

TO: Matthew Michael, Food Safety and Inspection Service

FROM: Shawn Karns
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DATE: September 22, 2005

SUBJECT: Relative Risks of Meat and Poultry Products: An Expert Elicitation (Contract no. 43-3A94-2-0260)

This memorandum describes the process RTI International (RTI) followed in conducting an expert elicitation for the U.S. Department of Agriculture's Food Safety and Inspection Service (FSIS). The purpose of the expert elicitation was to collect data on the relative risks posed to public health by various types of processed meat and poultry products. Aggregated results of the expert elicitation are presented below.

THE EXPERT PANEL

RTI recruited 23 experts to participate on the expert panel. The experts were recruited from a list of potential experts, identified by FSIS and RTI, who have an understanding of food science, meat and poultry processing, and foodborne illness. The experts are employed in industry, academia, and the federal government. Table 1 lists the experts who participated and their areas of specialization.¹

EXPERT ELICITATION PROCESS

The process of conducting the expert elicitation included recruiting experts, developing materials, conducting the elicitation, and summarizing the data. Specifically, we

- contacted experts to determine availability and willingness to participate;
- set up a panel participation (consulting) agreement with each expert who agreed to participate;² and

¹An additional nine experts were contacted but either declined to participate or could not be reached despite repeated attempts by e-mail and telephone.

²Some panel participants (i.e., federal government employees) were not able to accept an honorarium; thus, the panel participation agreement was not necessary.

Table 1. Participants in the Expert Elicitation

Panelist	Organization	Area of Specialization
Gary Acuff	Texas A & M	Food microbiologist with experience in the microbiological quality and safety of foods
Dane Bernard	Keystone Foods	A recognized authority on Hazard Analysis and Critical Control Point (HACCP) and food safety prevention systems
John Cerveney	Oscar Meyer (retired)	Microbiology and food safety consultant
Pat Curtis	Auburn University	Food scientist with experience in the quality and microbial safety of poultry and egg products
Catherine Cutter	Penn State University	Food microbiologist with expertise in meat science and technology
P. Michael Davidson	University of Tennessee	Extensive knowledge in applied food microbiology
Ann Draughon	University of Tennessee	Food microbiologist with expertise in microbiological food safety
Kelly Getty	Kansas State University	Meat scientist with experience in beef and pork
Dana Hanson	NC State University	Meat extension specialist
William Henning	Penn State University	Meat extension specialist with experience in beef and pork
John Henson	California State University, Fresno	Meat scientist with industry experience
Ann Hollingsworth	Better Built Foods	Meat scientist with industry experience
Lee-Ann Jaykus	NC State University	Food scientist with expertise in molecular methods for the detection of foodborne pathogens
Kevin Keener	Purdue University	Food processing engineer with experience in beef, pork, and poultry
Chris Kerth	Auburn University	Meat scientist and biologist
Lynn Knipe	Ohio State University	Meat extension specialist with experience in processed meats
Mohammad Koohmaraie	USDA ARS	Animal physiologist with expertise in enhancing meat quality and safety
Anne Marie McNamara	Silliker, Inc.	Food scientist with industry and regulatory experience
Benjy Mikel	Mississippi State University	Meat extension specialist with experience in beef, pork, and poultry
Donald Schaffner	Rutgers, The State University of New Jersey	Food scientist with experience in predictive microbiology of meat products
Robert Tauxe	CDC Fddb	Medical epidemiologist with expertise in the surveillance and prevention of bacterial enteric infections
Bruce Tompkin	ConAgra (retired)	Food microbiologist with expertise in red meat microbiology, processing, HACCP, sanitation, and hygiene
Don Zink	FDA CFSAN	Food scientist with extensive experience in food safety, microbiology, and food processing

- developed a timeline for conducting the expert elicitations, including scheduling conference calls and delivering documents by e-mail.

Materials developed for use in conducting the expert elicitation included a project description and an elicitation worksheet (see Attachment A). The project description, developed by RTI, was provided to the panelists prior to agreeing to participate in the expert elicitation process. The document described the reason why we were conducting an expert elicitation and what the experts would be expected to contribute. FSIS developed the expert elicitation worksheet and provided it to RTI. The elicitation worksheet included

- the assumptions for scoring,
- instructions for the panelists,
- the scoring sheet with the 24 products that the panelists were to score, and
- a list of product examples for each product type.

RTI conducted additional pretesting of the worksheet and, in consultation, with FSIS prepared the final worksheet.

After RTI recruited the 23 experts to serve on the panel, we conducted the following activities:

- scheduled and hosted teleconferences with the experts to discuss the purpose of the data collection, review the worksheet, and respond to questions;
- requested that the experts complete the worksheets using approximately 1 day of consulting time within 7 days;
- responded to questions raised by the panelists for which RTI needed clarification from FSIS (see Attachment B for a list of the questions and answers provided to the experts); and
- obtained the completed worksheets and lists of cited references from the consultants.

