

In one of the few studies that tracked cull dairy cattle in North America throughout their entire journey from the farm to slaughter, cows were found to spend 82 ± 46 hours in the marketing system before being slaughtered. Over half the cows were in the marketing system for more than 3 days, during which they often have little or no access to food and water.[70]

In 2020, the College of Veterinary Medicine at the University of Illinois Urbana-Champaign conducted an analysis of cull sow movements.[71] The analysis involved collecting premises identification tags (PITs) in partnership with USDA-APHIS Brucellosis Laboratory for one week each month for six months. A total of 17,493 PITs from 32 states were collected, representing about 8.4% of the total number of sows slaughtered each week at the 7 participating slaughter plants. The largest slaughter plant in the survey received sows from 26 states and 170 different production locations in a single week. The sows traveled a median straight-line distance of 293.7 miles with a maximum straight-line distance of 1,747.8 miles recorded.[72] An associated study collected sow farm removal dates for 2,886 of the sows in order to determine the length of time they spent in the marketing channel.[73] The median time from removal of the sow from the farm to slaughter was 3 days, with a maximum of 40 days for 2 individuals. Nearly 34% of sows were in the marketing channel for four days or longer.

Another study involved researchers collecting data from sows slaughtered at a plant in Illinois for a single week, using premise identification numbers to determine the sow's journey through collection points and to the farms of origin.[74] The 2,263 pigs came from 297 source farms in 21 states and Canada and then passed through 16 shipping locations in 7 states and Canada. The sows traveled a median straight-line distance of 657 miles to slaughter. The study indicated that between 2.5% and 14% of the sows likely were passed around and between multiple buying stations before being sent to slaughter.[75] It should be noted that the majority of Canadian cull sows are exported to the U.S. for processing.[76]

Due to their large size and skull anatomy, specialized slaughterhouses are often required for cull breeding pigs. There are only 17 federally inspected slaughter plants accepting sows in the U.S.[77] In

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[70] Stojkov, J. et al. (2020a) Management of cull dairy cows: Culling decisions, duration of transport, and effect on cow condition. *J. Dairy Sci*., 103(3):2636–2649. https://doi.org/10.3168/jds.2019-17435

[71] Blair, B.W. & Lowe, J.L. (2022) A descriptive exploration of animal movements within the United States cull sow marketing network. *J. Swine Health Production,* 30(2):72-78. 10.54846/jshap/1245

[72] *Id*.

[73] BENJAMIN W. BLAIR, A SPATIAL AND TEMPORAL ANALYSIS OF CULL SOW MOVEMENTS (2019, Swine Health Information Center) https://mnshmp.dl9.umn.edu/sites/mnshmp.umn.edu/files/2023-06/SHMP%202019l20.41%20%5BAnalysis%20of%20cull%20sow%20movement%5D.pdf

[74] Blair & Lowe (2019), *supra* note 59.

[75] Lowe, J & Blair, B. *Understanding Cull Sow Movements in North America: Implications on Disease Transmission,* Allen D. Leman Swine Conference, (Sep. 16-19, 2017, St. Paul, Minnesota). Available at https://www.slideshare.net/trufflemedia/dr-jim-lowe-understanding-cull-sow-movements-in-north-america-implications-on-disease-transmission

[76] ALEXANDREA WATTERS, USDA, NO. CA2023-0042, LIVESTOCK AND PRODUCTS ANNUAL (Sep. 2023) https://apps.fas.usda.gov/newgainapi/api/Report/DownloadReportByFileName?fileName=Livestock+and+Products+Annual_Ottawa_Canada_CA2023-0042.pdf

[77] Blair & Lowe (2019), *supra* note 59.

North America, there is only one slaughter plant that accepts cull boars, which means that boars are very likely subjected to protracted journeys prior to slaughter.[78]

E. Neonatal Replacement Heifers and Surplus Calves

1. Market

In the U.S. dairy industry, neonatal calves (less than 4 weeks of age[79]) born to cattle used for milk production are often transported soon after birth. Typically less than two weeks of age and often as young as one to three days of age, these calves may be intended to become replacement dairy heifers, but the majority, including most male calves, are considered "surplus," i.e., not needed or fit for dairy production, and are ultimately slaughtered for veal or dairy beef.[80] These calves may be slaughtered at under 3 weeks of age for "bob" veal, at 16 to 23 weeks of age for "special fed" or "milk fed" veal, or at 12 to 16 months of age for "dairy beef."[81]

"Surplus" calves spend many hours or even days on journeys either directly to a calf-rearing operation or slaughterhouse, or indirectly to these destinations via auctions or buying stations.[82] Livestock auctions are the most common destination for calves after leaving the farm. According to the USDA, 90% of dairies transport male calves off site soon after birth. Of these transported calves, around 40% are sold through auctions, 31% directly to a calf raiser, and 18% to a calf dealer, with the remaining 11% raised by the origin dairy at a secondary location or sold directly to another dairy.[83] Most small and medium dairy operations sell their surplus calves through an auction, and large operations sell calves directly to a calf raiser or another type of grower. It is common for surplus dairy calves to travel significantly long distances because calf-rearing facilities are often concentrated in specific areas of the country while dairies are more widely dispersed.[84]

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[78] Grandin (2016), *supra* note 35.

[79] Susana Astiz et al., *Bovine Neonatology*, UNESCO ENCYCLOPEDIA OF LIVE SUPPORT SYSTEMS (n.d.)

[80] Winder, C. B. et al. (2016) Mortality Risk Factors for Calves Entering a Multi-location White Veal Farm in Ontario, Canada. *J. of Dairy Sci.* 99(12):10174–10181. https://doi.org/10.3168/jds.2016-11345; Wilson, D. J. et al. (2020a) Hot Topic: Health and Welfare Challenges in the Marketing of Male Dairy Calves-Findings and Consensus of an Expert Consultation. *J. of Dairy Sci.* 103(12):11628–11635. https://doi.org/10.3168/jds.2020-18438; Hulbert, & Moisá (2016), *supra* note 45; Renaud, D., & Pardon, B. (2022) Preparing Male Dairy Calves for the Veal and Dairy Beef Industry. *Veterinary Clinics of North America: Food Animal Practice*, 38(1):77–92. https://doi.org/10.1016/j.cvfa.2021.11.006

[81] Pempek, J., et al. (2017) Veal Calf Health on the Day of Arrival at Growers in Ohio. *J. of Animal Sci.*, 95(9): 3863–3872. https://doi.org/10.2527/jas2017.1642; Maggard, H. L. (2022) Condition of Surplus Dairy Calves at Livestock Dealers in Ohio: A Cross-Sectional Study [Master's thesis, Ohio State University] available at OHIOLINK ELECTRONIC THESES AND DISSERTATIONS CENTER http://rave.ohiolink.edu/etdc/view?acc_num=osu1669978194658576

[82] Wilson et al. (2020a), *supra* note 80; González, L. A. et al. (2012a) Relationships between transport conditions and welfare outcomes during commercial long haul transport of cattle in North America. *J. of Animal Sci.*, 90(10):3640–3651. https://doi.org/10.2527/jas.2011-4796; Pempek et al. (2017), *supra* note 81; Renaud & Pardon (2022), *supra* note 80; Maggard (2022), *supra* note 81.

[83] NATIONAL AGRICULTURAL STATISTICS SERVICE, USDA, NO. 692.0216, DAIRY 2014: DAIRY CATTLE MANAGEMENT PRACTICES IN THE UNITED STATES 90-94 (Feb. 2016) [hereafter DAIRY 2014: CATTLE MANAGEMENT] https://www.aphis.usda.gov/animal_health/nahms/dairy/downloads/dairy14/Dairy14_dr_PartI_1.pdf; Animal and Plant Health Inspection Service, USDA, *Off-Site Heifer Raising on U.S. Dairy Operations: Information Brief* (Sep. 2021) https://www.aphis.usda.gov/animal_health/nahms/dairy/downloads/dairy17/off-site-heifer-raising-us-dairy-ops.pdf

[84] Wilson et al. (2020a), *supra* note 80.

The 2014 NAHMS dairy survey is the most recent information available on heifer raising practices in the U.S. It reports that most U.S. dairy operations raised replacement heifer calves on site or in relatively close proximity (<50 miles), but nearly half of large operations (those with 500+ productive cows) raised their calves off site.[85] It should be noted that "large" facilities increasingly have upwards of 10,000 cows.

Growing proportions of these replacement heifers are raised off site on "calf ranches" that are geographically distant from the dairy.[86] As of the 2014 survey, 12.3% of large operations transported heifers to an off-site facility 100 or more miles from the origin dairy.[87] A 2011 survey specifically on replacement calf-rearing practices reported that about 3 in 10 shipments to heifer-raising facilities traveled 100 miles or more, and one-third crossed State lines.[88] It is likely that the well documented consolidation of the U.S. dairy industry since these surveys were conducted has increased these percentages and the distances.[89] As of 2017, facilities containing 1,000 or more cows held 55% of the entire U.S. milk cow inventory. Facilities with 5,000 or more cows ("mega-dairies") held 16% of the inventory (collectively, 1.5 million cows in 189 such facilities).[90]

2. Numbers

While it is unknown precisely how many calves are transported interstate annually, available data suggest that several million surplus calves are born in the Canadian and U.S. dairy industries each year.[91] Because surplus calves very rarely stay at the dairy of origin, the majority of them are transported.

3. Evidence of Transport of Very Young Calves Often for Long Distances

AWI requested information from individual states to estimate the extent of interstate transport of neonatal calves. We requested certificates of veterinary inspection (CVIs) for calves under one month imported to New Mexico and California, and exported from California, Wisconsin, Idaho, New York, Michigan, and Minnesota in 2022. AWI was unable to analyze data from Texas, which is both a top producing state and a state receiving imports because of heavy redactions of its records.

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[85] DAIRY 2014: CATTLE MANAGEMENT, *supra* note 79 at 80.
[86] Machado, V. S. & Ballou, M. A. (2022) Overview of common practices in calf raising facilities. *Translational Animal Sci*., 6(1):txab234. https://doi.org/10.1093/tas/txab234
[87] DAIRY 2014: CATTLE MANAGEMENT, *supra* note 79, at 81.
[88] NATIONAL ANIMAL HEALTH MONITORING SYSTEM, USDA, NO. 613.1012 DAIRY HEIFER RAISER, 2011: AN OVERVIEW OF OPERATIONS THAT SPECIALIZE IN RAISING DAIRY HEIFERS 54-55 (Oct. 2012).
[89] Macdonald, J, Law J. & Mosheim, R. USDA, ERR NO. 274 CONSOLIDATION IN U.S. DAIRY FARMING (July 2020) https://www.ers.usda.gov/webdocs/publications/98901/err-274.pdf; Machado & Ballou (2022), *supra* note 83.
[90] *Id*. at 11.
[91] Wilson et al. (2020a), *supra* note 80; Renaud & Pardon (2022), *supra* note 80; Wilson, L. L. et al. (2000) Characteristics of veal calves upon arrival, at 28 and 84 days, and at end of the production cycle. *J. of Dairy Sci*, 83(4):843–854. https://doi.org/10.3168/jds.S0022-0302(00)74948-4

Table 1. Calves Under One Month Exported from Six Top Dairy Producing States*

State	Total Imports / Total <2 weeks*	Journey Distance Distribution			
		100-499 mi	500-999 mi	1,000-1,499 mi	1,500+ mi
California	15,745 13,469	0	13,469	2,276	0
Wisconsin	235,793 233,164	124,016	61,223	49,914	640
Idaho	26,440 19,941	1,123	15,324	9,956	37
New York	73,718 72,284	19,699	51,599	2,012	408
Michigan	31,961 18,039	15,505	4,717	11,739	0
Minnesota	142,795 141,870	8,050	6,112	107,354	21,279
Total	526,452	168,393	152,444	183,251	22,364
% of Total	94.7% under 2 weeks	31.9%	28.9%	34.8%	4.2%

Table 2. Calves Under One Month Imported into California and New Mexico*

State	Total Imports	Journey Distance Distribution			
	Total <2 weeks	100-499 mi	500-999 mi	1,000-1,499 mi	1,500+ mi
California	141, 082	30,580	80,530	14,869	15,103
	93,700 (66.4%)				
New Mexico	182,114	13,388	13,548	154,018	1,160
	157,749 (86.6%)				
Total	323,196	43,968	94,078	168,887	16,263
% of total	77.8% < 2 weeks	13.6%	29.1%	52.3%	5%

* The exact number of calves under two weeks is unknown, because some CVIs gave broad age ranges (e.g. "200 calves between 1-30 days") without further specification
* Shipments under 100 miles were excluded from totals

VI. VULNERABILITY OF CULL ANIMALS DURING TRANSPORT AND NEED FOR STRONGER PROTECTION

> "Some of the worst abuses the author has observed in transported animals were animals that were not fit for transport. They were treated badly because they were worth very little money. Emaciated weak old cows, sows, or ewes should be euthanized on the farm and not loaded on to a vehicle" – T. Grandin, *Improving Animal Welfare: A Practical Approach*, 3rd Edition, 2021

This section details why cull animals are particularly vulnerable during transport and begins with a discussion of the various health issues and conditions common in cull animals. These health issues can negatively affect animal welfare prior to transport and may render animals unfit for transport, increasing transport-associated stress and the risk that the animal will suffer or die during transport. While the focus is on breeding sows and boars and dairy cows in particular, sheep and goats used for breeding are also culled and face the same challenges.

Health conditions common in cull animals can be dramatically worsened by conditions of transport, including food and water deprivation, inability to rest, temperature extremes, and comingling with unfamiliar animals. When animals who are unfit are transported, potential outcomes include exacerbation of previous health conditions, new injuries, infections, becoming lame or non-ambulatory, and death. In the absence of a legal requirement that animals be fit to travel, cull animals are more likely to require euthanasia at intermediary stops and/or result in dead-on-arrival or dead-in-lairage condemnations upon reaching the slaughterhouse. When it comes to the human food supply, cull animals in general pose an increased risk in terms of foodborne pathogens and violative drug residues. These risks could be mitigated by prohibiting the transport of unfit animals.

A. Sows and Boars

Cull sows weigh, on average, over 400 lbs. when they are culled from a breeding herd.[92] Lameness has been reported as the cause for culling in nearly 50% of sows,[93] and poor reproductive performance is also commonly cited.[94] Both of these conditions can be caused by a range of pathologies. While conditions that lead to low reproductive performance may or may not cause pain or discomfort to the animal, nearly all causes of lameness or altered gait do.[95] Veterinary research examining 923 sows at two slaughter plants found that even sows culled for reasons other than lameness often had foot/hoof lesions.[96] Research conducted at two midwestern slaughterhouses found that the vast majority of sows have foot or hoof lesions at the time of culling. Post-mortem examination of over 3,000 cull sows found that 32.9% had heel lesions on the front feet and 67.5% had heel lesions on the rear feet; cracking and overgrowth of hooves was also noted in over 20% of sows.[97] Another study documented that other painful conditions, such as abscesses and decubital ulcers, are also common in sows at the time of slaughter.[98] Thus, it appears that at the time of culling, the majority of sows have one or more painful conditions that can make walking and prolonged standing difficult.

Breeding and maintaining sows for intensive production results in myriad other health issues including diarrhea, skin abrasions, mastitis, pneumonia, and severe emaciation, all of which can increase vulnerability to transport stress.[99] One study found that 40% of cull sows were lactating on the day of transport, and these sows were more likely to have swollen and/or inflamed udders—another source of pain.[100]

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[92] Peterson et al. (2017), *supra* note 40.
[93] Campler, M.R. et al. (2021) Description of on-farm treatment compliance and risk factors for culling in sows. *Porcine Health Mgmt*., 7:59. https://doi.org/10.1186/s40813-021-00238-7
[94] Grandin (2016), *supra* note 35; Anil, S. S. et al. (2005) Evaluation of patterns of removal and associations among culling because of lameness and sow productivity traits in swine breeding herds. *J. of the Am. Veterinary Med. Ass'n.*, *226*(6):956–961 https://doi.org/10.2460/javma.2005.226.956; Campler et al. (2021), *supra* note 93.
[95] Ison, S.H. et al. (2016) A Review of Pain Assessment in Pigs. *Front Vet Sci.,* 28(3):108. https://www.doi.org/10.3389/fvets.2016.00108; Grégoire, J., et al. (2013) Assessment of lameness in sows using gait, footprints, postural behaviour and foot lesion analysis. *Animal: International J. of Animal Bioscience*, 7(7):1163–1173. https://doi.org/10.1017/S1751731113000098; JOHN DEEN, ASSESSMENT OF LAMENESS, PAIN AND CULLING RISK IN SOWS – NPD #07-039. PORK CHECKOFF RESEARCH REPORT (2010) https://www.porkcheckoff.org/wp-content/uploads/2021/02/07-039-DEEN-UofMN.pdf
[96] Knauer M. et al. (2007a) Accuracy of sow culling classifications reported by lay personnel on commercial swine farms. *J. of the Am. Veterinary Med. Ass'n.,* 231(3):433-6. http://doi.org/10.2460/javma.231.3.433
[97] Knauer, M. et al. (2007b) A descriptive survey of lesions from cull sows harvested at two Midwestern U. S. facilities. *Preventative Veterinary Med.,* 82:198–212. http://doi.org/10.1016/j.prevetmed.2007.05.017
[98] Cleveland-Nielsen, A. et al. (2004) Prevalences of welfare-related lesions at post-mortem meat-inspection in Danish sows. *Preventive Veterinary Med*., 64(2-4):123–131. https://doi.org/10.1016/j.prevetmed.2004.05.003
[99] Knauer, M. (2007b), *supra* note 97; Grandin (2016), *supra* note 35, SUZANNE T. MILLMAN, CARING FOR COMPROMISED SWINE – AN ASSESSMENT SWINE MARKETED THROUGH BUYING STATIONS AND DEVELOPMENT OF FITNESS FOR TRANSPORT GUIDELINES – NPB #13-261 (2016) https://www.porkcheckoff.org/wp-content/uploads/2021/02/13-261-MILLMAN-ISU.pdf7; KURT STADLER & LOCKE KARRIKER, EVALUATION OF SOWS AT HARVEST TO DETERMINE INCIDENCE OF ABNORMALITIES THAT COULD LEAD TO CULLING OF BREEDING HERD FEMALES NPB#04-127, PORK CHECKOFF RESEARCH REPORT (2006) https://www.porkcheckoff.org/wp-content/uploads/2021/02/04-127-STALDER-ISU.pdf; Campler et al. (2021), *supra* note 93.
[100] Fogsgaard, K. K. et al. (2018) Transportation of cull sows-a descriptive study of the clinical condition of cull sows before transportation to slaughter. *Translational Animal Sci.*, 2(3):280–289. https://doi.org/10.1093/tas/txy057

For boars, common reasons for culling include obesity, poor reproductive performance, and leg problems/lameness.[101] While research in this area is scarce, three studies identified leg problems or lameness as the reason for culling in 8.4 to 14.9% of breeding boars.[102] Leg problems are typically painful and include joint problems and hoof or foot lesions like those described for sows above.[103]

Given the reasons that breeding pigs are culled, it may not be surprising that, in the absence of fitness to travel requirements, these animals are far more likely than market pigs to have serious problems en route to slaughter. A survey evaluating market weight and cull pigs (sows and boars) at fifteen intermediary buying stations found that the prevalence of emaciation (a body condition score of 1) was 2.4 times higher in sows than in market pigs.[104] Sows and gilts also had greater prevalence of severe skin lesions and abscesses than did market pigs.[105]

This study also evaluated the prevalence of "fatigue" in culled breeding sows and gilts, compared to market pigs. After transport, pigs can become "fatigued," meaning they are without obvious injury, trauma, or disease but are unable to walk or keep up with their contemporaries.[106] A "fatigued pig" may display open-mouth breathing, blotchy red skin, muscle tremors, and abnormal vocalizations.[107] Typically, nonambulatory pigs are permitted to rest and those who regain the ability to walk are classified as "fatigued" and continue with the marketing process rather than being euthanized. Among pigs at the 15 buying stations, 16% of the animals were classified as fatigued, however, sows and boars made up 86% of fatigued animals.[108] The prevalence of fatigue in sows, gilts, and boars was 2.2 times that of market pigs.[109]

Mortality upon or shortly after arrival at the slaughter plant has been found by multiple studies to be significantly higher for cull sows and boars than for market pigs or other types of livestock.[110] Research on USDA condemnation data has found that, compared to other categories of pigs, sows have the highest "dead loss ratio" (DLR)—calculated by dividing the number of "dead" condemnations by the total number of pigs in that category and multiplying by 100.[111] The study

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[101] Grandin (2016), *supra* note 35; D'Allaire, S., & Leman, A. D. (1990) Boar culling in swine breeding herds in Minnesota. *The Canadian Veterinary J.*, *31*(8): 581–583.
[102] D'Allaire & Leman (1990), *supra* note 101; Koketsu, Y. & Sasaki, Y. (2009) Boar culling and mortality in commercial swine breeding herds. *Theriogenology*, 71(7):1186–1191. https://doi.org/10.1016/j.theriogenology.2008.12.018; Knecht, D. et al. (2017) Analysis of the lifetime and culling reasons for AI boars. *J. of Animal Sci. and Biotechnology*, 8:49. https://doi.org/10.1186/s40104-017-0179-z
[103] Koketsu & Sasaki (2009), *supra* note 102.
[104] McGee et al. (2016), *supra* note 66; MILLMAN (2016), *supra* note 99.
[105] *Id.*
[106] Ritter, M. J. et al. (2009) Transport losses in market weight pigs: I. A review of definitions, incidence and economic impact. *The Prof. Animal Scientist,* 25:404–414. https://www.doi.org/10.15232/ S1080-7446(15)30735-X.
[107] Fitzgerald, R. F. et al. (2009) Factors associated with fatigued, injured, and dead pig frequency during transport and lairage at a commercial abattoir. *J. of Animal Sci.*, 87(3):1156–1166. https://doi.org/10.2527/jas.2008-1270
[108] McGee et al. (2016), *supra* note 66.
[109] MILLMAN (2016), *supra* note 99.
[110] Fogsgaard et al. (2018), *supra* note 100; Lykke, L. et al. INVESTIGATION OF PIG TRANSPORTS FOR MORE THAN 8 HOURS IN COLD AND WARM WEATHER CONDITIONS AND OF THE REQUIREMENTS FOR VENTILATION DURING THE TRANSPORT 81 (2007, Danish Meat Institute) https://www.teknologisk.dk/_/media/64606_Investigation%20of%20pig%20transports.pdf; Malena, M. et al. (2007) Comparison of mortality rates in different categories of pigs and cattle during transport for slaughter. *Acta Veterinaria Brno* (Czech) *76*(8):S109–S116. https://doi.org/10.2754/avb200776S8S109
[111] Peterson et al. (2017), *supra* note 40.

notes that, for every month of the year, cull sows were significantly more likely to die during transport or in lairage compared to market pigs or roasters.

B. Cull Dairy Cattle

The most common reasons for removal from the herd are infertility, low milk production, mastitis, injury, or lameness.[112] Breeding, feeding, and maintaining dairy cows for intensive production mean when culled, they often suffer from any number of clinical conditions and health issues, many of which cause moderate to severe pain.[113] As with sows, lameness can be caused by a range of pathologies, but almost always a painful condition.[114] Other common and potentially painful conditions include ocular squamous cell carcinoma, low body condition/emaciation, mastitis, pneumonia, abscesses, or displaced abomasum—a condition in which the abomasum (the fourth part of a cow's stomach) shifts to an abnormal location and becomes partially or fully twisted and obstructed.[115]

Research has long shown that cull dairy cows at auction have much higher incidence of lameness than beef cattle, with nearly 45% of cull dairy cows being affected in one study carried out in 2008.[116] A more recent study assessing the fitness of cull dairy cows at livestock markets found that almost a third of the cows had one or more conditions that would affect fitness (lameness, low body condition, or engorged or inflamed udders), and 7% were considered severely lame.[117] A study undertaken at North American auction markets documented that 27.2% of culled cows had unacceptable hock injuries while nearly 73% had an abnormal gait, likely indicating lameness.[118] Even on relatively shorter journeys (<8 hours), culled dairy cows frequently become lame or become more lame en route, and the risk increases for cows with low body condition scores and/or skin lesion of the hind feet.[119] It's clear that cull cattle are more likely to start a journey lame and it is not uncommon for them to arrive at the slaughter plant severely lame.[120]

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[112] Dahl-Pedersen, K. et al. (2018) Risk Factors for Deterioration of the Clinical Condition of Cull Dairy Cows During Transport to Slaughter. *Frontiers in Veterinary Sci*., 5:297. https://doi.org/10.3389/fvets.2018.00297; Pinedo, P. J. et al. (2010) Dynamics of culling risk with disposal codes reported by Dairy Herd Improvement dairy herds, *J. Dairy Sci.*, 93:2250-2261 https://doi.org/10.3168/jds.2009-2572b

[113] Oltenacu, P.A. & Broom, D. M. (2010) The impact of genetic selection for increased milk yield on the welfare of dairy cows. *Animal Welfare*, 19(1):39-49. https://doi.org/10.1017/S0962728600002220; Akkina, J. & Estberg, L. (2019) Use of slaughter condemnation data to detect cattle health events in near real-time. *Online J. Public Health Inform*., 11(1): e329. https://doi.org/10.5210/ojphi.v11i1.9787

[114] Coetzee, J. F. et al. (2017) An Update on the Assessment and Management of Pain Associated with Lameness in Cattle. *The Veterinary Clinics of North America: Food Animal Practice*, *33*(2):389–411. https://doi.org/10.1016/j.cvfa.2017.02.009

[115] Edwards-Callaway et al. (2019), *supra* note 57; Stojkov, J. et al. (2020b) Fitness for transport of cull dairy cows at livestock markets. *J. Dairy Sci*., 103(3):2650-2661. https://www.doi.org/10.3168/jds.2019-17454; DAIRY 2014: HEALTH AND MANAGEMENT, *supra* note 62.

[116] Ahola, J. K., et al. (2011) Survey of quality defects in market beef and dairy cows and bulls sold through livestock auction markets in the Western United States: I. Incidence rates. *J. of Animal Sci.*, *89*(5):1474–1483. https://doi.org/10.2527/jas.2010-3170

[117] Stojkov et al. (2020b), *supra* note 115.

[118] Moorman, A.K.G. et al. (2018) Associations between the general condition of culled dairy cows and selling price at Ontario auction markets. *J. Dairy Sci.* 101(11):1058010588. http://www.doi.org/0.3168/jds.2018-14519.

[119] Dahl-Pedersen et al. (2018), *supra* note 112.

[120] Edwards-Callaway, L. N., & Calvo-Lorenzo, M. S. (2020) Animal welfare in the U.S. slaughter industry-a focus on fed cattle. *J. of Animal Sci.*, 98(4):skaa040. https://doi.org/10.1093/jas/skaa040; Schwartzkopf-Genswein et al. (2012), *supra* note 44.

The National Beef Quality Audit (NBQA), a joint project of the Beef Quality Assurance program and the National Milk Producers Federation, conducts an audit approximately every 5 years of the cattle market, including cull dairy cows. The 2022 *Audit for Market Cows and Bulls* observed and noted mobility scores of cattle entering slaughter plants. Of the dairy cows entering the packing facility, 25.8% had a mobility score of 2 (minor stiffness, shortness of stride or a slight limp), 7.3% had a mobility score of 3 (obvious stiffness, difficulty taking steps, an obvious limp or obvious discomfort and lags behind when walking as a group), 0.9% had a mobility score of 4 (extremely reluctant to move, even when encouraged by a handler, described as statute like), and 0.3% were "downers" (non-ambulatory).[121]

A 2017 study analyzing condemnation of cattle carcasses found that, compared with beef cows and fed cattle (heifers and steers), dairy cattle were more likely to be condemned—1.7% of cull dairy cows were condemned, compared with 0.38% of beef cows and 0.02% of fed cattle.[122] In addition, dairy cattle were the most likely to be condemned due to being dead on arrival or dying just prior to slaughter. In addition to death, the most common reasons for condemnation included septicemia and pneumonia. A previous study, published in the *Journal of the American Veterinary Association*, reviewed records of all cattle (excluding calves) slaughtered at federally inspected plants from 2003-2007. It found that 769,339 cattle, or 0.47%, were condemned at either antemortem or postmortem inspection. While only 18% of the cattle processed were cull animals, they made up a majority of the condemned. During the study period, 2.50% of cull cows were condemned—34 times the rate of market cattle – and the rate was even higher for cull dairy cows, at 3.84%. Antemortem condemnations of dairy cattle were most often due to the animals being dead on arrival (62.5%) or non-ambulatory (35%).[123] The authors of this study note that there are typically no disincentives for producers to ship to slaughter animals who will eventually be condemned, and "the costs of euthanasia and disposal of cull animals may induce producers to send cattle to market."

In North America, cull cattle undergoing long distance transport have been found to be significantly more likely to die and become nonambulatory during the journey, when compared with other categories of cattle.[124] In fact, cull cattle were more than 10 times as likely to become nonambulatory compared to fattened cattle and more than 32 times more likely compared to feeder cattle.

Dying and/or becoming nonambulatory during or shortly after transport profoundly impacts animal welfare and may pose public health, food safety, and national animal health concerns, particularly because becoming nonambulatory is a potential sign of bovine spongiform encephalopathy (BSE).[125] Requiring adherence to a fitness for transport standard would help prevent the inappropriate transport of many of these animals.

