

***Salmonella* Knowledge, Attitudes, and Practices: A Survey of Backyard Poultry Owners  
Residing in Seattle and King County, Washington.**

Kelly J. Kauber

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Kelly J. Kauber

University of Washington

**Abstract**

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Kelly J. Kauber

Chair of the Supervisory Committee:

Peter Rabinowitz, Associate Professor

Department of Environmental and Occupational Health

**Background:** Backyard poultry flocks raised in urban settings are becoming increasingly popular across the country; however, hospitalizations related to contact with poultry are reported each year. Understanding husbandry practices and general *Salmonella* knowledge of backyard flock owners will help highlight future educational outreach to reduce exposure related to caretaking practices.

**Methods:** A cross-sectional descriptive study was developed to better understand the knowledge, attitudes, and practices around *Salmonella* risk and prevention in backyard poultry owners living in Seattle and King County, Washington. Fifty households were recruited from June through October 2014. Selection criteria required participants to be at least 18 years old, own at least one chicken and live in Seattle/ King County. A 61-question written survey was administered orally to the study participants. The questions focused on bird health, biosecurity practices, husbandry practices, attitudes about *Salmonella* risk, and general *Salmonella* knowledge. Participants were

videotaped while caring for their birds, and this information was transcribed using notational analysis to determine if reported behaviors differed from observed practices.

**Results:** The results from this survey indicated that while a large proportion of subjects knew that exposure to *Salmonella* is an inherent risk associated with raising poultry and harvesting eggs, preventive behaviors and husbandry practices of subjects did not consistently reduce risk of transmission of zoonotic disease. Approximately 1 in 4 participants reported performing behaviors that increase risk of hand to mouth contact around their birds, such as snuggling and kissing birds or eating/drinking near them. None of the participants were observed kissing their birds on video; however, holding birds or touching their face during routine care was observed in approximately two-thirds of the video recordings. Use of personal protective equipment, including gloves and masks when cleaning the coop was lower than reported when compared to the video recordings. Education and outreach targeting backyard flock owners to should aim to improve husbandry practices and awareness of how to reduce zoonotic risks associated with raising poultry in the backyard setting.

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## **Chapter 1: Introduction**

### **1.1 Chickens in the City**

Raising backyard poultry in an urban setting is increasing in popularity in many areas across the country, including Seattle, Washington. As people are becoming more health conscious and aware of where their food comes from, the movement towards sustainable farming and local foods has also influenced the rise of urban farming. Raising chickens in the city provides not only fresh eggs but also companionship to their caregivers.

### **1.2 Public Health Risk**

From a public health perspective there is an inherent risk associated with zoonotic transmission of pathogens commonly associated with poultry husbandry and production. Common pathogens of interest range from avian influenza to bacterial microbes including *Salmonella enteritidis* and *Campylobacter jejuni*. These two bacteria are the leading causes of diarrhea caused by foodborne illness due to consumption or contact with poultry products. These microbes can potentially be transmitted during care of live birds through contact with contaminated bedding, structures, and environment as well as during handling of birds and eggs. Prior research on backyard flocks has been heavily focused on avian influenza. Elkhoraibi conducted a survey of owners of backyard flocks through feed stores in California, Colorado, and Florida looking at general biosecurity and knowledge of poultry husbandry; this study indicated that there is a lack of awareness of poultry diseases and potential zoonotic risks associated with keeping poultry (1). However, recent publications have focused on *Salmonella* outbreaks associated with direct contact with live poultry.

### 1.3 From Industry to Backyards

The poultry production industry has adapted protocols to raise a large numbers of birds and achieve a high rate of product through a very controlled setting. The poultry industry is highly regulated and monitored by the United States Department of Agriculture (USDA) and Food and Drug Administration (FDA); however, there is an inherent risk of environmental contamination during production of poultry eggs and meat products with *Salmonella* and *Campylobacter*.

Modern agriculture, over the years, has adapted to minimize the risk of transfer of disease from wild birds to commercial flocks. Bringing production animals back into the city after decades of moving them out into open spaces has its benefits but also raises a few concerns related to general public health. A backyard flock in a densely populated area, sometimes with multiple other flocks within a one-mile radius, raises concern for transfer of zoonotic disease through wild bird populations as well as insect and rodent populations (1,3). Backyard poultry ownership by inexperienced individuals increases the likelihood of illness related to poor husbandry practices (4).

*Salmonella enterica* is the serotype that can cause severe gastroenteritis and septicemia in humans and it is generally the type that is implicated in cases of human salmonellosis (2). While *Salmonella* infections in young poultry can cause diarrhea, in-appetence, weight loss and death, most of the time the infection is subclinical. This means the bird can shed the bacteria without any noticeable signs or symptoms of disease (2). Since birds may carry *Salmonella* but not show outward signs of illness, it is important that poultry owners and handlers are aware of subclinical carriage of infection and practice risk reducing behaviors consistently. Literature examining risks associated with *Salmonella* in flocks is largely focused on commercial operations and is not

directly transferable to the backyard setting (3). Prevalence of *Salmonella* occurring in backyard poultry flocks is largely unknown, and likely variable depending on geographical location, husbandry practices, hatchery source, as well as socioeconomic status of the owner (3). Contact with baby poultry has been implicated in *Salmonella* outbreaks in the US, namely outbreaks that occurred associated with chicks from mail-order hatcheries in 2011, 2012, 2013 and 2014 (5-8).

