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Food Safety and Cage Egg Production

The Humane Society of the United States

An HSUS Report: Food Safety and Cage Egg Production

Abstract

States have begun legislating against cage egg production and dozens of major U.S. food retailers, restaurant chains, and foodservice providers—as well as hundreds of U.S. universities—are switching to cage-free eggs. Extensive scientific evidence strongly suggests this trend will improve food safety. All sixteen scientific studies published in the last five years comparing *Salmonella* contamination between caged and cage-free operations found that those confining hens in cages had higher rates of *Salmonella*, the leading cause of food poisoning related death in the United States. This has led prominent consumer advocacy organizations, such as the Center for Food Safety, to oppose the use of cages to confine egg-laying hens.

Introduction

How we treat animals can have serious public health implications. The AIDS virus, for example, has killed more than 25 million people,[1] and its emergence has been traced to the butchering of chimpanzees for their flesh.[2] The emergence of SARS, the contagious respiratory disease that infected thousands worldwide, has been linked to live animal markets,[3] and the introduction of monkeypox into the United States has been blamed on the exotic pet trade.[4] In fact, many of humanity's great disease scourges—including smallpox,[5] influenza,[6] and measles[7]—likely originally arose from our domestication of farm animals.[8]

Many current industrial farming practices threaten the health of Americans, including the feeding of millions of pounds of antibiotics to farm animals every year.[9] Antibiotics are routinely fed to farm animals in part to counteract stressful, overcrowded, and contaminated conditions found on factory farms.[10] The American Medical Association, the American Public Health Association, the Infectious Diseases Society of America, and the American Academy of Pediatrics—among 300 other organizations nationwide—have condemned the lacing the feed of farm animals with antibiotics.[11] Despite the widespread outcry against this practice from the public health community, agribusiness continues to engage in this dangerous custom.

Other hazardous practices include the cannibalistic feeding of slaughterhouse waste, blood, and manure to farmed animals, blamed for the emergence of bovine spongiform encephalopathy ("mad cow disease").[12] The subsequent slaughter for human consumption of "downer" cows too sick or crippled to walk led to the largest meat recall in this country's history.[13]

The intensive confinement of farm animals can also have negative public health implications.[14] High stocking densities—the number of animals confined in a given space—have been associated with an elevated risk of infecting farm animals with a number of parasites and pathogens that can affect humans:

- *Yersinia enterocolitica* in goats;[15]
- *Trichostrongylus* in sheep;[16]
- *Mycobacterium bovis*,[17] *Brucella*,[18] *Salmonella*,[19] *Neospora*,[20] and *Cryptosporidium* in cattle;[21]
- *E. coli* O157:H7 in both sheep and cattle;[22]
- *Ostertagia* in calves;[23]
- *Oesophagostomum*,[24] Aujeszky's disease virus, and swine flu virus in pigs.[25]

Farm animal well-being* and food safety issues are often inextricably linked. Improvements in animal welfare can improve food safety by reducing stress-induced immunosuppression, infectious disease incidence, pathogen shedding, and antibiotic use and resistance.[26] Acute foodborne illnesses strike an estimated 48 million Americans every year[27] at an annual cost to the United States in excess of $150 billion,[28] or nearly $500 per American per year.[29] Studies show that small improvements in farm animal health may result in significant reductions in human illness.[30]

Eggborne *Salmonella*


Compassion Over Killing

Salmonella poisoning is the most commonly diagnosed foodborne bacterial illness in the United States,[31] costs the country billions,[32] and remains the leading cause of food-related death.[33] Eggs are the leading cause of human *Salmonella* infection.[34] In 1994, a single egg-related outbreak sickened more than 200,000 Americans.[35] More typically, the FDA estimates that *Salmonella*-tainted eggs sicken 142,000 Americans every year.[36] A 2010 multistate outbreak of *Salmonella*[37] led to the largest egg recall in history—more than a half billion eggs. As the U.S. Food and Drug Administration concluded in a 2010 press release: "Egg-associated illness caused by *Salmonella* is a serious public health problem."[38]