C. Negative Impacts of Transporting Unfit Cull Animals

[121] Beef Quality Assurance, *2022 National Beef Quality Audit for Market Cows and Bulls*, https://www.bqa.org/Media/BQA/Docs/2022-nbqa-market-cows-bulls-four-pager.pdf
[122] Akkina & Estberg (2019), *supra* note 113.
[123] White, T. L. & Moore, D. A. (2009) Reasons for whole carcass condemnations of cattle in the United States and implications for producer education and veterinary intervention, *J. of the American Veterinary Med. Ass'n*., 235(8):937-941. https://doi.org/10.2460/javma.235.8.937
[124] González, L. A. et al. (2012a), *supra* note 82.
[125] JOSHUA COHEN & GEORGE GRAY, HARVARD CENTER FOR RISK ANALYSIS, HARVARD RISK ASSESSMENT OF BOVINE SPONGIFORM ENCEPHALOPATHY UPDATE PHASE IA (2005), https://www.fsis.usda.gov/sites/default/files/media_file/2020-07/BSE_Risk_Assess_Report_2005.pdf

1. Animal Health and Welfare

As mentioned above, transport in general carries the risk of compromising welfare, and in longer journeys like those undertaken by a large proportion of cull animals, welfare tends to decline as journey length increases.[126] In addition to enduring long distance journeys, cull animals frequently have preexisting health conditions that can worsen during transport.[127] These conditions also make them more vulnerable to compromised health and welfare resulting from transport stressors such as food and water deprivation, travelling with painful conditions, fatigue, and temperature extremes.

a. Food and Water Deprivation

In the U.S., farmed animals usually do not receive food or water during transport and are often fasted prior to transport as well.[128] In contrast to those used in European countries, animal transport trucks and trailers in the U.S. are not typically outfitted with means of providing food and water.[129] Food deprivation causes hunger (a psychological stressor and welfare concern if prolonged) as well as physiological stress when animals experience negative energy balance, requiring their body to break down tissues to use for energy. Both health problems and prolonged fasting can result in hypoglycemia in cull cattle, which can result in immunosuppression because immune cells preferentially utilize glucose, rather than fatty acids, as fuel.[130] Physical stress may also occur, as longer periods of food deprivation are associated with an increased prevalence of gastric ulcers in pigs.[131] Water deprivation leads to thirst (a psychological stressor and welfare concern if prolonged), as well as dehydration and, potentially, hypovolemia and even hypovolemic shock, if severely prolonged.[132]

Many of the health conditions that lead to culling also render cull animals more susceptible to stress and compromised welfare due to food and water deprivation. For example, prior to transport, animals who are significantly lame may have had difficulty accessing food and water, and thin or emaciated cows may be more prone to developing lameness.[133] In dairy cattle, many of the conditions that can result in culling, such as displaced abomasum, are associated with metabolic derangements, such as hyperketonemia and hypoglycemia, which cause immunosuppression and are worsened by food and

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[126] Broom, D.M. *Welfare of Transported Animals: Welfare Assessment and Factors Affecting Welfare*, *in* LIVESTOCK HANDLING AND TRANSPORT 12-29 (5th ed., 2019).
[127] Stojkov, J. et al. (2018) Hot topic: Management of cull dairy cows-Consensus of an expert consultation in Canada. *J. of Dairy Sci.*, *101*(12):11170–11174. https://doi.org/10.3168/jds.2018-14919
[128] Luigi Faucitano & Sebastien Goumon, *Transport of Pigs to Slaughter and Associated Handling*, *in* ADVANCES IN PIG WELFARE 261-293 (Spinka ed., 2018).
[129] González, L. A. et al. (2012b) Factors affecting body weight loss during commercial long haul transport of cattle in North America. *J. of Animal Sci.*, 90(10):3630–3639. https://doi.org/10.2527/jas.2011-4786
[130] Dubuc, J., & Buczinski, S. (2018) Short communication: Cow- and herd-level prevalence of hypoglycemia in hyperketonemic postpartum dairy cows. *J. of Dairy Sci.*, 101(4):3374–3379. https://doi.org/10.3168/jds.2017-13773; Ortolani, E. L. et al. (2020) Metabolic Profile of Steers Subjected to Normal Feeding, Fasting, and Re-Feeding Conditions. *Veterinary Sci.*, 7(3):95. https://doi.org/10.3390/vetsci7030095; Ingvartsen (2015), *supra* note 55.
[131] Driessen, B. et al (2020) Fasting Finisher Pigs before Slaughter Influences Pork Safety, Pork Quality and Animal Welfare. *Animals*, 10(12): 2206. https://doi.org/10.3390/ani10122206
[132] Tarrant, P.V. (1989) The effects of handling, transport, slaughter and chilling on meat quality and yield in pigs – a review. *Irish J. Food Sci. Tech.,*13:79–107. https://www.jstor.org/stable/25619576
[133] Jan K. Shearer & Sarel R. van Amstel, in DAIRY PRODUCTION MEDICINE, 233-253 (Risco & Melendez Retamal eds. 2011). https://doi.org/10.1002/9780470960554.ch19

water deprivation.[134] Fever, as seen with mastitis and some infectious causes of lameness, may lead to decreased food intake and increased water loss, with subsequent dehydration. Cattle suffering from conditions such as displaced abomasum typically exhibit anorexia and dehydration as clinical signs, meaning they start their long journeys already compromised. Cull dairy cows and cull breeding sows who are emaciated have little fat reserves to mobilize in the face of negative energy balance caused by starvation during transport.

Research shows that cull animals are in fact more affected by transport-associated food and water deprivation. "Shrink" is a measure of weight loss in animals during transport. Part of this weight loss is attributed to "fill shrink," or the loss of intestinal contents and urine, while the remainder (up to 60%) is due to dehydration and catabolism of body tissues (tissue shrink).[135] While fill shrink occurs primarily during the first 3 to 4 hours of transport, tissue shrink continues to accrue throughout the period of food and water deprivation.[136] Tissue shrink can be considered a rough measure of dehydration level. Compared with other classes of cattle, cull cattle exhibit the fastest rate of shrink.[137]

b. Painful Conditions and Transport-Associated Injuries

Animals who have preexisting conditions that cause pain—like mastitis, abscesses, hoof/foot lesions, and other causes of lameness—are at serious risk of worsening pain and compromised welfare during transport.[138] Loading and unloading, prolonged standing, and bracing against the movements of the vehicle and of other animals aggravates painful conditions and causes additional suffering.[139] Lame animals may have an impaired ability to retreat from aggressive conspecifics, potentially leading to additional injuries. Animals who may have had some degree of analgesia while on farm due to the administration of anti-inflammatories will have had this medication withdrawn to avoid violative residues.[140]

Even during short journeys, the development of engorged udders in lactating cull dairy cows is a serious welfare concern, causing pain, tissue damage, and difficulty walking and balancing; this condition is noted in 8.1% of dairy cows arriving at slaughterhouses.[141] Longer distance transport has been shown to be associated with milk leakage in cull dairy cows.[142] Cull sows are often still lactating at slaughter, because they are typically shipped immediately after abrupt weaning of their piglets.[143] Although less research has explored the welfare consequences of transporting sows with engorged udders, lactating sows have been shown to have an increased prevalence of udder lesions,

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[134] Hubner, A. et al. (2022), Characterization of metabolic profile, health, milk production, and reproductive outcomes of dairy cows diagnosed with concurrent hyperketonemia and hypoglycemia. *J. of Dairy Sci.*, 105(11):9054–9069. https://doi.org/10.3168/jds.2021-21327; Ingvartsen (2015), *supra* note 55. 4
[135] Schwartzkopf-Genswein, K. et al. (2016) Symposium Paper: Transportation issues affecting cattle well-being and considerations for the future. *The Prof. Animal Scientist,* 32(6):707-716. https://doi.org/10.15232/pas.2016-01517
[136] González et al. (2012b), *supra* note 129.
[137] *Id*.
[138] Dahl-Pedersen et al. (2018), *supra* note 112.
[139] Cockram (2019), *supra* note 33.
[140] Campler et al. (2021), *supra* note 93.
[141] Edwards-Callaway et al. (2019), *supra* note 57; Harris, M. K. et al. (2017) National Beef Quality Audit–2016: Transportation, mobility, live cattle, and carcass assessments of targeted producer-related characteristics that affect value of market cows and bulls, their carcasses, and associated by-products. *Translational Animal Sci.,* 1(4):570–584. https://doi.org/10.2527/tas2017.0063
[142] Dahl-Pedersen et al. (2018), *supra* note 112.
[143] Campler et al. (2021), *supra* note 93.

and the inflammation and pain associated with these conditions likely affects their welfare during transport.[144]

Animals may incur additional injury during transport due to slipping or falling, bumping into the sides of the vehicle, fighting between unfamiliar animals, and handling during loading and unloading. Moving vehicles require animals to keep their balance, especially during turning, gear shifting, and braking, when they are most likely to stumble or fall.[145]

As mentioned above, cull animals are at increased risk of becoming lame or non-ambulatory during transport compared to other livestock classes. At slaughter, cull cattle have also been found to have a higher prevalence of both bruising and critical or extreme bruising compared with market cattle.[146] Temple Grandin and other researchers have noted that these finding may be related to pre-existing painful conditions, as worsening pain during the journey can lead to animals losing their footing and sustaining further injuries.[147] One study found that 20% of cull dairy cows became lame or more lame during transport and 12% had more wounds after transport than before.[148]

Weak and emaciated cows are more likely to go down on a truck,[149] and low body condition increases risk of bruising.[150] As described above, low body condition is a frequent finding in cull cows. North American studies that define unacceptable body condition score as being 2 or less have found a prevalence of between 10.3 to 40.5% in cull dairy cows at the time of shipping.[151] A survey that focused only on extreme cases of emaciation found that 4.6% of cull cows had a BCS of less than 2 upon arriving at a U.S. slaughterhouse.[152]

Pigs are also prone to injury, the risk of which is always present, but increases with the length of the journey.[153] Transport-associated mortality rates are higher for loads of pigs bound for slaughter who have noticeable injuries upon arrival, compared to loads in which no injuries are noted.[154] The well documented fatigue, lameness, and low body condition score observed in cull sows are conditions that increase their risk of injury and pain during transport.[155]

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144 Fogsgaard et al. (2018), *supra* note 100.
145 Knowles, G. (1999) A review of the road transport of cattle. *Veterinary Record*, 144(8):197–201.
146 Kline, H. C. et al. (2020) From unloading to trimming: studying bruising in individual slaughter cattle. *Translational Animal Sci.*, 4(3):txaa165. https://doi.org/10.1093/tas/txaa165
147 *Id*.
148 Dahl-Pedersen et al. (2018), *supra* note 112.
149 Grandin, T. (2001) Perspectives on transportation issues: The importance of having physically fit cattle and pigs. *J. Animal Sci.,* 79:E201-E207. https://doi.org/10.2527/jas2001.79E-SupplE201x
150 Sánchez-Hidalgo, M. et al. (2019) Associations between Pre-Slaughter and Post-Slaughter Indicators of Animal Welfare in Cull Cows. *Animals*, 9(9):642. https://doi.org/10.3390/ani9090642
151 Moorman et al. (2018), *supra* note 118; Stojkov et al. (2020b), *supra* note 115.
152 Vogel (2018), *supra* note 66.
153 Sutherland, M.A. et al. (2009) Effects of variations in the environment, length of journey and type of trailer on the mortality and morbidity of pigs being transported to slaughter. *Veterinary Record*, *165*(1):13–18. https://doi.org/10.1136/vetrec.165.1.13
154 Averós, X. et al. (2008) Factors affecting the mortality of pigs being transported to slaughter. *The Veterinary Record*, *163*(13), 386–390. https://doi.org/10.1136/vr.163.13.386
155 Knauer et al. (2007b), *supra* note 97; Grandin (2016), *supra* note 35; MILLMAN (2016), *supra* note 99; STADLER & KARRIKER (2006), *supra* note 99.

c. Fatigue

Cattle and pigs are typically unable to rest while being transported in the U.S., leading to the development of fatigue, particularly during long journeys. Research has shown that, even in animals considered fit for transport, longer journeys result in both behavioral indicators of fatigue, such as prolonged resting after unloading, and biochemical indicators like elevated creatine kinase—an indicator muscle cell damage resulting from exertion.[156] Fatigue is an animal welfare concern because it is associated with negative affective states such as exhaustion, weakness, discomfort, and pain.[157] It is also a health concern, due to its potential to increase risk of injury and immunosuppression (see section V.C.1 above). For example, the distance cattle are transported is significantly associated with their risk of developing bovine respiratory disease complex, also known as "shipping fever," in the days and weeks after transport.[158]

With the exception of young calves, cattle typically do not lie down on transport vehicles, likely due to factors such as difficulty maneuvering under standard stocking densities, the availability of only a hard, manure-soiled surface, and fear of being trampled. However, after 12 to 16 hours, cattle often become so fatigued that they begin to lie down – or fall down – increasing the risk of injury.[159] Prolonged standing and bracing against vehicular movement is especially challenging for dairy cows who typically need to spend between 10.5 to 12.4 hours per day lying down.[160] Their need for rest is so strong that, when deprived of both the opportunity to lie down and to feed for as little as three hours, they will opt for rest when opportunities for both rest and food are presented.[161] The importance of rest to their welfare has also been quantified by research showing that cows will push with maximum force (40% of their body weight on average) to access an appropriate lying area.[162]

During transport, pigs may be unable to rest due to the need to brace against vehicular motion, stress associated with mixing with unfamiliar animals, lack of bedding, udder lesions, and motion

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[156] Kobek-Kjeldager, C. et al. (2023) Effects of journey duration and temperature during pre-slaughter transport on behaviour of cull sows in lairage. *Research in Veterinary Sci*., 164:105016. Advance online publication. https://doi.org/10.1016/j.rvsc.2023.105016; EFSA Panel on Animal Health and Welfare, Nielsen, S. S. et al. (2022) Welfare of cattle during transport. *EFSA J.*, 20(9):e07442 [hereinafter EFSA Welfare of cattle during transport] https://doi.org/10.2903/j.efsa.2022.7442; Aradom, S. et al. (2012) Effect of transport times on welfare of pigs. *J. Agric. Sci. Tech*.2:544; Sommavilla, R. et al. (2017) Season, transport duration and trailer compartment effects on blood stress indicators in pigs: relationship to environmental, behavioral and other physiological factors, and pork quality traits. *Animals* 7, 8. https://doi.org/10.3390/ani7020008

[157] Roadknight et al. (2021a), *supra* note 45; Mellor (2016), *supra* note 32.

[158] Karen Schwartzkoft-Genswein & Temple Grandin, *Cattle Transport in North America*, *in* Livestock Handling and Transport 153-183 (5th ed., 2019); Cernicchiaro, N. et al. (2012 Associations between the distance traveled from sale barns to commercial feedlots in the United States and overall performance, risk of respiratory disease, and cumulative mortality in feeder cattle during 1997 to 2009. *J. of Animal Sci.*, *90*(6):1929–1939. https://doi.org/10.2527/jas.2011-4599

[159] EFSA Panel on Animal Health and Welfare (2011) Scientific Opinion concerning the welfare of animals during transport. *EFSA J., 9*(1):1966. https://doi.org/10.2903/j.efsa.2011.1966

[160] Maselyne, J. et al. (2017), Daily lying time, motion index and step frequency in dairy cows change throughout lactation. *Research in Veterinary Sci.*, 110:1–3. https://doi.org/10.1016/j.rvsc.2016.10.003

[161] Metz, J.H.M. (1985) The reaction of cows to a short-term deprivation of lying. *Applied Animal Behavioral Sci*. 13:301–7. http://www.doi.org/10.1016/0168-1591(85)90010-3.

[162] Tucker, C.B. (2017) Use of a pneumatic push gate to measure dairy cattle motivation to lie down in a deep-bedded area. *Applied Animal Behavioral Sci*. (2018) 201:15–24. https://www.doi.org/10.1016/j.applanim.2017.12.018

sickness.[163] In the US, typical loading densities also prevent pigs from lying down. Research has found that, at higher loading densities (~ 278 kg/m^2, or 57 lbs./ft^2), all pigs cannot lie down at once, leading to a continuous changing of positions and inability to rest.[164] Unfortunately, pork industry standards recommend a loading density significantly higher than this.[165] The recommended loading density for a typical cull sow, ranging from 400 to 550 lbs., according to the Transport Quality Assurance Handbook is between 62.6-65.6 lbs./ft^2 (305.6-320.3 kg/m^2).[166] In addition, the majority of breeding sows are subject to continuous confinement during which exercise is not possible, contributing to leg weakness, which makes inability to rest even more problematic.[167]

While all categories of livestock can become fatigued due to the combination of food and water deprivation and the increase in energy expenditure required by prolonged transport, cull animals are both more likely to have ailments that increase their vulnerability to fatigue *and* more likely to undergo protracted journeys that contribute to fatigue. For example, as described above, cull animals are often underweight or even emaciated at the start of a journey and their access to food and water may have been decreased by painful conditions that limited their mobility. In addition, while in the marketing channel—often for days—animals often have limited access to feed and water; any feed provided is typically of low quality.[168]

Although little research on fatigue has been carried out on cull cattle specifically, it is reasonable to assume that fatigue is a contributing factor to their increased risk of becoming injured or nonambulatory, or of dying during long distance transports.[169] Regarding pigs, several studies show that, compared to market pigs, cull sows have more than twice the risk of developing the clinical condition of "fatigued pig" mentioned above.[170]

The negative impact of fatigue on the health and welfare of cull animals could be mitigated by requiring adherence to fitness to transport requirements proposed in this petition, as these specifically prohibit the shipment of fatigued animals, as well as the shipment of animals more vulnerable to developing fatigue, such as those who are sick, injured, weak, or disabled.

d. Temperature Extremes

Under natural conditions, farmed animals have many mechanisms for thermoregulation, which allows them to tolerate a range of temperature and humidity levels. However, during transport animals are unable to seek shade, sun, or windbreaks, cannot wallow, and cannot separate themselves

[163] Santurtun, E. & Phillips, C. J. (2015) The impact of vehicle motion during transport on animal welfare. *Research in Veterinary Sci.*, *100*:303–308. https://doi.org/10.1016/j.rvsc.2015.03.018; Driessen et al. (2020), *supra* note 131; Bradshaw, R.H. et al. (1996) Stress and travel sickness in pigs: effects of road transport on plasma concentrations of cortisol, beta-endorphin and lysine vasopressin. *Animal Sci., 63*(3):507-516. https://doi.org/10.1017/S135772980001540X; Randall, J.M. & Bradshaw, R.H. (1998) Vehicle motion and motion sickness in pigs. *Animal Sci., 66*(1): 239-245. https://doi.org/10.1017/S1357729800009012

[164] Lambooy, E., & Engel, B. (1991). Transport of slaughter pigs by truck over a long distance: some aspects of loading density and ventilation. *Livestock Production Science*, *28*(2), 163–174. https://doi.org/10.1016/0301-6226(91)90006-C

[165] *Version 8 TQA Handbook* (2023), *supra* note 35.

[166] *Id.*

[167] Schenck, E. L. et al. (2008) Exercising stall-housed gestating gilts: effects on lameness, the musculo-skeletal system, production, and behavior. *J. of Animal Sci.*, 86(11):3166–3180. https://doi.org/10.2527/jas.2008-1046.

[168] Stojkov, J. et al. (2020a), *supra* note 70.

[169] González et al. (2012a), *supra* note 82.

[170] Fogsgaard et al. (2018), *supra* note 100; McGee et al. (2016), *supra* note 66; MILLMAN (2016), *supra* note 99.

from other animals' heat-producing bodies. Dehydration and negative energy balance caused by prolonged food and water deprivation further inhibit adaptive responses such as evaporative cooling or shivering.[171]

Exposure to extreme temperatures is widely acknowledged as an issue affecting animal health and welfare—both high and low temperatures can lead to negative affective states, health problems, immunosuppression, and death.[172] Exposure to high temperatures can lead to various degrees of heat-induced illness, including heatstroke, and has been documented in pigs to lead to a two- to three-fold increase in blood cortisol levels.[173] Heat stress reduces intestinal integrity, which results in decreased appetite and increased ability of pathogens and endotoxin in the lumen of the gastrointestinal tract to enter the portal and systemic circulation.[174] This occurs because, in mammals, the body's physiologic response to heat stress involves shunting blood away from the gut, and the resultant hypoxia (decreased oxygen level) of the intestinal epithelium compromises the intestines' barrier function.[175] Heat and cold stress have also been documented to have a negative impact on immune function and to increase food safety risks by increasing fecal shedding and antimicrobial resistance of pathogens that can cause foodborne illness in humans.[176] USDA research has found that heat stress can have a significant effect on both stress and innate immune responses of cattle.[177]

Cull animals are more vulnerable to the health and welfare impacts of extreme temperatures for a number of reasons. Both lactating cattle and lactating sows are more sensitive to heat, due to the elevated internal heat loads caused by milk production.[178] One study used ambient temperature and humidity data from weather stations near US slaughter plants collected from 2010 to 2015 to predict the incidence and risk of death among swine in-transit and just prior to slaughter. It found that the risk of death for cull sows at high humidity index (85-92°F) was 1.93 times greater than that of average temperatures (54-79°F).[179] Boars who are culled due to obesity are at increased risk of heat-related illness during transport in hot environments.

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[171] González et al. (2012b), *supra* note 129.
[172] Polsky, L. & von Keyserlingk, M. A. G. (2017) Invited review: Effects of heat stress on dairy cattle welfare. *J. of Dairy Sci.*, *100*(11):8645–8657. https://doi.org/10.3168/jds.2017-12651; Carroll et al. (2012), *supra* note 56.
[173] Marple, D. N. et al. (1974) Physiological and endocrinological changes in response to terminal heat stress in swine. *J. of Animal Sci.*, 39(1):79–82. https://doi.org/10.2527/jas1974.39179x
[174] Pearce, S. C. et al. (2014) Short-term exposure to heat stress attenuates appetite and intestinal integrity in growing pigs. *J. of Animal Sci.*, 92(12):5444–5454. https://doi.org/10.2527/jas.2014-8407
[175] Pearce, S. C. et al. (2013) Heat stress reduces intestinal barrier integrity and favors intestinal glucose transport in growing pigs. *PloS One*, 8(8):e70215. https://doi.org/10.1371/journal.pone.0070215.
[176] Gupta, S. et al. (2022) The Impact of Heat Stress on Immune Status of Dairy Cattle and Strategies to Ameliorate the Negative Effects. *Animals*, 13(1):107. https://doi.org/10.3390/ani13010107; Rostagno M. H. (2009) Can stress in farm animals increase food safety risk?. *Foodborne Pathogens and Disease*, 6(7):767–776. https://doi.org/10.1089/fpd.2009.0315
[177] Carroll et al. (2012), *supra* note 56.
[178] Polsky & von Keyserlingk (2017), *supra* note 172; Thodberg et al. (2019), *supra* note 66; Cartwright, S.L. et al. (2023) Impact of heat stress on dairy cattle and selection strategies for thermotolerance: a review. *Frontiers in Veterinary Sci.,*10:1198697. https://doi.org/10.3389/fvets.2023.1198697; Carabaño, M. J. et al. (2017) BREEDING AND GENETICS SYMPOSIUM: Breeding for resilience to heat stress effects in dairy ruminants. A comprehensive review. *J. Animal Sci.*,95(4):1813-1826. https://doi.org/10.2527/jas.2016.1114
[179] Peterson et al. (2017), *supra* note 40.

As described above, cull sows and dairy cows often have thin or even emaciated body condition. This makes them more susceptible to hypothermia in the face of cold exposure, particularly after having been fasted.[180]

The health and welfare harms cull animals face from temperature extremes could be mitigated by adopting the WOAH code's requirement that animals should not be transported if their "body condition would result in poor welfare because of the expected climatic conditions."

2. Impact on Food Safety

a. Role of (Unfit) Cull Animals in Microbial Contamination

The Centers for Disease Control and Prevention estimates that in the U.S., 48 million people are sickened, 128,000 hospitalized, and 3,000 die annually due to foodborne illness.[181] In 2013, the agency published a report describing the origins of 9 million cases of foodborne illness in the U.S. each year, concluding that meat products (including poultry) were found to account for 22% of total cases and hospitalizations, and 43% of deaths.[182] An outbreak of foodborne disease can occur due to food safety lapses at various stages along the food chain. However, outbreaks from contamination originating at meat processing establishments are of particular concern because they often result in widespread contamination throughout the supply chain and affect a large number of people across a wide geographic area.[183]

The gastrointestinal tract of animals used for food production can act as a reservoir for foodborne pathogens.[184] While the muscle tissue of healthy animals is generally considered sterile, contamination with foodborne pathogens at the slaughter plant can occur via four basic mechanisms: contact with contaminated hides, contact with contents of gastrointestinal tracts during evisceration, contact with contaminated equipment or workers' hands, and airborne transmission.[185] In some cases, pathogens that cause foodborne illness in humans also cause clinical disease in food-producing animals,[186] and adopting fitness for transport requirements would help prevent these sick animals

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[180] EFSA Panel on Animal Health and Welfare, Nielsen, S.S. et al. (2022) Welfare of pigs during transport. *EFSA J.*, 20(9):e07445. http://www.doi.org/10.2903/j.efsa.2022.7445.

[181] *Estimates of Foodborne Illness of the United States, Burden of Foodborne Illness: Overview*, CENTERS FOR DISEASE CONTROL (Nov. 8, 2018) https://www.cdc.gov/foodborneburden/estimates-overview.html

[182] Painter, J. A. et al. (2013) Attribution of Foodborne Illnesses, Hospitalizations, and Deaths to Food Commodities by using Outbreak Data, United States, 1998–2008. *Emerging Infectious Diseases*, *19*(3):407-415. https://doi.org/10.3201/eid1903.111866

[183] Warmate, D., & Onarinde, B. A. (2023) Food safety incidents in the red meat industry: A review of foodborne disease outbreaks linked to the consumption of red meat and its products, 1991 to 2021. *Int'l J. of Food Microbiology*, *398*: 110240. https://doi.org/10.1016/j.ijfoodmicro.2023.110240

[184] Martín-Peláez, S. et al. (2009) Different feed withdrawal times before slaughter influence caecal fermentation and faecal Salmonella shedding in pigs. *Veterinary Journal (England)*, 182(3), 469–473. https://doi.org/10.1016/j.tvjl.2008.08.002

[185] Troutt, H.F et al. (1997) Meat from dairy cows: possible microbiological hazards and risks. *Scientific & Technical Rev*, 16 (2):405-414. http://dx.doi.org/10.20506/rst.16.2.1022.; Brichta-Harhay, D.M. et al. (2008) Salmonella and Escherichia coli O157:H7 contamination on hides and carcasses of cull cattle presented for slaughter in the United States: an evaluation of prevalence and bacterial loads by immunomagnetic separation and direct plating methods. *Applied and Envt'l Microbiology*, 74(20):6289–6297. https://doi.org/10.1128/AEM.00700-08

[186] Burrough, E.R., *Intestinal Salmonellosis in Pigs*, MERCK VETERINARY MANUAL (2022) https://www.merckvetmanual.com/digestive-system/intestinal-diseases-in-pigs/intestinal-salmonellosis-in-pigs;

from spreading infection and/or causing contamination with pathogens around the time of slaughter. However, for most foodborne pathogens, animals who are carrying the organism in their gastrointestinal tracts or organs, and/or shedding them in their feces, often do not show any clinical signs.[187] For this reason, intervention strategies aside from exclusion of sick animals are recognized as necessary to ensure food safety, and these are aimed at reducing pathogen levels on hides, in feces, and in tissues.[188]

The USDA recognizes that transport-associated stress as a potential food safety issue because of its immunosuppressive effects and its potential to increase the virulence and multiplication rate of foodborne pathogens within the gastrointestinal tract.[189] For the reasons detailed below, cull animals may pose an increased food safety risk, particularly cull animals who are not fit for transport.[190] The high rates of cull cattle becoming nonambulatory or dying during transport suggests that at least some of these animals were in compensated or even partially decompensated shock at the time of loading.

The risk of microbial contamination is amplified by the fact that the carcasses of cull animals are often used to produce ground meat products, the processing of which can increase contamination with foodborne pathogens.[191] Therefore, prohibiting the transport of unfit animals to markets, auctions, and slaughterhouses is an important component of ensuring food safety.

i) Unfit Cull Animals May Have a Higher Prevalence of Carrying and/or Shedding Pathogens That Impact Food Safety

Compared with fed cattle and market hogs, cull sows and cull dairy cows often have a higher prevalence of carrying and shedding pathogens of concern for food safety.[192] This risk appears to be increased in cull animals who are unfit for transport.[193] The available research in this area is discussed after a brief review of the pathogens in question: *Escherichia coli,* nontyphoid *Salmonella,* and *Campylobacter.*

Grünberg, W. *Salmonellosis in Animals*, MERCK VETERINARY MANUAL (2022) https://www.merckvetmanual.com/digestive-system/salmonellosis/salmonellosis-in-animals

[187] Brichta-Harhay et al. (2008), *supra* note 185.

[188] *Id*.

[189] Dr. Marcus Rostagno, *Stress in Farm Animals and Food Safety: Is there a Connection?* USDA LIVESTOCK BEHAVIOR RESEARCH UNIT NEWSLETTER, Fall 2010. Available at: https://www.ars.usda.gov/ARSUserFiles/50201500/Stress%20and%20Food%20Safety%20Fact%20Sheet.pdf.

[190] Larsen, S. T. et al. (2003) Impact of commercial preharvest transportation and holding on the prevalence of Salmonella enterica in cull sows. *J. of Food Protection*, 66(7):1134–1138. https://doi.org/10.4315/0362-028x-66.7.1134; Troutt, H. F. et al. (2001) Prevalence of Salmonella spp in cull (market) dairy cows at slaughter. *J. of the American Veterinary Med. Ass'n.*, 219(9):1212–1215. https://doi.org/10.2460/javma.2001.219.1212; Troutt et al. (1997), *supra* note 185.

