February 2012

Expert Elicitation on the Market Shares for Raw Meat and Poultry Products Containing Added Solutions and Mechanically Tenderized Raw Meat and Poultry Products

Final Report

Prepared for

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1 Introduction

An expert elicitation approach was used for estimating market shares for enhanced or mechanically tenderized meat and poultry products because the required data are not available from published sources or existing databases.

The U.S. Department of Agriculture's (USDA's) Food Safety and Inspection Service (FSIS) has responsibility to ensure that labels on meat and poultry products are truthful, are not misleading, and provide relevant information to consumers. Currently, FSIS is considering amending its regulations regarding labeling of enhanced meat and poultry products and some mechanically tenderized meat and poultry products and, therefore, requires estimates of market shares and the size distribution of firms for analyzing the impacts of these changes. Because these data are not currently available from published sources or databases, FSIS required an expert elicitation approach to obtain estimates to use in analyses.

In September 2011, FSIS contracted with RTI International to design and conduct an expert elicitation to determine the size of the market and the size distribution of the firms producing enhanced and/or mechanically tenderized meat and poultry products. Based on information needs identified by FSIS, we developed expert elicitation materials, recruited qualified experts, conducted the expert elicitation, and prepared this report. This report describes the background and objectives of the expert elicitation, describes the methodology used for conducting the expert elicitation, and provides a summary of the results.

1.1 BACKGROUND AND PURPOSE

The Federal Meat Inspection Act and Poultry Products Inspection Act provide that the labels on meat and poultry products must be approved by the Secretary of Agriculture, who has delegated this authority to FSIS, before these products can enter commerce. These acts also prohibit the distribution in commerce of meat or poultry products that are adulterated or misbranded. FSIS is proposing to amend its regulations to

establish a common or usual name for raw meat and poultry products that do not meet standard-of-identity regulations and to which solutions have been added. Products with added solutions are sometimes referred to as "enhanced products." The Agency is proposing that the common or usual name for such products include an accurate description of the raw meat or poultry component, the percentage of added solution incorporated into the raw meat or poultry product, and the individual ingredients or multi-ingredient components in the solution listed in the descending order of predominance by weight (USDA, FSIS, 2011a). FSIS is also proposing labeling changes to these products. In addition, the Agency is proposing to remove the regulatory standard of identity for "ready-to-cook poultry products to which solutions are added."

Mechanically tenderized products are those that have had mechanical alteration of the surface of the meat, thus improving the tenderness of less tender cuts (which may result in bacteria being transferred from the surface to the inside of the product). These products require a higher cooking temperature to ensure safe consumption. FSIS is proposing a rule requiring manufacturers to clearly label certain products as being "mechanically tenderized" (USDA, FSIS, 2011b, c), particularly those that are mechanically tenderized using needles or blades.

FSIS is responsible for implementing regulations to ensure the safety of meat and poultry products and analyzing the potential impact of those regulations on small businesses. However, information is limited regarding the size of the market for these two product groups and the size distribution of the firms producing these products. Thus, to help address the current gaps in available information, the purpose of this task order was to conduct an expert elicitation to obtain data for estimating the size of the market and the size distribution of the firms producing enhanced and/or mechanically tenderized meat and poultry products.

1.2 ORGANIZATION OF THIS REPORT

The remainder of this report is organized as follows. Section 2 describes the methodology for the expert elicitation, including the development of materials and selection of experts, and Section 3 summarizes the results of the expert elicitation.

Appendix A provides the materials used for conducting the expert elicitation including the project description, expert elicitation worksheet, and clarifications provided during the process.

1.3 REFERENCES

"Common or Usual Name for Raw Meat and Poultry Products Containing Added Solutions (Proposed Rule)." 76 Fed. Reg.:44855.. (July 27, 2011a). http://www.fsis.usda.gov/OPPDE/rdad/FRPubs/2010-0012.pdf.

"Labeling, Marking Devices, and Containers." 9 C.F.R. Chapter III, § 317.8. (2011b). http://www.gpo.gov/fdsys/pkg/CFR-2011-title9-vol2/pdf/CFR-2011-title9-vol2-sec317-8.pdf,

"Poultry Products Inspection Regulations." 9 C.F.R. Pt. 381.129. (2011c). http://www.gpo.gov/fdsys/pkg/CFR-2011-title9-vol2/pdf/CFR-2011-title9-vol2-sec381-129.pdf.

2 Expert Elicitation Methodology

This section describes the methodology RTI used for conducting the expert elicitation regarding market shares and the size distribution of the firms producing enhanced and/or mechanically tenderized meat and poultry products. We begin with a general overview of expert elicitation processes, discuss the development of the materials for the expert elicitation, explain the selection of experts to serve on the panel, and describe the process for conducting the expert elicitation.

2.1 GENERAL OVERVIEW OF THE EXPERT ELICITATION PROCESS

Expert judgment (or elicitation) refers to data provided by experts in response to a technical problem and is used when it would be too costly or impractical to measure a quantity of interest through other means (Meyer and Booker, 2001). The information obtained through the expert elicitation process is informed opinion based on experts' training and experience.

Several different processes can be used for conducting expert elicitations depending on the type and format of information to be obtained, the types and number of experts needed to participate, whether the elicitation is conducted remotely or in person, and how the information is combined across experts. Table 2-1 provides a very general overview of the process RTI uses. When conducting an expert elicitation, we tailor the process to meet the specific information needs for each project.

Table 2-1. Overview of General Steps for Conducting an Expert Elicitation

Step 1. Develop Expert Elicitation Materials. We prepare the following set of materials:

- background information for the expert panel members—provides a project description, the objectives of the expert elicitation, and information to aid in recruiting the experts;
- categorization of the commodities, pests, diseases, processes, or other attributes needed for the expert elicitation—identifies the units of analysis for the model and provides the categories to be included in the worksheets for data collection;
- facilitator guide for conducting the expert elicitation—helps the facilitator guide the experts through the expert elicitation process; and
- worksheets to collect expert judgment estimates—provides the structured format for gathering estimates from the experts according to the categorizations of commodities, pests, diseases, processes, or other attributes (worksheets are pretested with RTI staff who are not involved in developing the worksheets).

Step 2. Identify and Recruit Experts. We then identify and recruit the individuals to serve on each expert panel as follows:

- determine clearly defined criteria for selecting the panelists such as technical background and discipline, relevant experience, industry sector, and time availability;
- compile a list of potential candidates based on our literature review, talking with industry experts, and using our extensive network of expert consultants in academia and industry;
- ask each candidate to complete a form that collects self-ratings of their knowledge and experience relative to the study and to provide their curriculum vitae (CVs);
- based on our reviews of the self-ratings, the CVs, and the availability of the potential candidates, we select the individuals for each expert panel; and
- establish consulting agreements for panel participation with each individual who agrees to participate in the elicitation.

Step 3. Conduct the Expert Elicitation. We conduct the expert elicitation using the process developed for each individual project. The expert elicitation may be conducted in one round or two rounds (Delphi technique). The general process for an expert elicitation conducted by teleconference (to minimize travel costs) is as follows:

- schedule teleconference with the experts and e-mail or express mail elicitation materials;
- conduct teleconference following the facilitator guide developed in Step 1 (including reviewing the worksheets);
- experts independently complete the worksheets and e-mail or fax the responses back to RTI; and
- if a second round is conducted, we summarize the experts' responses, e-mail or express mail the tabulated responses and revised worksheets back to the experts, and ask the experts to complete a second round of estimates while considering the tabulated responses of the entire panel.

Step 4. Tabulate and Analyze the Results. After we obtain all final worksheets from the experts, we enter the results into a data set, prepare summaries, analyze the results, and prepare the inputs needed for the model or other purpose.

In conducting an expert elicitation, it is important to convey to the experts the general philosophy for using expert elicitation as a data collection method. In particular, experts may be concerned that their responses are opinions rather than actual data. We instruct the experts to use whatever data are available to them, but in cases where data are unavailable, their expert opinions are the next-best option. Because specific data are needed to conduct preliminary analyses of policies,

experts' informed opinions are often the best available information source. Experts are often more comfortable with the expert elicitation concept if they understand that the information they provide will be combined with that of other experts and that the information will be used as starting point values for additional refinement as new information becomes available.

2.2 EXPERT ELICITATION MATERIALS

The primary materials prepared for the expert elicitation included the following:

- Recruitment e-mail—used to introduce potential participants to the project and obtain an expression of interest in participating and information on the expert for determining his or her qualifications
- Project description and interest form—provided more detailed information on the expert elicitation process and requests specific information from the experts
- Expert elicitation worksheet—completed by the experts to provide responses to expert elicitation questions (also includes a statement of purpose, key definitions and assumptions, and instructions for completing the worksheet)
- Clarifications—as needed, follow-up information provided to the experts following discussions during teleconferences

In Appendix A, we provide copies of the project description and interest form and expert elicitation worksheet. Because several questions on the expert elicitation worksheet were raised by the experts during the teleconferences, we prepared a list of clarifications, which is also included in Appendix A.

