NO. 21-468

IN THE

Supreme Court of the United States

NATIONAL PORK PRODUCERS COUNCIL, ET AL.,

Petitioners,

v.

KAREN ROSS, IN HER OFFICIAL CAPACITY AS SECRETARY OF THE CALIFORNIA DEPARTMENT OF FOOD & AGRICULTURE, ET AL.,

Respondents.

On Writ of Certiorari to the United States Court of Appeals for the Ninth Circuit

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BRIEF OF AMERICAN PUBLIC HEALTH ASSOCIATION, INFECTIOUS DISEASES SOCIETY OF AMERICA, CENTER FOR FOOD SAFETY, ET AL. AS *AMICI CURIAE* IN SUPPORT OF RESPONDENTS

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INTERESTS OF *AMICI CURIAE*[1]

The American Public Health Association ("APHA") champions the health of all people and all communities; strengthens the profession of public health; shares the latest research and information; promotes best practices; and advocates for public health issues and policies grounded in scientific research. APHA represents more than 22,000 individual members and is the only organization that combines a 150-year perspective, a broad-based member community, and the ability to influence federal policy to improve the public's health.

The Infectious Diseases Society of America ("IDSA") represents a community of over 12,000 physicians, scientists, public health experts, and other health professionals who specialize in infectious diseases ("ID") medicine. IDSA members work across a variety of healthcare settings, including hospitals, academic medical centers, clinical laboratories, and public health departments.

IDSA advocates on behalf of its membership and the infectious diseases community on ID issues related to public health, global health, diagnostics, and clinical guidelines. IDSA has been highly involved in efforts to combat the growing threat of antimicrobial resistance ("AMR") and considers AMR an organizational strategic priority. The organization provides guidance on the treatment of antibiotic resistant infections and advocates for AMR interventions. Additionally, IDSA

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[1] No party or counsel for a party authored this brief in whole or in part. No party, counsel for a party, or person other than *amici curiae* or their counsel made any monetary contribution intended to fund the preparation or submission of this brief. All parties have consented to this brief's filing.

has supported efforts to combat antibiotic usage in animal agriculture as an essential component of preventing and reducing AMR emergence.

The Center for Food Safety ("CFS") is a 501(c)(3) non-profit consumer advocacy organization that empowers people, supports farmers, and protects the earth from the harmful impact of industrial agriculture. Through legal, scientific, and grassroots action, CFS protects and promotes the public's right to safe food. CFS has over one million members nationwide, including more than one hundred thousand in California.

Since 2009, CFS's industrial animal agriculture program has developed expertise and multifaceted strategies on addressing the known impacts of intensive animal confinement on food safety and public health. This overlaps two program areas: (1) work to halt the practices of concentrated animal feeding operations; and (2) to improve consumer awareness and knowledge of these practices, through labeling and other means of transparency. Proposition 12 is crucial to CFS's mission.

The Consumer Federation of America ("CFA") is an association of non-profit consumer organizations established in 1968 to advance the consumer interest through research, advocacy, and education. Through its Food Policy Institute, CFA conducts research and advocacy to promote a safer, healthier, and more affordable food supply. CFA also coordinates the Safe Food Coalition, which is dedicated to reducing the burden of foodborne illness in the U.S. by improving government food inspection programs.

Food & Water Watch ("FWW") is a 501(c)(3) non-profit organization working to create a heathy future for all people and generations to come—a world where everyone has food they can trust, clean drinking water and a livable climate. FWW mobilizes regular people to build political power to move solutions to the most pressing food, water, and climate problems of our time. FWW works with and advocates for small family farms and ranches against corporate control and abuse of food and water resources.

Dr. Gail Hansen, DVM, MPH is the current chair of the National Academy of Science Engineering and Medicine's One Health Action Collaborative. She has worked nationally and internationally with government agencies, universities, non-government organizations, and industry on public health policy and One Health.[2] She has published on antibiotic resistance related to food, animals, and the connection between antibiotic use in agriculture and resistant human infections. She was the state public health veterinarian and epidemiologist for the Kansas Department of Health and Environment from 1996-2008, has served in local and national organizations and in private veterinary practices, and testified before the U.S. House Committee on Energy and

[2] One Health is an integrated, unifying approach that aims to sustainably balance and optimize the health of people, animals and ecosystems. It recognizes the health of humans, domestic and wild animals, plants, and the wider environment (including ecosystems) are closely linked and inter-dependent. *Tripartite and UNEP support OHHLEP's definition of "One Health"*, World Health Org. ("WHO") (Dec. 1, 2021), https://www.who.int/news/item/01-12-2021-tripartite-and-unep-support-ohhlep-s-definition-of-one-health.

Commerce, Subcommittee on Health concerning antibiotic resistance from the use of antibiotics in food animals.

Dr. Joann Lindenmayer, DVM, MPH, Honorary Diplomate of the American Veterinary Epidemiology Society, is Associate Professor of Public Health, adjunct, in the Department of Public Health and Community Medicine, Tufts University School of Medicine; and Northeast Director of the Evidence-Based Veterinary Medical Association. Dr. Lindenmayer is the immediate past Chair of the Board of Directors, One Health Commission and is an alumnus of the Centers for Disease Control and Prevention's ("CDC") Epidemic Intelligence Service, served as an epidemiologist in the state health departments of Massachusetts, Vermont and Rhode Island, and is a former Track Director of the combined DVM-MPH Program at Tufts University Schools of Medicine and Cummings School of Veterinary Medicine.

Dr. Indu Mani, DVM, DSc has a Doctor of Veterinary Medicine degree from Colorado State University and a Doctor of Science degree from the Harvard T.H. Chan School of Public Health. Dr. Mani has published multiple peer-reviewed articles about zoonotic infectious diseases. She is a member of the One Health Initiative Advisory Board (Hon).

Dr. Kenneth E. Nusbaum, DVM, PhD, is Professor Emeritus of the College of Veterinary Medicine at Auburn University, Department of Pathobiology. Dr. Nusbaum is an educator in the fields of zoonotic and foreign animal disease, biosecurity, and healthcare, specializing in viral diseases of domestic and economically important animals and emergent zoonoses.

SUMMARY OF ARGUMENT

The undersigned *amici* are public health organizations and professionals working to promote awareness and address the effects of intensive animal confinement on food safety and public health. This brief describes how, contrary to Petitioners' allegations, Proposition 12's restrictions on the sale of pork derived from the intensive confinement of sows in gestation crates protect the health and safety of Californians. *See* Pet. Br. 11-14, 41-43.

Substantial scientific research demonstrates that the intensive confinement of sows in gestation crates threatens the health and safety of consumers in the U.S., and in California in particular. Specifically, the research shows that:

(1) Intensive confinement prevents sows from moving freely and performing almost all natural behaviors, inducing high levels of stress. That stress triggers a physiological response that severely suppresses the sows' immune function and that of their piglets, making the sows and their piglets more susceptible to disease.

(2) The physiological response to stress also facilitates the growth of pathogens in the confined sows and increases the likelihood that they will transmit diseases to their piglets, for example via pathogens excreted in their waste.

(3) Pathogen-infected piglets often do not exhibit any symptoms, meaning that infectious diseases will persist in the piglets through slaughter without detection, resulting in pork products contaminated with pathogens carried by piglets.

