Salmonellosis Associated with Backyard Poultry

The Growing Trend in Backyard Poultry Keeping

More and more people are choosing to keep live poultry, including chickens, ducks, geese and turkeys, as a home-grown source of eggs, meat and as pets. The reasons behind this trend may include a desire to support a greener lifestyle, consume organically-produced products and sell poultry products at local markets. This trend is not just occurring in rural areas. Data from a 2010 United States Department of Agriculture study of four urban areas (Denver, Los Angeles, Miami and New York City) indicate that 0.6 percent of city households owned chickens.\(^1\) Within these metro areas, 4.3 percent of single-family homes on at least one acre of land (more likely to be on the city outskirts) owned chickens. In addition, 3.8 percent of households without poultry planned to begin raising chickens within the next year.

Salmonella Infections Associated with Poultry Contact

While these data show a nationwide interest in home poultry keeping, people are also aware that having poultry in close proximity to their living space may pose some risks. Nearly 60 percent of individuals interviewed thought that raising chickens in urban areas would lead to more illnesses in humans. While high-profile poultry diseases such as avian influenza frequently make the news for causing illness or death in their human caretakers, common bacterial pathogens such as *Salmonella* and *Campylobacter* species cause many more infections each year.

So far in 2013, the Centers for Disease Control and Prevention (CDC) has reported nearly 400 human illnesses linked to backyard flocks. Two large outbreaks of *Salmonella* infection (salmonellosis) have been identified this year, affecting persons in 45 states, including Pennsylvania. Investigation of the first outbreak linked contact with chicks, ducklings and other live baby poultry with 271 cases of *Salmonella* Typhimurium infection in 37 states (Figure 1).\(^2\) The poultry were purchased from multiple feed stores and were also distributed through mail-order hatcheries. Twenty-seven percent of ill persons were hospitalized, and 62 percent of those ill were 10 years of age or younger. The second outbreak of 2013 affected 125 persons from 26 states (Figure 2), with 29 percent of ill persons hospitalized and 41 percent aged 10 years or younger.\(^3\) This outbreak involved multiple serotypes of *Salmonella enterica*, including *Salmonella* Infantis, *Salmonella* Lille, *Salmonella* Newport and *Salmonella* Mbandaka. These were just two of many outbreaks linked to poultry since the 1990s (Figure 3).\(^4\) While CDC has identified 1,563 illnesses, 221 hospitalizations and five deaths associated with poultry since the 1990s (not including the 2013 outbreaks), there have likely been hundreds more cases that were not diagnosed or reported.
Salmonella in Backyard Flocks
These large outbreaks are impressive in their size and geographic range. However, it is important to remember that persons raising backyard poultry may be at risk for Salmonella infection on a daily basis, not just when new poultry are acquired. Established flocks can shed bacteria in their feces, and it is important to consider the potential for illness that may result from handling live poultry, poultry products, or objects in the area where they live and roam. It is common for chickens, ducks and other poultry to carry Salmonella bacteria in the gastrointestinal tract and pass it into the environment along with their feces. Salmonella does not typically make the poultry sick, but it has the potential to make people very ill. Even poultry that are raised in organic conditions can shed Salmonella.

Fecal material containing bacteria can be on the birds themselves, on eggs and feathers, on feed or water surfaces, on fences or shovels, as well as on the ground inside the poultry pen. When birds are allowed to roam without restraint, or when other animals such as dogs and cats are allowed to go in and out of the poultry pen, Salmonella can spread widely, including into other animal pens and into homes. The same is true for people moving in and out of poultry areas, as they may carry the bacteria on their shoes, clothing or hands.

Human Infection with Salmonella
People become infected with Salmonella when bacteria on hands or other objects are ingested. Salmonella infection is diagnosed through laboratory testing of stool or, less often, blood or other body sites. Salmonellosis causes diarrhea, vomiting, fever and abdominal cramps, putting infected individuals at risk for dehydration. Most infections do not require any treatment other than rehydration with oral

* Based on information reported as of June 28, 2013 (n=271)  

* Based on information reported as of July 16, 2013 (n=125)  
fluids. People that suffer from severe diarrhea may require rehydration with intravenous fluids. Gastrointestinal infections usually resolve in five to seven days. Hospitalization for *Salmonella* infection does occur; infants, children, elderly persons and those with weakened immune systems are more likely to become severely ill. Since 1990, approximately 15 percent of ill patients associated with poultry salmonellosis outbreaks have been hospitalized. In some severe cases, sepsis (systemic infection) can occur. Antibiotic therapy can prolong the time that a person sheds *Salmonella* in their feces; therefore, even if symptoms do not resolve, it is only recommended for patients with severe illness (e.g., those with severe diarrhea, high fever, bloodstream infection, or who need hospitalization) or those at risk of severe disease or complications, including young infants, adults over 65 years of age and immunocompromised persons.