We developed the worksheet in consultation with FSIS beginning with a list of information needs for estimating market shares and the size distribution of the firms producing enhanced and/or mechanically tenderized meat and poultry products. FSIS requested specific information on the percentages of establishments by size that produce these products and percentages of product volumes for each type of product.

For each information need, we formulated the specific wording of the question and the format for the experts' responses. For

this expert elicitation, the format of the responses was in percentage values that could be applied to numerical estimates obtained from other sources. To allow for the maximum utility of the responses, all questions were designed to provide numerical responses that could be summarized and combined across experts. In other words, we avoided open-ended questions with written responses. However, we also asked experts to provide comments regarding their responses if they believed that additional explanation was needed to understand their responses.

After developing the initial worksheet, FSIS reviewed and commented on the worksheet both in terms of the information content of each question and the specific wording and clarity of each question. Through subsequent rounds of internal review, we further developed and refined the worksheet.

We also reviewed the worksheet with Mr. Scott Goltry, Vice President, Food Safety & Inspection Services, American Meat Institute. During a conference call, Mr. Goltry provided suggestions to clarify the background and assumptions, wording of the questions, and the format of the response items. Based on Mr. Goltry's feedback, we prepared a final version of the worksheet for review and approval by FSIS.

In addition to the worksheet, we also prepared a list of talking points to use as a moderator's guide for conducting the teleconference with experts at the initiation of the expert elicitation. The talking points covered the purpose of the panel, the purpose of the call, the philosophy of the expert elicitation approach, definitions and assumptions underlying the questions, how to complete and return the worksheet, and the timeline for completion and review.

2.2.1 Stated Purpose of the Expert Elicitation

The focus of the expert elicitation was on market volumes and the size distribution of the firms producing enhanced and/or mechanically tenderized meat and poultry products. In the expert elicitation worksheet, we stated the overall purpose of the expert elicitation to inform the experts and provide the overall context of the exercise. The purpose was stated as follows:

> The overall purpose of this expert elicitation is to provide information to the U.S. Department of Agriculture, Food

Safety and Inspection Service (FSIS) for calculating market volumes and numbers of affected establishments for raw meat and poultry products that contain added solutions, are mechanically tenderized using needle or blade tenderization, or overlap in both categories. These data will be used to assess the economic impacts of proposed or potential requirements for labeling of these products.

To offer further guidance, we provided a link to FSIS proposed rule "Common or Usual Name for Raw Meat and Poultry Products Containing Added Solutions" (http://www.fsis.usda.gov/OPPDE/rdad/FRPubs/2010-0012.pdf). FSIS has not yet published a proposed rule regarding labeling of mechanically tenderized products; thus, we were unable to provide a link to that rule.

2.2.2 Key Assumptions and Definitions for the Expert Elicitation

Because of the importance of ensuring that the experts provided responses from a common frame of reference, we provided key assumptions and definitions as background. First, we asked experts to consider the following FSIS establishment size categories when responding to questions concerning the distribution of establishments producing products which may be affected by the regulation:

- Very small—fewer than 10 employees or less than $2.5 million in annual sales
- Small—10 to 499 employees
- Large—500 or more employees

We also asked experts to consider establishments producing products from the following species (ignoring possible combination products):

- Beef—produced from steers, heifers, and cows (in some cases)
- Pork—produced from barrows and gilts
- Lamb and goat (combined)
- Chicken—produced from young chickens
- Turkey—produced from young turkeys

We then outlined definitions of key terms, including definitions of the products that may be affected by the regulation. These definitions included the following:

- **Meat and poultry products with added solutions—** Raw meat and poultry products to which solutions have been added; also often referred to as enhanced products. They are generally enhanced using one of the following methods:
  - Marinated—meat or poultry soaked in a seasoned liquid solution of water, oil, wine, or vinegar with spices, herbs, and other ingredients to season and/or tenderize the product (includes in-package marination).
  - Tumbled—meat or poultry placed in a tumbler that revolves with a solution. The tumbling process breaks down connective tissue and muscle fiber.
  - Vacuum tumbled—meat or poultry placed in a tumbler that uses a vacuum to enable the solution to penetrate the muscle. The tumbling process breaks down connective tissue and muscle fiber.
  - Injected—meat or poultry to which a solution has been introduced into its interior by injecting, pump marination, or stitch pumping.
- **Mechanically tenderized meat and poultry products—**Raw meat and poultry products that have had mechanical alteration to the surface of the meat. For this exercise, we focused on the following methods of mechanical tenderization:
  - Needle tenderization—uses a set of needles that cut through muscle fibers and connective tissue (including needle injection); may also be referred to as "pinning" or "jacarding"
  - Blade tenderization—uses a set of blades that cut through muscle fibers and connective tissue
- **Intact products—**cuts of muscle such as steaks, roasts, briskets, and stew meat
- **Nonintact products—**products that have undergone comminution (chopping, grinding, flaking, or mincing), mechanical tenderization, or injection with solutions
- **Branded products—**products labeled with a national or regional brand name

- **Private label products—**products labeled with a retail store brand name (either the store name or a brand name used by the store)
- **Retail stores—**supermarkets, mass merchandisers (e.g., big box stores with grocery sales), warehouse or club stores, meat markets, and other outlets that sell raw meat and poultry products
- **Foodservice—**restaurants, fast food stores, cafeterias, and other outlets that sell prepared meat and poultry products

Finally, the experts were asked to use the following assumptions in providing their responses to the expert elicitation questions:

- Consider the most recent calendar year (i.e., base their estimates on their knowledge of the industry over the past year).
- Include federally inspected establishments only (i.e., base their estimates on establishments that are under federal inspection. In other words, exclude establishments under state inspection or that are custom exempt.).
- Consider domestic production only (i.e., base their estimates on domestically produced products only).
- Group fresh and frozen products (i.e., base their estimates on the combined grouping of fresh and frozen products that might be mechanically tenderized or enhanced).

2.3 PARTICIPANTS ON THE EXPERT ELICITATION PANEL

We developed an initial list of 28 potential experts to serve on the expert elicitation panel based on RTI's experts database, Internet searches, identification of authors of relevant articles, and recommendations from a variety of sources. After a review of the experts' credentials, we contacted each of them using the initial recruitment letter to determine their interest and obtain CVs. After reviewing the information on each expert, we selected a list of 10 experts to serve on the panel. FSIS reviewed the list and approved all 10 experts.[1] The final list of

[1] On the day prior to the first teleconference, one of the experts was in an automobile accident and, therefore, unavailable to participate.

experts is provided in Table 2-2. The experts received an honorarium for their participation.

Table 2-2. Participants in the Expert Elicitation

Panelist	Organization	Title and Expertise
Dr. Christine Alvarado	Texas A &M University	Assistant Professor, Dept. of Poultry Science
Mr. Ronald Eustice	Minnesota Beef Council	Executive Director
Dr. Kevin Keener	Purdue University	Professor of Food Science, Dept. of Food Science
Dr. C. Lynn Knipe	Ohio State University	Associate Professor, Animal Sciences
Dr. Robert Maddock	North Dakota State University	Associate Professor, Animal Sciences
Dr. Barbara Masters	Olsson, Frank, Terman & Matz, PC	Senior Policy Advisor
Mr. Paul Mulcahy	Ross Industries, Inc.	Regional Sales Manager
Dr. Casey Owens-Hanning	University of Arkansas	Associate Professor, Center for Excellence for Poultry Science
Mr. Ronald Wheeler	FormTech Solutions, Inc.	COO and President

All of the experts have general processing and industry knowledge conducive to responding to the questions for the expert elicitation. In addition, Mr. Paul Mulcahy and Mr. Ronald Wheeler have specific knowledge regarding industry processes and practices. Based on their own self-assessments using a scale of 1=minimal/none, 2=moderate, and 3=extensive experience and knowledge, the experts' average level of experience and knowledge was as follows:

- Mechanically tenderized products: 2.4
- Products with added solutions: 2.5
- Beef: 2.4
- Pork: 2.2
- Lamb and goat: 1.4
- Chicken: 2.2
- Turkey: 2.3
- Very small establishments: 2.1
- Small establishments: 2.4
- Large establishments: 2.2

For all topics with the exception of lamb and goat, multiple experts indicated 3 for extensive experience and knowledge.

It should be noted that the experts provided responses to the elicitation questions based on their own experience and knowledge of the meat and poultry processing industry and practices. In some cases, the experts may have had access to survey or other published data that were used to inform their responses. In other cases, the experts provided best estimates from a more subjective viewpoint.

2.4 EXPERT ELICITATION PROCESS

The expert elicitation was completed using two rounds. In the first round, we conducted a teleconference asking the experts to complete their worksheets independently and provide them to RTI. A few days prior to the teleconference, we provided the experts with the worksheet, which includes an overview, key definitions and assumptions, instructions, and response fields. We conducted the initial teleconference on December 19, 2011, to review the worksheet and discuss any questions or concerns of the experts. We clarified most questions during the call, but some questions required additional input from FSIS. Following the teleconference, we clarified the remaining issues with FSIS and provided the list of clarifications to the experts shortly after the teleconference (see Appendix A for the list of clarifications).