Because *Salmonella* can infect the ovaries of hens, eggs from infected birds can be laid with the bacteria prepackaged inside.[39] *Salmonella* can then survive sunny-side-up, over-easy, and scrambled cooking methods according to research funded by the American Egg Board.[40]

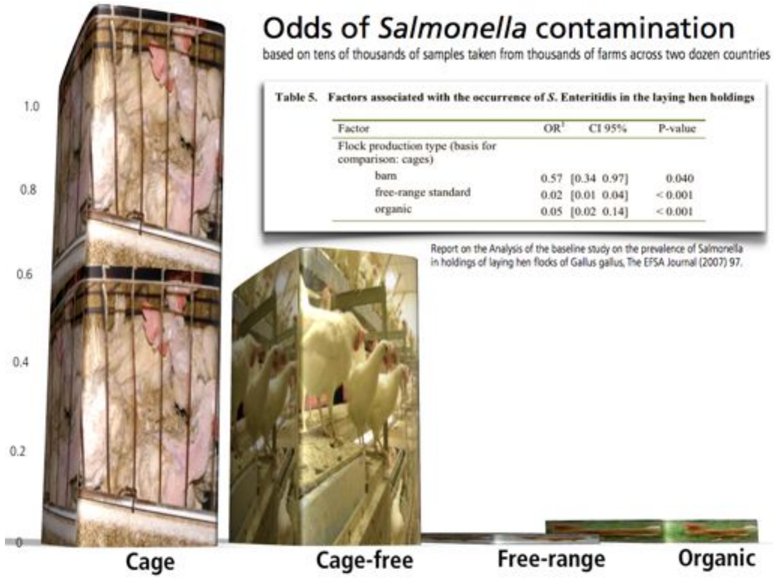
Infants and young children have been found to be at especially high risk.[41] Although thousands die from food poisoning every year in the United States, the vast majority of victims suffer only acute, self-limited illnesses. *Salmonella* poisoning, however, can result in chronic arthritic joint inflammation[42] and persistent irritable bowel syndrome in children.[43]

Caged Hens Pose Significantly Higher *Salmonella* Risk

In U.S. commercial egg production, approximately 95% of laying hens are confined in battery cages, small wire enclosures that afford each hen roughly 430 cm^2 (67 in^2)[44]—a space smaller than a single sheet of letter-sized paper. These cages are placed side-by-side in rows and stacked in tiers commonly 4-8 levels high. Each cage may hold 5-10 birds[45] and hundreds of thousands of hens may be confined within a single building.

This year, all 27 countries of the European Union (EU) are phasing out the use of these barren cages. To study the public health implications of this move, an EU-wide *Salmonella* survey was launched in which more than 30,000 samples were taken from more than 5,000 operations across two dozen countries. This represents the best available data set comparing *Salmonella* infection risk between different laying hen housing systems. Without exception, for every *Salmonella* serotype grouping reported and for every type of production system examined, there were significantly higher *Salmonella* rates found in operations that confine hens in cages.[46]

* For information on the animal welfare implications, see "The Welfare of Intensively Confined Animals" at www.farmanimalwelfare.org



The European Food Safety Authority analysis found 43% lower odds of *Salmonella* Enteritidis contamination in cage-free barns, where hens are raised indoors, than in cage production. In organic egg production the odds of *Salmonella* contamination were 95% lower and in free-range production the odds were 98% lower.[47] For *Salmonella* Typhimurium, the second most common source of *Salmonella* poisoning in the United States,[48] there was 77% lower odds of infection when hens were raised in barns compared to cages and 93% lower odds in organic and free-range systems. For the other *Salmonella* serotypes found, compared to operations with hens in cages there was 96% lower odds in barn-raised flocks, 98% lower odds in organic flocks, and 99% lower odds in free-ranging birds. That translates into at least 25-times greater odds of contamination on factory farms that confine hens in cages compared to cage-free production. The European Food Safety Authority analysis concluded: "Cage flock holdings are more likely to be contaminated with *Salmonella*."[49]