> (4) Contaminated pork products sold in U.S. retail stores have been traced to pigs carrying infectious diseases, and the consumption of such products sickens hundreds of thousands of Californians annually.
>
> (6) Pathogens that contaminate pork products are increasingly antibiotic resistant, exacerbating the human health risks associated with foodborne illness.

Moreover, pigs are "ideal mixing vessels" for various strains of influenza virus, including human influenza. Intensive confinement increases the chances that a strain of influenza carried by pigs will "jump" to humans. California has a strong interest in protecting its citizens from another public health crisis, like the 2009 H1N1 swine flu pandemic which killed thousands in the U.S., and during which the first U.S. cases were detected in California.

Proposition 12 addresses these risks to food safety and public health by restricting the sale of pork products in California produced using such intensive confinement practices. More space reduces stress in sows, which mitigates the cascade of stress-related negative health impacts on the sows and their piglets destined for slaughter—which, ultimately, reduces risk to California's food safety and public health.

The judgment of the Ninth Circuit Court of Appeals should be affirmed.

ARGUMENT

I. THE INTENSIVE CONFINEMENT OF SOWS POSES A PROFOUND DANGER TO FOOD SAFETY AND PUBLIC HEALTH IN CALIFORNIA

In the U.S., many breeding sows are intensively confined in individual gestation crates that prevent them from even turning around, let alone perform natural behaviors such as exploring and foraging or even avoiding neighboring sows to resolve conflict.[3] *See* Pet. Br. at 9. The facilities that house these sows generate enormous amounts of manure, urine, and other waste, which carry infectious viruses and, often antibiotic-resistant, bacteria[4] that spread disease among the intensively-confined sows and their offspring destined for slaughter. Contaminated pork products derived from the piglets of intensively-confined sows can infect humans through, *inter alia*,

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[3] *See* Pew Comm'n Indus. Farm Animal Prod., *Putting Meat on the Table: Industrial Farm Animal Production in America* at 85 (Apr. 29, 2008) *available at* https://www.pewtrusts.org/en/research-and-analysis/reports/0001/01/01/putting-meat-on-the-table ("Pew2008"); Verena Grün et al., *Influence of Different Housing Systems on Distribution, Function and Mitogen-Response of Leukocytes in Pregnant Sows*, 3 ANIMALS 1123, 1123 (2013) ("Grün2013").

[4] *See* Dana Cole et al., *Concentrated Swine Feeding Operations and Public Health: A Review of Occupational and Community Health Effects*, 108 ENVTL. HEALTH PERSPECTIVES 685, 685-88 (2000) *available at* https://www.ncbi.nlm.nih.gov/pmc/articles/PMC1638284/ ("Cole").

contact with or ingestion of contaminated meat and transmission from other infected humans.[5]

A. Intensive Confinement of Sows Is Directly Linked to Contaminated Pork, A Major Source of Foodborne Illness in the U.S. and California

Consumption of contaminated pork is a documented source of foodborne illness in the U.S. and California. In 2013, the CDC estimated that in the U.S. approximately 525,000 illnesses, 2,900 hospitalizations, and 82 deaths are attributed to pork consumption annually.[6] In 2020, the annual number of foodborne illnesses in the U.S. attributable to pork consumption had increased to 787,000, with the largest share attributable to pork—even more than beef or chicken.[7] Of particular relevance to Proposition 12, between 1998 and 2015, California had the second-highest number of foodborne illness outbreaks attributable to pork consumption of any single state—not including multi-state outbreaks.[8]

The increasing presence of antimicrobial-resistant pathogens in pork products exacerbates the risks of foodborne illness. Antibiotic-resistant infections are

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[5] *See* Cole at 685-88, 691-94.

[6] John A. Painter et al., *Attribution of Foodborne Illnesses, Hospitalizations, and Deaths to Food Commodities by using Outbreak Data, United States, 1998-2008*, 19 EMERGING INFECTIOUS DISEASES 407, 410-13 (2013).

[7] Robert L. Scharff, *Food Attribution and Economic Cost Estimates for Meat- and Poultry-Related Illnesses*, 83 J. FOOD PROTECTION 959, 964 (2020) ("Scharff").

[8] J.L. Self et al., *Outbreaks attributed to pork in the United States, 1998-2015*, 145 EPIDEMIOL INFECT. 2980, 2986 (2017) ("Self").

more difficult and more expensive to treat, costing the U.S. healthcare sector billions and causing the deaths of more than 35,000 Americans annually.[9] In 2022, the U.S. Food and Drug Administration ("FDA") reported that 89% and 76% of studied pork production facilities administered medically-important antibiotics and other antimicrobial drugs in feed and water, respectively, to their pigs—not only to treat illness but also to promote growth and increase feed efficiency.[10] Such extended exposure of bacteria to antibiotics facilitates the selection of mutations that cause antibiotic resistance, as non-resistant bacteria are killed off.[11]

Contrary to Petitioners' allegations, neither "[i]ndustry action and federal inspection" nor

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[9] CDC, *Antibiotic Resistance Threats in the United States, 2019* at vii, Section 4 (2019) *available at* https://www.cdc.gov/drugresistance/pdf/threats-report/2019-ar-threats-report-508.pdf; Ctr. For Veterinary Medicine, FDA, *Antimicrobial Use and Resistance in Animal Agriculture in the United States, 2016-2019, Summary Report* at 11-12 (June 2022) *available at* https://www.fda.gov/media/159544/download ("FDA2022"). Antibiotic resistance is a type of antimicrobial resistance in which bacteria become resistant to antibiotics through random genetic mutations or by one species of bacteria acquiring resistance from another. *About Antibiotic Resistance*, CDC (Dec. 13, 2021), https://www.cdc.gov/drugresistance/about.html; FDA2022 at 111; *Antimicrobial resistance*, WHO (Jul. 27, 2017), https://www.who.int/news-room/q-a-detail/antimicrobial-resistance.

[10] FDA2022 at 97-98.

[11] *See* Leslie Pray, *Antibiotic Resistance, Mutation Rates, and MRSA*, 1 NATURE ED. 30 (2008) *available at* https://www.nature.com/scitable/topicpage/ antibioticresistance-mutation-rates-and-mrsa-28360/ ("Pray"); FDA2022 at 11-12.

"geographic and temporal separation of sows from pigs" mitigate the risk of foodborne illness attributable to pork consumption. S*ee* Pet. Br. at 13, 42-43. As detailed below, the intensive confinement of sows in gestation crates weakens the immune function of the sows and their piglets destined for slaughter. This facilitates the spread of disease from sows to their piglets. Once infected, the piglets often do not show symptoms of illness, and thus become undetected vectors of disease as they are transported to various stages of the pork production process and, ultimately, to slaughter. As a result, the intensive confinement of sows threatens the safety of pork products sold in U.S. grocery stores, including in California.