Most of the worksheets were completed and returned by January 2, 2012, and all the worksheets were completed and returned by January 5, 2012. The individual responses were entered into an Excel spreadsheet, and we then calculated min, max, mean, and median responses for each question.

In the second round, we provided the experts their individual responses and the min, max, mean, and median of the responses across all nine experts and asked them to review their responses in light of the aggregated estimates. We then conducted a second teleconference with the experts on January 9, 2012, to review and discuss their responses. In cases in which their responses differed substantially from the other experts, we asked the experts to discuss why their responses might be different. Following the second teleconference, the experts were provided with an opportunity to revise their estimates in light of the others' responses and the discussion during the teleconference. The revised estimates were all

received by January 17, 2012, and entered into an Excel spreadsheet and responses were calculated to reflect any revisions that were made. The final aggregated responses are described in Section 3.

2.5 REFERENCES

Meyer, M.A. and J.M. Booker. 2001. *Eliciting and Analyzing Expert Judgment: A Practical Guide*. San Diego: Academic Press.

3 Expert Elicitation Results

This section provides the results of the expert elicitation and discusses approaches to integrating the results into economic impact analyses. The discussion of the results focuses on the median values of the responses from the set of experts to reduce the influence of occasional outlier values. For many of the questions, the mean and median values are relatively similar. We also note cases in which outliers in the responses cause the mean and median values to differ substantially.

The worksheet responses are grouped into three subsections: (1) the distribution of meat and poultry establishments that produce affected products, (2) the methods used to enhance and mechanically tenderize raw products, and (3) where these products are processed and labeled. We present a summary of their responses to each set of questions below.

3.1 ESTIMATES OF PROPORTIONS OF ESTABLISHMENTS PRODUCING AFFECTED PRODUCTS

This section outlines responses to questions regarding baseline (i.e., current) distribution of establishments producing products that might be affected by a labeling regulation. Experts were asked to base their estimates on domestic production from federally inspected establishments in the most recent calendar year. Experts were provided establishment counts obtained from FSIS's Public Health Inspection System (PHIS) and Performance-based Inspection System (PBIS) databases.[2] For each of the species presented below, establishments might

[2] The transition from PBIS to PHIS was still in progress at the time that the data were retrieved; thus, FSIS used both sources to obtain the establishment counts required for the project.

produce multiple product types—mechanically tenderized using blades or needles only, enhanced only, and mechanically tenderized using blades or needles *and* enhanced—and thus would be included in multiple rows of the table.

3.1.1 Raw Beef Products

For brevity, we refer to products that are mechanically tenderized using blades or needles as "mechanically tenderized" throughout the presentation of results. Experts were asked to exclude products using other methods of mechanical tenderization from their responses.

The estimated proportions of establishments producing each type of product or raw beef product by establishment size, as shown in Table 3-1[3], are as follows:

- Among *very small* establishments, 25.0% produce products that are mechanically tenderized only and mechanically tenderized and enhanced. Eighteen percent of establishments produce products that are enhanced only.
- Among *small* establishments, approximately 30.0% produce products that are enhanced only and mechanically tenderized and enhanced. An estimated 40.0% of establishments produce products that are mechanically tenderized only.
- An estimated 25.0% of *large* establishments process products that are mechanically tenderized only, an estimated 40.0% process enhanced only products, and an estimated 40.0% process mechanically tenderized and enhanced products. (The mean proportion of large establishments that produce mechanically tenderized products was substantially less than the median because one expert provided an estimate of 10%.)

In most cases, the median and mean were very similar, indicating that the experts were generally in agreement. Experts indicated that larger establishments typically do some type of enhancement to raw beef products based on specifications from retailers. One expert indicated that the number of establishments mechanically tenderizing products is decreasing because of concerns about bacterial contamination.

3.1.2 Raw Pork Products

The estimated proportions of establishments each type of raw pork product by establishment size, as shown in Table 3-2, are as follows:

[3] Note that minimum and maximum values were provided to FSIS in the detailed Excel spreadsheet of the experts' responses.

Table 3-1. Proportions of Establishments that Produce Raw Beef Products by Processing Method and Establishment Size[a]

	Median	Mean
Very small establishments		
Mechanically tenderized only	25.0%	25.8%
Enhanced only	18.0%	20.9%
Mechanically tenderized *and* enhanced	25.0%	26.9%
Small establishments		
Mechanically tenderized only	40.0%	39.7%
Enhanced only	30.0%	28.7%
Mechanically tenderized *and* enhanced	30.0%	33.0%
Large establishments		
Mechanically tenderized only[b]	25.0%	38.3%
Enhanced only	40.0%	43.3%
Mechanically tenderized *and* enhanced	40.0%	42.8%

[a]Based on FSIS data, 1,003 very small establishments, 728 small establishments, and 52 large establishments produce raw beef products, including intact and nonintact products.

[b]The median differs substantially from the mean because one expert provided an estimate of 10% for all large establishments producing mechanically tenderized raw beef products, which was much less than proportions provided by other experts.

- An estimated 25.0% and 22.5% of *very small* establishments produce enhanced-only and mechanically tenderized and enhanced raw pork products, respectively. Only 5.0% percent of *very small* establishments produce mechanically tenderized-only pork products.
- Among *small* establishments, approximately 60.0% produce enhanced-only and 40.0% produce mechanically tenderized and enhanced raw pork products. An estimated 5.0% of *small* establishments produce raw pork products that are mechanically tenderized only.
- An estimated 75.0% of *large* establishments produce products that are enhanced only, and 60.0% produce products that are both mechanically tenderized and enhanced. (The mean proportion of large establishments that produce enhanced-only products was substantially greater than the median because one expert provided an estimate of 90%.)

In most cases, the median and mean were very similar, indicating that the experts were generally in agreement.

Table 3-2. Proportions of Establishments that Produce Raw Pork Products by Processing Method and Establishment Size[a]

	Median	Mean
Very small establishments		
Mechanically tenderized only	5.0%	5.9%
Enhanced only[b]	25.0%	36.7%
Mechanically tenderized *and* enhanced	22.5%	22.5%
Small establishments		
Mechanically tenderized only	5.0%	7.1%
Enhanced only	60.0%	56.1%
Mechanically tenderized *and* enhanced	40.0%	39.4%
Large establishments		
Mechanically tenderized only	10.0%	11.5%
Enhanced only	75.0%	70.0%
Mechanically tenderized *and* enhanced	60.0%	58.1%

[a]Based on FSIS data, 1,138 very small establishments, 732 small establishments, and 45 large establishments produce raw pork products, including intact and nonintact products.

[b]The median differs substantially from the mean because one expert provided an estimate of 10% for all large establishments producing mechanically tenderized raw pork products, which was much less than proportions provided by other experts.

Experts indicated their estimates were partly based on a recent study by the National Pork Board on pork product processing.[4]

3.1.3 Raw Lamb and Goat Products

The estimated proportions of establishments producing each type of raw lamb and goat product by establishment size,[5] as shown in Table 3-3, are as follows:

- An estimated 6.5% of *very small* and *small* establishments produce raw lamb and goat products that are mechanically tenderized only.
- An estimated 5.5% and 8.0% of *very small* establishments produce raw lamb and goat products that are enhanced only and products that are both mechanically tenderized and enhanced, respectively.
- An estimated 12.5% and 15.0% of *small* establishments produce raw lamb and goat products that are enhanced

[4] The study results were presented in a PowerPoint presentation, "National Meat Case Study 2010," dated September 24, 2010. One of the experts provided the file, which was distributed among the panelists.

[5] Note that no large establishments produce lamb or goat products.

Table 3-3. Proportions of Establishments that Produce Raw Lamb and Goat Products by Processing Method and Establishment Size[a]

	Median	Mean
Very small establishments		
Mechanically tenderized only	6.5%	7.0%
Enhanced only[b]	5.5%	10.8%
Mechanically tenderized *and* enhanced	8.0%	8.3%
Small establishments		
Mechanically tenderized only	6.5%	7.9%
Enhanced only	12.5%	14.5%
Mechanically tenderized and enhanced	15.0%	12.6%

[a]Based on FSIS data, 443 very small establishments, 229 small establishments, and 0 large establishments produce raw lamb products, including intact and nonintact products. The number of establishments producing raw goat products was not available.

[b]The median differs substantially from the mean because one expert provided an estimate of 30% for all very small establishments producing mechanically tenderized raw lamb and goat products, which was much greater than proportions provided by other experts.

only and products that are both mechanically tenderized and enhanced, respectively.

In most cases, the median and mean were very similar, indicating that the experts were generally in agreement. Experts indicated that lamb and goat processing establishments typically produce enhanced products by marinating whole carcasses.

3.1.4 Raw Chicken Products

The estimated proportions of establishments producing each type of raw chicken product by establishment size, as shown in Table 3-4, are as follows:

- Among *very small* establishments that produce raw chicken products, 50.0% produce enhanced-only products and 47.5% produce products that are mechanically tenderized and enhanced. An estimated 1.0% of raw chicken establishments produce mechanically tenderized-only products.
- A majority of *small* establishments that produce raw chicken products produce enhanced-only products (72.5%) and products that are mechanically tenderized and enhanced (67.5%). An estimated 5.0% of raw chicken establishments produce mechanically tenderized-only products.