**Precautionary Measures for Poultry Owners**

Precautions can be taken to reduce the risk of infection with *Salmonella* and other enteric pathogens such as *Campylobacter* when touching poultry or poultry products, such as eggs, manure and feathers. It is important to focus on keeping oneself safe after contact with poultry by practicing good hand hygiene, changing soiled clothes and avoiding contact if at high risk from infection. In addition, having a healthy flock can significantly decrease the risk of illness for flock owners. Poultry can be kept from becoming infected with bacteria and viruses from other flocks with good biosecurity measures. The following safety measures are recommended by CDC and USDA to keep both humans and poultry as healthy as possible.

### Protect yourself from illness:

- Wash your hands thoroughly with soap and water immediately after touching live poultry or anything in the area where they live and roam. Avoid touching your mouth before washing your hands. Use hand sanitizer if soap and water are not readily available.
  - Adults should supervise hand washing for young children.
  - Wash hands after removing soiled clothes and shoes.
- Do not let children younger than 5 years of age handle or touch chicks, ducklings or other live poultry without supervision.
- Do not eat or drink in the area where the birds live or roam.
- If you collect eggs from the hens, thoroughly cook them, as *Salmonella* can pass from healthy looking hens into the interior of normal looking eggs.
- Do not let live poultry inside the house, in bathrooms, or especially in areas where food or drink is prepared, served, or stored, such as kitchens or outdoor patios.
  - If you have free-roaming live poultry, assume where they live and roam is contaminated.
  - Clean equipment and materials associated with raising or caring for live poultry, such as cages, feed or water containers, outside the house, not inside.
- Do not snuggle or kiss the birds.
- Do not touch your mouth when you are around live poultry.

### Protect your birds from illness:

- Wash your hands thoroughly before entering the bird area and before and after working with your birds.
- Scrub your shoes with disinfectant because your boots and shoes can easily track disease to your birds.
  - Or keep a separate pair of shoes or boots near your cages to wear only when working with your birds.
- Wear clean clothes that you use only when you feed and care for your birds.
- Clean cages and change food and water daily.
- Clean and disinfect equipment that comes in contact with your birds or their droppings, including cages and tools.
  - Make sure to clean off all dirt, manure, litter and debris with soap and water before you disinfect.
  - Wood surfaces cannot be disinfected as well as other surfaces unless they are covered with polyurethane.
- Keep clutter out of poultry areas so that they are easy to clean.
- If you do borrow tools or cages, clean and disinfect them before they reach your property.
Infant Botulism

Botulism is a rare but serious illness. It is characterized by progressive paralysis caused by neurotoxin produced by *Clostridium botulinum* and a few other species of *Clostridium*, such as *C. baratii* and *C. butyricum*. The bacteria form spores which can exist in the environment for long periods of time. *Clostridium* spores are ubiquitous in soils worldwide and have been detected in agricultural products such as honey, marine sediment and the intestinal tracts of animals, including fish. When exposed to anaerobic conditions, spores germinate into the bacterial form which produces toxin. Seven serologically distinct types of botulism toxin have been identified and are designated by letters A through G; human illness is only caused by types A, B, E and F.

