

## Food Safety Knowledge, Behavior, and Attitudes of Vendors of Poultry Products Sold at Pennsylvania Farmers' Markets

### Abstract

A needs assessment survey was developed to assess the knowledge and attitudes of poultry vendors at farmers' markets in Pennsylvania, on food safety, regulation, and poultry production. Vendors were administered a 32-question paper survey, in person, during market hours. The results revealed critical vendor practices and identified important vendor knowledge gaps and attitudes on food safety and poultry processing. The data obtained from the study will aid in the development of future farmers' market research, as well as generating training and outreach materials on food safety for vendors selling meat and poultry products at farmers' markets.

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### Introduction

The popularity of farmers' markets in the U. S. has continued to rise throughout the last decade with an increase from 1,755 in 1994 to over 7800 in 2012 (USDA-AMS, 2011). This recent resurgence of farmers' markets, however, is not a new phenomenon and may reflect changes in government and consumer attitudes towards locally produced foods. Many consumers expect to find higher quality and fresher food products at farmers' markets, while enjoying the social benefits of supporting local agriculture (Govindasamy, Italia, & Adelaja, 2002; Baker, Hamshaw, & Kolodinsky, 2009). Although government support and funding is now more widely available for farmers' markets and direct-to-consumer farming programs, the increase in farmers' markets is, no doubt, a result of social movements to support "local" food, as well as a fear or distrust of modern industrial farming. Although the rise in direct-to-consumer sales at farmers' markets may have a positive economic and social impact, it is questionable whether foods sold at farmers' markets may have increased food safety risks due to the way they were produced and sold.

The products sold at farmers' markets can vary. In a 2006 survey, 92% of market managers reported the sale of fresh fruits and vegetables at their markets, with 81% selling herbs and flowers and 45% selling meat or poultry (USDA, 2009). Potentially hazardous foods, such as milk, meat, and

poultry are popular items sold at farmers' markets but require specific processing and handling measures to ensure their safety. Food safety at farmers' markets is not only a concern for public health officials, but in a recent farmer's market survey, food safety was listed as a major consumer constraint to purchasing potentially hazardous foods, like meat (Gwin & Lev, 2011).

Only meat products (beef, lamb, pork) are required by federal law to be processed in a USDA-inspected facility. Poultry, however, can be grown and processed by individual farmers under exemption status afforded to farmers by the Poultry Products Inspection Act (PPIA) (USDA-FSIS, 2006). Those farmers who are exempt can grow, process, and sell their individual poultry products at farmers' markets without daily USDA inspection. As local, state, and federal regulations move to meet the requirements necessary to ensure safety of farmers' market food products, vendors will continue to provide a range of food products in which the quality and food safety is unknown.

A previous microbiological study of raw, whole chicken sold at Pennsylvania farmers' markets, performed by these researchers (data not shown), revealed high levels of *Salmonella* and *Campylobacter* bacterial contamination. In an effort to further understand potential causes and sources of the contamination found in the previous study, a needs assessment was developed to assess the processing methods, knowledge, and attitudes of poultry vendors at farmers' markets in Pennsylvania, specifically in the areas of poultry processing, food safety, and regulation. The data obtained from the study reported here will aid in the development of future farmers' market research by Extension personnel, as well as help to support the growth of farmers' markets through educational outreach, fact sheets, and guidelines on food safety issues for vendors selling meat and poultry products at farmers' markets.

## Purpose and Objectives

The overall purpose of the study was to examine food safety knowledge, attitudes, and behavior of vendors selling poultry products at farmer markets in Pennsylvania using a needs assessment survey. The following objectives guided the study:

1. To determine vendor poultry processing practices, including pre-harvest poultry production and post-harvest poultry processing, packaging, storage, and transportation.
2. To determine knowledge, attitudes, and behaviors of poultry vendors relative to poultry processing, food safety, and regulation.

## Methodology

The study was carried out in two phases. The first phase involved identification of farmers' market poultry vendors in Pennsylvania and development of a farmers' market poultry vendor needs assessment survey. The second phase involved conducting the needs assessment and using the results of the needs assessment for Extension program development in food safety and poultry processing.