Table 3-4. Proportions of Establishments that Produce Raw Chicken Products by Processing Method and Establishment Size[a]

	Median	Mean
Very small establishments		
Mechanically tenderized only	1.0%	4.3%
Enhanced only	50.0%	48.1%
Mechanically tenderized *and* enhanced	47.5%	40.6%
Small establishments		
Mechanically tenderized only	5.0%	5.9%
Enhanced only	72.5%	71.9%
Mechanically tenderized *and* enhanced	67.5%	62.5%
Large establishments		
Mechanically tenderized only	5.0%	6.9%
Enhanced only	85.0%	85.0%
Mechanically tenderized *and* enhanced	75.0%	72.5%

[a]Based on FSIS data, 563 very small establishments, 512 small establishments, and 154 large establishments produce raw chicken products, including intact and nonintact products.

- An estimated 85.0% and 75.0% of *large* raw chicken establishments process products that are enhanced only and products that are both mechanically tenderized and enhanced, respectively. Similar to small establishments, an estimated 5.0% of raw chicken establishments produce mechanically tenderized-only products.

In most cases, the median and mean were very similar, indicating that the experts were generally in agreement. Experts agreed that most large establishments are enhancing products through needle injection, and mechanical tenderization using blades is rare.

3.1.5 Raw Turkey Products

The estimated proportions of establishments producing each type of raw turkey product by establishment size, as shown in Table 3-5, are as follows:

- Among *very small* establishments that produce raw turkey products, 45.0% produce enhanced-only products and 42.5% produce products that are mechanically tenderized and enhanced. An estimated 3.0% of very small establishments that produce raw turkey products produce mechanically tenderized-only products.

Table 3-5. Proportions of Establishments that Produce Raw Turkey Products by Processing Method and Establishment Size[a]

	Median	Mean
Very small establishments		
Mechanically tenderized only	3.0%	2.9%
Enhanced only	45.0%	43.8%
Mechanically tenderized *and* enhanced	42.5%	43.1%
Small establishments		
Mechanically tenderized only	5.0%	4.3%
Enhanced only	67.5%	67.5%
Mechanically tenderized *and* enhanced	70.0%	65.0%
Large establishments		
Mechanically tenderized only	5.5%	6.5%
Enhanced only	75.5%	75.1%
Mechanically tenderized *and* enhanced	75.0%	68.8%

[a]Based on FSIS data, 177 very small establishments, 182 small establishments, and 28 large establishments produce raw turkey products, including intact and nonintact products.

- A majority (67.5% and 70.0%) of *small* establishments that produce raw turkey products produce enhanced-only products and products that are mechanically tenderized and enhanced, respectively. An estimated 5% of small establishments that produce raw turkey products produce mechanically tenderized-only products.
- An estimated 75.5% and 75.0% of *large* establishments that produce raw turkey products produce enhanced-only products and products that are both mechanically tenderized and enhanced, respectively. An estimated 5.5% of large establishments that produce raw turkey products produce mechanically tenderized-only products.

In most cases, the median and mean were very similar, indicating that the experts were generally in agreement. Experts indicated that most establishments process turkey products, particularly turkey breasts, using needle injection.

3.2 Estimates of Proportions of Pounds of Affected Products

The following section discusses responses to questions regarding the distribution of raw product pounds in each of the

product categories. Experts were asked to base their estimates on domestic production from federally inspected establishments in the most recent calendar year. For context, experts were provided total product pounds processed estimated using data from FSIS's PHIS and PBIS databases. We present results for each of the following:

- by species and product type relative to processing volumes (Section 3.2.1)
- by species and enhancement method relative to processing volumes (Section 3.2.2)
- by species and packaging type for each product type relative to consumption volumes (Section 3.2.3)

3.2.1 Proportions of Product Pounds by Species and Product Type

Experts were asked to provide estimates of percentages of raw product pounds by the processing method used at the processing facility. These include mechanically tenderized using blades, enhanced (using marination, tumbling, and vacuum tumbling), mechanically tenderized and enhanced (typically using needle injection), and other raw products. Other raw products include ground products and whole muscle cuts that are not mechanically tenderized or enhanced.

For context, the experts were provided with the following estimates of 2010 carcass weight pounds of production based on slaughter volumes multiplied by average carcass weights:

- Beef: 24.3 billion pounds
- Pork: 21.4 billion pounds
- Lamb and goat: 185 million pounds
- Chicken: 49.4 billion pounds
- Turkey: 7.0 billion pounds

In addition, experts were provided with ballpark estimates of raw product that is ground, which would be included in "All other raw products" in Table 3-6 below, to better estimate the percentages of products that fall into the other categories. The specific estimates and sources are listed in the clarifications provided to the experts in Appendix A.

Using rescaled medians, the estimated proportions of methods used to process raw meat and poultry products, as shown in Table 3-6, are as follows:

Table 3-6. Proportion of Raw Product Pounds by Species and Processing Type

	Median[a]	Mean
Beef Products		
Mechanically tenderized only	10.0% (10.5%)	14.1%
Enhanced only	5.0% (5.3%)	6.0%
Mechanically tenderized *and* enhanced	15.0% (15.8%)	16.5%
All other raw products	65.0% (68.4%)	63.4%
Pork Products		
Mechanically tenderized only	5.0% (5.4%)	5.6%
Enhanced only	15.0% (16.2%)	20.6%
Mechanically tenderized *and* enhanced	37.5% (40.5%)	44.4%
All other raw products	35.0% (37.8%)	29.4%
Lamb and Goat Products		
Mechanically tenderized only	3.0% (3.2%)	3.9%
Enhanced only	10.0% (10.8%)	10.9%
Mechanically tenderized *and* enhanced	17.5% (18.8%)	19.4%
All other raw products	62.5% (67.2%)	65.9%
Chicken Products		
Mechanically tenderized only	5.0% (4.9%)	3.9%
Enhanced only	40.0% (39.0%)	37.5%
Mechanically tenderized *and* enhanced	40.0% (39.0%)	38.8%
All other raw products	17.5% (17.1%)	19.9%
Turkey Products		
Mechanically tenderized only	5.0% (5.7%)	4.8%
Enhanced only	32.5% (37.1%)	36.1%
Mechanically tenderized *and* enhanced	32.5% (37.1%)	37.9%
All other raw products	17.5% (20.0%)	21.3%

[a]The rescaled medians are shown in parentheses, for example, (25%). Medians for questions that must sum to 100% were rescaled so that proportions sum to 100%.

- The majority (68.4%) of raw beef product pounds are not mechanically tenderized or enhanced. An estimated 10.5% are mechanically tenderized only, and 15.8% are mechanically tenderized and enhanced. The remaining 5% are enhanced only.
- An estimated 40.5% of pork product pounds are mechanically tenderized and enhanced, 37.8% are neither mechanically tenderized nor enhanced, and

16.2% are enhanced only. The remaining 5.4% are mechanically tenderized only.

- The majority (67.2%) of lamb and goat raw product pounds are not mechanically tenderized or enhanced. An estimated 10.8% are enhanced only, and 18.8% are mechanically tenderized and enhanced. The remaining 3.2% are mechanically tenderized only.
- An estimated 39.0% of chicken product pounds are enhanced, 39.0% are mechanically tenderized and enhanced, and 17.1% are neither mechanically tenderized nor enhanced. The remaining 4.9% are mechanically tenderized only.
- Similar to chicken products, 37.1% of raw turkey products are enhanced and another 37.1% are mechanically tenderized and enhanced. Twenty percent of product pounds are neither mechanically tenderized nor enhanced, and the remaining 5.7% are mechanically tenderized only.

3.2.2 Proportions of Product Pounds by Species and Enhancement Method

Based on a clarification provided by FSIS, the experts were asked to include products that are injected but also enhanced by another method in the row for injected products.

For each species, experts were asked to estimate the distribution of enhanced product pounds by method of enhancement, including products that are enhanced only and products that are both mechanically tenderized and enhanced. Overall, experts agreed that injection was the most widely used method of enhancement. Using rescaled medians, the estimated proportions of product pounds by method of enhancement, as shown in Table 3-7, are as follows:

- The majority (63.2%) of enhanced raw beef product pounds are enhanced using injection. An estimated 15.8% are enhanced using marination and another 15.8% are vacuum tumbled. The remaining 5.3% are tumbled.
- A substantial majority (79.5%) of enhanced raw pork product pounds are enhanced using injection. An estimated 10.3% are vacuum tumbled, and the remaining 10.2% products are evenly split between either being marinated or tumbled.
- The majority (52.9%) of enhanced raw lamb and goat product pounds are enhanced using injection. An estimated 23.5% are enhanced using marination and another 17.6% are vacuum tumbled. The remaining 5.9% are tumbled.