1. *Intensively-Confined Sows Experience Severe Stress, Which Suppresses Their Immune Function And Facilitates the Growth And Increased Virulence Of Pathogens In Their Bodies*

Numerous studies demonstrate that intensive confinement of sows in gestation crates—in which they are unable to turn around or perform almost all natural behaviors—induces severe stress in the sows, which in turn severely impairs their immune function and makes them more susceptible to disease. Crated sows have significantly higher levels of the stress hormones adrenaline and noradrenaline[12] compared

[12] Noradrenaline is a neurotransmitter that generates the "fight or flight" response. It induces the adrenal gland to release adrenaline. *See Epinephrine (Adrenaline)*, Cleveland Clinic (Mar. 27, 2022), https://my.clevelandclinic.org/health/articles/22611-epinephrine-adrenaline.

to group-housed sows.[13] The release of these stress hormones—a physiological response to stress—can have immunosuppressive effects.[14] Other studies show that crated sows, compared to group-housed sows, experience a significant decrease in the expression of 90 immune response genes,[15] decreased white blood cell count,[16] lower levels of antibodies that fight against foreign cells,[17] and significantly lower levels of indicators that show whether white blood

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[13] Yongdae Jeong et al., *Improving behavior characteristics and stress indices of gestating sows housed with group housing facility*, 62 J. ANIMAL SCI. & TECH. 875, 875 (2020); Xin Liu et al., *A Comparison of the Behavior, Physiology, and Offspring Resilience of Gestating Sows When Raised in a Group Housing System and Individual Stalls*, 11 ANIMALS Art. No. 2076 at 7 (2021) ("Liu").

[14] Lena Reiske et al., *Interkingdom Cross-Talk in Times of Stress:* Salmonella *Typhimurium Grown in the Presence of Catecholamines Inhibits Porcine Immune Functionality in vitro*, 11 FRONTIERS IN IMMUNOLOGY Art. No. 572056 at 1 (Sept. 2020) ("Reiske").

[15] Rossana Capoferri et al., *Comparison between Single- and Group-housed Pregnant Sows for Direct and Indirect Physiological, Reproductive, Welfare Indicators, and Gene Expression Profiling*, 24 J. APPLIED ANIMAL WELFARE SCI. 246, 253-57 (2021).

[16] Grün2013 at 1130; Guillermo A.M. Karlen et al., *The welfare of gestating sows in conventional stalls and large groups in deep litter*, 105 APPLIED ANIMAL BEHAVIOUR SCI. 87, 98 (2007); J.L. Salak-Johnson et al., *Space allowance for gestating sows in pens: Behavior and immunity*, 90 J. ANIMAL SCI. 3232, 3232 (2012).

[17] H.S. Siegel, *Effects of Intensive Production Methods on Livestock Health*, 8 AGRO-ECOSYSTEMS 215, 224 (1983).

cells are generating an immune response[18]—all indicative of impaired immune function. Indeed, a 2014 study of crated and group-housed sows showed that gestation crates affected crated sows' adaptive immunity, indicating that crated sows "might show an inadequate immune response in case of viral infections."[19]

Stress in intensively confined sows has also been found to increase the growth and virulence of the pathogens pigs commonly carry.[20] Stress hormones stimulate the growth of pathogens commonly found in pigs and pork products such as *Campylobacter*, *Salmonella*, *Yersinia*, *Listeria*, and *Staphylococcus aureus*.[21] Moreover, the presence of stress hormones actually *increases the virulence* of certain pathogens.

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[18] Michał Kulok et al., *Effect of lack of movement in sows during pregnancy period on cortisol, acute phase proteins and lymphocytes proliferation level—a pilot study*, BERLIN & MUNICH VETERINARY WEEKLY at 1 (Nov. 2017) ("Kulok2017").

[19] Verena Grün et al., *Characterization of the adaptive immune response following immunization in pregnant sows (*Sus Scrofa*) kept in two different housing systems*, 92 J. ANIMAL SCI. 3388, 3396 (2014); *see also* Kulok2017 at 1 ("[M]ovement restriction of pregnant sows in gestation crates stimulated several stress responses indicating compromised welfare and impaired immune response.").

[20] J.M. Lyte & M. Lyte, *Review: Microbial endocrinology: intersection of microbiology and neurobiology matters to swine health from infection to behavior*, 13 ANIMAL 2689, 2689 (2019).

[21] T.A. Cogan et al., *Norepinephrine increases the pathogenic potential of* Campylobacter jejuni, 56 GUT 1060, 1060 (2006) ("Cogan"); *see also* Amine Mohamed Boukerb et al., *Inter-Kingdom Signaling of Stress Hormones: Sensing, Transport and Modulation of Bacterial Physiology*, 12 FRONTIERS IN MICROBIOLOGY Art. No. 690942 at 3, 7 (Oct. 2021) ("Boukerb").

For example, a 2020 study demonstrated that *Salmonella* grown in the presence of adrenaline and noradrenaline appear to alter their environment to promote their own growth in their host, likely by producing substances that further suppress the host's immune response.[22] Noradrenaline has also been found to increase fecal excretion and the virulence of *Salmonella* in pigs.[23] Similarly, *Campylobacter* grown in the presence of noradrenaline has been shown to have increased virulence[24] and improved ability to survive oxygen exposure—making the bacteria a greater threat to food safety.[25]

2. *Piglets Born To Intensively Confined Sows Are More Likely To Have Suppressed Immune Function*

Piglets born to intensively confined mothers have suppressed immune function compared to piglets born to group-housed mothers, making them more susceptible to pathogens and disease transmitted from their mothers.

In one study published in 2021, pregnant sows randomly assigned to gestation crates for the duration

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[22] Reiske at 3.

[23] Gillian D. Pullinger et al., *6-hydroxydopamine-mediated release of norepinephrine increases faecal excretion of* Salmonella enterica *serovar Typhimurium in pigs*, 41 VETERINARY RES. 68, at 1 (2010).

[24] Cogan at 1064.

[25] Jae-Ho Guk et al., *Hyper-Aerotolerant* Campylobacter coli *From Swine May Pose a Potential Threat to Public Health Based on Its Quinolone Resistance, Virulence Potential, and Genetic Relatedness*, 12 FRONTIERS IN MICROBIOLOGY 703993 at 1-2 (Jul. 2021) ("Guk").

of their pregnancies had consistently higher levels of stress hormones in their blood than group-housed sows.[26] Piglets born to the crated sows also had higher stress hormones in their blood than piglets of group-housed sows.[27] To model illness, randomly selected piglets were injected with a component bacteria commonly used to stimulate a body's immune system for immune stress tests.[28] After several hours of temperature monitoring, the piglets of group-housed sows were found to have experienced a shorter period of fever *and* a faster recovery compared to piglets of crated sows, leading the authors to conclude that piglets of group-housed sows "had better resistance and resilience, which showed that these piglets were healthier" than piglets of crated sows.[29]

Similarly, in a second study published in 2021, piglets of sows intensively confined in gestation crates for the first hundred days of their pregnancies were found to have significantly higher levels of stress hormones than piglets of group-housed sows, particularly in the first few days of life.[30] Moreover, piglets of crated sows were found to have decreased immune response indicators compared to piglets of

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[26] Liu at 2-5.

[27] *Id.* at 7.

[28] *Id.*

[29] *Id.* at 5-7.