## Development of Farmers' Market Poultry Vendor Needs Assessment Survey

The survey used the methodology described by Witkin and Altschuld (1995) in which a needs assessment consists of three phases: a Pre-assessment Phase, Assessment Phase, and Post-assessment Phase. Questions were developed to explore the general practices performed by poultry vendors during the growing and processing of poultry, as well as test the knowledge and observe attitudes about food safety and regulation. A paper-based survey of 32 questions (multiple choice, true/false, and a 5-point Likert Scale) was developed, consisting of 15 exploratory, eight knowledge, six attitudinal, and two demographic questions, as well as one question assessing the vendor's willingness to participate in future Extension education programs.

## Identification of Farmers' Market Poultry Vendors

The study used multiple sources to identify farmers' markets throughout Pennsylvania, including several Web sites (Foodroutes.org, Local Harvest, and USDA-AMS Farmers' Market Search), contacting market managers directly, word of mouth, and visitation of identified markets. In the study, 44 poultry vendors within Pennsylvania were identified during the pre-assessment phase; 30 were chosen to be targeted for the survey. Due to time and budget constraints, 28 vendors were approached for participation in the survey; 21 agreed to participate in the survey.

## Conducting the Needs Assessment Survey

After gaining approval from market managers, researchers traveled to each individual farmers' market, and vendors were approached at their respective booths during market hours. Vendors were asked to participate in the survey using a pre-formatted and memorized verbal script. A \$10 cash incentive was used to promote participation in the survey. Typically, vendors took 15-30 minutes to complete each survey. Vendors also could complete the survey at a later date and were supplied with a pre-addressed and stamped envelope to be mailed to the Department of Food Science at Penn State. Fourteen (14%; 3/21) of vendors completed the survey at a later date, and all were successfully completed.

## Results

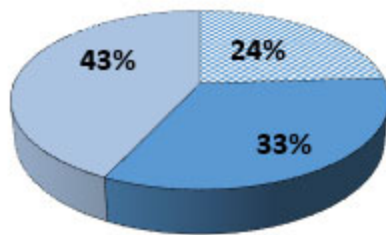
### Vendor Poultry Processing Practices

Among the vendors surveyed in the study, slightly under half did not process the poultry they sell at farmers' markets, while the remaining 52% of vendors did process their own poultry (Figure 1). Among those vendors who did not process poultry, 50% (5/10) used a local processor, and 20% (2/10) purchased poultry at wholesale to be sold at farmers' markets. Vendors who had knowledge of their poultry processing reported that the majority slaughtered/harvested the birds inside a fixed building; however, the remaining vendors processed outside or in a barn.

**Figure 1.**

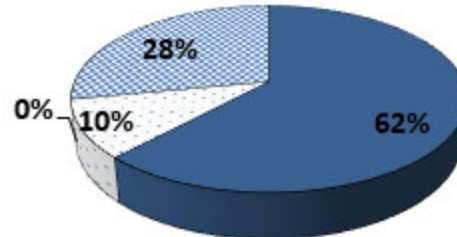
Poultry Processing Practices

**Vendor Use of Chemical Sanitizers During Poultry Processing (N=21)**



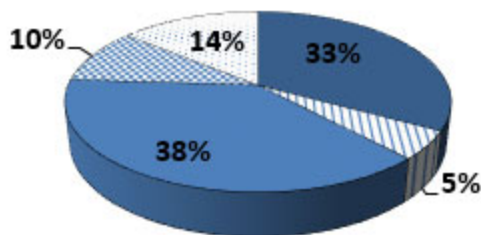
- ▣ Use Chemical Sanitizer in the Processing Environment
- ▣ Use Chlorinated or Peroxyacetic Acid Sanitizers on Poultry Before Packaging
- ▣ Do Not Use Chemical Sanitizers During Poultry Processing

**Poultry Chilling Temperature After Processing, But Before Packaging (N=21)**



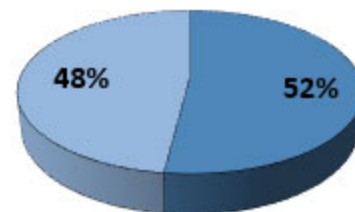
- ▣ 20 to 40°F
- ▣ 40 to 60°F
- ▣ I do not chill my poultry before packaging.
- ▣ I do not know.