[191] Brichta-Harhay et al. (2008), *supra* note 185; Larsen et al. (2003), *supra* note 190.

[192] Larsen et al. (2003), *supra* note 190; Troutt et al. (2001) *supra* note 185; Dodson, K., & LeJeune, J. (2005) Escherichia coli O157:H7, Campylobacter jejuni, and Salmonella Prevalence in cull dairy cows marketed in northeastern Ohio. *J. of Food Protection*, 68(5):927–931. https://doi.org/10.4315/0362-028x-68.5.927

[193] Sarnago Coello, M. J. et al. (2007) Microbiological differences between cull cattle slaughtered at an abattoir and cull cattle slaughtered on farms. *The Veterinary Record*, 161(21):719–722. https://doi.org/10.1136/vr.161.21.719

Escherichia coli O157:H7 is a bacterium that is harmless to most animals but produces a toxin that is dangerous to humans, especially to those with an immature or weakened immune system.[194] It is a particular concern in ground beef, despite the use of treatments during post-slaughter processing to reduce the risk of contamination.[195] *E. coli* typically contaminates meat when bacteria are transferred from the soiled hides of the incoming animals to the trimmings and subsequently to ground beef during the dressing and breaking of carcasses.[196]

Salmonella contamination is one of the most common causes of food poisoning in people, with pork recognized as a major source. Manure from transport vehicles is a common cause of carcass contamination,[197] and pigs with higher concentrations of *Salmonella* in their feces pose a greater food safety risk than pigs with lower concentrations.[198]

Campylobacter is the most commonly reported cause of foodborne illness in both developed and developing countries.[199] Cattle are the second most frequent source behind poultry. A study of 96 US dairy operations found that 97.9% of operations were positive for *Campylobacter*, with multidrug resistance identified in over 20% of *Campylobacter* strains.[200]

Several studies suggest that cull animals may play an outsized role as reservoirs for foodborne pathogens. With regard to *E. coli* 0157, research results have been inconsistent, but some studies have documented a higher prevalence in cull cattle (dairy and/or beef) compared to cattle of other ages and classes.[201] Numerous studies have documented a higher prevalence of *Salmonella* spp. in cull dairy cows and cull sows, compared with fed cattle and market-weight hogs. For example, this finding was reported in a 2001 study in the *Journal of the American Veterinary Medical Association* that evaluated cull dairy cows who were considered healthy at the time of slaughter.[202] It found *Salmonella* spp. in 23.1% of cecal-colon content samples from cull cows in five slaughterhouses in the U.S., with up to 93% of samples being positive in one establishment on a single day.

Salmonella can be detected by an array of different tests. It can be isolated (i.e., its presence detected) from tissues (muscles, internal organs, lymph nodes), within the lumen of the gastrointestinal tract, or in the feces. An early study evaluating the prevalence of *Salmonella* in slaughtered sows found that it could be isolated from the mesenteric lymph nodes and cecal contents of 84% of sows at a Minnesota

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[194] Stanford, K. (2023), *E. coli 0157:H7*. BEEF CATTLE RESEARCH COUNCIL https://www.beefresearch.ca/research-topic.cfm/e-coli-o157h7-10
[195] Kitanov, P. M. & Willms, A. R. (2018) Probability of Escherichia coli contamination spread in ground beef production. *Mathematical Biosciences and Engineering*, 15(4): 1011–1032. https://doi.org/10.3934/mbe.2018045
[196] *Id.*
[197] Driessen et al. (2020), *supra* note 131.
[198] Massacci, F. R. et al. (2020) Transport to the Slaughterhouse Affects the Salmonella Shedding and Modifies the Fecal Microbiota of Finishing Pigs. *Animals*, 10(4): 676. https://doi.org/10.3390/ani10040676
[199] García-Sánchez, L. et al. (2018) Campylobacter in the Food Chain. *Advances in Food and Nutrition Rsch.*, 86: 215–252. https://doi.org/10.1016/bs.afnr.2018.04.005
[200] Englen, M. D. et al. (2007) Prevalence and antimicrobial resistance of Campylobacter in US dairy cattle. *J. of Applied Microbiology*, 102(6): 1570–1577. https://doi.org/10.1111/j.1365-2672.2006.03189.x
[201] Rice, D. H. et al. (1997) Escherichia coli O157 in Cull Dairy Cows on Farm and at Slaughter. *J. of Food Protection*, 60(11): 1386–1387. https://doi.org/10.4315/0362-028X-60.11.1386; Venegas-Vargas, C. et al. (2016) Factors Associated with Shiga Toxin-Producing Escherichia coli Shedding by Dairy and Beef Cattle. *Applied and Env. Microbiology*, 82(16): 5049–5056. https://doi.org/10.1128/AEM.00829-16
[202] Troutt et al. (2001), *supra* note 185.

slaughter plant.[203] A subsequent study specifically evaluated the lymph nodes in the chuck and flank adipose tissue of various classes of cattle, as these organs are often incorporated into ground meat.[204] It found that lymph nodes from the flanks of cull cow and bull carcasses had the highest *Salmonella* prevalence at 3.86%, over ten times as high as lymph nodes from the chuck region of fed cattle carcasses. In this study, multidrug resistant *Salmonella* was found in three lymph node samples, and all three were from cull cattle.[205]

Cull sows are also recognized as potentially posing a higher risk of food-borne contamination with *Salmonella enterica*.[206] Breeding sows have been found to have a higher prevalence of *Salmonella* than nursery or finisher pigs. When assessed via fecal culture, one study found that 18 to 22% of sows were positive for *Salmonella*, as compared to 13.5% for finishers and 6% for nursery pigs.[207] When the isolation of *Salmonella* from mesenteric lymph nodes was used as a means of determining prevalence, healthy cull sows were found to have a prevalence of 58.2%—nearly twice that of market hogs (31.3%).[208]

Most studies on the prevalence of foodborne pathogens in cull animals have been performed on animals described as healthy. However, the limited research available suggests that infection with and shedding of these pathogens may be higher for cull animals who would fail to meet fitness requirements. Research carried out in England compared the microbiological profiles of healthy cull dairy cows with those who were slaughtered on-farm due to being unfit to transport or unable to pass inspection at slaughterhouses.[209] After slaughter, samples were obtained from the spleen, liver, and psoas major muscles. Across all tissues, the mean total viable count (a measure of microbial load) was significantly greater in the unfit cull animals (4.0 $\log_{10}$ colony forming units [cfu]/g vs. 3.0 $\log_{10}$ cfu/g). Muscle tissue contained foodborne pathogens in only 3% of the healthy animals, but nearly 30% of the unfit animals. While only two of the 32 (6%) healthy cull animals carried any of the three foodborne pathogens investigated (*E. coli*, *Salmonella* spp, and *Campylobacter*), at least one of the pathogens was carried by 33% (9 of 27) unfit cattle. Three of the unfit animals carried both *Salmonella* spp and *Campylobacter*.

From a veterinary perspective, these findings are intuitive. The final common pathway to death in animals is often shock—the clinical condition in which "profound and widespread reduction of effective tissue perfusion leads first to reversible and then, if prolonged, to irreversible cellular injury."[210] Compromised livestock in transit may experience various types of shock, including hypovolemic, distributive, circulatory, or metabolic. Unfit animals who die enroute to slaughter or shortly after arrival at the plant are likely to have been in a state of compensated shock at the outset

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203 Tay, S. C. K. et al. (1989) Salmonella in the Mesenteric Lymph Nodes and Cecal Contents of Slaughtered Sows. *J. of Food Protection*, 52(3): 202–203. https://doi.org/10.4315/0362-028X-52.3.202
204 Arthur, T. M. et al. (2008) Prevalence and characterization of Salmonella in bovine lymph nodes potentially destined for use in ground beef. *J. of Food Protection*, 71(8): 1685–1688. https://doi.org/10.4315/0362-028x-71.8.1685
205 *Id.*
206 Larsen et al. (2003), *supra* note 190; Davies, P. R. et al. (1998) Isolation of Salmonella serotypes from feces of pigs raised in a multiple-site production system. *J. of the Am. Vet. Med. Ass'n.*, 212(12): 1925–1929.
207 Davies et al. (1998), *supra* note 206.
208 Keteran, K. et al. (1982) Salmonella in the mesenteric lymph nodes of healthy sows and hogs. *Am. J. of Vet. Rsch.*, 43(4): 706–707.
209 Sarnago Coello et al. (2007), *supra* note 193.
210 Kate Hopper et al., *Shock Syndromes*, *in* FLUID, ELECTROLYTE, AND ACID-BASE DISORDERS IN SMALL ANIMAL PRACTICE 557-583 (4th ed. 2012). https://doi.org/10.1016/B978-1-4377-0654-3.00030-5

of the journey and then decompensated prior to expiring or becoming nonambulatory. However, unfit animals may also remain in a state of compensated shock and, thus, enter the food chain. Shock is typically characterized by hypotension (low blood pressure) and inadequate perfusion of the gastrointestinal tract, which can compromise the barrier function of the bowel and lead to bacterial translocation from within the gut lumen into the bloodstream, from which bacteria may be disseminated into the tissue.[211] Studies have shown that, within 30 minutes of gut hypoperfusion, bacterial translocation occurs in 35% of individuals, with the number increasing to 50% in 60 minutes.[212] This has obvious implications for food safety.

ii) Increased Stress is Correlated with Greater Fecal Shedding of Pathogens of Concern

High levels of stress, as measured with blood cortisol levels, has been shown to correlate with greater fecal shedding of pathogens that cause foodborne illness.[213] Most studies on the relationship between stress and foodborne pathogens have examined stress in the context of transport, food deprivation, and/or lairage, however, research has also identified handling and social stress as apparent causes of increased shedding of *E. coli* and *Salmonella typhimurium*, respectively.[214] Many of the conditions that render animals unfit for transport are also known to cause chronic stress. For example, rectal prolapse and both acute and chronic lameness are documented to causes a significant increase in blood and/or salivary cortisol levels.[215]

With *Salmonella typhimurium* in particular, asymptomatic animals can carry the bacteria in lymphoid tissues, shedding low numbers of bacteria only intermittently, until they are subjected to a period of stress, during which shedding can drastically increase. When this occurs enroute to slaughter, it can lead to greater carcass contamination and subsequent increased risk of foodborne *Salmonella* infections in humans.[216] A study in 2011 demonstrated that stress-related recrudescence of *S. typhimurium* in pigs could be induced by an intramuscular injection of the corticosteroid, dexamethasone.[217] This suggests that the conditions that render cull animals unfit for transport are also likely to cause *S. typhimurium* recrudescence. Furthermore, several studies have demonstrated

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[211] *Id.*; Frank, E. D. et al. (1961) Effect of hemorrhagic shock on viability of invading bacteria. *Proceedings of the Soc'y for Experimental Biology and Med.*, 106:394–398. https://doi.org/10.3181/00379727-106-26349
[212] Mori, T. et al. (2005) A free radical scavenger, edaravone (MCI-186), diminishes intestinal neutrophil lipid peroxidation and bacterial translocation in a rat hemorrhagic shock model. *Critical Care Med.*, 33(5): 1064–1069, https://doi.org/10.1097/01.ccm.0000162952.14590.ec
[213] Artuso-Ponte, V. et al. (2015) Supplementation with Quaternary Benzo(c)phenanthridine Alkaloids Decreased Salivary Cortisol and Salmonella Shedding in Pigs After Transportation to the Slaughterhouse. *Foodborne Pathogens and Disease*, 12(11): 891–897. https://doi.org/10.1089/fpd.2015.2009; Rostagno (2009), *supra* note 176.
[214] Dowd, S. E. et al. (2007) Handling may cause increased shedding of Escherichia coli and total coliforms in pigs. *Foodborne Pathogens and Disease*, 4(1):99–102. https://doi.org/10.1089/fpd.2006.53; Callaway, T. R. et al. (2006) Social stress increases fecal shedding of Salmonella typhimurium by early weaned piglets. *Current Issues in Intestinal Microbiology*, 7(2):65–71.
[215] Ley et al. (1994), *supra* note 54; Bustamante et al. (2015), *supra* note 54; O'Driscoll, K. et al. (2015) Differences in leukocyte profile, gene expression, and metabolite status of dairy cows with or without sole ulcers. *J. of Dairy Sci.*, 98(3): 1685–1695. https://doi.org/10.3168/jds.2014-8199; Contreras-Aguilar, M. D. et al. (2019) Application of a score for evaluation of pain, distress and discomfort in pigs with lameness and prolapses: correlation with saliva biomarkers and severity of the disease. *Res. in Vet. Sci.*, 126:155–163. https://doi.org/10.1016/j.rvsc.2019.08.004.
[216] Verbrugghe, E. et al. (2011) Stress induced Salmonella Typhimurium recrudescence in pigs coincides with cortisol induced increased intracellular proliferation in macrophages. *Veterinary Res.*, 42(1):118. https://doi.org/10.1186/1297-9716-42-118
[217] *Id.*

that catecholamines (neurotransmitters released in response to fear, pain, and other stressors) promote the growth and motility of *S. typhimurium* and enhance its excretion in feces. [218] These neurotransmitters may also increase the virulence of other foodborne pathogens like *Campylobacter jejuni* and *E. coli* O157:H7.[219] Thus, the negative affective states experienced by unfit cull animals during transport have implications for the shedding and virulence of foodborne pathogens.

iii) Prolonged Transport and Feed Withdrawal Increase the Prevalence, Shedding, and Hide Contamination with Pathogens of Concern

Relative to other market animals, cull animals commonly undergo longer periods of transport, holding, and fasting, each of which, as reviewed below, may increase pathogen prevalence, shedding, and/or hide contamination.[220] Animals who fail to meet the suggested fitness for travel standards—e.g., those who are severely lame, sick, injured, or weak or are in poor body condition prior to their journey to the slaughterhouse—may have already been fasting prior to being removed from the farm, either due to disease-induced inappetence or due to difficulty accessing feed because of lameness or other painful conditions. Given the length of time cull animals typically spend in the marketing channel prior to slaughter, it is essential that only fit animals embark on these journeys.

While studies have reported conflicting results about the impact of different transport durations, some research suggests that shedding of pathogenic *E. coli* 0157:H7 increases with longer transport duration.[221] For example, a study comparing the impact of short (3 hour) and long (15 hour) transport times on *E. coli* shedding in calves found that longer distance transport was correlated with increased shedding for three weeks in calves who were stressed due to lack of preconditioning.[222] The nonpreconditioned calves in this study were also subjected to a period of food deprivation of at least 40 hours. Research examining the impact that withdrawn feed has on *E. coli* shedding has found that,

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[218] *Id.*; Bearson, B.L. & Bearson, S.M. (2008) The role of the QseC quorum-sensing sensorkinase in colonization and norepinephrine-enhanced motility of Salmonella enterica serovar Typhimurium. *Microbial Pathogenesis,* 44:271-278. https://doi.org/10.1016/j.micpath.2007.10.001; Methner, U. et al. (2008) Effect of norepinephrineon colonisation and systemic spread of Salmonella enterica in infected animals: role of catecholate siderophore precursors and degradation products. *Int'l. J. Med. Microbiology*, 298:429-439. https://doi.org/10.1016/j.ijmm.2007.07.013; Toscano, M.J. et al. (2007) Cultivation of Salmonella enterica serovar Typhimurium in a norepinephrine-containing medium alters in vivo tissue prevalence in swine. *J. Experimental Animal Sci.,* 43:329-338. https://doi.org/10.1016/j.jeas.2006.09.007; Pullinger, G.D. et al. (2010) 6-hydroxydopamine-mediated release of norepinephrine increases faecal excretion of Salmonella enterica serovar Typhimurium in pigs. *Veterinary Res.*., 41:68. https://doi.org/10.1051/vetres/2010040

[219] Rostagno (2009), *supra* note 176.

[220] Mulder, R.W.A.W. (1995) Impact of transport and related stresses on the incidence and extent of human pathogens in pigmeat and poultry. *J. of Food Safety*, 15(3): 239–246. https://doi.org/10.1111/j.1745-4565.1995.tb00136.x; Fernandez, M. et al. (2021) Dynamics of microbial shedding in market pigs during fasting and the influence of alginate hydrogel bead supplementation during transportation. *Microbiology Rsch.,* 12(4): 888. doi:https://doi.org/10.3390/microbiolres12040065; Brichta-Harhay et al. (2008), *supra* note 185; Verbrugghe et al. (2011), *supra* note 216; Fike, K. & Spire, M. F. (2006) Transportation of Cattle. *The Veterinary Clinics of N. Am.: Food Animal Prac.,* 22(2): 305–320. https://doi.org/10.1016/j.cvfa.2006.03.012

[221] Fegan, N. et al. (2009) The effects of transport and lairage on counts of Escherichia coli O157 in the feces and on the hides of individual cattle. *Foodborne Pathogens and Disease*, 6(9): 1113–1120. https://doi.org/10.1089/fpd.2009.0338; Minihan, D. et al. (2003) Investigation on the Effect of Transport and Lairage on the Faecal Shedding Prevalence of Escherichia coli O157 in Cattle. *J. of Veterinary Med. Series B*, 50(8): 378–382. https://doi.org/10.1046/j.1439-0450.2003.00674.x

[222] Bach, S. J. et al. (2004) Long-haul transport and lack of preconditioning increases fecal shedding of Escherichia coli and Escherichia coli O157:H7 by calves. *J. of Food Protection*, 67(4): 672–678. https://doi.org/10.4315/0362-028X-67.4.672

even with very short or even no transport, feed withdrawal for as little as 24 hours increases fecal shedding.[223]

For *Salmonella*, more research has been performed on cull animals specifically and the evidence clearly shows that transport and food deprivation, particularly when prolonged, increase shedding and contamination, and that spending more time in the marketing channel increases prevalence of *Salmonella* in tissues, intestinal contents, and feces. For example, one study followed 181 cull sows from the farm to a live market to the slaughter plant. *Salmonella*-positive fecal samples were obtained from 3% of the sows on farm and 2% soon after a short (1 to 1.5 hour) journey to the market.[224] However, after a longer (10 to 11 hours) journey to the slaughterhouse, 11% of samples were positive. When counting pigs who had *Salmonella*-positive fecal, lymph node, and/or cecal content, the prevalence of this pathogen in the cull sows was 41%.[225] In addition, 7% of sow carcasses were still positive for *Salmonella* after a lactic acid carcass wash, indicating the potential of cull sows to be a source of *Salmonella* contamination of pork products.

Research by the USDA found that the prevalence of *Salmonella* in market pigs, assessed via fecal samples, increased from 11.3% pre-transport to 20% post-transport, to 42% post-holding in lairage at the slaughterhouse.[226] Another study compared *S. enterica* prevalence between market weight pigs necropsied on-farm and pigs necropsied after arrival at the slaughterhouse (following a 169 km journey and 2 to 3 hours in holding). The isolation rate for *S. enterica* was seven times higher for the pigs at the slaughterhouse, with increased contamination of the lymph nodes, cecal contents, and fecal material.[227] This study also demonstrated how rapidly pigs can become infected with different serovars of *Salmonella* during transport and holding.

This is not the only study to find that keeping pigs in holding or lairage pens (as frequently occurs with cull animals making their way through the marketing chain) is associated with increase prevalence of *S. enterica*. For example, a study on cull sows found that, postmortem, 44% of those slaughtered immediately after transport from a live market had *Salmonella* isolated while 59% of those held in a lairage pen did.[228] A study on market pigs also found that pigs can become infected with *Salmonella* in as little as two hours in a contaminated pen.[229] This suggests that transporting unfit cull animals is likely to disproportionately contribute to *Salmonella* food safety risks, given that the chronic stress these animals have often experienced pre-transport makes them more likely to be

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[223] Reid, C.A. et al. (2002) The effect of feed withdrawal on Escherichia coli shedding in beef cattle. *Food Control*, 13(6): 393–398. https://doi.org/10.1016/S0956-7135(01)00096-2; Rostagno (2009), *supra* note 176.
[224] Larsen et al. (2003), *supra* note 190; McKean, J. D. et al. (2001) Impact of commercial pre-harvest processes on the prevalence of Salmonella enterica in cull sows. *Berliner und Munchener tierarztliche Wochenschrift*, 114(9-10): 353–355. https://doi.org/10.31274/safepork-180809-239
[225] Larsen et al. (2003), *supra* note 190.
[226] MARCOS H. ROSTAGNO ET AL., DOES PRE-SLAUGHTER TRANSPORTATION AND LAIRAGE AFFECT SALMONELLA ENTERICA SHEDDING PREVALENCE AND LEVELS IN MARKET PIGS? - #07-025, PORK CHECKOFF RESEARCH REPORT (2009). https://porkcheckoff.org/wp-content/uploads/2021/02/07-025-ROSTAGNO-USDA.pdf
[227] Hurd, H. S. et al. (2002) Salmonella enterica infections in market swine with and without transport and holding. *Applied and Envtl. Microbiology*, 68(5):2376–2381. https://doi.org/10.1128/AEM.68.5.2376-2381.2002
[228] Larsen, S. T. et al. (2004) Effect of short-term lairage on the prevalence of Salmonella enterica in cull sows. *J. of Food Protection*, 67(7):1489–1493. https://doi.org/10.4315/0362-028x-67.7.1489
[229] Hurd, H. S. et al. (2001), Rapid infection in market-weight swine following exposure to a Salmonella typhimurium-contaminated environment. *American J. of Veterinary Res.*, 62(8):1194–1197. https://doi.org/10.2460/ajvr.2001.62.1194

shedding the pathogen, and they will likely be spending many hours or even days in pens with other cull animals experiencing protracted transport stress.

Longer feed withdrawal time is also associated with increased *Salmonella* shedding.[230] One study found that pigs on-farm had a *Salmonella* prevalence, as detected in fecal samples, of 13.3%. After a 15-hour period of feed withdrawal, 17.8% of pigs had positive fecal samples, and the prevalence climbed to 33.3% when the feed withdrawal period was increased to 30 hours.[231] Feed withdrawal for 12 hours, both with and without associated transport for two hours, was found to increase both cortisol levels and *Salmonella* levels within the lumen of the gastrointestinal tract.[232]

Less research has been done on the impact of transport and food deprivation on the prevalence of *Campylobacter*, but at least one study found a marked increase in the percentage of fecal samples of pigs testing positive for *Campylobacter* following a period of transport.[233] Another study found that a 48-hour fast led to a two-fold $\log_{10}$ increase in colony-forming units/gram cecal content of *Campylobacter jejuni* in gilts.[234]

Because of the prolonged periods of transport, holding, and food deprivation to which cull animals are subjected enroute to slaughter, their entry into the food chain poses an increased risk of leading to foodborne disease. This risk will only be higher for animals that are sick, injured, weak, disabled or fatigued, or who experience elevated stress during transport because of insufficient body condition for climatic conditions. Therefore, to protect food safety and consumer health, animals unfit to travel should be prohibited from transport.

b. Unfit Cull Animals Pose an Increased Risk of Antibiotic-Resistant Pathogens

Numerous studies have documented the persistence of livestock-derived antimicrobial-resistant pathogens in food, in the bodies of slaughterhouse workers, in soil, and in wastewater.[235] Research suggests that cull animals, particularly those who are unfit for transport, may disproportionately contribute to this problem.

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230 Driessen et al. (2020), *supra* note 131.

231 Martín-Peláez et al. (2009), *supra* note 184.

232 Eicher, S. D. et al. (2017) Feed withdrawal and transportation effects on *Salmonella enterica* levels in market-weight pigs. *J. of Animal Sci.*, 95(7):2848–2858. https://doi.org/10.2527/jas.2017.1454

233 Melo, R. T. et al. (2019) Campylobacter spp. isolates of swine feces submitted to transport stress: species and antimicrobial resistance. *Brazilian J. of Veterinary Med.*, 41(1):e086519. https://doi.org/10.29374/2527-2179.bjvm086519

234 Harvey, R. B. et al. (2001) Effects of feed withdrawal and transport on cecal environment and Campylobacter concentrations in a swine surgical model. *J. of Food Protection*, 64(5):730–733. https://doi.org/10.4315/0362-028x-64.5.730

235 Foyle, L. et al. (2023) Prevalence and distribution of antimicrobial resistance in effluent wastewater from animal slaughter facilities: A systematic review. *Environmental Pollution*, 318:120848. https://doi.org/10.1016/j.envpol.2022.120848; Savin, M. (2020) Antibiotic-resistant bacteria and antimicrobial residues in wastewater and process water from German pig slaughterhouses and their receiving municipal wastewater treatment plants. *The Science of the Total Environment*, 727:138788. https://doi.org/10.1016/j.scitotenv.2020.138788; Ivbule, M. et al. (2017) Presence of Methicillin-resistant *Staphylococcus Aureus* in Slaughterhouse Environment, Pigs, Carcasses, and Workers. *J. of Veterinary Res.*, 61(3):267–277. https://doi.org/10.1515/jvetres-2017-0037; Atlaw, N. A. et al. (2022) Evidence of sheep and abattoir environment as important reservoirs of multidrug resistant Salmonella and extended-spectrum beta-lactamase Escherichia coli. *Int'l J. of Food Microbiology*, 363:109516. https://doi.org/10.1016/j.ijfoodmicro.2021.109516

Cull animals generally appear to be more likely to have received antimicrobial drugs shortly before slaughter and to carry or shed antimicrobial resistant bacteria. One study found that, for cull dairy cattle, over 15% of animals had received antimicrobial drugs as part of a treatment protocol for the condition cited as the reason for culling.[236] As mentioned above, lameness is a common cause for culling dairy cattle, and a leading cause of lameness in dairy cows is bovine digital dermatitis (BDD).[237] Recent research has found that bacteria isolated from BDD lesions contained a widespread distribution of genes conferring antibiotics resistance.[238] Cull sows are also commonly treated with antibiotics prior to culling.[239] The limited research performed on antibiotic resistance in cull animals suggests that resistance to medically important antibiotics, such as third-generation cephalosporins, is higher in cull dairy cattle than in fed cattle.[240]

Antimicrobial resistance in *E.coli*, particular to the β-lactam class of antibiotics, has been named by the CDC as a serious antimicrobial resistance threat, and some researchers have concluded that meat is a source of human infections.[241] One study found that *E. coli* resistant to third-generation cephalosporins (a type of β-lactam) was isolated from 67.6% of the fecal samples from cull dairy cows, as compared with 52.2% of those from beef cattle.[242] The same study found *Salmonella* resistant to third-generation cephalosporins in the colon contents of 0.6% of cull dairy cattle—six times the prevalence in fed cattle using identical methods.[243]

Another study found much higher prevalence of antibiotic resistance in *Salmonella* isolated from dairy cattle: 31% of fecal samples were positive for *Salmonella*, 12% of *Salmonella* isolates were multidrug resistant, and 10% were resistant to the third generation cephalosporin, ceftriaxone.[244] In this study, culling due to lameness—a condition that, depending on severity, can render an animal unfit for transport—it increased the risk that *Salmonella* isolates would be resistant to ciprofloxacin, tetracycline, and/or ampicillin.

Prolonged transit times and increased stress, as often experienced by cull animals, has been linked in some studies to an increase in the diversity of antimicrobial resistance patterns, multidrug resistance, and shedding of resistant bacteria.[245]

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[236] Pandit, P. S. et al. (2021) Dairy management practices associated with multi-drug resistant fecal commensals and *Salmonella* in cull cows: a machine learning approach. *PeerJ Life & Environment,* 9:e11732. https://doi.org/10.7717/peerj.11732
[237] Krull, A. C. et al. (2016) Digital dermatitis: Natural lesion progression and regression in Holstein dairy cattle over 3 years. *J. of Dairy Sci.*, 99(5):3718–3731. https://doi.org/10.3168/jds.2015-10535; Afonso, J. S. et al. (2021) Diagnosis of Bovine Digital Dermatitis: Exploring the Usefulness of Indirect ELISA. *Frontiers in Veterinary Sci.*, 8:728691. https://doi.org/10.3389/fvets.2021.728691
[238] Beyi, A. F. et al. (2021) Tracking Reservoirs of Antimicrobial Resistance Genes in a Complex Microbial Community Using Metagenomic Hi-C: The Case of Bovine Digital Dermatitis. *Antibiotics (Basel, Switzerland)*, 10(2):221. https://doi.org/10.3390/antibiotics10020221
[239] Campler et al. (2021), *supra* note 93.
[240] Schmidt, J. W. et al. (2020) Antimicrobial Resistance at Two U.S. Cull Cow Processing Establishments. *J. of Food Protection*, 83(12): 2216–2228. https://doi.org/10.4315/JFP-20-201
[241] *Id*.
[242] *Id*.
[243] *Id*.
[244] Pereira, R. et al. (2019) Association between herd management practices and antimicrobial resistance in *Salmonella* spp. from cull dairy cattle in Central California. *PeerJ Life & Environment,* 7:e6546. https://doi.org/10.7717/peerj.6546
[245] Rostagno (2009), *supra* note 176.

c. Entry of Unfit Cull Animals into the Food Chain Increases Residue Risk

Cull dairy cattle are the class of livestock that contribute the most to violative drug residues in food.[246] In 2019, the most recent year available, FSIS reported that dairy cattle accounted for 412 drug residue of the total 606 cases in all types of livestock.[247] Most of these were for antibiotics.

Ceftiofur, a third-generation cephalosporin, is widely used in the dairy industry and is the drug most commonly associated with violative meat residues in cull dairy cattle. Research has found that the pharmacokinetics of this drug, which impacts the rate at which the drug is metabolized and removed from the tissues, is affected by the presence of disease. In one study, experimentally induced *E. coli* mastitis prolonged ceftiofur's half-life, meaning it persisted in tissues longer than it did in healthy cows.[248]

While research specifically assessing the connection between violative drug residues and fitness for transport is lacking, studies have documented that health conditions common in unfit animals—including dehydration, sepsis, and sickness—prolong the elimination half-life of drugs, including antibiotics.[249] Thus, the risk of violative drug residues could be mitigated by ensuring that unfit animals are not transported.

