

**THE RISK LEVEL ASSOCIATED WITH FOOD ACQUISITION
AND MANAGEMENT PRACTICES OF LOW INCOME
INDIVIDUALS**

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ABSTRACT OF THE THESIS

THE RISK LEVEL ASSOCIATED WITH FOOD ACQUISITION AND MANAGEMENT PRACTICES OF LOW INCOME INDIVIDUALS

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Foodborne illnesses are a significant health problem in the United States. Based on the most recent 2011 CDC estimates, each year roughly 1 in 6 Americans (or 48 million people) will get sick, 128,000 will be hospitalized, and 3,000 will die of foodborne diseases, with the top five pathogens contributing to domestically acquired foodborne illnesses listed as *Norovirus*, *Salmonella*, *Clostridium perfringens*, *Campylobacter spp*, and *Staphylococcus aureus*. To address these growing concerns, government agencies have implemented various social marketing, food safety educational campaigns and programs. Some of these programs specifically target limited-resource audiences such as participants of the Supplemental Nutrition Assistance Program (SNAP-Ed), the Expanded Food and Nutrition Education Program (EFNEP) and the Special Supplemental Nutrition Program for Women, Infants, and Children (WIC). Studies have suggested that limited resource populations exhibit deficiencies in food safety knowledge and safe food handling practices at higher rates compared to the general population. Further, limited resource, food insecure individuals, previously surveyed under the direction of Dr. Debra Palmer, admitted to engaging in a variety of non-traditional food acquisition and food management practices to survive hunger. To assess the relative risk level associated with

engaging in these practices, a preliminary, 21 question survey, was administered to 85 food safety experts from American Land Grant institutions. Consequently, a survey was developed to include conditions mentioned in the first survey that would alter the risk level of engaging in the practices examined, and to remove behaviors that experts had related were not a concern or for which expertise and consistent literature was lacking. The revised survey was completed by 67 food safety experts. It contained sixteen questions, 14 of which included a list of sub-questions that, according to responses from the first survey, altered risk level ratings. Descriptive statistics were used to describe the behaviors' risk levels under various conditions. Out of 105 practices, 54 practices were determined to be minimally risky, 29 were moderately risky, and 22 were highly risky. Most of the risk levels assigned by experts to the food acquisition and management practices studied varied from low to high, depending on the conditions under which the practices were performed, except for four practices. Factors such as temperature, foods' degree of exposure to contaminants and/or pathogens, certain food characteristic differences, and the cleanliness of the environment in which the food was stored, prepared, or served led to variation in risk level ratings. USDA consumer guidance on these food acquisition practices used by limited-resource individuals was also evaluated, and the practice of removing insects from grains before consumption was the only practice displaying risk variation from minimal to high that was not alluded to in USDA campaigns or consumer guidance. For 15 (about 14%) of the food acquisition and management practices studied, significantly different risk level ratings were found between Food Science experts and Nutrition Educators. For all 15 practices, nutrition educators responded with a higher risk level rating. Results of this study have helped to

recognize that the limited resource populations engaging in practices determined to be moderate or high risk have an increased likelihood of acquiring a foodborne illness caused by the five most potentially dangerous pathogens identified. Findings also suggest that supplementary food safety education messages that are culturally sensitive, contain content with a low grade level reading, and that are relevant to the high risk food practices identified in this study, may need to be developed. Lastly, students pursuing a career in Community Nutrition or Public Health Promotion, who will have an impact on food safety education disseminated to limited resource populations, should acquire more extensive training in the areas of food safety and food science.

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CHAPTER 1

INTRODUCTION

Foodborne illnesses are a significant health problem in the United States. In 1999, an analysis from multiple surveillance systems and other sources was published by the U.S. Centers for Disease Control and Prevention (CDC) that reported approximately 76 million cases of foodborne illnesses annually, with approximately 325,000 associated hospitalizations and 5,000 associated deaths occurring each year.⁽¹⁾ Based on an extensive CDC analysis, 13.6 million of the 38.6 million illnesses that occur each year, are attributable to foodborne transmission of pathogens, specifically bacteria (30%), parasites (3%), and viruses (67%).⁽¹⁾ Based on the most recent 2011 CDC estimates, each year roughly 1 in 6 Americans (or 48 million people) will get sick, 128,000 will be hospitalized, and 3,000 will die of foodborne diseases, with the top five pathogens contributing to domestically acquired foodborne illnesses listed as *Norovirus*, *Salmonella*, *Clostridium perfringens*, *Campylobacter*, and *Staphylococcus aureus*.⁽²⁾ Because only a fraction of illnesses are diagnosed and reported, periodic assessments via surveillance systems and surveys that assess the total burden of illness are in place.⁽²⁾ To produce these estimates, data for each pathogen is gathered from surveillance systems and corrected for underreporting and under-diagnosis. Consequently, the adjusted number is multiplied by the proportion of illnesses that was acquired in the United States (that is, not during international travel) and the proportion transmitted by food to yield an estimated number of illnesses that are domestically acquired and foodborne. Estimates are added for each of the pathogens to arrive at a total, and an uncertainty model is used

to generate a point estimate and 90% credible interval (upper and lower limits).⁽²⁾ These assessments provide vital information that is used to set public health goals, allocate resources, and measure the economic impact of disease.

Scientists predict that the number of victims who may become ill due to a foodborne illness may rise due to a number of factors.⁽³⁾ These include: the evolution of genetic resistance in disease-causing pathogens; difficulties associated with updating food safety and proper food handling practices education to the public and retail employees; insufficient consumer knowledge of food preparation and food hygiene practices; increased international travel and trade; increased global imports; terrorist activities; advances in food production and distribution methods; and longer life spans, which increase the number of vulnerable people i.e. elderly persons and those with chronic diseases.⁽³⁾ In addition, consumers are preferring to use convenience foods that can be quickly prepared or to eat in restaurants, rather than growing and preparing their own food, giving them less control over the foods they eat.⁽⁴⁾

The Healthy People's 2020 agenda for improving the nation's health includes these food safety objectives:⁽⁵⁾

- ☐ Reduce infections caused by key pathogens transmitted commonly through foods;
- ☐ Reduce the number of outbreak-associated infections due to Shiga toxin-producing *E. coli* O157, or *Campylobacter*, *Listeria*, or *Salmonella* species associated with food commodity groups;

- Prevent an increase in the proportion of nontyphoidal *Salmonella* and *Campylobacter jejuni* isolates from humans that are resistant to antimicrobial drugs.;
- Reduce severe allergic reactions to food among adults with a food allergy diagnosis;
- Increase the proportion of consumers who follow key food safety practices (Clean, Separate, Cook, and Chill); and
- (Developmental) Improve food safety practices associated with foodborne illness in foodservice and retail establishments.