Table 3-7. Proportion of Enhanced Product Pounds by Species and Enhancement Method

	Median[a]	Mean
Beef Products		
Marinated	15.0% (15.8%)	15.6%
Tumbled	5.0% (5.3%)	6.3%
Vacuum tumbled	15.0% (15.8%)	12.5%
Injected	60.0% (63.2%)	65.6%
Pork Products		
Marinated	5.0% (5.1%)	5.0%
Tumbled	5.0% (5.1%)	4.4%
Vacuum tumbled	10.0% (10.3%)	10.6%
Injected	77.5% (79.5%)	79.4%
Lamb and Goat Products		
Marinated	20.0% (23.5%)	24.4%
Tumbled	5.0% (5.9%)	6.3%
Vacuum tumbled	15.0% (17.6%)	15.0%
Injected	45.0% (52.9%)	41.9%
Chicken Products		
Marinated	12.5% (12.8%)	13.4%
Tumbled	5.0% (5.1%)	5.1%
Vacuum tumbled	30.0% (30.8%)	28.1%
Injected	50.0% (51.3%)	53.4%
Turkey Products		
Marinated	12.5% (12.8%)	11.3%
Tumbled	5.0% (5.1%)	5.9%
Vacuum tumbled	27.5% (28.2%)	26.3%
Injected	52.5% (53.8%)	59.1%

[a]The rescaled medians are shown in parentheses, for example, (25%). Medians for questions that must sum to 100% were rescaled so that proportions sum to 100%.

- An estimated 51.3% of enhanced raw chicken product pounds are enhanced using injection. An estimated 30.8% are vacuum tumbled, 12.8% are marinated, and the remaining 5.1% are tumbled.
- Similar to raw chicken products, the majority (53.8%) of enhanced raw turkey product pounds are enhanced using injection. An estimated 28.2% are vacuum tumbled, 12.8% are marinated, and the remaining 5.1% are tumbled.

3.2.3 Proportions of Product Pounds by Packaging and Labeling Type

In the final set of questions, the experts were asked to provide estimates of percentages of raw mechanically tenderized-only (applies to beef species only), enhanced-only, and mechanically tenderized and enhanced products that are packaged and labeled as follows:

- brand name products packaged by the processor for retail sales
- private-label products packaged by the processor for retail sales
- products packaged and labeled by the processor for foodservice use
- products processed (i.e., mechanically tenderized, enhanced, or mechanically tenderized and enhanced) and packaged by the retailer

Note that in contrast to the results presented in Sections 3.2.1 and 3.2.2, which are estimated relative to pounds shipped from processing establishments, the proportions are estimated relative to total products sold in retail and foodservice operations.[6] We present results for each of the product types below.

Mechanically Tenderized-Only Raw Beef Products

Using rescaled medians, an estimated 52.6% of mechanically tenderized raw beef products are processed and packaged by the processor for foodservice, as shown in Table 3-8. In addition, 20.5% are private label packaged by the processor for retail sales, 15.8% are mechanically tenderized and packaged in retail operations, and 10.5% are brand name packaged by the processor for retail sales. One expert noted that the percentage of beef product that is mechanically tenderized is decreasing over time because of food safety concerns.

Enhanced-Only Raw Products

Using rescaled medians, the estimated distributions of enhanced products according to where they are processed, packaged, and labeled by species, as shown in Table 3-9, are as follows:

[6] Note that the total estimated pounds of product sold in retail and foodservice operations by product type are provided in Section 3.3.

Table 3-8. Proportions of Mechanically Tenderized-Only Beef Product Pounds by Packaging and Labeling Type

	Median[a]	Mean
Beef Products		
Brand name packaged by the processor for retail sales	10.0% (10.5%)	11.9%
Private label packaged by the processor for retail sales	20.0% (21.1%)	22.5%
Packaged by the processor for foodservice sales	50.0% (52.6%)	50.0%
Mechanically tenderized and packaged in retail operations	15.0% (15.8%)	15.6%

[a]The rescaled medians are shown in parentheses, for example, (25%). Medians for questions that must sum to 100% were rescaled so that proportions sum to 100%.

Table 3-9. Proportions of Enhanced-Only Product Pounds by Species and Packaging and Labeling Type

	Median[a]	Mean
Beef Products		
Brand name packaged by the processor for retail sales	20.0% (20.5%)	19.4%
Private label packaged by the processor for retail sales	20.0% (20.5%)	23.8%
Packaged by the processor for foodservice sales	50.0% (51.3%)	47.5%
Enhanced and packaged in retail operations	7.5% (7.7%)	9.6%
Pork Products		
Brand name packaged by the processor for retail sales	32.5% (33.7%)	30.6%
Private label packaged by the processor for retail sales	30.0% (31.1%)	31.3%
Packaged by the processor for foodservice sales	30.0% (31.1%)	32.8%
Enhanced and packaged in retail operations	4.0% (4.1%)	5.3%
Lamb and Goat Products		
Brand name packaged by the processor for retail sales	25.0% (25.5%)	26.3%
Private label packaged by the processor for retail sales	25.0% (25.5%)	21.8%
Packaged by the processor for foodservice sales	44.5% (45.4%)	42.4%
Enhanced and packaged in retail operations	3.5% (3.6%)	4.6%
Chicken Products		
Brand name packaged by the processor for retail sales	30.0% (33.7%)	32.0%
Private label packaged by the processor for retail sales	20.0% (22.5%)	23.6%
Packaged by the processor for foodservice sales	34.0% (38.2%)	35.1%
Enhanced and packaged in retail operations	5.0% (5.6%)	6.1%
Turkey Products		
Brand name packaged by the processor for retail sales	40.0% (38.1%)	36.3%
Private label packaged by the processor for retail sales	25.0% (23.8%)	25.0%
Packaged by the processor for foodservice sales	35.0% (33.3%)	36.0%
Enhanced and packaged in retail operations	5.0% (4.8%)	4.0%

[a]The rescaled medians are shown in parentheses, for example, (25%). Medians for questions that must sum to 100% were rescaled so that proportions sum to 100%.

- An estimated 51.3% of enhanced beef products are packaged by the processor for foodservice sales. In addition, 20.5% are brand-name and another 20.5% are private-label packaged by the processor for retail sales. The remaining 8% are enhanced and packaged in retail operations.
- Of enhanced pork products, 33.7% are brand-name packaged by the processor for retail sales, 31.1% are private label packaged by the processor for retail sales, and 31.1% are packaged by the processor for foodservice. The remaining 4.1% are enhanced and packaged in retail operations.
- Of enhanced lamb and goat products, 45.4% are packaged by the processor for foodservice, 25.5% are brand name packaged by the processor for retail sales, and 25.5% are private label packaged by the processor for retail sales. The remaining 3.6% are enhanced and packaged in retail operations.
- An estimated 38.2% of enhanced chicken products are packaged by the processor for foodservice sales. In addition, 33.7% are brand name and 22.5% are private label packaged by the processor for retail sales. The remaining 5.6% are enhanced and packaged in retail operations.
- An estimated 38.1% of enhanced turkey products are brand name packaged and labeled by the processor for retail sales. In addition, 33.3% are packaged by the processor for foodservice sales and 23.8% are private label packaged by the processor for retail sales. The remaining 5.1% are enhanced and packaged in retail operations.

Mechanically Tenderized and Enhanced Products

Using rescaled medians, the estimated distributions of mechanically tenderized and enhanced products according to where they are processed, packaged, and labeled by species, as shown in Table 3-10, are as follows:

- An estimated 51.3% of enhanced beef products are packaged by the processor for foodservice sales. In addition, 20.5% are brand name and 23.1% are private label packaged by the processor for retail sales. The remaining 5.1% are enhanced and packaged in retail operations.
- Of enhanced pork products, 35.5% are brand name packaged by the processor for retail sales, 30.5% are private label packaged by the processor for retail sales,

Table 3-10. Proportions of Mechanically Tenderized and Enhanced Product Pounds by Species and Packaging and Labeling Type

	Median[a]	Mean
Beef Products		
Brand name packaged by the processor for retail sales	20.0% (20.5%)	21.3%
Private label packaged by the processor for retail sales	22.5% (23.1%)	24.4%
Packaged by the processor for foodservice sales	50.0% (51.3%)	44.9%
Mechanically tenderized, enhanced, and packaged in retail operations	5.0% (5.1%)	9.5%
Pork Products		
Brand name packaged by the processor for retail sales	35.0% (35.5%)	32.5%
Private label packaged by the processor for retail sales	30.0% (30.5%)	30.0%
Packaged by the processor for foodservice sales	28.5% (28.9%)	33.0%
Mechanically tenderized, enhanced, and packaged in retail operations	5.0% (5.1%)	5.1%
Lamb and Goat Products		
Brand name packaged by the processor for retail sales	35.0% (38.7%)	33.8%
Private label packaged by the processor for retail sales	24.5% (27.1%)	21.1%
Packaged by the processor for foodservice sales	30.0% (33.1%)	26.8%
Mechanically tenderized, enhanced, and packaged in retail operations	1.0% (1.1%)	3.4%
Chicken Products		
Brand name packaged by the processor for retail sales	37.5% (39.1%)	39.4%
Private label packaged by the processor for retail sales	20.0% (20.8%)	20.6%
Packaged by the processor for foodservice sales	35.0% (36.5%)	36.6%
Mechanically tenderized, enhanced, and packaged in retail operations	3.5% (3.6%)	3.4%
Turkey Products		
Brand name packaged by the processor for retail sales	37.5% (38.5%)	37.5%
Private label packaged by the processor for retail sales	20.0% (20.5%)	21.3%
Packaged by the processor for foodservice sales	35.0% (35.9%)	33.8%
Mechanically tenderized, enhanced, and packaged in retail operations	5.0% (5.1%)	7.5%

[a]The rescaled medians are shown in parentheses, for example, (25%). Medians for questions that must sum to 100% were rescaled so that proportions sum to 100%.

and 28.9% are packaged by the processor for foodservice. The remaining 5.1% are enhanced and packaged in retail operations.