**Vendor Processing Conditions (N=21)**



- ▣ Process Outside
- ▣ Process in a Barn
- ▣ Process in a Fixed Building
- ▣ Combination of Outside and Inside a Fixed Building
- ▣ I Do Not Know

**Do Vendors Process Their Own Poultry? (N=21)**



- ▣ Vendors Who Process
- ▣ Vendors Who Do Not Process

Less than half of the vendors reported the use of chlorinated or peroxyacetic acid sprays, washes, or dips on poultry before packaging, while the remaining vendors reported that they did not use any spray, wash, or dips in their processing or any sanitizing agents in their processing areas at all. A large portion of vendors reported chilling poultry below 40°C before packaging; however, a small portion did not or did not know their chilling temperatures. Over half of vendors surveyed, 57%, also reported separating their processing from packaging areas by more than 20 feet, 19% were less than 15 feet, and the remainder did not know.

## Poultry Packaging, Storage, and Transportation

Questions related to packaging, storage, and transportation revealed that vendors used a range and

combination of cold storage and transportation devices (vendors were allowed to answer multiple responses for each question). The majority of vendors stored poultry after processing but before packaging in an electrically powered freezer, 52% (11/21), refrigerator, 43% (9/21), or both, while a small number of vendors also used a pre-chilled ice box, 5% (1/21), or cooler with ice, 29% (6/21) for cold storage. Transportation of poultry to the market also was reported to vary because vendors used a combination of devices, with a majority, 57% (12/21), of vendors transporting poultry in a cooler with ice, 14% (3/21) using a cooler with no ice, and 24% (5/21) using a pre-chilled frozen ice chest. A small portion of vendors 29% (6/21), also reported the use of an electrically powered cooling truck or cooler.

Poultry sold at farmers' markets was reported to be packaged using a combination of either pre-packaged, 95% (19/20), or sold fresh or frozen and placed into a food-grade plastic bag at the time of sale 30% (6/20). The term "fresh" refers to poultry that has not been frozen at any time during processing. Forty-five percent (45%; 9/20) of vendors reported the use of vacuum packaging of their poultry. Additionally, 29% (6/21) of vendors who did not sell their poultry as fresh on a market day would attempt to re-sell their poultry items as fresh on a following market day. Alternatively, 48% (10/21) of vendors froze their unsold fresh poultry and attempted to re-sell the frozen poultry on the next market day.

## Pre-Harvest Poultry Production

Results from pre-harvest questions (Table 1) revealed that a small portion of poultry vendors used conventional poultry housing units, while the large majority of poultry vendors either used one or combination of pasture-based poultry housing systems. Among those vendors who used a pasture-based production system, all of the vendors reported raising fewer than 200 birds per pen.

**Table 1.**

Responses of Farmers' Market Poultry Vendors in Pennsylvania to Exploratory-Based Questions on Pre-Harvest Poultry Production

<b>*Q-13: How would you best describe your type of poultry production system? (n=20)</b>				
Conventional (fixed, enclosed houses)	Pasture-based with moveable pens	Pasture-based, day range	Pasture-based free range	I do not know
2 (10%)	12 (60%)	1 (5%)	6 (30%)	1 (5%)
<b>Q-14: If you have a pasture-based production system and use moveable pens, how many birds are kept in each pen? (n=16)</b>				
1-50	51-100	101-200	Over 200	
7 (44%)	6 (38%)	3 (19%)	0	
*Questions were answered with multiple responses.				

Note: Sum of rows may be greater than 100% due to rounding and multiple responses

## Regulatory Assessment

Two regulatory questions were used to assess the vendors' familiarity with poultry and farmers' market regulatory requirements (Table 2). Vendors reported that slightly under half had read a recent Pennsylvania Department of Agriculture's Act on Food Safety and Farmers' Markets, with the remaining did not read the Act or did not know of its existence. Similarly, 65% of vendors demonstrated knowledge of the U.S. Poultry Products Inspection Act (PPIA), while the remaining did not know.

**Table 2.**

Responses of Farmers' Market Poultry Vendors in Pennsylvania to Exploratory- and Knowledge-Based Questions on Government Regulations Affecting Poultry Vendors at Farmers' Markets

<b>Q-15: I have read and follow the Pennsylvania Department of Agriculture's Act on Food Safety and farmers' markets.</b>		
<b>Q-16: Under the U.S. Poultry Product Inspection Act, a producer/grower who, in a calendar year slaughters, processes, and distributes between no more than 20,000 poultry, that they raised, are exempt from bird-by-bird inspection and the presence of inspectors during the slaughter of poultry and processing of poultry products.</b>		
	Q-15 (n=21)	Q-16 (n=20)
Yes	10 (48%)	13 (65%)
No	6 (29%)	3 (15%)
I do not know	5 (24%)	4 (20%)
Note: Sum of rows may be greater than 100% due to rounding.		