#### **1.4 Significance and Prior Literature**

Salmonellosis cases linked to contact with backyard poultry have been reported every year since 1955 (9). In a report from the Centers for Disease Control and Prevention (CDC), an estimated 50 million chicks are sold each year (5), and since the 1990's there have been an estimated 45 outbreaks of human salmonellosis linked to live poultry (6,7). Non-typhoidal *Salmonella* infections are estimated to be the cause of more than 1.2 million hospitalizations and 370 deaths every year (10). Approximately 11 percent of *Salmonella* infections are associated with contact with live animals (11).

In 2011 there were two outbreaks of *Salmonella* associated with 96 cases caused by the serotypes Altona and Johannesburg identified in 24 states; these cases were traced back to contact with live poultry within weeks of purchasing chicks (5,8). Contact with live poultry, including chickens, ducks, geese and turkeys, continue to be a public health concern (5,8). A multi-state study targeting poultry owners at feed stores analyzed *Salmonella* awareness and related practices utilizing questionnaires at feed stores in Denver, Miami and Los Angeles in 2010; the study findings suggested there was limited awareness of risk associated with contact with live birds (2).

In 2014, there were 363 cases of *Salmonella* directly related to contact with live poultry in 43 states with a 33% hospitalization rate (7). The serotypes reported in this outbreak included

*Salmonella Infantis*, *Salmonella Hadar* and *Salmonella Newport* (7). These illnesses were traced back to baby poultry located at the homes of the infected persons. The source of the poultry was linked to a single hatchery that had also been implicated in outbreaks in 2012 and 2013 (7). In Washington State, there were 10 reported cases during this 2014 outbreak (7). While it is widely known that *Salmonellosis* can be acquired from consuming undercooked poultry and eggs or through cross-contamination in the kitchen, it is unclear if risk associated with raising chickens and handling eggs is acknowledged by those raising poultry in a backyard setting.

Prior studies looking at poultry husbandry practices involved written surveys. This type of study tool relies on responses from subjects and may include substantial response bias (12). In a study assessing cross-contamination during raw poultry handling in kitchens, a combination study design using direct observation with a survey was used to reduce response bias and to compare observed versus reported behaviors (12). This study uses a similar method to account for research bias as well as allows comparison of observed practices with reported answers to behavioral questions regarding husbandry practices. This study utilized a survey to collect information on knowledge, reported behaviors, and practices and direct observation of participants to evaluate reported practices.

The purpose of this cross-sectional study was to increase understanding about the level of knowledge of *Salmonella* and risk of infection in maintaining poultry, and to assess attitudes and practices that may influence exposure in owners of backyard flocks in Seattle and King County. The outcomes of this study may help direct future educational efforts to increase awareness and promote better husbandry practices to reduce the risk of exposure among flock owners and those who might come into contact with their flocks.

## **Chapter 2: Methods and Analysis**

### **2.1 Recruitment and Site Visits**

Potential participants responded to recruitment flyers that were posted at local feed stores, local veterinary clinics, online backyard poultry posting forums, Facebook group pages, and by word of mouth. Participants were recruited from June 2014 through October 2014 until 50 households, who met the criteria for selection, were scheduled for visits. Selection criteria required participants to be at least 18 years old, own at least one chicken and live in Seattle/King County. A 61 question written survey was administered orally to study participants that focused on bird health, biosecurity, husbandry practices, attitudes about *Salmonella* risk, and general *Salmonella* knowledge. Participants were videotaped while they cared for their birds to assess whether behaviors and practices aligned with owners' responses.

Each survey site was given a unique code and data were entered into a database system excluding any identifiable subject information. This paper discusses the knowledge, attitudes, and practices results of the survey. The other components of this survey along with additional environmental samples will be discussed in a separate analysis. A copy of the survey can be found in Appendix 1. The University of Washington's Institutional Review Board approved this study.

The sample size for this study included all 50 participants; they were pre-screened prior to scheduling site visits to ensure they met the selection criteria. Missing data due to unanswered questions were infrequent, and all non-responses were excluded from analysis. Responses were reported in tables showing the number of participants that responded and proportion based on valid percent. Chi-square tests were used to test the association between gender, age and education status to test for relationships between reported behaviors. SPSS version 19 was used to organize and analyze data.

## **Chapter 3: Results**

### **3.1 Flock Characteristics and Study Population Demographics**

The study population participants were predominantly White (94%), female (74%), and well educated. The level of education of participants was high. Over one-third (36%) of participants had a 4-year college degree and more than one-half (54%) of participants had a graduate degree or higher. Only 10% of the population had less than 4 years of post-high school education.

The average layer flock size was 5 hens, with the range of 2 to 21 birds; 90% of flocks contained 8 or fewer birds. Seattle city code permits up to 8 domestic fowl on city lots excluding roosters, Seattle Municipal code SMC 23.42.052 (13). Unincorporated King County dictates how many birds can be on a lot based on the size of the property. Other domestic poultry species reported living on the premises, in addition to chickens, included waterfowl, turkeys, and indoor pet birds (Table 1).

### **3.2 General Salmonella Knowledge**

A total of 80% of participants knew that *Salmonella* is a bacterium, while 10% responded that that it is a virus, and 10% reported that they did not know. A total of 40% of participants understood that chickens could have symptoms of disease caused by *Salmonella*, 20% responded that chickens could not have disease caused by *Salmonella*, and 40% reported they did not know. Almost all participants (98%) reported that they were aware *Salmonella* could cause significant disease in humans (Table 2).