- Of enhanced lamb and goat products, 38.7% are brand name and packaged by the processor for retail sales. An

estimated 33.1% are private label and packaged by the processor for retail sales, and 27.1% are packaged by the processor for foodservice. The remaining 1.1% are enhanced and packaged in retail operations.

- An estimated 39.1% of enhanced chicken products are brand name and packaged by the processor for retail sales. In addition, 36.5% are packaged by the processor for foodservice sales, and 20.8% are private label packaged by the processor for retail sales. The remaining 3.6% are enhanced and packaged in retail operations.
- An estimated 38.5% of enhanced turkey products are brand name packaged and labeled by the processor for retail sales. In addition, 35.9% are packaged by the processor for foodservice sales, and 20.5% are private label packaged by the processor for retail sales. The remaining 5.1% are enhanced and packaged in retail operations.

3.3 APPLYING THE DATA OBTAINED IN THE EXPERT ELICITATION FOR FURTHER ANALYSES

In this section, we apply the median proportions[7] obtained above to estimate the following values for use in further analyses:

- Number of establishments that produce each type of product by species and establishment size (see Table 3-11)
  - We multiplied the percentages of establishments in Tables 3-1 through 3-5 by the total numbers of establishments in each of the footnotes.
- Pounds of product of each type produced in processing establishments by species (see Table 3-12)
  - We multiplied the percentages of pounds in Table 3-6 by the estimated raw pounds listed in Section (3.2.1).
- Pounds of enhanced products produced in processing establishments by species and method of enhancement (see Table 3-13)
  - We added the total enhanced product pounds from Table 3-12 by species and multiplied by the

[7] In cases where the sum of the proportions must equal 100%, we used the rescaled medians in the calculations.

Table 3-11. Estimated Number of Establishments that Produce Each Type of Product by Species and Establishment Size

	Very Small	Small	Large
Beef establishments			
Mechanically tenderized only	251	291	13
Enhanced only	181	218	21
Mechanically tenderized *and* enhanced	251	218	21
Pork establishments			
Mechanically tenderized only	57	37	5
Enhanced only	285	439	34
Mechanically tenderized *and* enhanced	256	293	27
Lamb and goat establishments			
Mechanically tenderized only	29	15	0
Enhanced only	24	29	0
Mechanically tenderized *and* enhanced	35	34	0
Chicken establishments			
Mechanically tenderized only	6	26	8
Enhanced only	282	371	131
Mechanically tenderized *and* enhanced	267	346	116
Turkey establishments			
Mechanically tenderized only	5	9	2
Enhanced only	80	123	21
Mechanically tenderized *and* enhanced	75	127	21

Note: Establishments may produce multiple types of products and species and, therefore, may be represented in more than one row of the table.

percentages of pounds by species and enhancement method in Table 3-7.

- Pounds of mechanically tenderized beef products by packaging and labeling type (see Table 3-14)
  - We first estimated the total pounds of mechanically tenderized beef products, including products mechanically tenderized in retail operations, by dividing the pounds of mechanically tenderized beef products in Table 3-12 by the sum of the percentages of products packaged by the processor in Table 3-8. Then, we multiplied each of the percentages in Table 3-8 by the total estimated pounds of mechanically tenderized beef products.

Table 3-12. Estimated Pounds of Product Produced in Processing Establishments of Each Type by Species (Millions)

	Beef	Pork	Lamb and Goat	Chicken	Turkey
Mechanically tenderized only	2,552	1,156	6	2,421	399
Enhanced only	1,288	3,467	20	19,266	2,597
Mechanically tenderized *and* enhanced	3,839	8,667	35	19,266	2,597
Total	7,679	13,290	61	40,953	5,593

Table 3-13. Estimated Pounds of Enhanced Product Produced in Processing Establishments by Species and Method of Enhancement (Millions)

	Beef	Pork	Lamb and Goat	Chicken	Turkey
Marinated	810	619	13	4,932	665
Tumbled	272	619	3	1,965	265
Vacuum tumbled	810	1,250	10	11,868	1,465
Injected	3,235	9,647	29	19,767	2,800
Total	5,127	12,135	55	38,532	5,195

Table 3-14. Estimated Pounds of Mechanically Tenderized-Only Beef Products by Packaging and Labeling Type (Millions)

	Beef
Brand name packaged by the processor for retail sales	318
Private label packaged by the processor for retail sales	640
Packaged by the processor for foodservice sales	1,594
Mechanically tenderized and packaged in retail operations	479
Total	3,031

- Pounds of enhanced-only products by species and packaging and labeling type (see Table 3-15)
  - We first estimated the total pounds of enhanced-only products, including products enhanced in retail operations, by dividing the pounds of enhanced only products in Table 3-12 by the sum of the percentages of products packaged by the processor in Table 3-9. Then, we multiplied each of the percentages in Table 3-9 by the total estimated pounds of enhanced-only products by species.

Table 3-15. Estimated Pounds of Enhanced-Only Products by Species and Packaging and Labeling Type (Millions)

	Beef	Pork	Lamb and Goat	Chicken	Turkey
Brand name packaged by the processor for retail sales	286	1,218	5	6,878	1,039
Private label packaged by the processor for retail sales	286	1,124	5	4,592	649
Packaged by the processor for foodservice sales	716	1,124	9	7,796	908
Enhanced and packaged in retail operations	107	148	1	1,143	131
Total	1,395	3,614	20	20,409	2,727

- Pounds of mechanically tenderized and enhanced products by species and packaging and labeling type (see Table 3-16)
  - We first estimated the total pounds of mechanically tenderized and enhanced products by species, including products mechanically tenderized and enhanced in retail operations, by dividing the pounds of mechanically tenderized and enhanced products in Table 3-12 by the sum of the percentages of products packaged by the processor in Table 3-10. Then, we multiplied each of the percentages in Table 3-10 by the total estimated pounds of mechanically tenderized and enhanced products by species.

Table 3-16. Estimated Pounds of Mechanically Tenderized and Enhanced Products by Species and Packaging and Labeling Type (Millions)

	Beef	Pork	Lamb and Goat	Chicken	Turkey
Brand name packaged by the processor for retail sales	829	3,242	14	7,814	1,054
Private label packaged by the processor for retail sales	934	2,785	10	4,157	561
Packaged by the processor for foodservice sales	2,075	2,639	12	7,295	982
Mechanically tenderized, enhanced, and packaged in retail operations	206	466	0	719	140
Total	4,044	9,132	36	19,985	2,737

Note that calculated pounds of product in the tables above could be converted to numbers of packages by dividing the number of pounds by the average package size for each type of product. Average package size could potentially be calculated using scanner data available from other sources. For calculating the cost of changing labels to comply with the proposed regulations, it may be necessary to estimate the number of Universal Product Codes (UPCs) affected by the regulation. Thus, average numbers of UPCs produced per establishment (by size) would need to be estimated and then multiplied by the numbers of establishments shown in Table 3-11.

Appendix A: Expert Elicitation Materials

This appendix contains the following materials that were used in conducting the Market Shares for Raw Meat and Poultry Products expert elicitation:

- Project description and interest form
- Expert elicitation worksheet
- Clarifications provided to the experts

PROJECT DESCRIPTION
Market Shares for Raw Meat and Poultry Products Containing Added Solutions and Mechanically Tenderized Raw Meat and Poultry Products

RTI International is conducting an expert elicitation for the U.S. Department of Agriculture, Food Safety and Inspection Service to obtain data needed to assess the economic impacts of proposed or potential requirements for labeling of raw meat and poultry products containing added solutions and mechanically tenderized raw meat and poultry products. Specific data needs include the following:

- percentages of establishments by size and type that produce these products
- percentages of product volumes for each type of product

Because the required data are not available from published sources or existing databases, estimates are being obtained through an expert elicitation process. You would be asked to provide estimated values based on your experience and knowledge by completing a worksheet and participating in a discussion of the responses. In the study report, you would be identified as a participant in the panel, but your specific responses would be aggregated with those of the other panel participants.

This expert elicitation is designed to be conducted by teleconference and email with two rounds—in the first round, we will discuss the assumptions, definitions, and questions to be completed, and, in the second round, we will review the combined responses to determine reasons for differences in the provided values. If you choose to participate, you will be identified as a participant on the panel, but your specific responses will be combined with those of the other participants in the report we prepare for FSIS.

