GSA MOBIS SIN 874-1
CONTRACT NO. GS-10F-0125P
ORDER NO. HHSF223200720030G

MODELING THE EFFECTS OF FOOD HANDLING PRACTICES ON THE INCIDENCE OF FOODBORNE ILLNESS

FINAL

Submitted to:
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ERG Task No. 0193.16.004.001

March 18, 2009

ERG

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ACKNOWLEDGMENTS

We gratefully acknowledge Angela Lasher (FDA/CFSAN) for her leadership, guidance, and input throughout this study. We also would like to thank all of the following members of the expert panel convened for this study for their invaluable input: Carl Borchgrevink, Associate Professor, The Eli Broad College of Business, Michigan State University, East Lansing, MI; Christine M. Bruhn, Center for Consumer Research, University of California, Davis, Davis, CA; Michael Cheng, Southwest Minnesota State University (SMSU); Roy Costa, R.S., M.S., Hospitality and Tourism Institute, Valencia Community College, Orlando, FL; Doug Fee, Director of Hospitality and Culinology programs at Mercer County Community College; Lydia Medeiros, Department of Human Nutrition, Ohio State University Extension, Ohio Agricultural Research and Development Center; Debby Newslow, D. L. Newslow & Associates, Inc.; Brian Nummer, Nutrition and Food Sciences Department, Utah State University Cooperative Extension; Payton Pruett, Vice President of Corporate Food Technology and Regulatory Compliance, The Kroger Co., Cincinnati, OH; Don Schaffner, Rutgers, The State University of New Jersey; O. Peter Snyder, Jr., Hospitality Institute of Technology and Management, St. Paul, MN, and; Rich Vergili, Culinary Institute of America, Hyde Park, NY.

1. INTRODUCTION

In September of 2007, the Food and Drug Administration's (FDA's) Center for Food Safety and Applied Nutrition (CFSAN) contracted with Eastern Research Group, Inc. (ERG) to update its Food Handling Practices Model (FHPM) originally developed by RTI International. The model allows FDA to estimate the effects of various retail and household practices on the incidence of foodborne illness (FBI). This report documents the activities and results of this task.

1.1 Background on Food Handling Practices Model (FHPM)

FDA's Food Handling Practices Model (FHPM) is a stochastic simulation model that allows users to estimate changes in annual cases of foodborne illness (FBI), given one or more changes in the prevalence of food handling practices used in retail food establishments or in households. Food handling practices represented in the model are of two types: those that may contaminate food and those that may allow survival and growth of pathogens in food (RTI International, 2003).

According to the RTI International (2003) report, the model operates by simulating, tracking, and counting servings of food that become contaminated with one or more pathogens, followed by survival and growth of pathogens, followed by ingestion that causes noticeable illness. The model includes the following four modeling stages each of which includes several random variables associated with the incidence of FBI:

1. Source Contamination Stage (10 random variables)
2. Contamination Stage: Contributing Factors that May Contaminate Food
   - Retail channel (18 random variables)
   - Household channel (10 random variables)
3. Pathogen Control Stage: Contributing Factors that May Allow Survival and Growth of Pathogens in Food
   - Retail channel (18 random variables)
   - Household channel (10 random variables)
4. Foodborne Illness Stage
   - Retail channel (4 random variables)
   - Household channel (4 random variables)

The primary purpose of the FHPM model is to allow users to analyze the effect of changes in food handling practices on the incidence of FBI. For example, with the FHPM, the user is able to investigate such questions as "if food workers wash their hands 20 percent more effectively, how much will foodborne illness decline?" To produce quantitative estimates of changes in cases of FBI, given change in one or more food handling practices, users of FHPM conduct the following steps:

1. Define a baseline scenario.
2. Calibrate the baseline scenario.
3. Simulate the baseline scenario.

4. Define a change scenario.

5. Recalibrate the FHPM for the change scenario.

6. Simulate the change scenario.

7. Compare output of the FHPM for the baseline and change scenarios.

The FHPM model combines built-in data along with parameters that require external estimates. For version 1.0 of the model, hereinafter referred to as FHPM v.1.0, these have been obtained from:

- Secondary data sources – These include USDA, FDA, and CDC publications; several ongoing surveys of consumers (e.g., FDA's Food Safety Survey, USDA's Continuing Survey of Food Intakes by Individuals (CSFII); data from peer-reviewed scientific literature, and trade data.

- Primary data sources – Expert elicitation.

The types of pathogens and the food vehicles responsible for foodborne illness have changed over the last few years. Thus, an updating of the model's national baseline and contamination probabilities associated with particular handling practices is warranted. Based on discussions with the FDA Project Officer, the elements that are most likely to need updating in the FHPM model include:

- Baseline number of servings of food.

- Mix of foods.

- Source contamination data for food and pathogen categories:

  - For example, the probability of produce contamination is 0 percent in the model, which does not reflect recent produce-related outbreaks.

  - Although the model currently aggregates types of pathogens and type of food, the source contamination data for the food and pathogen categories needs to be as updated as possible because future FHPM models may be disaggregated.

- Some household handling practices – Certain household handling practices currently included in the model are not truly applicable to the household context (e.g., glove use).

1.2 Project Methodology

We worked closely with FDA for the duration of this project. We commenced the task by reviewing the current FHPM v.1.0 and its supporting documentation to update our understanding of the model. Because we have considered using the model as an add-on to other models we have developed for FDA (*Recordkeeping Cost-Benefit Model*), we already had a basic working knowledge of model inputs, outputs, and operation based on the following reports (available at http://www.foodrisk.org/fhpm.htm):

- Food Handling Practices Model: User's Guide Version 1.0.
- Modeling the Effects of Food Handling Practices on the Incidence of Foodborne Illness – Final Report.
- FDA Backgrounder – The Food Handling Practices Model (FHPM) Version 1.1.

In addition to the above, FDA also provided us with the following files:

- White Paper on Peer Review Procedures for FDA-CFSAN Food Safety Risk Assessments.
- Modeling the Effects of Food Handling Practices on the Incidence of Foodborne Illness – Presentation to FDA on May 19, 2003.
- Modeling the Effects of Food Handling Practices on the Incidence of Foodborne Illness – IAFP Poster Presentation.
- Expert Elicitation CD.
- FDA Report on the Occurrence of Foodborne Illness Risk Factors in Selected Institutional Foodservice, Restaurant, and Retail Food Store Facility Types 2000 and 2004.

Furthermore, we also consulted with the FDA Project Officer for this task and other FDA personnel throughout the project to improve our understanding of data needs. In addition to this initial review, the project included the following principal tasks:

- Survey of literature and collection of data from secondary sources.
- Expert elicitation.
- User application update.

This report documents the activities and results of each of the above subtasks.

2. OVERVIEW OF SOURCES FOR THE NATIONAL BASELINE SCENARIO UPDATE

FDA's FHPM v.1.0 model uses both primary and secondary data sources to estimate parameters needed for a national baseline scenario. To update the probability parameters associated with contributing factors used in FHPM v.1.0, we conducted an expert elicitation using the modified Delphi technique. To update other probability parameters used in the model, we compiled new/revised probability estimates gleaned from the scientific literature. If no new information was available on a particular parameter, we left it unchanged. Similar to the original FHPM v.1.0 model, we combined updated estimates from the scientific literature and from the expert elicitation for some parameters. These methods are discussed in greater detail below.

2.1 Secondary Data Sources

The FHPM v.1.0 utilizes secondary data from a variety of sources. As noted in the RTI International (2003) report, government sources provide a majority of secondary data collected for the FHPM v.1.0. These include various publications from the U.S. Department of Agriculture's (USDA's) Economic Research Service (ERS) and Food Safety and Inspection Service (FSIS) and the U.S. Department of Human Health Services' (DHHS) Food and Drug Administration (FDA) and Centers for Disease Control and Prevention (CDC).

In addition, the FHPM v.1.0 also utilizes data from various research reports published by the same agencies and the U.S. government sponsored surveys of consumers, such as FDA's Food Safety Survey, and USDA's Continuing Survey of Food Intakes by Individuals (CSFII). Moreover, data from peer-reviewed scientific literature are used to calibrate the FHPM v.1.0 for a national baseline scenario. Other secondary data sources for model parameters include information published on trade association web sites, such as the International Bottled Water Association, the Food Marketing Institute, and the National Association of Convenience Stores.

For the model update, hereinafter referred to as FHPM v.1.5, we undertook a comprehensive literature review to obtain updated estimates. As was done for the previous version of the model, we compiled these updated estimates from: ERS, FDA, and CDC publications, several ongoing surveys of consumers, data from peer-reviewed scientific literature, and trade data. FHPM v.1.5 utilizes updated versions of several key secondary data sources used in FHPM v.1.0. These include:

- What We Eat in America, part of the National Health and Nutrition Examination Survey, 2005-2006 (NHANES 05-06). This updates the Continuing Survey of Food Intakes by Individuals, 1994-1996 (CSFII), which provided much of the data for FHPM v.1.0.
- The 2004 "FDA Report on the Occurrence of Foodborne Illness Risk Factors in Selected Institutional Foodservice, Restaurant, and Retail Food Store Facility Types" (2004 FDA Retail Survey). This updates the 2000 "Report of the FDA Retail Food Program Database of Foodborne Illness Risk Factors" (2000 FDA Retail Survey).
- The 2005 FDA Food Safety Survey, which updates the 2001 FDA Food Safety Survey.

2.2 Primary Data Sources – Expert Elicitation Data

In FHPM v.1.0, the probability parameter estimates associated with retail- and household-level contributing factors (both at the contamination and pathogen control stages) are primarily based on data compiled via an expert elicitation. The original elicitation conducted for FHPM v.1.0 involved two rounds with a teleconference meeting in between. According to the RTI International (2003) report, for each of the 11 categories of retail establishments and seven categories of households included in the FHPM v.1.0, each expert completed MS Excel spreadsheets responding to questions on:

- Relative likelihoods of occurrence of specific food handling contributing factors.
- Relative likelihoods of contamination of food, given the occurrence of specific food handling contributing factors.
- Single probability estimates for the most likely event listed on each elicitation worksheet.

No pilot elicitation was conducted to refine the methods of questioning from the task report. An analysis of individual responses to the questions suggests that there was some disagreement among the experts on certain estimates. Furthermore, not all experts responded to all questions. The RTI International (2003) report also notes that there were disagreements on the interpretation of certain terms used in the questionnaire, such as "inappropriate hand washing."

For FHPM v.1.5, we conducted a new expert elicitation to update the probability parameter estimates associated with retail- and household-level contributing factors taking into account the lessons learned from the initial elicitation. The following sections describe the expert elicitation process in further detail.

2.2.1 Methodology – Modified Delphi Method

Expert opinion elicitation is a formal, heuristic process of obtaining subjective information or answers to specific questions about certain quantities (such as the expected service life of a product) and probabilities of future events (Ayyub, 2000). Because subjective information is often viewed as being "softer" than "hard scientific data," most expert opinion elicitations involve multiple experts (Clemen and Winkler, 1997). While a set of experts can provide more information than a single expert, use of multiple experts introduces the problem of aggregation, as judgments vary by expert.[1]

We utilized a two-round modified Delphi technique for this study. The Delphi method is the first structured method for eliciting and combining expert opinion. The method requires indirect interaction among experts through a moderator (Linstone and Turoff, 2002; Clemen and Winkler, 1997; Landeta, 2005). Although different variations of the method exist, in a typical Delphi study, experts make individual judgments. Next, these judgments are shared anonymously with the whole group. After viewing other experts' judgments, each expert is then given the opportunity to revise his own judgments, and the process is repeated. Theoretically, the goal of the Delphi is to reach a consensus after a few rounds. In reality this rarely happens. Thus,

[1] If experts never disagreed, there would be no point in consulting more than one expert.

at the end of the Delphi rounds, the experts' final judgments are typically combined mathematically.

As with any method, the Delphi method has its strengths and weaknesses. For example, the method has been criticized for using consensus as a way to approach the truth, the lack of social compensation for individual contribution to the group, and the impunity bestowed by anonymity for irresponsible actions by the experts, among others (Landeta, 2005).[2] While there are numerous skeptics of the Delphi method, there have also been several studies (Ament, 1970; Helmer, 1983) supporting the Delphi method. For example a study by Basu and Schroeder (1977) compared Delphi forecasts of five-year sales with both unstructured, subjective forecasts and quantitative forecasts that used regression analyses and exponential smoothing. The Delphi forecasting consisted of three rounds using 23 key organization members. When compared against actual sales for the first two years, errors of 3 to 4 percent were reported for Delphi, 10 to 15 percent for the quantitative methods, and of approximately 20 percent for the previously used unstructured, subjective forecasts.

2.2.2 Expert Selection

The successful application of the Delphi technique requires assembling a panel of experts in the given field of investigation. We recruited 12 participants for the expert panel based on FDA suggestions, our own food industry contacts, and recommendations by industry and academia. Because the selection of appropriate experts is essential for obtaining credible estimates from an expert elicitation, we carefully screened each expert prior to inclusion in our panel for the elicitation. The screening process involved:

- Reviewing each expert's credentials, such as curriculum vitae, publication record, and current research activity.
- Interviewing each expert to determine their ability and willingness to participate.

Because the success of an expert elicitation depends as much on the cooperation as the expertise of these individuals, we ensured that all participants were cognizant of project expectations, deadlines, and their respective responsibilities from the start.

Table 2-1 lists the expert panel members for both FHPM v.1.0 and v.1.5. As can be observed from the table, three of the five experts who participated in the FHPM v.1.0 elicitation agreed to participate in the FHPM v.1.5 elicitation. The remaining two declined to participate.

2.2.3 Expert Elicitation Process

We used the knowledge gained from the results of the initial expert elicitation as well as the recommendations in the RTI International (2003) report in designing and administering the elicitation for FHPM v.1.5. The elicitation for this version involved the following steps in accordance with the modified Delphi method:

[2] A full consensus is typically not attained in most Delphi studies. Thus, many rely on mathematical aggregation techniques to generate estimates.

Table 2-1: Expert Panel Members for FHPM v.1.0 and v.1.5

FHMP v.1.0
Janet B. Anderson, R.D, M.S. Clinical Associate Professor, Dietetics Program, Nutrition and Food Sciences Department, Utah State University, Logan, UT
Christine M. Bruhn Center for Consumer Research, University of California, Davis, Davis, CA
Roy Costa, R.S., M.S. Hospitality and Tourism Institute, Valencia Community College, Orlando, FL
John F. Schulz Director of Quality Assurance, Marriott International, Washington, DC
O. Peter Snyder, Jr. Hospitality Institute of Technology and Management, St. Paul, MN
FHPM v.1.5
Carl Borchgrevink Associate Professor, The Eli Broad College of Business, Michigan State University, East Lansing, MI
Christine M. Bruhn [a] Center for Consumer Research, University of California, Davis, Davis, CA
Michael Cheng Southwest Minnesota State University (SMSU)
Roy Costa, R.S., M.S. [a] Hospitality and Tourism Institute, Valencia Community College, Orlando, FL
Doug Fee Director of Hospitality and Culinology programs at Mercer County Community College
Lydia Medeiros Department of Human Nutrition, Ohio State University Extension, Ohio Agricultural Research and Development Center
Debby Newslow D. L. Newslow & Associates, Inc.
Brian Nummer Nutrition and Food Sciences Department, Utah State University Cooperative Extension
Payton Pruett Vice President of Corporate Food Technology and Regulatory Compliance, The Kroger Co., Cincinnati, OH
Don Schaffner Rutgers, The State University of New Jersey
O. Peter Snyder, Jr. [a] Hospitality Institute of Technology and Management, St. Paul, MN
Rich Vergili Culinary Institute of America, Hyde Park, NY

[a] Participated in both elicitations.

Instrument Design — Using the previous elicitation questions as a starting point, we designed an on-line questionnaire consisting of two rounds: Retail Practices and Household Practices. Both questionnaires are provided in Appendix A.

In the original elicitation conducted for the model, the frequency of inappropriate food handling practices in households and retail establishments were elicited in the form of relative likelihoods, which were then converted to probability estimates. We judged that this unduly increased the burden on respondents as most are in fact not very comfortable thinking about various improper handling frequencies in relative likelihood terms. Thus, in designing the revised questionnaires, we judged that it is more straightforward to inquire about the frequency of occurrence for certain food handling practices rather than require experts to contemplate how

much more/less likely a given practice X is in relation to Y in numerical terms. Although we considered asking for comparative responses (i.e., Lindley's [1970] comparative direct method), we concluded that the method is not preferable as it would require comparing the frequency of unrelated inappropriate practices.[3]

Based on the comments received during the teleconference held after the first elicitation, we also added a glossary explaining the meaning of each improper food handling practice that experts can refer to when making their judgments (see Appendix A).

As is also noted in the RTI International (2003) report, the conditional probability estimates (i.e., the probability of pathogen survival and growth given that a specific inappropriate food handling practice has occurred) will naturally depend on the type of food and pathogen the expert has in mind. That said, given the number of food categories and pathogens, asking experts to differentiate their estimates by type of food and pathogen substantially increases the responding burden to the point where most may choose not to respond. Thus, we strived to strike a balance by requesting experts to provide a range estimate for each conditional probability with the "hardiest" pathogen in mind where the lower bound corresponds to foods that are at low risk for pathogen survival or growth and the upper bound to those that are at high risk. Because the probability of pathogen introduction given the occurrence of an inappropriate food practice is less dependent on the food category, we opted not to prompt respondents to select the food categories that would be at most and at least risk for each practice for those set of questions.

Pilot Elicitation — Because of the crucial function of the expert elicitation in the project, we first conducted a small-scale pilot study using two of the experts selected for the elicitation, Roy Costa and Doug Powell.[4] We then compiled the results from the pilot elicitation, along with comments from the experts on the process, and reviewed them with guidance from FDA to identify any potential improvements or revisions in the methodology and in the way questions are worded. The pilot elicitation confirmed the appropriateness of soliciting point probability estimates using 100,000 as the denominator. Additionally, the pilot elicitation resulted in the following changes to the elicitation protocol:

- We revised the introduction to explain or clarify that:
  - The estimates cannot be pathogen-specific, even if the risks of contamination, survival, and growth may vary with the pathogen type.
  - These estimates will be going into a model that's already been created, and what we need are the estimates – the rankings are useful as a pre-conditioning exercise for the estimates of interest.

[3] According to the alternative method, experts that are familiar with an event A and its occurrence probability *p(A)* are used to subjectively assess the occurrence probability of event B. To assess the occurrence probability of event B that is not of the same probability familiarity to the experts as *p(B)*, experts are asked to assess the relative occurrence of B to A, say x times more frequent. Then, the probability of event B is simply computed as: *p(B) = xp(A)*.

[4] Although Doug Powell agreed to participate in the panel and took part in the pilot elicitation, he declined to participate in the full-scale elicitation.

  - The first set of questions, which relate to the frequency of inappropriate practices, will likely have higher probabilities than the second set of questions, which relate to pathogen introduction, growth, or survival due to the occurrence of an inappropriate practice.

  - These estimates are part of a model that incorporates data on source contamination, incidence of illness and death due to foodborne illness, and other estimates drawn from published literature.

- We prepared a Frequently Asked Questions (FAQs) document that answers questions about how the participants' estimates will be incorporated into FHPM v.1.5 (see Appendix A).

- When referring to inappropriate practices that contribute to "pathogen contamination," we clarified that this means "introduction of a pathogen in quantities sufficient to cause foodborne illness (FBI)."

- In the survival and growth section, we clarified that some of the inappropriate practices relate to pathogen survival while others relate to growth, but that we've grouped them together in the same section.

- We updated the description of grocery and convenient stores to include only food preparation activities or handling of unpackaged food items, including the seafood department, butchery, deli, and ready-to-eat meal preparation.

- We replaced the term "contamination" with "introduction of one or more pathogens in quantities sufficient to cause FBI."

- We changed "Food handling by contagious worker" to "Food handling by a worker with a communicable disease."

- To clear up any confusion on what the denominator of each estimate represents, we added the applicable post-field text for questions 13-23, 26-36, 51-61 and 74-84 (see Appendix A).

Full-Scale Expert Elicitation — We conducted the full-scale elicitation over two months. All 12 experts completed both the Retail and Household Rounds. After receiving all responses to a given round, we tabulated the data and conducted a comparative analysis of all responses. Next, we provided each expert with an MS Excel spreadsheet that showed the respondent's individual response as well as the group response to each question (in the form of a relative frequency histogram). Further, we asked experts to review how their response compared to the group's for each question, and to revise their responses, if appropriate.

In processing the responses to each round and each iteration round, we performed internal quality control reviews of the expert elicitation results to ensure that every participant has answered all questions as intended. We also monitored inconsistencies and patterns of persistent bias when reviewing and comparing responses, and when needed, followed up with experts to clarify their responses.

3. UPDATED NATIONAL BASELINE SCENARIO ESTIMATES

3.1 Source Contamination Stage

The source contamination stage of FHPM v.1.5 has two categories of parameters whose estimates must be updated: annual servings for each of seven food categories and probability that a serving of the i^{th} food category is contaminated with the j^{th} pathogen when it leaves the final supply source. Table 3-1 summarizes the parameters associated with this stage and their updates in FHPM v.1.5.

Table 3-1: Summary of Source Contamination Stage Parameters in FHPM

Channel	Name	Type	Description	FHPM v.1.5 Revision
N/A	N_{si}	Scenario Parameter	Annual servings of the i^{th} food category consumed in the United States	See Table 3-2
	$P(A_{ij})$	Scenario Probability	Probability that a serving of the i^{th} food category is contaminated with the j^{th} pathogen when it leaves the final supply source	See Table 3-3

Variable Name: **N_{si}**

Description: Annual servings of the i^{th} food category consumed in the United States

Data Used in FHPM v.1.0: Annual consumption figures for food categories were obtained from a variety of sources, including USDA Economic Research Service, International Bottled Water Association, National Chicken Council, and FDA dockets. Although not explicitly stated, the typical amount consumed per eating occasion appears to be computed using data from the CSFII.

Data Used in FHPM v.1.5: We used USDA Economic Research Service (ERS) loss-adjusted food availability data to estimate total annual consumption by food category (i.e., dairy, eggs, meat, poultry, seafood, and produce). To determine the amount consumed in each food category per serving, we divided total consumption by USDA Dietary Guidelines serving sizes. The total annual consumption for drinking water was estimated from NHANES 05-06 data by multiplying the average weighted daily drinking water consumption in the U.S. by 365. Table 3-2 presents the estimated annual servings figures in FHPM v.1.0 and FHPM v.1.5. Although we had initially used USDA ERS food availability data in the memorandum to CFSAN dated December 21, 2007, we subsequently concluded that the daily per-capita loss-adjusted food availability data are more appropriate for this purpose. The main advantage of this dataset is that its unit of reporting is equivalent to USDA's recommended serving sizes.

Computation Method Used in FHPM v.1.0: The figure is computed by dividing the total annual consumption by the typical amount consumed per eating occasion for each of the main food categories (i.e., dairy, eggs, meat, poultry, produce, seafood, and water). Because annual consumption data were unavailable for water, the figure was estimated from reported daily per capita water consumption in the United States.

Computation Method Used in FHPM v.1.5: We computed the updated figure by dividing USDA ERS loss-adjusted food availability data for 2006 by USDA's recommended serving

sizes. For water, however, we estimated the total annual drinking water consumption in the U.S. from NHANES data, which included information on both tap and bottled water consumption. We did, however, exclude water used in meal preparation from the computations.

Table 3-2: Parameter N_{si}

Food Category	Daily per capita consumption [a] [b]	Total Annual US Consumption [b] [c]	USDA Serving Sizes [b]	Number of Annual Servings	
				FHPM v.1.5	FHPM v.1.0
Dairy	1.77	192,789,656,939	1	192,789,656,939	345,702,445,683
Eggs [d]	0.53	57,748,004,639	3	19,249,334,880	57,203,104,242
Meat [e]	2.91	317,538,002,089	3	105,846,000,696	162,753,089,629
Poultry	1.87	203,920,746,479	3	67,973,582,160	129,219,082,353
Produce[f]	1.43	155,831,582,937	0.5	311,663,165,873	614,966,486,998
Seafood [g]	0.49	53,651,356,384	3	17,883,785,461	26,022,691,467
Water [i]	N/A	3,294,716,066,809	8	411,839,508,351	N/A
Total				**715,405,526,009**	**1,335,866,900,372**

[a] The figures are for 2006 and are provided in USDA ERS, 2008. All figures based on estimates of food availability minus estimates of food loss at retail, food institution, and household level. Excludes non-edible portions of food, including bones and non-edible seeds.
[b] Units are in cups for the Dairy and Produce categories and in ounces for the Eggs, Meat, Poultry, Seafood, and Water categories.
[c] Population used was July 1 2006 resident (excluding overseas military) population of 298,755,000.
[d] Ounces are meat equivalent ounces.
[e] Includes beef, veal, lamb, and pork.
[f] Produce is fresh fruit and fresh vegetables. Units are in cups, not ounces.
[g] Includes fish and shellfish.
[i] Total drinking water consumption figures were unavailable from USDA ERS. Thus, the total number of drinking water (tap and bottled, including vitamin water and other enhanced waters) servings per annum is computed from NHANES data.

Sources Used in FHPM v.1.0:

International Bottled Water Association. (undated). "Survey: America's Poor Drinking Habits Contradict Knowledge of Health Risks." http://www.bottledwater.org/public/InfoRepNat FactSheettest.htm [Accessed March 24, 2003].

Lucier, Gary, Susan Pollack, and Agnes Perez. (1997). "Import Penetration in the U.S. Fruit and Vegetable Industry." *Vegetables and Specialties/VGS-273*. Washington, DC: USDA, ERS. November. http://www.ers.usda.gov/briefing/vegetables/vegpdf/ImportPen.pdf.

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Food Consumption, Prices, and Expenditures, 1970-97/SB-965. http://www.ers.usda.gov/ publications/sb965/.P

U.S. Food and Drug Administration, Center for Food Safety and Applied Nutrition, FDA Prime Connection. "Proposed Seafood HACCP Rule." Docket Numbers 90N-0199 and 93N-0195.

Sources Used in FHPM v.1.5:

U.S. Centers for Disease Control (CDC) National Center for Health Statistics. (2008). *National Health and Nutrition Examination Survey 2005-2006*. Available at: http://www.cdc.gov/nchs/about/major/nhanes/nhanes2005-2006/exam05_06.htm [Accessed December 10, 2008].

U.S. Department of Agriculture, Economic Research Service. (2008). "Food Availability Data Sets – Population Spreadsheet – Updated March 15, 2008." Available at: http://www.ers.usda.gov/Data/FoodConsumption/FoodAvailSpreadsheets.htm. [Accessed January 5, 2009].

U.S. Department of Agriculture, Economic Research Service. (2008). "Loss-adjusted Food Availability Data Sets – Food Guide Pyramid Servings Spreadsheet – Updated March 15, 2008." Available at: http://www.ers.usda.gov/Data/FoodConsumption/FoodGuideIndex.htm. [Accessed January 5, 2009].

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Variable Name: **$P(A_{ij})$**

Description: Probability that a serving of the i^{th} food category is contaminated with the j^{th} pathogen when it leaves the final supply source

Data Used in FHPM v.1.0: The probability of source contamination for each food category was estimated using academic studies and government research, including USDA Food Safety Inspection Service (FSIS) microbiological baseline data.

Data Used in FHPM v.1.5: We compiled source contamination probability estimates from academic studies published after fall 2002. Since USDA FSIS has not updated its microbiological baseline data since FHPM v.1.0, an update was not possible for that data source. We did not include raw milk and field cress in our estimates because while we found contamination estimates for the two products, we were unable to identify consumption data. Although NHANES 05-06 database included a code for "Cress," no respondent reported consuming it during the two days included in the survey. FDA provided us with an estimate of raw milk sales in Pennsylvania. However, we decided not to use the estimate as a basis for extrapolating nationwide consumption of raw milk, as it equaled 30 percent of the total dairy consumption estimated from NHANES 05-06. Table 3-3 presents the estimated source contamination probabilities by pathogen and food category in FHPM v.1.0 and FHPM v.1.5.