Public health educators and nutritionists often include food safety education as a primary component of their work. Federal agencies, such as the United States Department of Agriculture's (USDA) Food Safety and Inspection Service (FSIS), the Food and Drug Administration's (FDA) Center for Food Safety and Applied Nutrition (CFSAN), *Food Marketing Institute*, and the U.S Department of Health and Human Services (DHHS), have responded to the need for food safety education with numerous social marketing campaigns designed to educate the public about food safety and the prevention of food-related illnesses.⁽⁶⁻¹¹⁾ Furthermore, the Partnership for Food Safety Education (PFSE) has created campaigns to educate the public about safe food handling.⁽¹¹⁾ The PFSE is a non-profit organization that unites industry associations including professional societies in food science, nutrition and health, consumer groups, and, governmental agencies, such as USDA, CDC, FSIS, the Environmental Protection Agency (EPA), FDA, and the Department of Health and Human Services.⁽¹²⁾

In addition to the use of campaigns aimed at improving food safety practices among the general public, food safety education is targeted towards limited-resource audiences is implemented in programs such as Supplemental Nutrition Assistance Program - Education (SNAP-Ed), the Expanded Food and Nutrition Education Program (EFNEP) and the Special Supplemental Nutrition Program for Women, Infants, and Children (WIC).⁽¹³⁻¹⁵⁾ General food safety education is also taught in low income public school systems and food/restaurant industry settings. The SNAP-Ed, EFNEP, and WIC programs are described below.

According to the USDA website, SNAP-Ed is a federal/state partnership that supports nutrition education for persons eligible for the Supplemental Nutrition Assistance Program (SNAP). The agency of the USDA that is responsible for SNAP-Ed is the USDA's Food and Nutrition Service (FNS). FNS determines national policies and procedures, monitors state programs, and reimburses each state's implementing agency's implementation costs.⁽¹³⁾ The main goal of SNAP-Ed is to provide nutrition education programs that teach and encourage food stamp program participants to make healthy food choices consistent with the most recent dietary advice, as reflected in the Dietary Guidelines for Americans. Nutrition messages are aimed at promoting impact outcomes or behavior changes. One of the foci in SNAP-Ed is safe food handling and food safety.⁽¹³⁾

The WIC program is administered by the FNS at national and regional levels. The mission of this program is to “safeguard the health of low-income women, infants, and children up to age 5 who are at nutrition risk by providing nutritious foods to supplement diets, information on healthy eating, and referrals to health care.”⁽¹⁴⁾ Low income women, infants, and children are provided with food and nutrition education, nutrition counseling, access to health care services, and vouchers for foods to supplement the food resources of qualifying participants.⁽¹⁴⁾

EFNEP is administered by the USDA and is implemented in all U.S. holdings, i.e., American Samoa, Guam, Micronesia, Northern Marianas, Puerto Rico, and the Virgin Islands. EFNEP’s objective is “to assist limited-resource audiences in acquiring the knowledge, skills, attitudes for nutritionally sound diets, and to contribute to their personal development and the improvement of the total family diet and nutritional well-being.” Among expected impact outcomes are improved practices in food production, preparation, storage, safety, and sanitation.⁽¹⁵⁾

The food safety education provided by these programs is necessary in order to narrow the widen gap of food safety knowledge that participants have demonstrated. Participants have both reported to, and at times observed, by researchers, to unsafely handle food.⁽¹⁶⁻²²⁾

Research suggests that deficiencies in food safety knowledge and the prevalence of unsafe food practices exist among limited-resource populations, in some cases at higher

rates than the general population.^(16-18, 20-21, 23-25) This deficiency may put them at a higher risk for acquiring foodborne illnesses.^(16-22, 26)

Research conducted under the direction of Dr. Debra Palmer provided further evidence that limited-resource consumers engage in unsafe food handling practices. Low income audiences surveyed admitted to their reliance on a variety of non-traditional and potentially unsafe food acquisition and food management practices that they employed to survive hunger. Examples of such practices were: acquiring and consuming road kill and discarded food, and removing slime and mold from meat and grains before consuming them.⁽¹⁸⁾ Since the definition of food security has been defined as “access to nutritionally adequate and safe foods,” and an ability to “acquire acceptable foods in socially acceptable ways,” Kempson et al., linked food safety to food insecurity.⁽²⁷⁾ Kempson et al. have argued that people who employ practices deemed “unsafe and socially unacceptable” should not be considered food secure, and that these practices should be measured in food security surveys.⁽¹⁶⁻¹⁸⁾

Most traditional food safety education and food security surveys fall short, in terms of addressing and assessing the use of these non-traditional food safety issues. Instead, education typically focuses on topics such as keeping food out of the “danger zone,” washing hands and cutting boards, avoiding cross contamination, and proper reheating and cooling procedures.^(11, 28-32) Kempson et al. have suggested that the food safety education needs of low socioeconomic audiences, particularly SNAP-Ed and EFNEP participants, have not been heavily considered in the development of food safety

education and monitoring.⁽¹⁶⁻¹⁸⁾ In other words, national campaigns designed to promote the improvement of food safety practices, have not targeted unsafe emerging food practices that may be common among vulnerable populations.