### **3.3 Reported Symptoms of Illness**

A large proportion of participants (88%) reported they had not experienced illness or symptoms that they believed were associated with contact with their chickens, their eggs, or the

chicken enclosure. A total of 6% of participants reported that they had experienced clinical symptoms associated with eating eggs from their chickens, and 12% reported that they believe they had experienced clinical symptoms of illness attributable to contact with their chickens and/or their environment. The symptoms attributed to contact with the chickens or their environment included diarrhea, vomiting, stomach cramps, and fever (Table 3). None of the reported illnesses were confirmed with any laboratory diagnosis.

### **3.4 Caretaking Practices Compared with CDC Guidelines**

CDC guidelines for chicken husbandry indicate certain high-risk behaviors that people handling poultry should avoid. The guidelines recommend washing hands with soap and water, or using hand sanitizer, after handling poultry or anything in their environment. CDC recommends cleaning all poultry equipment or materials associated with raising poultry outside the home, including feed and water containers and cages. Recommendations advise not allowing children under the age of five years or adults with suppressed immune systems to have contact with or handle chicks or other live poultry. Avoiding hand to mouth contact is advised, specifically not kissing or snuggling adult chickens or chicks, as well as not eating or drinking around poultry. Keeping poultry out of the house including bathrooms and kitchens, and away from areas where food and drink is served, including patios, is also recommended.

Questions on the survey derived from CDC guidelines for husbandry practices were designed to collect information on how often certain risky and risk reducing behaviors are performed. The responses to the CDC guideline questions were collected using a Likert Scale to assess how often participants perform a behavior (Table 4). These data were re-categorized into two categories according to their Likert Scale responses. Responses that were answered *not applicable* were excluded from the analysis. Participants who responded to the survey as

performing an activity *always*, *usually* or *sometimes* were considered to perform the practice often enough to be categorized as performing the behavior, while those who responded *never* or *rarely* were categorized as not performing the behavior.

When asked how often participants washed their hands with soap and water or used hand sanitizer after direct contact with live poultry or their environment, almost all (98%) responded that they perform this behavior. Two-thirds (66%) of participants responded that they do not wash poultry-related equipment in the house or in areas where food is prepared. Similarly in-line with guidelines, three-quarters (76%) of owners do not typically let live poultry inside their house, in bathrooms, or in areas where food or drink is prepared or stored.

One-quarter of participants reported that they snuggle, kiss, touch their mouth or eat/drink around chicks (26%) or adult chickens (22%). One-half of the participants responded that they eat raw or undercooked eggs, including restaurant dishes (51%). When asked if participants eat eggs from their chickens that were dirty or cracked, less than one-half of participants (42%) responded that they had (note: most participants clarified that their yes answer applied only to the dirty egg portion of this question and that they did not eat eggs that were cracked when collected). Over one-half (57%) of respondents indicated that they allow children younger than 5 years of age to have direct contact with chickens, especially chicks. When asked if participants wear personal protective equipment while cleaning the chicken coop, almost three-quarters (72%) reported that they do not wear a mask and over one-third (43%) said they do not wear gloves (Table 4).

### **3.5 Video Observation Comparisons**

The video recordings were analyzed to assess whether or not certain behaviors like kissing or snuggling (holding/touching) chickens or touching the face occurred during the 5 to 15

minute caregiving routine observed during the site visit. Caregiving involved checking the feed/water, cleaning out the coop or enclosure, adding bedding and collecting eggs. In some videos young children, suspected to be less than five years old, were observed in the chicken enclosure area, petting chickens and collecting eggs. There were also observations of children playing without shoes in the yard where chickens were foraging. Entering the home with flock shoes and touching doorknobs with dirty hands were also observed.

Video observations were compared with individual participant responses to the survey questions to see if people were observed kissing or snuggling their birds, or touching their face while caring for their birds, and if there were any differences between those who responded that they always/often/sometimes or rarely/never perform these behaviors. During daily care for their birds, almost one-half (46%) of respondents who reported they rarely or never “kiss/snuggle, touch their mouth, eat or drink, or smoke around adult chickens” were observed on video holding birds or engaging in other bird to clothes contact. None of the participants were observed kissing their birds on video; however, holding birds (bird to clothes contact) or touching their face while taking care of their birds was seen in almost two-thirds (65%) of the video recordings. Touching the face was the behavior performed most often and was observed in one-half of the video recordings (25/49, 51%). Most of (10/11, 91%) the participants who reported that they do kiss/snuggle birds/touch mouth/eat or drink near poultry were in fact observed on video touching their face or holding their birds during the site visit, compared to a much smaller proportion (22/38, 58%) of participants who reported that they rarely/never performed this behavior and were then observed on video holding birds or touching their face (Table 5).

Another observation from video analysis was inconsistent glove use. While almost one-half (43%) of respondents reported that they use gloves when cleaning the coop, a much smaller

proportion 6/49, 12% were observed wearing gloves (or hand coverings) while caring for their birds during the site visit. It is important to note that not all participants cleaned their coop during the site visit and that some participants reported only wearing gloves when “deep cleaning” their coop (Table 5).

## Chapter 4: Discussion

Almost one-fourth of participants answered that they kiss and snuggle live chicks or chickens, touch their mouth or eat/ drink near poultry. This type of close contact increases the risk of ingesting material that could be contaminated with pathogens such as *Salmonella*.

Although CDC recommends that young children are at higher risk of illness related to Salmonellosis, over one-half (54%) of participants reported that they do allow children younger than five years old to have direct contact with poultry. Prior studies indicate that parents with children gave ‘educational experience for kids’ as a reason for owning backyard poultry (2). From the observed practices, it was not uncommon for participants with children in the home to allow supervised interaction with the poultry and some allowed young children to help with chores such as collecting eggs. It is important that parents acknowledge that hand-mouth exposure is common and that children are more susceptible to illness.