Computation Method Used in FHPM v.1.0: When multiple studies for a particular food and pathogen combination were found, the findings from the studies were averaged using study size as the weight. Similarly, data on a specific food item were incorporated into its

Table 3-3: Parameter Estimates for $P(A_{ij})$

Pathogen	Dairy [b]	Eggs	Meat	Poultry	Produce [a] [b] [c] [d]	Seafood	Water
Bacillus cereus	*0.3358*			0.0846			
Campylobacter jejuni			0.0005 *0.0624*	0.1352 *0.7612*			
Clostridium perfringens	*0.1700*		*0.2132*	*0.4021*			
Cryptosporidium parvum							*0.0535*
E. coli O157:H7			0.0006 *0.0022*	*0.0000*	0.0000005402		
EHEC / STEC [e]			0.0060		0.0000223262		
E. coli spp			0.0048 *0.6564*	*0.9675*	0.0113		*0.6238*
Hepatitis A							
Listeria monocytogenes	0.0001 *0.0061*	*0.0000*	0.0060	0.0356 *0.1804*	0.0401 *0.1332*	0.0007 *0.3270*	
Norwalk virus group							
Salmonella Enteritidis		0.0005 *0.0000*			0.0000000002		
Salmonella spp			0.0019 *0.0190*	0.1543 *0.1599*	0.0000277286 *0.0082*		
Shigella spp					*0.0056*		
Staphylococcus aureus			*0.1566*	*0.6304*	0.0042 *0.02222*		
Streptococcus spp							
Vibrio spp						*0.0474*	
Yersinia enterocolitica			*0.0248*				

Note: Our estimates are in plain text. Estimates from the RTI International (2003) report for FHPM v.1.0 are in italics.
[a] All produce data applies only to the raw versions of each food type.
[b] Risk probabilities for field cress and raw milk contamination were found, but field cress consumption was solicited but not reported in NHANES 05-06, and raw milk consumption data were unavailable.
[c] Documentation of incidence of contamination for *Salmonella* in tomatoes and *E. Coli* O157:H7 in leafy greens could not be found. Percentages were calculated from the number of illnesses reported annually in FDA outbreak data (for *Salmonella* in tomatoes) and Center for Science in the Public Interest data (for *E. coli* O157:H7 in leafy greens), divided by the number of annual servings estimated by NHANES of raw tomatoes or raw lettuces and spinach, respectively. Grams were converted to annual servings based on the conversion figure 90 grams per serving for tomatoes and 43 grams per serving for leafy greens.
[d] Although RTI International (2003) report presented contamination probabilities to the fourth decimal place, we increased the number of decimal places for the three calculations involving raw tomatoes and leafy greens to depict that they are non-zero values.
[e] The pathogen category is newly introduced in FHPM v.1.5 and replaces the Hepatitis A category for which there were no published estimates identified.

corresponding food category by weighting the reported contamination probability by annual consumption of the food item.

Computation Method Used in FHPM v.1.5: We employed the same methodology for aggregating findings from multiple studies for the same pathogen-food combination, and for weighting the data found for a particular food item by its proportionate consumption within its larger food category. We used consumption data (in grams) from NHANES 05-06 to estimate the annual consumption for those food items with reported source contamination data. The revised source contamination estimates were not integrated with those in FHPM v.1.0 because sample size information for the studies included in FHPM v.1.0 was neither available in any of the supporting documentation received nor easily obtainable.

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3.2 Contributing Factors – Contamination Stage

This stage of the model involves two channels, retail and household, during which certain inappropriate handling practices can contaminate food. FHPM v.1.0 included a total of 9 food handling practices. After a careful review of these with the FDA Project Officer and select expert panel members, we revised the list to include a total of 6 practices (see Table 3-4). Table 3-5 summarizes the parameters associated with this stage and their updates in FHPM v.1.5.

3.2.1 Retail channel

Variable Name: $\mathbf{c_i}$

Description: Proportion of annual servings of the i^{th} food category that reaches final consumers through a retail establishment

Data Used in FHPM v.1.0: In FHPM v.1.0, the proportion of annual servings that reaches consumers through a retail establishment for dairy, eggs, meat, poultry, produce, and seafood

categories was estimated using data from the CSFII. For water, data from the International Bottled Water Association (IBWA) and CSFII were used to estimate the same proportion.

Table 3-4: List of Contributing Factors for the Contamination Stage

FHPM v.1.0	FHPM v.1.5
Inappropriate hand washing	Inappropriate hand washing
Inappropriate bare-hand contact with RTE foods	Inappropriate bare-hand contact with RTE/RTC foods [a]
Inappropriate bare-hand contact with RTC foods	
Inappropriate gloved-hand contact with RTE foods	Inappropriate gloved-hand contact with RTE/RTC foods [a][b]
Inappropriate gloved-hand contact with RTC foods	
Inappropriate sanitation or cleaning of cutting boards and other surfaces	Inappropriate sanitation or cleaning of cutting boards or other cutting surfaces
Food handling by ill person	Food handling by a worker/household member with a communicable disease [c]
Food handling by colonized, asymptomatic carrier	
Inappropriate sanitation of equipment or utensils	Inappropriate sanitation of equipment or utensils

RTE = Ready-to-eat
RTC = Ready-to-cook
[a] RTE and RTC foods are not differentiated in the revised model. The model utilizes the same baseline values for both practices.
[b] Included as a contributing factor for the retail channel only.
[c] The expert panel did not feel that the two categories were sufficiently distinct to merit separate estimates. Thus, the model utilizes the same baseline values for both practices.

Table 3-5: Summary of Contamination Stage Contributing Factors Parameters in FHPM

Channel	Name	Type	Description	FHPM v.1.5 Revision
Retail	c_i	Scenario Parameter	Proportion of annual servings of the i^{th} food category that reaches final consumers through a retail establishment	See Table 3-6
	b_{ij}	Scenario Parameter	Proportion of total annual servings of i^{th} food category served or sold to consumers by the j^{th} category of retail food establishment	See Table 3-7
	g_{ij}	Scenario Parameter	Proportion of annual servings of the i^{th} food category bought by consumers from the j^{th} category of retail food establishment for further preparation by households, which have been further handled or repackaged by the retail establishment	See Table 3-8
	$P(B'_{jk})$	Scenario Probability	Probability of occurrence of the k^{th} contributing factor that may contaminate food in the j^{th} category of retail food establishment	See Table 3-9
	$P(C'_{jk}\|B'_{jk})$	Scenario Probability	Probability that occurrence of the k^{th} contributing factor contaminates a serving of food in the j^{th} category of household	See Table 3-10
Household	$1 - c_i$	Scenario Parameter	Proportion of annual servings of the i^{th} food category that reaches final consumers without passing through a retail food establishment (e.g., gardens, direct farm sales, game from hunting)	See Table 3-6
	u_j	Scenario Parameter	Proportion of annual servings of food that are prepared by the j^{th} category of household	Same as FHPM v.1.0
	$P(B^*_{jk})$	Scenario Probability	Probability of occurrence of the k^{th} contributing factor that may contaminate food in the j^{th} category of household	See Table 3-11
	$P(C^*_{jk}\|B^*_{jk})$	Scenario Probability	Probability that occurrence of the k^{th} contributing factor contaminates a serving of food in the j^{th} category of household	See Table 3-12

Data Used in FHPM v.1.5: Unlike the CSFII, NHANES 05-06 includes data on tap as well as bottled water consumption by channel. Thus, we primarily relied on NHANES 05-06 data to estimate the parameter of interest.

Computation Method Used in FHPM v.1.0: In FHPM v.1.0, the food sources in CSFII were organized according to the two channels of the model (retail and household). Further, each ingredient was grouped by food category (i.e., dairy, eggs, meat, poultry, produce, and seafood) and the weights of the food category totaled by channel. The proportion of each food category going to the retail establishments, c_i, and directly to households without first passing through the retail channel, $(1 - c_i)$ was then computed directly. CSFII did not include data on tap water consumption. Thus, for water, the tap water consumption data estimated from IBWA were disaggregated into retail and household, using overall food consumption data from the CSFII. One hundred percent of bottled water was assumed to be from retail services. The retail portion of tap water was then added to the proportion of bottled water to determine the c_i for water.

Computation Method Used in FHPM v.1.5: We calculated the frequency of each food category's consumption by food source type, which we weighted by grams consumed (per eating occasion). We adapted the food source codes used in NHANES 05-06 to the FHPM categories. Foods coded as "Grown or caught by you or someone you know" or "Fish caught by you or someone you know" were included in the "Home-Grown or Caught" category. All other food sources, including "Other" were included in the "Obtained through Retail" category.

Our water estimates include tap and bottled water, but not water when used as an ingredient. Table 3-6 presents the estimated c_i and $1 - c_i$ parameters for FHPM v.1.5 and those used in FHPM v.1.0.

Table 3-6: Parameters c_i and $1 - c_i$

	Obtained Through Retail (c_i)		Home-Grown or Caught ($1 - c_i$)	
Food Category	**FHPM v.1.0**	**FHPM v.1.5**	**FHPM v.1.0**	**FHPM v.1.5**
Dairy	0.993	0.994	0.007	0.006
Eggs	0.988	0.983	0.012	0.017
Meat [a]	0.998	0.984	0.002	0.016
Poultry [a]	0.996	0.996	0.004	0.004
Produce	0.981	0.972	0.019	0.028
Seafood [a]	0.989	0.900	0.011	0.100
Water	0.465	0.999	0.535	0.001

Source: CDC, 2008.
[a] Does not include foods that are a combination of meat, poultry, or seafood, or that are either meat, poultry, or seafood but type is not further specified.

Sources Used in FHPM v.1.0:

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Variable Name: $\mathbf{b_{ij}}$

Description: Proportion of total annual servings of i^{th} food category served or sold to consumers by the j^{th} category of retail food establishment

Data Used in FHPM v.1.0: The proportion of servings by food category and retail channel in FHPM v.1.0 was estimated using data from the CSFII, USDA Economic Research Service (ERS), and U.S. Economic Census. The CSFII provides 11 categories of retail food sources. Because these categories did not match those used in the FHPM, the CSFII data were grouped into three retail groups: retail food stores, restaurants, and institutions, to generate aggregate ingredient weights for the seven food categories. The USDA ERS and U.S. Census data were then used to distribute these ingredient weights across the subcategories of each respective channel.

Data Used in FHPM v.1.5: For FHPM v.1.5, we utilized data from NHANES 05-06 to generate aggregate estimates of total servings by food category for the retail food store, restaurant, and institution channels. We then used annual sales figures reported in the U.S. Economic Census subject series to distribute the total serving estimates across the retail food store and restaurant subcategories. For the institution channel, we used the applicable categories reported in NHANES 05-06, mainly nursing homes, child care centers, schools, and other institutions. We did not identify any data to enable an estimate for the hospital subcategory under the institution channel. Thus, we used 50 percent of the share of non-school cafeterias as a proxy for the proportion of total servings through hospitals (see Table 3-7).

Computation Method Used in FHPM v.1.0: In FHPM v.1.0, ingredient weights were aggregated into the seven food categories listed in the model for each of the three channels. For each combination of food category and channel, the gram weights were converted into number of servings using individual serving size estimates. Reported annual sales figures were used to estimate proportions within the three broad channels for which consumption estimates (retail food stores, restaurants, and institutions) were available. The number of servings was multiplied by the proportion of food represented by the corresponding food category and then by the proportion represented by each retail category. Finally, the ingredient weights were summed for all retail categories to estimate the proportion of each food category prepared by retail category.

Computation Method Used in FHPM v.1.5: We calculated the frequency of each food category's consumption by food source type, which we weighted by grams consumed (per eating occasion). The U.S. Economic Census only included annual sales figures for retail food store (i.e., grocery stores, convenience stores, seafood stores) and restaurant (i.e., full-service, mixed-service, fast-food, temporary, other) channels. We did not identify annual sales figures for the institution channel. We also did not think that sales figures at the establishment level would constitute appropriate weights, as food service is not the primary engagement of these

Table 3-7: Parameter Estimates for b_{ij}

	Dairy		Eggs		Meat [e]		Poultry [e]		Produce		Seafood [e]		Water [f]	
Retail Category	**v.1.0**	**v.1.5**	**v.1.0**	**v.1.5**	**v.1.0**	**v.1.5**	**v.1.0**	**v.1.5**	**v.1.0**	**v.1.5**	**v.1.0**	**v.1.5**	**v.1.0**	**v.1.5**
Retail Food Stores [a]														
Grocery	0.4664	0.8251	0.6876	0.6391	0.7551	0.5712	0.7261	0.5209	0.7402	0.7411	0.1970	0.6121	0.1610	0.8323
Convenience	0.0576	0.0425	0.0850	0.0330	0.0933	0.0295	0.0897	0.0269	0.0914	0.0382	0.0090	0.0316	0.0192	0.0429
Seafood	0.0000	0.0031	0.0000	0.0024	0.0000	0.0022	0.0000	0.0020	0.0000	0.0028	0.0006	0.0023	0.00003	0.0032
Restaurants [b]														
Full-service	0.1589	0.0305	0.0786	0.1400	0.0507	0.1771	0.0462	0.2046	0.0472	0.0748	0.3048	0.1584	0.2809	0.0111
Mixed-service	0.0000	0.0011	0.0000	0.0050	0.0000	0.0064	0.0000	0.0074	0.0000	0.0027	0.0000	0.0057	0.0000	0.0004
Fast-food	0.1704	0.0246	0.0843	0.1128	0.0544	0.1427	0.0495	0.1648	0.0507	0.0603	0.3270	0.1276	0.3014	0.0089
Temporary	0.0202	0.0002	0.0100	0.0008	0.0065	0.0010	0.0059	0.0012	0.0060	0.0004	0.0388	0.0009	0.0358	0.0001
Institutions [c]														
Child care	0.0022	0.0055	0.0008	0.0009	0.0007	0.0016	0.0022	0.0008	0.0016	0.0055	0.0001	0.0013	0.0031	0.0002
Hospitals [d]	0.0033	0.0024	0.0012	0.0203	0.0010	0.0056	0.0033	0.0063	0.0024	0.0072	0.0002	0.0051	0.0047	0.0042
Schools	0.0265	0.0427	0.0099	0.0084	0.0084	0.0091	0.0264	0.0253	0.0189	0.0236	0.0015	0.0097	0.0374	0.0046
Nursing homes	0.0066	0.0003	0.0025	0.0003	0.0021	0.0006	0.0066	0.0003	0.0047	0.0009	0.0004	0.0016	0.0093	0.0000
Other	0.0886	0.0221	0.0406	0.0370	0.0282	0.0529	0.0445	0.0396	0.0374	0.0426	0.1207	0.0437	0.0374	0.0922
Total	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**

[a] The sales figures are based on Economic Census, Subject Series - Retail Trade.
[b] The sales figures are based on Economic Census, Subject Series - Accommodation & Food Services.
[c] There are no data on food expenditures at institutions. Thus, we used the institution categories reported in NHANES 05-06 to estimate daily consumption for each subcategory. We calculated an "Other Institution" value from half the share of "Non-school Cafeterias" and the full share of "Residential Facilities," then reapportioned this share over the other subcategories.
[d] NHANES 05-06 does not have a "Hospital" food source category. We calculated this as half the share of "Non-school Cafeterias."
[e] Does not include foods that are a combination of meat, poultry, or seafood, or that are meat, poultry, or seafood but type is not further specified.
[f] This category includes: "water, tap," "water, bottled, unsweetened," and "water, bottled, sweetened, with low or no calorie sweetener." The category does not include: "water as an ingredient,", "Propel fitness water," and "vitamin water."

establishments. Hence, we used the total weighted daily consumption figures for the institution categories reported in NHANES 05-06 and converted them into servings using the previously estimated individual serving sizes by food category. Our water estimates include tap and bottled water, but not water when used as an ingredient.

Sources Used in FHPM v.1.0:

U.S. Census Bureau. (2001). *Summary 1997 Economic Census, Retail Trade, Subject Series.* EC97R445-SM. Washington, DC: U.S. Department of Commerce.

U.S. Department of Agriculture, Agricultural Research Service. (2000a). *Continuing Survey of Food Intakes by Individuals 1994-96, 1998*. CD-ROM.

U.S. Department of Agriculture, Economic Research Service. *Food Market Structures: Food Retailing and Food Service*. http://www.ers.usda.gov/Briefing/FoodMarketStructures/foodservice.htm [Updated December 8, 2000].

Sources Used in FHPM v.1.5:

U.S. Census Bureau. (2005). *2002 Economic Census, Accommodation and Food Services, Subject Series*. EC0272A1US. Washington, DC: U.S. Department of Commerce.

U.S. Census Bureau. (2005). *2002 Economic Census, Retail Trade, Subject Series*. EC0244A1US. Washington, DC: U.S. Department of Commerce.

U.S. Centers for Disease Control (CDC) National Center for Health Statistics. (2008). National Health and Nutrition Examination Survey 2005-2006. Available at: http://www.cdc.gov/nchs/about/major/nhanes/nhanes2005-2006/exam05_06.htm [Accessed December 10, 2008].

Variable Name: $\mathbf{g_{ij}}$

Description: Proportion of annual servings of the i^{th} food category bought by consumers from the j^{th} category of retail food establishment for further preparation by households, which have been further handled or repackaged by the retail establishment

Data Used in FHPM v.1.0: The purpose of this variable is to capture foods that may have been exposed to contamination or conditions favoring the growth or survival of contaminants at both the retail and household stages. The RTI International (2003) report did not identify any documentation on this variable because it was added too close to project end. However, each food category and retail category in the FHPM v.1.0 application includes estimated values for the parameter.

Data Used in FHPM v.1.5: Our understanding of the purpose of the g_{ij} variable is to represent foods vulnerable to retail and household contamination. Per our discussion with the FDA Project Officer, we agreed to set the values of this variable equal to the values for w_j, proportion of annual servings of food sold by the j^{th} category of retail food establishment that is handled or repackaged by the retail establishment and then consumed after further preparation by a household. This decision was made because, in practice, the ready-to-eat foods represented by

the w_j variable are also vulnerable to both retail and household contamination. Because we lacked estimates of the variable by food category, however, we utilized the same estimate across all six food categories included in the model. We judged that most seafood store sales do not fall under this category and set the parameter value for seafood stores at 0 across all food categories (see Table 3-8), except for seafood.

Variable Name: **$P(B'_{jk})$**

Description: Probability of occurrence of the k^{th} contributing factor that may contaminate food in the j^{th} category of retail food establishment

Data Used in FHPM v.1.0: Both secondary literature sources and expert elicitation findings were used to estimate this variable. The 2000 FDA Retail Survey was the source for estimates on inappropriate hand washing and sanitation of cooking utensils and equipment. These data were supplemented with a study on food handling practices at a state fair. The remaining information was gathered from the expert elicitation.

Data Used in FHPM v.1.5: We replaced the estimates derived from the 2000 FDA Retail Survey data with those derived from the update of that report, the 2004 FDA Retail Survey. We supplemented the data on inappropriate hand washing practices in full-service restaurants with an observation study on restaurant food workers' practices. We found other studies on the microbiological quality of cooking equipment and surfaces at a university and several nursing homes. However, because these studies did not provide information on the incidence of inappropriate food handling practices, we were unable to use them to inform this parameter. Similar to FHPM v.1.0, the remaining values were updated via the new expert elicitation (see Table 3-9).

Table 3-8: Parameter Estimates for g_{ij}

	Dairy		Eggs		Meat		Poultry		Produce		Seafood	
Retail Category	**v.1.0**	**v.1.5**	**v.1.0**	**v.1.5**	**v.1.0**	**v.1.5**	**v.1.0**	**v.1.5**	**v.1.0**	**v.1.5**	**v.1.0**	**v.1.5**
Retail food stores												
Grocery	0	0.0476	0	0.0476	0.5	0.0476	0.05	0.0476	0.5	0.0476	0.1	0.0476
Convenience	0	0.1206	0	0.1206	0.15	0.1206	0	0.1206	0.1	0.1206	0	0.1206
Seafood	0	0	0	0	0	0	0	0	0	0	1	1
Restaurants												
Full-service	0	1	1	1	1	1	1	1	1	1	1	1
Mixed-service	0	1	1	1	1	1	1	1	1	1	1	1
Fast-food	0	1	1	1	1	1	1	1	1	1	1	1
Temporary	0	1	1	1	1	1	1	1	1	1	1	1
Institutions												
Child care	0	1	1	1	1	1	1	1	1	1	1	1
Hospitals	0	1	1	1	1	1	1	1	1	1	1	1
Schools	0	1	1	1	1	1	1	1	1	1	1	1
Nursing homes	0	1	1	1	1	1	1	1	1	1	1	1

Computation Method Used in FHPM v.1.0: The estimates drawn from secondary sources and the estimates gathered through expert elicitation were combined with a simple average.

Table 3-9: Parameter Estimates for $P(B'_{jk})$

Inappropriate Practice	Retail Food Stores			Restaurants				Institutions			
	Grocery	Conv.	Seafood	Full-Service	Mixed-Service	Fast Food	Temp.	Child Care	Hospitals	Schools	Nursing Homes
FHPM v.1.0											
Food handling by a symptomatic food handler	0.0989	0.2163	0.2482	0.0713	0.1098	0.1588	0.1367	0.1167	0.0433	0.1156	0.0978
Food handling by ill food handler	0.1661	0.2014	0.2171	0.1038	0.1069	0.1367	0.0938	0.1067	0.0433	0.0994	0.0972
Inappropriate bare-hand contact with ready-to-cook (RTC) foods	0.0696	0.0431	0.0646	0.0925	0.1183	0.1503	0.1292	0.2500	0.1400	0.2600	0.2300
Inappropriate bare-hand contact with ready-to-eat (RTE) foods	0.1489	0.1511	0.1929	0.1950	0.1933	0.3188	0.3200	0.1900	0.1033	0.1261	0.1239
Inappropriate gloved-hand contact with ready-to-cook (RTC) foods	0.0225	0.0125	0.0167	0.0275	0.0338	0.1513	0.0250	0.0484	0.0284	0.0350	0.0350
Inappropriate gloved-hand contact with ready-to-eat (RTE) foods	0.1071	0.1129	0.0743	0.1075	0.1183	0.2188	0.1667	0.1433	0.0950	0.1431	0.1336
Inappropriate hand washing	0.4092	0.3825	0.3967	0.6200	0.4925	0.5300	0.2333	0.3633	0.2867	0.3739	0.3344
Inappropriate sanitation of equipment or utensils	0.4084	0.3161	0.3756	0.4969	0.3198	0.3494	0.2833	0.1400	0.2250	0.1528	0.2553
Inappropriate sanitation or cleaning of cutting boards or other cutting surfaces	0.2489	0.2236	0.2895	0.2650	0.2717	0.2953	0.2292	0.2100	0.1500	0.2150	0.2383
FHPM v.1.5											
Food handling by a worker with a communicable disease	0.0385	0.0605	0.1209	0.0717	0.0560	0.0505	0.0747	0.0401	0.0213	0.0376	0.0188
Inappropriate bare-hand contact with RTE/RTC foods [a]	0.0924	0.1153	0.0769	0.5699	0.6647	0.5048	0.6343	0.2522	0.0947	0.1630	0.2022
Inappropriate gloved-hand contact with RTE/RTC foods	0.2942	0.1738	0.2313	0.2458	0.2442	0.1983	0.2479	0.2283	0.1688	0.2358	0.1896
Inappropriate hand washing [a]	0.4368	0.4478	0.3766	0.5835	0.5940	0.5385	0.6719	0.4589	0.3368	0.3191	0.4000
Inappropriate sanitation of equipment or utensils [a]	0.4677	0.5702	0.4220	0.5657	0.5553	0.5093	0.6944	0.4925	0.3814	0.2551	0.3723
Inappropriate sanitation or cleaning of cutting boards or other cutting surfaces	0.1525	0.1821	0.1588	0.2563	0.2000	0.1783	0.3158	0.2158	0.1267	0.1542	0.1650

[a] Estimates are from secondary sources, which provided data for "Grocery," "Seafood" "Full-Service," "Fast Food," "Hospitals," "Schools," and "Nursing Homes" only. Estimates for other categories were calculated by taking the percentage difference of the expert elicitation data for the retail category compared to an average of the expert elicitation data for those categories with available data to weight the secondary source data for each category.

Computation Method Used in FHPM v.1.5: To update this variable, we relied primarily on the published data where available. The data for the remaining practices came from the expert elicitation. We identified the practices to update with published data by identifying questions in the 2004 FDA Retail Survey that corresponded with elements of the $P(B'_{jk})$ variable: inappropriate bare-handed contact with ready-to-eat foods, inappropriate hand washing, and inappropriate sanitation of equipment or utensils. Observations of appropriate and inappropriate food handling practices were recorded for the following categories: hospitals, nursing homes, elementary schools, full-service restaurants, fast-food restaurants, produce departments/stores, deli departments/stores, seafood departments/markets, and meat and poultry departments. We aggregated the last four categories into the grocery store category by calculating a weighted average of the observations based on the number of observations per department. We also used the data on seafood departments/markets for seafood stores, given that the observations were collected from both supermarket seafood departments and stand-alone stores. We calculated a weighted average for the data on hand-washing practices in full-service restaurants based on the number of observations in both the 2004 FDA Retail Survey and the additional study we identified.

Sources Used in FHPM v.1.0:

Food and Drug Administration, Retail Food Program Steering Committee. (2000). "Report of the FDA Retail Food Program Database of Foodborne Illness Risk Factors."

Kendall, David, Catherine Viator, and Becky Durocher. February 28, 2003. "Modeling the Effects of Food Handling Practices on the Incidence of Foodborne Illness." Second Draft Report. Prepared for the Food and Drug Administration. Research Triangle Park, NC: RTI International.

Manning, C., and S. Snider. (1993). "Temporary Public Eating Places: Food Safety Knowledge, Attitudes, and Practices." *Journal of Environmental Health* 56(1):24-28.

Sources Used in FHPM v.1.5:

Food and Drug Administration, National Retail Food Team. (2004). "FDA Report on the Occurrence of Foodborne Illness Risk Factors in Selected Institutional Foodservice, Restaurant, and Retail Food Store Facility Types."

Green L.R., C.A. Selman, V. Radke, D. Ripley, J.C. Mack, D.W. Reimann, T. Stigger, M. Motsinger, and L. Bushnell L. (2006). "Food Worker Hand Washing Practices: An Observation Study." *Journal of Food Protection* 69(10): 2417-2423.

Expert Elicitation.

Variable Name: $\mathbf{P(C'_{jk}|B'_{jk})}$

Description: Probability that occurrence of the k^{th} contributing factor contaminates food in the j^{th} category of retail establishment

Data Used in FHPM v.1.0: The data for this variable were gathered through expert elicitation.

Table 3-10: Parameter Estimates for $P(C'_{jk}|B'_{jk})$

Inappropriate Practice	Retail Food Stores			Restaurants				Institutions			
	Grocery	Conv.	Seafood	Full-Service	Mixed-Service	Fast Food	Temp.	Child Care	Hospitals	Schools	Nursing Homes
FHPM v.1.0											
Food handling by a symptomatic food handler	0.0500	0.0217	0.1783	0.0783	0.1350	0.2117	0.1483	0.1850	0.1144	0.1150	0.1417
Food handling by ill food handler	0.0200	0.1900	0.0500	0.0500	0.0434	0.0434	0.0467	0.0434	0.0367	0.0434	0.0734
Inappropriate bare-hand contact with ready-to-cook (RTC) foods	0.0717	0.1683	0.0550	0.0800	0.1367	0.1667	0.1233	0.1933	0.1278	0.1133	0.0567
Inappropriate bare-hand contact with ready-to-eat (RTE) foods	0.0817	0.1867	0.2183	0.1350	0.1817	0.2550	0.2033	0.2317	0.1739	0.1642	0.3000
Inappropriate gloved-hand contact with ready-to-cook (RTC) foods	0.0361	0.1034	0.0237	0.0687	0.1153	0.2603	0.1803	0.1653	0.1076	0.1012	0.1620
Inappropriate gloved-hand contact with ready-to-eat (RTE) foods	0.0136	0.1437	0.1658	0.0967	0.1667	0.1667	0.1267	0.2300	0.1489	0.1417	0.1933
Inappropriate hand washing	0.1833	0.2367	0.2667	0.1400	0.1900	0.2500	0.2067	0.2000	0.1467	0.1650	0.1733
Inappropriate sanitation of equipment or utensils	0.0339	0.1233	0.3100	0.1500	0.1333	0.1933	0.1467	0.1800	0.2067	0.1933	0.0833
Inappropriate sanitation or cleaning of cutting boards or other cutting surfaces	0.0333	0.0334	0.1075	0.1133	0.0887	0.1175	0.1083	0.0940	0.0878	0.0867	0.1092
FHPM v.1.5											
Food handling by a worker with a communicable disease	0.2134	0.0817	0.0995	0.0751	0.0677	0.1018	0.2059	0.1200	0.1020	0.0859	0.1052
Inappropriate bare-hand contact with RTE/RTC foods [a]	0.1493	0.2126	0.0754	0.0695	0.0838	0.0643	0.1068	0.2135	0.0679	0.0579	0.0818
Inappropriate gloved-hand contact with RTE/RTC foods	0.0778	0.1284	0.2056	0.0967	0.0633	0.0802	0.0818	0.1063	0.2056	0.1083	0.0787
Inappropriate hand washing [a]	0.0934	0.0927	0.0701	0.2120	0.1017	0.0895	0.1063	0.1352	0.1776	0.2069	0.0959
Inappropriate sanitation of equipment or utensils [a]	0.0892	0.1159	0.0898	0.1038	0.1944	0.0792	0.0721	0.0883	0.0573	0.1105	0.2069
Inappropriate sanitation or cleaning of cutting boards or other cutting surfaces	0.0775	0.0742	0.0784	0.0657	0.0788	0.2252	0.1086	0.0980	0.1067	0.0879	0.1122

[a] Estimates are from secondary sources, which provided data for "Grocery," "Seafood" "Full-Service," "Fast Food," "Hospitals," "Schools," and "Nursing Homes" only. Estimates for other categories were calculated by taking the percentage difference of the expert elicitation data for the retail category compared to an average of the expert elicitation data for those categories with available data to weight the secondary source data for each category.