Since this comprehensive survey was completed, eighteen scientific studies have been published that compared *Salmonella* risk in caged and cage-free facilities. Without exception, each of them found higher rates of *Salmonella* in typical[50] battery cage production units.[51,52,53,54,55,56,57,58,59,60,61,62,63,64,65,66,67,68]

A recent article in the trade publication *World Poultry*, titled "*Salmonella* Thrives in Cage Housing," acknowledged that "the majority of the studies clearly indicate that a cage housing system has an increased risk of being *Salmonella*-positive in comparison to non-cage housing systems."[69] Cage-free hens experimentally infected with *Salmonella* may even clear the infection faster than caged hens.[70]

Every scientific study published in the last 5 years found higher *Salmonella* rates in cage operations
2010: 20 times greater odds of *Salmonella* shedding in caged flocks
2010: 7 times greater odds of *Salmonella* in operations caging hens†
2010: 6 times greater odds of *Salmonella* in operations caging hens†
2010: 3 times greater odds in caged hens (though not statistically significant)
2010: More *Salmonella*-contaminated eggs from caged hens
2009: 35 times greater odds of *Salmonella* in operations caging hens†
2009: 10 times greater odds of *Salmonella* in operations caging hens†
2009: 26% greater odds in caged hens (though not statistically significant)
2008: 10 to 20 times greater odds of *Salmonella* in operations caging hens†
2008: 3 times greater odds of *Salmonella* in operations caging hens†
2008: 90% greater odds in caged hens (though not statistically significant)
2008: 70% greater odds of *Salmonella* in operations caging hens†
2007: 2 to 25 times greater odds of *Salmonella* in operations caging hens†
2007: 5 times greater odds of *Salmonella* in operations caging hens†
2007: 3 times greater odds of *Salmonella* in operations caging hens†
2006: 3 times greater odds of *Salmonella* in operations caging hens
† Data overlap

The leading U.S. egg industry trade group has claimed that caging hens is "better for food safety,"[71] but in response to a landslide vote in California to ban the practice, the editor-in-chief of the trade journal *Egg Industry* admitted that such claims are "invalid…unconvincing, unsupportable and easily refuted."[72] A review funded by the American Egg Board concluded the link between the cage confinement of hens and *Salmonella* risk is inconclusive,[73] but only by ignoring nearly 90% of the data published over the last five years (at least 5198 of the 5907 flocks studied).*

* For more information see "American Egg Board-Funded Review Scrambles the Science" at bit.ly/AEBfundedreview

Cage Production Factors That Increase *Salmonella* Risk

The reason cage operations have consistently been found to be at such higher risk for *Salmonella* is multifactorial. From the European Food Safety Authority analysis:

> "In general, the higher prevalence [of *Salmonella*] in cage flocks might partly be explained by the fact that hens in the more intensive systems have a higher risk of being infected due to a relatively large flock size and higher density of hens. Moreover, cages can be difficult to disinfect and the housing may harbour breeding populations of rodents and other potential vectors such as flies or litter beetles. *Salmonella* has been shown to be more persistent in consecutive cage flocks compared with non-cage flocks in which the infection is more easily cleaned out during the empty period between flocks."[74]

Factor 1: Greater volume of fecal dust

Cage production facilities confine greater numbers of birds in a single building, as the caged birds are stacked in vertical tiers. There are single cage egg factories in the United States that cage millions of hens.[75] Such high densities of birds can produce a larger volume of contaminated airborne fecal dust, which may be responsible in part for the elevated threats to food safety posed by battery cage operations.[76] The latest national USDA survey of the domestic egg industry found that sheds confining more than 100,000 birds were four times more likely to be contaminated with *Salmonella*. The average number of hens confined in *Salmonella* tainted sheds in the United States was 109,777,[77] much higher than cage-free operations typically hold.