Research is needed to ascertain and assess the relative food safety risk associated with these non-traditional food acquisition and management practices reported in the findings of Kempson et al. and to evaluate their prevalence among limited-resource populations. Public health educators may then be made aware as to whether additional food safety practices should be addressed.

To this end, this study was designed to address one of the aforementioned research needs, i.e., to assess the relative food safety risk associated with non-traditional food acquisition and management practices. To accomplish this, this investigation sought the expert guidance and opinions of food safety and/or food science experts at land grant institutions regarding the associated risk of each of the food practices observed in Palmer's previous work. The findings from this investigation are predominantly descriptive in nature. Specifically, it uses the original list of practices to: 1) compile a more comprehensive and adequately detailed inventory of unsafe food practices utilized by limited-resource audiences, and 2) evaluate the comparative level of risk associated with engaging in these practices. Further, it compares the assessed level of food safety risk of each practice in terms of responses gleaned from those experts whose primary emphasis was nutrition, as opposed to those received from experts whose primary area of expertise was food safety/food science. The findings elicited from this work can be used in surveys to assess

the prevalence of non-traditional food safety practices and the development of more effective food safety education/campaigns to address those that are most prevalent among limited-resource populations.

CHAPTER 2

REVIEW OF THE LITERATURE

Food safety is the appropriate usage of practices to preserve food and to prevent its contamination, and thereby decrease the risk for experiencing subsequent foodborne illnesses.⁽⁶⁾ Although studies have shown that the general public lacks knowledge of food safety and, therefore, commonly engage in unsafe food practices, several studies have specifically examined how common unsafe food practices are amongst limited-resource populations.^(16-25, 33) As is discussed in detail in this literature review, food safety campaigns and projects have been developed and implemented by governmental agencies charged with the responsibility of inspecting and surveying the public's food handling practices.⁽⁶⁻¹¹⁾ The mission of these projects and campaigns is to provide education to the general public about key safe food handling practices in order to prevent and reduce the occurrence of foodborne illness outbreaks. According to Dr. Palmer's preliminary research with low income food stamp (SNAP) recipients, non-traditional and potentially unsafe food practices that have not been identified or addressed in these campaigns may exist amongst this population, e.g., eating food that became moldy after the mold is removed.⁽¹⁶⁻¹⁸⁾ Depending on the prevalence and relative risk associated with the use of these practices, changes in food safety education may be necessary to address them. Limited-resource populations who engage in non-traditional, potentially unsafe food practices may be categorized as "food insecure" according to the current definition due to the unconventional methods with which they acquire and handle food as seen in Dr. Palmer's studies.^(16-18, 34) This literature review opens with a review of the recognized causes of foodborne illness and the U.S. agencies that have been established to regulate

and inspect the U.S. food supply in order to protect the public from potential outbreaks. It further reviews food safety education campaigns and efforts aimed at the general public as well as limited resource populations. The review concludes by exploring the connection between food insecurity and food safety knowledge and behavior deficiencies among limited resource populations.

Causes of Foodborne Illnesses

More than 200 known diseases are transmitted through food. As stated in the introduction of this thesis, causes of food borne illnesses include viruses, bacteria, parasites, toxins, metals, and prions.⁽¹⁾ Known pathogens account for an estimated 38.6 million illnesses each year, including 5.2 million (13%) due to bacteria, 2.5 million (7%) due to parasites, and 30.9 million (80%) due to viruses.⁽¹⁾ Overall, foodborne transmission accounts for 13.8 million of the 38.6 million illnesses. Excluding illness caused by *Listeria*, *Toxoplasma*, and hepatitis A virus (three pathogens that typically cause non-gastrointestinal illness), 38.3 million cases of acute gastroenteritis are caused by known pathogens, and 13.6 million (36%) of these are attributable to foodborne transmission.⁽¹⁾ Among all illnesses attributable to foodborne transmission, 30% are caused by bacteria, 3% by parasites, and 67% by viruses.⁽¹⁾ Whether the majority of foodborne illnesses occur in private homes versus restaurants is unclear.⁽³⁵⁾

Medeiros et. al highlighted the importance of specific food handling practices that, if not strictly adhered to, could lead to the majority of foodborne illnesses. Those include 1) improper personal hygiene, 2) inadequately cooking foods, 3) cross contamination, 4)

foods held at unsafe temperatures, and 5) foods from unsafe sources.⁽³⁶⁾ According to Medeiros et al. the organisms that cause the majority of food related illness and the factors that lead to the outbreaks are directly related to these “five constructs,” four of which are constantly emphasized in the aforementioned campaigns and initiatives.⁽³⁶⁾

The first construct, personal hygiene, is a control factor for pathogens that are usually transmitted through human feces. Specifically, *Shigella* species and *E.coli* O157:H7 have low infectious doses and may be transmitted by cross contamination.⁽³⁷⁾ According to Hillers et.al, hand washing was ranked as the most important behavior in preventing shigellosis by food safety experts.⁽³⁸⁾ Thus, it has been stressed that food handlers must be educated about the importance of washing their hands after bowel movements in order to prevent illnesses caused by these pathogens.

In addition to the pasteurization process, the second construct named, adequately cooking foods, helps to prevent the spread of zoonotic pathogens in foods such as meat, eggs, and milk products.⁽³⁶⁾ Zoonotic pathogens refer to pathogens naturally transmitted between animals and humans such as *Escherichia coli* O157:H7, *Campylobacter*, *Caliciviridae*, and *Salmonella*.⁽³⁷⁾ According to research findings by PFSE, only about 15% of people consistently use a food thermometer.⁽¹¹⁾ Using color as a guide to determine if food is cooked thoroughly is misleading and can increase an individual’s risk of becoming ill.⁽³⁹⁻⁴³⁾ Thermometer use has been ranked by food safety experts as being of primary importance in preventing illness caused by pathogens such as *Campylobacter jejuni*, *Salmonella*, and *E.coli* O157:H7.⁽³⁸⁾ Because many consumers rely on color to decide

whether a food has been cooked properly, Medeiros et al recommend that “adequate cooking messages needed to include various time/temperature combinations that produce safe meat, eggs, and dairy products.”⁽³⁷⁾