3. Risk to Nation's Herds and Public Health

In addition to compromising the health and welfare of the individual animal and increasing food safety risks, shipping unfit animals increases risk of widespread dissemination of diseases of concern, with potential consequences for human health and putting the health of the nation's herds at risk.

Infectious disease is a major risk for many transported animals, both because they may encounter novel pathogens via comingling with other animals from various origins during the transport process and because of the immunosuppressive effect of transport-associated stressors.[250] Conditions quickly become unhygienic on transport trucks. Despite food and water being withheld during and usually before transport, animals continue to urinate and defecate during the journey and these waste products remain on the truck until it reaches its destination. In fact, cattle urinate and defecate more frequently when beginning their journeys, due to being anxious and restless in the novel environment.[251] If accumulated urine, feces, and other bodily fluids contain infectious organisms—

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[246] FOOD SAFETY INSPECTION SERVICE, USDA, NATIONAL RESIDUE PROGRAM QUARTERLY REPORT (JUL-SEP 2021) https://www.fsis.usda.gov/sites/default/files/media_file/2021-10/FY2021_Quarterly_Sampling_Summary_Report_Residue_Q4.pdf

[247] FOOD SAFETY INSPECTION SERVICE, USDA, FY 2019 RESIDUE SAMPLE RESULTS (2020) https://www.fsis.usda.gov/sites/default/files/media_file/2020-07/fy2019-red-book.pdf

[248] Gorden, P. J. et al. (2018) Comparative plasma and interstitial fluid pharmacokinetics and tissue residues of ceftiofur crystalline-free acid in cattle with induced coliform mastitis. *J. of Veterinary Pharmacology and Therapeutics*, 41(6):848–860. https://doi.org/10.1111/jvp.12688

[249] Elsheikh, H. A. et al. (1998) Effect of dehydration on the pharmacokinetics of oxytetracycline hydrochloride administered intravenously in goats (Capra hircus). *General Pharmacology*, 31(3):455–458. https://doi.org/10.1016/s0306-3623(98)00013-5; Lee, J. H. et al. (2008) Effects of water deprivation on drug pharmacokinetics: correlation between drug metabolism and hepatic CYP isozymes. *Archives of Pharmacal Res.*, 31(8):951–964. https://doi.org/10.1007/s12272-001-1269-3; Roberts, J. A., & Lipman, J. (2009) Pharmacokinetic issues for antibiotics in the critically ill patient. *Critical Care Med.*, 37(3):840–859. https://doi.org/10.1097/CCM.0b013e3181961bff

[250] Speer, N.C. et al. (2001) Economic factors associated with livestock transportation. *J. of Animal Sci.*, 79(E):E166–E170. https://doi.org/10.2527/jas2001.79E-SupplE166x

[251] Knowles (1999), *supra* note 145.

bacteria, viruses, or parasites—risk of disease transmission will increase because direct contact with the infectious material is prolonged and inescapable.

Livestock movements have historically been associated with the spread of disease.[252] In 2001, the transport of infected sheep from northeast England led to the rapid spread of foot and mouth disease throughout Great Britain and into Ireland.[253] An epidemic in Italy of Porcine Epidemic Diarrhea Virus was traced to trucks used to transport animals to slaughterhouses.[254] Transport between farms has been identified as the primary risk factor for farmed animal-associated methicillin-resistant *Staphylococcus aureus* (MRSA).[255] Although not well studied in the United States, transport of pigs between farms and to slaughterhouses in Norway was documented to be the primary cause of spread of MRSA to both pigs and humans.[256]

Cull livestock movements in general pose an increased risk of disease dissemination and amplification because of 1) the long distances and numerous stops made by vehicles to gather animals, 2) the extended time spent in the marketing network, and 3) the practice of mixing animals from different sources. [257]

Biosecurity and biocontainment are especially challenging when trucks, animals, and people flow in and out of livestock markets, making them a potentially serious source of disease transmission. Researchers have noted that collection points where cull animals are sorted and mixed with animals from other facilities are often designed and constructed in such a way that proper cleaning and disinfection is not possible, further increasing risk of pathogen dissemination.[258] One study of the movement of cull sows in the U.S. concluded: "The cull sow marketing channel is a poorly understood and unmanaged reservoir population. It also has a high degree of connectivity, creating an ideal situation for the expansion and transmission of a novel pathogen in the US swineherd."[259]

Unfit cull animals in particular pose a greater risk of spreading diseases of concern over wide geographical areas. Appearing obviously sick, depressed, weak, or lethargic can be early signs of diseases that are considered a particular risk to the nation's agricultural herds.[260] For example, cull sows were involved in two cases of *Streptococcus equi* subsp. *zooepidemicus* that caused high

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[252] Shields & Mathews (2003), *supra* note 23.
[253] Cockram, M.S. (2007) Criteria and potential reasons for maximum journey times for farm animals destined for slaughter. *Applied Animal Behaviour Sci.*, 106(4):234-243. https://doi.org/10.1016/j.applanim.2007.01.006
[254] Boniotti, M. B. et al. (2018) Porcine Epidemic Diarrhoea Virus in Italy: Disease spread and the role of transportation. *Transboundary and Emerging Diseases*, 65(6):1935–1942.
[255] Espinosa-Gongora, C. et al. (2012) Transmission of MRSA CC398 strains between pig farms related by trade of animals. *Veterinary Record*, 170(22):564–564.
[256] Grøntvedt, C. A. et al. (2016) Methicillin-Resistant Staphylococcus aureus CC398 in Humans and Pigs in Norway: A "One Health" Perspective on Introduction and Transmission. *Clinical Infectious Diseases,* 63(11):1431–1438.
[257] Blair & Lowe (2019), *supra* note 59; Lowe J. et al. (2014) Role of transportation in spread of porcine epidemic diarrhea virus infection, Emerging Infectious Disease. 20(5):872-4. https://www.doi.org/10.3201/eid2005.131628.
[258] Blair & Lowe (2019), *supra* note 59.
[259] Blair & Lowe (2022), *supra* note 68.
[260] ANIMAL AND PLANT HEALTH INSPECTION SERVICE, USDA, VOLUNTARY 2023 U.S. NATIONAL ANIMAL HEALTH REPORTING SYSTEM (NAHRS) REPORTABLE DISEASES, INFECTIONS, AND INFESTATIONS LIST (2023) https://www.aphis.usda.gov/animal_health/nahrs/downloads/nlrad-nahrs-disease-list.pdf; EMERGING AND RE-EMERGING INFECTIOUS DISEASES OF LIVESTOCK (Bayry, J. ed. 2017).

mortality events at an Ohio buying station and a Tennessee slaughter plant in 2019.[261] Cull sows were the initial cases at the buying station, and were the only animals involved at the slaughterhouse. In these cases, the sows appear to have introduced to the premises a pathogen that results in rapid high mortality, yet on initial presentation, some of them had weakness and lethargy as their only clinical signs.

Implementation of the suggested transport standards is important not only for the sake of minimizing animal suffering, but also to reduce the risks of animal disease outbreaks, negative impacts on public health, and food safety issues.

VII. VULNERABILITY OF NEONATAL CALVES DURING TRANSPORT AND THE NEED FOR STRONGER PROTECTION

Neonatal calves are widely acknowledged as being especially vulnerable to compromised health and welfare during transport.[262] Transporting calves under 4 weeks, especially over long distances, significantly increases the risk that calves will develop disease conditions during or shortly after shipping. This section discusses the several contributing factors identified in scientific and veterinary literature, including 1) reduced immune function in calves, 2) their increased vulnerability to immunosuppression due to transport stressors compared with older animals, 3) their high levels of pre-transport morbidity, and 4) mixing of calves from different facilities. The resulting higher rates of disease subsequently lead to increased use of antibiotics, an attendant increased risk of contributing to antibiotic resistance, and high mortality rates during and after transport. Prohibiting the transport of particularly young and vulnerable calves is necessary to protect their health and welfare and to mitigate the risks to public health. Therefore, we recommend adoption of the criterion in the WOAH code requiring that neonatal animals have a healed navel in order to be transported.

A. The Mammalian Immune Systems is Not Fully Functional at Birth and Immune Function is Worsened by Transport-related Stress

1. Development of the Immune System and Failure of Passive Transfer

Immunocompetence is necessary for animals to defend themselves against pathogens, such as bacteria, viruses, and parasites.[263] In mammals the immune system is comprised of two components: the innate immune system, which reacts immediately to common broad categories of pathogens, and the adaptive immune system, which mounts a highly specific response to particular pathogens.[264] A brief review of immune system development in the neonatal period shows why neonatal calves (and other mammals) are not yet fully immunocompetent and thus particularly vulnerable to disease.

As with other mammals with long gestation periods, calves are born with an immune system that, while fully developed, does not function at adult levels for several weeks to months.[265] There are a number of reasons for this. First, the adaptive immune system of mammals is largely "unprimed"

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[261] Sitthicharoenchai, P. et al. (2020) Cases of high mortality in cull sows and feeder pigs associated with *Streptococcus equi* subsp. *zooepidemicus* septicemia. *J. of Veterinary Diagnostic Investigation (American Association of Veterinary Laboratory Diagnosticians),* 32(4):565–571. https://doi.org/10.1177/1040638720927669
[262] Roadknight et al. (2021a), *supra* note 45.
[263] Hulbert & Moisá (2016), *supra* note 45.
[264] IAN TIZARD, *Defense of the Body in* VETERINARY IMMUNOLOGY (9th ed. 2013).
[265] IAN TIZARD, *Immunity in the Fetus and Newborn* in VETERINARY IMMUNOLOGY 226 (9th ed. 2013); Victor Cortese, *Immunology and Vaccination of Dairy Cattle*, in DAIRY PRODUCTION MEDICINE, 165-73 (Risco & Melendez Retamal eds. 2011). https://doi.org/10.1002/9780470960554.ch14; Cortese (2009), supra note 45.

at birth, i.e., the neonate has just emerged from a sterile uterus and has had little exposure to common pathogens.[266] Any adaptive immune response mounted by a neonatal mammal will therefore have a prolonged lag period between exposure to the pathogen and production of adequate levels of antibodies (proteins that counteract specific pathogens).[267] In addition, while fetal blood lymphocytes can respond to some pathogens in utero, high steroid levels in the blood at the time of birth result in temporary loss of antibody-generating ability.[268] It is only after several weeks that calf-produced antibodies reach significant levels.[269] Finally, antibodies are produced by B cells, which do not reach adult levels until around 6 months after birth.[270]

Some subsystems of calves' innate immune system are also immature. For example, the function of phagocytes (a type of immune cell that ingests and kills pathogens) is decreased at birth and remains so for up to 4 months.[271] In addition, the complement cascade (an important component of the immune system that affects the body's ability to mount a fast response to pathogens) develops slowly, reaching adult levels only around 6 months of age.[272] For all of these reasons, immediately after birth, the immune systems of young calves are less able to mount a rapid and robust response to pathogens.

Early in life, most of calves' protection against disease challenges is contingent on what is termed "passive immunity," or receiving an adequate amount (3 to 4 liters) of good quality colostrum (the first secretions of a mother cow's mammary glands) within six hours after birth.[273] Colostrum contains immune cells, cytokines, and antibodies against pathogens and other antigens to which the mother cow has been exposed.[274] (Importantly, colostrum does not contain antibodies to pathogens to which the dam who produces it has been neither exposed or nor vaccinated.) In calves who absorb adequate colostrum, the blood levels of colostrum-derived antibodies begin to drop when they are four days old and are typically gone by three weeks of age.[275] This drop occurs even as the calves' own adaptive immune systems are significantly less advanced than those of calves 4 weeks or older.[276] Thus, their serum antibody levels reach a nadir at roughly 2 to 3 weeks of age, at a time when other immune components are still developing, creating a "window of susceptibility" to pathogens, as illustrated in the following figure:[277]

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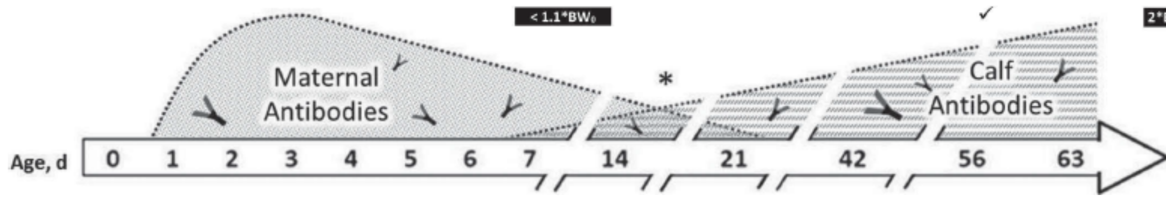
266 Cortese (2011), *supra* note 265.
267 TIZARD, *supra* note 265 at 229.
268 *Id*. at 227; Roth, J. A., & Kaeberle, M. L. (1982) Effect of glucocorticoids on the bovine immune system. *J. of the American Veterinary Med*. Ass'n., 180(8):894–901.
269 Hulbert & Moisá (2016), *supra* note 45.
270 TIZARD, *supra* note 265.
271 Cortese (2011), *supra* note 265.
272 *Id*.
273 Cortese (2011), *supra* note 265.
274 *Id*.
275 Hulbert & Moisá (2016), *supra* note 45.
276 Marcato, F. et al. (2022a) Effects of transport age and calf and maternal characteristics on health and performance of veal calves. *J. of Dairy Sci*., 105(2):1452–1468. https://doi.org/10.3168/jds.2021-20637; Marcato, F. et al. (2022b) Calf and dam characteristics and calf transport age affect immunoglobulin titers and hematological parameters of veal calves. *J. of Dairy Sci*., 105(2):1432–1451. https://doi.org/10.3168/jds.2021-20636
277 Excerpted from Hulbert & Moisá (2016), *supra* note 45.



Unfortunately, calves who are transported early in life frequently suffer from a condition called *failure of passive transfer* (FPT), meaning the amount, quality, timing, or absorption of colostrum ingestion was inadequate, further increasing their susceptibility to infectious disease.[278] Numerous studies carried out around the world have found that prevalence of FPT varies widely between farms, but is especially common among calves who are considered "surplus," i.e., male calves and/or females calves who are not needed for the farm's dairy herd.[279]

A common means of diagnosing FPT is to measure serum or plasma protein levels (in g/dL). Calves who have not absorbed sufficient antibodies from colostrum will typically have lower protein levels. However, this is an imperfect measure, because blood protein levels naturally rise with dehydration, so blood samples taken from dehydrated calves may test "false negative" for FPT, i.e., if measured at normal hydration levels, their protein levels would be low enough to warrant a FPT diagnosis. As discussed further below, because neonatal calves transported in North America typically do not receive fluids or feed enroute, it is common for them to be dehydrated upon arrival. [280] These factors complicate efforts to determine the true prevalence of FPT among surplus calves transported into and around the U.S.

FPT occurs even among higher value replacement heifer calves. A study that evaluated 2,874 calves from 19 commercial dairy farms in Minnesota and Ontario found incidences of FPT of between 11 and 32%, depending on the reference range used (i.e. serum protein <5.2 g/dl or <5.7 g/dl, respectively, indicating FPT).[281]

A 1994 study looking at 1,403 Holstein bull calves from Pennsylvania livestock auctions concluded that between 20% and 49% of calves had definitive evidence of FPT, depending on reference range used.[282] That study concluded that "a marked regional difference" exists in the management of bull calves in dairy herds because research carried out in the same time period in California documented

[278] EFSA Welfare of cattle during transport, *supra* note 156: Roadknight et al. (2021a), *supra* note 45.
[279] EFSA Welfare of cattle during transport, *supra* note 156; Winder, et al. (2016), *supra* note 80; Renaud, D. L. et al. (2018a) Clinical and metabolic indicators associated with early mortality at a milk-fed veal facility: A prospective case-control study. *J. of Dairy Sci.*, 101(3):2669–2678. https://doi.org/10.3168/jds.2017-14042; Shivley, C. B. et al. (2019) Management of preweaned bull calves on dairy operations in the United States. *J. of Dairy Sci.*, 102(5):4489–4497. https://doi.org/10.3168/jds.2018-15100; Creutzinger, K. et al. (2021) Perspectives on the Management of Surplus Dairy Calves in the United States and Canada. *Frontiers in Veterinary Sci.*, 8:661453. https://doi.org/10.3389/fvets.2021.661453; Bolton, S. E., & von Keyserlingk, M. A. G. (2021) The Dispensable Surplus Dairy Calf: Is This Issue a "Wicked Problem" and Where Do We Go From Here?. *Frontiers in Veterinary Sci.*, 8:660934. https://doi.org/10.3389/fvets.2021.660934
[280] Pempek et al. (2017), *supra* note 81; Wilson et al. (2000), *supra* note 91; Kells, N. J. et al. (2020) Indicators of dehydration in healthy 4- to 5-day-old dairy calves deprived of feed and water for 24 hours. *J. of Dairy Sci.*, 103(12):11820–11832. https://doi.org/10.3168/jds.2020-18743
[281] Windeyer, M. C. et al. (2014) Factors associated with morbidity, mortality, and growth of dairy heifer calves up to 3 months of age. *Preventive Veterinary Med.*, 113(2):231–240. https://doi.org/10.1016/j.prevetmed.2013.10.019
[282] Wilson, L. L., et al. (1994) Blood, growth, and other characteristics of special-fed veal calves in private cooperator herds. *J. of Dairy Sci.*, 77(8):2477–2485. https://doi.org/10.3168/jds.s0022-0302(94)77189-7

that 78% of bull calves had FPT upon arrival at a veal facility.[283] Another study of 1,179 Holstein bull calves obtained from livestock auctions or buying stations in the eastern U.S. found an FPT rate of 43%, even using a relatively insensitive cut-off (serum protein levels <5.5 g/dl) to indicate FPT.[284] Because most of these calves exhibited some level of dehydration, their serum proteins may have been falsely elevated, and the true incidence of FPT was likely higher.

Despite improved education among producers about colostrum management, recent studies continue to document FPT as a common problem. A 2017 study on veal calves being shipped from the northeastern U.S. to Ohio found between 6 and 22.5% had FPT, depending on the reference range used (plasma protein <5.5 g/dl or <6.0 g/dl, respectively); the authors suspected that the high prevalence of dehydration in this study may have "led to false positives for adequate passive transfer."[285]

FPT increases morbidity and mortality for at least the first 3 weeks of life, and potentially negatively impacts calf health for up to ten weeks.[286] During the first few weeks of life, calves with FPT are extremely susceptible to all manner of infectious disease. [287]

Under current conditions, dairy farms that transport calves who are only days old typically have little financial incentive to invest in optimizing their colostrum management, a factor often cited as a reason why FPT continues to have a high prevalence among surplus calves.[288] Requiring compliance with the suggested fitness to travel standards would require that neonatal calves remain on or near their farm of origin until their navels are fully healed and would require they be healthy prior to transport. This would create a financial incentive for improving colostrum management and other aspects of neonatal calf care.

2. Impact of Transport Stressors on Immune Function

Stress impacts the immune systems of neonatal calves just as it does in older animals.[289] (See section V.C. above).

Early research suggesting that the cortisol levels of calves under 4 weeks old rise much less than older calves in response to stressors, (potentially due to immaturity of the HPA axis).[290] However,

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[283] STULL, C.L. & MCMARTIN, D.A. WELFARE PARAMETERS IN VEAL CALF PRODUCTION FACILITIES. SPECIAL REPORT TO THE CALIFORNIA LEGISLATURE (1992 University of California Davis); Stull, C. L., & McDonough, S. P. (1994) Multidisciplinary approach to evaluating welfare of veal calves in commercial facilities. *J. of Animal Sci*., 72(9):2518–2524. https://doi.org/10.2527/1994.7292518x
[284] Wilson et al. (2000), *supra* note 91.
[285] Pempek et al. (2017), *supra* note 81.
[286] Winder, et al. (2016), *supra* note 80; Roadknight et al. (2021a), *supra* note 45.
[287] Winder, et al. (2016), *supra* note 80; Roadknight et al. (2021a), *supra* note 45; Wilson et al. (2000), *supra* note 91; Windeyer et al. (2014), *supra* note 281.
[288] Wilson, D. J. et al. (2023) A survey of male and female dairy calf care practices and opportunities for change. *J. of Dairy Sci.*, 106(1):703–717. https://doi.org/10.3168/jds.2022-22238
[289] Goetz, H. M. et al (2022) Characterizing the literature surrounding transportation of young dairy calves: A scoping review. *J. of Dairy Sci.*, *105*(2): 1555–1572. https://doi.org/10.3168/jds.2021-21211
Cortese (2009), *supra* note 45.
[290] Knowles T. G. (1995) A review of post transport mortality among younger calves. *The Veterinary Record*, 137(16):406–407. https://doi.org/10.1136/vr.137.16.406

recent research has found that most calves arrive at veal production facilities with high cortisol levels and that these higher cortisol levels are associated with increased disease risk.[291]

Aside from cortisol-dependent mechanisms of immunosuppression, there are additional means by which immune function may be decreased by specific stressors. The following review of transport-associated stressors highlights the ways in which neonatal calves are potentially more vulnerable, such that similar transport conditions cause greater levels of transport stress in neonatal calves relative to older animals.

a. Transport Stressors

As mentioned above, transport of farmed animals in the U.S. typically involves withholding food and water for the duration of the journey and often for a period of time prior to departure. Stressors associated with transport include dehydration and thirst; negative energy balance, hypoglycemia, and hunger; thermal stress from exposure to extreme temperatures; handling stress (including the potential for physical injury); social stress from co-mingling with unfamiliar conspecifics; and exposure to vibration, noise, fumes, and unfamiliar environments.[292] Because no laws or regulations cover transport conditions, there are no requirements to mitigate or minimize these stressors (e.g. the provision of bedding, protection from extreme weather or maximum stocking density), even when these are recommended for vulnerable neonates by veterinary experts.

Transport stressors can also be experienced during loading, unloading, and during holding periods at auctions or collection centers. Neonatal calves are especially vulnerable to transport stressors due to their immaturity, lower levels of reserves from which to draw, and reduced ability to regulate their body temperature and control the osmolality of their blood. [293]

i) Dehydration

While in severe cases dehydration can lead to hypovolemic shock and death, even moderate degrees of dehydration not only cause severe thirst, lethargy, and weakness, but also increase disease susceptibility.[294] Prolonged dehydration causes an increase in blood levels of cortisol, which can result in immunosuppression, as described above.[295]

In addition, dehydration may decrease the removal of pathogens from the respiratory tract by mucocillary clearance—the primary defense mechanism of the lungs.[296] This is highly pertinent

[291] Masmeijer, C. et al. (2021) Arrival cortisol measurement in veal calves and its association with body weight, protein fractions, animal health and performance. *Preventive Veterinary Med.*, 187:105251. https://doi.org/10.1016/j.prevetmed.2020.105251
[292] Cusack (2023), *supra* note 45; Renaud & Pardon (2022), *supra* note 80.
[293] Wilson et al. (2020a), *supra* note 80; Hulbert & Moisá (2016), *supra* note 45.
[294] Roadknight et al. (2021a), *supra* note 45; Kells et al. (2020), *supra* note 280; Renaud et al. (2018b) Risk factors associated with mortality at a milk-fed veal calf facility: A prospective cohort study. *J. of Dairy Sci.*, 101(3):2659–2668. https://doi.org/10.3168/jds.2017-13581; Renaud et al. (2018a), *supra* note 279.
[295] Parker, A. J. et al. (2004) Excess cortisol interferes with a principal mechanism of resistance to dehydration in Bos indicus steers. *J. of Animal Sci.*, 82(4):1037–1045. https://doi.org/10.2527/2004.8241037x
[296] Bustamante-Marin, K. & Ostrowski, L. E. (2017) Cilia and Mucociliary Clearance. *Cold Spring Harbor Perspectives in Biology*, 9(4): a028241. https://doi.org/10.1101/cshperspect.a028241; Kalhoff H. (2003) Mild dehydration: a risk factor of broncho-pulmonary disorders?. *European J. of Clinical Nutrition*, 57(2):S81–S87. https://doi.org/10.1038/sj.ejcn.1601906

because, as discussed below, respiratory diseases like pneumonia are the primary reason calves are given antibiotics in the veal industry.[297]

Research in humans suggests that poor hydration increases the risk of mortality in cases of pneumonia, with a recent systematic review and meta-analysis concluding that "supporting hydration and reversing dehydration has the potential to have rapid positive impacts on pneumonia outcomes."[298] Similarly, bovine respiratory disease (BRD), which often involves pneumonia (as discussed in more detail in section VII.C.3 below) has been found to develop more often in cattle who become dehydrated during transport,[299] though researchers have found it difficult to isolate the impact of dehydration from the many other physiologic impacts of long-distance transport that increase risk of BRD.[300] Recent research indicates that many calves have subclinical pneumonia (i.e., they are not yet showing obvious clinical signs but pneumonia can be detected with ultrasonographic examination of the lungs and other diagnostics) at the time of transport.[301]

In addition to its role in predisposing and worsening pneumonia, dehydration in young calves is more generally associated with an increased risk of post-transport morbidity, mortality, and carcass condemnation.[302] Dehydration is correlated with calves that arrive at feeding facilities in a depressed state, ranging from moderate signs of weakness to moribund recumbency.[303]

During transport, young calves are at increased risk of dehydration for multiple reasons, not least because they typically do not receive milk or water during the journey. Because their bodies are comprised of a higher percentage of water compared to adult cattle,[304] neonatal calves become dehydrated more quickly than older calves or adult cattle.[305] Younger calves (14 days old) are more likely to be dehydrated prior to embarking on transport than are older calves (28 days old).[306] Finally, common neonatal calf disease conditions, such as diarrhea or fever (discussed in section VII.C.2 below), increase water loss and hasten the development of dehydration.[307]

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[297] Wilson, D. J. et al. (2020b) Risk factors for poor health outcomes for male dairy calves undergoing transportation in western Canada. *The Canadian Veterinary J.* 61(12):1265–1272; Bustamante-Marin & Ostrowski (2017), supra note 296; Hooper, L. et al. (2022) Effects of fluid and drinking on pneumonia mortality in older adults: A systematic review and meta-analysis. *Clinical Nutrition ESPEN*, 47:96–105. https://doi.org/10.1016/j.clnesp.2021.11.021; Kalhoff (2003), *supra* note 296.

[298] Hooper (2022), *supra* note 297.

[299] Mormede et al. (1982), *supra* note 45; Taylor, J. D. et al. (2010) The epidemiology of bovine respiratory disease: What is the evidence for predisposing factors?. *The Canadian Veterinary J.*, 51(10):1095–1102.

[300] Cusack (2023), *supra* note 45.

[301] Jourquin, S. et al. (2023) Dynamics of subclinical pneumonia in male dairy calves in relation to antimicrobial therapy and production outcomes. *J. of Dairy Sci*., 106(1):676–689. https://doi.org/10.3168/jds.2022-22212

[302] Roadknight et al. (2021a), *supra* note 45; Renaud et al. (2018a), *supra* note 279; Scott, K. et al. (2019) Risk factors identified on arrival associated with morbidity and mortality at a grain-fed veal facility: A prospective, single-cohort study. *J. of Dairy Sci*., 102(10):9224–9235. https://doi.org/10.3168/jds.2019-16829; Boulton, A. C. et al. (2020) Risk factors for bobby calf mortality across the New Zealand dairy supply chain. *Preventive Veterinary Med.*, 174:104836. https://doi.org/10.1016/j.prevetmed.2019.104836; González et al. (2012a), *supra* note 82.

[303] Pempek et al. (2017), *supra* note 81.

[304] Kells et al. (2020), *supra* note 280; Johnson, I. R., et al. (2012) A generic model of growth, energy metabolism, and body composition for cattle and sheep. *J. of Animal Sci.*, *90*(13):4741–4751. https://doi.org/10.2527/jas.2011-5053

[305] Kells et al. (2020), *supra* note 280; Parker (2004), *supra* note 295; González et al. (2012b), *supra* note 129.

[306] Marcato et al. (2022a), *supra* note 276.

[307] Roadknight et al. (2021a), *supra* note 45; Kells et al. (2020), *supra* note 280.