Factor 2: More rodent disease vectors

The preponderance of disease-carrying rodents, flies, and other pests in battery cage sheds is another factor contributing to increased *Salmonella* infection rates in cage systems. Rodent infestations are closely tied to *Salmonella* rates.[78] The manure pits typical of many cage operations are considered "ideal nesting grounds for rodents."[79] Indeed, rodents have been found to be "particularly persistent" in cage operations because they can breed in manure pits and gain access to feeders without interference from the birds, who are confined in cages.[80] With more flocks per site, cross contamination between houses may also play a role in facilitating the rodent-borne spread of infection between hens in battery cage operations.[81]

Factor 3: More insect disease vectors

According to the latest edition of Commercial Chicken Meat and Egg Production, the leading poultry science text,[82] one of many disadvantages of battery cage systems is that flies "are generally a greater nuisance" compared to cage-free production.[83] More than merely an annoyance, flies are considered vectors for *Salmonella* on egg farms.[84] According to Richard Axtell, a Professor Emeritus of Entomology: "By far the greatest populations of flies occur in the caged-layer houses that are widely used for commercial egg production."[85] Scientists with the Food and Drug Administration agree: "In the poultry industry, the greatest numbers of houseflies and other disease-carrying flies occur in caged-layer houses (poultry houses with laying hens in cages for commercial egg production), where the flies breed in accumulated manure beneath the cages."[86] In contrast, in cage-free broiler chicken houses, flies are "rarely a problem."[87]

Factor 4: Most difficult to disinfect

S*almonella* can survive for more than two years in dried chicken feces,[88] but can often be eliminated from laying hen houses with thorough cleaning and disinfection. Experts have noted, however, that cage operations are the "most difficult to clean properly"[89] because of the "difficulty to efficiently disinfect the cages."[90] The manure pits common in cage systems, which may not even be cleared between flocks, pose additional hygiene challenges.[91] From a poultry science journal:

> "[C]age houses are intrinsically difficult to clean and disinfect to a good standard. Cages are normally organised in 3-12 tier stacks with associated complicated structures including dropping boards/belts drinkers, automatic egg belts, and feeder systems….Residual feed in particular may facilitate the

> multiplication of *Salmonella* after washing. In many cases older houses have no drainage, and electrical systems may not be water-proof. Because of these limitations, some buildings have only been 'dry-cleaned', which is normally…not satisfactory to achieve elimination of *Salmonella*."[92]

This has been validated in other countries. The Danish Veterinary and Food Administration states: "Experience shows that battery cage systems are particularly difficult to clean and disinfect."[93] Research performed by the British Veterinary Laboratories Agency found "that there are particular problems with the disinfection of cage layer farms. This may be due to the larger flocks of birds kept at higher densities, which result in a larger volume of contaminated faecal material and dust, and the difficult access for cleaning in and around the cages."[94]

In comparison, cleaning and disinfecting equipment in cage-free facilities has been found to be more than twice as effective in combating *Salmonella* than attempts to disinfect battery cage operation equipment.[95] Even saturating a battery cage operation with formaldehyde-spiked steam for 24 consecutive hours at more than 140 degrees Fahrenheit—considered a gold standard treatment[96] found to effectively sterilize cage-free houses for *Salmonella*—may not effectively disinfect battery cage sheds.[97] To combat the rise of food poisoning caused by *Salmonella*, CDC researchers have called for a "sanitary revolution in farm-animal production."[98]

Factor 5: More gut colonization and shedding

Research published in *Poultry Science* suggests another reason that chickens raised on bedding, rather than in bare, wire cages, have lower risk. On bedding, chickens may acquire natural gut flora that competitively prevents *Salmonella* colonization.[99] Chicks would normally obtain natural microflora from their mothers and the environment. In industrial systems, however, chicks are no longer raised by hens but by incubators, after which they are confined in barren wire cages, potentially delaying or preventing the development of the normal adult gut flora helpful in preventing *Salmonella* infection.[100] Faster declines in *Salmonella* shedding have also been noted in experimentally infected cage-free hens compared to those confined in barren cages.[101]