[30] M. Kulok et al., *The effects of lack of movement in sows during pregnancy period on cortisol, acute phase proteins and lymphocytes proliferation level in piglets in early postnatal period*, 24 POLISH J. VETERINARY SCIS. 85, 86 & 89 (2021).

group-housed sows.[31] The researchers concluded that "the piglets from mothers kept in [gestation crates] will have a weaker immunity barrier compared to the piglets given birth by mothers kept in free movement pens" and are therefore more susceptible to disease.[32]

The results of a 2002 study were even more dramatic. There, sows were randomly selected to be restrained in a gestation crate for just five minutes every day during the 12th through 16th weeks of their 17-week pregnancy.[33] Piglets born to the restrained sows had decreased antibody concentrations and decreased white blood cell generation compared to the piglets of unrestrained sows.[34] And piglets born to restrained sows had a significantly atrophied thymus, indicating that the cellular immune function of these piglets would suffer long-term impairment.[35]

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[31] *Id.* at 90.

[32] *Id.*

[33] M. Tuchscherer et al., *Effects of prenatal stress on cellular and humoral immune responses in neonatal pigs*, 86 VETERINARY IMMUNOLOGY & IMMUNOPATHOLOGY 195, 196 (2002) ("Tuchscherer").

[34] *Id.* at 201.

[35] *Id.* at 202. The thymus produces white blood cells called T cells that (1) stimulate the production of antibodies, (2) control immune reactions, and (3) bind to and kill infected cells. *Thymus*, Cleveland Clinic (May 15, 2022), http://my.clevelandclinic.org/health/body/23016-thymus; *T cell*, Britannica, https://www.britannica.com/science/T-cell (last visited July 25, 2022).

3. *Intensively Confined Sows Are A Documented Source of Contaminated Pork Products*

Piglets of sows intensively confined in gestation crates are not only born less able to fight illness, but are also exposed to higher levels of pathogens from their mothers. As a result, they are at greater risk of infection compared to piglets of group-housed sows.[36] For example, crated sows are more likely to excrete *Campylobacter* in their waste,[37] and piglets are infected "within the first few hours of birth" and most "remain carriers until slaughter."[38] Indeed, Petitioners concede that diseases can be transmitted from sows to their offspring. *See* Pet. Br. at 13, 43.

Further, contrary to Petitioners' assertions, neither "[i]ndustry action and federal inspection" nor "geographic and temporal separation of sows from pigs" mitigate the risk of foodborne illness from pork. *See* Pet. Br. at 13, 41-43. Instead of reducing disease, live transport of animals has been described by the Food and Agriculture Organization of the United Nations ("FAO") as "ideally suited for spreading disease."[39] This is because the stresses associated

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[36] *See* E. Merlot et al., *Prenatal stress, immunity and neonatal health in farm animal species*, 7 ANIMAL 2016, 2020 (2013).

[37] Martine Denis et al., Campylobacter *from sows in farrow-to-finish pig farms: Risk indicators and genetic diversity*, 154 VETERINARY MICROBIOLOGY 163, 163-69 (2011) ("Denis").

[38] C.R. Young et al., *Enteric colonization following natural exposure to* Campylobacter *in pigs*, 68 RES. VETERINARY SCI. 75, 77 (2000) ("Young").

[39] FAO, *FAO Animal Production and Health Paper 153: Improved Animal Health for Poverty Reduction and Sustainable*

with live transport cause more pigs to excrete pathogens such as *Salmonella* and *Yersinia* in their waste, increasing the likelihood of transmission to healthy pigs at their destination.[40] For example, the live transport of pigs between production stages and to slaughter involves serious stressors such as handling, fluctuating temperatures, social stress associated with mixing with unfamiliar pigs, feed and water withdrawal, exposure to new environments, vibrations, and noise.[41] Moreover, infected piglets, which often do not exhibit symptoms of infection, are unlikely to be identified as ill during inspection and quarantined.

Thus, the increased risk that piglets will be infected by their intensively confined mothers—coupled with live transport between production stages and the lack of symptoms in infected pigs—leads to transmission to other healthy pigs and a continued heightened risk of persistent infection through to retail pork. Indeed, a 2013 study tracing pork from farm to retail found that nearly 15% of carcasses infected with *Listeria* resulted

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Livelihoods at 19 (2002) *available at* https://www.fao.org/3/y3542e/y3542e.pdf.

[40] Sonja Virtanen et al., *Piglets Are a Source of Pathogenic* Yersinia enterocolitica *on Fattening-Pig Farms*, 78 APPLIED & ENVTL. MICROBIOLOGY 3000, 3000 (Apr. 2012) ("Virtanen"); I. Alpigiani et al., *The associations between animal-based welfare measures and the presence of indicators of food safety in finishing pigs*, 25 ANIMAL WELFARE 355, 358 (2016) ("Alpigiani").

[41] Mhairi Sutherland et al., *Effects of Transport at Weaning on the Behavior, Physiology and Performance of Pigs*, 4 ANIMALS 657, 668 (2014); Nathalie Nollet et al., *Distribution of* Salmonella *Strains in Farrow-to-Finish Pig Herds: A Longitudinal Study*, 68 J. FOOD PROTECTION 2012, 2018 (2005) ("Nollet").

in retail meat slices that were positive for *Listeria*.[42] Thus, as detailed immediately below, piglets born to crated sows are linked to serious food safety risks in pork.

Campylobacter infects more than 2.4 million Americans annually.[43] An estimated 37,000 annual *Campylobacter* infections in the US are attributable to contaminated pork.[44] Moreover, more than 200,000 Californians are infected annually.[45] A leading cause of human bacterial gastroenteritis,[46] *Campylobacter* infection can also lead to blood and brain infections, joint inflammation, paralysis, and even death.[47]

Gestation crates are considered "a significant risk indicator for *Campylobacter* contamination" because crated sows are nearly three times more likely to excrete the bacteria in their waste than group-housed sows.[48] A U.S. Department of Agriculture ("USDA") study found that nearly 60 percent of tested piglets

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[42] Y.M. Choi et al., *Changes in microbial contamination levels of porcine carcasses and fresh pork in slaughterhouses, processing lines, retail outlets, and local markets by commercial distribution*, 94 RES. VETERINARY SCI. 413, 417 (2013) ("Choi").

[43] *Campylobacteriosis*, Cal. Dept. Pub. Health (May 25, 2017), https://www.cdph.ca.gov/Programs/CID/DCDC/Pages/Campylobacteriosis.aspx ("CDPHCampylobacteriosis").

[44] Scharff at 966

[45] CDPHCampylobacteriosis.

[46] Young at 75.

[47] Guk at 2; Lea S. Eiland et al., *Optimal Treatment of* Campylobacter *Dysentery*, 13 J. PEDIATRIC PHARMACOLOGY & THERAPEUTICS 170, 172 (2008) ("Eiland").

[48] Denis at169.

were found to be infected with *Campylobacter* the same day they were born, and all were infected by the time the they are weaned.[49] This suggests that piglets are infected "within the first few hours of birth," while they are still with their mothers; and most "remain carriers until slaughter."[50] Epidemiological studies conducted during the fattening stages to slaughter further show that more than 85% of pigs remain intestinal carriers of *Campylobacter* through slaughter.[51] Moreover, *Campylobacter*-infected pigs do not show symptoms of infection and therefore would not be identified as ill on inspection, contrary to Petitioners' conclusory assertions.[52] *See* Pet. Br. at 13, 43. As a result, the more virulent *Campylobacter* carried by crated sows[53] are more likely to infect their piglets and to reach consumers in the form of contaminated pork products derived from their piglets.