Experimental research on healthy 4-day old dairy calves indicated that being deprived of food and water for 24 hours, even without being transported, led the calves to lose, on average, 8.4% of their total body water (a range of 5.6-11.9% body water loss).[308] Clinical signs of dehydration were apparently long before the 24-hour mark, and the authors noted that dehydration was likely to develop even more quickly in transported calves due to exposure to additional stressors and the potential for a lower baseline nutritional status.[309] Another study found that depriving 5-to-9-day-old calves of milk for 30 hours caused an average of 6% body weight loss, even when water was available for much of that time.[310]

Further studies have documented a range of prevalences of transport-associated dehydration in neonatal calves in North America. One found that 17% of neonatal bull calves arriving at veal growers in the eastern U.S. via auctions or buying stations were dehydrated.[311] While this study included calves arriving in the fall and winter, another study of calves arriving Ohio veal farms from the northeastern U.S. in the late spring and summer found (using a skin tent test) that an average of 35.1% of calves per load were clinically dehydrated; in some loads, up to 46.6% of calves were clinically dehydrated.[312] Another study in southwestern Ontario found that 50% of calves arriving at a veal calf producer's facility between November and the following September were dehydrated.[313] A study published in 2023 found that, on average, 68.6% of "bob veal" calves arriving at a slaughterhouse in Ohio were dehydrated.[314]

ii) Hunger, Decreased Blood Sugar, and Negative Energy Balance

When left with their mothers, calves will nurse up to 11 times per day.[315] As noted above, young calves are typically not fed during transport, while at auction, or while in lairage at slaughterhouses.[316] Any nutrition that *is* provided just before or during transport typically fails to meet the calf's nutritional requirements.[317] It is not uncommon for the farm of origin to withhold feeding on the day of transport.[318] Because of this, calves often experience hunger, decreased blood sugar, and negative energy balance.[319] Additionally, calves spend significantly more time standing during transport than they do in their home pens and the need to balance and adjust posture in a moving vehicle only increases energy demands. Besides negatively impacting animal welfare, these

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[308] Kells et al. (2020), *supra* note 280.
[309] *Id*.
[310] Fisher, A. D. et al. (2014) The effects of direct and indirect road transport consignment in combination with feed withdrawal in young dairy calves. *The J. of Dairy Res.*, 81(3):297–303. https://doi.org/10.1017/S0022029914000193
[311] Wilson et al. (2000), *supra* note 91.
[312] Pempek et al. (2017), *supra* note 81.
[313] Renaud et al. (2018a), *supra* note 279.
[314] England et al. (2023) Condition of bob veal calves on arrival at an abattoir in Ohio. *Animal Welfare*, 32:E7. https://doi.org/10.1017/awf.2022.8
[315] MICHAEL MARAHRENS & LARS SCHRADER, FEDERAL RESEARCH INSTITUTE FOR ANIMAL HEALTH ANIMAL WELFARE DURING TRANSPORT: TECHNICAL REQUIREMENTS FOR LONG-DISTANCE TRANSPORT OF UNWEANED CALVES (Mar. 2020) Available at: https://www.openagrar.de/servlets/MCRFileNodeServlet/openagrar_derivate_00030363/Empfehlung-Tierschutz-beim-Transport_2020-03-12_en.pdf
[316] Roadknight et al. (2021a), *supra* note 45.
[317] Wilson et al. (2020a), *supra* note 80.
[318] Wilson (2020b), *supra* note 297; Roadknight et al. (2021a), *supra* note 45.
[319] Goetz, H. M. et al. (2023a) A randomized controlled trial investigating the effect of transport duration and age at transport on surplus dairy calves: Part II. Impact on hematological variables. *J. of Dairy Sci.*, 106(4):2800–2818. https://doi.org/10.3168/jds.2022-22367

physiologic and psychological stressors can decrease immune function. Immune responses require energy to activate and maintain; the starvation of calves during transport and while in the marketing chain further depresses the immune system.[320]

Calves are particularly vulnerable to hypoglycemia (low blood sugar) for a number of reasons, including the immaturity of some of their metabolic pathways. While preterm calves in particular have severely decreased function of endogenous glucose production, even full-term neonatal calves have lower levels of endogenous glucose production for at least several days after birth.[321] Additionally, neonatal calves, particularly "surplus" calves, have very limited fat reserves and therefore often cannot convert adipose (fat) tissue into nonesterified fatty acids (NEFA) in order to cope with negative energy balance.[322] Male calves are often provided inferior nutrition compared to female calves, so they are frequently underweight or emaciated at the time of shipment.[323] One study of calves arriving at veal facilities in the northeastern U.S. described 21.4% of calves as either emaciated or having no discernable subcutaneous fat.[324] Another more recent study put the figure at 50.7% for calves arriving at growers in Canada.[325] A 2023 study on "bob veal" calves arriving at a slaughterhouse in Ohio found that 39.8% of calves were emaciated.[326] Lack of adipose tissue makes these calves less able to cope with prolonged food deprivation.[327]

A large body of research documents negative energy balance, as indicated by decreased blood glucose levels and/or increased serum levels of NEFA, in neonatal calves who are fasted and transported for prolonged periods, i.e., 12 hours or longer.[328] As far back as 1982, research on 4-to 32-day-old calves found that blood glucose dropped markedly on journeys lasting 11 hours and even more dramatically in calves transported 34 hours; in the latter group, the hypoglycemia persisted for at least a week.[329] Numerous subsequent studies over the past 40 years show a clear decline in blood glucose correlating with longer transport distances.[330] In 2023, two studies demonstrated the impact

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320 Carroll & Forsberg (2007), *supra* note 41.

321 Hammon, H. M. et al. (2012) Energy metabolism in the newborn farm animal with emphasis on the calf: endocrine changes and responses to milk-born and systemic hormones. *Domestic Animal Endocrinology*, 43(2):171–185. https://doi.org/10.1016/j.domaniend.2012.02.005; Steinhoff-Wagner et al. (2011) Maturation of endogenous glucose production in preterm and term calves. *J. of Dairy Sci.*, 94(10):5111–5123. https://doi.org/10.3168/jds.2011-4355

322 Bernardini, D. et al. (2012) The effects of different environmental conditions on thermoregulation and clinical and hematological variables in long-distance road-transported calves. *J. of Animal Sci.*, 90(4):1183–1191. https://doi.org/10.2527/jas.2011-4113; EFSA Welfare of cattle during transport, *supra* note 156.

323 Creutzinger et al. (2021), *supra* note 279; Renaud et al. (2018b), *supra* note 294; Wilson et al. (2000), *supra* note 91.

324 Wilson et al. (2000), *supra* note 91.

325 Renaud et al. (2018b), *supra* note 294.

326 England et al. (2023), *supra* note 314.

327 Renaud et al. (2018a), *supra* note 279; Roadknight et al. (2021a), *supra* note 45; Goetz, H. M. et al. (2023b) A randomized controlled trial investigating the effect of transport duration and age at transport on surplus dairy calves: Part II. Impact on hematological variables. *J. of Dairy Sci.*, 106(4):2800–2818. https://doi.org/10.3168/jds.2022-22367

328 EFSA Welfare of cattle during transport, *supra* note 156; Roadknight et al. (2021a), *supra* note 45.

329 Mormede et al. (1982), *supra* note 45.

330 *Id.*; Todd, S. E. et al. (2000) Effects of food withdrawal and transport on 5- to 10-day-old calves. *Res. in Veterinary Sci.*, 68(2):125–134. https://doi.org/10.1053/rvsc.1999.0345; Fisher et al. (2014), *supra* note 310; Roadknight, N. et al. (2021b) Blood parameters of young calves at abattoirs are related to distance transported and farm of origin. *J. of Dairy Sci.*, 104(8):9164–9172. https://doi.org/10.3168/jds.2020-19729; Goetz et al. (2023b), *supra* note 327; England et al. (2023), *supra* note 314.

of transport on blood sugar levels of calves. One carefully controlled study of 2-to-19-day old calves documented significantly lower blood sugar in surplus dairy calves transported 16 hours compared to those transported 6 hours. Another study evaluating "bob veal" calves (<3 weeks) arriving at a slaughterhouse in Ohio found that nearly 74% of calves were hypoglycemic when blood was collected within two hours of arrival.[331]

Further research on NEFA levels of transported calves also demonstrates negative energy balance with longer distances.[332] While most studies evaluating NEFA have been done in adult dairy cattle, available studies show that, as in older cattle, NEFA levels in calves increase when calves mobilize their fat reserves to cope with starvation and subsequent negative energy balance.[333] In one recent study involving calves 1 to 19 days old, NEFA levels increased in all groups, whether they were transported for 6, 12, or 16 hours. However, the calves transported for 12 or 16 hours had higher levels of NEFA and other markers of negative energy balance compared to calves transported only 6 hours.[334]

Experiencing hypoglycemia and negative energy balance can affect immune function and disease susceptibility by several mechanisms. Elevation of NEFA and other markers of negative energy balance "facilitates disease development and suppresses immune function."[335] Prolonged negative affective states associated with protracted food deprivation, like hunger and helplessness, may increase cortisol levels.[336] In addition, most immune cells rely predominantly on glucose as their source of intracellular energy,[337] so hypoglycemia may also decrease immune function independent of cortisol-mediated immunosuppression.

iii) Thermal Stress

Thermal stress—caused by exposure to extreme temperatures or drastically changing climatic conditions—is recognized as another component of transport stress.[338] Especially when transported long distances, calves may experience dramatic shifts in environmental conditions; one study found that, on long-haul journeys of cattle, most of which started in Canada and ended in the U.S., cattle could experience as much as an 82ºF (46ºC) difference in temperature on a single journey.[339] During hot weather, stops during the journey are particularly dangerous in vehicles without a mechanical ventilation system, because temperatures rise rapidly within stationary trailer compartments due to poor airflow.[340]

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331 England et al. (2023), *supra* note 314.
332 *NEFA*, ECLINPATH, CORNELL COLLEGE OF VETERINARY MEDICINE (n.d.) https://eclinpath.com/chemistry/energy-metabolism/non-esterified-fatty-acids/
333 Goetz et al. (2023b), *supra* note 327.
334 *Id.*
335 *Id.*
336 Masmeijer et al. (2021), *supra* note 291.
337 Jeon, J. H. et al. (2020) Current Understanding on the Metabolism of Neutrophils. *Immune Network*, 20(6):e46. https://doi.org/10.4110/in.2020.20.e46
338 Renaud & Pardon (2022), *supra* note 80.
339 González, L. A. et al. (2012c) Benchmarking study of industry practices during commercial long haul transport of cattle in Alberta, Canada. *J. of Animal Sci.*, 90(10):3606–3617. https://doi.org/10.2527/jas.2011-4770
340 Fisher, A. D. et al. (2005) The effects of stationary periods and external temperature and humidity on thermal stress conditions within sheep transport vehicles. *New Zealand Veterinary J.*, 53(1):6–9. https://doi.org/10.1080/00480169.2005.36461; Marti, S., et al. (2021). PSXVI-19 Posture behavior and truck

As it is for cull animals, neonatal calves' behavioral means of thermoregulation are largely thwarted by transport conditions. Dehydration and negative energy balance further inhibit physiologic adaptive responses like evaporative cooling or shivering to generate heat. Their small size makes young calves more susceptible to both heat stress and hypothermia, and this vulnerability is exacerbated by the immaturity of the body's thermoregulatory system and calves' limited bodily reserves.[341] Thus, young calves cannot tolerate the same range of temperatures as older calves or adult cattle. While some countries have regulations to protect young calves from thermal stress during transport (for example, New Zealand mandates calves be protected from drafts),[342] this is not the case in the U.S.

As mentioned above, neonatal calves typically have little fat tissue,[343] and some studies have documented that up to half of the calves shipped to veal facilities are emaciated or have no discernable subcutaneous fat, increasing their susceptibility to hypothermia when shipped in cold weather.[344] Iron deficiency anemia, another common finding among calves arriving at veal farms,[345] can also impair thermoregulation and predispose animals to hypothermia.[346]

Exposure to harsh weather conditions, particularly cold temperatures, precipitation, and wind, has been shown to increase susceptibility to neonatal calf diarrhea, and both hypothermia and hyperthermia lead to immune system impairment.[347]

iv) Handling Stress and Social Stress

Handling stress is also well accepted to have the potential to suppress immunity to disease.[348] Young calves lack the natural herding behavior seen in older calves and adult cattle, making them more difficult to move.[349] Research found that it took 38% longer to move 3-day-old calves than 9-to-11-day-old calves, and that the handler had to intervene nearly twice as much to navigate the same obstacles.[350] As calves mature, they become stronger, better coordinated, and more responsive to environmental stimuli, making them easier to move.

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microclimate in a very long journey of unweaned dairy beef calves: A field study. *J. of Animal Sci.*, 99(S3):222–222. https://doi.org/10.1093/jas/skab235.404

341 Roccaro, M. et al. (2022) Navel Healing and Calf Fitness for Transport. *Animals,* 12(3):358. https://doi.org/10.3390/ani12030358; EFSA Welfare of cattle during transport, *supra* note 156; Wilson et al. (2020a), *supra* note 80; Knowles (1995), *supra* note 290.

342 Fisher et al. (2014), *supra* note 310.

343 Bernardini et al. (2012), *supra* note 322; EFSA Welfare of cattle during transport, *supra* note 156.

344 Wilson et al. (2000), *supra* note 91; Renaud et al. (2018b), *supra* note 294; Wilson (2020b), *supra* note 297; Prodanović, R. et al. (2019) Occurrence of neonatal diarrhea in calves with iron-deficiency anemia. *Veterinarski Glasnik (Pol.)*, 73(1):1–9. https://doi.org/10.2298/VETGL181210011P

345 Wilson et al. (2000), *supra* note 91; Stull & McDonough (1994), *supra* note 283; Prodanović et al. (2019), *supra* note 344.

346 Rosenzweig, P. H., & Volpe, S. L. (1999) Iron, thermoregulation, and metabolic rate. *Critical Reviews in Food Sci. and Nutrition*, 39(2):131–148. https://doi.org/10.1080/10408399908500491

347 Cho, Y. I., & Yoon, K. J. (2014) An overview of calf diarrhea - infectious etiology, diagnosis, and intervention. *J. of Veterinary Sci*., 15(1):1–17. https://doi.org/10.4142/jvs.2014.15.1.1

348 Wilson et al. (2020a), *supra* note 80; Renaud & Pardon (2022), *supra* note 80.

349 Roadknight et al. (2021a), *supra* note 45; Jongman, E. C., & Butler, K. L. (2014) The Effect of Age, Stocking Density and Flooring during Transport on Welfare of Young Dairy Calves in Australia. *Animals*, 4(2):184–199. https://doi.org/10.3390/ani4020184; EFSA Welfare of cattle during transport, *supra* note 156.

350 Jongman, E. C., & Butler, K. L. (2013) Ease of moving young calves at different ages. *Australian Veterinary J.*, 91(3):94–98. https://doi.org/10.1111/avj.12014

The increased difficulty associated with moving very young calves increases the risk of poor handling and injury (e.g., trauma from slips and fall), discomfort, and pain during handling.[351] Painful injuries can continue to be a source of stress even after arrival at the destination. Handling stress may be compounded by the fact that 1) calves are often experiencing processes like weighing and loading for the first time, and 2) calves may have recently undergone painful procedures, such as castration and disbudding, leaving them with open wounds.[352]

The impact on pathogen exposure risk by mixing young calves with unfamiliar conspecifics is discussed below. However, it is also recognized that such comingling leads to social stress, which itself may impact immune function and increase pathogen shedding.[353] During the marketing process, calves who have previously been kept in isolation may experience social mixing multiple times, including when first loaded on the transport truck, when off-loaded into pens at an auction or buying station, and when eventually transported to their destination.[354]

v) Fatigue

During the "hider" phase of their lives, young calves normally spend up to 80% of their day lying down and sleeping, particularly during the first week of life.[355] However, laying time is usually significantly reduced during transport.[356] High stocking densities on transport trucks or trailers, especially without sufficient bedding, can make it difficult to lie down and to rise, and can increase the risk of trampling.[357] Fatigue resulting from prolonged periods of standing, lack of sufficient bedding material to permit adequate rest, and the need to brace against truck movements is thus an additional stressor—one frequently exacerbated by the stressors described above, such as prolonged hunger, dehydration, thermal stress, etc.[358]

Longer journeys (16 hours) have been documented to result in "more fatigue during and after the journey," as evidenced by increased lying behavior the day after the journey, compared to shorter journeys (6 hours).[359] In addition, fatigue also appeared to be worse in younger calves (2 to 5 days) compared to older calves (14-19 days). Research has found that due to "intense musculoskeletal activity" during long transport, metabolic acidosis occurs in neonatal calves transported 12 hours or longer; such an imbalance can contribute to the weakness and lethargy often noted on arrival.[360] Numerous studies have noted increases in biochemical measurements of analytes of muscular origin

[351] Roadknight et al. (2021a), *supra* note 45; EFSA Welfare of cattle during transport, *supra* note 156.
[352] Roccaro et al. (2022), *supra* note 341.
[353] Roadknight et al. (2021a), *supra* note 45; Renaud & Pardon (2022), *supra* note 80.
[354] Roadknight et al. (2021a), *supra* note 45.
[355] Jongman & Butler (2013), *supra* note 350.
[356] Marcato, F. et al. (2020a) Transport of Young Veal Calves: Effects of Pre-transport Diet, Transport Duration and Type of Vehicle on Health, Behavior, Use of Medicines, and Slaughter Characteristics. *Frontiers in Veterinary Sci*., 7:576469. https://doi.org/10.3389/fvets.2020.576469; Fisher et al. (2014), *supra* note 310.
[357] Jongman & Butler (2014), *supra* note 349.
[358] Maggard (2022), *supra* note 81.
[359] Bajus, A. et al. (2023) Effects of transportation duration on lying behavior in young surplus dairy calves. *J. of Dairy Sci.*, 106(11):7932–7941. https://doi.org/10.3168/jds.2023-23229
[360] Goetz et al. (2023b), *supra* note 327.

(e.g., creatine kinase) that indicate fatigue and exhaustion, particularly when calves undergo longer journeys, are prevented from lying, and are not provided milk shortly before departure.[361]

vi) Other Stressors

Finally, transport causes physical and psychological stress via additional mechanisms. These include exposure to dust and engine fumes (which can cause respiratory and/or ocular irritation) and to noise, vibrations, and the motion of the transport vehicle (which can induce fear and anxiety).[362]

3. Impact of Stressors on Disease Risk

The cumulative effect of transported-associated stressors is widely recognized as increasing the risk of disease in neonatal calves, and in fact, increased disease incidence is frequently observed in transported neonatal calves.[363] A recent study measured the cortisol levels of male dairy calves upon arrival at a commercial veal farm and found that higher levels were associated with development of a chronic, unresponsive pneumonia and increased risk of lung consolidation, even weeks after arriving at the facility.[364] Transport stress can also result in increased pathogen shedding, thus increasing disease risk for other calves in the environment, both during and after transport.[365] Compared to neonatal replacement heifers, who are less likely to be transported long distances under 2 weeks old, veal calves require substantially more disease treatment—particularly antimicrobials—to maintain similar mortality rates and reportedly have poorer health outcomes generally.[366] A recent study on "bob veal" calves arriving at an Ohio slaughterhouse found that over 95% of calves had at least one poor health outcome (e.g., fever, signs of disease, fractures, dehydration, emaciation, evidence of FPT) and over 82% had two or more poor health outcomes.[367]

B. Transport Increases Exposure to Pathogens

In North America, neonatal calves have relatively high levels of morbidity, both clinical and subclinical, prior to being transported. In the absence of fitness for transport requirements, transporting calves often involves mixing (for prolonged periods) previously healthy calves with those shedding pathogens, often under stressful and crowded conditions. This sets the stage for weeks of illness upon arrival at the calf-rearing facility.

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[361] Marcato, F. et al. (2020b) Effects of pretransport diet, transport duration, and type of vehicle on physiological status of young veal calves. *J. of Dairy Sci*., 103(4):3505–3520. https://doi.org/10.3168/jds.2019-17445; Mormede et al. (1982), *supra* note 45; Goetz et al. (2023b), *supra* note 327.
[362] Wilson et al. (2000), *supra* note 91; Roadknight et al. (2021a), *supra* note 45.
[363] Renaud & Pardon (2022), *supra* note 80; Pempek et al. (2017), *supra* note 81; Trunkfield, H.R. & Broom, D. M. (1990) The welfare of calves during handling and transport. *Applied Animal Behavioral Sci*., 28(1):135–152. https://doi.org/10.1016/0168-1591(90)90050-N
[364] Masmeijer et al. (2021), *supra* note 291.
[365] Muñoz-Vargas, L. et al. (2022) The Impact of Overstocking and Negative Energy Balance on Quantitative Measurement of Non-typhoidal Salmonella in Periparturient Dairy Cattle. *Frontiers in Veterinary Sci.*, 9:779900. https://doi.org/10.3389/fvets.2022.779900; Roadknight et al. (2021a), *supra* note 45.
[366] Renaud & Pardon (2022), *supra* note 80; Wilson et al. (2020b), *supra* note 297.
[367] England et al. (2023), *supra* note 314.

1. Pre-Transport Morbidity Rates

Neonatal calves are generally prone to illness and most likely to become ill within the first two weeks of life.[368] One study found that 21.2% of non-transported dairy replacement heifer calves from 19 herds in Ontario and Minnesota were treated for neonatal calf diarrhea and almost 8% were treated for bovine respiratory disease.[369] There is significant variability in calf condition between farms, and it is generally agreed that this is likely due to some dairy production facilities providing less attentive care, or even neglecting, calves of low economic value.[370] Regardless of intended use, there is a high level of pre-existing morbidity in neonatal dairy calves, even prior to transport.[371]

Research documents that the clinical signs of illness are often present at the start of transport journeys. While much of this research has been undertaken in Canada, many neonatal calves are shipped from Canada to the U.S. each year, and the numbers are increasing. Between October 2021 and October 2022, at least 23,000 calves (all under 15 days of age) were imported from Canada according to import records from 3 northeastern ports. In a recent report on neonatal calf transport, a group of Canadian experts on dairy and veal farms, veterinary medicine, and other relevant areas describe that they regularly observe male dairy calves who are weak and dull at the time of transport.[372] Research evaluating calf health in western Canada immediately prior to shipping found that, just prior to transport at a median age of 5 days, 37% of calves had a least one health abnormality, with 17% of calves presenting with diarrhea, 8% with navel disease, and 4% with fever.[373] In all of these cases, the etiology may be one that is easily transmissible under typical transport conditions.

2. Transport Conditions are Ideal for Disease Transmission and Amplification

The physical environment within the truck or trailer is a significant contributor to increased disease risk of neonatal calves. During transport, lack of bedding and overcrowding are believed to increase the risk of calves developing navel infections.[374] As mentioned above, neonatal calves typically spend most of their time lying down; thus, bedding management is recognized in veterinary texts as "extremely important in minimizing the fecal–oral transmission of pathogenic organisms that cause diarrhea."[375] In addition to providing basic comfort to allow sufficient rest to mitigate fatigue, bedding depths serves to distance calves from pathogens shed in feces.[376] Bedding must also be changed often enough that it remains clean and dry.[377] However, bedding is not required for any transport within the U.S., and veal industry best practices refer to bedding as being necessary only "to protect animals from weather extremes" and do not include bedding during transport on their

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[368] Dachrodt, L., et al. (2021) Prevalence of disorders in preweaned dairy calves from 731 dairies in Germany: A cross-sectional study. *J. of Dairy Sci.*, 104(8):9037–9051. https://doi.org/10.3168/jds.2021-20283
[369] Windeyer et al. (2014), *supra* note 281.
[370] Roccaro et al. (2022), *supra* note 341; Wilson (2020b), *supra* note 297; Wilson et al. (2020a), *supra* note 80; Jourquin et al. (2023), *supra* note 301.
[371] Roadknight et al. (2021a), *supra* note 45.
[372] Wilson et al. (2020a), *supra* note 80.
[373] Wilson et al. (2020b), *supra* note 297.
[374] Pempek et al. (2017), *supra* note 81.
[375] Sheila McGuirk (2011) *Management of Dairy Calves from Birth to Weaning*, in DAIRY PRODUCTION MEDICINE 175-93 (Risco & Melendez Retamal eds. 2011) https://doi.org/10.1002/9780470960554.ch15
[376] *Id.*
[377] Katrine Bazeley, *The Farm Audit: Health and Management of the Calf*, *in* BOVINE MEDICINE 360-372 (3rd ed. 2015).

accompanying certification assessment.[378] Even if bedding is provided during transport, it is unlikely to remain hygienic during the course of prolonged journeys, particularly given the high incidence of diarrhea. As discussed further below, common post-transport health conditions, such as omphalitis (navel infection) and diarrhea, may be caused by or exacerbated by unhygienic conditions during transport.

As currently practiced in the U.S. and Canada, transport of neonatal calves increases the risk of infectious disease by drastically increasing exposure of calves to pathogens to which they have no immunity.[379] Because neonatal calves rely on colostral antibodies for disease resistance, they are typically protected only against diseases to which their mothers (or donor cow(s), if colostrum is obtained from another cow) have been exposed via infection or vaccination.[380] APHIS notes that commingling calves from different operations increases disease risk.[381] Mixing calves from different operations commonly occurs at auctions, collection centers, and buying stations, but may also occur when calf drovers pick up calves from multiple different farms and transport them to a single calf grower.[382] Calves from different backgrounds are typically carrying and shedding a wide range of pathogens. As one veterinary journal article put it, when calves from a multitude of different herds are mingled, there is "an almost 100% chance of bringing every infectious disease possible into the veal or dairy beef farm."[383] During transport, calves are in very close contact in trailers, trucks, or holding pens with conspecifics whose high stress levels may result in increased shedding of pathogens.[384]

Research studies confirm that there is a high incidence of neonatal calf disease at commercial auctions. At an auction in British Columbia, researchers found that, of the 355 neonatal calves assessed, 20% had at least one health abnormality, with evidence of infectious disease (navel disease, discharge from nose and eyes), being the most common.[385] Similarly, at five auctions in Quebec primarily selling dairy calves, only 57.4% of the 3,820 calves examined by a veterinarian had "no abnormal clinical features." Omphalitis (inflamed/infected navel) was the most common finding (20.3% of calves) and 7.7% of the calves had "the general appearance of an unhealthy animal."[386]

C. Common Transport-Associated Health Problems

Given the impact that transport, especially long journeys, has on the immune function and disease risk of neonatal calves, it is not surprising that health problems are very common during the period immediately after transport.[387] Early research found that neonatal calves suffered very high rates (64-

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[378] VEAL QUALITY ASSURANCE CERTIFICATION RESOURCE MANUAL. BEEF CHECKOFF (2018). Available at: https://www.veal.org/wp-content/uploads/2020/11/VQA_Manual_2018_FINAL.pdf
[379] Bazeley (2015), *supra* note 377.
[380] Marcato et al. (2020b), *supra* note 361.
[381] NATIONAL AGRICULTURAL STATISTICS SERVICE, USDA, NO. 550.0110, DAIRY 2007: HEIFER CALF HEALTH AND MANAGEMENT PRACTICES ON U.S. DAIRY OPERATIONS, 2007 118-121 (Jan. 2010) https://www.aphis.usda.gov/animal_health/nahms/dairy/downloads/dairy07/Dairy07_ir_CalfHealth_1.pdf
[382] Wilson et al. (2020a), *supra* note 80; Roadknight et al. (2021a), *supra* note 45.
[383] Renaud & Pardon (2022), *supra* note 80.
[384] Roadknight et al. (2021a), *supra* note 45.; Peter Cockcroft, *Bovine Respiratory Disease (BRD)*, *in* BOVINE MEDICINE 525-530 (3rd ed. 2015).
[385] Wilson, D. J. et al. (2020c) Short communication: Condition of male dairy calves at auction markets. *J. of Dairy Sci*., 103(9):8530–8534. https://doi.org/10.3168/jds.2019-17860
[386] Marquou, S. et al. (2019) Health parameters and their association with price in young calves sold at auction for veal operations in Québec, Canada. *J. of Dairy Sci*., 102(7):6454–6465. https://doi.org/10.3168/jds.2018-16051
[387] Roadknight et al. (2021a), *supra* note 45.