There are five distinct forms of botulism that differ by site of toxin production. Foodborne botulism is caused by consumption of preformed toxin present in contaminated foods. Wound botulism occurs when spores enter a wound, replicate and produce toxin in the anaerobic environment. Iatrogenic botulism occurs when botulinum toxin is injected into the circulatory system instead of the intended site during a therapeutic procedure. Finally, in infant botulism (IB) and the rarely reported adult intestinal toxemia, spores are ingested and germinate into bacteria in the patient's intestinal tract, eventually releasing toxin.¹,²

A baby with IB exhibits symptoms of constipation, poor feeding and failure to thrive that may be followed by progressive weakness, impaired breathing and possibly death. In order to be confirmed as a case of IB, *Clostridium botulinum* must be isolated in stool or botulinum toxin detected in stool or serum.³ Infants with mild symptoms may be managed as outpatients if carefully monitored. Those with more severe botulism require ventilator and nutritional support and may need to be hospitalized for up to two months.⁴ Botulism Immune Globulin Intravenous (BIG-IV) or “BabyBIG” was created by the California Department of Health Services and tested in a five-year randomized, double-blind, placebo-controlled trial in the same state. The Food and Drug Administration licensed BIG-IV in 2003. Use of BIG-IV has notably decreased the length of mechanical ventilation, length of stay in the intensive care unit and length of overall hospital stay.⁵ BIG-IV should be administered as early as botulism is suspected in order to interrupt neuromuscular blockade. Administration of antibiotics does not change the course of illness or recovery.⁴

Infant botulism is the most commonly reported form of botulism, with approximately 100 cases reported in the U.S. each year; no deaths have been reported since 2004.⁶ Although cases have been identified in

References
at least 46 states, California and Pennsylvania consistently lead case reporting annually. The most commonly reported toxin types are A and B, with rare occurrence of type F. Although infants reported with infant botulism in the United States range from 1 week to 51 weeks of age, the median age of onset of illness is 17 weeks.\textsuperscript{6,7}

Pennsylvania reports between nine and 20 cases of infant botulism annually. All cases reported in Pennsylvania in the past five years have been toxin type B; this finding is expected, as studies have found that toxin type A spores are found west of the Mississippi River and type B spores are found to the east.\textsuperscript{4,5} Although some studies suggest a seasonal trend of case occurrence in March through October,\textsuperscript{4} this trend has not been observed in Pennsylvania (see Figure 1). Geographic distribution of cases in Pennsylvania is markedly found in the southern part of the state (see Figure 2). Montgomery and Bucks counties, both located in the eastern part of the state, regularly report the highest number of cases annually (see Figure 3). This phenomenon of case clustering as a discrete ring around Philadelphia was first described in medical literature in 1985.\textsuperscript{8}

\textbf{Figure 1: Confirmed cases of infant botulism by month-year reported, 2008-2012}

\begin{figure}[h!]
\centering
\includegraphics[width=\textwidth]{infant_botulism_cases.png}
\caption{Confirmed cases of infant botulism by month-year reported, 2008-2012}
\end{figure}

\textbf{Figure 2: Confirmed infant botulism, five-year average incidence per 1,000 live births, 2008-2012}

\begin{figure}[h!]
\centering
\includegraphics[width=\textwidth]{infant_botulism_incidence.png}
\caption{Confirmed infant botulism, five-year average incidence per 1,000 live births, 2008-2012}
\end{figure}

Risk factor data for infant botulism has been collected inconsistently in the United States and in Pennsylvania; however, literature has identified several. Arnon, et al. reported identification of \textit{C. botulinum} organisms (not preformed toxin) in numerous honey specimens that had been fed to infants diagnosed with botulism. Honey is the only avoidable source of infant botulism that has been identified.\textsuperscript{9} Other food items, including chamomile obtained in bulk from herbal stores, have been identified as posing a potential risk because spores were detected in these products. One commonly mentioned type of food, light and dark corn syrup, was found to contain spores in the early 1980s, but manufacturing methods have changed;
more recent epidemiologic and laboratory data do not support the idea that corn syrup is associated with infant botulism.10,11 Because spores are ubiquitous, transmission of botulism through environmental sources is also postulated. These include exposure to house dust and to soil disrupted by agricultural practice, weather or earthquake.4,9,11 Though almost all infants will be exposed to dust and/or soil during their first year of life, infant botulism remains a rare disease even in hot spots such as southeastern Pennsylvania. It remains a mystery as to why only a tiny proportion of infants develop this disease; it may be due to a transient circumstance in which botulism spores are swallowed at a time when a particular infant’s gastrointestinal tract happens to be especially susceptible. Colonization and growth of C.\textit{botulinum} spores may occur when normal bowel flora that could compete with \textit{C. botulinum} have not been fully established in the infant’s intestines.12

References
**Infectious Disease Aberration Detection in Allegheny County**

For the past three years, the Allegheny County Health Department (ACHD) has been using a historical limits aberration detection program to determine when a disease is above its expected threshold. This is the same type of aberration detection that is used by the Centers for Disease Control and Prevention for national surveillance data featured in the Morbidity and Mortality Weekly Report (MMWR). The goal of this activity is to identify disease counts that are higher than what is expected based on historic data in order to detect abnormalities and outbreaks that otherwise may have gone unnoticed.