Exacerbating the risks of infection, *Campylobacter* found in pigs and retail pork chops have been found to be increasingly resistant to the medically important antibiotics used to treat it. Between 1998-1999 and 2015, scientists observed in *Campylobacter* a notable

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[49] Young at 77.

[50] *Id.*

[51] M.J.B.M. Weijtens, et al., *Prevalence of* Campylobacter *in pigs during fattening; an epidemiological study*, 15 VETERINARY Q. 138, 138 (1993).

[52] *See* Guk at 2.

[53] Cogan at 1064; Guk at 1-2.

increase in resistance to six common antibiotics.[54] Moreover, in 2015, 83% of *Campylobacter* found on commercial pork chops were found to be resistant to at least one medically important antibiotic.[55] Most distressingly, in 2015, more than 40% of *Campylobacter* found in retail pork chops were found to be resistant to azithromycin, the antibiotic of choice for severe pediatric infections.[56]

<u>Salmonella</u> kills hundreds, hospitalizes thousands, and sickens more than a million people annually—including about 5,000 reported cases in California annually.[57] Between 2018 and 2019, the number of pork chops found to be infected with *Salmonella* increased more than five-fold to the highest level in recent years.[58] Pork consumption costs the U.S. more than $1.9 billion annually in social costs.[59]

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[54] Ross C. Beier et al., *Disinfectant and Antimicrobial Susceptibility Profiles of* Campylobacter Coli *Isolated in 1998 to 1999 and 2015 from Swine and Commercial Pork Chops*, 84. J. FOOD SCI. 1501, 1510 (2019).

[55] *Id.* at 1505.

[56] *Id.* at 1504; Eiland at 173.

[57] Elaine Scallan et al., *Foodborne Illness Acquired in the United States—Major Pathogens*, 17 EMERGING INFECTIOUS DISEASES 7, 11-12 (2011) *available at* https://wwwnc.cdc.gov/eid/article/17/1/p1-1101_article ("Scallan"); *Salmonellosis*, Cal. Dept. Pub. Health (Jun. 16, 2022) https://www.cdph.ca.gov/Programs/CID/DCDC/Pages/Salmonellosis.aspx.

[58] FDA2022 at 111.

[59] Scharff at 966.

Salmonella rates in pigs are higher than in any other common livestock—in 2019, approximately 60% of tested sows were positive, compared to 50% of chickens.[60] DNA analyses show that 75% of *Salmonella* species found in piglets matched at least one species found in their mothers, suggesting that sows transmit *Salmonella* to their piglets.[61] Indeed, researchers analyzing a farm transmission model for *Salmonella* in pigs concluded that, until the level of infection in a country's breeding herd is brought below

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[60] Nat'l Antimicrobial Resistance Monitoring Sys., *2019 Integrated Report Summary* at 6 (Apr. 19, 2022) *available at* https://www.fda.gov/animal-veterinary/national-antimicrobial-resistance-monitoring-system/2019-narms-update-integrated-report-summary-interactive-version ("NARMS2019"). A collaboration among state and local public health departments, the CDC, the USDA, and the FDA, NARMS tracks changes in the antimicrobial susceptibility of intestinal bacteria found in ill people, retail meat, and livestock. *See National Antimicrobial Resistance Monitoring System for Enteric Bacteria (NARMS)*, CDC, https://www.cdc.gov/narms/index.html (last visited July 25, 2022).

[61] Alejandro Casanova-Higes et al., *Weaned piglets: another factor to be considered for the control of* Salmonella *infection in breeding pig farms*, 50 VETERINARY RES. Art. No. 45 at 9 (2019) ("Casanova-Higes"); *see also* Joana Campos et al., *Non-typhoidal* Salmonella *in the Pig Production Chain: A Comprehensive Analysis of Its Impact on Human Health*, 8 PATHOGENS Art. No. 1:19 at 3 (2019) (finding that breeding pigs are a source of *Salmonella* dissemination along the pig production chain, "leading to pork meat contamination and consequently to human infections.").

10%, sows will be the "dominant source of infection to pigs raised for meat production."[62]

The vertical segmentation of pork production does nothing to mitigate these risks, and likely exacerbates them because *Salmonella* infections in pigs are a "prime example for [*sic*] stress-induced flare-up of infections."[63]. *See* Pet. Br. at 11-12, 42. Transferring piglets between production stages, including to slaughter, is "an important trigger to induce *Salmonella* [excretion in waste], leading to horizontal spread" from infected pigs to healthy pigs.[64] Several studies have found that transporting piglets, even for as little as two hours, will increase the number of piglets actively excreting *Salmonella* in their waste.[65]

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[62] Andrew A. Hill et al., *A Farm Transmission Model for* Salmonella *in Pigs, Applicable to E.U. Member States*, 36 RISK ANAL. 461, 461 (2016).

[63] Elin Verbrugghe et al., *Host Stress Drives* Salmonella *Recrudescence*, 6 SCI. REPS. 20849 at 1 (2016).

[64] Nollet at 2012 & 2018-19.

[65] *See* Sheila K. Patterson et al., *Towards an understanding of* Salmonella enterica *serovar Typhimurium persistence in swine*, 17 ANIMAL HEALTH RES. REVS. 159, 160 (2017) ("Patterson"); *see also* Leslie P. Williams, Jr. et al., Salmonella *Excretion in Joy-Riding Pigs*, 60 AM. J. PUB. HEALTH NATION'S HEALTH 926, 927 (1970); Francesca Romana Massacci et al., *Transport to the Slaughterhouse Affects the* Salmonella *Shedding and Modifies the Fecal Microbiota of Finishing Pigs*, 10 ANIMALS Art. No. 676 at 9 (2020); Peter Davies et al., *Fecal Shedding of* Salmonella *by a cohort of finishing pigs in North Carolina*, 7 SWINE HEALTH & PRODUCTION 231, 232 (1999) ("Davies1999"); German B. Vigo et al., Salmonella enterica *Subclinical Infection: Bacteriological, Serological, Pulsed-Field Gel Electrophoresis, and Antimicrobial Resistance Profiles—Longitudinal Study in a Three-Site Farrow-*

In one study, a two-hour truck ride caused the number of experimentally infected piglets actively excreting *Salmonella* in their waste to increase from 4% to 80%.[66] In another study, piglets transported just over three miles from a nursery to a fattening facility exhibited a more than 30% increase in *Salmonella*-positive fecal samples,[67] leading researchers to recommend that "transportation and litter comingling should be diminished to reduce *Salmonella* spp. excretion from the residual infected pigs."[68]

Nor are federal inspection or farm biosecurity sufficient to mitigate risk. *See* Pet. Br. at 13, 43. Infected piglets often do not show symptoms or exhibit detectable changes in their growth and production parameters,[69] despite remaining active *Salmonella* carriers through slaughter,[70] and thus are unlikely to be detected on inspection. In one study, piglets were found to be actively excreting *Salmonella* in their waste more than four months after being experimentally infected with the bacteria, indicating

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to-Finish Farm, 6 FOODBORNE PATHOGENS & DISEASE 965, 970 (2009) ("Vigo").