Once we obtained the completed worksheets, we aggregated the responses into the tables described later in this memorandum.

SUMMARY OF RESULTS

The data collected from the experts will be used to measure the relative risks posed by various types of processed meat and poultry products. To ensure consistency of product definitions, FSIS provided a list of example products for each of the 24 product categories. Using the list of example products for each product category, the panel was asked to score each of the product categories according to the relative risk of illness, per serving that each product category poses. The experts could assign a score of 1 to multiple products if they believed that multiple products posed the minimum level of risk of illness per serving. The

experts were asked to assign their scores assuming typical production and consumption practices.

Table 2 summarizes the results of the elicitation. The average rank was calculated by first calculating the sequential rank of scores for each expert and then averaging the sequential ranks for each product. Highlights of the results are as follows:

- The maximum scores assigned by individual experts ranged from 3 to 300,000,000 with a median value of 10.³
- Raw products were generally assigned the *highest* scores, and ready-to-eat (RTE) products were generally assigned the *lowest* scores with the exception of **RTE fully-cooked poultry**.
- Poultry products generally were assigned *higher* scores than red meat products.
- **RTE meat fully cooked without subsequent exposure to the environment** and **RTE poultry fully cooked without subsequent exposure to the environment** were scored by many experts as the products with *least* risk of illness.
- **Raw ground, comminuted, or otherwise nonintact chicken** and **raw ground, comminuted, or otherwise nonintact turkey** were scored by many experts as the products with the *highest* risk of illness.

The individual scores were provided to FSIS in a separate Excel worksheet. The worksheet also contains brief comments provided by the experts on their individual scores.

³Because the maximum score of 300,000,000 was substantially higher than the maximum scores assigned by other experts, we verified over the phone that the expert who assigned this maximum score correctly understood the interpretation of the scoring. The expert indicated complete understanding and believes the scores accurately reflect the relative risks of these products.

Table 2. Relative Risk of Illness per Serving Among 24 Types of Processed Meat and Poultry Products

Finished Product Type	Average Sequential Rank	Median Score	Minimum Score	Maximum Score
Raw intact beef	11	5.0	1.0	3,000
Raw intact pork	9	4.0	1.0	1,000
Raw intact meat— other than beef or pork	13	5.0	2.0	1,000
Raw intact chicken	19	8.0	2.0	5,000
Raw intact turkey	20	9.0	2.2	5,000
Raw intact poultry— other than chicken or turkey	17	8.0	2.0	5,000
Raw ground, comminuted, or otherwise nonintact beef	21	10.0	3.0	100,000
Raw ground, comminuted, or otherwise nonintact pork	16	8.0	1.5	50,000
Raw ground, comminuted, or otherwise nonintact meat—other than beef or pork	18	9.7	2.0	50,000
Raw ground, comminuted, or otherwise nonintact chicken	23	10.0	2.0	200,000
Raw ground, comminuted, or otherwise nonintact turkey	23	10.0	2.0	150,000
Raw ground, comminuted, or otherwise nonintact poultry—other than chicken or turkey	22	10.0	2.5	150,000
Raw otherwise processed meat	14	7.0	1.0	50,000
Raw otherwise processed poultry	15	7.0	1.2	50,000
RTE acidified/fermented meat (without cooking)	7	2.0	1.0	40,000,000
RTE acidified/fermented poultry (without cooking)	8	2.0	1.0	40,000,000
RTE dried meat	4	2.0	1.0	200,000,000
RTE dried poultry	6	2.0	1.0	300,000,000
RTE salt-cured meat	3	2.0	1.0	600,000
RTE salt-cured poultry	5	2.0	1.0	2,500,000
RTE fully-cooked meat	9	3.0	1.0	125
RTE fully-cooked poultry	12	3.0	1.0	10,000
RTE meat fully cooked without subsequent exposure to the environment	1	1.0	1.0	5.0
RTE poultry fully cooked without subsequent exposure to the environment	2	1.0	1.0	30,000

Attachment A

PROJECT DESCRIPTION
RELATIVE RISKS OF MEAT AND POULTRY PRODUCTS:
AN EXPERT ELICITATION
RTI Project No. 08610.000

Description

The U.S. Department of Agriculture, Food Safety and Inspection Service (USDA, FSIS) has contracted with RTI International (RTI) to assist in conducting an expert elicitation. The purpose of the expert elicitation is to measure the relative risks posed to public health by various types of processed meat and poultry products. We are asking for your assistance as a participant in the expert elicitation process to score each of 24 product categories according to the relative risk of illness, per serving, that you believe the product category poses. While scoring the categories, we will ask that you consider the biological, chemical, and physical hazards inherent to both the source material and the processes used to produce the products in the category.