Historical limits aberration detection works by comparing the disease counts for the current week to the same week for each of the previous five years. In addition to creating disease counts for the current week, the aberration detection program averages in counts for the week before and the week following for each of the previous five years (Figure 1). Including the prior week and subsequent week for each year ensures stable estimates with which to compare current disease counts.

ACHD’s aberration detection program uses disease investigation data downloaded from Pennsylvania’s National Electronic Disease Surveillance System (PA-NEDSS). PA-NEDSS disease investigations consist of patient identifiers, demographics, lab results, symptoms and risk factor data collected during interviews with public health nurses. The aberration detection program is a SAS program that searches PA-NEDSS for infectious disease investigations that were initiated in the past week and tallies the number of investigations for each disease.

A current ratio is calculated for each disease using the following formula:

\[
\text{Current ratio} = \frac{\text{Total current week count}}{\text{mean of historic weeks count}}
\]

Next, the program calculates a historic threshold, represented by:

\[
\text{Historic threshold} = \left(1 + \frac{2 \times \text{STDDEV of historic weeks count}}{\text{mean of historic weeks count}}\right)
\]

When the current ratio is greater than the historic threshold for any given disease, that disease is flagged as exceeding its historic threshold.

The investigations for each flagged disease are individually reviewed by epidemiologists to look for similarities among cases to find previously unnoticed outbreaks and clusters. Because there may be a delay between the date a report is entered in PA-NEDSS and the date an investigation is initiated, the program has recently been enhanced to analyze PA-NEDSS reports. This new report-based analysis may alert us to outbreaks sooner. It is too early to say if this analysis will be of practical use on a regular basis.

When used at the national level in MMWR, historical limits aberration detection offers a broad overview of disease counts that are generally increasing or decreasing. While interesting, this information does not translate easily into local public health action. However, when applied to the local level, historical limits...
aberration detection offers a number of additional benefits and insights. First, this program provides epidemiologists with a quick way to determine if current disease counts are above what is expected historically, allowing them to focus their time and resources on diseases of concern. In addition to determining when outbreaks begin, historical limits aberration detection also helps to determine when outbreaks end. This was particularly helpful during Allegheny County’s 2009-2010 outbreak of shigellosis, during which historical limits aberration detection was used to pinpoint the end of the outbreak, defined by shigellosis counts dropping below their calculated historical threshold. Historical limits aberration detection has become a useful tool at ACHD, and we are happy to share this program with other epidemiologists.

**Avian Influenza A (H7N9) Virus**

In February 2013, the first cases of human infection with a new strain of influenza A (H7N9) were reported in China. Soon after, the virus was also detected in poultry. The virus is believed to be a reassortment of genes from domestic ducks, wild birds and domestic poultry, as shown in Figure 1.

![Figure 1: Genetic Evolution of H7N9 Virus in China, 2013](http://www.cdc.gov/flu/avianflu/h7n9-images.htm#reassortment)

Some mild illnesses have been observed, but most known human cases have had severe illness, with a case fatality rate of approximately 30 percent. Many of the cases have had contact with poultry, but some have not, indicating limited human-to-human transmission may have occurred. However, even though human-to-human transmission is not currently widespread, the virus could mutate at any time (as influenza viruses tend to do) and become more easily transmissible among humans. Sustainable human-to-human transmission could create a pandemic.

As of July 10, 2013, more than 130 cases had been reported with 43 deaths. The majority of cases occurred in April, and then the number of detected cases dropped off dramatically. The decrease may have been due to containment measures, such as the closing of live bird markets, or the change in
(Avian influenza continued)

seasons or a combination of the two factors. If the change was indeed seasonal, H7N9 infections could increase in the fall when the weather turns cooler in China.

In efforts to control the virus, Chinese authorities in affected locations are conducting enhanced surveillance, epidemiologic investigations, tracing of close contacts, clinical management, laboratory testing, and providing guidance on prevention and control measures.