[66] Patterson at 160.

[67] Vigo at 968, 970; *see also* Davies1999 at 232.

[68] Vigo at 971.

[69] Agnieszka Chlebicz & Katarzyna Śliżewska, *Campylobacteriosis, Salmonellosis, Yersiniosis, and Listeriosis as Zoonotic Foodborne Diseases: A Review*, 15 INT'L J. ENVTL. RES. & PUBLIC HEALTH E863 at 9 (2018) ("Chlebicz").

[70] Casanova-Higes at 10; Maria Cevallos-Almeida, *Longitudinal study describing time to* Salmonella *seroconversion in piglets on three farrow-to-finish farms*, 6 VETERINARY RECORD OPEN e000287 at 1 (2019).

that infections in piglets can persist until market age, which is five months.[71] Similarly, a study of *Salmonella* infection among sows and their piglets from birth to fattening (approximately 165 days after birth) showed that the same infection can persist through all stages of pork production, up to slaughter.[72]

Drug-resistant strains of *Salmonella* exacerbate the risk associated with *Salmonella* infections. In 2019, NARMS reported the highest percentage of *Salmonella*-positive retail pork since testing began in 2002, and an increased presence in retail pork of *Salmonella* with resistance to ciprofloxacin[73]—a "Highest Priority Critically Important Antimicrobial"[74]—from none to 14%.[75] Further, the often multidrug-resistant *Salmonella* strain I 4,[5],12:i:-, has also emerged as a prominent cause of pork-related *Salmonella* outbreaks.[76] Finally, in 2020 about 10% of *Salmonella* in U.S. were multidrug-resistant.[77]

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[71] Kathrin Scherer et al., *Time Course of Infection with* Salmonella *Typhimurium and Its Influence on Fecal Shedding, Distribution in Inner Organs, and Antibody Response in Fattening Pigs*, 71 J. FOOD PROTECTION 699, 702 (2008).

[72] Vigo at 970.

[73] NARMS2019 at 4.

[74] WHO, *Critically Important Antimicrobials for Human Medicine* at 10, 18, 28 (2016).

[75] NARMS2019 at 4; *see also* FDA2022 at 214.

[76] Self at 2986.

[77] Roger B. Harvey et al., *A Preliminary Study on the Presence of* Salmonella *in Lymph Nodes of Sows at Processing Plants in the*

Yersinia can cause gastroenteritis and appendicitis-like symptoms in humans, and can result in blood infections and chronic joint inflammation.[78] *Yersinia* causes thousands of illnesses, hundreds of hospitalizations, and dozens of deaths in the U.S. annually[79]—and 76% of infections are attributable to pork.[80] In California, *Yersinia* infection rates rose every year between 2014 and 2019, tripling during that time.[81] In 2012, Consumer Reports found *Yersinia* on 69% of retail pork samples; more than 90% were resistant to at least one antimicrobial drug.[82]

And, again contrary to Petitioners' argument that vertical segmentation of pig production reduces risk to food safety, *see* Pet. Br. at 11-12, 42, pigs carry strains of *Yersinia*[83] that pose a risk to food safety without

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United States, 8 MICROORGANISMS Art. No. 1602 at 1 (2022); *see also* FDA2022 at 214.

[78] Yersinia enterocolitica *(Yersiniosis)*, CDC (Aug. 1, 2019) https://www.cdc.gov/yersinia/faq.html ("CDCYersiniosis"); Virtanen at 3000.

[79] CDCYersiniosis.

[80] Scharff at 963; Agata Bancerz-Kisiel & Wojciech Szweda, *Yersiniosis – a zoonotic foodborne disease of relevance to public health*, 22 ANNALS AGRIC. & ENVTL. MED. 397, 401 (2015); Virtanen at 3000; Cal. Dept. Pub. Health, *Epidemiologic Summary of Yersiniosis in California, 2013-2019* at 7 *available at* https://www.cdph.ca.gov/Programs/CID/DCDC/CDPH%20Document%20Library/YersiniosisEpiSummary2013-2019.pdf.

[81] *Id.* at 4.

[82] Greg Cima, *Organization finds* Yersinia enterocolitica *in most pork samples*, Am Veterinary Med. Assoc. (Dec. 31, 2012), https://www.avma.org/javma-news/2013-01-15/organization-finds-yersinia-enterocolitica-most-pork-samples.

[83] *See also supra* Section II.A.3.

showing symptoms.[84] Even a few piglets infected with *Yersinia* at a breeding farm can, once transported to a separate fattening farm, infect healthy piglets after their arrival.[85] In addition, stress induces the growth of *Yersinia*.[86] One study found a strong association between the fear reaction of pigs and the presence of *Yersinia* in the pigs' pen.[87] Moreover, several studies have found *Yersinia* to be more prevalent in specialized fattening herds than in combined herds of piglets and mature pigs.[88] In one study, combined herds of piglets and mature pigs were free from *Yersinia*, while 42.9% of herds from specialized facilities carried *Yersinia*.[89] Another study concluded that combined herds were the most protective factor against *Yersinia*.[90]

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[84] Kacper Libera et al., *Selected Livestock-Associated Zoonoses as a Growing Challenge for Public Health*, 14 INFECTIOUS DISEASE REPS. 63, 70 (2022); Niall Drummond et al., Yersinia Enterocolitica*: A Brief Review of the Issues Relating to the Zoonotic Pathogen, Public Health Challenges, and the Pork Production Chain*, 9 FOODBORNE PATHOGENS & DISEASE 179, 183 (2012).

[85] Virtanen at 3000.

[86] Boukerb at 3, 7.

[87] Alpigiani at 358, 360.

[88] T. Nesbakken & E. Skjerve, *Interruption of Microbial Cycles in Farm Animals from Farm to Table*, 43 MEAT SCI. S47, S50 (1996).

[89] Truls Nesbakken et al., *Occurrence of* Yersinia enterocolitica *and* Campylobacter *spp. in slaughter pigs and consequences for meat inspection, slaughtering, and dressing procedures*, 80 INT'L J. FOOD MICROBIOLOGY 231, 234 (2003).

[90] Eystein Skjerve et al., *Control of* Yersinia enterocolitica *in pigs at herd level*, 45 INT'L J. FOOD MICROBIOLOGY 195, 195 (1998).

Other pathogens posing a risk to food safety may also be carried by pigs without causing detectable symptoms, including *Listeria*,[91] *Toxoplasma gondii*,[92] hepatitis E,[93] and MRSA.[94] This increases the risk that these pathogens will avoid detection and enter the food supply. *See* Pet. Br. at 13, 43.

Listeria can cause severe illness in pregnant women, newborns, seniors older than 65, and the immunocompromised.[95] Although pregnant women typically experience only fever and flu-like symptoms, *Listeria* infections can lead to miscarriage, stillbirth, premature delivery, or life-threatening infection of the newborn.[96] In seniors and the immunocompromised, severe *Listeria* infections can develop into sepsis or

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91 Chlebicz at 17.