Factor 6: Stress due to confinement

Physiological stress may also play a role.[102] In general, "the bulk of the evidence suggests that chronic or prolonged stress generally inhibits the immune response to infection, thus potentially rendering animals more susceptible to infectious disease."[103] Specifically, research has shown that stress hormones can increase *Salmonella* colonization and systemic spread in chickens.[104] The stress hormone noradrenaline can boost the growth rate of *Salmonella* bacteria by orders of magnitude;[105] at the same time stress-related corticosteroids can impair the immune system.[106] A USDA researcher recently concluded that "there is increasing evidence to demonstrate that stress can have a significant deleterious effect on food safety."[107]

Increased Flock Risk Directly Translates To Increased Food Safety Risk

Contemporary studies universally show higher *Salmonella* rates in dust and manure samples from cage operations provide convincing evidence that measures to eliminate cages will likely improve the safety of the food supply. USDA researchers have found that "[f]locks with high levels of manure contamination were 10 times as likely to produce contaminated eggs as were flocks with low levels," concluding that flocks with the highest levels of contamination "appeared to pose the greatest public health threat."[108] A key finding of a joint World Health Organization and Food and Agriculture Organization of the United Nations *Salmonella* risk assessment was that "[r]educing flock prevalence results in a directly proportional reduction in human health risk. For example, reducing flock prevalence from 50% to 25% results in a halving of the mean probability of illness per serving [of eggs]."[109]

Infected hens can lay infected eggs. Nine studies have been published comparing *Salmonella* contamination rates of the eggs themselves from barren cage production versus typical cage-free systems. Not a single one showed more *Salmonella* in cage-free eggs. All nine studies either found no *Salmonella* in eggs from either system or a trend towards higher infection rates in eggs from caged hens compared to barn-raised birds.[110,111,112,113,114,115,116,117,118]

In 1994-1995, a study was conducted at a California egg farm with both cage and cage-free housing systems, including three battery cage sheds and three cage-free barns. The prevalence of *Salmonella* in pooled egg samples from caged hens was nearly three times that of eggs from the cage-free (barn-raised) hens.[119] Though the farm's free-range eggs were found to have higher rates, this was attributed to exceptional circumstances in that a creek "entirely composed of sewage effluent" bordered the property.[120] More recently, the U.K. Food Standards Agency tested eggs from grocery stores. While 9 out of the 2,376 egg samples from caged hens came up positive for *Salmonella*, none of the 785 cartons of cage-free eggs tested was contaminated.[121] Testing foreign eggs coming into the country, the scientists found 132 of 1,329 samples of eggs from caged birds to be tainted with *Salmonella*, but, once again, none of the tested eggs from cage-free facilities were found to be positive with the pathogen.[122]

Type of eggs used	Cases		Controls		Odds ratio†	95% CI‡
	No.	%	No.	%		
White table eggs from battery flocks	48	19.8	38	9.4	2.4	1.5, 3.8
Brown table eggs from battery flocks	47	19.7	46	11.3	1.9	1.2, 3.0
Eggs from deep litter or free-range production	125	51.0	195	47.8	1.1	0.8, 1.6
Eggs from organic production	36	14.6	107	26.3	0.5	0.3, 0.8
Eggs sold at barnyards	49	19.8	109	26.5	0.6	0.4, 0.9
Pasteurized egg products	4	1.6	16	3.9	0.5	0.1, 1.4

American Journal of Epidemiology 156(7):654-61

Eating eggs from caged birds has been specifically tied to human illness. In a 2002 prospective case-control study published in the *American Journal of Epidemiology*, people who recently ate eggs from caged hens had about twice the odds of being sickened by *Salmonella* compared to people who did not eat eggs from hens kept in cages. Those eating cage-free eggs were not at significantly elevated risk.[123] The only other study ever published comparing egg types at a consumer level found nearly 5 times lower odds of *Salmonella* poisoning in consumers who chose free-range eggs.[124]