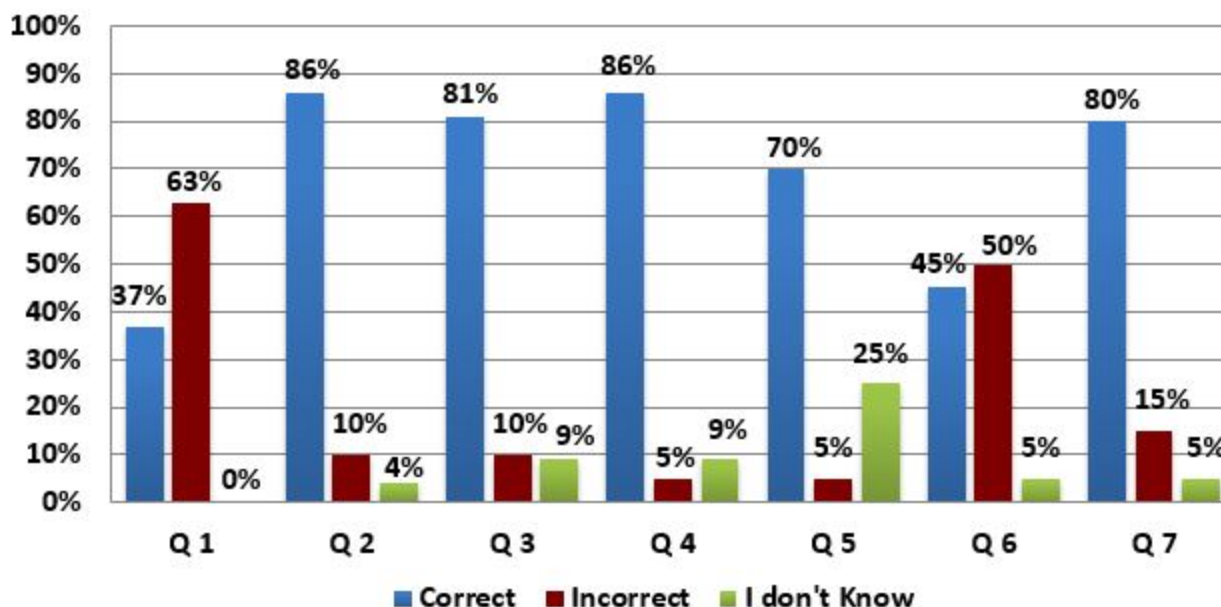
## Vendor Knowledge of Poultry Processing, Food Safety, and Regulations

Poultry vendors were asked eight questions to evaluate the knowledge their in the areas of poultry processing, food safety, and regulation (Figure 2). Q-1 of the knowledge questions asked vendors to select, among multiple responses, which pathogenic bacteria could be found in raw poultry. Those vendors who did not select two responses; *Campylobacter* and *Salmonella*, or also selected probiotics or methicillin-resistant *Staphylococcus aureus*, were considered incorrect. Q-6 also was answered incorrectly 50% of the time, with a correct answer of (blood, feces, feathers, internal organs) or "all of the above." The remaining knowledge questions, Q-2,3,4,7 had correct response rates above 80%

with, Q-2,3,7 all relating to knowledge of vendors on proper temperature control of poultry during processing. Q-4 and Q-5, which explored processing area separation and use of antimicrobial sprays, dips, or washes, were found to have the lowest incorrect response rates. In addition, Q-5 had the highest rate of "I do not know" responses, with 25%, among all knowledge questions in the survey. The results also revealed that questions formatted in a true/false form had the lowest incorrect response rates, while those multiple choice questions with multiple answers had the highest incorrect response rates.