92 *See* Walter Basso et al., *Experimental* Toxoplasma gondii *infections in pigs: humoral immune response, estimation of specific IgG avidity and the challenges of reproducing vertical transmission in sows*, 236 VETERINARY PARASITOLOGY 76 at Abstract (2017).

93 Samantha Treagus et al., *The Foodborne Transmission of Hepatitis E Virus to Humans*, 13 FOOD & ENVTL. VIROLOGY 127, 130 (2021) ("Treagus").

94 Giuseppe Merialdi et al., *Livestock-associated methicillin-resistant* Staphylococcus aureus *(LA-MRSA)* spa *type t127, Sequence Type (ST)1, quickly spreads and persists among young pigs*, 77 PATHOGENS & DISEASE Art. No. ftz033 at 3 (2019) ("Merialdi").

95 Listeria *Infection¸* Mayo Clinic (Feb. 11, 2022), https://www.mayoclinic.org/diseases-conditions/listeria-infection/symptoms-causes/syc-20355269 ("MayoListeria"); Listeria *(Listeriosis) - Questions and Answers*, CDC (Dec. 12, 2016), https://www.cdc.gov/listeria/faq.html ("CDCListeria").

96 MayoListeria; CDCListeria.

meningitis.[97] *Listeria* is one of the deadliest foodborne pathogens, with a 94% hospitalization rate and 15.9% death rate.[98] Approximately 9% of *Listeria* infections are attributable to pork.[99]

Sows have been found to excrete *Listeria* in their waste, suggesting that the transmission of *Listeria* from sow to piglet is possible.[100] And *Listeria* has been found to reach the food supply from infected pigs. A 2013 study that followed pigs from farm to retail found, based on DNA testing, that nearly 15% of pig carcasses carrying *Listeria* resulted in retail meat slices that were positive for *Listeria*, suggesting that pigs carrying *Listeria* may pose a food safety threat.[101]

Toxoplasma gondii is a brain parasite that can cause blindness, seizures, and encephalitis in humans with weakened immune systems, miscarriages, and congenital illness in surviving newborns resulting in hearing loss, mental disability, and blindness.[102] The

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[97] MayoListeria; CDCListeria.

[98] Scallan at 12.

[99] Arie H. Havelaar et al., *Attribution of Foodborne Pathogens Using Structured Expert Elicitation*, 5 FOODBORNE PATHOGENS & DISEASE 649, 655 (2008).

[100] Evelyne Boscher et al., *Prevalence and Distribution of* Listeria monocytogenes *Serotypes and Pulsotypes in Sows and Fattening Pigs in Farrow-to-Finish Farms (France, 2008)*, 75 J. FOOD PROTECTION 889, 893 (2012).

[101] Choi at 417.

[102] J.P. Dubey et al., *Prevalence of Viable* Toxoplasma gondii *in Beef, Chicken, and Pork From Retail Meat Stores in the United States: Risk Assessment to Consumers*, 91 J. PARASITOLOGY 1082, 1082 (2005) ("Dubey"); Peter Davies, *Intensive Swine Production*

annual cost to society of congenital toxoplasmosis in the U.S. is an estimated $8.8 billion.[103]

About 35,000 pork-borne *Toxoplasma* infections in humans occur in the U.S. annually, which is approximately 41% of all *Toxoplasma* infections.[104] Based on the USDA-estimated rate of pork consumption in the U.S.—51.8 pounds per person annually—the risk of purchasing pork contaminated with *Toxoplasma* over a ten-year period was nearly 50%.[105] *Toxoplasma* in pork, specifically, is the fourth costliest pathogen-food pair at $1.85 billion annually, after *Campylobacter* and *Salmonella* in chicken and *Salmonella* in pork.[106]

Staphylococcus aureus bacteria—known as "staph"—is the most common cause of skin infections in humans and can lead to hospitalization and even death if it enters the bloodstream.[107] Approximately 19,000 human deaths in U.S. are caused by methicillin-resistant *Staphylococcus aureus* ("MRSA") annually.[108] Between 1995 and 2004, the percentage

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and Pork Safety, 8 FOODBORNE PATHOGENS & DISEASE 189, 191 (2011); *Toxoplasmosis*, Mayo Clinic (Oct. 13, 2020), https://www.mayoclinic.org/ diseases-conditions/toxoplasmosis/symptoms-causes/syc-20356249.

[103] Dubey at 1082.

[104] Scharff at 963.

[105] *See* Dubey at 1090.

[106] Scharff at 963.

[107] *See* Pray.

[108] *See id.* Methicillin was developed in the 1950s as an alternative treatment for staph infections that had become resistant to penicillin. *See id.*

of all staph infections in the U.S. caused by MRSA nearly tripled from 22% to 63%.[109] MRSA has been found to contaminate 1% to 2% of retail pork sold in the U.S.,[110] and its presence in food is considered a public health risk.[111]

Pigs are considered a MRSA reservoir for the general human population.[112] And sows are an important source of MRSA for piglets.[113] Once infected, piglets persistently test positive for MRSA.[114]

Hepatitis E can cause chronic infections, acute liver failure, and death in the immunocompromised or pregnant.[115] Pork consumption is "a significant risk

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[109] *See id.*

[110] Beilei Ge et al., *MRSA and multidrug-resistant* Staphylococcus aureus *in U.S. retail meats, 2010-2011*, 62 FOOD MICROBIOLOGY 289, 289 (2017).

[111] D. Sergelidis & A.S. Angelidis, *Methicillin-resistant* Staphylococcus aureus*: a controversial food-borne pathogen*, 64 LETTERS IN APPLIED MICROBIOLOGY 409, 413 (2017) *available at* https://sfamjournals.onlinelibrary.wiley.com/doi/epdf/10.1111/lam.12735.

[112] Verhegghe at 680.

[113] Marijke Verhegghe et al., *Cohort study for the presence of livestock-associated MRSA in piglets: Effect of sow status at farrowing and determination of the piglet colonization age*, 162 VETERINARY MICROBIOLOGY 679, 685 (2013) ("Verhegghe").

[114] Merialdi at 3; Verhegghe at 680; A. Burns et al., *A longitudinal study of* Staphylococcus aureus *colonization in pigs in Ireland*, 174 VETERINARY MICROBIOLOGY 504, 511 (2014); Patrick Daniel Bangerter et al., *Longitudinal study on the colonisation and transmission of methicillin-resistant* Staphylococcus aureus *in pig farms*, 183 VETERINARY MICROBIOLOGY 125, 132 (2016).

[115] *Hepatitis E*, WHO (June 24, 2022), https://www.who.int/news-room/fact-sheets/detail/ hepatitis-e.

factor and known transmission route for the [hepatitis E] virus to humans."[116] A study following piglets infected with hepatitis E found that 23% still carried the virus at slaughter.[117] A survey of more than 5,000 market-weight pigs at 25 slaughter plants across 10 U.S. states conducted between 2017 and 2019, detected hepatitis E virus in 6.3% of blood samples.[118]

And products derived from infected pigs can reach the food supply. For example, 11% of retail pig livers in the U.S. have been found to contain infectious hepatitis E virus.[119] In California, 45% of retail pig liver samples collected in 2018 were positive for hepatitis E virus.[120]

California thus has a strong interest in maintaining the safety of its food supply by preventing products derived from the piglets of crated sows from entering its borders.