What We Would Need From You

If you agree to participate in the expert elicitation process, you will need to do the following:

- complete the accompanying Interest Form;
- review the one-page worksheet you will be completing for the expert elicitation;
- participate in a 20-minute teleconference to discuss the worksheet and ask questions about the process;
- using resources at your disposal, complete the worksheet providing your best estimates of the needed information within one week of the initial teleconference; and
- deliver your responses to the worksheet and a list of citations to RTI by Federal Express or e-mail.

To compensate you for your time, we will pay you an honorarium of \$250 for completing the worksheet. If you are not able to accept the honorarium, we would still like to encourage your participation.

For additional information on this project, you can contact:

Shawn Karns
Food and Agricultural Policy Research Program
RTI International
Research Triangle Park, NC 27709-2194
E-mail: karns@rti.org
Phone: 919-541-6380

RTI is an independent, nonprofit organization that serves clients in government, industry, academia, and public service throughout the United States and abroad. Our headquarters are located on a 180-acre campus in Research Triangle Park, NC, and we employ a worldwide staff of more than 2,000 people. The Food and Agriculture Policy Program at RTI has been conducting analyses of the economic effects of food safety and nutrition regulations for USDA and FDA for more than 15 years.

WORKSHEET FOR RELATIVE RISKS OF MEAT AND POULTRY PRODUCTS: AN EXPERT ELICITATION

The purpose of this expert elicitation is to measure the relative risks posed to public health by various types of processed meat and poultry products. Please score each of the 24 cells according to the relative risk of illness, per serving, that you believe the corresponding product category poses. Consider the biological, chemical, and physical hazards inherent to both the source material and the processes used to produce the products in the category. Take into account all that you know about meat and poultry science, food processing, food transport, consumer handling, and foodborne illness, but assume the following when scoring:

- Each of the 24 cells represents finished products that will reach the consumer without further processing after it leaves the producing plant, e.g. raw ground chicken or canned meat product. Examples of each of the finished product types are provided in the attached table titled "Finished Product Type Examples."
- Do not account for products that are prepared (sliced, ground, cooked, etc.) at the retail or institutional level. Consider preparation only by the producing plant and the consumer.
- Each product is produced in a USDA-regulated processing plant that operates under sanitation standard operating procedures (SSOP) and a Hazard Analysis Critical Control Point (HACCP) system.
- The incoming source material (raw meat or poultry and other ingredients) comes from a slaughter plant, trim producer, grinder, or other firm with average or typical food safety controls.
- The processing plant's food safety controls are average or typical; do not think of extreme or unusual processing situations.
- The products receive typical handling by all parties from the time the products leave the processing plant through the time they are consumed (so you may account for safe handling or mishandling if you believe either to be typical).
- The consumers are healthy adults.
- None of the products are irradiated.
- In regard to the ready-to-eat (RTE) products:
 - Unless specifically stated, all are exposed to the environment during handling after lethality treatment(s);
 - None contain an additive to inhibit growth of *L. monocytogenes*;
 - None receive any post-lethality treatment to destroy *L. monocytogenes*.

SCORING INSTRUCTIONS

1. First, place a "1" in the cell corresponding to product that poses the *least risk* of illness per serving.
2. Second, choose the cell corresponding to product that poses the *greatest risk* of illness per serving and give it a value proportionate to the increase in risk over that posed by the product posing the least risk. For example, if you believe that the riskiest product poses four times more risk than the product posing the least risk, place a "4" in its cell; if you believe it poses twenty times more risk, place a "20" in its cell. You may use fractions.
3. You now have established your range of values. Now assign values to the remaining products. Remember that each value is proportionately relative to any other. A product receiving a score of "10" for example, would be considered to be ten-times as risky as the product posing the least risk. A product receiving a score of "20" would be considered twice as risky as the product that received a "10." You may score two or more products with equal values (including your highest or lowest scores) if you believe the risk they pose per serving is equal.

Please complete your scores independently without discussing them with the other panelists. If you have questions, please contact Shawn Karns at 919-541-6380 or karns@rti.org.

**Relative Risk of Illness per Serving among 24 Types
 of Processed Meat and Poultry Products**

Finished Product Type	Score	Brief Explanation of Your Score (If Needed)
Raw intact beef		
Raw intact pork		
Raw intact meat – other than beef or pork		
Raw intact chicken		
Raw intact turkey		
Raw intact poultry – other than chicken or turkey		
Raw ground, comminuted, or otherwise non-intact beef		
Raw ground, comminuted, or otherwise non-intact pork		
Raw ground, comminuted, or otherwise non-intact meat – other than beef or pork		
Raw ground, comminuted, or otherwise non-intact chicken		
Raw ground, comminuted, or otherwise non-intact turkey		
Raw ground, comminuted, or otherwise non-intact poultry – other than chicken or turkey		
Raw otherwise processed meat		
Raw otherwise processed poultry		
RTE acidified/fermented meat (without cooking)		
RTE acidified/fermented poultry (without cooking)		
RTE dried meat		
RTE dried poultry		
RTE salt - cured meat		
RTE salt - cured poultry		
RTE fully - cooked meat		
RTE fully - cooked poultry		
RTE meat fully-cooked without subsequent exposure to the environment		
RTE poultry fully-cooked without subsequent exposure to the environment		