A small proportion of participants (12%) reported that they had experienced symptoms of illness they associated with contact with their chickens and/or their environment or consumption of eggs from their coop. The reported symptoms included diarrhea, vomiting, stomach cramps, and fever. It is impossible to know whether the participants’ reported symptoms are related to *Salmonella* without clinical testing, however these symptoms are consistent with clinical illness associated with Salmonellosis.

The video data allowed a unique opportunity to compare reported behaviors with actions observed during the site visit. Specifically looking at how participants responded to the question, “*How often do you kiss/snuggle, touch your mouth, eat or drink near adult birds?*,” we were able to see differences in how participants may respond to questions that ask about perceived “risky” behaviors. Those who responded that they did perform the behavior (always/often/sometimes)

were commonly observed on video performing this behavior, while those who responded that they did not perform the behavior (rarely/never) were observed on video performing the behavior over 50% of the time. This indicates that participants may be more likely to under-report risky behaviors and practices.

Limitations of this study might include lack of diversity of the study population. The self-selected group of participants was predominantly White, female and well-educated. We know that the study population is not representative of the general population in Seattle, King County; however, the general population does not own poultry. Ownership of backyard poultry in King County is not regulated, so there is not a source of demographic data to better understand the demographics of the owner population. Another limitation of this study could be misinterpretation or lack of understanding of survey questions, but in order to reduce this factor the questions were read to the participants and a research associate was able to help clarify questions as needed. Administering the survey orally may have created response bias, and participants' may be less likely to report risky behaviors to a research associate than if the written survey had been filled out individually. Owners may have been trying to give the "right answer" to the research assistant performing the interview. Because the population of this study sample was primarily White and female and there is not sufficient information on the overall population of backyard poultry owners, the overall generalizability of this study is unknown.

## Chapter 5: Conclusion

The data from this survey reveal that backyard poultry owners are conscious of the association between *Salmonella* and chickens, but that they do not consistently perform risk-reducing husbandry practices as recommended by CDC to help prevent infection with *Salmonella*. There is a need for better education to effectively communicate the risk of potential for zoonotic disease transmission and provide recommendations for husbandry practices. While *Salmonella* knowledge, attitudes and practices were the focus of this particular study, it is not the only relevant zoonotic exposure owners should be made aware. Flock owners should understand that there are risks, but by practicing good husbandry they can reduce transmission of bacteria to keep the chickens, themselves and their family healthy.

Education to reduce exposure to *Salmonella* has been implemented at feed stores in King County, Washington. Flyers describing *Salmonella* and CDC recommendations are made available to feed stores by local public health. Feed stores that sell poultry in King County are required to post signs encouraging hand washing and to distribute *Salmonella* educational information to customers at the time of sale. Additional educational information, including best husbandry practices and information on other diseases associated with live poultry contact, should be distributed at the time of sale to increase awareness (8). Owners' experience with animal husbandry is variable, and the feed store setting would be an ideal place to reach owners for best practice recommendations as this is a point of contact people trust and visit frequently for feed and husbandry supplies. Proper egg processing and use of personal protective equipment (mask and gloves) when cleaning the coop are important husbandry behaviors that flock owners should improve. These behaviors not only reduce transmission of *Salmonella* but also protect flock owners from other zoonotic diseases related to poultry.

Future areas of study should include accessing factors that influence the detection of *Salmonella* in backyard flocks and the rates at which adult chickens shed *Salmonella* to help determine the risk associated with raising and maintaining backyard flocks. It might also be beneficial to do a longitudinal study to look new owners' practices and how they change over time to further investigate illness attributable to raising birds in the backyard setting. To better understand measurable risks associated with raising backyard poultry there should also be further study to assess how long chicks shed *Salmonella* and what the rate and concentration is for shedding in adult chickens, including factors that influence detection in the backyard setting. Evaluation of feed store educational messaging and husbandry practices would help determine the best way to influence and improve husbandry practices.

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## Appendix 1

**Table 1** Demographics and Flock Characteristics

<b>Demographics of Primary Caregiver</b>	<b>No. (%)</b>
<b>Sex</b>	
Female	37 (74)
Male	13 (26)
<b>Race</b>	
White	47 (94)
Non-White	3 (6)
<b>Education</b>	
2- year college	5 (10)
4- year college	18 (36)
Graduate school	24 (48)
Professional school	3 (6)
<b>Age Mean (Range)</b>	<b>44.5 (30-75)</b>
<b>Flock Characteristics</b>	
	n=50 (n %)
Chickens	50 (100)
Other poultry (not including pet birds)	2 (4)
<b>Flock size: Mean (Range)</b>	<b>5.6 (2-21)</b>

**Table 2** General *Salmonella* Knowledge

<b>Survey Questions</b>	<b>Frequency n=50 (n %)</b>
<b>Salmonella is a</b>	
Bacteria	40 (80)
Virus	5 (10)
Don't know	5 (10)
<b>Salmonella can cause severe disease in poultry</b>	
Yes	20 (40)
No	10 (20)
Don't know	20 (40)
<b>Salmonella can cause severe disease in humans</b>	
Yes	49 (98)
No	1 (2)