90%) of post-transport morbidity during the 4 weeks after they arrived at the destination farm, with younger age and longer journeys being associated with greater rates of illness.[388] More recent research suggests some improvement in these astronomical morbidity rates, but they are still far higher than for older cattle.[389] In a study of veal calves in Canada who were slaughtered at 16 to 20 weeks of age, 85% of the medical treatments were administered within the first 7 weeks after arrival at the farm.[390] Infectious diseases predominate and it is common for calves undergoing transport to arrive on farm or at the slaughterhouse with pyrexia (fever).[391]

Clinical health problems noted soon after transport are associated with early mortality and increased antibiotic use,[392] issues that will be discussed further below. This section provides a review of the most common transport-associated calf diseases: omphalitis, gastrointestinal disease, and respiratory disease. These are also the most common reasons for antibiotic use in preweaned calves and the most common causes of post-transport mortality.[393]

1. Omphalitis

Because the umbilicus, or navel, of newborn mammals is essentially an open wound, neonatal calves are at risk for infections at this site. The umbilical cord is comprised of two arteries, a vein, and the urachus (remnant of the canal that drains the fetus's urinary bladder), with both extra-abdominal and intra-abdominal components.[394] Researchers have identified five distinct stages of navel healing, beginning with a red or pink hydrated flexible stalk and completing with formation of a fully epithelialized scar at the site of detachment.[395] Most calves require 15 to 40 days after birth for the extra-abdominal portion, the umbilical stalk, to completely dry and slough (fall off).[396] Until the final stage, and especially prior to being fully dry, the umbilicus is a portal of entry to the outside environment, allowing pathogens to enter, colonize the surrounding tissues, and cause disease.[397] The umbilicus is most vulnerable to infection immediately after birth, so ensuring sanitation in maternity pens can help reduce omphalitis risk. However, research has found that even calves with a dry and shriveled stalk (stage 3 of navel healing, as typically occurs within the first 2 to 3 weeks of life) can

388 Mormede et al. (1982), *supra* note 45; Staples, G.E. & Haugse, C. N. (1974) Losses in Young Calves after Transportation. *British Veterinary J.*, 130(4):374–379. https://doi.org/10.1016/S0007-1935(17)35841-4
389 Wilson et al. (2020b), *supra* note 297.
390 Wilson et al. (2000), *supra* note 91.
391 Wilson et al. (2020b), *supra* note 297; Roadknight et al. (2021a), *supra* note 45; Maggard (2022), *supra* note 81; England et al. (2023), *supra* note 314.
392 Marquou et al. (2019), *supra* note 386; Vinayamohan, P. G. et al. (2022) Antimicrobial Use and Resistance in Surplus Dairy Calf Production Systems. *Microorganisms*, 10(8):1652. https://doi.org/10.3390/microorganisms10081652
393 Salaheen, S. et al. (2021) Metagenomic Analysis of the Microbial Communities and Resistomes of Veal Calf Feces. *Frontiers in Microbiology*, 11:609950. https://doi.org/10.3389/fmicb.2020.609950
394 Wieland, M. et al. (2017) The influence of 3 different navel dips on calf health, growth performance, and umbilical infection assessed by clinical and ultrasonographic examination. *J. of Dairy Sci.*, 100(1):513–524. https://doi.org/10.3168/jds.2016-11654; Van Camp, M. B. et al. (2022) Describing and Characterizing the Literature Regarding Umbilical Health in Intensively Raised Cattle: A c Review. *Veterinary Sci.*, 9(6):288. https://doi.org/10.3390/vetsci9060288;
395 Roccaro et al. (2022), *supra* note 341.
396 Roccaro et al. (2022), *supra* note 341.
397 *Id.*; Van Camp et al. (2022), *supra* note 394.

develop navel infections and inflammation, so having a "dry" navel alone cannot be relied upon for eliminating the risk of developing omphalitis.[398]

Omphalitis is the term used to describe inflammation of the umbilical cord and potentially surrounding tissues.[399] Early signs include localized swelling, discharge, and pain.[400] As omphalitis progresses, lesions can progress to involve the umbilical vessels, bacteremia (bacteria spread through the blood stream) occurs, and lesions can be found in the liver, kidneys, lungs, joints, and other organs.[401] Calves with navel disease are at increased risk of sepsis and death, and navel infections are a common cause of both preslaughter mortality and carcass condemnation.[402]

Transporting neonatal calves increases their risk of developing omphalitis—both because of the immunosuppressive effects of transport stress and because a calf's open umbilical wound is likely to spend considerable time in contact with bacteria-laden feces during transport. Unlike older calves and adult cattle who typically stand during transport by road, neonatal calves are likely to spend a significant portion of the trip lying down. Research has found neonatal calves spend between 22 and 80% of the time lying down during long journeys—the time varies depending on the calf's age, the duration of the journey, the loading density and availability of bedding, and other factors.[403] Younger calves (3-days old), whose umbilical cords are also more vulnerable to infection, were found to spend more time lying down during a 12-hour journey than 5- or 10-day-old calves.[404]

Numerous studies have found that a proportion of calves already have omphalitis prior to transport, and numbers appear to increase as they travel through the marketing channel. A 2008 study found that 5 to 15% of replacement heifer calves on dairy farms, i.e. calves less likely to be transported long distances during the neonatal period, develop omphalitis.[405] A more recent study found that 8% of male calves have navel disease prior to leaving the farm of origin.[406] By the time surplus calves arrive at auction, research indicates that 12 to 20% of them exhibit signs of navel disease.[407] After arrival at the grower, several studies have found that 20 to 32% exhibit signs of significant omphalitis, e.g., palpable swelling and serous, purulent, and/or malodorous exudate.[408] In some of

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398 Marquou et al. (2019), *supra* note 386.; Roccaro et al. (2022), *supra* note 341.
399 Van Camp et al. (2022), *supra* note 394.
400 Marquou et al. (2019), *supra* note 386.
401 Wilson et al. (2000), *supra* note 91; Biss, M. E et al. (1994) Evaluation of the risk of potential bacteraemia in carcasses from very young slaughter calves with localized navel ill. *The British Veterinary J.*, 150(4):377–384. https://doi.org/10.1016/s0007-1935(05)80154-x; Wieland et al. (2017), *supra* note 394.
402 Bazeley (2015), *supra* note 377; Roccaro et al. (2022), *supra* note 341; Thomas, G. W., & Jordaan, P. (2013) Pre-slaughter mortality and post-slaughter wastage in bobby veal calves at a slaughter premises in New Zealand. *New Zealand Veterinary J.*, 61(3):127–132. https://doi.org/10.1080/00480169.2012.734374; Donovan, G. A. et al. (1998) Associations between passive immunity and morbidity and mortality in dairy heifers in Florida, USA. *Preventive Veterinary Med.*, 34(1):31–46. https://doi.org/10.1016/s0167-5877(97)00060-3; Mee, J.F. (2008) Newborn Dairy Calf Management. *The Veterinary Clinics of N. America:Food Animal Practice*, 24(1):1–17. https://doi.org/10.1016/j.cvfa.2007.10.002.
403 Marcato et al. (2020a), *supra* note 356.
404 Buczinski, S. et al. (2020) Validation of serum gamma-glutamyl transferase activity and body weight information for identifying dairy calves that are too young to be transported to auction markets in Canada. *J. of Dairy Sci*., 103(3): 2567–2577. https://doi.org/10.3168/jds.2019-17601; Jongman & Butler (2014), *supra* note 349.
405 Mee (2008), *supra* note 402.
406 Wilson et al. (2020b), *supra* note 297.
407 Wilson et al. (2020c), *supra* note 385; Marquou et al. (2019), *supra* note 386.
408 Scott (2019), *supra* note 286; Pempek et al. (2017), *supra* note 81; Wilson et al. (2000), *supra* note 91; Renaud et al. (2018a), *supra* note 279; Renaud et al. (2018b), *supra* note 294.

these studies, many calves without overt omphalitis still had enlarged, swollen, or otherwise abnormal navels, such that only between 9 and 35% were assessed as having a completely normal umbilicus upon arrival to the grower. [409] A recent study on bob veal calves less than 3 weeks old found that over 25% of them had signs of significant navel inflammation (either moderate enlargement with pain or moisture, or severe enlargement with heat, pain, or malodorous discharge) upon arriving at a slaughterhouse.[410] A recent randomized controlled trial conducted in North America, found that older calves (12 to 19 days of age) had significantly lower odds of developing omphalitis in the 14 days following transport compared to 2-to-6-day-old calves.[411]

All these figures were derived from studies carried out in the U.S. and Canada, where calves as young as one day of age may be transported. Research from Swiss farms, in which calves were at least three weeks of age when transported, found a lower risk of omphalitis at the time of arrival on the veal farm, with 15.5% of calves arriving with any type of navel pathology, including umbilical hernias, inflammation, and infection.[412] Similarly, a recent study from the Netherlands found omphalitis risk decreased as age at transport increased: when calves were assessed two weeks after arrival at a veal farm, navel inflammation was found in 15.1% of calves transported at 14 days of age, compared to 10.1% of calves transported at 28 days of age.[413]

Calves diagnosed with navel inflammation around the time of transport are at increased risk of dying in their first 3 weeks (or later, according to some studies) at the grower.[414] Omphalitis often causes death via peritonitis (inflammation and infection of abdominal cavity) and sepsis.[415] In addition, in calves transported to veal facilities during their first week of life, the pain associated with navel inflammation has been found to reduce the time spent lying down for at least 2 weeks after transport, likely interfering with their recovery from transport-associated stress, omphalitis, and other concurrent diseases.[416] Research in Canada has found that calves with navel disease are more likely to experience negative health outcomes and be treated for other diseases, such as diarrhea, within the first two weeks after arriving at the grower. [417]

Implementing selected WOAH fitness to travel criteria, as recommended in this petition, would help to address this issue, as they bar transport of sick animals, such as those with omphalitis, as well as calves with an unhealed navel.[418] Delaying transport of calves until at least four weeks of age, or using an easily observable proxy for age, such as a completely healed umbilical wound, would ensure calves are not at risk for developing omphalitis during transport. Complete navel healing, defined as scarring of the umbilical wound, as a requirement for transporting calves has been recommended as a

[409] Wilson et al. (2000), *supra* note 91; Renaud et al. (2018b), *supra* note 294; Pempek et al. (2017), *supra* note 81.
[410] England et al. (2023), *supra* note 314.
[411] Goetz et al. (2023a), *supra* note 319.
[412] Bähler, C. et al. (2012) Risk factors for death and unwanted early slaughter in Swiss veal calves kept at a specific animal welfare standard. *Res. in Veterinary Sci.*, 92(1):162–168. https://doi.org/10.1016/j.rvsc.2010.10.009
[413] Marcato et al. (2022a), *supra* note 276.
[414] Renaud et al. (2018a), *supra* note 279; Renaud et al. (2018b), *supra* note 294.
[415] Thomas & Jordaan (2013), *supra* note 402.
[416] Studds, M. J. et al. (2018) Short communication: The effect of diarrhea and navel inflammation on the lying behavior of veal calves. *J. Dairy Sci.*, 101(12), 11251–11255. https://doi.org/10.3168/jds.2018-15003; Roccaro et al. (2022), *supra* note 341.
[417] Wilson et al. (2020b), *supra* note 297.
[418] World Organization for Animal Health [WOAH], *Terrestrial Animal Health Code, Chapter 7.3, Transport of Animals by Land* (2011).

best practice by researchers in the field and by the European Food Safety Authority,[419] and is required by EU regulations.[420]

2. Gastrointestinal Disease

Long distance transport contributes to gastrointestinal health conditions in neonatal calves including neonatal calf diarrhea and reticuloruminal milk accumulation.[421] In young calves, the gastrointestinal tract is still developing.[422] Immediately after birth until approximately 2 to 3 weeks of age, the digestive system of the calf functions as that of a non-ruminant, or simple-stomached animal.[423] During this pre-ruminant phase, the rumen is still growing and developing, and secretion of enzymes required for digesting certain nutrients is limited. [424] Calves have a physiological and behavioral need to feed via suckling to ensure that milk (or milk replacer) passes from the esophagus into the abomasum without entering the underdeveloped reticulorumen.[425] Following ingestion of milk, calves require at least three hours of rest to help ensure proper digestion.[426] It is not until approximately 30 days of age that the rumen and its resident bacteria and protozoa are functional for the digestion of nutrients. [427]

Neonatal diarrhea (also called "scours") is a common health problem of calves in general, especially those who have FPT. However, it can also be caused or worsened by transport, particularly when calves are very young and/or when journeys are prolonged.[428] Transport stress increases the risk of diarrhea in part due to stress-related immunosuppression.[429]

Diarrhea in calves often has an infectious cause, including common pathogens like rotavirus, bovine coronavirus, cryptosporidia, coccidia, salmonellae, and colibacillosis.[430] While calves can be asymptomatically infected with some of these agents, stress-related immunosuppression and/or coinfection with another pathogen may allow pathogens to overwhelm the body's defenses and lead to the development of diarrhea, and sequelae such as dehydration.[431] As noted above, mixing with

[419] Roccaro et al. (2022), *supra* note 341; EFSA Welfare of cattle during transport, *supra* note 156.
[420] Annex 1, EU Council Regulation (EC) No 1/2005, *supra* note 36 (defining as unfit for transport "new-born mammals in which the navel has not completely healed").
[421] Ingrid Lorenz, *Reticuloruminal Milk Accumulation ("Ruminal Drinking") in Calves*, MSD VETERINARY MANUAL (Merck, 2022). Available at: https://www.msdvetmanual.com/digestive-system/diseases-of-the-ruminant-forestomach/reticuloruminal-milk-accumulation-ruminal-drinking-in-calves; Goetz et al. (2023a), *supra* note 319.
[422] EFSA Welfare of cattle during transport, *supra* note 156.
[423] Drackley J. K. (2008) Calf nutrition from birth to breeding. *The Veterinary Clinics of N. America. Food Animal Prac.*, 24(1):55–86. https://doi.org/10.1016/j.cvfa.2008.01.001
[424] *Id.*; EFSA Welfare of cattle during transport, *supra* note 156; Longenbach, J.I. & Heinrichs, A. (1998) A review of the importance and physiological role of curd formation in the abomasum of young calves. *Animal Feed Sci. and Tech.*, 73(1):85–97. https://doi.org/10.1016/S0377-8401(98)00130-8
[425] Wise, G. H. et al. (1984) Relationship of milk intake by sucking and by drinking to reticular-groove reactions and ingestion behavior in calves. *J. of Dairy Sci.*, 67(9):1983–1992. https://doi.org/10.3168/jds.S0022-0302(84)81533-7; EFSA Welfare of cattle during transport, *supra* note 153; Drackley (2008), *supra* note 406.
[426] EFSA Welfare of cattle during transport, *supra* note 156.
[427] *Id*.
[428] Goetz et al. (2023a), *supra* note 319.
[429] *Id*.
[430] Bazeley (2015), *supra* note 377; Phil Scott, *Beef Suckler Cow Diseases: Monitoring and Surveillance*, *in* BOVINE MEDICINE 489-492 (3rd ed., 2015).
[431] Lorenz (2022), *supra* note 421.

other calves during transport exposes calves to a larger number and variety of pathogens than they would have otherwise encountered, especially as stress may be causing increased pathogen shedding.

As many of these pathogens are zoonotic, transport of neonatal calves also has potential public health impacts.[432] For example, in 2018, APHIS Veterinary Services (VS) published an information sheet about an outbreak of multidrug resistant *Salmonella* Heidelberg, "a bacterium that can cause severe illness in calves and humans," including diarrhea and death.[433] According to research published about this outbreak, at least 68 people were sickened and over a third were hospitalized; most of the *S.* Heidelberg isolates were resistant to 5 or more classes of antibiotics.[434] Long distance transport of young calves, many of whom passed through a single livestock market in Wisconsin, disseminated this zoonotic pathogen to at least 17 states, as far away as Texas. In its information sheet, VS recommends minimizing transport distances, noting the role of transport stress in making calves more susceptible and more likely to shed *S.* Heidelberg.[435] They also highlight the risk posed by commingling cattle from different sources, which had previously been implicated in transmission of other multidrug resistant *Salmonella* serovars between dairy herds.[436]

In addition, noninfectious diarrhea may occur with abrupt changes in quantity and quality of milk/milk replacer, which is often inevitable with transport, but particularly likely if time is spent at auction or collection centers. [437] Failure to allow calves to rest for at least three hours after feeding, in an area with space and bedding sufficient to permit lying down, may also affect digestion and lead to diarrhea.[438] In the U.S., the norm is for neonatal calves to be deprived of food (and often water) during the entire transport process. Research suggests that, as described for cull animals above (see section VI.C.2.a.iii), prolonged fasting during transport can increase intestinal permeability and decrease the barrier function of the intestinal tract, potentially increasing the risk of both infectious and noninfectious diarrhea and worsening other health conditions.[439]

Neonatal diarrhea can be both a cause and a consequence of another transport-related gastrointestinal condition called reticuloruminal milk accumulation.[440] As described above, ingested milk or milk replacer should pass through the reticular groove and into the animal's abomasum, bypassing the other immature forestomachs. Factors including transport stress can lead to failure of this "reticular groove reflex," such that milk spills into the reticulorumen.[441] Another cause is failure to feed milk in

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[432] Walter Grünberg, *Diarrhea in Neonatal Ruminants*, MSD VETERINARY MANUAL (Merck, 2022). Available at: https://www.msdvetmanual.com/digestive-system/intestinal-diseases-in-ruminants/diarrhea-in-neonatal-ruminants
[433] VETERINARY SERVICES, USDA, NO. 778.0318, SALMONELLA HEIDELBERG INFECTIONS IN DAIRY CALVES CAN BE DEADLY: WHAT PRODUCERS NEED TO KNOW (March 2018) https://www.aphis.usda.gov/animal_health/nahms/dairy/downloads/S-Heidelberg.pdf
[434] Nichols, M. et al. (2022) Outbreak of Multidrug-Resistant *Salmonella* Heidelberg Infections Linked to Dairy Calf Exposure, United States, 2015-2018. *Foodborne Pathogens and Disease*, 19(3):199–208. https://doi.org/10.1089/fpd.2021.0077
[435] VETERINARY SERVICES, NO. 778.0318, *supra* note 433.
[436] Adhikari, B. et al. (2009) The role of animal movement, including off-farm rearing of heifers, in the interherd transmission of multidrug-resistant Salmonella. *J. of Dairy Sci.*, 92(9):4229–4238. https://doi.org/10.3168/jds.2008-1494
[437] EFSA Welfare of cattle during transport, *supra* note 156.
[438] *Id.*; MARAHRENS & SCHRADER (2020), *supra* note 315.
[439] Devant, M., & Marti, S. (2020). Strategies for Feeding Unweaned Dairy Beef Cattle to Improve Their Health. Animals : an open access journal from MDPI, 10(10), 1908. https://doi.org/10.3390/ani10101908
[440] Lorenz (2022), *supra* note 421.
[441] *Id.*; MARAHRENS & SCHRADER (2020), *supra* note 315.

a way that properly positions the head and permits two-phase sucking.[442] This latter mechanism may be associated with transport, if calves who are fed during transport receive nutrition via a bucket without a nipple.

When misdirected to the rumen, milk ferments into short-chain fatty acids or lactic acid, leading to a drop in pH of the rumen, inflammation of the mucosa of the forestomachs, and systemic consequences like metabolic acidosis. Calves show signs of lethargy and weakness. If ruminal drinking persists, sequelae such as impaired ruminal motility and intestinal atrophy may result. Ruminal drinking may be a complication of neonatal diarrhea or can cause it, either via release of milk fermentation products from the rumen or, in chronic cases, via malabsorption caused by intestinal villous atrophy.[443]

Neonatal diarrhea is extremely common in recently transported calves and is a common cause of mortality.[444] Calves, particularly the very young, may be suffering from diarrhea before and during transport. For example, prior to departing their farm of origin, one study found 23.6% of 14-day-old veal calves had diarrhea, as compared to only 7% of 28-day-old calves.[445] At auctions in Quebec, another study found 6.3% of calves with evidence of ongoing or recent diarrhea.[446] Upon arriving at Ohio veal farms from the northeastern U.S., 14% of calves in another study were noted to have diarrhea on initial exam.[447]

It has long been accepted that calves are at the greatest risk for enteric disease within the first week or two of life,[448] but research increasingly confirms that both longer transport durations and transporting calves at a younger age increase risk of diarrhea. In the two weeks following arrival at their destination farm, studies have found that between 23% and 100% of neonatal calves develop diarrhea.[449] A randomized controlled trial performed in southern Ontario evaluated the impact of transport duration on fecal scores of surplus dairy calves between 1 and 19 days old in the two weeks after arrival at the veal farm. It found that longer transport duration (12 to 16 hours, as compared to 6 hours) resulted in higher incidence of abnormal fecal scores, and older calves (15 to 19 days old at the time of transport) had lower incidence of abnormal fecal scores compared with those transported at 2 to 6 days of age.[450]

Calves who are having diarrhea tend to spend less time lying down than healthy calves.[451] Thus, calves who develop diarrhea or experience a worsening of pre-existing diarrhea during transport may struggle to recover from the fatigue and stress induced by transport after arrival at the destination—making them more susceptible to additional health issues.

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[442] MARAHRENS & SCHRADER (2020), *supra* note 315.
[443] Lorenz (2022), *supra* note 421; MARAHRENS & SCHRADER (2020), *supra* note 315.
[444] Stull & McDonough (1994), *supra* note 283; Pardon, B. et al. (2013) Impact of respiratory disease, diarrhea, otitis and arthritis on mortality and carcass traits in white veal calves. *BMC Veterinary Research*, 9:79. https://doi.org/10.1186/1746-6148-9-79
[445] Marcato et al. (2022a), *supra* note 276.
[446] Marquou et al. (2019), *supra* note 386.
[447] Pempek et al. (2017), *supra* note 81.
[448] Hulbert & Moisá (2016), *supra* note 45.
[449] Wilson et al. (2020b), *supra* note 297; Goetz et al. (2023a), *supra* note 319.
[450] Goetz et al. (2023a), *supra* note 319.
[451] Studds et al. (2018), *supra* note 416.

Unsurprisingly, diarrhea that develops during or soon after transport is a common cause of antibiotic use and death in calves.[452] Dehydration, hypovolemia, septicemia, and severe acid-base and electrolyte disturbances are the primary causes of death in diarrheic calves.[453] One study found that 52% of calf losses (including death, euthanasia, and unwanted early slaughter) on a veal farm were caused by digestive disorders.[454]

Numerous measures have been proposed for decreasing the incidence of and mortality from diarrhea in young calves. These include 1) delaying transport until calves are older, with more robust immune systems and lower susceptibility to diarrhea, 2) setting limits on maximum transport times (6-8 hours is typically suggested) and maximum fasting times, and 3) feeding milk replacer four hours prior to loading to allow calves at least three hours to rest. [455] Requiring adherence to the proposed fitness to travel standards would help achieve the first of these, by requiring navels to be healed, and would also prevent decrease pathogen spread and amplification by prohibiting the shipment of calves already suffering from diarrhea.

3. Respiratory Disease

Bovine respiratory disease (BRD), a.k.a. "shipping fever," can affect the upper respiratory tract but more commonly affects the lungs, causing pneumonia of varying degrees of severity.[456] The syndrome can be caused by a range of viruses (including bovine respiratory syncytial virus (BRSV), parainfluenza-3 virus (PI3V) and bovine viral diarrhea virus (BVDV)), and bacteria (*Mannheimia haemolytica*, *Pasteurella multocida*, *Histophilus somni*, *Arcanobacterium pyogenes*, *Mycoplasma dispa*r, and *Mycoplasma bovis*), and mixed infections are common.[457] BRD, and the pathogen *M. bovis* in particular, is far more common in veal calves than calves who remain on dairy farms because veal operations rely on purchasing, mixing, and transporting neonatal calves from multiple farms.[458] *M. bovis* can increase the severity of respiratory disease from other pathogens and such superinfections may develop several weeks after initial infection with *M. bovis*.[459] Because *M. bovis* has both natural and acquired resistance to antibiotics, it often leads to chronic pneumonia even in calves who are treated for infection.[460] Antibiotics are a mainstay for treatment of BRD in calves;[461] in the veal industry, respiratory disease accounts for 53 to over 60% of antimicrobial use.[462]

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[452] Windeyer et al. (2014), *supra* note 281; Grünberg, (2022), *supra* note 432; Bazeley (2015), *supra* note 377.
[453] Hulbert & Moisá (2016), *supra* note 45; Grünberg, (2022), *supra* note 432.
[454] Bähler et al. (2012), *supra* note 411.
[455] EFSA Welfare of cattle during transport, *supra* note 156.
[456] Zhang, M. et al. (2020) The pulmonary virome, bacteriological and histopathological findings in bovine respiratory disease from western Canada. *Transboundary and Emerging Diseases*, 67(2):924–934. https://doi.org/10.1111/tbed.13419
[457] Arcangioli, M. A. et al. (2008) The role of Mycoplasma bovis in bovine respiratory disease outbreaks in veal calf feedlots *The Veterinary J.* 177(1):89–93. https://doi.org/10.1016/j.tvjl.2007.03.008; Cockcroft (2015), *supra* note 384.
[458] Jourquin et al. (2023), *supra* note 301; Renaud & Pardon (2022), *supra* note 80; Dachrodt et al. (2021), *supra* note 368. Prevalence of disorders in preweaned dairy calves from 731 dairies in Germany: A cross-sectional study. Journal of dairy science, 104(8), 9037–9051. https://doi.org/10.3168/jds.2021-20283
[459] Arcangioli et al. (2008), *supra* note 457; Jourquin et al. (2023), *supra* note 301.
[460] Jourquin et al. (2023), *supra* note 301.
[461] Cockcroft (2015), *supra* note 384.
[462] Renaud & Pardon (2022), *supra* note 80; Pardon, B. et al. (2012) Prospective study on quantitative and qualitative antimicrobial and anti-inflammatory drug use in white veal calves. *The J. of Antimicrobial Chemotherapy*, 67(4):1027–1038. https://doi.org/10.1093/jac/dkr570

In both neonatal calves and older cattle, the pathogenesis of BRD typically involves exposure to stressors that lower immune system function combined with environmental conditions that expose animals to a wide array of pathogens.[463] Again, transport creates ideal conditions for respiratory disease transmission, because it often involves mixing calves from different farms, exposing them to numerous stressors, and potentially subjecting them to harmful environmental conditions (extreme temperatures, exhaust fumes, etc.) at a time when their immune function is at its lowest and they are most difficult to handle and move.[464] Research dating back over 30 years found that that serum taken from calves after transport impaired the function of two types of immune cells, lymphocytes and alveolar macrophages (an immune cell of the lungs), that had been obtained from healthy, non-transported calves.[465]

Most cases of BRD occur in the first three weeks following transport.[466] Post-mortem and ultrasonographic examinations of neonatal calves indicate that even those who appear healthy after transport often have pneumonia, with findings such as pleuritis, extensive pneumonia, and significant lung lobe consolidation.[467] The tendency of farmers and veterinarians to detect BRD late in the disease course may explain why some studies have found lower rates of respiratory disease on the day of arrival; this may also have implications for antibiotic use and subsequent development of antibiotic resistance.[468]

A recent study that focused on calves transported about 1,000 km (621 miles) directly from one Canadian farm to another (at a median age of 5 days) found that, within the first two weeks, an average of 44% of calves were treated for BRD.[469] On one of the farms in the study, 78% of calves received BRD treatment.[470] Another recent randomized controlled trial found that 63% of transported calves had abnormal respiratory scores in the 14 days after transport, with younger calves (2 to 6 days old) being at higher risk than older calves (>7 days) and calves transported for a longer period (16 hours) being at greatest risk than those transported for shorter period (6 hours).[471] This echoes research from the 1980s which found that calves aged 4 to 32 days had approximately twice the risk of being treated for respiratory disease in the first three weeks after undergoing a longer journey (approximately 34 hours) compared to those undergoing a shorter journey (13 hours).[472] In this study,

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[463] Cockcroft (2015), *supra* note 384; Schönecker, L. et al. (2020). Prevalence and antimicrobial resistance of opportunistic pathogens associated with bovine respiratory disease isolated from nasopharyngeal swabs of veal calves in Switzerland. Preventive veterinary medicine, 185, 105182. https://doi.org/10.1016/j.prevetmed.2020.105182

[464] Marcato et al. (2020b), *supra* note 361; Pempek et al. (2017), *supra* note 81; Cockcroft (2015), *supra* note 384.

[465] Murata, H. & Hirose, H. (1991). Effect of transportation stress on bovine lymphocyte and neutrophil functions. JARQ. Japan Agricultural Research Quarterly, 25(1), 61–64.

[466] Cockcroft (2015), *supra* note 384.

[467] Brscic, M. et al. (2012). Prevalence of respiratory disorders in veal calves and potential risk factors. *J. of dairy Sci.*, 95(5): 2753–2764. https://doi.org/10.3168/jds.2011-4699 ; Jourquin et al. (2023), *supra* note 301; Pardon et al. (2013), *supra* note 423; Leruste, H. et al. (2012). The relationship between clinical signs of respiratory system disorders and lung lesions at slaughter in veal calves. *Preventive veterinary. Med.*, 105(1-2): 93–100. https://doi.org/10.1016/j.prevetmed.2012.01.015 ; Stull & McDonough (1994), *supra* note 283; Pardon, B. et al. (2019) Accuracy and inter-rater reliability of lung auscultation by bovine practitioners when compared with ultrasonographic findings. *The Veterinary Record*, 185(4):109. https://doi.org/10.1136/vr.105238

[468] Pardon et al. (2013), *supra* note 423; Pempek et al. (2017), *supra* note 81.

[469] Wilson et al. (2020b), *supra* note 297.

[470] *Id*.

[471] Goetz et al. (2023a), *supra* note 319.

[472] Mormede et al. (1982), *supra* note 45.

8 out of 30 calves on the short journey were treated for respiratory disease, compared to 16 out of 32 animals on the long journey.

Several measures could be instituted to decrease the risk of transport-associated respiratory disease in neonatal calves. Research supports delaying transport of calves until they are older and the risk of developing respiratory disease decreases [473] —adopting the proposed fitness to travel requirements would have this effect. It would also create an incentive for dairy farms to vaccinate dairy cows and/or their calves against common respiratory pathogens, a practice which decreases the incidence and severity of respiratory disease and is recommended by the World Health Organization to reduce the need for antibiotics.[474] Although vaccination is typically considered more efficacious if performed after blood levels of maternal antibodies have declined significantly, research shows that maternal antibody interference of vaccines is not absolute, and vaccination may be particularly useful against pathogens which the body defends against primarily via cell-mediated, rather than antibody-dependent, immune mechanisms, such as BRSV and parainfluenza virus.[475] Vaccinations are often labeled for use only after a minimum age (e.g., one week of age) and animals typically require five to ten days after vaccination to become protected.[476] Aligning calf transport practices with the suggested fitness to travel requirements would thus help make use of vaccines more practical and prudent for dairy producers.

The proposed fitness to travel standards also prohibit shipping of sick calves. Visual examination and gauging temperature are very basic and easily assessable means of detecting sick animals whose shipment would violate fitness to travel requirements. Given that, as discussed above, many calves without clinical signs of respiratory disease are often found to have severe pneumonia on necropsy or via ultrasonography, "quick thoracic lung ultrasonography" (qTUS) could be incorporated during pre-shipment examination. A standardized technique for point-of-care portable ultrasound with a short learning curve for inexperienced operators, qTUS could help further decrease the risk of shipping sick and infectious calves and increase the incentive of producers to protect the health of neonatal calves prior to transport.[477]

Given that longer journeys have been found to increase risk of calves developing respiratory diseases, it is likely that setting limits on maximum journey duration would also decrease respiratory disease risk.

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[473] Schnyder, P. et al. (2019) Effects of management practices, animal transport and barn climate on animal health and antimicrobial use in Swiss veal calf operations. *Preventive Veterinary Med.*, 167:146–157. https://doi.org/10.1016/j.prevetmed.2019.03.007

[474] World Health Organization. (2020). Antibiotic resistance. Available at: https://www.who.int/news-room/fact-sheets/detail/antibiotic-resistance

[475] Cortese (2011), *supra* note 265.

[476] Schnyder, P. (2019), *supra* note 473.