What We Would Need from You
If you agree to participate in this expert elicitation, we will need to have you do the following:

- complete the attached interest and availability form by **December 6, 2011**
- complete a panel participation agreement form that RTI's contracts office will send to you after the list of participants is finalize
- participate in two (approximately 1-hour) teleconferences with the other panelists
- based on your experience and knowledge, complete a worksheet to provide estimates of percentages of establishments and products in the affected categories

We are offering an honorarium of $750 for completion of the exercise.

Please return the form to Michaela Cimini Coglaiti, Coglaiti@rti.org, phone 919-990-8498

Technical questions regarding this project can be directed to:

FSIS Project Officer

Dr. Gary Roseman
301-504-0892
Gary.Roseman@fsis.usda.gov

RTI Technical Lead

Dr. Mary K. Muth
919-541-7289
muth@rti.org

INTEREST FORM
Market Shares for Raw Meat and Poultry Products Containing Added Solutions and Mechanically Tenderized Raw Meat and Poultry Products

Name:

Preferred email address:

Phone:

Fax number:

Mailing address (payment address):

Citizenship:

Please indicate whether you are available for the initial 1-hour teleconference for these dates and times:

___ Wed., 12/14 10:00am – Noon
___ Wed., 12/14 1:30 pm – 3:30pm
___ Thur., 12/15 10:30am – 12:30pm
___ Thur., 12/15 3:00pm – 5:00pm
___ Fri., 12/16 3:00pm – 5:00pm
___ Mon., 12/19 1:00pm – 3:00pm

Once we receive all of the responses, we will email you with the selected date/time. The second teleconference will be scheduled in January.

Please indicate your level of experience or knowledge of the following:

Products	**Level of Experience/Knowledge**		
Mechanically tenderized products	☐ 1 Minimal / none	☐ 2 Moderate	☐ 3 Extensive
Products with added solutions	☐ 1 Minimal / none	☐ 2 Moderate	☐ 3 Extensive

Species	Level of Experience/Knowledge		
Beef	☐ 1 Minimal / none	☐ 2 Moderate	☐ 3 Extensive
Pork	☐ 1 Minimal / none	☐ 2 Moderate	☐ 3 Extensive
Lamb & goat	☐ 1 Minimal / none	☐ 2 Moderate	☐ 3 Extensive
Chicken	☐ 1 Minimal / none	☐ 2 Moderate	☐ 3 Extensive
Turkey	☐ 1 Minimal / none	☐ 2 Moderate	☐ 3 Extensive

Establishment Sizes	*Level of Experience/Knowledge*		
Very small (1–9 employees or <$2.5 million in annual sales)	☐ 1 Minimal / none	☐ 2 Moderate	☐ 3 Extensiv
Small (10–499 employees)	☐ 1 Minimal / none	☐ 2 Moderate	☐ 3 Extensiv
500 or more employees	☐ 1 Minimal / none	☐ 2 Moderate	☐ 3 Extensiv

Please return this form by December 6, 2011 to Michaela Cimini Coglaiti (Coglaiti@rti.org), 919-990-9498.

EXPERT ELICITATION WORKSHEET

Market Shares for Raw Meat and Poultry Products Containing Added Solutions and Mechanically Tenderized Raw Meat and Poultry Products

The overall purpose of this expert elicitation is to provide information to the U.S. Department of Agriculture, Food Safety Inspection Service (FSIS) for calculating market volumes and numbers of affected establishments for raw meat and poultry products that contain added solutions, are mechanically tenderized using needle or blade tenderization, or overlap in both categories. These data will be used to assess the economic impacts of proposed or potential requirements for labeling of these products[8]. Specific data needs include the following:

- percentages of establishments by size that produce these products

percentages of product volumes for each type of product

Because the data to address these requirements are not available from published sources or existing databases, estimates are being obtained through this expert elicitation. We are asking you to provide estimated values based on your experience and knowledge by completing this worksheet and participating in a discussion of the responses. In the study report, you will be identified as a participant in the panel, but your specific responses will be aggregated with those of the other panel participants.

For this exercise, we will focus on the following species and establishment sizes:

Species categories:

- Beef—produced from steers, heifers, and cows (in some cases)
- Pork—produced from barrows and gilts
- Lamb and goat (combined)
- Chicken—produced from young chickens
- Turkey—produced from young turkeys

Processing establishment sizes:

- Very small—fewer than 10 employees or $2.5 million in annual sales
- Small—10 to 499 employees
- Large—500 or more employees

[8] FSIS published a proposed rule, "Common or Usual Name for Raw Meat and Poultry Products Containing Added Solutions" on July 27, 2011 (see http://www.fsis.usda.gov/OPPDE/rdad/FRPubs/2010-0012.pdf). A proposed rule has not been published regarding mechanically tenderized raw meat and poultry products.

DEFINITIONS

Meat and poultry products with added solutions—Raw meat and poultry products to which solutions have been added; also often referred to as enhanced products. They are generally enhanced using one of the following methods:

- Marinated—meat or poultry soaked in a seasoned liquid solution of water, oil, wine, or vinegar with spices, herbs, and other ingredients to season and/or tenderize the product (includes in-package marination).
- Tumbled—meat or poultry placed in a tumbler that revolves with a solution. The tumbling process breaks down connective tissue and muscle fiber.
- Vacuum tumbled—meat or poultry placed in a tumbler that uses a vacuum to enable the solution to penetrate the muscle. The tumbling process breaks down connective tissue and muscle fiber.
- Injected—meat or poultry to which a solution has been introduced into its interior by injecting, pump marination, or stitch pumping.

Mechanically tenderized meat and poultry products—Raw meat and poultry products that have had mechanical alteration to the surface of the meat. For this exercise, we are focusing on the following methods of mechanical tenderization:

- Needle tenderization—uses a set of needles that cut through muscle fibers and connective tissue (including needle injection); may also be referred to as "pinning" or "jacarding"
- Blade tenderization—uses a set of blades that cut through muscle fibers and connective tissue

These products are typically indistinguishable in appearance from whole, intact products and may or may not have added solutions. *Note that we are excluding products that are mechanically tenderized using pounding or cubing.*

Intact products—cuts of muscle such as steaks, roasts, briskets, and stew meat

Non-intact products—products that have undergone comminution (chopping, grinding, flaking, or mincing), mechanical tenderization, or injection with solutions

Branded products—products labeled with a national or regional brand name

Private label products—products labeled with a retail store brand name (either the store name or a brand name used by the store)

Retail stores—supermarkets, mass merchandisers (e.g. big box stores with grocery sales), warehouse or club stores, meat markets, and other outlets that sell raw meat and poultry products

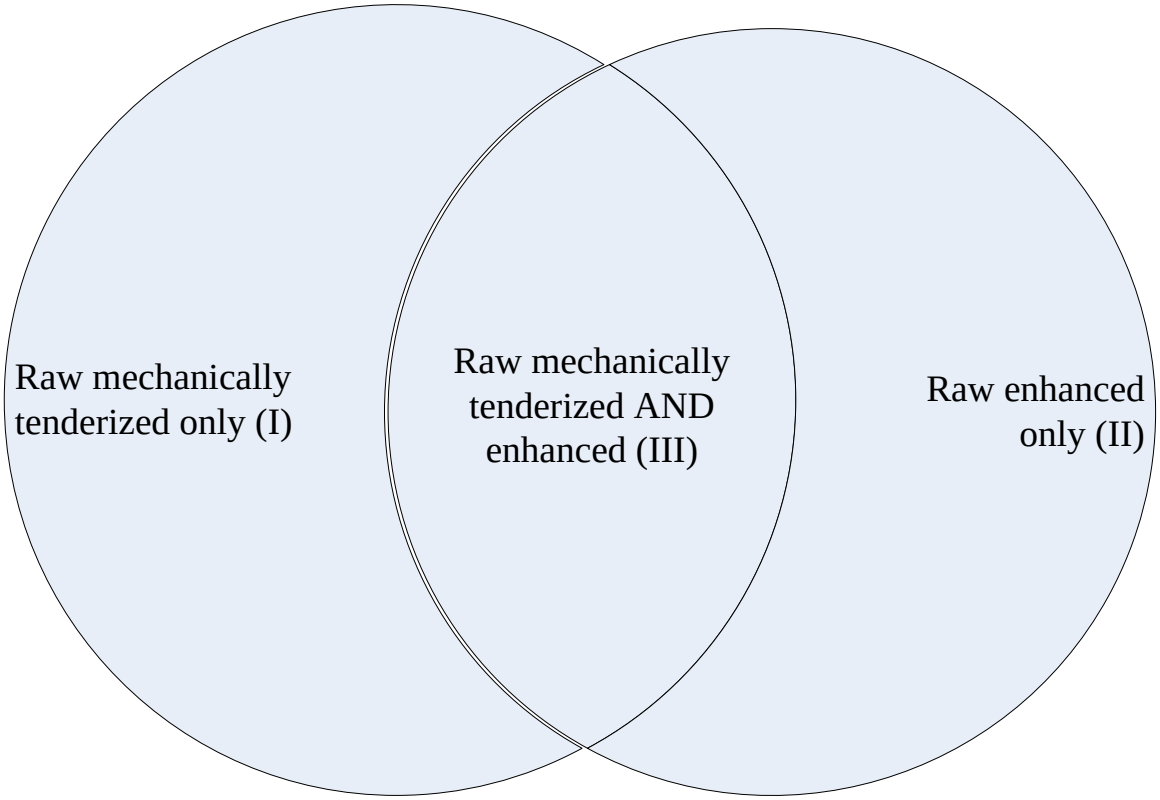
Foodservice—restaurants, fast food stores, cafeterias, and other outlets that sell prepared meat and poultry products

ASSUMPTIONS

In providing your estimates, please use the following assumptions to ensure that all panelists are responding in a similar context:

- **Consider the most recent calendar year**—Base your estimates on your knowledge of the industry over the past year
- **Federally inspected establishments only—**Base your estimates on establishments that are under Federal inspection. In other words, we are excluding establishments under state inspection or that are custom-exempt.
- **Consider domestic production only**—Base your estimates on domestically produced products only.
- **Group fresh and frozen products**—Base your estimates on the combined grouping of fresh and frozen products that might be mechanically tenderized or enhanced.