<b>Salmonella is only found in poultry and poultry products</b>	
Yes	2 (4)
No	43 (86)
Don't know	5 (10)
<b>Salmonella can be found on which part of the egg</b>	
Egg white (albumin)	30 (60)
Egg Yolk	29 (58)
External egg shell	44 (88)
Selected ALL Parts of the egg	27 (54)
<b>Salmonella can be transmitted by</b>	
Eating undercooked/raw eggs	50 (100)
Handling chicks/chickens	49 (98)
Eating a dish made with raw eggs	49 (98)
Contact with eggs	50 (100)
Contaminated surfaces	49 (98)
Not washing hands	49 (98)
Selected all of the above transmissions	47 (94)

**Table 3** Reported Symptoms Associated with Flock/Coop

<b>Symptoms Reported</b>	Frequency n=50 (n %)
Any symptoms reported	6 (12)
Associated with dish/meal prepared with eggs from coop	3 (6)
Associated with contact with live birds or coop environment	6 (12)
<b>Type of symptoms/illness disclosed</b>	
Diarrhea	5 (10)
Fever	2 (4)
Vomiting	3 (6)
Stomach Cramps	4 (8)
Other	2 (4)

**Table 4** Public Health Practices: Dichotomized for behavior trends

	Always/Often sometimes n (%)	Rarely or Never n (%)	n
a. Wash hands after touching chickens or ducks or anything in the area where they live, using soap and water or hand sanitizer if soap and water are not available	49 (98)	1 (2)	50
b. Wash clean cages, feed or water containers, or other poultry related equipment inside your house or in areas where food is prepared	16 (32)	33 (66)	49
c. Let live poultry inside your house, in bathrooms, or in areas where food or drink is prepared, served, or stored, such as kitchens, or outdoor patios	12 (24)	38 (76)	50
d. Snuggle or kiss baby chicks, touch your mouth or eat or drink or smoke around baby chicks	13 (26)	37 (74)	50
e. Snuggle or kiss (adult) chickens, touch your mouth or eat or drink or smoke around chickens	11 (22)	39 (78)	50
f. Eat raw or undercooked eggs, including restaurant dishes	25 (51)	24 (49)	49
g. Eat eggs from your chickens that were dirty or cracked**	20 (42)	28 (58)	48
h. Thoroughly wash hands and all food contact surfaces with soap and water after contact with raw eggs	43 (86)	7 (14)	50
i. Allow children younger than 5 years of age to handle (or have other contact with) your chickens, especially chicks	27 (57)	20 (43)	47
j. Wear a mask when cleaning the chicken coop	13 (28)	34 (72)	47
l. Wear gloves when cleaning the chicken coop	27 (57)	20 (43)	47

\*\*Applies to dirty eggs, cracked eggs where reported as not being eaten in most surveys.

**Table 5** Survey Reported vs. Video Observed Husbandry Practices

		<b>Behaviors Observed in Video</b>		N=49
		<b>Yes No. (%)</b>	<b>No No. (%)</b>	
<b>Reported kiss, snuggle, touching mouth, eat/drink around adult birds</b>	Yes	10 (20)	1 (2)	
	No	22 (45)	16 (33)	

\* p-value= 0.071

## Appendix 2 Survey

Facility Number \_\_\_\_\_ Owner Name \_\_\_\_\_  
 Test Results? \_\_\_\_\_ Address \_\_\_\_\_  
 Surveyor \_\_\_\_\_ Name of Company/Operation \_\_\_\_\_  
 GPS Coordinates \_\_\_\_\_ Phone \_\_\_\_\_  
 Email address \_\_\_\_\_

**For each multiple choice question, please circle the letter that best describes you or your flock.**

**For all others, please provide the information specified by each question.**

**1. Are you over 18 years of age?**

A. Yes

B. No

### Part 1 - Flock Characterization (8 Questions)

**2. How many birds of the following types do you keep on your premises currently and how many have you kept in the past 12 months?**

**# Currently**

**# Last 12 mos**

	# Currently	# Last 12 mos
A. Chickens – egg layer breeds.....	_____	_____
B. Chickens – meat breeds.....	_____	_____
C. Chickens – show, exhibition, companion, etc.....	_____	_____
D. Turkeys.....	_____	_____
E. Waterfowl (ducks, geese, swans, etc).....	_____	_____
F. Game birds (pheasant, quail, chukar).....	_____	_____
G. Guinea fowl.....	_____	_____
H. Peafowl.....	_____	_____
I. Pigeons, Doves.....	_____	_____

<b>J. Indoor pet birds (non-poultry).....</b>	_____	_____
<b>K. Other birds (specify).....</b>	_____	_____

**3. Do you keep other animals on your premises? Circle all that apply.**

- |                  |                             |                                |
|------------------|-----------------------------|--------------------------------|
| <b>A.</b> Cattle | <b>D.</b> Cats              | <b>G.</b> Swine                |
| <b>B.</b> Horses | <b>E.</b> Sheep/Goats       | <b>H.</b> Other Livestock_____ |
| <b>C.</b> Dogs   | <b>F.</b> Other Pet Animals |                                |

**4. What housing management style best describes your flock? (1= layers, 2=meat birds)**

- A.** Inside, confined to coop/barn/house (no outdoor access)
- B.** Inside coop/barn/house with outdoor access but unable to leave property (ie: coop with attached flight pen)
- C.** Inside coop/barn/house with outdoor access but able to leave property (ie: outdoor birds that return to coop in evening)
- D.** Outdoors only, but confined to property (ie: flight pen only)
- E.** Outdoors only and able to leave property (ie: no confinement or housing used)
- F.** Other (please specify) \_\_\_\_\_

**5. Please indicate the number of houses/coops that you use or own. Please also indicate the premises name, nearest town or zip code of any houses on different premises. *If all houses are located on this premise, please write "here."***

Number of Houses/Coops	Location (City, State, Zip) or Facility
_____	_____
_____	_____
_____	_____





11. From the list in question 10, did any of the birds return to your premises after visiting specified places?

If YES, please record the corresponding letters to each event listed above where birds returned from (ie: F = Auction) and the approximate number of birds that returned.  
*Example: Yes: C=Poudre Pet and Feed. 6 chickens*

- A. Yes \_\_\_\_\_
- B. No \_\_\_\_\_

12. In the *past 12 months*, have you purchased or obtained birds or hatching eggs from the following places? If so, please state the corresponding letter, type of bird, number of birds and the name of the location or facility or zip code (ie: Murray McMurray).  
If not, please leave blank.