No human or bird cases have been detected in the U.S. and the risk to U.S. citizens is low, but the Centers for Disease Control and Prevention (CDC) is following the situation closely. Authorities at CDC are providing up-to-date guidance for physicians and public health authorities on the use of antiviral medications, infection control practices, and diagnosis and laboratory testing. In addition, CDC is developing a candidate vaccine virus that could be used to make a vaccine if necessary.

As the situation is continuously evolving, please see the CDC website for the most current information.

**Resources**

CDC: [http://www.cdc.gov/flu/avianflu/h7n9-virus.htm](http://www.cdc.gov/flu/avianflu/h7n9-virus.htm)

MMWR, Emergence of Avian Influenza A(H7N9) Virus Causing Severe Human Illness — China, February–April 2013: [http://www.cdc.gov/mmwr/preview/mmwrhtml/mm6218a6.htm?s_cid=mm6218a6_w](http://www.cdc.gov/mmwr/preview/mmwrhtml/mm6218a6.htm?s_cid=mm6218a6_w)


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**Middle East Respiratory Syndrome Coronavirus (MERS-CoV)**

Middle East Respiratory Syndrome Coronavirus (MERS-CoV) was first reported in Saudi Arabia in 2012. The virus, which had never been seen before, is not the same coronavirus that caused SARS in 2003. The original source of the virus and modes of transmission (from original source to human and human-to-human) have yet to be identified. Most people with the virus have been severely ill with fever, cough and shortness of breath, and approximately half have died, though a small proportion of cases have had a mild respiratory illness. There is no treatment for MERS-CoV except for supportive care to relieve symptoms. MERS-CoV has been transmitted between people who are in close contact, including from patients to healthcare workers; however, no sustained transmission has occurred. Clusters of cases have been recognized in Saudi Arabia, Jordan, the United Kingdom, France, Tunisia and Italy. With global travel, there is potential for the virus to spread farther. So far, no one in the United States has been recognized as being infected with the virus.

CDC is monitoring the situation and working with WHO and others to learn more about the virus. CDC assisted in investigations in Saudi Arabia and Jordan and is continuing to provide advice and laboratory diagnostic support to countries in the affected region. CDC has also developed a diagnostic test to identify cases and has provided test kits to state health departments. It is offering recommendations to concerned travelers and assessing ill travelers returning from affected areas. Finally, it is looking into the possibility of developing a vaccine.

Healthcare providers and health departments should refer to CDC’s website for up-to-date information on case definitions, infection control, case investigation, and specimen collection and shipment.

For the latest information, please see CDC’s website on [Middle East Respiratory Syndrome Coronavirus](http://www.cdc.gov/middleeastrespiratorysyndrome).
### Disease Reporting

Healthcare practitioners, healthcare facilities and clinical laboratories are required to report certain diseases to the Pennsylvania Department of Health. In addition to the diseases on the list, all disease outbreaks and/or unusual occurrences of disease are reportable within the commonwealth. In most cases, reporting must be done electronically via Pennsylvania's version of the National Electronic Disease Surveillance System (PA-NEDSS). To request a PA-NEDSS account, healthcare providers may email PA-NEDSS@pa.gov; please include your contact information and the name and address of the facility for which you will be reporting.

### Cases of select notifiable diseases in Pennsylvania *

(as of 09/16/2013)

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* Confirmed cases only
† Case counts for 2013 are provisional and subject to change. Counts for earlier years are for complete years.

### Employment Opportunities

The State Civil Service Commission is currently accepting applications for the following Pennsylvania Department of Health positions:

- **Epidemiologist**
- **Epidemiology Program Specialist**
- **Public Health Physician**

To apply, click on the links above or visit the Pennsylvania State Civil Service Commission website and click on Job Seekers.

Complete a civil service application for each position for which you are interested. Some positions also require an application supplement. The commission will send you the results of your examination or rating. If you meet the minimum requirements, your name will be placed on the list of eligible candidates (eligible list) for that job title according to your score. Positions in the merit system are filled from this pool of eligible candidates. When a job vacancy occurs, the hiring agency requests an eligible list from which to interview for that job title. If you are ranked high enough on the eligible list, you will be contacted for a job interview. See How to Get a Civil Service Job for more information.

### Pennsylvania Epi Notes

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