The Industrialization of Egg Production Led To the *Salmonella* Pandemic

According to Dr. Robert Tauxe, the deputy director of the CDC′s Division of Foodborne, Bacterial and Mycotic Diseases, foodborne *Salmonella* infections "became important public health concerns in parallel with the modern intensification of animal rearing…in the 1950s and 1960s in North America,"[125] which is when U.S. egg industry began embracing cage systems.[126] In the 1940s, *Salmonella* was only implicated in sickening a few hundred Americans a year.[127] Before the industrial intensification of egg production, *Salmonella* Enteritidis was not even found in eggs in the United States.[128] By the beginning of the 21st century, however, *Salmonella* Enteritidis-contaminated eggs were sickening an estimated 182,000 Americans annually.[129]

In its landmark report, Emerging Infections: Microbial Threats to Health in the United States, the National Academy of Sciences' Institute of Medicine states that "the introduction of feedlots and large-scale poultry rearing and processing facilities has been implicated in the increasing incidence of human pathogens, such as *Salmonella*, in domestic animals over the past 30 years."[130] There are many industrial practices that have contributed to the emergence of the eggborne *Salmonella* threat. For example, the egg industry's eradication of *Salmonella* Gallinarum, a serotype that primarily affects birds but not humans, may have created the ecological niche necessary for the emergence of *Salmonella* Enteritidis, which poses little threat to birds (and hence industry profits)[131] but sickens more than 100,000 Americans every year.[132]

Another contributory factor may be overcrowding. From the *Journal of the American Veterinary Medical Association*: "If salmonellae are inadvertently introduced into a large confinement rearing-production unit, a catastrophic epizootic [animal disease epidemic] might occur due to certain inherent environmental and stress factors, e.g.…[o]verpopulation or crowding…."[133] Professor John Evans, a poultry specialist and former FDA senior microbiologist, correctly predicted decades ago that "*Salmonella* infection of animals will occur more frequently and affect more individual animals as concentration of confinement increases."[134] U.S. caged hens are currently confined 5-10 birds per cage[135] for virtually their entire 1-2 year lifespan.[136]

Factory farming practices may have not only facilitated the emergence of the eggborne *Salmonella* threat, but also to its global proliferation. It has been recognized for nearly 40 years that the "adoption of intensive rearing systems in the poultry and livestock industries today may create environments which encourage rapid spread of salmonella…infections…."[137] According to the World Health Organization, "[t]he factors facilitating the spread of salmonellosis are associated with the intensification of animal and poultry production…."[138] Specifically, these factors include industry's selective breeding practices,[139] the feeding of slaughterhouse waste to hens,[140] and forced starvation molting,[141] which collectively placed the corporate interests of agribusiness above the safety of consumers by facilitating the spread of *Salmonella*.

Just as the feeding of dead animals to live ones triggered the mad cow disease crisis, this same practice has also been implicated in the worldwide spread of *Salmonella*.[142] Once egg production wanes, hens may be ground up and rendered into what is called "spent hen meal," and then fed to other hens.[143] Annually, the United States has produced the majority[144] of the estimated 10 million tons of animal protein concentrates (such as meat, blood, and bone meal) incorporated worldwide into farm animal feed.[145]

More than half the feed samples for farmed birds that contain slaughterhouse waste were found contaminated with *Salmonella* in FDA tests,[146] and numerous human *Salmonella* outbreaks have been specifically tied to feeding farm animals contaminated meat and bone meal.[147,148,149] The use of manure in farm animal feed may have also played a role in the spread of *Salmonella*.[150] CDC researchers have estimated that more than 1,000,000 cases of *Salmonella* poisoning in the United States can be directly tied to feed containing animal byproducts.[151]

Industry Response to the Eggborne *Salmonella* Epidemic

U.S. efforts to control *Salmonella* pale in comparison to those made in other countries that have virtually eliminated the problem.[152] In fact, attempts to enact similar farm safety programs domestically have been eliminated at the urging of the egg industry itself.[153] The U.S. industry trade group United Egg Producers openly praises its own efforts to obstruct public health measures, even publishing in its *Washington Report* that it added language to the USDA inspection budget that effectively killed the *Salmonella* testing program.[154] According to Marion Nestle, former U.S. Department of Health and Human Services Senior Nutrition Policy Advisor: "Major food industries oppose pathogen-control measures by every means at their disposal."[155]