Data Used in FHPM v.1.5: We updated this variable entirely through the new expert elicitation (see Table 3-10).

Sources Used in FHPM v.1.0:

Kendall, David, Catherine Viator, and Becky Durocher. February 28, 2003. Modeling the Effects of Food Handling Practices on the Incidence of Foodborne Illness. Second Draft Report. Prepared for the Food and Drug Administration. Research Triangle Park, NC: RTI International.

Sources Used in FHPM v.1.5:

Expert Elicitation.

3.2.2 Household Channel

Variable Name: $\mathbf{u_j}$

Description: Proportion of annual servings of food that are prepared by the j^{th} category of household

Data Used in FHPM v.1.0: The estimate is based on the sample size of each type of household in the CSFII.

Data Used in FHPM v.1.5: The updated version of CFSII, NHANES 05-06, does not provide data on the household type of the respondent. Therefore, the values used in FHPM v.1.0 were kept unchanged.

Sources Used in FHPM v.1.0:

U.S. Department of Agriculture, Agricultural Research Service. (2000*). Continuing Survey of Food Intakes by Individuals 1994-96, 1998*. CD-ROM.

Sources Used in FHPM v.1.5:

Kendall, David, Catherine Viator, Shawn Karns, and Becky Durocher. (2003). *Modeling the Effects of Food Handling Practices on the Incidence of Foodborne Illness – Final Report*. Prepared for the Food and Drug Administration. Research Triangle Park, NC: RTI International. April.

Variable Name: $\mathbf{P(B^*_{jk})}$

Description: Probability of occurrence of the k^{th} contributing factor that may contaminate food in the j^{th} category of household

Data Used in FHPM v.1.0: FHPM v.1.0 drew on data from the 2001 FDA Food Safety Survey to estimate the probabilities of inappropriate hand washing, inappropriate sanitation of cutting boards, and inappropriate sanitation of equipment and utensils. These data were supplemented with findings from other secondary studies, including one on food preparation by ill household members. The remaining information was gathered via an expert elicitation.

Data Used in FHPM v.1.5: The FDA Food Safety Survey was conducted again in 2005. After examining the topline frequency data made available in July 2008, we determined that the information provided was not suitable for updating this variable because it did not provide a breakdown by household category. While the Food Safety Survey did include some demographic questions, these did not enable an approximation of the FHPM household categories. We did not use the Audits International source because the data were collected by observing people acquainted with researchers. Instead, we utilized a published study, which analyzes U.S. young adults' food handling practices in regards to hand washing and sanitation of cutting boards and cooking utensils. We updated the remaining values through expert elicitation (see Table 3-11).

Computation Method Used in FHPM v.1.0: The parameter was estimated from the 2001 Food Safety Survey data by using a weighted average, based on the number of sample points, to aggregate the responses to multiple questions addressing the same contributing factor. We can infer that data from other secondary sources were integrated through a similar weighting procedure.

Computation Method Used in FHPM v.1.5: To update this variable, we used published prevalence data on inappropriate hand washing and inappropriate sanitation of equipment or utensils practices. The data for the remaining practices came from the expert elicitation.

Sources Used in FHPM v.1.0:

Altekruse, S., S. Yang, B. Timbo, and F. Angulo. (1999). "A Multi- State Survey of Consumer Food-Handling and Food- Consumption Practices." *American Journal of Preventative Medicine* 16(3): 216-221.

Audits International. "Audits International's Home Food Safety Survey." http://audits.com/Report.html. [Accessed September 20, 2002].

Centers for Disease Control and Prevention, FoodNet. Revised July 20, 2000. "Population Survey Atlas of Exposures: 1998–1999." http://www.cdc.gov/foodnet/surveys/Pop_surv.htm [Accessed March 4, 2002].

Kendall, David, Catherine Viator, and Becky Durocher. February 28, 2003. Modeling the Effects of Food Handling Practices on the Incidence of Foodborne Illness. Second Draft Report. Prepared for the Food and Drug Administration. Research Triangle Park, NC: RTI International.

Shiferaw, B., et al. (2000). "Prevalence of High-Risk Food Consumption and Food Handling Practices among Adults: A Multistate Survey, 1996-1997." *Journal of Food Protection* 63(11): 1538-1543.

U.S. Food and Drug Administration/Food Safety and Inspection Service (FDA/FSIS). 2001. "Food Safety Survey." Washington, DC.

Sources Used in FHPM v.1.5:

Byrd-Bredbenner C., J. Maurer, V. Wheatley, E. Cottone, and M. Clancy. (2007). "Observed food safety behaviors of young adults." *British Food Journal* 109(7): 519-530.

Table 3-11: Parameter Estimates for $P(B^{*}_{jk})$

Inappropriate Practice	Single Female	Single Male	Single Parent with Children	Couple with Children	Couple without Children	Senior Male	Senior Female
FHPM v.1.0							
Food handling by a symptomatic food handler	0.0880	0.0787	0.0861	0.1060	0.0960	0.0833	0.0770
Food handling by ill food handler	0.1140	0.1717	0.1353	0.1828	0.1188	0.1333	0.1225
Inappropriate bare-hand contact with ready-to-cook (RTC) foods	0.0661	0.0720	0.0660	0.0661	0.0720	0.1500	0.1420
Inappropriate bare-hand contact with ready-to-eat (RTE) foods	0.2440	0.2535	0.2365	0.2623	0.2493	0.2765	0.2180
Inappropriate gloved-hand contact with ready-to-cook (RTC) foods	0.0085	0.0075	0.0065	0.0280	0.0210	0.0085	0.0078
Inappropriate gloved-hand contact with ready-to-eat (RTE) foods	0.0196	0.0223	0.0139	0.0161	0.0131	0.0159	0.0179
Inappropriate hand washing	0.4202	0.4089	0.3772	0.3779	0.3713	0.4222	0.3602
Inappropriate sanitation of equipment or utensils	0.3190	0.3390	0.2990	0.3740	0.3460	0.3550	0.3275
Inappropriate sanitation or cleaning of cutting boards or other cutting surfaces	0.2707	0.2393	0.2020	0.2433	0.2291	0.2941	0.1970
FHPM v.1.5							
Food handling by a household member with a communicable disease	0.0536	0.0823	0.1134	0.0893	0.0582	0.0989	0.0728
Inappropriate bare-hand contact with RTE/RTC foods	0.3625	0.4750	0.4694	0.4333	0.3800	0.4600	0.3983
Inappropriate hand washing [a]	0.4750	0.6050	0.5377	0.5285	0.4450	0.5736	0.4759
Inappropriate sanitation of equipment or utensils [a]	0.4700	0.5100	0.4694	0.4823	0.4598	0.4985	0.5420
Inappropriate sanitation or cleaning of cutting boards or other cutting surfaces [a]	0.4200	0.5100	0.4780	0.4390	0.4375	0.4698	0.4743

[a] Estimates for "Single Female" and "Single Male" categories are from a secondary source. Estimates for other household categories were calculated by taking the percentage difference of the expert elicitation data for that household category compared to an average of the expert elicitation data for the "Single Female" and "Single Male" categories, and using this percentage to weight the averaged "Single Female' and "Single Male" secondary source data.

U.S. Food and Drug Administration, Center for Food Safety and Applied Nutrition. (2008). "2006 FDA/FSIS Food Safety Survey Topline Frequency Report." July, 2008. Available at http://www.cfsan.fda.gov/~comm/crnutri7.html. [Accessed November 18, 2008.]

Variable Name: **$P(C^*_{jk}|B^*_{jk})$**

Description: Probability that occurrence of the k^{th} contributing factor contaminates a serving of food in the j^{th} category of household

Data Used in FHPM v.1.0: The data for this variable came from were gathered through an expert elicitation.

Data Used in FHPM v.1.5: We updated this variable entirely through expert elicitation (see Table 3-12).

Sources Used in FHPM v.1.0:

Kendall, David, Catherine Viator, and Becky Durocher. February 28, 2003. Modeling the Effects of Food Handling Practices on the Incidence of Foodborne Illness. Second Draft Report. Prepared for the Food and Drug Administration. Research Triangle Park, NC: RTI International.

Sources Used in FHPM v.1.5:

Expert Elicitation.

Table 3-12: Parameter Estimates for $P(C^*_{jk}|B^*_{jk})$

Inappropriate Practice	Single Female	Single Male	Single Parent with Children	Couple with Children	Couple without Children	Senior Male	Senior Female
FHPM v.1.0							
Food handling by a symptomatic food handler	0.0467	0.0467	0.0467	0.0500	0.0533	0.0567	0.0333
Food handling by ill food handler	0.0767	0.0800	0.0767	0.0767	0.0800	0.0833	0.0700
Inappropriate bare-hand contact with ready-to-cook (RTC) foods	0.0053	0.0057	0.0053	0.0053	0.0083	0.0080	0.0087
Inappropriate bare-hand contact with ready-to-eat (RTE) foods	0.0800	0.1017	0.0967	0.0833	0.0833	0.1000	0.0800
Inappropriate gloved-hand contact with ready-to-cook (RTC) foods	0.0003	0.0007	0.0003	0.0003	0.0002	0.0002	0.0002
Inappropriate gloved-hand contact with ready-to-eat (RTE) foods	0.0007	0.0010	0.0007	0.0003	0.0003	0.0003	0.0003
Inappropriate hand washing	0.1567	0.1933	0.1900	0.1767	0.1633	0.1833	0.1500
Inappropriate sanitation of equipment or utensils	0.0833	0.1733	0.0933	0.0633	0.0667	0.0867	0.0733
Inappropriate sanitation or cleaning of cutting boards or other cutting surfaces	0.2233	0.2400	0.2367	0.2233	0.2233	0.2400	0.2167
FHPM v.1.5							
Food handling by a household member with a communicable disease	0.1775	0.1301	0.1893	0.1401	0.1385	0.1776	0.2246
Inappropriate bare-hand contact with RTE/RTC foods	0.2354	0.1577	0.1585	0.2142	0.2304	0.2788	0.1951
Inappropriate hand washing [a]	0.2026	0.2134	0.2279	0.2701	0.1901	0.1951	0.1775
Inappropriate sanitation of equipment or utensils [a]	0.1434	0.1943	0.1601	0.1543	0.2043	0.2601	0.2850
Inappropriate sanitation or cleaning of cutting boards or other cutting surfaces [a]	0.2060	0.2010	0.2000	0.2209	0.2601	0.1793	0.1776

[a] Estimates for "Single Female" and "Single Male" categories are from a secondary source. Estimates for other household categories were calculated by taking the percentage difference of the expert elicitation data for that household category compared to an average of the expert elicitation data for the "Single Female" and "Single Male" categories, and using this percentage to weight the averaged "Single Female' and "Single Male" secondary source data.

3.3 Contributing Factors –Pathogen Control Stage

The pathogen control stage of FHPM also has two channels: retail and household. Many of the studies analyzing contributing factors that contaminate food also look at contributing factors that allow pathogens to survive and grow. There are a total of nine factors that contribute to pathogen growth and survival modeled in FHPM (see Table 3-13). We kept these practices unchanged in the update. Table 3-14 summarizes the parameters associated with this stage and their updates in FHPM v.1.5.

Table 3-13: List of Contributing Factors for the Pathogen Control Stage

FHPM v.1.0 and FHPM v.1.5
Food kept at room temperature too long
Food served raw/lightly cooked
Inappropriate advance preparation
Inappropriate thawing of frozen foods
Inappropriate time/temperature for cold holding
Inappropriate time/temperature for cooking
Inappropriate time/temperature for cooling
Inappropriate time/temperature for hot holding
Inappropriate time/temperature for reheating

Table 3-14: Summary of Pathogen Control Stage Contributing Factors Parameters in FHPM

Channel	Name	Type	Description	FHPM v.1.5 Revision
Retail	w_j	Scenario Parameter	Proportion of annual servings of food sold by the j^{th} category of retail food establishment that is consumed without further preparation by a household	See Table 3-15
	$P(B''_{jk})$	Scenario Probability	Probability of occurrence of the k^{th} contributing factor that may allow pathogen survival and growth in the j^{th} category of retail food establishment	See Table 3-16, Table 3-17, Table 3-18
	$P(C''_{jk} \mid B''_{jk})$	Scenario Probability	Probability that occurrence of the k^{th} contributing factor in the j^{th} retail establishment allows pathogens to survive or grow on a serving of pathogen-contaminated food	See Table 3-19, Table 3-20, Table 3-21
Household	$1 - w_j$	Scenario Parameter	Proportion of annual servings of food sold by the j^{th} category of retail food establishment that is further prepared by households before consumption	See Table 3-15
	$1 - g_{ij}$	Scenario Parameter	Proportion of annual servings of the i^{th} food category bought by consumers from the j^{th} category of retail food establishment, as packaged by the final manufacturing source, without further preparation by the retail establishment	See Table 3-8
	$P(B^{**}_{jk})$	Scenario Probability	Probability of the occurrence of the k^{th} contributing factor that may allow survival and growth of pathogens in food in the j^{th} category of household	See Table 3-22
	$P(C^{**}_{jk} \mid B^{**}_{jk})$	Scenario Probability	Probability that occurrence of the k^{th} contributing factor allows pathogens to survive or grow on a serving of pathogen-contaminated food prepared in the j^{th} category of household	See Table 3-23, Table 3-24, Table 3-25

3.3.1 Retail channel

Variable Name: $\mathbf{w_j}$

Description: Proportion of annual servings of food sold by the j^{th} category of retail food establishment that is consumed without further preparation by a household

Data Used in FHPM v.1.0: In FHMP v.1.0, the percentages of ready-to-eat food sold by grocery and convenient stores were drawn from sales data provided by two national associations: the Food Marketing Institute and the National Association of Convenience Stores.

Data Used in FHPM v.1.5: We revised this parameter to represent foods handled at both the retail and household levels. To update the retail figures, we used data from the same two national associations: the Food Marketing Institute and the National Association of Convenience Stores (see Table 3-15). However, we were unable to find figures on the percentage of food handled by seafood stores. We also did not identify any data on the percentage of restaurant meals ordered for take-out, which would be affected by both retail and household handling.

Computation Method Used in FHPM v.1.0: In FHMP v.1.0, the percentage of food sold by restaurants and institutions and consumed without further preparation by a household was assumed to be 100 percent. The percentage of ready-to-eat foods sold by grocery stores was then computed by adding the percentage of sales from the "Service Deli," "Deli/Self Service," and "Frozen Foods" categories. The percentage of ready-to-eat food sold by convenient stores was taken from the percentage of foodservice sales.

Computation Method Used in FHPM v.1.5: We have used the same methods to calculate the percentages for grocery stores and convenience stores. However, because most frozen foods require further preparation, we excluded the "Frozen Food" category. We made the same assumptions about foods sold by institutions. We did not identify any resources to estimate the percentage of seafood store sales that are prepared ready-to-eat. Thus, we used the same estimate for seafood stores that we found for grocery stores. As was done in FHPM v.1.0, we assumed that restaurants and institutions prepare and sell ready-to-eat foods only. Thus, we set the share consumed without further preparation by households to 100 percent.

Sources Used in FHPM v.1.0:

Food Marketing Institute. (2002). "Facts and Figures: Supermarket Sales by Department." http://www.fmi.org/facts_figs/ keyfacts/grocerydept.htm.

National Association of Convenience Stores (NACS). (2002). "Convenience Store Industry: Totals, Trends, and Averages." http://www.nacsonline.com/PDFs/soihighlights2002.pdf.

Sources Used in FHPM v.1.5:

Food Marketing Institute. (2007). "Key Facts: Supermarket Sales by Department – Percent of Total Supermarket Sales." http://www.fmi.org/facts_figs/keyfacts/?fuseaction= grocerydept [Accessed December 12, 2007].

National Association of Convenience Stores (NACS). (2006). 2007 State of the Industry Report and Fact Book. Figure provided by Deb Taguba, National Association of Convenience Stores, Email communication, December 14, 2007.

Table 3-15: Parameter Estimates for w_j and 1-w_j

Retail Category	Prepared Ready-to-Eat		Prepared Not-Ready-to-Eat	
	v.1.0	v.1.5	v.1.0	v.1.5
Retail Food Stores				
Grocery store [a]	0.1135	0.0476	0.8865	0.9524
Convenience store	0.1140	0.1206	0.8860	0.8794
Seafood store [b]	0.1140	0.0476	0.8860	0.9524
Restaurants				
Full-service restaurants [c]	1	1	0	0
Mixed-service restaurants [c]	1	1	0	0
Fast-food restaurants [c]	1	1	0	0
Temporary establishments [c]	1	1	0	0
Institutions				
Child care centers	1	1	0	0
Hospitals	1	1	0	0
Schools	1	1	0	0
Nursing homes	1	1	0	0

Variable Name: **$P(B''_{jk})$**

Description: Probability of occurrence of the k^{th} contributing factor that may allow pathogen survival and growth in the j^{th} category of retail food establishment

Data Used in FHPM v.1.0: The sole secondary source for this variable was the 2000 FDA Retail Survey, which provided estimates on food kept at room temperature too long and inappropriate time or temperature for cold holding, cooking, cooling, hot holding, and reheating. The remaining information needed was gathered from the expert elicitation.

Data Used in FHPM v.1.5: We replaced the estimates derived from the 2000 FDA Retail Survey data with those derived from the update of that report, the 2004 FDA Retail Survey. We updated the remaining values through expert elicitation.

Computation Method Used in FHPM v.1.0: Although it was not explicitly indicated in the RTI International (2003) report, it appears that the parameter was calculated as a simple average of the estimates drawn from secondary sources and the estimates gathered through expert elicitation.

Computation Method Used in FHPM v.1.5: To update this variable (see Table 3-16 through Table 3-18); we used the published data alone when available. The data for the remaining practices came from the expert elicitation. We identified the practices to update with published data by identifying questions in the 2004 FDA Retail Survey that corresponded with elements of the $P(B''_{jk})$ variable: food kept at room temperature too long, inappropriate time or temperature for cold holding, cooking, cooling, hot holding, and reheating. Observations of appropriate and inappropriate food handling practices were recorded for the following categories: hospitals, nursing homes, elementary schools, full-service restaurants, fast-food

restaurants, produce departments/stores, deli departments/stores, seafood departments/markets, and meat and poultry departments. We aggregated the last four categories into the grocery store category by calculating a weighted average of the observations based on the number of observations per department. We also used the data on seafood departments/markets for seafood stores, given that the observations were collected from both supermarket seafood departments and stand-alone stores.

Sources Used in FHPM v.1.0:

Food and Drug Administration, Retail Food Program Steering Committee. (2000). "Report of the FDA Retail Food Program Database of Foodborne Illness Risk Factors."

Kendall, David, Catherine Viator, and Becky Durocher. February 28, 2003. Modeling the Effects of Food Handling Practices on the Incidence of Foodborne Illness. Second Draft Report. Prepared for the Food and Drug Administration. Research Triangle Park, NC: RTI International.

Sources Used in FHPM v.1.5:

Food and Drug Administration, National Retail Food Team. (2004). "FDA Report on the Occurrence of Foodborne Illness Risk Factors in Selected Institutional Foodservice, Restaurant, and Retail Food Store Facility Types."

Expert Elicitation.

Table 3-16: Parameter Estimates for $P(B''_{jk})$ – Food Stores

Inappropriate Practice	Grocery Stores		Convenience Stores		Seafood Stores	
	v.1.0	v.1.5	v.1.0	v.1.5	v.1.0	v.1.5
Food kept at room temperature too long [a]	0.3000	0.0000	0.3067	0.0000	0.4067	0.0000
Food served raw/lightly cooked	0.0028	0.0981	0.0070	0.0468	0.0134	0.0982
Inappropriate advance preparation	0.2025	0.0955	0.2496	0.1076	0.2926	0.0959
Inappropriate thawing of frozen foods	0.2375	0.1394	0.2014	0.1021	0.2678	0.1377
Inappropriate time/temperature for cold holding [a]	0.4269	0.4296	0.1411	0.4226	0.1344	0.1619
Inappropriate time/temperature for cooking [a]	0.2450	0.0744	0.2726	0.0399	0.3259	0.0000
Inappropriate time/temperature for cooling [a]	0.1800	0.3974	0.1459	0.3429	0.1059	0.2000
Inappropriate time/temperature for hot holding [a]	0.3688	0.5739	0.2011	0.5269	0.0678	0.5000
Inappropriate time/temperature for reheating [a]	0.2000	0.1905	0.2478	0.7224	0.2478	0.6667

[a] Estimates are from a secondary source, which provided data for "Grocery," "Seafood" "Full-Service Restaurants," "Fast-Food Restaurants," "Hospitals," "Schools," and "Nursing Homes" categories only. Estimates for other retail categories were calculated by taking the percentage difference of the expert elicitation data for that retail category compared to an average of the expert elicitation data for the "Grocery," "Seafood" "Full-Service Restaurants," "Fast Food Restaurants," "Hospitals," "Schools," and "Nursing Homes" categories to weight the secondary source data for each category.

Variable Name: **$P(C''_{jk} | B''_{jk})$**

Description: Probability that occurrence of the k^{th} contributing factor in the j^{th} retail establishment allows pathogens to survive or grow on a serving of pathogen-contaminated food

Data Used in FHPM v.1.0: The data the variable was gathered through expert elicitation in FHPM v.1.0.

Table 3-17: Parameter Estimates for $P(B''_{jk})$ – Restaurants

Inappropriate Practice	Full Service		Mixed-Service		Fast Food		Temporary	
	v.1.0	v.1.5	v.1.0	v.1.5	v.1.0	v.1.5	v.1.0	v.1.5
Food kept at room temperature too long [a]	0.3275	0.6000	0.2750	0.3879	0.3425	0.2222	0.3167	0.7186
Food served raw/lightly cooked	0.0400	0.0954	0.0178	0.0477	0.0063	0.0499	0.0150	0.0658
Inappropriate advance preparation	0.2900	0.1175	0.2350	0.0808	0.2639	0.0713	0.2333	0.0988
Inappropriate thawing of frozen foods	0.2625	0.1363	0.2125	0.0814	0.2542	0.0704	0.2067	0.1025
Inappropriate time/temperature for cold holding [a]	0.5063	0.7778	0.1050	0.5214	0.3726	0.5648	0.1100	0.7780
Inappropriate time/temperature for cooking [a]	0.2775	0.1299	0.2500	0.0916	0.3739	0.0652	0.2733	0.1327
Inappropriate time/temperature for cooling [a]	0.5400	0.6026	0.1450	0.4256	0.1169	0.4474	0.1867	0.4808
Inappropriate time/temperature for hot holding [a]	0.3288	0.4891	0.0875	0.5476	0.0952	0.3100	0.0900	0.5241
Inappropriate time/temperature for reheating [a]	0.2425	0.2381	0.2225	0.2294	0.2292	0.1667	0.2833	0.3882

[a] Estimates are from a secondary source, which provided data for "Grocery," "Seafood" "Full-Service Restaurants," "Fast-Food Restaurants," "Hospitals," "Schools," and "Nursing Homes" categories only. Estimates for other retail categories were calculated by taking the percentage difference of the expert elicitation data for that retail category compared to an average of the expert elicitation data for the "Grocery," "Seafood" "Full-Service Restaurants," "Fast Food Restaurants," "Hospitals," "Schools," and "Nursing Homes" categories to weight the secondary source data for each category.

Table 3-18: Parameter Estimates for $P(B''_{jk})$ – Institutions

Inappropriate Practice	Childcare		Hospitals		Schools		Nursing Homes	
	v.1.0	v.1.5	v.1.0	v.1.5	v.1.0	v.1.5	v.1.0	v.1.5
Food kept at room temperature too long [a]	0.2300	0.0000	0.2333	0.0000	0.3200	0.0000	0.1184	0.0000
Food served raw/lightly cooked	0.0050	0.0232	0.0184	0.0431	0.0184	0.0438	0.0183	0.0449
Inappropriate advance preparation	0.2259	0.0625	0.2019	0.1143	0.3111	0.1113	0.2833	0.1042
Inappropriate thawing of frozen foods	0.2111	0.0395	0.1489	0.1233	0.2167	0.1055	0.0983	0.0943
Inappropriate time/temperature for cold holding [a]	0.1138	0.3624	0.3511	0.5773	0.2750	0.2857	0.2294	0.3617
Inappropriate time/temperature for cooking [a]	0.3059	0.0353	0.1919	0.0602	0.2644	0.0000	0.1013	0.0370
Inappropriate time/temperature for cooling [a]	0.1139	0.1592	0.0852	0.4146	0.1111	0.1707	0.1333	0.3971
Inappropriate time/temperature for hot holding [a]	0.0838	0.1403	0.2178	0.3600	0.1333	0.2561	0.1213	0.2368
Inappropriate time/temperature for reheating [a]	0.2111	0.0767	0.1789	0.0674	0.2200	0.0429	0.0983	0.0755

[a] Estimates are from a secondary source, which provided data for "Grocery," "Seafood" "Full-Service Restaurants," "Fast-Food Restaurants," "Hospitals," "Schools," and "Nursing Homes" categories only. Estimates for other retail categories were calculated by taking the percentage difference of the expert elicitation data for that retail category compared to an average of the expert elicitation data for the "Grocery," "Seafood" "Full-Service Restaurants," "Fast Food Restaurants," "Hospitals," "Schools," and "Nursing Homes" categories to weight the secondary source data for each category.

Data Used in FHPM v.1.5: We updated this variable entirely through expert elicitation (see Table 3-19 through Table 3-21).

Sources Used in FHPM v.1.0:

Kendall, David, Catherine Viator, and Becky Durocher. February 28, 2003. Modeling the Effects of Food Handling Practices on the Incidence of Foodborne Illness. Second Draft Report.

Prepared for the Food and Drug Administration. Research Triangle Park, NC: RTI International.

Sources Used in FHPM v.1.5:

Expert Elicitation.

3.3.2. Household Channel

Variable Name: **$P(B^{**}_{jk})$**

Description: Probability of the occurrence of the k^{th} contributing factor that may allow survival and growth of pathogens in food in the j^{th} category of household

Data Used in FHPM v.1.0: The probability estimates of food served raw or under cooked, improper leftover procedures, and improper thermometer use were based on the 2001 FDA Food Safety Survey. These data were supplemented with findings from other secondary studies. The remaining information needed was compiled through an expert elicitation.

