



Lessons Learned from *Salmonella* in Eggs Outbreaks

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Regulation of Shell Eggs

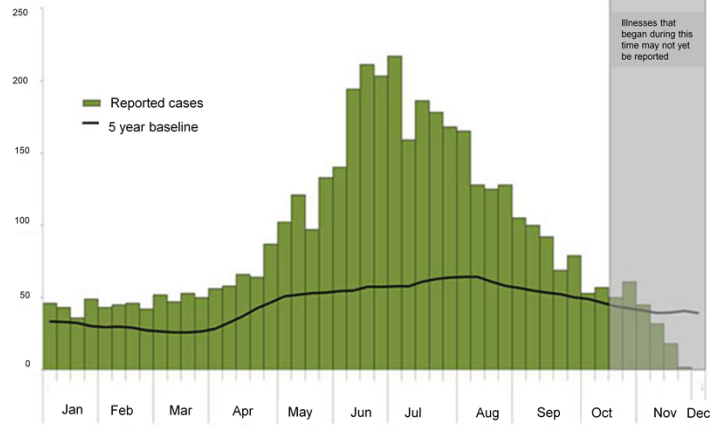
- Egg & egg product regulation is complex
 - FDA regulates shell eggs, including the laying operation based on authority from the Federal Food Drug and Cosmetic Act and can take regulatory action based on the US Public Health Service Act
 - USDA-FSIS regulates egg products under the Egg Products Inspection Act
 - USDA Agricultural Marketing Service provides grading and certification services on a voluntary basis and conducts surveillance to prevent the distribution of adulterated or mis-branded eggs
 - USDA Animal and Plant Health Inspection Service is responsible for the health of layer flocks, including SE control programs

The Shell Egg Outbreak of 2010

- A nationwide outbreak of *Salmonella* Enteritidis (SE) resulted in 1,939 reported cases from May 1 to November 30, 2010
 - The outbreak was detected through PulseNet
 - Data from 29 restaurant or event “clusters” indicated that shell eggs were the likely source
 - Wright County Egg was an egg supplier to 15 of these 29 restaurant or event clusters
 - Traceback investigations showed that Wright County Egg was the common source and Hillandale Farms of Iowa was identified as a potential source



Outbreak Curve



The Shell Egg Outbreak of 2010

- Evidence supporting the role of Wright County Egg and Hillandale Farms of Iowa in the outbreak:
 - FDA found 11 samples from the Wright County Egg feed mill positive for SE with a matching PFGE pattern. The feed went to pullets raised at Wright County Egg in Iowa.
 - Pullets raised at Wright County Egg were distributed to Hillandale Farms in Iowa.
 - The feed from Wright County Egg was distributed only to Wright County Egg and Hillandale Farms of Iowa.
 - A positive SE with matching PFGE pattern was also collected from egg wash water at Hillandale Farms of Iowa.
 - Whole genome sequencing confirmed the role of Wright County Egg

The Shell Egg Outbreak of 2010

- Consequences of the outbreak:
 - As many as 62,000 people may have been sickened
 - A costly months-long investigation was conducted by numerous state and federal agencies
 - More than 500 million eggs were recalled, with a wholesale value of over \$42 million
 - The resulting temporary shortage of eggs increased the retail price of eggs for consumers



Lessons Learned

- The outbreak could only be detected because of the large number of cases
 - Based on the 5 previous years, we expect approximately 1,693 cases to be reported in the same period as the outbreak, yet 3,578 cases were reported
 - Because of the close genetic relatedness of the strains and the large number of cases, standard methods of genetic sub-typing alone cannot determine the outbreak associated cases
 - Post-outbreak studies with whole genome sequencing could discriminate outbreak-related cases from unrelated cases
 - Not all cases of SE with matching PFGE patterns come from contaminated eggs

Lessons Learned

- Egg and layer production is complex and involves many inter-related firms
 - Wright County Egg and Hillandale Farms of Iowa were connected through the pullet rearing operation and the common feed source
 - Eggs from Wright County egg were sold to distributors in 22 states and Mexico and these distributors then distributed the eggs further throughout the country under many brands
- Ultimately, SE control will require implementation of the Egg Safety Rule by the industry as well the development of other effective control measures such as vaccination