CATEGORIZATION OF PRODUCTS



(Note: Mechanical tenderization = needle and blade tenderization)

1. Based on your experience and knowledge, please provide your best estimates of the percentage of establishments producing raw products that produce each of the following products. *Note that establishments may produce products in multiple rows.*

1.a. Percentage of establishments producing raw beef products[a]

Product Type	Very Small Establishments	Small Establishments	Large Establishments
I. Mechanically tenderized using needles or blades (but not enhanced)	%	%	%
II. Enhanced (but not mechanically tenderized using needles or blades)	%	%	%
III. Mechanically tenderized using needles or blades *and* enhanced	%	%	%

[a]Based on FSIS data, 1,003 very small establishments, 728 small establishments, and 52 large establishments produce raw beef products, including intact and non-intact products.

1.b. Percentage of establishments producing raw pork products[a]

Product Type	Very Small Establishments	Small Establishments	Large Establishments
I. Mechanically tenderized using needles or blades (but not enhanced)	%	%	%
II. Enhanced (but not mechanically tenderized using needles or blades)	%	%	%
III. Mechanically tenderized using needles or blades *and* enhanced	%	%	%

[a] Based on FSIS data, 1,138 very small establishments, 732 small establishments, and 45 large establishments produce raw pork products, including intact and non-intact products.

1.c. Percentage of establishments producing raw lamb and goat products[a]

Product Type	Very Small Establishments	Small Establishments	Large Establishments
I. Mechanically tenderized using needles or blades (but not enhanced)	%	%	%
II. Enhanced (but not mechanically tenderized using needles or blades)	%	%	%
III. Mechanically tenderized using needles or blades *and* enhanced	%	%	%

[a] Based on FSIS data, 443 very small establishments, 229 small establishments, and 0 large establishments produce raw lamb products, including intact and non-intact products. The number of establishments producing raw goat products is not available.

1.d. Percentage of establishments producing raw chicken products[a]

Product Type	Very Small Establishments	Small Establishments	Large Establishments
I. Mechanically tenderized using needles or blades (but not enhanced)	%	%	%
II. Enhanced (but not mechanically tenderized using needles or blades)	%	%	%
III. Mechanically tenderized using needles or blades *and* enhanced	%	%	%

[a] Based on FSIS data, 563 very small establishments, 512 small establishments, and 154 large establishments produce raw chicken products, including intact and non-intact products.

1.e. Percentage of establishments producing raw turkey products[a]

Product Type	Very Small Establishments	Small Establishments	Large Establishments
I. Mechanically tenderized using needles or blades (but not enhanced)	%	%	%
II. Enhanced (but not mechanically tenderized using needles or blades)	%	%	%
III. Mechanically tenderized using needles or blades *and* enhanced	%	%	%

[a] Based on FSIS data, 177 very small establishments, 182 small establishments, and 28 large establishments produce raw turkey products, including intact and non-intact products.

Notes & Comments on Question 1:

2. Please provide your best estimates of the percentages of total product pounds that fall into each of the following single-species categories (ignoring products that combine species). *Base your estimates on product pounds as they are leaving the processing establishment; in other words, ignore the products that are mechanically tenderized or enhanced in retail operations.*

Product Type	Beef	Pork	Lamb/ Goat	Chicken	Turkey
I. Mechanically tenderized using needles or blades (but not enhanced)	%	%	%	%	%
II. Enhanced (but not mechanically tenderized using needles or blades)	%	%	%	%	%
III. Mechanically tenderized using needles or blades *and* enhanced	%	%	%	%	%
All other raw products	%	%	%	%	%
Total pounds of raw products	100%	100%	100%	100%	100%

Note: Based on FSIS data, total 2010 carcass-weight pounds for each species are as follows:

	Beef	Pork	Lamb/Goat	Chicken	Turkey
Total pounds	24.3 billion	21.4 billion	185 million	49.4 billion	7.0 billion

Notes & Comments:

3. Please provide your best estimates of the percentages of raw enhanced product pounds (i.e., products with added solutions) that use each of the following methods of enhancement. Include products that are enhanced only (group II) and mechanically tenderized *and* enhanced (group III). *Base your estimates on product pounds as they are leaving the processing establishment; in other words, ignore the products that are enhanced in retail operations.*

Enhancement Method	Beef	Pork	Lamb/ Goat	Chicken	Turkey
Marinated	%	%	%	%	%
Tumbled	%	%	%	%	%
Vacuum tumbled	%	%	%	%	%
Injected	%	%	%	%	%
Total raw enhanced pounds	100%	100%	100%	100%	100%

Notes & Comments:

4. Please provide your best estimates of the percentages of raw beef product pounds that are mechanically tenderized using needles or blades (group I only) that are packaged as follows. *Base your estimates on total products sold in retail and foodservice operations.*

Packaging Type	Beef
Brand name packaged by the processor for retail sales	%
Private label packaged by the processor for retail sales	%
Packaged by the processor for foodservice sales	%
Mechanically tenderized and packaged in retail operations	%
Total raw mechanically tenderized product pounds	100%

Note: Provide responses for raw beef products that are mechanically tenderized using needles or blades (but not also enhanced).

Notes & Comments:

5. Please provide your best estimates of the percentages of enhanced product pounds (group II only) that are packaged as follows. *Base your estimates on total products sold in retail and foodservice operations.*

Packaging Type	Beef	Pork	Lamb/ Goat	Chicken	Turkey
Brand name packaged by the processor for retail sales	%	%	%	%	%
Private label packaged by the processor for retail sales	%	%	%	%	%
Packaged by the processor for foodservice sales	%	%	%	%	%
Enhanced and packaged in retail operations	%	%	%	%	%
Total raw enhanced product pounds	100%	100%	100%	100%	100%

Note: Provide responses for raw products that are only enhanced (i.e., not also mechanically tenderized).

Notes & Comments:

6. Please provide your best estimates of the percentages of mechanically tenderized *and* enhanced (group III) product pounds that are packaged as follows. *Base your estimates on total products sold in retail and foodservice operations.*

Packaging Type	Beef	Pork	Lamb/ Goat	Chicken	Turkey
Brand name packaged by the processor for retail sales	%	%	%	%	%
Private label packaged by the processor for retail sales	%	%	%	%	%
Packaged by the processor for foodservice sales	%	%	%	%	%
Mechanically tenderized, enhanced, and packaged in retail operations	%	%	%	%	%
Total raw mechanically tenderized *and* enhanced product pounds	100%	100%	100%	100%	100%

Note: Provide responses for raw products that are both enhanced *and* also mechanically tenderized).

Notes & Comments:

Your Initials: _____

Clarifications Provided to Experts During the Expert Elicitation Process

- To assist in responding to Question 1 regarding proportions of establishments:

  The overall percentages of establishments producing raw products that also slaughter by species is as follows:

  - Beef 19%
  - Pork 16%
  - Lamb 31%
  - Chicken 12%
  - Turkey 13%

  This is based on just the plants in PHIS and combines all establishment sizes.

- Regarding Question 2 on percentages of ground product relative to all raw product:

  Note that we are asking you to include raw, ground product with all other raw products that are not enhanced or mechanically tenderized using blades in the "All other raw products" row. This is so that we can apply your percentages to the carcass-weight pounds shown below the table to get an estimate of pounds of mechanically tenderized using blades, enhanced, and combination products.

  This is what we were able to find:

  - Ground beef is 50–60% of all raw beef (Beef Checkoff)
  - Pork sausage is about 20% of all pork (Pork Checkoff)
  - Ground lamb is about 13% of lamb products (National Meat Case Study)
  - Ground turkey is about 10% of all raw turkey (National Turkey Federation)

- Regarding Question 3 on methods of enhancement:

  "Marinated" should only be for products that are soaked in a solution, not injected. Products that are injected with a marination solution would be in "injected." So there should be no need to insert a row for combination of enhancement method.