Avoiding cross contamination was the third construct Medeiros et al named, due to the incidences of illness caused by *Campylobacter*.⁽³⁶⁻³⁷⁾ According to the CDC, *Campylobacter* is one of the most common bacterial causes of diarrheal illness in the United States.^(26, 37) Campylobacteriosis may be caused by improperly handling raw poultry. For example, cutting poultry meat on a cutting board and then using the unwashed cutting board to prepare vegetables can cause the poultry juices left on the cutting board to contaminate the vegetables.⁽³⁶⁾

Keeping food at safe temperatures was the fourth construct named, and it is of primary importance in preventing illness caused by *Bacillus cereus*, *Clostridium perfringens*, and *Staphylococcus aureus* according to food safety experts surveyed by Hillers et.al.⁽³⁸⁾ Since there are less than 500,000 illnesses per year from these three pathogens and they cause mild illness, it was suggested that this construct be a secondary message rather than traditionally being the focus of the food safety lesson.⁽³⁶⁾

Regarding the fifth, and last, construct “unsafe food sources,” Medeiros et al. were referring to products such as ready to eat foods that were improperly produced or processed in a way that does not kill pathogens.⁽¹⁹⁾ Examples would also include raw and unpasteurized milk and raw milk cheeses, uncooked seafood from contaminated water,

and home canned, low acid foods that were improperly processed. In other words, food sources such as road-kill and meats purchased from meat trucks or private meat vendors were not investigated when establishing this construct. Medeiros et al. notes that because consuming food from unsafe food sources may be a habit present amongst some ethnic groups or high risk groups such as pregnant women, food safety educators need to understand the food habits of their particular target audience to determine how much focus should be placed on this educational topic.^(19, 36)

Though it is not covered by the five constructs explained above, Medeiros et al suggested that consumers are encouraged to wash fruits and vegetables since this is the only practice known to reduce the amount of pathogens on fresh produce.⁽³⁶⁾ Of note, washing only partially removes pathogens from fresh produce. Washing poultry, eggs, or meat at home is not recommended.⁽³⁶⁾

Therefore, it has been recommended that food safety education primarily focus on food safety behaviors such as hand washing, adequate cooking, preventing cross-contamination, keeping food at safe temperatures, and avoiding food from unsafe sources which are behaviors that if followed properly, have the most impact on preventing a foodborne illness.⁽³⁶⁾

Federal Regulation and Surveillance of the U.S. Food Supply to Prevent Occurrence of Foodborne Illnesses

Surveillance of foodborne illness is complicated by several factors, with the primary factor being underreporting. Milder, less severe food borne illness cases are often not detected through routine surveillance.⁽²⁶⁾ Many pathogens that are transmitted through food are also spread through water or from person to person, and therefore disguises the role of foodborne transmission.⁽²⁶⁾ Finally, some proportion of foodborne illness is caused by pathogens or agents that have not yet been identified and thus cannot be diagnosed.⁽¹⁾ Food safety surveillance has become a growing concern among the public and federal agencies whose mission is to ensure that the public food supply is safe from disease. Establishing food safety standards, conducting inspections, monitoring that standards are met, and maintaining a strict protocol to penalize those who do not comply with standards, are measures taken to prevent foodborne illnesses caused by infection or by contamination from hazardous substances.^(26, 44-46) Several major federal agencies are responsible for food regulation and food safety, to reduce the occurrence of foodborne illnesses. These include: the Food and Drug Administration (FDA), the Centers for Disease Control and Prevention (CDC), the Food Safety and Inspection Service (FSIS), and the Environmental Protection Agency (EPA).^(26, 44-46) The vital role each of these agencies play in ensuring food safety standards are met is described below.

The Food and Drug Administration (FDA). The FDA, an agency within the Department of Health and Human Services, is responsible for “protecting consumers against impure, unsafe, and fraudulently labeled products” through one of its six product oriented centers,

the Center for Food Safety & Applied Nutrition (CFSAN).⁽⁴⁴⁾ The CFSAN regulates foods other than meat, poultry, and egg products that are regulated by FSIS and also oversees the safety of imported food products.⁽¹⁰⁾ The safety of drugs, medical devices, biologics, animal feed and drugs, cosmetics, and radiation emitting devices are also regulated by the FDA through the Center for Biologics and Evaluation and Research, Center for Devices and Radiological Health, Center for Drug Evaluation and Research, Center for Tobacco Products, Center for Veterinary Medicine, and National Center for Toxicological Research.⁽⁹⁾ Because of the large volume of imported food that enters the U.S., CFSAN also works with international organizations such as the World Health Organization, Food and Agriculture Organization of the United Nations, Codex Alimentarius Commission, International Cooperation on Cosmetic Regulation and with foreign governments to educate them on U.S. requirements and develop safety standards, rules, and regulations for these imported products.⁽¹⁰⁾ The FDA has been responsible for creating food safety safeguards, such as the “The Food Protection Plan” and established an electronic reporting tool available to both food industries as well as governmental agencies.⁽⁴⁴⁾ The Food Protection Plan, developed in 2007, was designed to protect the nation's food supply from “both unintentional contamination and deliberate attack.”⁽⁴⁴⁾ The plan consisted of the following main elements: *Prevention, Intervention, and Response*. Prevention meant building safety in from the start, from the production to the consumption of food.⁽⁴⁴⁾ Intervention meant implementing risk-based inspections and testing to ensure that preventive actions are working and that resources are utilized in the areas of greatest concern to achieve maximum risk reduction. Response meant ensuring rapid reaction, effective communication with consumers and others during a food related

emergency when there is a potential or actual harm to consumers using science and modern technology systems. The success of the plan heavily depended, and continues to depend, on the utilization of scientific and technological advances to protect the nation's food supply.⁽⁴⁴⁾

Additionally, The FDA Food Safety Modernization Act (FSMA) was signed into law by President Obama on January 4th, 2011 to ensure the U.S. food supply is safe by shifting the focus of federal regulators from responding to contamination to preventing it.⁽⁴⁷⁾ The FDA's key new authorities and mandates include:

- Requirement to obtain a written preventative controls plan from all food facilities to implement, develop science based minimum standards for the safe production and harvesting of fruits and vegetables, and develop regulations to protect against the intentional adulteration of food.
- Requirement for a mandated inspection frequency, based on risk, for food facilities and requires the frequency of inspection to increase immediately.
- Access to industry food safety plans.
- Requirement for food testing to be carried out by accredited laboratories and establishment of a program for laboratory accreditation.
- Authority to detain products that are potentially in violation of the law.
- Authority to issue mandatory recalls when a company fails to voluntarily recall unsafe food after being asked by the FDA.