Data Used in FHPM v.1.5: After examining the topline frequency data made available in July 2008, we determined that the data cannot be used to update this variable because it did not provide breakdowns by household category. While the Food Safety Survey did include demographic questions, these did not enable an approximation of the FHPM household categories. We judged that the Audits International data were also inadequate because the data

Table 3-19: Parameter Estimates for $P(C''_{jk}|B''_{jk})$ – Food Stores

Inappropriate Practice	Grocery Stores				Convenience Stores				Seafood Stores			
	v.1.0	v.1.5			v.1.0	v.1.5			v.1.0	v.1.5		
		L	H	M		L	H	M		L	H	M
Food kept at room temperature too long	0.1667	0.0060	0.1000	0.0530	0.2011	0.0228	0.1301	0.0765	0.1917	0.0030	0.1078	0.0554
Food served raw/lightly cooked	0.0489	0.0062	0.1240	0.0651	0.0461	0.0019	0.1074	0.0547	0.2117	0.0035	0.1170	0.0603
Inappropriate advance preparation	0.0778	0.0077	0.1138	0.0608	0.2200	0.0027	0.0805	0.0416	0.2492	0.0024	0.0879	0.0452
Inappropriate thawing of frozen foods	0.0084	0.0101	0.1326	0.0714	0.0084	0.0023	0.1005	0.0514	0.0084	0.0353	0.1351	0.0852
Inappropriate time/temperature for cold holding	0.1461	0.0511	0.1179	0.0845	0.1922	0.0409	0.1393	0.0901	0.3033	0.0184	0.0763	0.0474
Inappropriate time/temperature for cooking	0.0744	0.0236	0.1397	0.0817	0.1444	0.0039	0.0868	0.0454	0.1583	0.0040	0.1083	0.0562
Inappropriate time/temperature for cooling	0.0583	0.0369	0.1496	0.0933	0.0500	0.0023	0.0884	0.0454	0.0683	0.0021	0.0542	0.0282
Inappropriate time/temperature for hot holding	0.1078	0.0356	0.1450	0.0903	0.1089	0.0089	0.0938	0.0514	0.0908	0.0027	0.0706	0.0367
Inappropriate time/temperature for reheating	0.0417	0.0222	0.1264	0.0743	0.0439	0.0234	0.1078	0.0656	0.0496	0.0021	0.0783	0.0402

L = Low (denotes the probability for the food category that each expert identified as having the lowest probability of pathogen survival or growth to levels sufficient to cause foodborne illness in a serving of food)
H = High (denotes the probability for the food category that each expert identified as having the highest probability of pathogen survival or growth to levels sufficient to cause foodborne illness in a serving of food)
M = Midpoint of Low and High (estimate used in FHPM v.1.5)

Table 3-20: Parameter Estimates for $P(C''_{jk}|B''_{jk})$ – Restaurants

Inappropriate Practice	Full-Service				Mixed-Service				Fast-food				Temporary			
	v.1.0	v.1.5			v.1.0	v.1.5			v.1.0	v.1.5			v.1.0	v.1.5		
		L	H	M		L	H	M		L	H	M		L	H	M
Food kept at room temperature too long	0.1617	0.0068	0.1023	0.0546	0.1700	0.0103	0.1130	0.0617	0.2183	0.0104	0.0749	0.0427	0.1683	0.0418	0.1363	0.0891
Food served raw/lightly cooked	0.1450	0.0031	0.1052	0.0542	0.1533	0.0031	0.1113	0.0572	0.2283	0.0031	0.1106	0.0569	0.1725	0.0035	0.1325	0.0680
Inappropriate advance preparation	0.1625	0.0130	0.1150	0.0640	0.1542	0.0120	0.1022	0.0571	0.0858	0.0122	0.1191	0.0657	0.1208	0.0075	0.1035	0.0555
Inappropriate thawing of frozen foods	0.0084	0.0353	0.1513	0.0933	0.0084	0.0061	0.0938	0.0500	0.0101	0.0060	0.0911	0.0486	0.0300	0.0193	0.1243	0.0718
Inappropriate time/temperature for cold holding	0.2000	0.0354	0.1198	0.0776	0.2200	0.0196	0.0875	0.0536	0.3433	0.0196	0.1098	0.0647	0.2250	0.0179	0.0942	0.0561
Inappropriate time/temperature for cooking	0.1617	0.0203	0.1059	0.0631	0.1367	0.0106	0.1093	0.0600	0.1492	0.0077	0.1233	0.0655	0.2008	0.0209	0.1475	0.0842
Inappropriate time/temperature for cooling	0.1150	0.0501	0.1350	0.0926	0.2250	0.0410	0.1204	0.0807	0.2542	0.0361	0.0947	0.0654	0.2633	0.0163	0.0818	0.0491
Inappropriate time/temperature for hot holding	0.0875	0.0076	0.1063	0.0570	0.0917	0.0122	0.0957	0.0540	0.2808	0.0115	0.0977	0.0546	0.1767	0.0151	0.1071	0.0611
Inappropriate time/temperature for reheating	0.0379	0.0205	0.0883	0.0544	0.0342	0.0097	0.0736	0.0417	0.2675	0.0073	0.1016	0.0545	0.2458	0.0130	0.1235	0.0683

L = Low (denotes the probability for the food category that each expert identified as having the lowest probability of pathogen survival or growth to levels sufficient to cause foodborne illness in a serving of food)
H = High (denotes the probability for the food category that each expert identified as having the highest probability of pathogen survival or growth to levels sufficient to cause foodborne illness in a serving of food)
M = Midpoint of Low and High (estimate used in FHPM v.1.5)

Table 3-21: Parameter Estimates for $P(C''_{jk} | B''_{jk})$ – Institutions

Inappropriate Practice	Childcare				Hospitals				Schools				Nursing Homes			
	v.1.0	v.1.5			v.1.0	v.1.5			v.1.0	v.1.5			v.1.0	v.1.5		
		L	H	M		L	H	M		L	H	M		L	H	M
Food kept at room temperature too long	0.1617	0.0118	0.1195	0.0657	0.1608	0.0028	0.0619	0.0324	0.1642	0.0035	0.0970	0.0503	0.1858	0.0194	0.1063	0.0629
Food served raw/lightly cooked	0.0808	0.0023	0.1157	0.0590	0.0746	0.0031	0.1046	0.0539	0.0746	0.0038	0.1175	0.0607	0.1121	0.0025	0.1013	0.0519
Inappropriate advance preparation	0.1075	0.0016	0.0853	0.0435	0.0954	0.0031	0.0944	0.0488	0.1388	0.0024	0.0877	0.0451	0.1579	0.0025	0.1028	0.0527
Inappropriate thawing of frozen foods	0.0084	0.0020	0.1115	0.0568	0.0084	0.0228	0.1175	0.0702	0.0084	0.0186	0.1233	0.0710	0.0084	0.0228	0.1349	0.0789
Inappropriate time/temperature for cold holding	0.1850	0.0088	0.0848	0.0468	0.1625	0.0175	0.0846	0.0511	0.1658	0.0117	0.0768	0.0443	0.2408	0.0181	0.0810	0.0496
Inappropriate time/temperature for cooking	0.1575	0.0123	0.1281	0.0702	0.1404	0.0127	0.1338	0.0733	0.1471	0.0052	0.1069	0.0561	0.2096	0.0048	0.1125	0.0587
Inappropriate time/temperature for cooling	0.2600	0.0036	0.0861	0.0449	0.2367	0.0073	0.0650	0.0362	0.2433	0.0080	0.0641	0.0361	0.3433	0.0035	0.0504	0.0270
Inappropriate time/temperature for hot holding	0.1367	0.0029	0.0974	0.0502	0.1183	0.0368	0.1085	0.0727	0.1283	0.0288	0.1174	0.0731	0.1783	0.0282	0.1094	0.0688
Inappropriate time/temperature for reheating	0.2025	0.0198	0.1248	0.0723	0.1779	0.0198	0.1210	0.0704	0.1846	0.0081	0.0932	0.0507	0.2721	0.0031	0.0694	0.0363

L = Low (denotes the probability for the food category that each expert identified as having the lowest probability of pathogen survival or growth to levels sufficient to cause foodborne illness in a serving of food)
H = High (denotes the probability for the food category that each expert identified as having the highest probability of pathogen survival or growth to levels sufficient to cause foodborne illness in a serving of food)
M = Midpoint of Low and High (estimate used in FHPM v.1.5)

Table 3-22: Parameter Estimates for $P(B^{**}_{jk})$

Inappropriate Practice	Single Female		Single Male		Single Parent with Children		Couple with Children		Couple without Children		Senior Male		Senior Female	
	v.1.0	v.1.5	v.1.0	v.1.5	v.1.0	v.1.5	v.1.0	v.1.5	v.1.0	v.1.5	v.1.0	v.1.5	v.1.0	v.1.5
Food kept at room temperature too long [a]	0.2380	0.2000	0.2640	0.2500	0.2780	0.2270	0.3223	0.2316	0.2140	0.2356	0.2469	0.2500	0.2325	0.2211
Food served raw/lightly cooked	0.1589	0.1175	0.1664	0.1425	0.1405	0.1084	0.1638	0.1092	0.1543	0.1104	0.1576	0.1271	0.1249	0.1188
Inappropriate advance preparation	0.0860	0.1133	0.1000	0.1242	0.1410	0.1354	0.1720	0.1304	0.0710	0.1417	0.1020	0.1421	0.0800	0.1175
Inappropriate thawing of frozen foods [a]	0.1890	0.6400	0.1950	0.6700	0.2065	0.5536	0.2165	0.7078	0.2500	0.6318	0.1976	0.7730	0.1858	0.6472
Inappropriate time/temperature for cold holding	0.1510	0.1792	0.1600	0.1892	0.1510	0.1771	0.1470	0.1621	0.1580	0.1379	0.1770	0.1700	0.1550	0.1817
Inappropriate time/temperature for cooking	0.3086	0.1204	0.3248	0.1454	0.3020	0.1296	0.3051	0.1863	0.3044	0.1283	0.3202	0.2142	0.3100	0.2000
Inappropriate time/temperature for cooling	0.2420	0.1375	0.2550	0.1333	0.2480	0.1479	0.2925	0.1846	0.2500	0.1454	0.2557	0.1683	0.2581	0.1709
Inappropriate time/temperature for hot holding	0.1132	0.1200	0.0960	0.1283	0.0826	0.1446	0.1010	0.1446	0.0770	0.1296	0.1187	0.1596	0.1041	0.2867
Inappropriate time/temperature for reheating	0.1640	0.1625	0.1600	0.1608	0.1840	0.1725	0.3500	0.2025	0.1720	0.1475	0.1731	0.2044	0.1653	0.2162

[a] Estimates for "Single Female" and "Single Male" categories are from a secondary source. Estimates for other household categories were calculated by taking the percentage difference of the expert elicitation data for that household category compared to an average of the expert elicitation data for the "Single Female" and "Single Male" categories, and using this percentage to weight the averaged "Single Female' and "Single Male" secondary source data.

were collected by observing people acquainted with researchers. To estimate the variable, we relied on one published study, which analyzed U.S. young adults' food handling practices in regards to food kept at room temperature too long and inappropriate thawing of frozen foods. We updated the remaining values through expert elicitation. Table 3-22 displays these findings.

Computation Method Used in FHPM v.1.0: The parameter was estimated from the 2001 Food Safety Survey data by using a weighted average, based on the number of sample points, to aggregate the responses to multiple questions addressing the same contributing factor. We can infer that data from other secondary sources were integrated through a similar weighting procedure.

Computation Method Used in FHPM v.1.5: To update this variable, we used the published data to update the estimates for food kept at room temperature too long and inappropriate thawing of frozen foods. The data for the remaining practices came from the expert elicitation.

Sources Used in FHPM v.1.0:

Altekruse, S., S. Yang, B. Timbo, and F. Angulo. (1999). "A Multi- State Survey of Consumer Food-Handling and Food- Consumption Practices." *American Journal of Preventative Medicine* 16(3): 216-221.

Audits International. "Audits International's Home Food Safety Survey." http://audits.com/Report.html [Accessed September 20, 2002].

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Sources Used in FHPM v.1.5:

Byrd-Bredbenner C., J. Maurer, V. Wheatley, E. Cottone, and M. Clancy. (2007). "Observed food safety behaviors of young adults." *British Food Journal* 109(7): 519-530.

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Expert Elicitation.

Variable Name: **$P(C^{**}_{jk} | B^{**}_{jk})$**

Description: Probability that occurrence of the k^{th} contributing factor allows pathogens to survive or grow on a serving of pathogen-contaminated food prepared in the j^{th} category of household

Data Used in FHPM v.1.0: The data the variable was gathered through expert elicitation in FHPM v.1.0.

Data Used in FHPM v.1.5: We updated this variable entirely through expert elicitation (see Table 3-23 through Table 3-25).

Sources Used in FHPM v.1.0:

Kendall, David, Catherine Viator, and Becky Durocher. February 28, 2003. Modeling the Effects of Food Handling Practices on the Incidence of Foodborne Illness. Second Draft Report. Prepared for the Food and Drug Administration. Research Triangle Park, NC: RTI International.

Sources Used in FHPM v.1.5:

Expert Elicitation.

Table 3-23: Parameter Estimates for $P(C^{**}_{jk} | B^{**}_{jk})$ – Singles

Inappropriate Practice	Single Female				Single Male				Single Parent with Children			
	v.1.0	v.1.5			v.1.0	v.1.5			v.1.0	v.1.5		
		L	H	M		L	H	M		L	H	M
Food kept at room temperature too long	0.0717	0.0467	0.2200	0.1334	0.0750	0.0467	0.2271	0.1369	0.0727	0.0675	0.2306	0.1491
Food served raw/lightly cooked	0.0717	0.0643	0.1504	0.1074	0.1067	0.0658	0.1561	0.1110	0.0780	0.0643	0.1457	0.1050
Inappropriate advance preparation	0.0187	0.0230	0.1132	0.0681	0.0203	0.0250	0.1179	0.0715	0.0687	0.0280	0.1376	0.0828
Inappropriate thawing of frozen foods	0.0350	0.0196	0.1756	0.0976	0.0367	0.0180	0.1781	0.0981	0.0348	0.0330	0.1961	0.1146
Inappropriate time/temperature for cold holding	0.0684	0.0176	0.1567	0.0872	0.0734	0.0196	0.1475	0.0836	0.0678	0.0184	0.1209	0.0697
Inappropriate time/temperature for cooking	0.0427	0.0155	0.1817	0.0986	0.1160	0.0167	0.1942	0.1055	0.0400	0.0243	0.1925	0.1084
Inappropriate time/temperature for cooling	0.0737	0.0147	0.1521	0.0834	0.0803	0.0147	0.1375	0.0761	0.0710	0.0347	0.1501	0.0924
Inappropriate time/temperature for hot holding	0.0184	0.0276	0.1425	0.0851	0.0200	0.0325	0.1401	0.0863	0.0194	0.0363	0.1240	0.0802
Inappropriate time/temperature for reheating	0.0700	0.0155	0.1577	0.0866	0.0733	0.0167	0.1643	0.0905	0.0707	0.0184	0.1557	0.0871

L = Low (denotes the probability for the food category that each expert identified as having the lowest probability of pathogen survival or growth to levels sufficient to cause foodborne illness in a serving of food)
H = High (denotes the probability for the food category that each expert identified as having the highest probability of pathogen survival or growth to levels sufficient to cause foodborne illness in a serving of food)
M = Midpoint of Low and High (estimate used in FHPM v.1.5)

Table 3-24: Parameter Estimates for $P(C^{**}_{jk} | B^{**}_{jk})$ – Couples

Inappropriate Practice	Couple with Children				Couple without Children			
	v.1.0	v.1.5			v.1.0	v.1.5		
		L	H	M		L	H	M
Food kept at room temperature too long	0.0727	0.0617	0.2267	0.1442	0.0733	0.0508	0.1958	0.1233
Food served raw/lightly cooked	0.0793	0.0651	0.1435	0.1043	0.0727	0.0622	0.1445	0.1034
Inappropriate advance preparation	0.0703	0.0297	0.1338	0.0818	0.0197	0.0251	0.1113	0.0682
Inappropriate thawing of frozen foods	0.0361	0.0350	0.1976	0.1163	0.0360	0.0221	0.1608	0.0915
Inappropriate time/temperature for cold holding	0.0694	0.0184	0.1229	0.0707	0.0697	0.0155	0.1338	0.0747
Inappropriate time/temperature for cooking	0.0467	0.0188	0.1879	0.1034	0.0477	0.0197	0.1636	0.0917
Inappropriate time/temperature for cooling	0.0777	0.0305	0.1429	0.0867	0.0787	0.0226	0.1492	0.0859
Inappropriate time/temperature for hot holding	0.0194	0.0322	0.1319	0.0821	0.0197	0.0363	0.1169	0.0766
Inappropriate time/temperature for reheating	0.0720	0.0197	0.1369	0.0783	0.0713	0.0209	0.1164	0.0687

L = Low (denotes the probability for the food category that each expert identified as having the lowest probability of pathogen survival or growth to levels sufficient to cause foodborne illness in a serving of food)
H = High (denotes the probability for the food category that each expert identified as having the highest probability of pathogen survival or growth to levels sufficient to cause foodborne illness in a serving of food)
M = Midpoint of Low and High (estimate used in FHPM v.1.5)

Table 3-25: Parameter Estimates for $P(C^{**}_{jk} | B^{**}_{jk})$ – Seniors

Inappropriate Practice	Senior Male				Senior Female			
	v.1.0	v.1.5			v.1.0	v.1.5		
		L	H	M		L	H	M
Food kept at room temperature too long	0.1060	0.0571	0.2000	0.1286	0.1060	0.0567	0.1963	0.1265
Food served raw/lightly cooked	0.0817	0.0738	0.1448	0.1093	0.0813	0.0796	0.1393	0.1095
Inappropriate advance preparation	0.0197	0.0354	0.1473	0.0914	0.0190	0.0334	0.1179	0.0757
Inappropriate thawing of frozen foods	0.0351	0.0188	0.1741	0.0965	0.0348	0.0208	0.1678	0.0943
Inappropriate time/temperature for cold holding	0.0688	0.0367	0.1781	0.1074	0.0678	0.0388	0.1714	0.1051
Inappropriate time/temperature for cooking	0.1103	0.0229	0.1853	0.1041	0.1063	0.0243	0.1743	0.0993
Inappropriate time/temperature for cooling	0.0730	0.0275	0.1481	0.0878	0.0713	0.0263	0.1389	0.0826
Inappropriate time/temperature for hot holding	0.0185	0.0844	0.1702	0.1273	0.0195	0.0963	0.1735	0.1349
Inappropriate time/temperature for reheating	0.0717	0.0263	0.1902	0.1083	0.0707	0.0251	0.1684	0.0968

L = Low (denotes the probability for the food category that each expert identified as having the lowest probability of pathogen survival or growth to levels sufficient to cause foodborne illness in a serving of food)
H = High (denotes the probability for the food category that each expert identified as having the highest probability of pathogen survival or growth to levels sufficient to cause foodborne illness in a serving of food)
M = Midpoint of Low and High (estimate used in FHPM v.1.5)

3.4 Foodborne Illness (FBI) Stage

The parameter estimates in the foodborne illness (FBI) stage of FHPM are based on two key sources:

- The seminal Mead et al. (1999) article on food-related illness and death in the United States, and
- Poster presentation by Hedberg et al. (1997) at the FoodNet Conference in Baltimore, MD in 1997.

There have been no updates to these studies. Thus, we kept all of the FBI stage parameters in the FHPM unchanged. Table 3-26 presents the FBI-related parameter estimates used in FHPM.

Table 3-26: Parameter Estimates for P(FBI)

FBI Parameter	Estimate
P(FBI treated)	0.08
$P(FBI_U)$	0.92
$P(FBI_H)$	0.00425
$P(FBI_D)$	6.84211 x 10-5

Variable Name: **P(FBI)**

Description: Probability that ingesting a serving of pathogen contaminated food results in a noticeable case of FBI

Data Used in FHPM v.1.0: The estimate was derived from the seminal Mead et al. (1999) study.

Data Used in FHPM v.1.5: Although CDC noted working on an update of the Mead et al. (2003), the results of the updated study are not yet available. Thus, we kept the values for this variable unchanged in FHPM v.1.5.

Sources Used in FHPM v.1.0:

Mead, P., L. Slutsker, V. Dietz, L.F. McCaig, J.S. Bresee, C. Shapiro, P.M. Griffin, and R.V. Tauxe. (1999.) "Food-Related Illness and Death in the United States." *Emerging Infectious Diseases* 5(5):607-625.

Sources Used in FHPM v.1.5:

Mead, P., L. Slutsker, V. Dietz, L.F. McCaig, J.S. Bresee, C. Shapiro, P.M. Griffin, and R.V. Tauxe. (1999.) "Food-Related Illness and Death in the United States." *Emerging Infectious Diseases* 5(5):607-625.

Variable Name: **$P(FBI_M)$**

Description: Probability that ingesting a serving of pathogen contaminated food results in a case of FBI sufficiently severe that treatment by a physician is sought

Data Used in FHPM v.1.0: The parameter was estimated using data from a FoodNet population survey on the percentage of respondents with non-bloody diarrhea who sought medical attention.

Data Used in FHPM v.1.5: We did not identify any additional secondary sources to update the FoodNet population survey data used in FHPM v.1.0. We therefore left the estimate unchanged in FHPM v.1.5.

Sources Used in FHPM v.1.0:

Hedberg, C., F. Angulo, J. Townes, et al. (1997). "Differences in Escherichia coli 0157:H7 Annual Incidence among FoodNet Active Surveillance Sites." Poster presented at FoodNet Conference, Baltimore, MD, June 22-26, 1997.

Sources Used in FHPM v.1.5:

Hedberg, C., F. Angulo, J. Townes, et al. (1997). "Differences in Escherichia coli 0157:H7 Annual Incidence among FoodNet Active Surveillance Sites." Poster presented at FoodNet Conference, Baltimore, MD, June 22-26, 1997.

Variable Name: **$P(FBI_H|FBI_M)$**

Description: Probability that a case of FBI that requires professional medical treatment becomes sufficiently severe to require hospitalization: $P(FBI_H|FBI_M) = P(FBI_H)/P(FBI_M)$; $P(FBI_H) = FBI_H/FBI$

Data Used in FHPM v.1.0: The estimate was derived from the seminal Mead et al. (1999) study.

Data Used in FHPM v.1.5: Although CDC noted working on an update of the Mead et al. (2003), the results of the updated study are not yet available. Thus, we kept the values for this variable unchanged in FHPM v.1.5.

Sources Used in FHPM v.1.0:

Mead, P., L. Slutsker, V. Dietz, L.F. McCaig, J.S. Bresee, C. Shapiro, P.M. Griffin, and R.V. Tauxe. (1999.) "Food-Related Illness and Death in the United States." *Emerging Infectious Diseases* 5(5): 607-625.

Sources Used in FHPM v.1.5:

Mead, P., L. Slutsker, V. Dietz, L.F. McCaig, J.S. Bresee, C. Shapiro, P.M. Griffin, and R.V. Tauxe. (1999.) "Food-Related Illness and Death in the United States." *Emerging Infectious Diseases* 5(5): 607-625.

Variable Name: **$P(FBI_D|FBI_H)$**

Description: Probability that a case of FBI that requires medical treatment by a physician becomes sufficiently severe that death occurs: $P(FBI_D|FBI_H) = P(FBI_D)/P(FBI_H)$; $P(FBI_D) = FBI_D/FBI$

Data Used in FHPM v.1.0: The estimate was derived from the seminal Mead et al. (1999) study.

Data Used in FHPM v.1.5: Although CDC noted working on an update of the Mead et al. (2003), the results of the updated study are not yet available. Thus, we kept the values for this variable unchanged in FHPM v.1.5.

Sources Used in FHPM v.1.0:

Mead, P., L. Slutsker, V. Dietz, L.F. McCaig, J.S. Bresee, C. Shapiro, P.M. Griffin, and R.V. Tauxe. (1999.) "Food-Related Illness and Death in the United States." *Emerging Infectious Diseases* 5(5): 607-625.

Sources Used in FHPM v.1.5:

Mead, P., L. Slutsker, V. Dietz, L.F. McCaig, J.S. Bresee, C. Shapiro, P.M. Griffin, and R.V. Tauxe. (1999.) "Food-Related Illness and Death in the United States." *Emerging Infectious Diseases* 5(5): 607-625.

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APPENDIX A: FOOD HANDLING PRACTICES MODEL (FHPM) EXPERT ELICITATION PROTOCOL

FOOD HANDLING PRACTICES MODEL (FHPM) EXPERT ELICITATION
ROUND 1 – RETAIL HANDLING PRACTICES

Each year millions of cases of foodborne illness occur in the United States. Preceding most cases of foodborne illness is contamination of food by pathogens, coupled with failure to destroy or sufficiently control pathogens in retail food establishments or households. The Food and Drug Administration (FDA) developed a quantitative simulation model of the effects of contributing factors on the incidence of foodborne illness: the Food Handling Practices Model (FHPM). The model allows FDA to analyze changes in the incidence of foodborne illness that may be associated with changes in food handling practices. Using stochastic simulation methods, the model incorporates inherent uncertainty of key relationships involved.

The FHPM incorporated data from food intake surveys, food safety surveys, contamination prevalence studies, outbreak studies, and other published scientific literature. Data needed for the model that were not available from previous research were gathered through expert elicitation. An initial calibration of the FHPM was done using a panel of experienced, highly qualified food safety experts to provide expert judgments for several scenario parameters required in the model.
The goal of this study is to update the initial parameters and re-calibrate the model. The information you provide will be incorporated along with data gathered from peer-reviewed or government-published studies, including data on the likelihood that a food will be contaminated before being handled at the retail or household level, and data on the probability of foodborne illness resulting from food contaminated with one or more pathogens.

We welcome suggestions for published studies that may provide data for the probabilities being sought in this elicitation.

ELICITATION METHOD

We are employing the Delphi method to obtain expert opinion on the frequency of specific improper food handling practices in households and retail establishments for use in the FHPM model. The Delphi method has tremendous value as a communications system for policy questions (Linstone and Turoff, 2002). The method involves multiple rounds of questioning, with each round building on the results of previous rounds. In order to achieve sufficient convergence on responses, some rounds may require multiple iterations. During these iteration rounds, experts are asked to reconsider their answers in light of an anonymous summary of the group's response.

The goal of the first round is to solicit information on the frequency of specific improper food handling practices in different retail settings (i.e., retail food stores, restaurants, and institutions). In addition to simple probabilities, this round will also elicit information on conditional probabilities (i.e., the probability that one or more pathogens are introduced into a serving of food in quantities sufficient to cause foodborne illness GIVEN the occurrence of a specific food handling practice) across different retail settings.

Following Round 1, we will conduct an iteration round, where each expert will review the group results for Round 1 and reconsider their answers. If there is sufficient convergence among experts' responses after the original round, there may not be a need for the iteration round .

The objective of Round 2 will be to solicit information on the frequency of specific improper food handling practices in different household types (i.e., single female, single male, couple with children, etc. households). Similar to Round 1, Round 2 will also elicit information on conditional probabilities (i.e., the probability that one or more pathogens are introduced into a serving of food in quantities sufficient to cause foodborne illness GIVEN the occurrence of a specific food handling practice) across household types. Following Round 2, there will be an iteration round, where each expert will review the group results for Round 2 and reconsider their answers. Again, if there is sufficient convergence among experts' responses after the original round there may not be a need for the iteration round.

DATA CONSIDERATIONS

You will be asked to gauge pathogen introduction, growth, and survival risks without regard to the type of pathogen. The likelihood that a pathogen will be introduced into food, survive, or grow in quantities sufficient enough to cause a foodborne illness may depend on the pathogen type. However, the Food Handling Practices Model does not distinguish among pathogen types. Please make your determinations based on the range of pathogens that may be introduced, survive, or grow in quantities sufficient to cause foodborne illness due to the given inappropriate food handling practices.

At the end of each page, please hit "next page" to save your responses, even if you have not responded to all the questions on the page. You can also leave and return to this survey at any time, as long as you hit "next page" to save your responses before navigating away from a particular page.

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Pathogen Contamination: Introduction of one or more pathogens in quantities sufficient to cause foodborne illness.

We will first ask you to gauge the frequency in different retail settings of various inappropriate food handling practices that contribute to the introduction of one or more pathogens into food in quantities sufficient to cause foodborne illness. Next, we will ask you to gauge the frequency with which each inappropriate practice actually results in the introduction of one or more pathogens into food. The first set of questions, which relate to the frequency of inappropriate practices, will likely have higher probabilities than the second set of questions, which relate to the frequency of pathogen introduction due to the occurrence of an inappropriate practice.

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Intro 1. Please indicate the MOST and LEAST frequently occurring food handling practices that contribute to the introduction of one or more pathogens into food in quantities sufficient to cause foodborne illness, in each of the following retail settings. On the following page, you will have the opportunity to estimate the frequency of each handling practice.

Q1. GROCERY STORES – Food preparation activities or handling of unpackaged food items, including seafood, meats, deli products, and ready-to-eat foods at retail food stores that sell a broad selection of grocery items, canned goods, and nonfood items plus some perishable items.