- A. Bird wholesaler or dealer
- B. Another premises with birds
- C. Farm or Feed Store
- D. Swap meet or Flea/Farmer's Market
- E. Fair or Show
- F. Auction
- G. In-State Breeder
- H. Other\_\_\_\_\_

	<u>Place (letter)</u>	<u>Type</u>	<u># of Birds</u>	<u>Location (city, state) or Facility</u>
Example	<u>  A  </u>	<u>Turkey</u>	<u>  20  </u>	<u>Murray McMurray, Webster IA 50595</u>
	_____	_____	_____	_____
	_____	_____	_____	_____
	_____	_____	_____	_____
	_____	_____	_____	_____

**13. Are your birds purchased from National Poultry Improvement Plan (NPIP) certified Salmonella Enteritidis Clean stock?**

- A. Yes
- B. No
- C. Don't Know

**Part 3 - Biosecurity  
(3 Questions)**

**14. Do you separate birds you bring onto the premises before they are introduced into your established flock, including your own birds returning from travel? If yes, for how long?**

- A. Yes \_\_\_\_\_  
(days)
- B. No
- C. N/A - I do not (re)introduce birds to the flock

**15. How many times in the past 12 months have you shared equipment (lent, borrowed or co-owned) with another flock owner?**

- A. Zero
- B. 1-3 times
- C. 4-12 times
- D. Over 12 times

---

**16. How often do the people who have contact with your flock do the following?  
Please circle frequency.**

	<u>Frequency</u>			
	Always	Usually	Sometimes	Never
A. Use a disinfectant footbath before/after contact .....	Always	Usually	Sometimes	Never
B. Change into clean clothes/coveralls before contact.....	Always	Usually	Sometimes	Never
C. Change into specified "flock shoes" before contact.....	Always	Usually	Sometimes	Never

D. Change into clean boots or use shoe covers before contact.....	Always	Usually	Sometimes	Never
E. Shower before contact.....	Always	Usually	Sometimes	Never
F. Shower after contact.....	Always	Usually	Sometimes	Never
G. Scrub & disinfect shoes before entry to flock.....	Always	Usually	Sometimes	Never
H. Scrub & disinfect shoes after leaving flock.....	Always	Usually	Sometimes	Never
I. Wash hands before handling birds.....	Always	Usually	Sometimes	Never
J. Wash hands after handling birds.....	Always	Usually	Sometimes	Never
K. Park away from the bird area.....	Always	Usually	Sometimes	Never

**Part 4- Human Interaction  
(2 Questions)**

17. In the past 12 months, how many people (*including* yourself) have had contact with your flock?

A. Number of People by Age Group: (Age groups: Child, Teen, Adult)

B. Reason for Contact (Ex: Family, Friend, Worker, Customer, etc)

C. Frequency of Contact (please circle 1)

D. Number of people from group that have contact with other flocks (ex: Have birds at home or work at another facility with birds)

Total # of People \_\_\_\_\_

A. Number & Age Group	B. Reason for Contact	C. Frequency				D. Number in Contact with Other Flocks
Ex: 3 adults	Ex: Workers	<u>Daily</u>	Weekly	Monthly	Rarely	<u>2</u>



how often do you test? If No, please skip to question 22.

- A. Yes Frequency \_\_\_\_\_  
 B. No  
 C. Don't Know Name of Program \_\_\_\_\_

21. If yes on #20, Where are samples collected for Salmonella testing? Please circle all that apply.

- A. Feed Supply E. Environment outside poultry house  
 B. Feces F. Water Supply  
 C. Equipment inside the poultry house G. Birds  
 D. Shoes/Clothing H. Eggs

22. Have any of the birds in your flock experienced any of the following health problems in the past 12 months? Please circle yes or no.

If yes, please state the number of events in the past 12 months.

	Yes	No	# Events
A. Arrhenia.....			_____
B. Respiratory (nasal/eye discharge, cough/sneeze, swollen mucous membranes).....	Yes	No	_____
C. Neurological (lack of coordination, ataxia, paralysis).....	Yes	No	_____
D. Weight loss.....	Yes	No	_____
E. Feed refusal/depression (droopy wings).....	Yes	No	_____
F. Sudden decreased production not related to molting (reduced egg laying, hatching rate, weight gain or loss).....	Yes	No	_____
G. Unexplained death.....	Yes	No	_____
H. Mortality.....	Yes	No	_____
I. External parasites (lice, mites).....	Yes	No	_____
J. Internal parasites (worms).....	Yes	No	_____
K. Other.....	Yes	No	_____

**23. What is the expected mortality (death) rate in your flock? Please circle 1.**

- |                             |                             |
|-----------------------------|-----------------------------|
| <b>A.</b> 1-5 birds/month   | <b>D.</b> 21-30 birds/month |
| <b>B.</b> 6-10 birds/month  | <b>E.</b> 31-50 birds/month |
| <b>C.</b> 11-20 birds/month | <b>F.</b> > 50 birds/month  |
|                             | <b>G.</b> None/don't know   |