**Figure 2.**

Responses of Farmers' Market Poultry Vendors in Pennsylvania to Knowledge-Based Questions on Poultry Processing and Food Safety During Poultry Processing



Q-1: Raw poultry can contain the following pathogenic (harmful) bacteria. (Check all that apply) (N=19)

Q-2: Chilling or cooling poultry is required during processing to reduce the internal temperature of the birds to less than 40°F. (True/False) (N=21)

Q-3 Poultry that is not chilled to an internal temperature of less than 40°F can have the following risks. (Check all that apply) (N=21)

Q-4: Cross-contamination of harmful bacteria can occur if the poultry slaughter and de-feathering areas are too close to the cutting and packaging areas. (True/False) (N=21)

Q-5: The use of antimicrobial sprays, dips, or washes can reduce the amount of harmful bacteria on raw poultry before packaging. (True/False) (N=20)

Q-6: During poultry processing, which of the following can contaminate the raw poultry carcass with pathogenic (harmful) bacteria before packaging. (Check all that apply) (N=20)

Q-7: Fresh poultry products should be stored at what temperature. (Select one answer) (N=20)

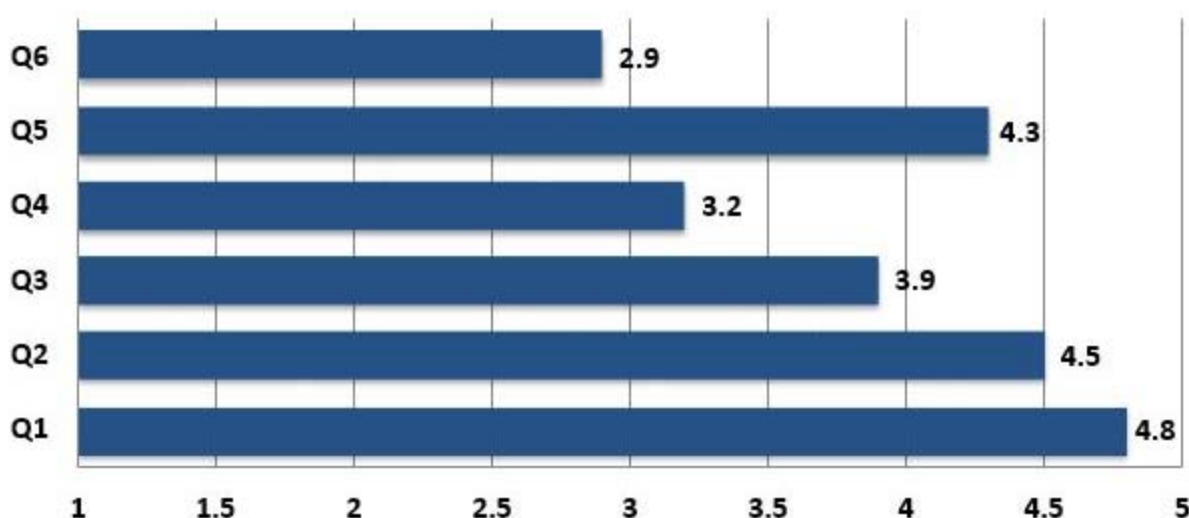
## Vendor Attitudes on Food Safety and Regulations

In the study, vendors also were asked to respond to six questions that explored their attitudes on

their products, food safety, and government regulations (Figure 3). The attitudinal questions were formatted using a five-point Likert scale, in which a response of 5 reflected a strong agreement, 3 with neutral, and a response of 1 reflected strong disagreement with a statement. The results demonstrated that all vendors agreed or strongly agreed that their poultry products were safe, and the majority, 95%, agreed or strongly agreed that poultry products sold at farmers' markets were safer than conventional poultry sold at supermarkets. Over 50% of vendors surveyed were concerned about pathogens in their poultry, although 35% agreed or strongly agreed that they did not need any additional food safety interventions in their poultry processing. Alternatively, 71% of vendors agreed or strongly agreed that food safety is important and that they would like to learn more about keeping their poultry products safe. Few vendors (30%) responded in agreement to supporting government regulations of poultry sold at farmers' markets.

**Figure 3.**

Responses of Farmers' Market Poultry Vendors in Pennsylvania to Attitudinal-Based Questions on Food Safety, Poultry Processing, and Regulations



Q-1: Poultry products I sell at the farmers' markets are safe. (N=21)

Q-2: Poultry produced and sold locally at farmers' markets are safer than conventional poultry sold at commercial supermarkets. (N=21)

Q-3: I am concerned about pathogenic (harmful) bacteria being present on my poultry. (N=21)

Q-4: I do not need any additional food safety interventions in my poultry processing. (N=20)

Q-5: Food safety is important and I would like to learn more about keeping my poultry products safe. (N=21)

Q-6: I support government regulation of poultry products sold at farmers' markets. (N=20)

## Discussion

The study reported here revealed that vendors who sell poultry at farmers' markets in Pennsylvania] can vary dramatically in their experience in poultry processing, because many vendors relied on private processors, while others performed slaughter and processing on their farms. Responses to the survey revealed that approximately half of the vendors surveyed were performing all or some of



their poultry processing outside, which significantly increases the risk of cross contamination from the environment, thereby increasing the difficulty of maintaining sanitary conditions for poultry processing. Furthermore, over one-half of vendors surveyed were not utilizing chemical interventions at any point in their processing. However, the 33% of vendors who did, suggests that vendors may still be willing to include an intervention step in their processing.