MOST frequently occurring practice is _____[Drop-down 4]
LEAST frequently occurring practice is _____[Drop-down 4]

Q2. CONVENIENCE STORES – Food preparation activities or handling of unpackaged food items, including seafood, meats, deli products, and ready-to-eat foods at small retail food stores that offer a limited selection of high-convenience items; open long hours to provide convenient access

MOST frequently occurring practice is _____[Drop-down 4]
LEAST frequently occurring practice is _____[Drop-down 4]

Q3. SEAFOOD STORES – Retail stores that sell only seafood and other sundry items associated with preparation of seafood

MOST frequently occurring practice is _____[Drop-down 4]
LEAST frequently occurring practice is _____[Drop-down 4]

Q4. FULL-SERVICE RESTAURANTS – Restaurants that provide table wait service and offer a menu of meal selections that are prepared onsite

MOST frequently occurring practice is _____[Drop-down 4]
LEAST frequently occurring practice is _____[Drop-down 4]

Q5. MIXED-SERVICE RESTAURANTS – Restaurants offering meal selections that are prepared onsite and in which customers generally order at a cash register or select items from a food bar and pay before they eat

MOST frequently occurring practice is _____[Drop-down 4]
LEAST frequently occurring practice is _____[Drop-down 4]

Q6. FAST-FOOD RESTAURANTS – Restaurants that do not provide table wait service and that offer a narrow menu of food items designed for quick preparation and carry out consumption

MOST frequently occurring practice is _____[Drop-down 4]
LEAST frequently occurring practice is _____[Drop-down 4]

Q7. TEMPORARY ESTABLISHMENTS – Food service establishments that operate at a fixed location for not more than 14 consecutive days in conjunction with a single event or celebration

MOST frequently occurring practice is _____[Drop-down 4]
LEAST frequently occurring practice is _____[Drop-down 4]

Q8. CHILDCARE CENTERS – A program, facility, or organization that provides care for infants and children; does not include home-based daycares

MOST frequently occurring practice is _____[Drop-down 4]
LEAST frequently occurring practice is _____[Drop-down 4]

Q9. HOSPITALS – Cafeterias within voluntary, proprietary, long-term general, tuberculosis, nervous and mental hospitals that prepare meals for patients and employees. This does not include restaurants located in hospitals

MOST frequently occurring practice is _____[Drop-down 4]
LEAST frequently occurring practice is _____[Drop-down 4]

Q10. SCHOOLS – Cafeterias within public and parochial elementary and secondary schools. This does not include cafeterias located on university or college campuses

MOST frequently occurring practice is _____[Drop-down 4]
LEAST frequently occurring practice is _____[Drop-down 4]

Q11. NURSING HOMES – Cafeterias within traditional nursing homes and assisted living centers

MOST frequently occurring practice is _____[Drop-down 4]
LEAST frequently occurring practice is _____[Drop-down 4]

Q12. Additional comments (if any) _____
_____

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Intro 2. For each of the following retail settings, please gauge the number of instances a given inappropriate food handling practice occurs out of 100,000 times. For example, if inappropriate hand washing occurs about half the time in GROCERY STORES, please enter “50,000” in the field corresponding to inappropriate hand washing under that retail category.

You will see the handling practices you previously identified as MOST and LEAST frequently occurring for each of the retail settings.

Q13. GROCERY STORES – Food preparation activities or handling of unpackaged food items, including seafood, meats, deli products, and ready-to-eat foods at retail food stores that sell a broad selection of grocery items, canned goods, and nonfood items plus some perishable items

MOST frequently occurring practice is [Piped in from Q1]
LEAST frequently occurring practice is [Piped in from Q1]

Inappropriate hand washing	_____ out of 100,000 hand washings
Inappropriate bare-hand contact with ready-to-eat foods	_____ out of 100,000 bare-hand contacts with ready-to-eat foods
Inappropriate gloved-hand contact with ready-to-eat foods	_____ out of 100,000 gloved-hand contacts with ready-to-eat foods
Inappropriate sanitation or cleaning of cutting boards or other cutting surfaces	_____ out of 100,000 cutting surface sanitations
Food handling by worker with a communicable disease	_____ out of 100,000 handlings by any worker
Inappropriate sanitation of equipment or utensils	_____ out of 100,000 equipment sanitations

Q14. CONVENIENCE STORES – Food preparation activities or handling of unpackaged food items, including seafood, meats, deli products, and ready-to-eat foods at small retail food stores that offer a limited selection of high-convenience items; open long hours to provide convenient access

MOST frequently occurring practice is [Piped in from Q2]
LEAST frequently occurring practice is [Piped in from Q2]

Inappropriate hand washing	_____ out of 100,000 hand washings
Inappropriate bare-hand contact with ready-to-eat foods	_____ out of 100,000 bare-hand contacts with ready-to-eat foods
Inappropriate gloved-hand contact with ready-to-eat foods	_____ out of 100,000 gloved-hand contacts with ready-to-eat foods
Inappropriate sanitation or cleaning of cutting boards or other cutting surfaces	_____ out of 100,000 cutting surface sanitations
Food handling by worker with a communicable disease	_____ out of 100,000 handlings by any worker
Inappropriate sanitation of equipment or utensils	_____ out of 100,000 equipment sanitations

Q15. SEAFOOD STORES – Retail stores that sell only seafood and other sundry items associated with preparation of seafood

MOST frequently occurring practice is [Piped in from Q3]
LEAST frequently occurring practice is [Piped in from Q3]

Inappropriate hand washing	_____ out of 100,000 hand washings
Inappropriate bare-hand contact with ready-to-eat foods	_____ out of 100,000 bare-hand contacts with ready-to-eat foods
Inappropriate gloved-hand contact with ready-to-eat foods	_____ out of 100,000 gloved-hand contacts with ready-to-eat foods
Inappropriate sanitation or cleaning of cutting boards or other cutting surfaces	_____ out of 100,000 cutting surface sanitations
Food handling by worker with a communicable disease	_____ out of 100,000 handlings by any worker
Inappropriate sanitation of equipment or utensils	_____ out of 100,000 equipment sanitations

Q16. FULL-SERVICE RESTAURANTS – Restaurants that provide table wait service and offer a menu of meal selections that are prepared onsite

MOST frequently occurring practice is [Piped in from Q4]
LEAST frequently occurring practice is [Piped in from Q4]

Inappropriate hand washing	_____ out of 100,000 hand washings

Inappropriate bare-hand contact with ready-to-eat foods	_____ out of 100,000 bare-hand contacts with ready-to-eat foods
Inappropriate gloved-hand contact with ready-to-eat foods	_____ out of 100,000 gloved-hand contacts with ready-to-eat foods
Inappropriate sanitation or cleaning of cutting boards or other cutting surfaces	_____ out of 100,000 cutting surface sanitations
Food handling by worker with a communicable disease	_____ out of 100,000 handlings by any worker
Inappropriate sanitation of equipment or utensils	_____ out of 100,000 equipment sanitations

Q17. MIXED-SERVICE RESTAURANTS – Restaurants offering meal selections that are prepared onsite and in which customers generally order at a cash register or select items from a food bar and pay before they eat

MOST frequently occurring practice is [Piped in from Q5]
LEAST frequently occurring practice is [Piped in from Q5]

Inappropriate hand washing	_____ out of 100,000 hand washings
Inappropriate bare-hand contact with ready-to-eat foods	_____ out of 100,000 bare-hand contacts with ready-to-eat foods
Inappropriate gloved-hand contact with ready-to-eat foods	_____ out of 100,000 gloved-hand contacts with ready-to-eat foods
Inappropriate sanitation or cleaning of cutting boards or other cutting surfaces	_____ out of 100,000 cutting surface sanitations
Food handling by worker with a communicable disease	_____ out of 100,000 handlings by any worker
Inappropriate sanitation of equipment or utensils	_____ out of 100,000 equipment sanitations

Q18. FAST-FOOD RESTAURANTS – Restaurants that do not provide table wait service and that offer a narrow menu of food items designed for quick preparation and carry out consumption

MOST frequently occurring practice is [Piped in from Q6]
LEAST frequently occurring practice is [Piped in from Q6]

Inappropriate hand washing	_____ out of 100,000 hand washings
Inappropriate bare-hand contact with ready-to-eat foods	_____ out of 100,000 bare-hand contacts with ready-to-eat foods
Inappropriate gloved-hand contact with ready-to-eat foods	_____ out of 100,000 gloved-hand contacts with ready-to-eat foods
Inappropriate sanitation or cleaning of cutting boards or other cutting surfaces	_____ out of 100,000 cutting surface sanitations
Food handling by worker with a communicable disease	_____ out of 100,000 handlings by any worker
Inappropriate sanitation of equipment or utensils	_____ out of 100,000 equipment sanitations

Q19. TEMPORARY ESTABLISHMENTS – Food service establishments that operate at a fixed location for not more than 14 consecutive days in conjunction with a single event or celebration

MOST frequently occurring practice is [Piped in from Q7]
LEAST frequently occurring practice is [Piped in from Q7]

Inappropriate hand washing	_____ out of 100,000 hand washings
Inappropriate bare-hand contact with ready-to-eat foods	_____ out of 100,000 bare-hand contacts with ready-to-eat foods
Inappropriate gloved-hand contact with ready-to-eat foods	_____ out of 100,000 gloved-hand contacts with ready-to-eat foods
Inappropriate sanitation or cleaning of cutting boards or other cutting surfaces	_____ out of 100,000 cutting surface sanitations
Food handling by worker with a communicable disease	_____ out of 100,000 handlings by any worker
Inappropriate sanitation of equipment or utensils	_____ out of 100,000 equipment sanitations

Q20. CHILDCARE CENTERS – A program, facility, or organization that provides care for infants and children; does not include home-based daycares

MOST frequently occurring practice is [Piped in from Q8]
LEAST frequently occurring practice is [Piped in from Q8]

Inappropriate hand washing	_____ out of 100,000 hand washings
Inappropriate bare-hand contact with ready-to-eat foods	_____ out of 100,000 bare-hand contacts with ready-to-eat foods
Inappropriate gloved-hand contact with ready-to-eat foods	_____ out of 100,000 gloved-hand contacts with ready-to-eat foods
Inappropriate sanitation or cleaning of cutting boards or other cutting surfaces	_____ out of 100,000 cutting surface sanitations
Food handling by worker with a communicable disease	_____ out of 100,000 handlings by any worker
Inappropriate sanitation of equipment or utensils	_____ out of 100,000 equipment sanitations

Q21. HOSPITALS – Cafeterias within voluntary, proprietary, long-term general, tuberculosis, nervous and mental hospitals that prepare meals for patients and employees. This does not include restaurants located in hospitals

MOST frequently occurring practice is [Piped in from Q9]
LEAST frequently occurring practice is [Piped in from Q9]

Inappropriate hand washing	_____ out of 100,000 hand washings
Inappropriate bare-hand contact with ready-to-eat foods	_____ out of 100,000 bare-hand contacts with ready-to-eat foods
Inappropriate gloved-hand contact with ready-to-eat foods	_____ out of 100,000 gloved-hand contacts with ready-to-eat foods
Inappropriate sanitation or cleaning of cutting boards or other cutting surfaces	_____ out of 100,000 cutting surface sanitations
Food handling by worker with a communicable disease	_____ out of 100,000 handlings by any worker
Inappropriate sanitation of equipment or utensils	_____ out of 100,000 equipment sanitations

Q22. SCHOOLS – Cafeterias within public and parochial elementary and secondary schools. This does not include cafeterias located on university or college campuses

MOST frequently occurring practice is [Piped in from Q10]
LEAST frequently occurring practice is [Piped in from Q10]

Inappropriate hand washing	_____ out of 100,000 hand washings
Inappropriate bare-hand contact with ready-to-eat foods	_____ out of 100,000 bare-hand contacts with ready-to-eat foods
Inappropriate gloved-hand contact with ready-to-eat foods	_____ out of 100,000 gloved-hand contacts with ready-to-eat foods
Inappropriate sanitation or cleaning of cutting boards or other cutting surfaces	_____ out of 100,000 cutting surface sanitations
Food handling by worker with a communicable disease	_____ out of 100,000 handlings by any worker
Inappropriate sanitation of equipment or utensils	_____ out of 100,000 equipment sanitations

Q23. NURSING HOMES – Cafeterias within traditional nursing homes and assisted living centers

MOST frequently occurring practice is [Piped in from Q11]
LEAST frequently occurring practice is [Piped in from Q11]

Inappropriate hand washing	_____ out of 100,000 hand washings
Inappropriate bare-hand contact with ready-to-eat foods	_____ out of 100,000 bare-hand contacts with ready-to-eat foods

Inappropriate gloved-hand contact with ready-to-eat foods	_____ out of 100,000 gloved-hand contacts with ready-to-eat foods
Inappropriate sanitation or cleaning of cutting boards or other cutting surfaces	_____ out of 100,000 cutting surface sanitations
Food handling by worker with a communicable disease	_____ out of 100,000 handlings by any worker
Inappropriate sanitation of equipment or utensils	_____ out of 100,000 equipment sanitations

Q24. Additional comments (if any) _____
_____

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Q25. Below is a summary of your responses to the question on the number of instances a given food handling practice occurs out of 100,000 times by type of retail setting. Please review your figures. If you would like to revise any of them, please use the "Previous Page" button to go back to the applicable question.

Food Handling Practice That Contributes to the Introduction of One or More Pathogens	**No. of Instances out of 100,000 the Practice Occurs**										
	Grocery Stores	**Convenience Stores**	**Seafood Stores**	**Full-service Restaurants**	**Mixed-service Restaurants**	**Fast-food Restaurants**	**Temporary Establishments**	**Childcare Centers**	**Hospitals**	**Schools**	**Nursing Homes**
Inappropriate hand washing											
Inappropriate bare-hand contact with **ready-to-eat** foods											
Inappropriate gloved-hand contact with **ready-to-eat** foods											
Inappropriate sanitation or cleaning of cutting boards or other cutting surfaces											
Food handling by a worker with a communicable disease											
Inappropriate sanitation of equipment or utensils											

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We now would like you to focus on conditional probabilities. We will ask you to gauge the probability that one or more pathogens are introduced into a serving of food in quantities sufficient to cause foodborne illness GIVEN the occurrence of a specific food handling practice that contributes to pathogen introduction.

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Intro 3. For each of the following retail settings, please gauge the number of instances out of 100,000 that one or more pathogens will be introduced into a serving of food in quantities sufficient to cause foodborne illness GIVEN the occurrence of a specific inappropriate food handling practice. For example, if one or more pathogens will be introduced in quantities sufficient to cause foodborne illness in 25,000 out of 100,000 servings prepared, given that inappropriate hand washing has occurred in GROCERY STORES, please enter "25,000" in the field corresponding to inappropriate hand washing under that retail category.

Q26. GROCERY STORES – Food preparation activities or handling of unpackaged food items, including seafood, meats, deli products, and ready-to-eat foods at retail food stores that sell a broad selection of grocery items, canned goods, and nonfood items plus some perishable items

One or more pathogens are introduced into a serving of food in quantities sufficient to cause foodborne illness GIVEN THAT

Inappropriate hand washing occurred	_____ out of 100,000 inappropriate hand washings
Inappropriate bare-hand contact with **ready-to-eat** foods occurred	_____ out of 100,000 inappropriate bare-hand contacts with ready-to-eat foods
Inappropriate gloved-hand contact with **ready-to-eat** foods occurred	_____ out of 100,000 inappropriate gloved-hand contacts with **ready-to-eat** foods
Inappropriate sanitation/cleaning of cutting surfaces occurred	_____ out of 100,000 inappropriate cutting surface sanitations
Food handling by a worker with a communicable disease occurred	_____ out of 100,000 handlings by a worker with a communicable disease
Inappropriate sanitation of equipment or utensils occurred	_____ out of 100,000 inappropriate equipment sanitations

Q27. CONVENIENCE STORES – Food preparation activities or handling of unpackaged food items, including seafood, meats, deli products, and ready-to-eat foods at small retail food stores that offer a limited selection of high-convenience items; open long hours to provide convenient access

One or more pathogens are introduced into a serving of food in quantities sufficient to cause foodborne illness GIVEN THAT

Inappropriate hand washing occurred	_____ out of 100,000 inappropriate hand washings
Inappropriate bare-hand contact with **ready-to-eat** foods occurred	_____ out of 100,000 inappropriate bare-hand contacts with ready-to-eat foods
Inappropriate gloved-hand contact with **ready-to-eat** foods occurred	_____ out of 100,000 inappropriate gloved-hand contacts with **ready-to-eat** foods
Inappropriate sanitation/cleaning of cutting surfaces occurred	_____ out of 100,000 inappropriate cutting surface sanitations
Food handling by a worker with a communicable disease occurred	_____ out of 100,000 handlings by a worker with a communicable disease
Inappropriate sanitation of equipment or utensils occurred	_____ out of 100,000 inappropriate equipment sanitations

Q28. SEAFOOD STORES – Retail stores that sell only seafood and other sundry items associated with preparation of seafood

One or more pathogens are introduced into a serving of food in quantities sufficient to cause foodborne illness GIVEN THAT

Inappropriate hand washing occurred	_____ out of 100,000 inappropriate hand washings
Inappropriate bare-hand contact with **ready-to-eat** foods occurred	_____ out of 100,000 inappropriate bare-hand contacts with ready-to-eat foods
Inappropriate gloved-hand contact with **ready-to-eat** foods occurred	_____ out of 100,000 inappropriate gloved-hand contacts with **ready-to-eat** foods
Inappropriate sanitation/cleaning of cutting surfaces occurred	_____ out of 100,000 inappropriate cutting surface sanitations
Food handling by a worker with a communicable disease occurred	_____ out of 100,000 handlings by a worker with a communicable disease
Inappropriate sanitation of equipment or utensils occurred	_____ out of 100,000 inappropriate equipment sanitations

Q29. FULL-SERVICE RESTAURANTS – Restaurants that provide table wait service and offer a menu of meal selections that are prepared onsite

One or more pathogens are introduced into a serving of food in quantities sufficient to cause foodborne illness GIVEN THAT

Inappropriate hand washing occurred	_____ out of 100,000 inappropriate hand washings
Inappropriate bare-hand contact with **ready-to-eat** foods occurred	_____ out of 100,000 inappropriate bare-hand contacts with ready-to-eat foods
Inappropriate gloved-hand contact with **ready-to-eat** foods occurred	_____ out of 100,000 inappropriate gloved-hand contacts with **ready-to-eat** foods
Inappropriate sanitation/cleaning of cutting surfaces occurred	_____ out of 100,000 inappropriate cutting surface sanitations
Food handling by a worker with a communicable disease occurred	_____ out of 100,000 handlings by a worker with a communicable disease
Inappropriate sanitation of equipment or utensils occurred	_____ out of 100,000 inappropriate equipment sanitations

Q30. MIXED-SERVICE RESTAURANTS – Restaurants offering meal selections that are prepared onsite and in which customers generally order at a cash register or select items from a food bar and pay before they eat

One or more pathogens are introduced into a serving of food in quantities sufficient to cause foodborne illness GIVEN THAT

Inappropriate hand washing occurred	_____ out of 100,000 inappropriate hand washings
Inappropriate bare-hand contact with **ready-to-eat** foods occurred	_____ out of 100,000 inappropriate bare-hand contacts with ready-to-eat foods
Inappropriate gloved-hand contact with **ready-to-eat** foods occurred	_____ out of 100,000 inappropriate gloved-hand contacts with **ready-to-eat** foods
Inappropriate sanitation/cleaning of cutting surfaces occurred	_____ out of 100,000 inappropriate cutting surface sanitations
Food handling by a worker with a communicable disease occurred	_____ out of 100,000 handlings by a worker with a communicable disease
Inappropriate sanitation of equipment or utensils occurred	_____ out of 100,000 inappropriate equipment sanitations

Q31. FAST-FOOD RESTAURANTS – Restaurants that do not provide table wait service and that offer a narrow menu of food items designed for quick preparation and carry out consumption

One or more pathogens are introduced into a serving of food in quantities sufficient to cause foodborne illness GIVEN THAT

Inappropriate hand washing occurred	_____ out of 100,000 inappropriate hand washings
Inappropriate bare-hand contact with **ready-to-eat** foods occurred	_____ out of 100,000 inappropriate bare-hand contacts with ready-to-eat foods
Inappropriate gloved-hand contact with **ready-to-eat** foods occurred	_____ out of 100,000 inappropriate gloved-hand contacts with **ready-to-eat** foods
Inappropriate sanitation/cleaning of cutting surfaces occurred	_____ out of 100,000 inappropriate cutting surface sanitations
Food handling by a worker with a communicable disease occurred	_____ out of 100,000 handlings by a worker with a communicable disease
Inappropriate sanitation of equipment or utensils occurred	_____ out of 100,000 inappropriate equipment sanitations

Q32. TEMPORARY ESTABLISHMENTS – Food service establishments that operate at a fixed location for not more than 14 consecutive days in conjunction with a single event or celebration

One or more pathogens are introduced into a serving of food in quantities sufficient to cause foodborne illness GIVEN THAT

Inappropriate hand washing occurred	_____ out of 100,000 inappropriate hand washings
Inappropriate bare-hand contact with **ready-to-eat** foods occurred	_____ out of 100,000 inappropriate bare-hand contacts with ready-to-eat foods
Inappropriate gloved-hand contact with **ready-to-eat** foods occurred	_____ out of 100,000 inappropriate gloved-hand contacts with **ready-to-eat** foods
Inappropriate sanitation/cleaning of cutting surfaces occurred	_____ out of 100,000 inappropriate cutting surface sanitations
Food handling by a worker with a communicable disease occurred	_____ out of 100,000 handlings by a worker with a communicable disease
Inappropriate sanitation of equipment or utensils occurred	_____ out of 100,000 inappropriate equipment sanitations

Q33. CHILDCARE CENTERS – A program, facility, or organization that provides care for infants and children; does not include home-based daycares

One or more pathogens are introduced into a serving of food in quantities sufficient to cause foodborne illness GIVEN THAT

Inappropriate hand washing occurred	_____ out of 100,000 inappropriate hand washings
Inappropriate bare-hand contact with **ready-to-eat** foods occurred	_____ out of 100,000 inappropriate bare-hand contacts with ready-to-eat foods
Inappropriate gloved-hand contact with **ready-to-eat** foods occurred	_____ out of 100,000 inappropriate gloved-hand contacts with **ready-to-eat** foods
Inappropriate sanitation/cleaning of cutting surfaces occurred	_____ out of 100,000 inappropriate cutting surface sanitations
Food handling by a worker with a communicable disease occurred	_____ out of 100,000 handlings by a worker with a communicable disease
Inappropriate sanitation of equipment or utensils occurred	_____ out of 100,000 inappropriate equipment sanitations

Q34. HOSPITALS – Cafeterias within voluntary, proprietary, long-term general, tuberculosis, nervous and mental hospitals that prepare meals for patients and employees. This does not include restaurants located in hospitals

One or more pathogens are introduced into a serving of food in quantities sufficient to cause foodborne illness GIVEN THAT

Inappropriate hand washing occurred	_____ out of 100,000 inappropriate hand washings
Inappropriate bare-hand contact with **ready-to-eat** foods occurred	_____ out of 100,000 inappropriate bare-hand contacts with ready-to-eat foods
Inappropriate gloved-hand contact with **ready-to-eat** foods occurred	_____ out of 100,000 inappropriate gloved-hand contacts with **ready-to-eat** foods
Inappropriate sanitation/cleaning of cutting surfaces occurred	_____ out of 100,000 inappropriate cutting surface sanitations
Food handling by a worker with a communicable disease occurred	_____ out of 100,000 handlings by a worker with a communicable disease
Inappropriate sanitation of equipment or utensils occurred	_____ out of 100,000 inappropriate equipment sanitations

Q35. SCHOOLS – Cafeterias within public and parochial elementary and secondary schools. This does not include cafeterias located on university or college campuses

One or more pathogens are introduced into a serving of food in quantities sufficient to cause foodborne illness GIVEN THAT

Inappropriate hand washing occurred	_____ out of 100,000 inappropriate hand washings
Inappropriate bare-hand contact with **ready-to-eat** foods occurred	_____ out of 100,000 inappropriate bare-hand contacts with ready-to-eat foods
Inappropriate gloved-hand contact with **ready-to-eat** foods occurred	_____ out of 100,000 inappropriate gloved-hand contacts with **ready-to-eat** foods
Inappropriate sanitation/cleaning of cutting surfaces occurred	_____ out of 100,000 inappropriate cutting surface sanitations
Food handling by a worker with a communicable disease occurred	_____ out of 100,000 handlings by a worker with a communicable disease
Inappropriate sanitation of equipment or utensils occurred	_____ out of 100,000 inappropriate equipment sanitations

Q36. NURSING HOMES – Cafeterias within traditional nursing homes and assisted living centers

One or more pathogens are introduced into a serving of food in quantities sufficient to cause foodborne illness GIVEN THAT

Inappropriate hand washing occurred	_____ out of 100,000 inappropriate hand washings
Inappropriate bare-hand contact with **ready-to-eat** foods occurred	_____ out of 100,000 inappropriate bare-hand contacts with ready-to-eat foods
Inappropriate gloved-hand contact with **ready-to-eat** foods occurred	_____ out of 100,000 inappropriate gloved-hand contacts with **ready-to-eat** foods
Inappropriate sanitation/cleaning of cutting surfaces occurred	_____ out of 100,000 inappropriate cutting surface sanitations
Food handling by a worker with a communicable disease occurred	_____ out of 100,000 handlings by a worker with a communicable disease
Inappropriate sanitation of equipment or utensils occurred	_____ out of 100,000 inappropriate equipment sanitations

Q37. Additional comments (if any) _____
_____

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Q38. Below is a summary of your responses to the question on the number of instances out of 100,000 one or more pathogens are introduced into a serving of food in quantities sufficient to cause foodborne illness GIVEN that an inappropriate food handling practice occurred by type of retail setting. Please review your figures. If you would like to revise any of them, please use the “Previous Page” button to go back to the applicable question.

Occurrence of a Food Handling Practice That Contributes to the Introduction of One or More Pathogens into a Serving of Food	No. of Times out of 100,000, One or More Pathogens are Introduced into a Serving of Food in Quantities Sufficient to Cause Foodborne Illness										
	Grocery Stores	Convenience Stores	Seafood Stores	Full-service Restaurants	Mixed-service Restaurants	Fast-food Restaurants	Temporary Establishments	Childcare Centers	Hospitals	Schools	Nursing Homes
Inappropriate hand washing											
Inappropriate bare-hand contact with **ready-to-eat** foods											
Inappropriate gloved-hand contact with **ready-to-eat** foods											
Inappropriate sanitation or cleaning of cutting boards or other cutting surfaces											
Food handling by a worker with a communicable disease											
Inappropriate sanitation of equipment or utensils											

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Pathogen Survival or Growth

We will now ask you to gauge the frequency of various inappropriate food handling practices that contribute to pathogen survival or growth in different types of retail settings. Next, we will ask you to gauge the frequency of pathogen survival or growth in food GIVEN that an inappropriate food handling practice has occurred. As in the previous section, the first set of questions, which relate to the frequency of inappropriate practices, will likely have higher probabilities than the second set of questions, which relate to the frequency of pathogen survival or growth due to the occurrence of an inappropriate handling practice.

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Intro 4. Now, we would like you to focus on those food handling practices that contribute to pathogen survival or growth. For each of the following types of retail settings, please indicate the MOST and LEAST frequently occurring food handling practices that contribute to pathogen survival or growth. On the following page, you will have the opportunity to estimate the frequency of each practice. Please note that some of the inappropriate handling practices listed below relate to pathogen survival while others relate to growth. When considering the most and least frequently occurring practice please consider both types of practices together.