- Authority to suspend a facility if it determines that the food poses a reasonable probability of serious adverse health consequences or death and that facility is prohibited from distributing food.
- Responsibility for establishing a system that will enhance its ability to track and trace both domestic and imported foods.
- Authority to issue rule-making to establish recordkeeping requirements for facilities that manufacture, process, pack or hold high risk foods.
- Requirement of importers to verify that foreign suppliers have adequate preventative controls in place to ensure food is safe, certify that foreign food facilities comply with U.S. food safety standards, high risk imported foods are accompanied by a credible third party certification.
- Authority to refuse entry of food into the U.S. from a foreign facility if the FDA has denied access
- Requirement to develop and implement strategies to leverage and enhance the food safety and defense capacities of state and local agencies as well as rely on inspections of other Federal, State, and local agencies to meet its increased inspection mandate for both domestic and foreign facilities.

The Centers for Disease Control and Prevention (CDC). The CDC “leads federal efforts to gather data, investigate foodborne illnesses and outbreaks, and monitor the effectiveness of prevention and control efforts in reducing foodborne illnesses.”⁽²⁶⁾ CDC is also involved in “building state and local health department epidemiology, laboratory, and environmental health capacity to support foodborne disease surveillance and outbreak response.”⁽⁴⁸⁾ In 1995, The Emerging Infections Programs (EIP) was launched

in response to CDC's 1994 strategy titled "Addressing Emerging Infectious Disease Threats: A Prevention Strategy for the United States."⁽⁴⁸⁾ The 1998 updated version is entitled "Preventing Emerging Infectious Diseases: A Strategy for the 21st Century." These strategies outline EIP's national role in surveying, preventing, and controlling emerging infections. The EIP network of 10 state health departments collaborate with local health departments, academic institutions, federal agencies, public health and clinical laboratories, infection preventionists, and healthcare providers to utilize the knowledge and findings gained through research activities and help incorporate them into public policy and public health practices. The EIP also develops and evaluates public health interventions for use by public health agencies.⁽⁴⁸⁾

CDC's Foodborne Diseases Active Surveillance Network, also known as FoodNet, consists of a collaborative project with 10 Emerging Infections Program (EIP) sites.^(26, 48) These sites are located in California, Colorado, Connecticut, Georgia, Maryland, New Mexico, New York, Oregon, and Tennessee.

The main objectives of FoodNet are to:

- ☐ Determine the burden of foodborne illness in the United States
- ☐ Monitor trends in the burden of specific foodborne illness over time
- ☐ Attribute the burden of foodborne illness to specific foods and settings
- ☐ Disseminate information that can lead to improvements in public health practice and the development of interventions to reduce the burden of foodborne illness.

The USDA and the FDA also collaborate with the CDC to actively monitor foodborne illnesses and examine related epidemiologic studies to help authorities understand the epidemiology of foodborne illnesses.⁽²⁶⁾ Each year the total catchment or surveillance area has expanded and the most recent estimates include a surveillance of 44.5 million people across the U.S. which is approximately 15% of the population.⁽²⁶⁾

The Food Safety and Inspection Service (FSIS). The FSIS is “responsible for ensuring that the nation’s commercial supply of meat, poultry, and egg products is safe, wholesome, and correctly labeled and packaged.” The agency carries out its responsibilities under the Federal Meat Inspection Act and the Poultry Products Inspection Act.⁽⁴⁹⁾ With regard to imported food products, such as meat, poultry, and processed egg products, they must be produced under standards equal to that of U.S. inspection standards before being introduced into the U.S. food supply.⁽⁴⁹⁾

The Environmental Protection Agency (EPA). The mission of EPA is “to protect human health and to safeguard the natural environment air, water and land upon which life depends.”⁽⁴⁶⁾ The EPA’s main responsibilities include writing regulations and setting national standards to implement environmental laws that states and tribes must comply with, conducting environmentally focused research to help identify and resolve environmental problems, and educating consumers and or the general public about current issues that may negatively affect human health such as air and water pollution and the changing climate.⁽⁴⁶⁾

The federal agencies described above continue to identify key pathogens and food practices associated with the occurrence of foodborne illness outbreaks. The knowledge they obtain is then translated into recommendations for the general public to adhere to. In order to effectively reach consumers, several food safety campaigns were developed to translate the science behind food safety into layman's terms that the public can easily understand and implement.⁽¹¹⁾

Food Safety Campaigns

The surveillance of food safety issues and recommendations provided by the aforementioned agencies have informed educational efforts directed to the public regarding necessary behaviors to prevent foodborne illness.⁽¹¹⁾ As a result, several key food safety education campaigns have been launched to advocate the adoption of essential food safety management practices among individuals. Chief among those that have gained special attention due to their national focus were Fight BAC! [®], *Be Food Safe*, BAC Down!, Thermy,[™] and *Is it done yet?*⁽¹¹⁾

Fight BAC!® Campaign.⁽⁵⁰⁾ The Fight BAC!® food safety initiative was developed to educate the public about safe food handling. It was created and launched after extensive consumer research in 1998 by the Partnership for Food Safety Education (PFSE).^(11, 50) The PFSE is a not-for-profit organization that unites industry associations, professional societies in food science, nutrition and health, consumer groups, and the U.S. government. The Partnership's membership consists of associations and nonprofit organizations including the American Dietetic Association, Food Marketing Institute, and Institute of Food Technologists, among others. Federal Government liaisons of PFSE include the CDC, EPA, CFSAN, and FSIS.⁽³⁰⁾