B. The Intensive Confinement of Sows Increases Pathogen Virulence And

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[116] Treagus at 127.

[117] Yuta Kanai et al., *Long-Term Shedding of Hepatitis E Virus in the Feces of Pigs Infected Naturally, Born to Sows With and Without Maternal Antibodies*, 82 J. MED. VIROLOGY 69, 74 (2010).

[118] Harini Sooryanarain et al., *Hepatitis E Virus in Pigs from Slaughterhouses, United States, 2017-2019*, 26, EMERGING INFECTIOUS DISEASES 354, 354 (Feb. 2020).

[119] A.R. Feagins et. al., *Detection and Characterization of infectious Hepatitis E virus from commercial pig livers sold in local grocery stores in the USA*, 88 J. GEN. VIROLOGY 912, 914-15 (2007).

[120] La'Chia Harrison et al., *Presence of hepatitis E virus in commercially available pork products*, 339 INT'L J. FOOD MICROBIOLOGY 109033 at 2, 4 (2021).

Facilitates The Transmission of Pathogens And Disease To Humans

The intensive confinement of sows is not just a significant risk to food safety; it creates more opportunity for the transmission of disease between confined sows, and facilitates the mutation of pathogens through a process called "amplification." This can lead to more virulent diseases and more diseases, including antibiotic resistant bacteria, that are transmissible to humans.

Physical proximity facilitates the spread of disease.[121] The intensive confinement of animals facilitates disease transmission because the animals cannot physically distance themselves from each other.[122] Livestock herds are also genetically close, making them more vulnerable to infection than genetically diverse populations because genetically diverse populations are more likely to include

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[121] *See* John R. Rohr et al., *Emerging Human Infectious Diseases and the Links to Global Food Production*, 2 NATURE SUSTAINABILITY 445, 451 (2019) *available at* https://www.nature.com/articles/s41893-019-0293-3.pdf ("A central tenet of epidemiology is that the incidence of many infectious diseases should increase proportionally with host density because of increased contact rates and thus transmission among hosts.").

[122] *See* Delia Grace Randolph et al., United Nations Env't Programme, *Preventing the Next Pandemic*: *Zoonotic diseases and how to break the chain of transmission* at 15 (2020) *available at* https://www.unep.org/resources/report/preventing-future-zoonotic-disease-outbreaks-protecting-environment-animals-and ("Randolph"); European Food Safety Authority, *Scientific Opinion Food Safety Aspects of Different Pig Housing and Husbandry Systems*, 613 THE EFSA J. 1, 10 (2007); Pew2008 at 13.

individuals that are better able to resist disease.[123] And, as discussed above, intensive confinement induces a physiological stress response in sows, not only impairing their resistance to disease, but also that of their piglets, making transmission of disease among pigs even more likely.[124]

Indeed, a United Nations report found that the intensive farming of pigs "promoted transmission of swine influenza due to lack of physical distancing between the animals."[125] This is because pigs are susceptible to swine, human, *and* avian influenza, making them "ideal mixing vessels" for influenza strains, and could result in an influenza strain that can make the jump to humans.[126] The risk of pig-to-human transmission of influenza is very real, as demonstrated by the 2009 H1N1 swine flu pandemic. DNA analysis of the 2009 H1N1 influenza virus revealed gene segments that originated from humans, birds, North American pigs, and Eurasian pigs. [127] Two months after it was first detected *in California* in April 2009, the H1N1 influenza virus was declared a

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[123] *See* Randolph at 15; Pew2008 at 85.

[124] *See supra* Sections II.B.1 & 2.

[125] Randolph at 15.

[126] Cassandra Willyard, *Flu on the farm*, S62-63 NATURE 573 *available at* www.nature.com/articles/d41586-019-02757-4; Wenjun Ma, et al., *The pig as a mixing vessel for influenza viruses: Human and veterinary implications*, 3 J. MOLECULAR & GENETIC MED. 158 (2009) *available at*. www.ncbi.nlm.nih.gov/pmc/articles/PMC2702078/.

[127] CDC, *Origin of 2009 H1N1 Flu (Swine Flu): Questions and Answers* (Nov. 25, 2009), https://www.cdc.gov/h1n1flu/information_h1n1_virus_qa.htm.

worldwide pandemic.[128] In just the first year, the H1N1 swine flu pandemic resulted in millions of infections and up to 575,000 deaths worldwide, and more than 60 million cases, 274,000 hospitalizations, and 12,000 deaths in the U.S.[129]

II. PROPOSITION 12 MITIGATES THE RISKS TO FOOD SAFETY AND PUBLIC HEALTH CAUSED BY INTENSIVE PIG CONFINEMENT

Contrary to Petitioners' allegations, vertical segmentation of pork production, biosecurity measures, and inspections do not address the risks to food safety and public health posed by the intensive confinement of sows. *See* Pet. Br. at 11-13, 41-43. Intensively confined sows experience a physiological stress response that (1) weakens their immune function and that of their piglets, (2) increases the growth and virulence of pathogens in the sows, and (3) increases the excretion of pathogens in their waste, all of which facilitate the transmission of pathogens from the sows to their piglets destined for slaughter, and then into the pork products sold to Californians.[130] Moreover, intensively confined sows cannot physically distance themselves from one another, which facilitates the transmission and mutation of pathogens into more virulent forms that can be transmitted to and sicken, or even kill, humans.

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[128] CDC, *2009 H1N1 Pandemic Timeline*, https://www.cdc.gov/flu/pandemic-resources/2009-pandemic-timeline.html (last visited July 27, 2022).

[129] CDC, *2009 H1N1 Pandemic (H1N1pdm09 virus)*, https://www.cdc.gov/flu/pandemic-resources/2009-h1n1-pandemic.html (last visited July 27, 2022).

[130] *See supra* Section I.A.

Proposition 12's restrictions on the sale of pork products specifically address a root cause of these risks—the intensively confined sow. Sows with more space necessarily experience reduced stress, which will mitigate the cascade of stress-related effects on the immune function of the sows and their piglets, as well as reduce transmission of disease among the sows and from sows to their piglets.[131] Indeed, the USDA just proposed to revise the Organic Livestock and Poultry Standards to require that shelter for livestock, including pigs, "must be designed to accommodate natural behaviors over every 24-hour period."[132] Although the proposed rule permits livestock to be temporarily constrained each day, it specifically "does not permit the use of gestation crates or other confinement systems in which swine would be housed individually in stalls for months at a time."[133] Indeed, in proposing these rules, the USDA commented, "support[ing] the natural behaviors of livestock . . . may result in healthier livestock products for human consumption[.]"[134]

CONCLUSION

For the foregoing reasons, the Court should affirm the judgment below.

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[131] *See id.*

[132] National Organic Program: Organic Livestock and Poultry Standards, 87 Fed. Reg. 48562, 48574 (Aug. 9, 2022) (proposed rule) *available at* https://www.govinfo.gov/content/pkg/FR-2022-08-09/pdf/2022-16980.pdf.

[133] *Id.*

[134] *Id.* at 48565.

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