Q39. GROCERY STORES – Food preparation activities or handling of unpackaged food items, including seafood, meats, deli products, and ready-to-eat foods at retail food stores that sell a broad selection of grocery items, canned goods, and nonfood items plus some perishable items

MOST frequently occurring practice is _____[Drop-down 2]
LEAST frequently occurring practice is _____[Drop-down 2]

Q40. CONVENIENCE STORES – Food preparation activities or handling of unpackaged food items, including seafood, meats, deli products, and ready-to-eat foods at small retail food stores that offer a limited selection of high-convenience items; open long hours to provide convenient access

MOST frequently occurring practice is _____[Drop-down 2]
LEAST frequently occurring practice is _____[Drop-down 2]

Q41. SEAFOOD STORES – Retail stores that sell only seafood and other sundry items associated with preparation of seafood

MOST frequently occurring practice is _____[Drop-down 2]
LEAST frequently occurring practice is _____[Drop-down 2]

Q42. FULL-SERVICE RESTAURANTS – Restaurants that provide table wait service and offer a menu of meal selections that are prepared onsite

MOST frequently occurring practice is _____[Drop-down 2]
LEAST frequently occurring practice is _____[Drop-down 2]

Q43. MIXED-SERVICE RESTAURANTS – Restaurants offering meal selections that are prepared onsite and in which customers generally order at a cash register or select items from a food bar and pay before they eat

MOST frequently occurring practice is _____[Drop-down 2]
LEAST frequently occurring practice is _____[Drop-down 2]

Q44. FAST-FOOD RESTAURANTS – Restaurants that do not provide table wait service and that offer a narrow menu of food items designed for quick preparation and carry out consumption

MOST frequently occurring practice is _____[Drop-down 2]
LEAST frequently occurring practice is _____[Drop-down 2]

Q45. TEMPORARY ESTABLISHMENTS – Food service establishments that operate at a fixed location for not more than 14 consecutive days in conjunction with a single event or celebration

MOST frequently occurring practice is _____[Drop-down 2]
LEAST frequently occurring practice is _____[Drop-down 2]

Q46. CHILDCARE CENTERS – A program, facility, or organization that provides care for infants and children; does not include home-based daycares

MOST frequently occurring practice is _____[Drop-down 2]
LEAST frequently occurring practice is _____[Drop-down 2]

Q47. HOSPITALS – Cafeterias within voluntary, proprietary, long-term general, tuberculosis, nervous and mental hospitals that prepare meals for patients and employees. This does not include restaurants located in hospitals

MOST frequently occurring practice is _____[Drop-down 2]
LEAST frequently occurring practice is _____[Drop-down 2]

Q48. SCHOOLS – Cafeterias within public and parochial elementary and secondary schools. This does not include cafeterias located on university or college campuses

MOST frequently occurring practice is _____[Drop-down 2]
LEAST frequently occurring practice is _____[Drop-down 2]

Q49. NURSING HOMES – Cafeterias within traditional nursing homes and assisted living centers

MOST frequently occurring practice is _____[Drop-down 2]
LEAST frequently occurring practice is _____[Drop-down 2]

Q50. Additional comments (if any) _____
_____

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Intro 5. For each of the following retail settings, please gauge the number of instances a given food handling practice occurs out of 100,000 times. For example, if inappropriate time or temperature for cooking occurs about half the time in GROCERY STORES, please enter "50,000" in the field corresponding to inappropriate time or temperature for cooking under that retail category.

You will see the handling practices you previously identified as MOST and LEAST frequently occurring for each of the retail settings.

Q51. GROCERY STORES – Food preparation activities or handling of unpackaged food items, including seafood, meats, deli products, and ready-to-eat foods at retail food stores that sell a broad selection of grocery items, canned goods, and nonfood items plus some perishable items

MOST frequently occurring practice is [Piped in from Q39]
LEAST frequently occurring practice is [Piped in from Q39]

Inappropriate time or temperature for cooking	_____ out of 100,000 instances of cooking
Inappropriate time or temperature for reheating	_____ out of 100,000 instances of reheating
Inappropriate time or temperature for cooling	_____ out of 100,000 instances of cooling
Inappropriate time or temperature for cold holding	_____ out of 100,000 instances of cold holding
Inappropriate advance preparation	_____ out of 100,000 instances of advance preparation
Inappropriate time or temperature for hot holding	_____ out of 100,000 instances of hot holding
Food kept at room temperature too long	_____ out of 100,000 instances of food kept at room temperature
Inappropriate thawing of frozen foods	_____ out of 100,000 instances of thawing of frozen foods
Food served raw or lightly cooked	_____ out of 100,000 instances of cooking food to prevent pathogen survival or growth

Q52. CONVENIENCE STORES – Food preparation activities or handling of unpackaged food items, including seafood, meats, deli products, and ready-to-eat foods at small retail food stores that offer a limited selection of high-convenience items; open long hours to provide convenient access

MOST frequently occurring practice is [Piped in from Q40]
LEAST frequently occurring practice is [Piped in from Q40]

Inappropriate time or temperature for cooking	_____ out of 100,000 instances of cooking
Inappropriate time or temperature for reheating	_____ out of 100,000 instances of reheating
Inappropriate time or temperature for cooling	_____ out of 100,000 instances of cooling
Inappropriate time or temperature for cold holding	_____ out of 100,000 instances of cold holding
Inappropriate advance preparation	_____ out of 100,000 instances of advance preparation
Inappropriate time or temperature for hot holding	_____ out of 100,000 instances of hot holding
Food kept at room temperature too long	_____ out of 100,000 instances of food kept at room temperature
Inappropriate thawing of frozen foods	_____ out of 100,000 instances of thawing of frozen foods
Food served raw or lightly cooked	_____ out of 100,000 instances of cooking food to prevent pathogen survival or growth

Q53. SEAFOOD STORES – Retail stores that sell only seafood and other sundry items associated with preparation of seafood

MOST frequently occurring practice is [Piped in from Q41]
LEAST frequently occurring practice is [Piped in from Q41]

Inappropriate time or temperature for cooking	_____ out of 100,000 instances of cooking
Inappropriate time or temperature for reheating	_____ out of 100,000 instances of reheating
Inappropriate time or temperature for cooling	_____ out of 100,000 instances of cooling
Inappropriate time or temperature for cold holding	_____ out of 100,000 instances of cold holding
Inappropriate advance preparation	_____ out of 100,000 instances of advance preparation
Inappropriate time or temperature for hot holding	_____ out of 100,000 instances of hot holding
Food kept at room temperature too long	_____ out of 100,000 instances of food kept at room temperature
Inappropriate thawing of frozen foods	_____ out of 100,000 instances of thawing of frozen foods
Food served raw or lightly cooked	_____ out of 100,000 instances of cooking food to prevent pathogen survival or growth

Q54. FULL-SERVICE RESTAURANTS – Restaurants that provide table wait service and offer a menu of meal selections that are prepared onsite

MOST frequently occurring practice is [Piped in from Q42]
LEAST frequently occurring practice is [Piped in from Q42]

Inappropriate time or temperature for cooking	_____ out of 100,000 instances of cooking
Inappropriate time or temperature for reheating	_____ out of 100,000 instances of reheating
Inappropriate time or temperature for cooling	_____ out of 100,000 instances of cooling
Inappropriate time or temperature for cold holding	_____ out of 100,000 instances of cold holding
Inappropriate advance preparation	_____ out of 100,000 instances of advance preparation
Inappropriate time or temperature for hot holding	_____ out of 100,000 instances of hot holding
Food kept at room temperature too long	_____ out of 100,000 instances of food kept at room temperature
Inappropriate thawing of frozen foods	_____ out of 100,000 instances of thawing of frozen foods
Food served raw or lightly cooked	_____ out of 100,000 instances of cooking food to prevent pathogen survival or growth

Q55. MIXED-SERVICE RESTAURANTS – Restaurants offering meal selections that are prepared onsite and in which customers generally order at a cash register or select items from a food bar and pay before they eat

MOST frequently occurring practice is [Piped in from Q43]
LEAST frequently occurring practice is [Piped in from Q43]

Inappropriate time or temperature for cooking	_____ out of 100,000 instances of cooking
Inappropriate time or temperature for reheating	_____ out of 100,000 instances of reheating
Inappropriate time or temperature for cooling	_____ out of 100,000 instances of cooling
Inappropriate time or temperature for cold holding	_____ out of 100,000 instances of cold holding
Inappropriate advance preparation	_____ out of 100,000 instances of advance preparation
Inappropriate time or temperature for hot holding	_____ out of 100,000 instances of hot holding
Food kept at room temperature too long	_____ out of 100,000 instances of food kept at room temperature
Inappropriate thawing of frozen foods	_____ out of 100,000 instances of thawing of frozen foods
Food served raw or lightly cooked	_____ out of 100,000 instances of cooking food to prevent pathogen survival or growth

Q56. FAST-FOOD RESTAURANTS – Restaurants that do not provide table wait service and that offer a narrow menu of food items designed for quick preparation and carry out consumption

MOST frequently occurring practice is [Piped in from Q44]
LEAST frequently occurring practice is [Piped in from Q44]

Inappropriate time or temperature for cooking	_____ out of 100,000 instances of cooking
Inappropriate time or temperature for reheating	_____ out of 100,000 instances of reheating
Inappropriate time or temperature for cooling	_____ out of 100,000 instances of cooling
Inappropriate time or temperature for cold holding	_____ out of 100,000 instances of cold holding
Inappropriate advance preparation	_____ out of 100,000 instances of advance preparation
Inappropriate time or temperature for hot holding	_____ out of 100,000 instances of hot holding
Food kept at room temperature too long	_____ out of 100,000 instances of food kept at room temperature
Inappropriate thawing of frozen foods	_____ out of 100,000 instances of thawing of frozen foods
Food served raw or lightly cooked	_____ out of 100,000 instances of cooking food to prevent pathogen survival or growth

Q57. TEMPORARY ESTABLISHMENTS – Food service establishments that operate at a fixed location for not more than 14 consecutive days in conjunction with a single event or celebration

MOST frequently occurring practice is [Piped in from Q45]
LEAST frequently occurring practice is [Piped in from Q45]

Inappropriate time or temperature for cooking	_____ out of 100,000 instances of cooking
Inappropriate time or temperature for reheating	_____ out of 100,000 instances of reheating
Inappropriate time or temperature for cooling	_____ out of 100,000 instances of cooling
Inappropriate time or temperature for cold holding	_____ out of 100,000 instances of cold holding
Inappropriate advance preparation	_____ out of 100,000 instances of advance preparation
Inappropriate time or temperature for hot holding	_____ out of 100,000 instances of hot holding
Food kept at room temperature too long	_____ out of 100,000 instances of food kept at room temperature
Inappropriate thawing of frozen foods	_____ out of 100,000 instances of thawing of frozen foods
Food served raw or lightly cooked	_____ out of 100,000 instances of cooking food to prevent pathogen survival or growth

Q58. CHILDCARE CENTERS – A program, facility, or organization that provides care for infants and children; does not include home-based daycares

MOST frequently occurring practice is [Piped in from Q46]
LEAST frequently occurring practice is [Piped in from Q46]

Inappropriate time or temperature for cooking	_____ out of 100,000 instances of cooking
Inappropriate time or temperature for reheating	_____ out of 100,000 instances of reheating
Inappropriate time or temperature for cooling	_____ out of 100,000 instances of cooling
Inappropriate time or temperature for cold holding	_____ out of 100,000 instances of cold holding
Inappropriate advance preparation	_____ out of 100,000 instances of advance preparation
Inappropriate time or temperature for hot holding	_____ out of 100,000 instances of hot holding
Food kept at room temperature too long	_____ out of 100,000 instances of food kept at room temperature

Inappropriate thawing of frozen foods	_____ out of 100,000 instances of thawing of frozen foods
Food served raw or lightly cooked	_____ out of 100,000 instances of cooking food to prevent pathogen survival or growth

Q59. HOSPITALS – Cafeterias within voluntary, proprietary, long-term general, tuberculosis, nervous and mental hospitals that prepare meals for patients and employees. This does not include restaurants located in hospitals

MOST frequently occurring practice is [Piped in from Q47]
LEAST frequently occurring practice is [Piped in from Q47]

Inappropriate time or temperature for cooking	_____ out of 100,000 instances of cooking
Inappropriate time or temperature for reheating	_____ out of 100,000 instances of reheating
Inappropriate time or temperature for cooling	_____ out of 100,000 instances of cooling
Inappropriate time or temperature for cold holding	_____ out of 100,000 instances of cold holding
Inappropriate advance preparation	_____ out of 100,000 instances of advance preparation
Inappropriate time or temperature for hot holding	_____ out of 100,000 instances of hot holding
Food kept at room temperature too long	_____ out of 100,000 instances of food kept at room temperature
Inappropriate thawing of frozen foods	_____ out of 100,000 instances of thawing of frozen foods
Food served raw or lightly cooked	_____ out of 100,000 instances of cooking food to prevent pathogen survival or growth

Q60. SCHOOLS – Cafeterias within public and parochial elementary and secondary schools. This does not include cafeterias located on university or college campuses

MOST frequently occurring practice is [Piped in from Q48]
LEAST frequently occurring practice is [Piped in from Q48]

Inappropriate time or temperature for cooking	_____ out of 100,000 instances of cooking
Inappropriate time or temperature for reheating	_____ out of 100,000 instances of reheating
Inappropriate time or temperature for cooling	_____ out of 100,000 instances of cooling
Inappropriate time or temperature for cold holding	_____ out of 100,000 instances of cold holding
Inappropriate advance preparation	_____ out of 100,000 instances of advance preparation
Inappropriate time or temperature for hot holding	_____ out of 100,000 instances of hot holding
Food kept at room temperature too long	_____ out of 100,000 instances of food kept at room temperature
Inappropriate thawing of frozen foods	_____ out of 100,000 instances of thawing of frozen foods
Food served raw or lightly cooked	_____ out of 100,000 instances of cooking food to prevent pathogen survival or growth

Q61. NURSING HOMES – Cafeterias within traditional nursing homes and assisted living centers

MOST frequently occurring practice is [Piped in from Q49]
LEAST frequently occurring practice is [Piped in from Q49]

Inappropriate time or temperature for cooking	_____ out of 100,000 instances of cooking
Inappropriate time or temperature for reheating	_____ out of 100,000 instances of reheating
Inappropriate time or temperature for cooling	_____ out of 100,000 instances of cooling
Inappropriate time or temperature for cold holding	_____ out of 100,000 instances of cold holding
Inappropriate advance preparation	_____ out of 100,000 instances of advance preparation
Inappropriate time or temperature for hot holding	_____ out of 100,000 instances of hot holding

Food kept at room temperature too long _____ out of 100,000 instances of food kept at room temperature
Inappropriate thawing of frozen foods _____ out of 100,000 instances of thawing of frozen foods
Food served raw or lightly cooked _____ out of 100,000 instances of cooking food to prevent pathogen survival or growth

Q62. Additional comments (if any) _____
_____

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Q63. Below is a summary of your responses to the question on the number of instances a given food handling practice occurs out of 100,000 times, by type of retail setting. Please review your figures. If you would like to revise any of them, please use the "Previous Page" button to go back to the applicable question.

Food Handling Practice That Contributes to Pathogen Survival or Growth	No. of Instances out of 100,000 the Practice Occurs										
	Grocery Stores	Convenience Stores	Seafood Stores	Full-service Restaurants	Mixed-service Restaurants	Fast-food Restaurants	Temporary Establishments	Childcare Centers	Hospitals	Schools	Nursing Homes
Inappropriate time or temperature for cooking											
Inappropriate time or temperature for reheating											
Inappropriate time or temperature for cooling											
Inappropriate time or temperature for cold holding											
Inappropriate advance preparation											
Inappropriate time or temperature for hot holding											
Food kept at room temperature too long											
Inappropriate thawing of frozen foods											
Food served raw or lightly cooked											

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Intro 6. Because pathogen survival or growth resulting from inappropriate food handling is dependent on the type of food being handled, we now would like you to focus on the food categories used in the FDA model. Please indicate the food categories that are at HIGHEST and LOWEST risk of pathogen survival or growth in quantities sufficient to cause foodborne illness due to the handling practices listed below, given the prior introduction of one or more pathogens. Please do not take into account the likelihood that contamination has been introduced On the following page, we will ask you to gauge the probability that one or more pathogens will survive or grow in quantities sufficient to cause foodborne illness in the food categories you designated as HIGHEST and LOWEST risk, given the occurrence of an inappropriate food practice.

Q64. Inappropriate time or temperature for cooking

Food category at HIGHEST risk for pathogen survival or growth is _____[Drop-down 3]
Food category at LOWEST risk for pathogen survival or growth is _____[Drop-down 3]

Q65. Inappropriate time or temperature for reheating

Food category at HIGHEST risk for pathogen survival or growth is _____[Drop-down 3]
Food category at LOWEST risk for pathogen survival or growth is _____[Drop-down 3]

Q66. Inappropriate time or temperature for cooling

Food category at HIGHEST risk for pathogen survival or growth is _____[Drop-down 3]
Food category at LOWEST risk for pathogen survival or growth is _____[Drop-down 3]

Q67. Inappropriate time or temperature for cold holding

Food category at HIGHEST risk for pathogen survival or growth is _____[Drop-down 3]
Food category at LOWEST risk for pathogen survival or growth is _____[Drop-down 3]

Q68. Inappropriate advance preparation

Food category at HIGHEST risk for pathogen survival or growth is _____[Drop-down 3]
Food category at LOWEST risk for pathogen survival or growth is _____[Drop-down 3]

Q69. Inappropriate time or temperature for hot holding

Food category at HIGHEST risk for pathogen survival or growth is _____[Drop-down 3]
Food category at LOWEST risk for pathogen survival or growth is _____[Drop-down 3]

Q70. Food kept at room temperature too long

Food category at HIGHEST risk for pathogen survival or growth is _____[Drop-down 3]
Food category at LOWEST risk for pathogen survival or growth is _____[Drop-down 3]

Q71. Inappropriate thawing of frozen foods

Food category at HIGHEST risk for pathogen survival or growth is _____[Drop-down 3]
Food category at LOWEST risk for pathogen survival or growth is _____[Drop-down 3]

Q72. Food served raw or lightly cooked

Food category at HIGHEST risk for pathogen survival or growth is _____[Drop-down 3]
Food category at LOWEST risk for pathogen survival or growth is _____[Drop-down 3]

Q73. Additional comments (if any) _____
_____

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We again would like you to focus on conditional probabilities. We will ask you to gauge the probability that one or more pathogens survive or grow in a serving of food GIVEN the occurrence of a specific food handling practice that contributes to pathogen survival or growth.

Although the probability that a pathogen will survive or grow in a serving of food may depend on the type of pathogen, we will not ask you to distinguish between pathogens when making your determinations.

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Intro 7. For each of the following retail settings, please gauge the number of instances out of 100,000 that one or more pathogens will survive and grow in a serving of food GIVEN the occurrence of a specific inappropriate food handling practice, for each the food categories that you previously identified as most and least at risk. For example, for GROCERY STORES, if one or more pathogens will survive and grow in 25,000 out of 100,000 servings prepared using a given inappropriate handling practice for the food category you identified as highest risk and 1,000 out of 100,000 for the category you identified as lowest risk, please enter "25,000" next to HIGH and 1,000 next to LOW in the field corresponding to the specific practice under that retail category.

Below are the food categories you identified as the highest and lowest risks for pathogen survival or growth in Round 1, by handling practice. Please keep these in mind in responding to the following questions.

Food Handling Practice That Contributes to Pathogen Survival or Growth	**Food Category At Lowest and Highest Risk for Pathogen Survival or Growth**	
	Low	**High**
Inappropriate time or temperature for cooking		
Inappropriate time or temperature for reheating		
Inappropriate time or temperature for cooling		
Inappropriate time or temperature for cold holding		
Inappropriate advance preparation		
Inappropriate time or temperature for hot holding		
Food kept at room temperature too long		
Inappropriate thawing of frozen foods		
Food served raw or lightly cooked		

Q74. GROCERY STORES – Food preparation activities or handling of unpackaged food items, including seafood, meats, deli products, and ready-to-eat foods at retail food stores that sell a broad selection of grocery items, canned goods, and nonfood items plus some perishable items

One or more pathogens survive or grow to levels sufficient to cause foodborne illness in a serving of food GIVEN THAT

Inappropriate time or temperature for cooking occurred	LOW_____ out of 100,000	HIGH _____ out of 100,000 occurrences
Inappropriate time or temperature for reheating occurred	LOW_____ out of 100,000	HIGH _____ out of 100,000 occurrences
Inappropriate time or temperature for cooling occurred	LOW_____ out of 100,000	HIGH _____ out of 100,000 occurrences
Inappropriate time or temperature for cold holding occurred	LOW_____ out of 100,000	HIGH _____ out of 100,000 occurrences
Inappropriate advance preparation occurred	LOW_____ out of 100,000	HIGH _____ out of 100,000 occurrences
Inappropriate time or temperature for hot holding occurred	LOW_____ out of 100,000	HIGH _____ out of 100,000 occurrences
Food kept at room temperature too long occurred	LOW_____ out of 100,000	HIGH _____ out of 100,000 occurrences
Inappropriate thawing of frozen foods occurred	LOW_____ out of 100,000	HIGH _____ out of 100,000 occurrences
Food served raw or lightly cooked occurred	LOW_____ out of 100,000	HIGH _____ out of 100,000 occurrences

Q75. CONVENIENCE STORES – Food preparation activities or handling of unpackaged food items, including seafood, meats, deli products, and ready-to-eat foods at small retail food stores that offer a limited selection of high-convenience items; open long hours to provide convenient access

One or more pathogens survive or grow to levels sufficient to cause foodborne illness in a serving of food GIVEN THAT

Inappropriate time or temperature for cooking occurred	LOW_____ out of 100,000 occurrences	HIGH _____ out of 100,000 occurrences
Inappropriate time or temperature for reheating occurred	LOW_____ out of 100,000 occurrences	HIGH _____ out of 100,000 occurrences
Inappropriate time or temperature for cooling occurred	LOW_____ out of 100,000 occurrences	HIGH _____ out of 100,000 occurrences
Inappropriate time or temperature for cold holding occurred	LOW_____ out of 100,000 occurrences	HIGH _____ out of 100,000 occurrences
Inappropriate advance preparation occurred	LOW_____ out of 100,000 occurrences	HIGH _____ out of 100,000 occurrences
Inappropriate time or temperature for hot holding occurred	LOW_____ out of 100,000 occurrences	HIGH _____ out of 100,000 occurrences
Food kept at room temperature too long occurred	LOW_____ out of 100,000 occurrences	HIGH _____ out of 100,000 occurrences
Inappropriate thawing of frozen foods occurred	LOW_____ out of 100,000 occurrences	HIGH _____ out of 100,000 occurrences
Food served raw or lightly cooked occurred	LOW_____ out of 100,000 occurrences	HIGH _____ out of 100,000 occurrences

Q76. SEAFOOD STORES – Retail stores that sell only seafood and other sundry items associated with preparation of seafood

One or more pathogens survive or grow to levels sufficient to cause foodborne illness in a serving of food GIVEN THAT

Inappropriate time or temperature for cooking occurred	LOW_____ out of 100,000 occurrences	HIGH _____ out of 100,000 occurrences
Inappropriate time or temperature for reheating occurred	LOW_____ out of 100,000 occurrences	HIGH _____ out of 100,000 occurrences
Inappropriate time or temperature for cooling occurred	LOW_____ out of 100,000 occurrences	HIGH _____ out of 100,000 occurrences
Inappropriate time or temperature for cold holding occurred	LOW_____ out of 100,000 occurrences	HIGH _____ out of 100,000 occurrences
Inappropriate advance preparation occurred	LOW_____ out of 100,000 occurrences	HIGH _____ out of 100,000 occurrences
Inappropriate time or temperature for hot holding occurred	LOW_____ out of 100,000 occurrences	HIGH _____ out of 100,000 occurrences
Food kept at room temperature too long occurred	LOW_____ out of 100,000 occurrences	HIGH _____ out of 100,000 occurrences
Inappropriate thawing of frozen foods occurred	LOW_____ out of 100,000 occurrences	HIGH _____ out of 100,000 occurrences
Food served raw or lightly cooked occurred	LOW_____ out of 100,000 occurrences	HIGH _____ out of 100,000 occurrences

Q77. FULL-SERVICE RESTAURANTS – Restaurants that provide table wait service and offer a menu of meal selections that are prepared onsite

One or more pathogens survive or grow to levels sufficient to cause foodborne illness in a serving of food GIVEN THAT

Inappropriate time or temperature for cooking occurred	LOW_____ out of 100,000 occurrences	HIGH _____ out of 100,000 occurrences
Inappropriate time or temperature for reheating occurred	LOW_____ out of 100,000 occurrences	HIGH _____ out of 100,000 occurrences
Inappropriate time or temperature for cooling occurred	LOW_____ out of 100,000 occurrences	HIGH _____ out of 100,000 occurrences
Inappropriate time or temperature for cold holding occurred	LOW_____ out of 100,000 occurrences	HIGH _____ out of 100,000 occurrences
Inappropriate advance preparation occurred	LOW_____ out of 100,000 occurrences	HIGH _____ out of 100,000 occurrences
Inappropriate time or temperature for hot holding occurred	LOW_____ out of 100,000 occurrences	HIGH _____ out of 100,000 occurrences
Food kept at room temperature too long occurred	LOW_____ out of 100,000 occurrences	HIGH _____ out of 100,000 occurrences
Inappropriate thawing of frozen foods occurred	LOW_____ out of 100,000 occurrences	HIGH _____ out of 100,000 occurrences
Food served raw or lightly cooked occurred	LOW_____ out of 100,000 occurrences	HIGH _____ out of 100,000 occurrences

Q78. MIXED-SERVICE RESTAURANTS – Restaurants offering meal selections that are prepared onsite and in which customers generally order at a cash register or select items from a food bar and pay before they eat

One or more pathogens survive or grow to levels sufficient to cause foodborne illness in a serving of food GIVEN THAT

Inappropriate time or temperature for cooking occurred	LOW_____ out of 100,000 occurrences	HIGH _____ out of 100,000 occurrences
Inappropriate time or temperature for reheating occurred	LOW_____ out of 100,000 occurrences	HIGH _____ out of 100,000 occurrences
Inappropriate time or temperature for cooling occurred	LOW_____ out of 100,000 occurrences	HIGH _____ out of 100,000 occurrences
Inappropriate time or temperature for cold holding occurred	LOW_____ out of 100,000 occurrences	HIGH _____ out of 100,000 occurrences
Inappropriate advance preparation occurred	LOW_____ out of 100,000 occurrences	HIGH _____ out of 100,000 occurrences
Inappropriate time or temperature for hot holding occurred	LOW_____ out of 100,000 occurrences	HIGH _____ out of 100,000 occurrences
Food kept at room temperature too long occurred	LOW_____ out of 100,000 occurrences	HIGH _____ out of 100,000 occurrences
Inappropriate thawing of frozen foods occurred	LOW_____ out of 100,000 occurrences	HIGH _____ out of 100,000 occurrences
Food served raw or lightly cooked occurred	LOW_____ out of 100,000 occurrences	HIGH _____ out of 100,000 occurrences

Q79. FAST-FOOD RESTAURANTS – Restaurants that do not provide table wait service and that offer a narrow menu of food items designed for quick preparation and carry out consumption

One or more pathogens survive or grow to levels sufficient to cause foodborne illness in a serving of food GIVEN THAT

Inappropriate time or temperature for cooking occurred	LOW_____ out of 100,000 occurrences	HIGH _____ out of 100,000 occurrences
Inappropriate time or temperature for reheating occurred	LOW_____ out of 100,000 occurrences	HIGH _____ out of 100,000 occurrences
Inappropriate time or temperature for cooling occurred	LOW_____ out of 100,000 occurrences	HIGH _____ out of 100,000 occurrences
Inappropriate time or temperature for cold holding occurred	LOW_____ out of 100,000 occurrences	HIGH _____ out of 100,000 occurrences
Inappropriate advance preparation occurred	LOW_____ out of 100,000 occurrences	HIGH _____ out of 100,000 occurrences
Inappropriate time or temperature for hot holding occurred	LOW_____ out of 100,000 occurrences	HIGH _____ out of 100,000 occurrences
Food kept at room temperature too long occurred	LOW_____ out of 100,000 occurrences	HIGH _____ out of 100,000 occurrences
Inappropriate thawing of frozen foods occurred	LOW_____ out of 100,000 occurrences	HIGH _____ out of 100,000 occurrences
Food served raw or lightly cooked occurred	LOW_____ out of 100,000 occurrences	HIGH _____ out of 100,000 occurrences

Q80. TEMPORARY ESTABLISHMENTS – Food service establishments that operate at a fixed location for not more than 14 consecutive days in conjunction with a single event or celebration

One or more pathogens survive or grow to levels sufficient to cause foodborne illness in a serving of food GIVEN THAT

Inappropriate time or temperature for cooking occurred	LOW_____ out of 100,000 occurrences	HIGH _____ out of 100,000 occurrences
Inappropriate time or temperature for reheating occurred	LOW_____ out of 100,000 occurrences	HIGH _____ out of 100,000 occurrences
Inappropriate time or temperature for cooling occurred	LOW_____ out of 100,000 occurrences	HIGH _____ out of 100,000 occurrences
Inappropriate time or temperature for cold holding occurred	LOW_____ out of 100,000 occurrences	HIGH _____ out of 100,000 occurrences
Inappropriate advance preparation occurred	LOW_____ out of 100,000 occurrences	HIGH _____ out of 100,000 occurrences
Inappropriate time or temperature for hot holding occurred	LOW_____ out of 100,000 occurrences	HIGH _____ out of 100,000 occurrences
Food kept at room temperature too long occurred	LOW_____ out of 100,000 occurrences	HIGH _____ out of 100,000 occurrences
Inappropriate thawing of frozen foods occurred	LOW_____ out of 100,000 occurrences	HIGH _____ out of 100,000 occurrences
Food served raw or lightly cooked occurred	LOW_____ out of 100,000 occurrences	HIGH _____ out of 100,000 occurrences