The campaign emphasizes the “core four” basic safe food handling behaviors: Clean, Separate, Cook and Chill. Fight BAC!®'s bacteria mascot was the metaphorical “invisible enemy” named “BAC” whose goal was to spread himself on food to contaminate it. This mascot was implemented to allow for easier and more fun learning concepts for children.⁽⁵⁰⁾ To assist in educating the public on safe produce handling, the FightBAC!® campaign was enhanced with relevant educational materials/brochures and activity ideas for food safety advocates, retailers, and produce leaders, as well as suggestions on how to involve the community in these efforts. Supporting materials and free downloads for the FightBAC!® campaign are available at Fightbac.org.⁽⁵⁰⁾

Before it was decided that Fight BAC!® would be the slogan or theme for this campaign, the partnership for Food Safety Education sought to obtain feedback from consumers regarding various elements of the campaign.⁽⁵⁰⁾ To accomplish this, focus groups were

conducted among key target groups: young parents (21-35 years), younger individuals without children (21-35 years), older individuals (60-75 years), teenagers, and Hispanic mothers. Sixteen focus groups were conducted nationwide from May 20 to May 29, 1997 to obtain sufficient feedback from these key target groups.⁽⁵¹⁾

Each focus group addressed: food preparation behaviors and knowledge of food safety; participants' reactions to campaign characters; and the campaign food safety guidelines. Participants attributed much of their knowledge about food safety to the media, especially television news shows. Others got information from their mothers, work experience, and package labeling. They acknowledged that their concern for food safety had increased in the past several years due to media focus on this issue. Despite a good understanding of food safety guidelines and a concern for food safety, they still harbored some misconceptions.⁽⁵¹⁾ For example, when asked what populations other than children are at high risk for foodborne illness, participants mentioned senior citizens. However, in spite of knowing that children are at higher risk, most participants said they were not more cautious and have not changed behaviors since having children. In regards to cooking safely, participants thought "cook thoroughly" meant to cook to a certain temperature or cook until the juices run clear. No one mentioned using a food thermometer as method for protecting their families from foodborne illness.⁽⁵¹⁾

Their overall reaction to the BAC character was positive. The majority agreed that the image was consistent with the character's message and purpose which added to the character's effectiveness as part of the campaign. In addition, the campaign slogan Fight

BAC![®] was well liked by nearly all participants for its clear message and aggressiveness.⁽⁵¹⁾

Only one study could be found that assessed the Fight BAC![®] campaign after its launch.⁽³⁰⁾ As previously noted, the national the Fight BAC![®] campaign was launched in 1998; however, it was broadly disseminated in 2000 in Connecticut and Southwestern Massachusetts. The campaign delivery included the dissemination of campaign messages via English and Spanish language radio stations, television channels, newspaper, posters, and distribution of stickers, brochures, coloring books, and plastic bags displaying the Fight BAC![®] Logo. Dharod, JM et al,⁽³⁰⁾ examined the campaign's effects on the food safety knowledge, attitudes, and behaviors of a sample of 500 Puerto Ricans living in inner-city Hartford, Connecticut.

Study participants were required to have at least one child 12 years of age or under. Surveys were administered pre and post exposure to this regional campaign. They were administered in both English and Spanish, and were comprised of 30 food safety questions. The FightBAC![®] logo was displayed in both pre- and post-surveys, so the investigators could determine whether it had been seen prior to the regional intervention. The post survey asked participants to recall if they had been exposed to each of the campaign media items.⁽³⁰⁾

Findings indicated that approximately 73% of respondents recalled having been exposed to at least one of the Fight BAC![®] promotional materials.⁽³⁰⁾ Recognition of the Fight

BAC![®] logo increased significantly as after the regional campaign, i.e., from 10% pre-intervention to 40% post-intervention.⁽³⁰⁾ Individuals who recalled having been exposed to the Hartford campaign were also more likely to have an “adequate” food safety knowledge score than those who did not recall having been exposed to the campaign.⁽³⁰⁾ Pre and post surveys also revealed statistically significant improvements in reported proper hand washing and meat defrosting behaviors. Lastly, there was a dose response association between the degree of campaign exposure and awareness of the term “cross-contamination” as well as recognition of the Fight BAC![®] logo.⁽³⁰⁾

Subsequent USDA initiatives, such as *Be Food Safe*, BAC Down! and Thermy[™] Fight BAC![®] campaign, reinforced the same four core food safety messages.⁽¹¹⁾

Be Food Safe Campaign. The *Be Food Safe* campaign⁽¹¹⁾ was designed to educate consumers about preventing foodborne illness through four lessons, including the following objectives:

- *Clean*
 - Wash hands, utensils and surfaces in hot soapy water before and after food preparation and especially after preparing meat, poultry, eggs or seafood to protect adequately against bacteria.
 - Wash hands the “right way,” that is for 20 seconds with soap and running water.
 - Wash fruits and veggies, but not meat, poultry, or eggs.

- Use a disinfectant cleaner or a mixture of bleach and water on surfaces and antibacterial. soap on hands can provide some added protection.
- Separate (don't cross contaminate)
 - Keep raw meat, poultry, eggs and seafood and their juices away from ready-to-eat foods.
 - Use separate cutting boards and plates for produce and for meat, poultry, seafood, and eggs.
 - Keep meat, poultry, seafood, and eggs separate from all other foods in the fridge.

- Cook
 - Cook food to the proper internal temperature (this varies for different cuts and types of meat and poultry).
 - Check for doneness with a food thermometer.
 - Keep food hot after cooking (at 140° F or above).
 - Microwave food thoroughly (to 165° F).
 - Cook eggs until both the yolk and white are firm.
- Chill:
 - Refrigerate or freeze perishables and leftovers within 2 hours.
 - Never thaw or marinate foods on the counter.
 - Make sure the refrigerator is set at no higher than 40° F and the freezer unit is set at 0° F.
 - Know when to throw out food; you cannot tell by looking or smelling whether harmful bacteria has started growing in your leftovers or refrigerated foods.