**24. In the past 12 months, have you experienced any of the following mortality events (bird deaths) in your flock?**

**Please circle all that apply and specify the *cause of death* (if known) and the *number of times* it has occurred.**

	<u>Cause of Death</u>	<u># of times</u>
<b>A.</b> Less than 10% mortality in one week	_____	_____
<b>B.</b> Approximately 10% mortality in 1 week	_____	_____
<b>C.</b> Approximately 10-50% mortality in 1 week	_____	_____
<b>D.</b> Greater than 50% mortality in 1 week	_____	_____

**Part 6 - Farm Environment  
(12 Questions)**

**25. What is your *primary* method of disposing of dead birds? Please circle only 1.**

- |                                     |                                    |
|-------------------------------------|------------------------------------|
| <b>A.</b> Renderer pick-up          | <b>F.</b> Taken to landfill        |
| <b>B.</b> Carcass taken to renderer | <b>G.</b> Put in trash (picked up) |
| <b>C.</b> Incinerate                | <b>H.</b> Fed to other animals     |
| <b>D.</b> Bury on premises          | <b>I.</b> Added to manure pile     |
| <b>E.</b> Compost                   | <b>J.</b> Other method _____       |

**26. How often do you remove dead birds from the flock?**

A. Daily

C. As Needed

B.  
Weekly

D. Other \_\_\_\_\_

**27A. Do you clean and disinfect between flocks? If in continuous production, how often do you clean and disinfect? Please circle only 1. (1= layers, 2= meat birds)**

A. Yearly

D. At end of production cycle

B. Monthly

E.  
Never

C. Weekly or bi-weekly

**27B. How often do you clean and disinfect your coop? Please circle only 1. (1= layers, 2= meat birds)**

A. Yearly

D. At end of production cycle

B. Monthly

E. Never

C. Weekly or bi-weekly

**28. How do you clean and/or disinfect your flock housing? Please circle only 1.**

A. Wash and disinfect

D. Dry cleanout only

B. Disinfect only

E. No washing or disinfection

C. Wash only

F. Other method \_\_\_\_\_

**29. What types of litter are used in your poultry house(s)? Please circle all that apply. (1= layers, 2= meat birds)**

A. Straw

C. No bedding is used

B. Wood shavings

D. Other \_\_\_\_\_

**30. What type of flooring is used in your poultry house(s)? Please circle all that apply. (1= layers, 2= meat birds)**

A. Concrete

D. Metal/wire

B. Soil

E. Other \_\_\_\_\_

C. Wood

**31. How do you dispose of manure? Please circle all that apply.**

A. Pit storage

B. Compost

C. Sell/give away

D.

Landfill/trash

E. Spread on your own  
land

F. Other \_\_\_\_\_

**32. Do you see rodents in contact with your flock?**

A. Yes

B. No

**33. Do you use rodent control? Please circle all that apply.**

A. Traps

B. Cats

C. Rodenticides

D. No rodent  
control

E. Other \_\_\_\_\_

**34. Do you perform insect control? Please circle all that apply.**

A. Traps

B. Fumigation

C. Spray or Dust for birds

D. No insect  
control

E. Other \_\_\_\_\_

**35. Do you see wild birds in contact with your flock?**

A. Yes

B. No

**36. Do you ever find pests (insects, rodents) getting into your stored feed?**

A. Yes

B. No

**37. Is there another farm with poultry within 1 mile?**

A. Yes

B. No

C. Don't know

**Part 7 - Egg Processing and Sales/Distribution  
(14 Questions)**

**38. Frequency of egg collection: Please indicate frequency and time(s) of day.**

\_\_\_\_\_ # times/day      Times of day (ex: morning and evening)\_\_\_\_\_

**39. Are your eggs collected by hand?**

A. Yes

B. No

**40. Do you wash eggs? *If no*, please skip to question 44.**

A. Yes

B. No

**41. *If yes on #40*, How are the eggs washed? Please circle only 1.**

A. Hand washed

B. Machine washed

C. Other \_\_\_\_\_

**42. Do you control water temperature? *If yes*, please indicate what temperature is used.**

A. Yes

What temperature? \_\_\_\_\_

B. No





**Part 8 - Salmonella Knowledge  
(9 Questions)**

The next section of the survey asks a few questions about general Salmonella knowledge.

**53. Salmonella is a.....**

- A. Bacteria
- B. Virus
- C. Don't Know

**54. Salmonella can cause severe disease in adult poultry.**

- A. True
- B. False
- C. Don't Know

**55. Salmonella can cause severe disease in humans.**

- A. True
- B. False
- C. Don't Know

**56. Salmonella is only found in poultry and poultry products.**

- A. True
- B. False
- C. Don't Know

**57. In/on what parts of the egg can Salmonella be found? Circle all that apply.**

- A. External shell
- B. Egg white/albumin
- C. Egg yolk
- D. Don't Know

**58. Salmonella can be transmitted by which of the following? Circle all that apply.**

- A. Eating raw or undercooked eggs
- B. Handling chicks/chickens
- C. Eating a dish made with raw eggs
- D. Handling eggs
- E. Contaminated surfaces
- F. Not washing hands

**59. Have you experienced symptoms or illness you thought may have been related to a dish/meal prepared with eggs from your coop?**