[477] Jourquin et al. (2023), *supra* note 301; Bart Pardon, *A quick scan lung ultrasound method and flow chart as a decision aid for bronchopneumonia diagnosis*, in XXIV CONGRESO INTERNACIONAL ANEMBE DE MEDICINA BOVINA 258-260 (2019, Asociación Nacional de Especialistas en Medicina Bovina de España) https://core.ac.uk/download/pdf/200974434.pdf; Ollivett, T. L. et al. (2015) Thoracic Ultrasonography and Bronchoalveolar Lavage Fluid Analysis in Holstein Calves with Subclinical Lung Lesions. *J. of Veterinary Internal Med*. 29(6):1728–1734. https://doi.org/10.1111/jvim.13605

D. Antibiotic Use and Resistance

Antimicrobial resistance is recognized as a major threat to human and animal health, with the World Health Organization (WHO) noting that it "is rising to dangerously high levels in all parts of the world."[478] The Centers for Disease Control and Prevention (CDC) reports that antibiotic-resistant bacteria cause more than 2.8 million infections and 35,000 deaths in the US each year.[479] Research suggests that, by 2050, antimicrobial resistance will causes 10 million deaths globally per year.[480] There is extensive evidence that antibiotic-resistant bacteria from farmed animals, particularly veal calves, can be transmitted to humans via a variety of mechanisms, including direct contact with animals, walking through animal housing, through the food chain, and even living near contaminated environments (e.g., crop fields to which livestock manure is applied).[481]

Any use of antibiotics selects for bacteria resistant to that antibiotic, so frequent or widespread use of antibiotics is the driving force behind increasing levels of antibiotic resistance. In the veal industry, the high level of antibiotics use has led to antimicrobial resistance in commensal, pathogenic, and zoonotic bacteria.[482] A recent review by researchers at the Ohio State University and the University of Guelph states that surplus calves "are an underrecognized source of antimicrobial-resistant (AMR) pathogens," noting that the high degree of commingling during auction and transport contribute to increased disease risk, higher antimicrobial use, and the development of antimicrobial resistance.[483]

While antibiotic resistance has been documented in all farmed animal species, there is extensive evidence that, because of the high disease burden of the veal and dairy beef industries, both rates of antibiotic use and prevalence of antibiotic resistance are higher than in other animal production industries.[484] One study found that high-density veal calf herds had a far higher prevalence of

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[478] *Antibiotic resistance*, WORLD HEALTH ORGANIZATION (July 31, 2020). Available at: https://www.who.int/news-room/fact-sheets/detail/antibiotic-resistance; Pardon (2012), *supra* note 441.
[479] CENTERS FOR DISEASE CONTROL AND PREVENTION (CDC), ANTIBIOTIC RESISTANCE THREATS IN THE UNITED STATES (Dec. 2019). https://www.cdc.gov/drugresistance/pdf/threats-report/2019-ar-threats-report-508.pdf
[480] Jim O'Niell, Chair, TACKLING DRUG RESISTANT INFECTIONS GLOBALLY: FINAL REPORT AND RECOMMENDATIONS 1 (May 2016, Review on Antimicrobial Resistance). https://www.biomerieuxconnection.com/wp-content/uploads/2018/04/Tackling-Drug-Resistant-Infections-Globally-Final-Report-and-Recommendations.pdf
[481] Marshall, B. M., & Levy, S. B. (2011) Food animals and antimicrobials: impacts on human health. *Clinical Microbiology Reviews*, 24(4):718–733. https://doi.org/10.1128/CMR.00002-11: Hoelzer, K. et al. (2017) Antimicrobial drug use in food-producing animals and associated human health risks: what, and how strong, is the evidence? *BMC Veterinary Res.*, 13(1):211. https://doi.org/10.1186/s12917-017-1131-3; Casey, J. A. et al. (2013) High-density livestock operations, crop field application of manure, and risk of community-associated methicillin-resistant Staphylococcus aureus infection in Pennsylvania. *JAMA Internal Med.*, 173(21): 1980–1990. https://doi.org/10.1001/jamainternmed.2013.10408; Dorado-García, A. et al. (2013) Risk factors for persistence of livestock-associated MRSA and environmental exposure in veal calf farmers and their family members: an observational longitudinal study. *BMJ Open*, 3(9):e003272. https://doi.org/10.1136/bmjopen-2013-003272; Vinayamohan et al. (2022), *supra* note 392.
[482] Renaud et al. (2018a), *supra* note 279.
[483] Vinayamohan et al. (2022), *supra* note 392.
[484] Renaud & Pardon (2022), *supra* note 80; Bos, M.E. et al. (2013) Consumption of antimicrobials in pigs, veal calves, and broilers in the Netherlands: quantitative results of nationwide collection of data in 2011. PLOS ONE, 8(10):e77525. https://doi.org/10.1371/journal.pone.0077525; Cheng, T. Y. et al. (2022) The use of common antimicrobial agents in US veal calves. *Zoonoses and Public Health*, 69(4):359–369. https://doi.org/10.1111/zph.12928; Filippitzi, M. E. et al. (2014), Antimicrobial use in pigs, broilers and veal calves in Belgium. *Vlaams Diergeneeskundig Tijdschrift*, 83:215–224. https://doi.org/10.21825/vdt.v83i5.16633; Bokma, J.

antibiotic-resistant *Pasteurella* and *Mannheimia* isolates (71.9%) compared to dairy calves (17.6%) and beef calves (21.9%), with 32.6% of the bacterial isolates obtained from veal calves in the study demonstrated resistance to at least three of the antimicrobials tested.[485]

Sales of antimicrobial drugs in the U.S. (those considered medically important and those that are not) are tracked by the Food and Drug Administration (FDA).[486] Because data is broken down only in terms of species, little information is available regarding antimicrobial use in neonatal calves generally or in surplus dairy calves in particular.[487] In an attempt to rectify this knowledge gap, a recent benchmarking study tracked antimicrobial treatments on eight U.S. veal calf farms, each with 120 to 320 animals, during one rearing cycle.[488] Calves were transported to the veal farm at less than two weeks of age and, as has been documented in other studies,[489] most antibiotics were administered in the first three weeks after transport.[490] The following classes of antibiotics were administered to either individuals or the group: amoxicillin, 3rd-generation cephalosporins (ceftiofur), aminoglycosides (neomycin), and macrolides (tildipirosin, tulathromycin, tylosin). Individual farms used between 8 and 14 different antimicrobial products.[491]

A recent review focused on the role of U.S. surplus calf production systems in driving antimicrobial resistance.[492] It notes that prophylactic and metaphylactic use of antibiotics to combat BRD after transport influences the prevalence of resistance among both commensal (normal flora) and pathogenic respiratory bacteria.[493] This is supported by another recent study which used two diagnostic tests (quick thoracic ultrasound and testing of samples obtained via broncho-alveolar lavage (BAL)) to better understand the evolution of respiratory disease in calves.[494] It found that, in calves aged 14 to 21 days upon arrival at the veal farm, 17.6% had lung consolidation indicative of pneumonia, though most (86.8%) were not yet showing clinical signs. One week after arrival, the prevalence had increased to 30.8%, despite metaphylactic treatment with the antibiotic tulathromycin on the day of arrival of the last batch of calves. Despite a treatment with a second antibiotic, doxycycline, 43.8% of calves had pneumonia by week four.

In discussing the failure of antibiotics to effectively treat pneumonia in newly arrived calves, the authors note that upon arrival, many calves tested positive for viral causes of pneumonia (specifically BRSV), for which antimicrobials are ineffective, and suggest that transport-associated stressors may have suppressed the calves' immune systems. Multidrug resistant *M. bovis* played a major role in the

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et al. (2019) Risk factors for antimicrobial use in veal calves and the association with mortality. *J. of Dairy Sci.*, 102(1):607–618. https://doi.org/10.3168/jds.2018-15211; Pardon, B. et al. (2012), *supra* note 441; Wilson et al. (2020b), *supra* note 297; Vinayamohan et al. (2022), *supra* note 392.

[485] Catry, B. et al. (2005) Variability in acquired resistance of Pasteurella and Mannheimia isolates from the nasopharynx of calves, with particular reference to different herd types. *Microbial Drug Resistance*, 11(4):387–394. https://doi.org/10.1089/mdr.2005.11.387

[486] CENTER FOR VETERINARY MEDICINE, FOOD AND DRUG ADMINISTRATION, 2021 SUMMARY REPORT ON ANTIMICROBIALS SOLD OR DISTRIBUTED FOR USE IN FOOD-PRODUCING ANIMALS (Dec. 2022) https://www.fda.gov/media/163739/download

[487] Vinayamohan et al. (2022), *supra* note 392.

[488] Cheng et al. (2022), *supra* note 484.

[489] Marcato et al. (2022a), *supra* note 276.

[490] Pardon et al. (2012), *supra* note 441.

[491] Cheng et al. (2022), *supra* note 484.

[492] Vinayamohan et al. (2022), *supra* note 392.

[493] *Id*.

[494] Jourquin et al. (2023), *supra* note 301.

first respiratory disease outbreak noted after transport, with immunosuppression suspected to having aided *M. bovis* in causing chronic pneumonia and predisposing calves to superinfections with other bacteria weeks after arrival. *M. bovis* is intrinsically resistant to certain antibiotics (beta-lactams and sulfonamides) and veal calves have often acquired resistance to other antibiotics that had previously been effective.[495]

While it could be argued that calves are more susceptible to bacterial infections regardless of transport, research indicates that calf ranches are much more likely to routinely feed antibiotics in milk replacer than are dairy farms.[496] Moreover, while mortality rates in the veal industry are similar to the dairy industry, the veal and dairy beef industry heavily rely on antimicrobial use to keep calves alive.[497] Because of the prevalence of infectious disease, antibiotics are often administered often upon arrival to the entire group regardless of clinical signs and/or results of diagnostic tests.[498]

Research has found that antibiotic-resistant organisms with a high zoonotic potential are highly prevalent on veal farms.[499] A European study that assessed *Escherichia coli* (*E. coli*) from the digestive tract of veal calves for resistance to seven different antibiotics found that multidrug resistance (resistance to more than two drugs) was present in 93.5% of bacterial samples collected.[500] European studies have also found a high prevalence of livestock-associated methicillin-resistant *Staphylococcus aureus* (LA-MRSA) on veal farms and in veal meat, and have documented its apparent spread, including via inhalation of contaminated air, to humans working in barns.[501] Research indicates that treating groups of calves (rather than individuals) with antibiotics, as is commonly performed on arrival at the farm, is a risk factor for MRSA.[502] It also suggests that decreasing antibiotic use on veal calves curbs LA-MRSA transmission to people working on veal farms.[503]

Far less research on the prevalence of LA-MRSA has been conducted at North American operations, but there is no reason to think findings would be significantly different, given the current level of antibiotic use on these operations. A Canadian study found *E. coli* in 87% of fresh retail veal meat in

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[495] Vinayamohan et al. (2022), *supra* note 392.
[496] Renaud & Pardon (2022), *supra* note 80.
[497] *Id.*
[498] Pardon et al. (2012), *supra* note 441; Pempek et al. (2017), *supra* note 81; Wilson et al. (2020a), *supra* note 80.
[499] Renaud & Pardon (2022), *supra* note 80.
[500] Catry, B. et al. (2007), Antimicrobial resistance patterns of Escherichia coli through the digestive tract of veal calves. *Microbial Drug Resistance,* 13(2):147–150. https://doi.org/10.1089/mdr.2007.744
[501] Bos, M. E. et al. (2016) Transmission through air as a possible route of exposure for MRSA. *J. of Exposure Sci. & Envtl. Epidemiology*, 26(3):263–269. https://doi.org/10.1038/jes.2014.85; Zoppi, S. et al. (2021), Livestock-Associated Methicillin-Resistant Staphylococcus aureus and Related Risk Factors in Holdings of Veal Calves in Northwest Italy. *Microbial Drug Resistance*, 27(8):1136–1143. https://doi.org/10.1089/mdr.2020.0226; Bos, M. E. et al. (2012) Livestock-associated MRSA prevalence in veal calf production is associated with farm hygiene, use of antimicrobials, and age of the calves. *Preventive Veterinary Med*., 105(1-2):155–159. https://doi.org/10.1016/j.prevetmed.2012.01.002; de Boer, E. et al. (2009), Prevalence of methicillin-resistant Staphylococcus aureus in meat. *Int'l J. of Food Microbiology*, 134(1):52–56. https://doi.org/10.1016/j.ijfoodmicro.2008.12.007; Dorado-García, A. et al. (2015) Effects of Reducing Antimicrobial Use and Applying a Cleaning and Disinfection Program in Veal Calf Farming: Experiences from an Intervention Study to Control Livestock-Associated MRSA. PLOS ONE, 10(8):e0135826. https://doi.org/10.1371/journal.pone.0135826
[502] Bos et al. (2012), *supra* note 501.
[503] Dorado-García (2015), *supra* note 501.

grocery stores and 70% of these isolates were resistant to at least one antimicrobial.[504] Thirty-three percent of the isolates were resistant to 5 or more antibiotics. Another recent study on the prevalence of antimicrobial resistant *E. coli* in veal calves at 6 auctions and 12 calf operations in Pennsylvania also documented high levels of multidrug resistance.[505] *E. coli* that was resistant to 4 or more antibiotics was identified in 76.8% of the samples from the auction, 90.8% of the samples from farms soon after calves were transported there, and 100% of the samples from farms just prior to calves being transported to slaughter.

A 2021 study evaluated antibiotic resistance on 12 commercial veal operations in Pennsylvania by conducting metagenomic sequencing (a technique that determines the primary structure of genetic material) on feces collected from calves on arrival at the farm and again just before slaughter.[506] Researchers found a diverse set of transferrable antimicrobial resistance genes (ARGs)—genetic elements that allow genes for antibiotic resistance to be transferred horizontally between bacteria, even those of very different taxa. The most common ARGs conferred resistance to aminoglycosides, tetracyclines, and macrolide-lincosamide-streptogramin B; however, the researchers also found transferrable ARGs that conferred resistance to antimicrobials classified as "critically important" for humans by the WHO. In addition, in many cases, ARGs from multiple antibiotic classes co-occurred—suggesting the potential for pathogens to rapidly acquire resistance to multiple drugs at once. In this study, calves had significantly more ARGs at the time of slaughter than upon arrival at the farm, suggesting that antimicrobial treatment for post-transport health conditions may play a role in driving antimicrobial resistance.

The benchmarking study described above found that, compared with other livestock production systems, significantly more antimicrobial doses were administered to veal calves.[507] Similar to studies from other countries that found veal calves spend a significant portion of their lives on antibiotic treatment,[508] this U.S.-based study found an average of 34.4 daily doses (based on the FDA-approved labeled dose) were administered per 100 days of rearing.[509] By comparison, dosing rates of 1.44 and 2.08 per 100 days are reported for beef or dairy production systems.[510]

The study also notes the impact of long-distance transport and exposure to pathogens through livestock auctions on increasing the risk of bacterial disease, stating "the stressors and pathogen exposure prior to arrival at the growing farms may predetermine high levels of antimicrobial use in surplus dairy calf operations, including growers raising calves for either veal or dairy-beef."[511] This is echoed in research from other countries:

"The most likely explanation for the higher antimicrobial drug use in veal calves compared with in poultry and pigs is the typical organization of the veal industry. Whereas pig herds and poultry flocks are mainly closed or only combine animals from a limited number of origins, the veal industry commingles young, recently transported, highly stressed calves that originate from multiple farms,

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[504] Cook, A. et al. (2011) Antimicrobial resistance in Escherichia coli isolated from retail milk-fed veal meat from Southern Ontario, Canada. *J. of Food Protection*, 74(8):1328–1333. https://doi.org/10.4315/0362-028X.JFP-10-495
[505] Salaheen, S. et al. (2019) Antimicrobial Resistance Among Escherichia coli Isolated from Veal Calf Operations in Pennsylvania. *Foodborne Pathogens and Disease*, 16(1):74–80. https://doi.org/10.1089/fpd.2018.2530
[506] Salaheen et al. (2021), *supra* note 393.
[507] Cheng et al. (2022), *supra* note 484.
[508] Pardon et al. (2013), *supra* note 423.
[509] Cheng et al. (2022), *supra* note 484.
[510] Vinayamohan et al. (2022), *supra* note 392.
[511] Cheng et al. (2022), *supra* note 484.

both domestic and foreign. The combination of these factors is known to cause a higher disease risk."[512]

Because transport-associated factors are frequently cited as the cause for high disease rates on veal farms, better regulation of transport is necessary to decrease disease risk.[513] A recent study evaluating veal calves in terms of "robustness" (defined as "the ability of calves to cope with environmental challenges and to bounce back rapidly when challenges occur") noted that more robust calves are better able to fight disease and cope with endemic infections and likely "have a lower need for antimicrobials."[514] It found that calves transported at 28 days of age are significantly more robust than those transported at 14 days of age, requiring less treatment after arrival at the farm and having a lower mortality risk. Another recent paper, which summarized a two-day discussion of a diverse group of Canadian experts, specifically identified the concern that blanket antimicrobial treatment, including drugs of very high importance in human medicine, are often administered upon arrival to the farm.[515] It identified a host of stressors that potentially suppress immunity during marketing and transport of neonatal calves. The mounting evidence regarding the role of surplus dairy calf production in antimicrobial resistance suggests that measures must immediately be taken to decrease the prevalence of infectious disease in this animal population, including by avoiding transport conditions known to result in high levels of morbidity.

E. Impact on Mortality Risk

As would be expected given the information above regarding stressors and health problems associated with transport, neonatal calves who are transported are at greater risk of dying during or shortly after transport compared to those who are not.[516] Numerous studies document that transported calves are most likely to die within 2 to 3 weeks after transport.[517] Those at greatest risk appear to be 1) those who are very young and/or compromised prior to loading at the farm of origin and 2) those who undergo prolonged journeys, especially if the journey involves a stop at an auction or assembly point.[518] Mortality is an important indicator because it typically reflects severely compromised welfare and animal stress, and is often the result of prolonged or severe disease.[519]

Records obtained by AWI illustrate the significant toll transport takes on young calves. For example, USDA Food Safety and Inspection Service (FSIS) inspection personnel at a slaughter plant in Rupert, Idaho, documented the mortality of "bob veal" calves transported from California. Although the identity and location of the supplier is withheld by FSIS, it is likely that the animals were transported 9 to 12 hours from the point of collection to the slaughter plant. Over the 18-month period that the records cover, an average of 12.3% of the calves were reported dead upon arrival and 6.9% euthanized as "non-ambulatory, disabled" (NAD)—an astounding total transport loss of 18.5%. For detailed data, see Appendix A.

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512 Pardon et al. (2012), *supra* note 441.
513 Bokma et al. (2019), *supra* note 484; Vinayamohan et al. (2022), *supra* note 392.
514 Marcato et al. (2022a), *supra* note 276.
515 Wilson et al. (2020a), *supra* note 80.
516 Trunkfield & Broom (1990), *supra* note 363; Knowles (1995), *supra* note 290.
517 Pardon et al. (2013), *supra* note 423; Staples & Haugse (1974), *supra* note 388; Renaud et al. (2018a), *supra* note 279; Barnes, M.A. et al. (1975) Age at transport and calf survival. *J. Dairy Sci*., 58:1247. https://doi.org/10.3168/jds.S0022-0302(75)84699-6
518 Knowles (1995), *supra* note 290; Pempek et al. (2017), *supra* note 81; Barnes et al. (1975), *supra* note 517; Staples & Haugse (1974), *supra* note 388.
519 Kells et al. (2020), *supra* note 280.

1. Impact of Age

Research as far back as the 1970s has documented that age at time of transport is inversely correlated with mortality risk during or shortly after transport – that is, all other things being equal, calves transported at a younger age are more likely to die than older calves.[520] The sparse research done on neonatal calf mortality during transport indicates that, compared to other classes of cattle, neonatal calves are far more likely to die and/or become nonambulatory during long distance journeys.[521]

An Australian study followed 220,519 calves aged approximately 5 to 7 days old, who were being transported to slaughter.[522] It found that the overall mortality rate (signifying calves who died on the truck or immediately after arrival) was over 58 times that reported for all classes of cattle being transported long distances in North America (0.64% v. 0.011%).[523]

A set of North American studies examining the impact of transport on several different classes of cattle found a mortality rate of nearly 2.6% for Holstein veal calves who were transported from Alberta to California (1,350 km or 839 miles), compared to the overall mortality rate of only 0.011% for all classes of cattle undergoing similar long-distance transport.[524] In addition, over 5% of the veal calves became nonambulatory enroute, compared to 0.022% for all classes of cattle. The authors noted that some of the 155 calves were assessed by the transport drivers as not being in good condition at the time of loading—preexisting issues, such as disease and poor nutritional plane, may have weakened the calves, such that they succumbed to issues like dehydration and sepsis enroute.

In 2023, a U.S. study of "bob veal" calves (all less than 3 weeks of age and being transported to slaughter) found that, upon arrival, nearly 1% of calves were dead and an additional 0.43% were euthanized soon after arrival.[525] These calves came from three different buying stations, located 431 miles (694 km), 255 miles (410km), and 7 miles (11 km) from the slaughterhouse, respectively, but it was not known how far the calves traveled prior to arriving at the buying station or the total duration of their journeys.

Mortality during the 2 to 3 weeks after arrival at a calf growing operation is also common. This is widely understood to be due largely to younger calves' greater risk of infection stemming from their immature immune system and being exposed to stress and pathogens during transport.[526] Research shows that, as determined by hematological parameters, the adaptive immunity of 14-day-old calves is significantly less developed than that of 28-day-old calves.[527] Adaptive immunity helps calves to

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520 Barnes et al. (1975), *supra* note 517.
521 González et al. (2012a), *supra* note 82; González et al. (2012c), *supra* note 339; Cave, J. G. et al. (2005) Mortalities in bobby calves associated with long distance transport. *Australian Veterinary J.*, 83(1-2), 82–84. https://doi.org/10.1111/j.1751-0813.2005.tb12203.x
522 Cave et al. (2005), *supra* note 521.
523 *Id.*; González et al. (2012a), *supra* note 82.
524 González et al. (2012a), *supra* note 82; González et al. (2012c), *supra* note 339.
525 England et al. (2023), *supra* note 314.
526 Marcato et al. (2022a), *supra* note 276.
527 *Id.*; Marcato et al. (2022b), *supra* note 276.

survive the top causes of calf mortality: gastrointestinal disease, omphalitis with associated sepsis, and pneumonia.[528]

One of the early studies on post-transport mortality utilized questionnaires sent to each person applying for a permit to import calves into North Dakota.[529] Numerous questions were asked about various calf characteristics, rearing practices, and medication administration. Only five items appeared closely related to rates of death and sickness, and calf age was among them. In this study, 19.71% of calves who were transported at one week of age and 22.85% of calves transported at 8 to 14 days of age were dead within 4 weeks. The authors noted that most of the calves aged 1 to 7 days were purchased directly from another farm and did not pass through sales facilities, as was common for the 8-to-14-day-old calves. By comparison, for calves who were at least three weeks of age at the time of purchase, the mortality rate was far lower: 5.53% died within four weeks of arrival.

Neonatal calf mortality rates overall have improved since this early study, but the association of higher mortality rates with transport of younger calves persists. Much of the relevant research comes from the European Union, where calves cannot be transported more than 62 miles (100 km) prior to 10 days of age, and for more than 8 hours between 10 and 13 days of age.[530] A study from the Netherlands found that mortality risk of calves transported at 14 days of age was over twice as high as that of calves transported at 28 days of age.[531] In this study, mortality risk was determined over the entire rearing period and was calculated based on the number of calves who died, were euthanized by a veterinarian for health reasons, or were prematurely slaughtered because of poor performance.

One challenge with research on this topic, particularly in studies with large numbers of animals going through the marketing chain, is that calf age is often not precisely known. In general, weight increases after birth, meaning lighter-weight calves are typically younger than heavier calves; thus, although weight is affected by other factors, such as size at birth, plane of nutrition, and hydration status, weight is often used as a proxy for age. A 2016 study involving the collection of data from 10,910 calves entering a grower in Ontario found that lighter-weight calves had increased mortality risk in the first three weeks after arrival. [532] A 2019 observational case-control study compared various characteristics of each calf who died within 21 days of arrival at the veal farm and characteristics of two randomly selected control calves who arrived at the same time and were housed in the same barn, but survived beyond 21 days.[533] This study also found that calves who weighed more at the time of arrival were less likely to die within three weeks of arrival.

A recent article in a veterinary journal reviewed a number of studies that demonstrate that body weight at arrival to veal and dairy beef facilities is the most important indicator of future mortality, especially in the first 21 days after arrival.[534] While the authors acknowledge that it is difficult to determine the ideal threshold for body weight at arrival, they speculate that, based on the available research, it should be 50 kg (110 lbs.) minimum. A Canadian study investigating weight as a proxy

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[528] Thomas & Jordaan (2013), *supra* note 402; Sargeant, J. M. et al. (1994) Production practices, calf health and mortality on six white veal farms in Ontario. *Canadian J. of Veterinary Res.*, 58(3):189–195; Pardon et al. (2012), *supra* note 441; Bazeley (2015), *supra* note 377; Bähler et al. (2012), *supra* note 411; Staples & Haugse (1974), *supra* note 388.
[529] Staples & Haugse (1974), *supra* note 388.
[530] Roadknight et al. (2021a), *supra* note 45.
[531] Marcato et al. (2022a), *supra* note 276.
[532] Winder et al. (2016), *supra* note 80.
[533] Renaud et al. (2018a), *supra* note 279.
[534] Renaud & Pardon (2022), *supra* note 80.

for age determined that many calves have not achieved a weight of 50 kg by 9 days of age, the minimum required in Canada for calves to be transported long distances via an auction.[535] Previous research found that the average weight of calves at one month of age is just shy of the recommend 50kg cut-off: 49.1 kg.[536]

2. Impact of Longer Transport Duration

As mentioned above, because calf-rearing facilities are often concentrated in particular regions of North America while the dairies on which calves are born may be more dispersed—long-distance transport of surplus calves is common.[537]

According to the 2022 export data AWI obtained from six top dairy producing states (Table 1 section V.E.3. above), of the 526,452 calves transported, 31.9% traveled between 100-499 mi (approx. 2-8 hours), 28.9% traveled between 500-999 mi (approx. 8-18 hours), 34.8% traveled between 1000-1499 mi (approx. 18-26 hours), and the final 4.2% traveled over 1500 mi (26+ hours). The 2022 import data for California and New Mexico (Table 2) showed that of the 323,196 calves transported, 13.6% traveled between 100-499 mi, 29.1% traveled between 500-999 mi, 52.3% traveled between 1000-1499mi, and 5% traveled over 1500 mi. The two longest journeys of 2,466 and 2,141 miles were made by 750 and 14,353 calves, respectively.

The connection between long transport times and subsequent poor health and/or mortality is widely recognized in the literature.[538] Prolonged transport times increase the risk of a neonatal calf dying in transit, prior to unloading, as well as in the three weeks after arrival at the rearing farm.

One study was carried out in Australia on neonatal calves aged 5 days or older who were being transported directly to slaughter plants, and calculated the mortality rate based on the number of calves who were found dead or moribund in the truck.[539] The calves were transported for between 62 miles (100 km) up to around 500 miles (800 km).[540] Average mortality rate increased with increasing distance of transport. For example, for calves transported within one of the study years, the average mortality rate was less than 0.25% for those transported the shortest distances compared with approximately 2.5% for those transported 500 miles.

Similarly, a study was performed in New Zealand on "bob veal" calves that traveled between 0.1 and 10 hours directly to slaughter.[541] When mortality (dying enroute or shortly after arrival, or being condemned on arrival) was assessed, it was determined that each additional hour of travel time increased the odds of mortality by a factor of approximately 1.5.

Research also suggests that increased journey duration increases mortality rate in the weeks following transport.[542] In addition to increased pathogen exposure and transport stress, research has found that dehydration on arrival at the raiser is associated with a higher risk of mortality within the

[535] Buczinski, (2020), *supra* note 404.
[536] Barnes et al. (1975), *supra* note 517.
[537] Wilson et al. (2020a), *supra* note 80.
[538] Pempek et al. (2017), *supra* note 81; EFSA Welfare of cattle during transport, *supra* note 156; Roadknight et al. (2021a), *supra* note 45.
[539] Cave et al. (2005), *supra* note 521.
[540] *Id.*
[541] Boulton et al. (2020), *supra* note 302.
[542] Goetz et al. (2023a), *supra* note 319.

first 21 days.[543] As noted above, calves become more dehydrated the longer they are kept without access to feed (milk) or water.[544] An early study found that acute dehydration was more pronounced in 4-to-32-day-old calves undergoing a long journey (approximately 34 hours, including a night at a transport center without food or water) compared to a shorter one (approximately 13 hours).[545] Calves undergoing more prolonged transport were more likely to develop respiratory disease, and, though too few animals were included in the study to establish a definitive connection between journey duration and mortality rate, the mortality rate during the fattening period was higher for the calves undergoing transport for a more prolonged period.[546]

Reducing transport time is frequently cited as an opportunity to improve the health and welfare of surplus calves.[547] While requiring the proposed fitness to travel criteria would not automatically decrease the average or typical transport times for calves, they would help ensure that long journeys are not undertaken by the most vulnerable, least robust calves.

VIII. ARGUMENT IN SUPPORT OF REQUESTED RULEMAKING

As shown above, the regular transport of unfit animals—very young calves and ill, injured, or compromised cull animals—presents a serious risk to the health and welfare of individual animals, food safety, public health, and the health of the nation's agricultural herds.

Although most industry trade groups recommend various fitness criteria and encourage participating producers to refrain from transporting animals they deem "unfit," this has proven to be insufficient to curb the practice. Diseased, nonambulatory, and dead animals arrive on a daily basis at slaughter establishments and neonatal calves continue to experience high rates of morbidity and mortality after transport. The voluntary nature of industry fitness for transport standards along with the lack of disincentives for transporting unfit animals, explain why the transport of unfit animals continues to be common.[548]

Pursuant to the AHPA, the purpose of which is to protect animal health and the health and welfare of people of the US,[549] the department should adopt the three suggested standards to ensure the fitness of vulnerable animals transported interstate by land.