BAC Down! Campaign. The BAC Down! Initiative was developed to increase public awareness of appropriate refrigerator temperatures, i.e., 40° F or below, and of using a thermometer to monitor refrigerator temperatures.⁽¹¹⁾ The importance of these practices was evident as a result of:

1. The FDA issued the revised *Listeria monocytogenes* risk assessment in 2003 which demonstrated that the incidence of Listeriosis, a common illness associated

with foods improperly chilled, would be reduced by more than 70% if refrigerator temperatures did not exceed 41° F,⁽⁷⁾ and

2. Research findings from the March 2005 PFSE consumer survey on refrigeration revealed that only 20% of consumers reported they used a refrigerator thermometer.⁽⁷⁾

Educational materials associated with this campaign are available at fightbac.org/campaigns/bac-down. The site provides consumers and food safety education professionals with free materials such as fliers and brochures, children's activity sheets, campaign logos and graphics, Microsoft Powerpoint presentations, public service announcements and television clips, and other resources in the Spanish language. No studies evaluating the effectiveness of this campaign have been published.

Thermy™ Campaign.⁽⁵²⁾ The Thermy™ campaign,⁽⁵²⁾ launched on May 25, 2000, was a national consumer education initiative developed by the FSIS and USDA to promote food thermometer use and to support the Fight BAC!® message of “Cook food to the proper internal temperature and check for doneness with a food thermometer.” The campaign slogan read “It’s Safe to Bite When the Temperature is Right!”⁽⁵³⁾

The campaign was based on studies showing significant risk for foodborne illness when color is used to judge when food has been cooked to a safe temperature. Factors such as pH, fat level, cooking temperature, natural pigments found in meat, and added seasonings and flavorings all exerted an effect on the color of meat.⁽³⁹⁻⁴³⁾ Specifically, a 1995 study

conducted by Kansas State University, revealing that ground beef may turn brown before being cooked to a safe internal temperature, prompted this educational campaign.⁽⁴³⁾ This study prompted subsequent research by the USDA's Agricultural Research Service to further examine beef color as it relates to doneness. Their findings revealed that one in every four burgers turned brown before being cooked to a safe internal temperature and provided the evidence to support the message to consumers regarding cooking of beef patties of "use an accurate food thermometer and cook beef patties to 160°F (71.1°C)" in place of messages based on consumer judgment of cooked color.⁽⁴³⁾

The USDA's FSIS conducted extensive research with focus groups to develop this food thermometer campaign, i.e., educational materials in English and Spanish, a catchy and informative slogan, and the FSIS campaign icon—Thermy.^{TM(53)} Focus groups were conducted in 2 cities, Raleigh, NC (to represent a semi-rural area) and New Orleans, Louisiana (to represent an urban area). There were 38 participants in total: 17 young parents, aged 21-35 years with children 6 years of age or younger; 11 seniors, aged 60 to 75 years; and 10 individuals, aged 21-65 yrs, representing the general population. Sixty six percent of participants were female, 62% were Caucasian, 19% were African American, and 19% were Hispanic. Participants' average years of education were 15, and their average income level was \$43,712. In order to participate, individuals had to meet the following criteria: were the primary food preparer or had the shared responsibility for preparing meals; prepared/cooked food at home at least 3 times/week; were saving or eating leftovers; and were not vegetarians.⁽⁵³⁾

Notably, 42% of participants reported owning a thermometer. Twenty one percent reported always or often using a food thermometer when cooking beef or pork, 24% reported always or often using a food thermometer when cooking poultry; and 5% reported using a food thermometer when cooking hamburgers.⁽⁵³⁾ While working on concept testing for characters to symbolize the importance of using a food thermometer, the majority of participants preferred a round shaped thermometer with a smiling digital display of 160° F, features resembling a chef, the name Thermy,TM and the slogan, “It’s safe to bite when the temperature is right!” The ThermyTM campaign was officially launch in May of 2000.⁽⁵²⁾ To further support and disseminate the importance of thermometer use when cooking, FSIS collaborates with the thermometer industry and grocery stores nationally to teach the importance of using food thermometer.⁽³¹⁾

Since the campaign’s launch, the FDA’s Food Safety Surveys have been used by the FDA’s Center for Food Safety and Applied Nutrition to analyze changes in food thermometer ownership and usage beginning in 1998 and until more recently in 2010.⁽³¹⁻³²⁾ Survey findings revealed that over time, more consumers have reported owning a meat thermometer and using thermometers when cooking various foods. The number of people who reported they owned a thermometer increased from 48% in 1998 to 66% in 2010.⁽³¹⁻³²⁾ The proportion of cooks using a food thermometer for hamburger has rose from less than 10% in 1998 to approximately 30% in 2010. The number of people reporting using a thermometer to check for doneness of chicken parts rose from about 15% in 1998 to about 54% in 2010.⁽³¹⁻³²⁾

The *Is it done yet?* Campaign. The *Is it done yet?* campaign was also developed by the USDA's FSIS to further increase consumers' usage of food thermometers daily to properly cook meat, poultry, and eggs, especially small cuts such as hamburgers and chicken breasts, to safe temperatures.⁽⁵⁴⁾ The campaign furthered FSIS's Food Thermometer Education Campaign, and specifically targeted upscale, suburban parents of children under age 10, termed "Boomburbs."⁽⁵⁵⁾

The Boomburbs were chosen as the target audience because they were believed to be those most likely to move rapidly through the stages of behavior change, to fully adopt the desired behavior.⁽⁵⁵⁾ They are known to have a propensity for acquiring and using new information and are considered major influences of mass culture, setting trends and disseminating new ideas. In addition, Boomburbs prefer high quality, gourmet foods, which are often served at lower than safe internal temperatures. Previous focus groups studies confirmed that this group did not know about the unreliability meat and poultry color as an indicator of doneness, nor were they aware of the need to use a food thermometer for safety. Thus, the campaign was designed to increase Boomburbs' awareness that they need to use a food thermometer and their intent to use one. The campaign used social marketing principles in an attempt to create lasting behavior change.⁽⁵⁵⁾