The results from the study indicated a preference towards pasture-based poultry production, which may reflect current vendor and consumer attitudes towards agriculture. Organic poultry production in the U.S. has increased substantially in the last decade, and although vendors do not typically advertise or claim their products are certified organic, confusion exists among consumers as to what organic standards and practices are. Consumers tend to associate organic with other label claims like "cage-free," "natural," and possibly "pasture-raised" (Hughner, McDonagh, Prothero, Shultz, & Stanton, 2007; Chryssochoidis, 2000; Hutchins & Greenhalgh, 1995; Fotopoulos, Krystallis, & Ness, 2003; Aarset et al., 2004).

Vendors also reported the use of multiple types of cold storage and transport devices, with over half of vendors using an electrically powered freezer or refrigerator. A small portion of vendors, however, were storing poultry in non-electrically powered cold storage devices or in coolers with ice. It is questionable whether those storage units can maintain proper freezing or refrigeration temperatures during market hours. Of concern were those vendors who reported the transportation of poultry in coolers with no ice (14%) and those using a form of a pre-chilled ice chest (24%). Proper cold storage is a critical step in preventing the growth and survival of potential pathogens present on raw poultry. The use of questionable cold storage devices by poultry vendors is an important finding, but one which could be easily mitigated through basic food safety training.

## **Vendor Knowledge of Poultry Processing, Food Safety, and Regulations**

Among the eight knowledge questions included in this survey, two questions (Q-1 and Q-6) resulted in an incorrect response rate greater or equal to 50% (Figure 2). Responses to these questions do appear to suggest that there are apparent vendor knowledge gaps of pathogens and cross-contamination during poultry processing, although this observation also may reflect the difficulty of the question and format. In contrast, the results from the remaining knowledge questions revealed over 80% of vendors correctly answered questions related to optimal poultry chilling and storage temperatures. This finding is promising, because it suggests that although vendors may not be utilizing optimal chilling and storage processes, they do have an understanding that those processes require strict temperature controls.

## **Vendor Attitudes on Food Safety and Regulations**

As expected, 100% of vendors agreed or strongly agreed that their poultry products were safe, while 95% agreed or strongly agreed that their products were safer than conventional poultry sold at supermarkets (Figure 3). The responses to these statements suggest that vendors believed their products were safe using their current practices, although they may not have been unaware that they were using processes that do not address pathogen control. Interestingly, half of the vendors

were concerned with pathogenic bacteria on their raw poultry. However, 35% felt they did not need additional food safety interventions in their processing. These results appear to be conflicting, but may demonstrate that vendors were satisfied with their current practices, even if they had concerns about food safety. Further responses were promising, because 71% of vendors agreed or strongly agreed that food safety was important and that they would like to learn more. Although this general attitude towards food safety will be important to the success of future vendor training, attitudes of vendors towards regulations will be equally important for their future success. The results from Q-6 demonstrates that few vendors supported regulation of poultry products sold at farmers' markets, while the remainder were neutral or were in disagreement.

## **Opportunities for Program Development, Training and Evaluation in Food Safety and Poultry Processing**

Future training and education will be critical in ensuring the continued success of farmers' markets and poultry vendors. Due to the growing size and scope of farmers' markets, additional regulatory requirements may be imminent, and many states have already begun to implement regulation that addresses food safety at farmers' markets. The study reported here has identified numerous gaps in vendor knowledge and attitudes on poultry production, food safety, and regulation that offer a unique opportunity for Extension personnel to develop training and outreach for farmers' markets. Farmers' markets create a distinct connection among consumers, local agriculture, and food producers, in a way that generates numerous benefits for each party (Abel, Thomson, & Maretzki, 1999). Farmers' markets also are ideal venues to promote current and future Extension programs (Burrows, 2008). Development of training and outreach for farmers' market vendors in the areas of food safety and food production will not only ensure the continued success of the individual vendor, but also ensure and promote public health and safety for consumers.

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