Q81. CHILDCARE CENTERS – A program, facility, or organization that provides care for infants and children; does not include home-based daycares

One or more pathogens survive or grow to levels sufficient to cause foodborne illness in a serving of food GIVEN THAT

Inappropriate time or temperature for cooking occurred	LOW_____ out of 100,000 occurrences	HIGH _____ out of 100,000 occurrences
Inappropriate time or temperature for reheating occurred	LOW_____ out of 100,000 occurrences	HIGH _____ out of 100,000 occurrences
Inappropriate time or temperature for cooling occurred	LOW_____ out of 100,000 occurrences	HIGH _____ out of 100,000 occurrences
Inappropriate time or temperature for cold holding occurred	LOW_____ out of 100,000 occurrences	HIGH _____ out of 100,000 occurrences
Inappropriate advance preparation occurred	LOW_____ out of 100,000 occurrences	HIGH _____ out of 100,000 occurrences
Inappropriate time or temperature for hot holding occurred	LOW_____ out of 100,000 occurrences	HIGH _____ out of 100,000 occurrences
Food kept at room temperature too long occurred	LOW_____ out of 100,000 occurrences	HIGH _____ out of 100,000 occurrences
Inappropriate thawing of frozen foods occurred	LOW_____ out of 100,000 occurrences	HIGH _____ out of 100,000 occurrences
Food served raw or lightly cooked occurred	LOW_____ out of 100,000 occurrences	HIGH _____ out of 100,000 occurrences

Q82. HOSPITALS – Cafeterias within voluntary, proprietary, long-term general, tuberculosis, nervous and mental hospitals that prepare meals for patients and employees. This does not include restaurants located in hospitals

One or more pathogens survive or grow to levels sufficient to cause foodborne illness in a serving of food GIVEN THAT

Inappropriate time or temperature for cooking occurred	LOW_____ out of 100,000 occurrences	HIGH _____ out of 100,000 occurrences
Inappropriate time or temperature for reheating occurred	LOW_____ out of 100,000 occurrences	HIGH _____ out of 100,000 occurrences
Inappropriate time or temperature for cooling occurred	LOW_____ out of 100,000 occurrences	HIGH _____ out of 100,000 occurrences
Inappropriate time or temperature for cold holding occurred	LOW_____ out of 100,000 occurrences	HIGH _____ out of 100,000 occurrences
Inappropriate advance preparation occurred	LOW_____ out of 100,000 occurrences	HIGH _____ out of 100,000 occurrences
Inappropriate time or temperature for hot holding occurred	LOW_____ out of 100,000 occurrences	HIGH _____ out of 100,000 occurrences
Food kept at room temperature too long occurred	LOW_____ out of 100,000 occurrences	HIGH _____ out of 100,000 occurrences
Inappropriate thawing of frozen foods occurred	LOW_____ out of 100,000 occurrences	HIGH _____ out of 100,000 occurrences
Food served raw or lightly cooked occurred	LOW_____ out of 100,000 occurrences	HIGH _____ out of 100,000 occurrences

Q83. SCHOOLS – Cafeterias within public and parochial elementary and secondary schools. This does not include cafeterias located on university or college campuses

One or more pathogens survive or grow to levels sufficient to cause foodborne illness in a serving of food GIVEN THAT

Inappropriate time or temperature for cooking occurred	LOW_____ out of 100,000 occurrences	HIGH _____ out of 100,000 occurrences
Inappropriate time or temperature for reheating occurred	LOW_____ out of 100,000 occurrences	HIGH _____ out of 100,000 occurrences
Inappropriate time or temperature for cooling occurred	LOW_____ out of 100,000 occurrences	HIGH _____ out of 100,000 occurrences
Inappropriate time or temperature for cold holding occurred	LOW_____ out of 100,000 occurrences	HIGH _____ out of 100,000 occurrences
Inappropriate advance preparation occurred	LOW_____ out of 100,000 occurrences	HIGH _____ out of 100,000 occurrences
Inappropriate time or temperature for hot holding occurred	LOW_____ out of 100,000 occurrences	HIGH _____ out of 100,000 occurrences
Food kept at room temperature too long occurred	LOW_____ out of 100,000 occurrences	HIGH _____ out of 100,000 occurrences
Inappropriate thawing of frozen foods occurred	LOW_____ out of 100,000 occurrences	HIGH _____ out of 100,000 occurrences
Food served raw or lightly cooked occurred	LOW_____ out of 100,000 occurrences	HIGH _____ out of 100,000 occurrences

Q84. NURSING HOMES – Cafeterias within traditional nursing homes and assisted living centers

One or more pathogens survive or grow to levels sufficient to cause foodborne illness in a serving of food GIVEN THAT

Inappropriate time or temperature for cooking occurred	LOW_____ out of 100,000 occurrences	HIGH _____ out of 100,000 occurrences
Inappropriate time or temperature for reheating occurred	LOW_____ out of 100,000 occurrences	HIGH _____ out of 100,000 occurrences

Inappropriate time or temperature for cooling occurred	LOW_____ out of 100,000 occurrences	HIGH _____ out of 100,000 occurrences
Inappropriate time or temperature for cold holding occurred	LOW_____ out of 100,000 occurrences	HIGH _____ out of 100,000 occurrences
Inappropriate advance preparation occurred	LOW_____ out of 100,000 occurrences	HIGH _____ out of 100,000 occurrences
Inappropriate time or temperature for hot holding occurred	LOW_____ out of 100,000 occurrences	HIGH _____ out of 100,000 occurrences
Food kept at room temperature too long occurred	LOW_____ out of 100,000 occurrences	HIGH _____ out of 100,000 occurrences
Inappropriate thawing of frozen foods occurred	LOW_____ out of 100,000 occurrences	HIGH _____ out of 100,000 occurrences
Food served raw or lightly cooked occurred	LOW_____ out of 100,000 occurrences	HIGH _____ out of 100,000 occurrences

Q85. Additional comments (if any) _____
_____

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Q86. As before, below is a summary of your responses to the question on the number of instances out of 100,000 that one or more pathogens will survive and grow in a serving of food in quantities sufficient to cause foodborne illness GIVEN that a food handling practice that contributes to pathogen survival or growth has occurred, by type of retail setting and food category at lowest and highest risk. Please review your figures. If you would like to revise any of them, please use the "Previous Page" button to go back to the applicable question.

Occurrence of a Food Handling Practice That Contributes to the Survival or Growth of One or More Pathogens	**No. of Instances out of 100,000 That One or More Pathogens Survive or Grow in a Serving of Food in Quantities Sufficient to Cause Foodborne Illness**																					
	Grocery Stores		**Convenience Stores**		**Seafood Stores**		**Full-service Restaurants**		**Mixed-service Restaurants**		**Fast-food Restaurants**		**Temporary Establishments**		**Childcare Centers**		**Hospitals**		**Schools**		**Nursing Homes**	
	L	**H**	**L**	**H**	**L**	**H**	**L**	**H**	**L**	**H**	**L**	**H**	**L**	**H**	**L**	**H**	**L**	**H**	**L**	**H**	**L**	**H**
Inappropriate time or temperature for cooking																						
Inappropriate time or temperature for reheating																						
Inappropriate time or temperature for cooling																						
Inappropriate time or temperature for cold holding																						
Inappropriate advance preparation																						
Inappropriate time or temperature for hot holding																						
Food kept at room temperature too long																						
Inappropriate thawing of frozen foods																						
Food served raw or lightly cooked																						

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Q87. Please enter any additional comments you may have about the questions you responded to _____
_____
_____
_____

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Thank you for your time!

ROUND 1 ITERATION

This round will be an iteration round of Round 1, where each expert will be asked to review the group results for Round 1 and reconsider their answers. We will also request that they provide commentary on their answers. While it is expected that only one iteration round is necessary to achieve sufficient convergence of responses, additional iterations might be needed depending on the degree of convergence.

FOOD HANDLING PRACTICES MODEL (FHPM) EXPERT ELICITATION
ROUND 2 – HOUSEHOLD HANDLING PRACTICES

Each year millions of cases of foodborne illness occur in the United States. Preceding most cases of foodborne illness is contamination of food by pathogens, coupled with failure to destroy or sufficiently control pathogens in retail food establishments or households. The Food and Drug Administration (FDA) developed a quantitative simulation model of the effects of contributing factors on the incidence of foodborne illness: the Food Handling Practices Model (FHPM). The model allows FDA to analyze changes in the incidence of foodborne illness that may be associated with changes in food handling practices. Using stochastic simulation methods, the model incorporates inherent uncertainty of key relationships involved.

The FHPM incorporated data from food intake surveys, food safety surveys, contamination prevalence studies, outbreak studies, and other published scientific literature. Data needed for the model that were not available from previous research were gathered through expert elicitation. An initial calibration of the FHPM was done using a panel of experienced, highly qualified food safety experts to provide expert judgments for several scenario parameters required in the model.

The goal of this study is to update the initial parameters and re-calibrate the model. The information you provide will be incorporated along with data gathered from peer-reviewed or government-published studies, including data on the likelihood that a food will be contaminated before being handled at the retail or household level, and data on the probability of foodborne illness resulting from food contaminated with one or more pathogens.

We welcome suggestions for published studies that may provide data for the probabilities being sought in this elicitation.

ELICITATION METHOD

We are employing the Delphi method to obtain expert opinion on the frequency of specific improper food handling practices in households and retail establishments for use in the FHPM model. The Delphi method has tremendous value as a communications system for policy questions (Linstone and Turoff, 2002). The method involves multiple rounds of questioning, with each round building on the results of previous rounds. In order to achieve sufficient convergence on responses, some rounds may require multiple iterations. During these iteration rounds, experts are asked to reconsider their answers in light of an anonymous summary of the group's response.

The goal of the first round was to solicit information on the frequency of specific improper food handling practices in different retail settings (i.e., retail food stores, restaurants, and institutions). In addition to simple probabilities, this round also elicited information on conditional probabilities (i.e., the probability that one or more pathogens are introduced into a serving of food in quantities sufficient to cause foodborne illness GIVEN the occurrence of a specific food handling practice) across different retail settings. Following Round 1, we conducted an iteration round, where each expert reviewed the group results for Round 1 to reconsider their answers.

The objective of Round 2 is to solicit information on the frequency of specific improper food handling practices in different household types (i.e., single female, single male, couple with children, etc. households). Similar to Round 1, Round 2 will also elicit information on conditional probabilities (i.e., the probability that one or more pathogens are introduced into a serving of food in quantities sufficient to cause foodborne illness GIVEN the occurrence of a specific food handling practice) across household types. Following Round 2, there will be an iteration round, where each expert will review the group results for Round 2 and reconsider their answers. If there is sufficient convergence among experts' responses after the original round there may not be a need for the iteration round.

DATA CONSIDERATIONS

You will be asked to gauge pathogen introduction, growth, and survival risks without regard to the type of pathogen. The likelihood that a pathogen will be introduced into food, survive, or grow in quantities sufficient enough to cause a foodborne illness may depend on the pathogen type. However, the Food Handling Practices Model does not distinguish among pathogen types. Please make your determinations based on the range of pathogens that may be introduced, survive, or grow in quantities sufficient to cause foodborne illness due to the given inappropriate food handling practices.

At the end of each page, please hit “next page” to save your responses, even if you have not responded to all the questions on the page. You can also leave and return to this survey at any time, as long as you hit “next page” to save your responses before navigating away from a particular page.

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Pathogen Contamination

We will first ask you to gauge the frequency of various inappropriate food handling practices that contribute to pathogen contamination in different types of households. Next, we will ask you to gauge the frequency of pathogen contamination of food GIVEN that an inappropriate food handling practice has occurred.

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Intro 8. Please indicate the MOST and LEAST frequently occurring food handling practices that contribute to pathogen contamination in each of the following types of households.

Q88. SINGLE FEMALE HOUSEHOLDS – Households comprising one single woman under the age of 60

MOST frequently occurring practice is _____[Drop-down 1]
LEAST frequently occurring practice is _____[Drop-down 1]

Q89. SINGLE MALE HOUSEHOLDS – Households comprising one single man under the age of 60

MOST frequently occurring practice is _____[Drop-down 1]
LEAST frequently occurring practice is _____[Drop-down 1]

Q90. SINGLE PARENT WITH CHILDREN HOUSEHOLDS – Households comprising one adult parent or guardian and one or more minor children

MOST frequently occurring practice is _____[Drop-down 1]
LEAST frequently occurring practice is _____[Drop-down 1]

Q91. COUPLE WITH CHILDREN HOUSEHOLDS – Households comprising two adult parents or guardians and one or more minor children

MOST frequently occurring practice is _____[Drop-down 1]
LEAST frequently occurring practice is _____[Drop-down 1]

Q92. COUPLE WITHOUT CHILDREN HOUSEHOLDS – Households comprising two adults and no minor children

MOST frequently occurring practice is _____[Drop-down 1]
LEAST frequently occurring practice is _____[Drop-down 1]

Q93. SENIOR MALE HOUSEHOLDS – Households comprising one male age 60 or over

MOST frequently occurring practice is _____[Drop-down 1]

LEAST frequently occurring practice is _____[Drop-down 1]

Q94. SENIOR FEMALE HOUSEHOLDS – Households comprising one female age 60 or over

MOST frequently occurring practice is _____[Drop-down 1]
LEAST frequently occurring practice is _____[Drop-down 1]

Q95. Additional comments (if any) _____
_____

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Intro 9. For each of the following household types, please gauge the number of instances a given inappropriate food handling practice occurs out of 100,000 times. For example, if inappropriate hand washing occurs about half the time in SINGLE FEMALE HOUSEHOLDS, please enter "50,000" in the field corresponding to inappropriate hand washing under that household category.

You will see the handling practices you previously identified as MOST and LEAST frequently occurring for each of the household types.

Q96. SINGLE FEMALE HOUSEHOLDS – Households comprising one single woman under the age of 60

MOST frequently occurring practice is [Piped in from Q88]
LEAST frequently occurring practice is [Piped in from Q88]

Inappropriate hand washing	_____ out of 100,000 hand washings
Inappropriate bare-hand contact with **ready-to-eat foods**	_____ out of 100,000 bare-hand contacts with ready-to-eat foods
Inappropriate sanitation or cleaning of cutting boards or other cutting surfaces	_____ out of 100,000 cutting surface sanitations
Food handling by household member with a communicable disease	_____ out of 100,000 handlings by any household member
Inappropriate sanitation of equipment or utensils	_____ out of 100,000 equipment sanitations

Q97. SINGLE MALE HOUSEHOLDS – Households comprising one single man under the age of 60

MOST frequently occurring practice is [Piped in from Q89]
LEAST frequently occurring practice is [Piped in from Q89]

Inappropriate hand washing	_____ out of 100,000 hand washings
Inappropriate bare-hand contact with **ready-to-eat foods**	_____ out of 100,000 bare-hand contacts with ready-to-eat foods
Inappropriate sanitation or cleaning of cutting boards or other cutting surfaces	_____ out of 100,000 cutting surface sanitations
Food handling by household member with a communicable disease	_____ out of 100,000 handlings by any household member
Inappropriate sanitation of equipment or utensils	_____ out of 100,000 equipment sanitations

Q98. SINGLE PARENT WITH CHILDREN HOUSEHOLDS – Households comprising one adult parent or guardian and one or more minor children

MOST frequently occurring practice is [Piped in from Q90]
LEAST frequently occurring practice is [Piped in from Q90]

Inappropriate hand washing	_____ out of 100,000 hand washings
Inappropriate bare-hand contact with **ready-to-eat foods**	_____ out of 100,000 bare-hand contacts with ready-to-eat foods
Inappropriate sanitation or cleaning of cutting boards or other cutting surfaces	_____ out of 100,000 cutting surface sanitations
Food handling by household member with a communicable disease	_____ out of 100,000 handlings by any household member
Inappropriate sanitation of equipment or utensils	_____ out of 100,000 equipment sanitations

Q99. COUPLE WITH CHILDREN HOUSEHOLDS – Households comprising two adult parents or guardians and one or more minor children

MOST frequently occurring practice is [Piped in from Q91]
LEAST frequently occurring practice is [Piped in from Q91]

Inappropriate hand washing	_____ out of 100,000 hand washings
Inappropriate bare-hand contact with **ready-to-eat foods**	_____ out of 100,000 bare-hand contacts with ready-to-eat foods
Inappropriate sanitation or cleaning of cutting boards or other cutting surfaces	_____ out of 100,000 cutting surface sanitations
Food handling by household member with a communicable disease	_____ out of 100,000 handlings by any household member
Inappropriate sanitation of equipment or utensils	_____ out of 100,000 equipment sanitations

Q100. COUPLE WITHOUT CHILDREN HOUSEHOLDS – Households comprising two adults and no minor children

MOST frequently occurring practice is [Piped in from Q92]
LEAST frequently occurring practice is [Piped in from Q92]

Inappropriate hand washing	_____ out of 100,000 hand washings
Inappropriate bare-hand contact with **ready-to-eat foods**	_____ out of 100,000 bare-hand contacts with ready-to-eat foods
Inappropriate sanitation or cleaning of cutting boards or other cutting surfaces	_____ out of 100,000 cutting surface sanitations
Food handling by household member with a communicable disease	_____ out of 100,000 handlings by any household member
Inappropriate sanitation of equipment or utensils	_____ out of 100,000 equipment sanitations

Q101. SENIOR MALE HOUSEHOLDS – Households comprising one male age 60 or over

MOST frequently occurring practice is [Piped in from Q93]
LEAST frequently occurring practice is [Piped in from Q93]

Inappropriate hand washing	_____ out of 100,000 hand washings
Inappropriate bare-hand contact with **ready-to-eat foods**	_____ out of 100,000 bare-hand contacts with ready-to-eat foods
Inappropriate sanitation or cleaning of cutting boards or other cutting surfaces	_____ out of 100,000 cutting surface sanitations
Food handling by household member with a communicable disease	_____ out of 100,000 handlings by any household member
Inappropriate sanitation of equipment or utensils	_____ out of 100,000 equipment sanitations

Q102. SENIOR FEMALE HOUSEHOLDS – Households comprising one female age 60 or over

MOST frequently occurring practice is [Piped in from Q94]
LEAST frequently occurring practice is [Piped in from Q94]

Inappropriate hand washing	_____ out of 100,000 hand washings

Inappropriate bare-hand contact with **ready-to-eat foods**	_____ out of 100,000 bare-hand contacts with ready-to-eat foods
Inappropriate sanitation or cleaning of cutting boards or other cutting surfaces	_____ out of 100,000 cutting surface sanitations
Food handling by household member with a communicable disease	_____ out of 100,000 handlings by any household member
Inappropriate sanitation of equipment or utensils	_____ out of 100,000 equipment sanitations

Q103. Additional comments (if any) _____

_____

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Q104. Below is a summary of your responses to the question on the number of instances a given food handling practice occurs out of 100,000 times by type of household. Please review your figures. If you would like to revise any of them, please use the "Previous Page" button to go back to the applicable question.

Food Handling Practice That Contributes to Pathogen Contamination	**No. of Instances out of 100,000 the Practice Occurs**						
	Single Female	**Single Male**	**Single Parent w/ Children**	**Couple w/ Children**	**Couple w/o Children**	**Senior Male**	**Senior Female**
Inappropriate hand washing							
Inappropriate bare-hand contact with **ready-to-eat** foods							
Inappropriate sanitation or cleaning of cutting boards or other cutting surfaces							
Food handling by contagious household member							
Inappropriate sanitation of equipment or utensils							

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We now would like you to focus on conditional probabilities. We will ask you to gauge the probability that a serving of food is contaminated with one or more pathogens GIVEN the occurrence of a specific food handling practice that contributes to pathogen contamination.

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Intro 10. For each of the following household types, please gauge the number of instances out of 100,000 that a serving of food will be contaminated with one or more pathogens GIVEN the occurrence of a specific inappropriate food handling practice. For example, if 25,000 out of 100,000 servings prepared will be contaminated with one or more pathogens given that inappropriate hand washing has occurred in SINGLE FEMALE HOUSEHOLDS, please enter "25,000" in the field corresponding to inappropriate hand washing under that household category.

Q105. SINGLE FEMALE HOUSEHOLDS – Households comprising one single woman under the age of 60

A serving of food is contaminated with one or more pathogens GIVEN THAT

Inappropriate hand washing occurred	_____ out of 100,000 occurrences
Inappropriate bare-hand contact with **ready-to-eat** foods occurred	_____ out of 100,000 occurrences
Inappropriate sanitation or cleaning of cutting boards or other cutting surfaces occurred	_____ out of 100,000 occurrences
Food handling by contagious household member occurred	_____ out of 100,000 occurrences
Inappropriate sanitation of equipment or utensils occurred	_____ out of 100,000 occurrences

Q106. SINGLE MALE HOUSEHOLDS – Households comprising one single man under the age of 60

A serving of food is contaminated with one or more pathogens GIVEN THAT

Inappropriate hand washing occurred	_____ out of 100,000 occurrences
Inappropriate bare-hand contact with **ready-to-eat** foods occurred	_____ out of 100,000 occurrences
Inappropriate sanitation or cleaning of cutting boards or other cutting surfaces occurred	_____ out of 100,000 occurrences
Food handling by contagious household member occurred	_____ out of 100,000 occurrences
Inappropriate sanitation of equipment or utensils occurred	_____ out of 100,000 occurrences

Q107. SINGLE PARENT WITH CHILDREN HOUSEHOLDS – Households comprising one adult parent or guardian and one or more minor children

A serving of food is contaminated with one or more pathogens GIVEN THAT

Inappropriate hand washing occurred	_____ out of 100,000 occurrences
Inappropriate bare-hand contact with **ready-to-eat** foods occurred	_____ out of 100,000 occurrences
Inappropriate sanitation or cleaning of cutting boards or other cutting surfaces occurred	_____ out of 100,000 occurrences
Food handling by contagious household member occurred	_____ out of 100,000 occurrences
Inappropriate sanitation of equipment or utensils occurred	_____ out of 100,000 occurrences

Q108. COUPLE WITH CHILDREN HOUSEHOLDS – Households comprising two adult parents or guardians and one or more minor children

A serving of food is contaminated with one or more pathogens GIVEN THAT

Inappropriate hand washing occurred	_____ out of 100,000 occurrences
Inappropriate bare-hand contact with **ready-to-eat** foods occurred	_____ out of 100,000 occurrences
Inappropriate sanitation or cleaning of cutting boards or other cutting surfaces occurred	_____ out of 100,000 occurrences
Food handling by contagious household member occurred	_____ out of 100,000 occurrences
Inappropriate sanitation of equipment or utensils occurred	_____ out of 100,000 occurrences

Q109. COUPLE WITHOUT CHILDREN HOUSEHOLDS – Households comprising two adults and no minor children

A serving of food is contaminated with one or more pathogens GIVEN THAT

Inappropriate hand washing occurred	_____ out of 100,000 occurrences
Inappropriate bare-hand contact with **ready-to-eat** foods occurred	_____ out of 100,000 occurrences
Inappropriate sanitation or cleaning of cutting boards or other cutting surfaces occurred	_____ out of 100,000 occurrences
Food handling by contagious household member occurred	_____ out of 100,000 occurrences
Inappropriate sanitation of equipment or utensils occurred	_____ out of 100,000 occurrences

Q110. SENIOR MALE HOUSEHOLDS – Households comprising one male age 60 or over

A serving of food is contaminated with one or more pathogens GIVEN THAT

Inappropriate hand washing occurred	_____ out of 100,000 occurrences

Inappropriate bare-hand contact with **ready-to-eat** foods occurred _____ out of 100,000 occurrences
Inappropriate sanitation or cleaning of cutting boards or other cutting surfaces occurred _____ out of 100,000 occurrences
Food handling by contagious household member occurred _____ out of 100,000 occurrences
Inappropriate sanitation of equipment or utensils occurred _____ out of 100,000 occurrences

Q111. SENIOR FEMALE HOUSEHOLDS – Households comprising one female age 60 or over

A serving of food is contaminated with one or more pathogens GIVEN THAT

Inappropriate hand washing occurred _____ out of 100,000 occurrences
Inappropriate bare-hand contact with **ready-to-eat** foods occurred _____ out of 100,000 occurrences
Inappropriate sanitation or cleaning of cutting boards or other cutting surfaces occurred _____ out of 100,000 occurrences
Food handling by contagious household member occurred _____ out of 100,000 occurrences
Inappropriate sanitation of equipment or utensils occurred _____ out of 100,000 occurrences

Q112. Additional comments (if any) _____
_____

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Q113. Below is a summary of your responses to the question on the number of instances out of 100,000 a serving is contaminated with one or more pathogens GIVEN that an inappropriate food handling practice occurred, by type of household. Please review your figures. If you would like to revise any of them, please use the "Previous Page" button to go back to the applicable question.

Occurrence of a Food Handling Practice That Contributes to Pathogen Contamination	**No. of Times out of 100,000, a Serving of Food is Contaminated with One or More Pathogens**						
	Single Female	**Single Male**	**Single Parent w/ Children**	**Couple w/ Children**	**Couple w/o Children**	**Senior Male**	**Senior Female**
Inappropriate hand washing occurred							
Inappropriate bare-hand contact with **ready-to-eat** foods occurred							
Inappropriate sanitation or cleaning of cutting boards or other cutting surfaces occurred							
Food handling by contagious household member occurred							
Inappropriate sanitation of equipment or utensils occurred							

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Pathogen Survival or Growth

We will now ask you to gauge the frequency of various inappropriate food handling practices that contribute to pathogen survival or growth in different types of households. Next, we will ask you to gauge the frequency of pathogen survival or growth in food GIVEN that an inappropriate food handling practice has occurred.

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Intro 11. Now, we would like you to focus on those food handling practices that contribute to pathogen survival or growth. For each of the following types of households, please indicate the MOST and LEAST frequently occurring food handling practices that contribute to pathogen survival or growth.

Q114. SINGLE FEMALE HOUSEHOLDS – Households comprising one single woman under the age of 60

MOST frequently occurring practice is _____[Drop-down 2]
LEAST frequently occurring practice is _____[Drop-down 2]

Q115. SINGLE MALE HOUSEHOLDS – Households comprising one single man under the age of 60

MOST frequently occurring practice is _____[Drop-down 2]
LEAST frequently occurring practice is _____[Drop-down 2]

Q116. SINGLE PARENT WITH CHILDREN HOUSEHOLDS – Households comprising one adult parent or guardian and one or more minor children

MOST frequently occurring practice is _____[Drop-down 2]
LEAST frequently occurring practice is _____[Drop-down 2]

Q117. COUPLE WITH CHILDREN HOUSEHOLDS – Households comprising two adult parents or guardians and one or more minor children

MOST frequently occurring practice is _____[Drop-down 2]
LEAST frequently occurring practice is _____[Drop-down 2]

Q118. COUPLE WITHOUT CHILDREN HOUSEHOLDS – Households comprising two adults and no minor children

MOST frequently occurring practice is _____[Drop-down 2]
LEAST frequently occurring practice is _____[Drop-down 2]

Q119. SENIOR MALE HOUSEHOLDS – Households comprising one male age 60 or over

MOST frequently occurring practice is _____[Drop-down 2]
LEAST frequently occurring practice is _____[Drop-down 2]

Q120. SENIOR FEMALE HOUSEHOLDS – Households comprising one female age 60 or over

MOST frequently occurring practice is _____[Drop-down 2]
LEAST frequently occurring practice is _____[Drop-down 2]

Q121. Additional comments (if any) _____
_____

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Intro 12. For each of the following household types, please gauge the number of instances a given food handling practice occurs out of 100,000 times. For example, if inappropriate time or temperature for cooking occurs about half the time in SINGLE FEMALE HOUSEHOLDS, please enter “50,000” in the field corresponding to inappropriate time

or temperature for cooking under that household category.

You will see the handling practices you previously identified as MOST and LEAST frequently occurring for each of the household types.