- A. Yes
- B. No

**60. Have you ever suspected that contact with your chicks/chickens or coop made you sick?**

- A. Yes
- B. No

**61. If Yes on #59 and/or #60, did symptoms include (circle all that apply)**

- A. Diarrhea
- B. Vomiting
- C. Fever
- D. Stomach cramps
- E. Cough, sore throat, flu-like symptoms
- F. Other \_\_\_\_\_

**Part 9 - Public Health Knowledge  
(1 Question)**

The next section of the survey asks a few questions about tasks you perform

**62. How often do you perform the following tasks.....**

<b>A. Task</b>	<b>B. Frequency</b>					
a. Wash hands after touching chickens or ducks or anything in the area where they live, using soap and water or hand sanitizer if soap and water are not available.	Always	Often	Sometimes	Never	Rarely	NA
b. Wash clean cages, feed or water containers, or other poultry related equipment inside your house or in areas where food is prepared.	Always	Often	Sometimes	Never	Rarely	NA
c. Let live poultry inside your house, in bathrooms, or in areas where food or drink is prepared, served, or stored, such as kitchens, or outdoor patios.	Always	Often	Sometimes	Never	Rarely	NA
d. Snuggle or kiss baby chicks, touch your mouth or eat or drink or smoke around baby chicks.	Always	Often	Sometimes	Never	Rarely	NA
e. Snuggle or kiss (adult) chickens, touch your mouth or eat or drink or smoke around chickens.	Always	Often	Sometimes	Never	Rarely	NA
f. Eat raw or undercooked eggs, including restaurant dishes.	Always	Often	Sometimes	Never	Rarely	NA
g. Eat eggs from your chickens that were dirty or cracked.	Always	Often	Sometimes	Never	Rarely	NA
h. Thoroughly wash hands and all food contact surfaces with soap and water after contact with raw eggs.	Always	Often	Sometimes	Never	Rarely	NA
i. Allow children younger than 5 years of age to handle (or have other contact with) your chickens, especially chicks.	Always	Often	Sometimes	Never	Rarely	NA
j. Wear a mask when cleaning the chicken coop	Always	Often	Sometimes	Never	Rarely	NA
k. Wear gloves when cleaning the chicken coop.	Always	Often	Sometimes	Never	Rarely	NA
l. Wear gloves when cleaning the chicken coop.	Always	Often	Sometimes	Never	Rarely	NA

**Part 10 - Demographics  
(4 Questions)**

Before I go, I would like to ask you some basic questions about your background.....

63. What is your age? \_\_\_\_\_

64. What is your sex?

- A. Male
- B. Female

65. What is your race?

- A. White
- B. Black
- C. Asian
- D. Other

66. What is the highest level of education you have completed?

- A. High School
- B. 2-year college/trade school
- C. 4-year college (Bachelor's degree)
- D. Graduate school (Master's, PhD)
- C. Professional school (MD, VMD, PharmD, etc.)

**Part 11 - Surveyor Observations**

1. What is the estimated flock density? Please circle

1.

**Definitions:**

**Low** = birds unconfined or have very large area to roam

**Medium** = birds confined but have some area to roam, ample room between birds

**High** = birds confined in small area, some crowding

**Industrial** = similar to industrial production, indoor only with crowding/caging

- A. Low      B. Medium      C. High      D. Industrial

**2. Any clinical signs of illness observed? Please list.**

---

---

---

**3. Cleanliness of poultry housing areas. Please circle 1.**

- |                          |                          |
|--------------------------|--------------------------|
| <b>A.</b> Very clean     | <b>C.</b> Somewhat dirty |
| <b>B.</b> Somewhat clean | <b>D.</b> Very dirty     |

- |  |          |
|--|----------|
| <b>3a. Debris seen around poultry house?</b> | Yes / No |
| <b>3b. Strong odors noted?</b>               | Yes / No |

**4. Cleanliness of egg processing areas. Please circle 1.**

- |                          |                          |
|--------------------------|--------------------------|
| <b>A.</b> Very clean     | <b>C.</b> Somewhat dirty |
| <b>B.</b> Somewhat clean | <b>D.</b> Very dirty     |

**5. Feed delivery. Please circle all that apply.**

- |  |  |
|--|--|
| <b>A.</b> Feed in container indoors, elevated  | <b>D.</b> Feed in container outdoors on ground |
| <b>B.</b> Feed in container indoors on floor   | <b>E.</b> Feed on floor inside, no container   |
| <b>C.</b> Feed in container outdoors, elevated | <b>F.</b> Feed on ground outside, no container |

**6. Water delivery. Please circle all that apply.**

- |   |  |
|---|--|
| <b>A.</b> Water in container indoors, elevated  | <b>D.</b> Water in container outdoors on ground              |
| <b>B.</b> Water in container indoors on floor   | <b>E.</b> Natural water source (pond, stream, puddle)        |
| <b>C.</b> Water in container outdoors, elevated | <b>F.</b> Continuous water supply (e.g. nipple water system) |

**7. Cleanliness of feed and water. Please circle 1.**

- |                          |                          |
|--------------------------|--------------------------|
| <b>A.</b> Very clean     | <b>C.</b> Somewhat dirty |
| <b>B.</b> Somewhat clean | <b>D.</b> Very dirty     |

**8. Any evidence of rodents (live or dead animals, feces, holes)?** Yes / No

**9. Any evidence of insects (live or dead flies/beetles/etc)?** Yes / No

**10. Please describe feed storage. Please circle all that apply.**

**A.** Open container on the ground

**C.** Closed impermeable bin

**B.** Open container elevated off the ground

**D.** Other \_\_\_\_\_