A. Adopting Select WOAH Fitness Standards

The World Organisation for Animal Health (WOAH) was established in 1924 to address animal diseases at the global level and is now well known as the intergovernmental organization responsible for improving animal health. It is recognized by the World Trade Organization (WTO), and has 183 member countries and territories, including the U.S.[550] Over time, the scope of the organization's

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[543] Renaud et al. (2018a), *supra* note 279; Renaud et al. (2018b), *supra* note 294.
[544] Knowles, T. G. et al. (1997) Effects on calves less than one month old of feeding or not feeding them during road transport of up to 24 hours. *The Veterinary Record*, 140(5):116–124. https://doi.org/10.1136/vr.140.5.116v; Marcato et al. (2022a), *supra* note 276. Renaud, D. L. et al. (2018c) Effect of health status evaluated at arrival on growth in milk-fed veal calves: A prospective single cohort study. *J. of Dairy Sci.*, 101(11):10383–10390. https://doi.org/10.3168/jds.2018-14960
[545] Mormede et al. (1982), *supra* note 45.
[546] *Id.*
[547] Pempek et al. (2017), *supra* note 81; Renaud & Pardon (2022), *supra* note 77.
[548] Edwards-Callaway et al. (2019), *supra* note 54.
[549] 7 U.S.C. §8305(1)
[550] *Members*, WORLD ORGANISATION FOR ANIMAL HEALTH (n.d.) https://www.woah.org/en/who-we-are/members/

mission expanded to include animal welfare, in recognition of the close link between animal health and welfare, and it benefits from the collaboration of the chief veterinary officers of all member countries.[551] In 2005, WOAH adopted animal welfare standards for the transport of animals by land, sea, and air.[552] A number of member countries have subsequently adopted fitness standards equal to or more protective than WOAH's.[553]

Specifically in regard to young calves, because of their increased susceptibility to disease, injury, and poor welfare during transport, many countries set limits on their transport. For example, the European Union (EU) prohibits the transport of calves under 10 days of age for more than 100 kilometers (62 miles), and calves must be at least 14 days old for journeys lasting more than 8 hours.[554] The EU also addresses transport conditions, such as bedding and how long calves can be without food. Australia and New Zealand prohibit the transport of calves younger than 5 and 4 days of age, respectively.[555] Amendments to Part XII of Canada's *Health of Animals Regulations* that became effective in 2020 prohibit the sale of calves 8 days of age or younger via auction or assembly points.[556] In addition, they limit the transportation of any unweaned calves to 12 hours or less.[557] For a summary of these country's regulations, see Appendix B.

For decades, scientists and veterinarians have identified the transport of very young calves as a practice that causes a high level of stress and immunosuppression which contribute to the high rates of disease, death, and antimicrobial use and resistance seen in these calves in the immediate post-transport period.[558] Adopting the WOAH standard with regard to navel healing would help ensure that calves are more robust at the time of transport and decrease transport-associated risks to health and welfare. Because determining a calf's precise date of birth is not always possible under commercial conditions, the WOAH standard refers to stage of navel healing. In-depth research has been done to determine the calf age at which various stage of navel healing are attained.[559] A score of 4 (presence of a scab or granulation tissue on the umbilical wound) has been suggested as a minimum requirement for transporting calves in the European Union for up to 8 hours, as calves with this degree of healing are usually at least 10-14 days of age. However, given the distances neonatal calves are commonly transported in the U.S., requiring complete healing (scarring of the umbilical wound) would be ideal because it would minimize the risk that calves less than three weeks of age undergo

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[551] "As a mark of the close relationship between animal health and animal welfare, the OIE has become, at the request of its Member Countries, the leading international organisation for animal welfare." *Our Missions*, WORLD ORGANISATION FOR ANIMAL HEALTH (n.d.) https://www.woah.org/en/who-we-are/mission/

[552] WOAH, *Terrestrial Animal Health Code, Chapter 7.2, Transport of Animals by Sea* (2011); WOAH, *Terrestrial Animal Health Code, Chapter 7.3, Transport of Animals by Land*; WOAH, *Terrestrial Animal Health Code, Chapter 7.4, Transport of Animals by Air* (2011)

[553] For example, (EC) No 1/2005 applies to "the transport of live vertebrate animals carried out within the Community". The aim of the regulation is to prevent "injury or undue suffering" to animals during transport, to limit the length of transport of as far as possible, and "to safeguard the welfare and health of animals during and after transport".

[554] Roccaro et al. (2022), *supra* note 325; Roadknight et al. (2021a), *supra* note 45.

[555] Animal Health Australia (AHA), *Australian Animal Welfare Standards and Guidelines — Land Transport of Livestock,* SB4.1-4.8 (2012) *Code of Welfare—Transport within New Zealand*, pt 5, cl 5.2 (2018); *see also* Roadknight et al. (2021a), *supra* note 45.

[556] C.R.C c. 296 Health of Animals Regulations: Part XII Transport of Animals s.141, 143 (2022) (Can.); *see also* Wilson et al. (2020a), *supra* note 80.

[557] *Id*.

[558] Hulbert & Moisá (2016), *supra* note 45; Renaud & Pardon (2022), *supra* note 77.

[559] Roccaro et al. (2022), *supra* note 341.

prolonged transport. Requiring only a dry and shriveled navel would be inadequate, as nearly half of calves with this level of healing would be under 10 days of age.

Scientists and veterinarians have identified the transport of unfit cull animals as an extremely pressing issue affecting animal health and welfare.[560] Adopting the suggested fitness to travel standards would be an important step toward addressing these issues.

The USDA has recognized the WOAH criteria as sufficient to ensure fit animals are transported. When describing the proposed rule to adopt fitness requirements for export by sea in the federal register, it stated that the proposed regulation "would provide a list of conditions that make an animal unfit to travel. The list is not intended to be exhaustive or all-inclusive, but would cover the most common situations that we encounter."[561]

Above we have shown that the transport of neonatal calves with unhealed navels contributes to introduction and dissemination of disease and the proliferation of antibiotic resistant bacteria—a serious public health risk. We have similarly shown that the transport of cull animals who experience elevated stress levels because they are sick, injured, weak, disabled, fatigued, or have insufficient body condition for climatic conditions, increases the risk of disease spread and food safety concerns. The suggested fitness criteria are drawn directly from the WOAH code chapter on transport by land, and also cover situations that we have shown are commonly encountered in neonatal and cull animals.

Establishing fitness to travel requirements, through adoption of the selected WOAH standards, will make domestic transport regulations more consistent with the international export requirements of the U.S. and domestic transport standards of some of its largest trading partners.

B. Using CVIs as the Most Effective Enforcement Mechanism

Understanding reasons why producers and carriers transport unfit animals is useful in determining the most appropriate method for preventing the practice. First, a producer may choose to have an animal transported while unfit, or a carrier may choose to load an unfit animal inadvertently because they lack the knowledge, training, or guidance to recognize when an animal's physical state is such that they are unfit for the planned journey.[562] Second, producers and carriers may purposefully transport unfit animals because there is an economic incentive to do so.[563] This could be a matter of receiving money for the animal at slaughter, avoiding expenses associated with on-farm euthanasia and carcass disposal, and/or lacking infrastructure or desire to perform on-farm euthanasia.[564]

In both cases, an APHIS-accredited veterinarian (those that are licensed in the state where they practice and have received additional training and certification by APHIS to perform certain activities) armed with objective criteria and without a financial interest is in the best position to determine fitness. There is a fine line between a compromised animal (one at risk of becoming unfit)

[560] Donald Broom, *The Welfare of Livestock During Road Transport,* in LONG DISTANCE TRANSPORT AND WELFARE OF FARM ANIMALS 158-59 (Michael Appleby et al. eds, 2008).
[561] Exportation of Live Animals, Hatching Eggs, and Animal Germplasm From the United States, 80 FR 10398-10417 (proposed Feb 26, 2015) (codified at 9 C.F.R. §91).
[562] Dahl-Pedersen, K. et al. (2018) Lameness scoring and assessment of fitness for transport in dairy cows: Agreement among and between farmers, veterinarians and livestock drivers. *Res. in Veterinary Sci.*, 119:162–166. https://doi.org/10.1016/j.rvsc.2018.06.017
[563] White & Moore (2009), *supra* note 123.
[564] Edwards-Callaway et al. (2019), *supra* note 57.

and one that is unfit, and veterinarians are most suited to making such a determination. Thus, the USDA should institute a requirement for veterinary inspection and confirmation of fitness as a part of the issuance of a CVI. This is likely the simplest, most practical, and most effective method of enforcement. CVIs are familiar to USDA officials, carriers, producers, veterinarians, and state officials and are already widely used.

Presently, the use of CVIs is insufficient to prevent the transport of unfit animals. Under current regulations, accredited veterinarians are expected to use their professional judgment based on their training and experience to determine if any abnormality in physical condition or bodily function is suggestive of clinical signs of communicable disease before issuing a CVI. Yet, as explained above, there are indicators of poor fitness that are unrelated to active communicable disease but nevertheless have important implications for animal health and welfare, food safety, public health, and the nation's agricultural herds.

In attempting to analyze the interstate movement of farmed animals, the USDA Economic Research Service has identified several limitations of the current CVI requirements: 1) not all states require these certifications/permits, 2) transport of animals for immediate slaughter is typically excluded, and 3) inconsistency exists in how these forms are filed and what type of data is collected by the states.[565] Implementing a CVI requirement for all cull animals transported interstate will also ensure the USDA has the ability to track their interstate movements, which would make analyzing the potential for zoonotic disease spread significantly easier, as well as allowing for easier traceability and faster response in the event of a disease outbreak.

C. Responsible Parties

Transportation often coincides with changes in ownership and thus the party with responsibility for the animal's welfare can be unclear and complicated—especially in the case of neonatal calves and cull animals who pass through complex market structures of selling and reselling (see section V.D.1 above). Carriers (transport companies, vehicle owners, and drivers) are the party with the greatest control over planning and carrying out the journey in a manner that ensures the welfare of animals in their care. Producers and sellers are those with the greatest control over ensuring only animals that are physically fit enough to undertake the journey are loaded for transport.

In order to curb the practice of transporting animals known to be unfit, it is necessary to remove the financial incentive to do so. This would require levying fines of a sufficiently high amount to act as a deterrent, so that fines are not treated as a cost of doing business. After evaluating the method and effectiveness of the enforcement of EU transport laws by member states, the European Commission identified too low fines or too lenient sanctions as one of the immediate barriers to curbing the transport of unfit animals in the EU. [566]

Specifically in regard to cull animals, if the consequences of shipping unfit cull animals are great enough, carriers will refuse to load unfit animals, and producers will have incentive to make timely culling decisions and to increase infrastructure to perform on-farm euthanasia.

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[565] Shields & Mathews (2003), *supra* note 23, at 12, 18.

[566] DIRECTORATE-GENERAL FOR HEALTH AND FOOD SAFETY, EUROPEAN COMMISSION, OVERVIEW REPORT ON SYSTEMS TO PREVENT THE TRANSPORT OF UNFIT ANIMALS IN THE EU (2015).

D. Mitigation of Unintended Negative Consequences

If the regulations are adopted as we suggest, dairy producers who currently transport their calves across state lines and beyond 100 miles shortly after birth will be required to keep their calves on farm until their navels are healed—or find more local options. While large operations have the means to adjust calf rearing practices to comply with suggested regulation, it is likely that many smaller farmers will not have the infrastructure or means to build facilities to keep the calves for this additional period. This leads to an increased risk that producers will choose to kill otherwise healthy calves immediately on farm (potentially via unacceptable methods, such as blunt force trauma)[567] or offer inadequate care to calves for that period—both of which have significant implications for calf welfare. AWI suggests several possible steps to mitigate this risk.

First, the rule should carry a phase in period to allow producers time to prepare. During this phase in period, the USDA could offer subsidies, grants, or forgivable loans for producers to build on-farm infrastructure to care for calves for longer periods. Infrastructure might include on-site or nearby calf rearing facilities or retrofitting operations to permit rearing of calves by their dams.[568]

In addition to infrastructure, it is important to consider what is important to calf raisers purchasing calves from smaller farms. They desire healthy calves that have had good quality colostrum and some kind of preventive care. Raisers are likely to pay higher prices for healthy (heavier) calves, providing more income for dairy producers.[569] Educational initiatives to instruct producers on the importance of colostrum management and other aspects of calf care to ensure surplus calves are not neglected. In addition, government agency- or industry-led initiatives could be developed to promote direct sale of calves to buyers, thus reducing marketing of calves through livestock auctions and motivating dairy farmers to "maintain good relationships with direct calf buyers by supplying them with healthy calves."[570]

Given that the market for surplus calves is volatile and that the market price for calves is a good indicator of the care they will receive, producers should be encouraged to introduce greater use of beef genetics in breeding dairy cows so as to produce cross-bred calves with greater commercial value.[571] The phase in period will allow for farms to introduce new breeds and build up infrastructure; calf purchasers will have time to develop facilities to receive calves within major dairy producing states. The greater commercial value of healthier and/or crossbred calves could provide return on the investment into new facilities.

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[567] Bolton & von Keyserlingk (2021) *supra* note 279.

[568] Bertelsen, M., & Vaarst, M. (2023) Shaping cow-calf contact systems: Farmers' motivations and considerations behind a range of different cow-calf contact systems. *Journal of Dairy Sci.*, 106(11):7769–7785. https://doi.org/10.3168/jds.2022-23148; Eriksson, H. (2022) Strategies for keeping dairy cows and calves together - a cross-sectional survey study. *animal* 16(9):100624. https://doi.org/10.1016/j.animal.2022.100624 ; Johnsen, J. F. et al. (2021) Investigating cow-calf contact in cow-driven systems: behaviour of the dairy cow and calf. *J. of Dairy Res.*, *88*(1): 52–55. https://doi.org/10.1017/S0022029921000194; Johnsen, J. F. et al. (2016) Is rearing calves with the dam a feasible option for dairy farms?—Current and future research. *Applied Animal Behaviour Sci.*, 181:1–11. https://doi.org/10.1016/j.applanim.2015.11.011

[569] Marquou, et al. (2019) *supra* note 386; Wilson, et al. (2020c) *supra* note 385.

[570] Creutzinger et al. (2021), *supra* note 279.

[571] *Id*.

IX. PROPOSED REGULATION AND/OR POLICY CHANGE

We recommend that a new section be added to 9 C.F.R. Part 71:

(a) Except as provided in paragraph (c) of this section, no person or entity, including an owner, buyer, seller, dealer, or carrier shall cause a vulnerable animal to be transported interstate if it:
  (1) is sick, injured, weak, disabled or fatigued;
  (2) has an unhealed navel; or
  (3) has a body condition that would result in poor welfare because of the expected climatic conditions.

(b) The interstate movement of vulnerable animals is prohibited except when the animals are accompanied by an ICVI as provided in 9 C.F.R. § 86.5.

(c) This section shall not apply to:
  (1) animals not transported beyond the state of origin
  (2) animals transported directly for veterinary care
  (3) animals whose entire journey will not exceed 100 miles

(d) Violations
  (1) The Secretary is authorized to assess civil penalties of up to $5,000 per violation of any of the regulations in this part.
  (2) Each animal transported in violation of this section will be considered a separate violation.

"Vulnerable animal" means any neonatal livestock (as defined in 9 C.F.R. § 91.1) or any cow, pig, sheep, or goat used for breeding or milk production that is removed from the productive herd. This definition should be added to 9 C.F.R. § 71.1.

Also, 9 C.F.R. § 86.5 *Documentation requirements for interstate movement of covered livestock*, should be amended to require CVIs for all vulnerable animals shipped interstate, consistent with the above.

In addition to the proposed regulation above, AWI suggests that the USDA consider additional rulemaking or guidance to ensure the health and welfare of animals and to ensure the proposed regulation is adequately enforced.

- The USDA should engage in a stakeholder discussion with producers to determine the best way to ensure those cull animals not sent directly to slaughter remain fit throughout the entire marketing process. Because of the high probability that the welfare of cull animals that pass through auctions will deteriorate (and thus they may be judged fit for transport to the auction, but not at subsequent stops), the USDA should consider guidance or rulemaking requiring the fitness of animals be specifically assessed at approved livestock facilities (regulated in §§ 9 C.F.R. 71.4-.7).
- The USDA may consider implementing protocols similar to those used in Canada, where officials who identify unfit animals are authorized to take measures to prevent unnecessary suffering, including immediate euthanasia, or transport directly to the closest plant for slaughter.[572]

[572] C.R.C c. 296 Health of Animals Regulations: Part XII Transport of Animals s.139.2 (2022) (Can.).

If APHIS determines that it lacks authority to adopt the suggested regulatory language in its entirety, AWI encourages it to adopt whatever portion APHIS believes it has authority for in order to mitigate the immediate risks of the transport of unfit vulnerable animals.

X. CONCLUSION

As described above, there is ample evidence that significant numbers of unfit vulnerable farmed animals are transported interstate regularly. This transport can result in negative impacts to animal health and welfare, food safety, and public health. There are no federal laws or regulations addressing the fitness of animals or prohibiting the domestic transport of those that are unfit. Accordingly, AWI urges the USDA to 1) establish fitness standards for interstate transport of vulnerable animals, 2) require certificates of veterinary inspection for interstate transport of vulnerable animals, and 3) assess penalties for violations of the rules.

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APPENDIX A

Transport Mortality and Losses of "Bob Veal" Calves Shipped Interstate for Slaughter

For more than 18 months, USDA Food Safety and Inspection Service (FSIS) inspection personnel at the Ida Meats (M46433) slaughter plant in Rupert, Idaho, documented the mortality of "bob veal" calves transported from California. FSIS records report the number and percent of calves dead upon arrival and the number and percent euthanized as non-ambulatory, disabled (NAD). Ambient temperatures on arrival were also noted but not the distance travelled by the calves or the number of hours in transit. Although the identity and location of the supplier is withheld by FSIS, it is likely that the animals were transported 9 to 12 hours from the point of collection to the slaughter plant.

Date	Transport Mortality	NAD Condemned	Total Transport Losses	Ambient Temperature
3/16/2022	10.0%	Not reported	Not reported	58º F
3/28/2022	13.7%	Not reported	Not reported	51 F
4/4/2022	26.5%	Not reported	Not reported	38 F
4/7/2022	13.9%	Not reported	Not reported	29 F
4/11/2022	15.9%	Not reported	Not reported	32 F
4/14/2022	13.0%	Not reported	Not reported	31 F
4/18/2022	14.1%	Not reported	Not reported	41 F
4/25/2022	12.7%	Not reported	Not reported	37 F
5/9/2022	15.3%	Not reported	Not reported	42 F
5/19/2022	8.0%	Not reported	Not reported	57 F
5/23/2022	15.0%	Not reported	Not reported	35 F
5/26/2022	10.8%	Not reported	Not reported	66 F
6/27/2022	21.0%	Not reported	Not reported	54 F
6/30/2022	7.1%	Not reported	Not reported	64 F
7/4/2022	11.0%	Not reported	Not reported	61 F
7/7/2022	8.4%	Not reported	Not reported	64 F
7/11/2022	10.4%	Not reported	Not reported	61 F
7/14/2022	20.0%	Not reported	Not reported	71 F
7/18/2022	17.0%	Not reported	Not reported	73 F
7/21/2022	11.7%	Not reported	Not reported	63 F
7/25/2022	13.3%	Not reported	Not reported	64 F

7/28/2022	14.5%	Not reported	Not reported	62 F
8/1/2022	15.7%	Not reported	Not reported	73 F
8/4/2022	11.5%	Not reported	Not reported	68 F
8/18/2022	22.1%	Not reported	Not reported	64 F
9/5/2022	20.9%	Not reported	Not reported	58 F
9/8/2022	29.0%	Not reported	Not reported	64 F
9/12/2022	15.8%	Not reported	Not reported	50 F
9/15/2022	7.7%	Not reported	Not reported	61 F
9/19/2022	11.7%	Not reported	Not reported	Not reported
9/22/2022	6.1%	Not reported	Not reported	51 F
9/26/2022	10.4%	Not reported	Not reported	44 F
9/29/2022	10.4%	Not reported	Not reported	66 F
10/17/2022	11.9%	4.0%	15.9%	43 F
10/20/2022	13.3%	3.4%	16.7%	37 F
10/24/2022	11.2%	11.7%	22.9%	33 F
10/27/2022	9.1%	4.0%	13.1%	31 F
10/31/2022	11.7%	6.8%	18.5%	41 F
11/3/2022	12.4%	3.1%	15.5%	36 F
11/7/2022	8.9%	3.9%	12.8%	31 F
11/10/2022	14.5%	11.5%	26.0%	27 F
11/14/2022	10.3%	4.3%	14.6%	23 F
11/17/2022	11.4%	7.0%	18.4%	15 F
11/21/2022	17.5%	5.5%	23.0%	18 F
11/25/2022	16.9%	10.2%	27.1%	26 F
11/28/2022	9.9%	5.9%	15.8%	33 F
12/1/2022	9.8%	7.3%	17.1%	40 F
12/5/2022	11.0%	9.6%	20.6%	37 F
12/8/2022	9.9%	4.5%	14.4%	23 F
12/12/2022	11.1%	11.1%	22.2%	31 F
12/19/2022	11.1%	11.7%	22.8%	2 F

12/22/2022	11.3%	6.9%	18.2%	-2 F
2/6/2023	17.2%	5.6%	22.8%	23 F
2/9/2023	9.0%	6.0%	15.0%	28 F
2/13/2023	7.8%	0.0%	7.8%	Not reported
2/16/2023	12.4%	6.7%	19.1%	29 F
2/21/2023	12.3%	2.0%	14.3%	27 F
2/23/2023	12.2%	5.6%	17.8%	9 F
2/28/2023	17.9%	6.0%	23.9%	28 F
3/2/2023	13.1%	0.0%	13.1%	31 F
3/7/2023	14.6%	4.9%	19.5%	16 F
3/30/2023	17.8%	0.0%	17.8%	37 F
4/1/2023	18.5%	0.0%	18.5%	41 F
4/4/2023	19.6%	4.9%	24.5%	32 F
4/6/2023	17.2%	4.5%	21.7%	29 F
4/8/2023	13.2%	0.0%	13.2%	38 F
4/11/2023	11.9%	5.3%	17.2%	42 F
4/13/2023	11.7%	16.7%	28.4%	29 F
4/15/2023	21.5%	3.4%	24.9%	36 F
5/2/2023	7.0%	10.2%	17.2%	41 F
5/4/2023	5.9%	10.7%	16.6%	36 F
5/9/2023	4.0%	7.4%	11.4%	38 F
5/11/2023	5.0%	11.7%	16.7%	41 F
5/20/2023	8.3%	9.2%	17.5%	51 F
5/23/2023	6.9%	8.3%	15.2%	54 F
5/25/2023	5.4%	3.8%	9.2%	48 F
5/27/2023	7.9%	9.9%	17.8%	53 F
5/30/2023	10.0%	7.0%	17.0%	54 F
6/2/2023	7.3%	4.5%	11.8%	55 F
6/3/2023	9.2%	12.6%	21.8%	52 F
6/6/2023	6.2%	9.0%	15.2%	51 F

6/8/2023	8.0%	8.0%	16.0%	55 F
6/10/2023	10.2%	12.0%	22.2%	55 F
6/13/2023	6.5%	7.9%	14.4%	56 F
6/15/2023	8.3%	10.0%	18.3%	52 F
6/17/2023	8.0%	10.3%	18.3%	54 F
6/20/2023	6.2%	8.2%	14.4%	46 F
6/22/2023	7.3%	8.2%	15.5%	46 F
6/24/2023	6.1%	6.1%	12.2%	52 F
6/27/2023	7.3%	9.1%	16.4%	54 F
6/29/2023	9.0%	9.7%	18.7%	52 F
7/1/2023	7.3%	14.6%	20.9%	56 F
7/4/2023	8.0%	10.0%	18.0%	56 F
7/6/2023	6.9%	8.3%	15.2%	54 F
7/11/2023	12.7%	14.8%	27.5%	62 F
7/13/2023	6.6%	9.8%	16.4%	61 F
7/18/2023	17.0%	11.0%	28.0%	64 F
7/20/2023	20.0%	8.0%	28.0%	64 F
7/22/2023	19.0%	0.0%	19.0%	63 F
7/25/2023	26.0%	0.0%	26.0%	64 F
7/27/2023	23.1%	0.0%	23.1%	66 F
8/1/2023	15.3%	6.0%	21.3%	61 F
8/3/2023	16.8%	6.0%	22.8%	63 F
8/5/2023	10.3%	4.9%	15.2%	65 F
8/8/2023	15.7%	5.6%	21.3%	54 F
8/10/2023	14.0%	6.1%	20.1%	64 F
8/12/2023	11.5%	5.8%	17.3%	65 F
8/15/2023	14.4%	5.0%	19.4%	66 F
8/17/2023	16.5%	8.7%	25.2%	65 F
8/19/2023	13.9%	8.6%	22.5%	64 F
8/22/2023	16.4%	9.2%	25.6%	Not reported

8/24/2023	11.6%	5.2%	16.8%	Not reported
8/29/2023	0.0%	12.3%	12.3%	Not reported
8/30/2023	8.4%	5.4%	13.8%	Not reported
8/31/2023	10.3%	5.6%	15.9%	Not reported
9/7/2023	0.0%	4.8%	4.8%	57 F
9/9/2023	15.3%	7.6%	22.9%	62 F
9/12/2023	12.7%	7.0%	19.7%	63 F
9/14/2023	14.1%	7.0%	21.1%	52 F
9/16/2023	11.7%	3.3%	15.0%	54 F
9/20/2023	14.7%	7.3%	22.0%	49 F

Mean/Range
Transport mortality: **12.3%** (0.0% - 29.0%)
Non-ambulatory, disabled (NAD) condemned: **6.9%** (0.0% - 16.7%)
Total transport loss: **18.5%** (4.8% - 29.0%+)
Temperature: **46.8^{0} F** (-2^{0} F to 73^{0} F)

Source
USDA Food Safety and Inspection Service, Livestock Humane Handling Inspection Task Data, available at https://www.fsis.usda.gov/science-data/data-sets-visualizations/inspection-task-data.

Appendix B

Country Comparison of Requirements for Transport of Neonatal Calves

Australia	Canada	European Union	New Zealand	United States
Summary: restrictions on length and nature of transport based on age; requirements for conditions of transport based on age	**Summary: restrictions on length and nature of transport based on age; requirements for conditions of transport based on age**	**Summary: prohibition on transport of very young calves based on navel healing; restrictions on length of transport; requirements for conditions of transport based on age**	**Summary: prohibition on transport of very young calves; restrictions on transport times and requirements for conditions of transport**	**Summary: no age-specific requirements; prohibition on transport of any animal over 28 hours**
Minimum age: none	**Minimum age**: none	**Minimum age**: 10 days old or a "completely healed navel" excluding those transported less than 100 km	**Minimum age**: 4 days old	**Minimum age**: none
Maximum transport time: *6 hours* (calves under 5 days old); *12 hours* (calves 5–30 days old)	**Maximum transport time**: *12 hours* including loading/unloading (all ruminants too young to be fed exclusively on hay or grain)	**Maximum transport time:** *8 hours* (calves 14 days old and under); *17 hours* (calves over 14 days old)	**Maximum transport time**: 12 hours (calves up to 14 days old)	**Maximum transport time**: *28 hours* before required to unload for feed, water, and rest; this can be extended to *36 hours* with permission by phone
General fitness requirements: Yes	**General fitness requirements**: Yes[1]	**General Fitness requirements:** Yes	**General fitness requirements**: Yes	**General fitness requirements**: No
Specific requirements: Calves under 5 days old: - cannot be sold through sale yards (must go directly to calf-rearing facility) - must be fed within 6 hours before loading - must be provided bedding and room for all animals	**Specific requirements:** Calves 8 days old and under: - can only be transported once (no assembly centers or auction markets) - must be loaded individually without having to use ramps	**Specific requirements:** Calves over 14 days old if transported more than 8 hours: - must be given 1 hour to be fed and rested after the first 8 hours and then can be transported a further 9 hours	**Specific requirements:** Calves under 14 days old: - can only be transported once - must be free from signs of any injury, disease, disability, or impairment that could compromise the welfare during the journey	**Specific requirements:** None

to lie down at the same time Calves between 5 and 30 days old: - must be transported in a way that protects from heat and cold - must be in good health, alert, and able to rise from a lying position - must have been fed milk or milk replacer within 6 hours of loading and be assembled and transported to ensure delivery in less than 18 hours from last feed, with no more than 12 hours spent on transports All calves under 30 days old must have sufficient space in the trailer to lie down on their sternums.	- must have room to lie down without lying on top of another animal - must take measures to prevent suffering, injury, or death during transport (for example, bedding, ventilation, protection from cold) - must be provided feed, water, and rest 12 hours after they were last provided feed, water, and rest General requirements for ventilation and temperature monitoring and regulation are applicable to all animals. [1] Note: animals with an "unhealed or infected navel" are defined as unfit for transport. However, regulation guidance indicates that "unhealed" is not considered a restriction on minimum age, as compared with EU regulation, which requires a "completely healed navel."	- must have access to water within the transport vehicle All calves must be provided bedding, and stocking density cannot exceed 0.30-0.04m^2/ 50 kg animal. General requirements for ventilation and for temperature monitoring and regulation are applicable to all animals.	- must be alert and able to rise from a lying position, stand and bear weight evenly on all four limbs, and move freely - must be able to protect themselves from being trampled or otherwise injured by other calves - must be provided ventilation, bedding, and adequate protection from adverse weather (including precipitation) - must have room to stand up and lie down in a natural posture General requirements for ventilation, and temperature monitoring and regulation are applicable to all animals.	