Q122. SINGLE FEMALE HOUSEHOLDS – Households comprising one single woman under the age of 60

MOST frequently occurring practice is [Piped in from Q114]
LEAST frequently occurring practice is [Piped in from Q114]

Inappropriate time or temperature for cooking	_____ out of 100,000 instances of cooking
Inappropriate time or temperature for reheating	_____ out of 100,000 instances of reheating
Inappropriate time or temperature for cooling	_____ out of 100,000 instances of cooling
Inappropriate time or temperature for cold holding	_____ out of 100,000 instances of cold holding
Inappropriate advance preparation	_____ out of 100,000 instances of advance preparation
Inappropriate time or temperature for hot holding	_____ out of 100,000 instances of hot holding
Food kept at room temperature too long	_____ out of 100,000 instances of food kept at room temperature
Inappropriate thawing of frozen foods	_____ out of 100,000 instances of thawing of frozen foods

Q123. SINGLE MALE HOUSEHOLDS – Households comprising one single man under the age of 60

MOST frequently occurring practice is [Piped in from Q115]
LEAST frequently occurring practice is [Piped in from Q115]

Inappropriate time or temperature for cooking	_____ out of 100,000 instances of cooking
Inappropriate time or temperature for reheating	_____ out of 100,000 instances of reheating
Inappropriate time or temperature for cooling	_____ out of 100,000 instances of cooling
Inappropriate time or temperature for cold holding	_____ out of 100,000 instances of cold holding
Inappropriate advance preparation	_____ out of 100,000 instances of advance preparation
Inappropriate time or temperature for hot holding	_____ out of 100,000 instances of hot holding
Food kept at room temperature too long	_____ out of 100,000 instances of food kept at room temperature
Inappropriate thawing of frozen foods	_____ out of 100,000 instances of thawing of frozen foods

Q124. SINGLE PARENT WITH CHILDREN HOUSEHOLDS – Households comprising one adult parent or guardian and one or more minor children

MOST frequently occurring practice is [Piped in from Q116]
LEAST frequently occurring practice is [Piped in from Q116]

Inappropriate time or temperature for cooking	_____ out of 100,000 instances of cooking
Inappropriate time or temperature for reheating	_____ out of 100,000 instances of reheating
Inappropriate time or temperature for cooling	_____ out of 100,000 instances of cooling
Inappropriate time or temperature for cold holding	_____ out of 100,000 instances of cold holding
Inappropriate advance preparation	_____ out of 100,000 instances of advance preparation
Inappropriate time or temperature for hot holding	_____ out of 100,000 instances of hot holding
Food kept at room temperature too long	_____ out of 100,000 instances of food kept at room temperature
Inappropriate thawing of frozen foods	_____ out of 100,000 instances of thawing of frozen foods

Q125. COUPLE WITH CHILDREN HOUSEHOLDS – Households comprising two adult parents or guardians and one or more minor children

MOST frequently occurring practice is [Piped in from Q117]
LEAST frequently occurring practice is [Piped in from Q117]

Inappropriate time or temperature for cooking	_____ out of 100,000 instances of cooking
Inappropriate time or temperature for reheating	_____ out of 100,000 instances of reheating
Inappropriate time or temperature for cooling	_____ out of 100,000 instances of cooling
Inappropriate time or temperature for cold holding	_____ out of 100,000 instances of cold holding
Inappropriate advance preparation	_____ out of 100,000 instances of advance preparation
Inappropriate time or temperature for hot holding	_____ out of 100,000 instances of hot holding
Food kept at room temperature too long	_____ out of 100,000 instances of food kept at room temperature
Inappropriate thawing of frozen foods	_____ out of 100,000 instances of thawing of frozen foods

Q126. COUPLE WITHOUT CHILDREN HOUSEHOLDS – Households comprising two adults and no minor children

MOST frequently occurring practice is [Piped in from Q118]
LEAST frequently occurring practice is [Piped in from Q118]

Inappropriate time or temperature for cooking	_____ out of 100,000 instances of cooking
Inappropriate time or temperature for reheating	_____ out of 100,000 instances of reheating
Inappropriate time or temperature for cooling	_____ out of 100,000 instances of cooling
Inappropriate time or temperature for cold holding	_____ out of 100,000 instances of cold holding
Inappropriate advance preparation	_____ out of 100,000 instances of advance preparation
Inappropriate time or temperature for hot holding	_____ out of 100,000 instances of hot holding
Food kept at room temperature too long	_____ out of 100,000 instances of food kept at room temperature
Inappropriate thawing of frozen foods	_____ out of 100,000 instances of thawing of frozen foods

Q127. SENIOR MALE HOUSEHOLDS – Households comprising one male age 60 or over

MOST frequently occurring practice is [Piped in from Q119]
LEAST frequently occurring practice is [Piped in from Q119]

Inappropriate time or temperature for cooking	_____ out of 100,000 instances of cooking
Inappropriate time or temperature for reheating	_____ out of 100,000 instances of reheating
Inappropriate time or temperature for cooling	_____ out of 100,000 instances of cooling
Inappropriate time or temperature for cold holding	_____ out of 100,000 instances of cold holding
Inappropriate advance preparation	_____ out of 100,000 instances of advance preparation
Inappropriate time or temperature for hot holding	_____ out of 100,000 instances of hot holding
Food kept at room temperature too long	_____ out of 100,000 instances of food kept at room temperature
Inappropriate thawing of frozen foods	_____ out of 100,000 instances of thawing of frozen foods

Q128. SENIOR FEMALE HOUSEHOLDS – Households comprising one female age 60 or over

MOST frequently occurring practice is [Piped in from Q120]
LEAST frequently occurring practice is [Piped in from Q120]

Inappropriate time or temperature for cooking	_____ out of 100,000 instances of cooking
Inappropriate time or temperature for reheating	_____ out of 100,000 instances of reheating
Inappropriate time or temperature for cooling	_____ out of 100,000 instances of cooling
Inappropriate time or temperature for cold holding	_____ out of 100,000 instances of cold holding
Inappropriate advance preparation	_____ out of 100,000 instances of advance preparation
Inappropriate time or temperature for hot holding	_____ out of 100,000 instances of hot holding
Food kept at room temperature too long	_____ out of 100,000 instances of food kept at room temperature
Inappropriate thawing of frozen foods	_____ out of 100,000 instances of thawing of frozen foods

Q129. Additional comments (if any) _____
_____

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Q130. Below is a summary of your responses to the question on the number of instances a given food handling practice that contributes to pathogen survival or growth occurs out of 100,000 times, by type of household. Please review your figures. If you would like to revise any of them, please use the "Previous Page" button to go back to the applicable question.

Food Handling Practice That Contributes to Pathogen Survival or Growth	No. of Instances out of 100,000 the Practice Occurs						
	Single Female	Single Male	Single Parent w/ Children	Couple w/ Children	Couple w/o Children	Senior Male	Senior Female
Inappropriate time or temperature for cooking							
Inappropriate time or temperature for reheating							
Inappropriate time or temperature for cooling							
Inappropriate time or temperature for cold holding							
Inappropriate advance preparation							
Inappropriate time or temperature for hot holding							
Food kept at room temperature too long							
Inappropriate thawing of frozen foods							
Food served raw or lightly cooked							

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Intro 13. Because pathogen survival or growth resulting from inappropriate food handling is dependent on the type of food being handled, we now would like you to focus on the food categories used in the FDA model. Please indicate the food categories that are at HIGHEST and LOWEST risk of pathogen survival or growth due to the handling practices listed below.

Q131. Inappropriate time or temperature for cooking

Food category at HIGHEST risk for pathogen survival or growth is _____[Drop-down 3]
Food category at LOWEST risk for pathogen survival or growth is _____[Drop-down 3]

Q132. Inappropriate time or temperature for reheating

Food category at HIGHEST risk for pathogen survival or growth is _____[Drop-down 3]
Food category at LOWEST risk for pathogen survival or growth is _____[Drop-down 3]

Q133. Inappropriate time or temperature for cooling

Food category at HIGHEST risk for pathogen survival or growth is _____[Drop-down 3]
Food category at LOWEST risk for pathogen survival or growth is _____[Drop-down 3]

Q134. Inappropriate time or temperature for cold holding

Food category at HIGHEST risk for pathogen survival or growth is _____[Drop-down 3]
Food category at LOWEST risk for pathogen survival or growth is _____[Drop-down 3]

Q135. Inappropriate advance preparation

Food category at HIGHEST risk for pathogen survival or growth is _____[Drop-down 3]
Food category at LOWEST risk for pathogen survival or growth is _____[Drop-down 3]

Q136. Inappropriate time or temperature for hot holding

Food category at HIGHEST risk for pathogen survival or growth is _____[Drop-down 3]
Food category at LOWEST risk for pathogen survival or growth is _____[Drop-down 3]

Q137. Food kept at room temperature too long

Food category at HIGHEST risk for pathogen survival or growth is _____[Drop-down 3]
Food category at LOWEST risk for pathogen survival or growth is _____[Drop-down 3]

Q138. Inappropriate thawing of frozen foods

Food category at HIGHEST risk for pathogen survival or growth is _____[Drop-down 3]
Food category at LOWEST risk for pathogen survival or growth is _____[Drop-down 3]

Q139. Food served raw or lightly cooked

Food category at HIGHEST risk for pathogen survival or growth is _____[Drop-down 3]
Food category at LOWEST risk for pathogen survival or growth is _____[Drop-down 3]

Q140. Additional comments (if any) _____
_____

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We again would like you to focus on conditional probabilities. We will ask you to gauge the probability that one or more pathogens survive or grow in a serving of food GIVEN the occurrence of a specific food handling practice that contributes to pathogen survival or growth.

Although the probability that a pathogen will survive or grow in a serving of food may depend on the type of pathogen, we will not ask you to distinguish between pathogens when making your determinations.

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Intro 14. For each of the following household types, please gauge the number of instances out of 100,000 that one or more pathogens will survive and grow in a serving of food GIVEN the occurrence of a specific inappropriate food handling practice for each the food categories that you previously identified as most and least at risk. For example, for SINGLE FEMALE HOUSEHOLDS, if one or more pathogens will survive and grow in 25,000 out of 100,000 servings prepared using a given inappropriate handling practice for the food category you identified as highest risk and 1,000 out of 100,000 for the category you identified as lowest risk, please enter "25,000" next to HIGH and 1,000 next to LOW in the field corresponding to the specific practice under that household category.

Below are the food categories you identified as the highest and lowest risks for pathogen survival or growth, by handling practice. Please keep these in mind in responding to the following questions.

Food Handling Practice That Contributes to Pathogen Survival or Growth	Food Category At Lowest and Highest Risk for Pathogen Survival or Growth	
	Low	**High**
Inappropriate time or temperature for cooking		
Inappropriate time or temperature for reheating		
Inappropriate time or temperature for cooling		
Inappropriate time or temperature for cold holding		
Inappropriate advance preparation		
Inappropriate time or temperature for hot holding		
Food kept at room temperature too long		
Inappropriate thawing of frozen foods		
Food served raw or lightly cooked		

Q141. SINGLE FEMALE HOUSEHOLDS – Households comprising one single woman under the age of 60

One or more pathogens survive or grow in a serving of food GIVEN THAT

Inappropriate time or temperature for cooking occurred	LOW_____ out of 100,000 occurrences	HIGH _____ out of 100,000 occurrences
Inappropriate time or temperature for reheating occurred	LOW_____ out of 100,000 occurrences	HIGH _____ out of 100,000 occurrences
Inappropriate time or temperature for cooling occurred	LOW_____ out of 100,000 occurrences	HIGH _____ out of 100,000 occurrences
Inappropriate time or temperature for cold holding occurred	LOW_____ out of 100,000 occurrences	HIGH _____ out of 100,000 occurrences
Inappropriate advance preparation occurred	LOW_____ out of 100,000 occurrences	HIGH _____ out of 100,000 occurrences
Inappropriate time or temperature for hot holding occurred	LOW_____ out of 100,000 occurrences	HIGH _____ out of 100,000 occurrences
Food kept at room temperature too long occurred	LOW_____ out of 100,000 occurrences	HIGH _____ out of 100,000 occurrences
Inappropriate thawing of frozen foods occurred	LOW_____ out of 100,000 occurrences	HIGH _____ out of 100,000 occurrences
Food served raw or lightly cooked occurred	LOW_____ out of 100,000 occurrences	HIGH _____ out of 100,000 occurrences

Q142. SINGLE MALE HOUSEHOLDS – Households comprising one single man under the age of 60

One or more pathogens survive or grow in a serving of food GIVEN THAT

Inappropriate time or temperature for cooking occurred	LOW_____ out of 100,000 occurrences	HIGH _____ out of 100,000 occurrences
Inappropriate time or temperature for reheating occurred	LOW_____ out of 100,000 occurrences	HIGH _____ out of 100,000 occurrences
Inappropriate time or temperature for cooling occurred	LOW_____ out of 100,000 occurrences	HIGH _____ out of 100,000 occurrences
Inappropriate time or temperature for cold holding occurred	LOW_____ out of 100,000 occurrences	HIGH _____ out of 100,000 occurrences
Inappropriate advance preparation occurred	LOW_____ out of 100,000 occurrences	HIGH _____ out of 100,000 occurrences
Inappropriate time or temperature for hot holding occurred	LOW_____ out of 100,000 occurrences	HIGH _____ out of 100,000 occurrences
Food kept at room temperature too long occurred	LOW_____ out of 100,000 occurrences	HIGH _____ out of 100,000 occurrences
Inappropriate thawing of frozen foods occurred	LOW_____ out of 100,000 occurrences	HIGH _____ out of 100,000 occurrences
Food served raw or lightly cooked occurred	LOW_____ out of 100,000 occurrences	HIGH _____ out of 100,000 occurrences

Q143. SINGLE PARENT WITH CHILDREN HOUSEHOLDS – Households comprising one adult parent or guardian and one or more minor children

One or more pathogens survive or grow in a serving of food GIVEN THAT

Inappropriate time or temperature for cooking occurred	LOW_____ out of 100,000 occurrences	HIGH _____ out of 100,000 occurrences
Inappropriate time or temperature for reheating occurred	LOW_____ out of 100,000 occurrences	HIGH _____ out of 100,000 occurrences
Inappropriate time or temperature for cooling occurred	LOW_____ out of 100,000 occurrences	HIGH _____ out of 100,000 occurrences
Inappropriate time or temperature for cold holding occurred	LOW_____ out of 100,000 occurrences	HIGH _____ out of 100,000 occurrences
Inappropriate advance preparation occurred	LOW_____ out of 100,000 occurrences	HIGH _____ out of 100,000 occurrences
Inappropriate time or temperature for hot holding occurred	LOW_____ out of 100,000 occurrences	HIGH _____ out of 100,000 occurrences
Food kept at room temperature too long occurred	LOW_____ out of 100,000 occurrences	HIGH _____ out of 100,000 occurrences
Inappropriate thawing of frozen foods occurred	LOW_____ out of 100,000 occurrences	HIGH _____ out of 100,000 occurrences
Food served raw or lightly cooked occurred	LOW_____ out of 100,000 occurrences	HIGH _____ out of 100,000 occurrences

Q144. COUPLE WITH CHILDREN HOUSEHOLDS – Households comprising two adult parents or guardians and one or more minor children

One or more pathogens survive or grow in a serving of food GIVEN THAT

Inappropriate time or temperature for cooking occurred	LOW_____ out of 100,000 occurrences	HIGH _____ out of 100,000 occurrences
Inappropriate time or temperature for reheating occurred	LOW_____ out of 100,000 occurrences	HIGH _____ out of 100,000 occurrences
Inappropriate time or temperature for cooling occurred	LOW_____ out of 100,000 occurrences	HIGH _____ out of 100,000 occurrences
Inappropriate time or temperature for cold holding occurred	LOW_____ out of 100,000 occurrences	HIGH _____ out of 100,000 occurrences
Inappropriate advance preparation occurred	LOW_____ out of 100,000 occurrences	HIGH _____ out of 100,000 occurrences
Inappropriate time or temperature for hot holding occurred	LOW_____ out of 100,000 occurrences	HIGH _____ out of 100,000 occurrences
Food kept at room temperature too long occurred	LOW_____ out of 100,000 occurrences	HIGH _____ out of 100,000 occurrences
Inappropriate thawing of frozen foods occurred	LOW_____ out of 100,000 occurrences	HIGH _____ out of 100,000 occurrences
Food served raw or lightly cooked occurred	LOW_____ out of 100,000 occurrences	HIGH _____ out of 100,000 occurrences

Q145. COUPLE WITHOUT CHILDREN HOUSEHOLDS – Households comprising two adults and no minor children

One or more pathogens survive or grow in a serving of food GIVEN THAT

Inappropriate time or temperature for cooking occurred	LOW_____ out of 100,000 occurrences	HIGH _____ out of 100,000 occurrences
Inappropriate time or temperature for reheating occurred	LOW_____ out of 100,000 occurrences	HIGH _____ out of 100,000 occurrences
Inappropriate time or temperature for cooling occurred	LOW_____ out of 100,000 occurrences	HIGH _____ out of 100,000 occurrences
Inappropriate time or temperature for cold holding occurred	LOW_____ out of 100,000 occurrences	HIGH _____ out of 100,000 occurrences
Inappropriate advance preparation occurred	LOW_____ out of 100,000 occurrences	HIGH _____ out of 100,000 occurrences
Inappropriate time or temperature for hot holding occurred	LOW_____ out of 100,000 occurrences	HIGH _____ out of 100,000 occurrences
Food kept at room temperature too long occurred	LOW_____ out of 100,000 occurrences	HIGH _____ out of 100,000 occurrences
Inappropriate thawing of frozen foods occurred	LOW_____ out of 100,000 occurrences	HIGH _____ out of 100,000 occurrences
Food served raw or lightly cooked occurred	LOW_____ out of 100,000 occurrences	HIGH _____ out of 100,000 occurrences

Q146. SENIOR MALE HOUSEHOLDS – Households comprising one male age 60 or over

One or more pathogens survive or grow in a serving of food GIVEN THAT

Inappropriate time or temperature for cooking occurred	LOW_____ out of 100,000 occurrences	HIGH _____ out of 100,000 occurrences
Inappropriate time or temperature for reheating occurred	LOW_____ out of 100,000 occurrences	HIGH _____ out of 100,000 occurrences
Inappropriate time or temperature for cooling occurred	LOW_____ out of 100,000 occurrences	HIGH _____ out of 100,000 occurrences
Inappropriate time or temperature for cold holding occurred	LOW_____ out of 100,000 occurrences	HIGH _____ out of 100,000 occurrences
Inappropriate advance preparation occurred	LOW_____ out of 100,000 occurrences	HIGH _____ out of 100,000 occurrences
Inappropriate time or temperature for hot holding occurred	LOW_____ out of 100,000 occurrences	HIGH _____ out of 100,000 occurrences
Food kept at room temperature too long occurred	LOW_____ out of 100,000 occurrences	HIGH _____ out of 100,000 occurrences
Inappropriate thawing of frozen foods occurred	LOW_____ out of 100,000 occurrences	HIGH _____ out of 100,000 occurrences
Food served raw or lightly cooked occurred	LOW_____ out of 100,000 occurrences	HIGH _____ out of 100,000 occurrences

Q147. SENIOR FEMALE HOUSEHOLDS – Households comprising one female age 60 or over

One or more pathogens survive or grow in a serving of food GIVEN THAT

Inappropriate time or temperature for cooking occurred	LOW_____ out of 100,000 occurrences	HIGH _____ out of 100,000 occurrences
Inappropriate time or temperature for reheating occurred	LOW_____ out of 100,000 occurrences	HIGH _____ out of 100,000 occurrences
Inappropriate time or temperature for cooling occurred	LOW_____ out of 100,000 occurrences	HIGH _____ out of 100,000 occurrences
Inappropriate time or temperature for cold holding occurred	LOW_____ out of 100,000 occurrences	HIGH _____ out of 100,000 occurrences
Inappropriate advance preparation occurred	LOW_____ out of 100,000 occurrences	HIGH _____ out of 100,000 occurrences
Inappropriate time or temperature for hot holding occurred	LOW_____ out of 100,000 occurrences	HIGH _____ out of 100,000 occurrences
Food kept at room temperature too long occurred	LOW_____ out of 100,000 occurrences	HIGH _____ out of 100,000 occurrences
Inappropriate thawing of frozen foods occurred	LOW_____ out of 100,000 occurrences	HIGH _____ out of 100,000 occurrences
Food served raw or lightly cooked occurred	LOW_____ out of 100,000 occurrences	HIGH _____ out of 100,000 occurrences

Q148. Additional comments (if any) _____

_____

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Q149. As before, below is a summary of your responses to the question on the number of instances out of 100,000 that one or more pathogens will survive and grow in a serving of food GIVEN that a food handling practice that contributes to pathogen survival or growth has occurred, by type of household. Please review your figures. If you would like to revise any of them, please use the "Previous Page" button to go back to the applicable question.

Occurrence of a Food Handling Practice That Contributes to Pathogen Survival or Growth	No. of Instances out of 100,000 That One or More Pathogens Survive or Grow in a Serving of Food													
	Single Female		Single Male		Single Parent w/ Children		Couple w/ Children		Couple w/o Children		Senior Male		Senior Female	
	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High
Inappropriate time or temperature for cooking occurred														
Inappropriate time or temperature for reheating occurred														
Inappropriate time or temperature for cooling occurred														
Inappropriate time or temperature for cold holding occurred														
Inappropriate advance preparation occurred														
Inappropriate time or temperature for hot holding occurred														
Food kept at room temperature too long occurred														
Inappropriate thawing of frozen foods occurred														
Food served raw or lightly cooked occurred														

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Q150. Please enter any additional comments you may have about the questions you responded to _____
_____
_____
_____

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Thank you for your time!

Drop-down 1:
Inappropriate hand washing
Inappropriate bare-hand contact with **ready-to-eat** foods
Inappropriate sanitation or cleaning of cutting boards or other cutting surfaces
Food handling by a household member with a communicable disease
Inappropriate sanitation of equipment or utensils

Drop-down 2:
Inappropriate time or temperature for cooking
Inappropriate time or temperature for reheating
Inappropriate time or temperature for cooling
Inappropriate time or temperature for cold holding
Inappropriate advance preparation
Inappropriate time or temperature for hot holding
Food kept at room temperature too long
Inappropriate thawing of frozen foods
Food served raw or lightly cooked

Drop-down 3:
Dairy
Eggs
Meat (includes beef, lamb, and pork)
Poultry (includes chicken and turkey)
Produce
Seafood
Water

Drop-down 4:
Inappropriate hand washing
Inappropriate bare-hand contact with **ready-to-eat** foods
Inappropriate gloved-hand contact with **ready-to-eat** foods
Inappropriate sanitation or cleaning of cutting boards or other cutting surfaces
Food handling by a worker with a communicable disease
Inappropriate sanitation of equipment or utensils

GLOSSARY

Inappropriate hand washing
Hand washing that does not include all of the following:

- Cleaning of hands and exposed portions of arms under clean, running warm water
- Applying a manufacturer-recommended amount of cleaning compound
- Rubbing hands together vigorously for at least 10 to 15 seconds
- Thoroughly rinsing and drying hands.

OR
Hand washing that does not occur as needed in food preparation to prevent cross contamination or after any of the following:

- Touching body parts other than clean hands and exposed portions of arms
- Using the toilet room
- Handling or caring for animals
- Coughing, sneezing, or using tissues
- Eating or drinking, using tobacco
- Handling soiled equipment or utensils
- Before donning gloves for food preparation
- Engaging in any other activities that contaminate the hands

Inappropriate bare-hand contact with ready-to-eat foods
Any bare-hand contact with ready-to-eat food, except immediately after proper hand washing, when washing fruits and vegetables, or if approved safety procedures are in place. See definition of inappropriate hand washing.

Inappropriate gloved-hand contact with ready-to-eat foods
Any of the following circumstances:
- Use of gloves for any task besides working with ready-to-eat food
- Use of gloves after an interruption
- Use of gloves that are damaged or soiled
- Use of slash-resistant gloves that do not have a smooth, durable, and nonabsorbent outer surface, or are not a single-use glove
- Use of cloth gloves

Inappropriate sanitation or cleaning of cutting boards or other cutting surfaces
Sanitation and cleaning that does not involve all of the following:
- Cleaning to remove or completely loosen soils
- Rinsing so that abrasives are removed and cleaning chemicals are removed or diluted
- Soaking for at least 30 seconds in water at least 171°F or in a chemical solution, or at least 7-10 seconds in a chlorine solution

OR
Sanitation and cleaning does not occur each time:
- There is a change from working with raw foods to ready-to-eat foods
- There is a change from one type of raw meat to another type of raw meat being cooked to a lower temperature
- There is a change from potentially hazardous food to raw fruits and vegetables
- Before using or storing a food temperature measuring device
- Any time during the operation when contamination may have occurred.

Food handling by contagious household member or worker
Handling by an individual infected with one or more communicable bacterial or viral pathogens, whether or not the individual demonstrates symptoms of infection.

Inappropriate sanitation of equipment or utensils
Sanitation and cleaning that does not involve all of the following:
- Cleaning to remove or completely loosen soils
- Rinsing so that abrasives are removed and cleaning chemicals are removed or diluted
- Soaking for at least 30 seconds in water at least 171°F or in a chemical solution, or at least 7-10 seconds in a chlorine solution

OR
Sanitation and cleaning does not occur each time:

- There is a change from working with raw foods to ready-to-eat foods
- There is a change from one type of raw meat to another type of raw meat being cooked to a lower temperature
- There is a change from potentially hazardous food to raw fruits and vegetables
- Before using or storing a food temperature measuring device
- Any time during the operation when contamination may have occurred.

Inappropriate time or temperature for cooking

- Cooking that does not reach the temperatures listed below for the corresponding holding times: Eggs cracked and cooked-to-order, fish and meat not specified below: 145°F for 15 seconds
- Eggs not cooked to order, ratites[1], and comminuted fish and meat: 145°F for 3 minutes, 150°F for 1 minute, 155°F for 15 seconds, 158°F instantaneously
- Poultry and fertilized poultry eggs with embryos; wild game meat; stuffed fish, meat, past, poultry or ratites; or stuffing containing fish, meat, poultry, or ratites: 165°F for 15 seconds
- Whole meat roasts: 130°F for 112 minutes, 135°F for 36 minutes, 140°F for 12 minutes, 145°F for 4 minutes, 151°F for 54 seconds, 155°F for 22 seconds, or 158°F instantaneously
- Intact beef steaks: surface reaches 145°C and exterior changes color

Inappropriate time or temperature for reheating

Reheating that does not meet one of the following conditions:

- The temperature in all parts of the food reaches 165°F for 15 seconds
- Food requiring time/temperature control to limit pathogen growth or toxin formation that is reheated in the microwave reaches 165°F in all parts, is stirred, and stands covered for 2 minutes after reheating
- Hermetically sealed ready-to-eat food from an inspected processing plant reaches 135°F
- Unsliced portions of meat roasts are heated to the following temperatures for the corresponding holding times: 130°F for 112 minutes, 135°F for 36 minutes, 140°F for 12 minutes, 145°F for 4 minutes, 151°F for 54 seconds, 155°F for 22 seconds, or 158°F instantaneously

Inappropriate time or temperature for cooling

Cooling in which cooked food is at a temperature between 135°F and 70°F for more than two hours and between 135°F and 41°F for more than six hours (or four hours if food was prepared from ingredients that were at ambient temperature).

Inappropriate time or temperature for cold holding

Cold holding that is above 41°F, or above 45°F for eggs.

Inappropriate advance preparation

Holding ready-to-eat food at 5°C for more than 7 days or for longer than the manufacturer-specified use-by date, unless the food is a deli-salad produced in accordance with good manufacturing practice, a hard or semi-soft cheese, a cultured dairy product, or a preserved, cured, or shelf-stable meat or seafood product.

Inappropriate time or temperature for hot holding

Hot holding that is below 135°F, or below 130°F for roasts cooked to an appropriate temperature for an appropriate amount of time.

Food kept at room temperature too long

Food held between 135°F and 70°F for more than two hours and between 70°F and 41°F for more than four hours.

[1] A bird with a flat breastbone; especially any of various mostly flightless birds, such as an ostrich, rhea, emu, moa, or kiwi (Merriam-Webster Online, 2008).

Inappropriate thawing of frozen foods
Food that is not thawed using one of the following methods:

- Refrigerated at 41°F
- Submerged under running water at a temperature of 70°F or below for a time period that prevents thawed portions of ready-to-eat food to rise above 41°F or raw animal portions to rise above 41°F for more than 4 hours before returning to 41°F or being cooked
- Cooked appropriately
- Microwaved and then immediately cooked

Food served raw or lightly cooked
Food that is not cooked long enough or does not reach a temperature high enough to prevent pathogen survival or growth.