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Please return the completed worksheet by email, fax, or FedEx:

Email: coglaiti@rti.org

Fax: 919-541-6683, Attn: Michaela Cimini Coglaiti

FedEx: Michaela Cimini Coglaiti
RTI International
REPR, Hobbs 123
3040 Cornwallis Rd.
Research Triangle Park, NC 27709-2194
(919) 990-8498

Finished Product Type Examples

Finished Product Type	Product Examples
Raw intact beef	Steaks, roasts
Raw intact pork	Chops, roasts, ribs, loins
Raw intact meat – other (sheep, goat)	Chops, roasts
Raw intact chicken	Whole bird not stuffed and stuffed, parts (including necks/feet and giblets), boneless/skinless parts
Raw intact turkey	Whole bird not stuffed and stuffed, parts (including necks/feet and giblets), boneless/skinless parts
Raw intact poultry – other (ducks, geese, squab)	Whole bird not stuffed and stuffed, carcass parts
Raw ground, comminuted, or otherwise non-intact beef	Ground, restructured, tenderized/injected/marinated, AMR
Raw ground, comminuted, or otherwise non-intact pork	Ground, restructured, tenderized/injected/marinated, AMR, MS pork
Raw ground, comminuted, or otherwise non-intact meat – other (sheep, goat)	Ground, restructured, tenderized/injected/marinated
Raw ground, comminuted, or otherwise non-intact chicken	Ground, restructured, tenderized/injected/marinated, MS chicken
Raw ground, comminuted, or otherwise non-intact turkey	Ground, restructured, tenderized/injected/marinated, MS turkey
Raw ground, comminuted, or otherwise non-intact poultry – other (ducks, geese, squab)	Ground, restructured, tenderized/injected/marinated, MS Poultry
Raw otherwise processed meat	Batter set nuggets and tenders, char marked patties
Raw otherwise processed poultry	Batter set nuggets and breaded parts, partially cooked rolls and loaves
RTE acidified/fermented meat (without cooking)	Genoa salami, hard salami, pepperoni
RTE acidified/fermented poultry (without cooking)	Turkey pepperoni
RTE dried meat	Dried beef, jerky, landjager, meat sticks, some chorizo
RTE dried poultry	Jerky (basically turkey)
RTE salt-cured meat	Country ham, prosciutto, coppa, capocola, basturma, bresaola
RTE salt-cured poultry	Ducks, geese
RTE fully-cooked meat	Hot dogs, deli meats, roasts
RTE fully-cooked poultry	Whole birds, parts, hot dogs, deli items, roasts
RTE meat fully-cooked without subsequent exposure to the environment	Cooked in package (canned ham (not shelf stable), cook-in-bag), hot packed (chili, sauces, soups)
RTE poultry fully-cooked without subsequent exposure to the environment	Cooked in package (cook-in-bag), hot packed (soups)

AMR = Advanced Meat Recovery.

MS = Mechanically separated.

Attachment B

Questions Raised by Panelists with FSIS's Responses

Question: When considering the risk of illness, should we take into account the severity of illness or just the incidence of illness?

Response: Do NOT consider severity of illness. Just consider the incidence or risk of illness. Severity of illness will be addressed in any risk analysis that uses this data.

Question: Would the agency clarify the RTE statements about additives and post-lethality treatments for *L. monocytogenes*?

Response: Assume all RTE products are manufactured using Alternative 3 of the final rule (Use only sanitation measures to prevent LM). The results of the elicitation will be used as a "ceiling" for the RTE products.

Question: Does RTE fully-cooked meat and RTE fully-cooked poultry include cured and uncured product?

Response: Yes.

Question: Does "RTE meat (poultry) fully-cooked without subsequent exposure to the environment" include shelf-stable products?

Response: The categories include the example product types which might be considered "shelf-stable". They do NOT include thermally processed, commercially sterile products.

Question: Should allergies be considered when scoring the relative risk of products?

Response: No. Allergies will be addressed in any risk analysis that uses the expert elicitation data.

Question: Is a healthy pregnant woman a "healthy adult"?

Response: The woman is a healthy adult but the fetus is part of the at-risk population. Do NOT consider pregnant women as part of the healthy adult population. Please consider typical healthy adults as the population. FSIS plans to use the elicitation data as a baseline. The data will be scaled or weighted for at-risk populations or other extreme circumstances.