Rather than working to ensure the safety of their own products, the intensive farm animal industries have often tried shifting that responsibility to their own consumers. The safe-handling label on eggs is a prime example. "There has been a subtle turning of this on to the consumer," wrote Steve Bjerklie, former editor of *Meat and Poultry*, "and it's morally reprehensible."[156] Patricia Griffin, Chief of the Enteric Diseases Epidemiological Branch at the CDC, responded famously to this blame-the-victim attitude with regard to *E. coli* O157:H7, another dangerous pathogen. "Is it reasonable," she asked, '"that if a consumer undercooks a hamburger…their three-year-old dies?"[157] *Salmonella* has been estimated to kill 10 times more Americans every year than *E. coli* O157:H7.[158]

Animal agribusiness understands that many profitable but risky practices must be kept hidden from the public. "One of the best things modern animal agriculture has going for it is that most people…haven't a clue how animals are raised and processed," wrote an editor of the *Journal of Animal Science* in an animal agriculture textbook. "For modern animal agriculture, the less the consumer knows about what's happening before the meat hits the plate, the better."[159]

Pew Commission on Industrial Farm Animal Production

The Pew Commission on Industrial Farm Animal Production was formed to conduct a comprehensive, fact-based, and balanced examination of key aspects of the farm animal industry. Former Kansas Governor John Carlin chaired this prestigious independent panel, which included former U.S. Secretary of Agriculture Dan Glickman, former Assistant Surgeon General Michael Blackwell, and James Merchant, then Dean of the University of Iowa College of Public Health, among many other experts across several disciplines. After a rigorous two-and-one-half-year inquiry, the Commissioners emphasized that the "ethical treatment of animals raised for food is essential to, and consistent with, achieving a safe and sustainable system for producing food animals"[160] and concluded that "[d]ue to the large numbers of animals housed in close quarters in typical [industrial farm animal production] facilities there are many opportunities for animals to be infected by several strains of pathogens, leading to increased chance for a strain to emerge that can infect and spread in humans."[161]

The Commissioners affirmed that "[f]ood animals that are treated well and provided with at least minimum accommodation of their natural behaviors and physical needs are healthier and safer for human consumption."[162] Specifically, they asserted that "[p]ractices that restrict natural motion…induce high levels of stress in the animals and threaten their health, which in turn may threaten human health."[163] The Pew Commission on Industrial Farm Animal Production unanimously concluded that battery cages should be eliminated from American agriculture.[164]

Conclusion

Institutions, corporations, electorates, and legislatures are increasingly embracing the recommendations of the Pew Commission. In a landslide 2008 vote, California moved to criminalize the cage confinement of egg-laying hens.[165] In 2009, Michigan's governor signed legislation that similarly phases out battery cages,[166] and in 2010 agricultural leaders agreed to a moratorium on new battery cage operations in Ohio[167] and Governor Schwarzenegger signed a bill to ban the sale of shell eggs from caged hens imported into California.[168]

Supermarket chains such as Safeway, Harris Teeter, Winn-Dixie, Trader Joe's, and Whole Foods have all taken steps to increase their sales of cage-free eggs. All of Wal-Mart's and Costco's private label eggs are now cage-free. National restaurant chains, including Burger King, Wendy's, Denny's, Red Robin, Subway, Quiznos, Sonic, Hardee's and Carl's Jr., have also started using cage-free eggs. Hellman's mayonnaise is switching all its eggs to cage-free and Compass Group, the world's largest food service provider switched to cage-free shell eggs for all of its 8,500 U.S. clients.

The best available science suggests that confining hens in cages means increased *Salmonella* infection risk in the birds, their eggs, and the consumers of caged eggs. The cage-free trend in the United States is therefore expected to increase the safety of the American food supply.

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