The Michigan State University (MSU) National Food Safety and Toxicology Center partnered with FSIS to conduct a pilot for this public health campaign in Michigan during two weeks in August 2004.⁽⁵⁵⁾ The message promoted was, "Is it done yet? You can't tell

by looking. Use a food thermometer to be sure.” The campaign consisted of daily special events and extensive web and media outreach. Specific materials and promotional items were designed especially to appeal to the target audience.⁽⁵⁵⁾

To assess the effectiveness and improve upon the pilot campaign, several research means were employed. Pre- and post-campaign mail surveys were conducted; surveys were completed onsite by attendees of campaign events were administered; and focus groups were held and evaluated. Focus groups included discussions regarding participants’ use of thermometers; impressions of the campaign brochure, suggestions on how the campaign could be improved, and impacts the campaign had on their awareness and knowledge of food thermometers. Participants also provided feedback on the *Is it done yet?*: magnet, web site, radio public service announcement, and print advertisements.

The FSIS and MSU pilot was successful in meeting all of the campaign pilot objectives. The overall proportion of Boomburbs using food thermometers (including sometimes, most of the time, and all of the time) increased by about nine percent.⁽⁵⁵⁾ For Boomburb respondents that reported not using a thermometer when cooking or grilling prior to the campaign, 50% of the respondents indicated that they were likely to think about using one after the campaign.⁽⁵⁵⁾ When cooking or grilling for their young children 47% more thought about it.⁽⁵⁵⁾

Information obtained during this pilot was used to plan and develop the nationwide campaign which began in July 2005. The campaign supports the following objectives:

- Build and use partnerships among national, regional, and local entities
- Build and use partnerships among government, education, health organizations and industry in common localities
- Report and share success stories through the campaign website:
www.IsItDoneYet.gov
- Provide coordination, materials, ideas, plans, and other resources from FSIS to partners in this multi-year effort.

The Check Your Steps: Food Safe Families Campaign. In June of 2011, the USDA, FDA, CDC, and the Ad Council cooperatively launched this national, multi-media public service campaign in an effort to help families protect themselves from food poisoning in their homes.⁽⁸⁾ This campaign, again, aimed to help consumers adopt the four food preparation steps necessary for the protection from foodborne illness: Clean, Separate, Cook, and Chill. These four food preparation steps have been repeatedly emphasized and supported in previous food safety campaigns listed above.⁽⁸⁾

National Food Safety Education Month (NFSEM). Although NFSEM was not a food safety campaign, per se, it is similar in that it is a national initiative created by the National Restaurant Association Educational Foundation in 1994 to “heighten the awareness about the importance of food safety education.”⁽⁵⁶⁾ This initiative aims to provide resources to the public that reinforce food safety education, provide training to restaurant and foodservice workers, and educate the public about food safety topics that range from cooking to serving leftovers each September. Each year a new theme and free

training activities and posters are specifically created to help reinforce proper food safety practices and procedures to employees of the restaurant and foodservice industry. The complementary posters and training activities created for NFSEM were based on the SERVSAFE® food safety training and certification program and designed to communicate concepts clearly and quickly.⁽⁵⁶⁾ In September 2011 theme was “Lessons Learned from the Health Inspection.” Sub-messages created for the 2011 campaign included:

- The Health Inspection:
 - Ask for identification.
 - Don’t make the inspector wait to come inside.
 - Answer all of the inspector’s questions at best you can.
- What to Watch for When Handling Food:
 - Avoid touching your body and then touching food.
 - Use gloves the right way.
- What to Watch out for When Cleaning and Sanitizing:
 - Clean and sanitize food contact surfaces the right way.
 - Mix sanitizing solutions the right way.
 - Store cloths for wiping food spills the right way.
- What to Watch out for When Storing Food:
 - Store food in containers made for food.
 - Label food before storing it.
 - Do not refill condiment bottles.
- What to Watch out for When Handling Utensils and Equipment:

- Wash your hands between handling dirty and clean dishes.
- Store clean and sanitized items upside down.
- Handle ice buckets and scoops the right way.

The most recent September 2012 theme was titled, “Be Safe, Don’t Cross Contaminate.”⁽⁵⁶⁾ Five weeks of activities, posters and archives are available for download in English and Spanish and target the following sub themes:

- Week 1: Personal Hygiene Practices That Prevent Cross-Contamination
- Week 2: Preventing Cross-Contamination through Hand washing
- Week 3: Cleaning and Sanitizing Practices That Will Prevent Cross-Contamination
- Week 4: Preventing Cross-Contamination During Storage, Preparation, and Cooking
- Week 5: Preventing Cross-Contact.

The Food Safety Discovery Zone Mobile.⁽⁵⁷⁾ To further support and advertise the food safety campaigns listed above the USDA designed the *Safety Mobile* to spread the message of food safety importance across the country.⁽⁵⁷⁾ It has been described as a traveling educational tool, bearing the four steps to keeping food safe (Clean, Separate, Cook, and Chill) and characters like Thermy™. Its primary goal is to provide food safety lessons to schools and other institutions on the road, and to establish and develop partnerships with various local educators and others interested in food safety in their communities.⁽⁵⁷⁾

Food Safety Education

Evidence suggests that food safety education efforts have improved food safety practices among consumers.^(4, 29) A study conducted by Jayaratne al. to evaluate whether changes in food safety knowledge led to changes in behavior among in-home childcare providers who participated in a childcare self-study Extension course, found a moderately positive correlation between changes in participants' food safety knowledge and changes in their subsequent safe food handling practices.⁽²⁹⁾ More specifically, studies have shown that such programs have resulted in improvements in: washing cutting boards with soap,⁽⁴⁾ using thermometers when cooking food,⁽⁴⁾ cooking foods more thoroughly;⁽⁴⁾ and taking measures to reduce cross-contamination after handling raw meats, poultry, and seafood.⁽⁴⁾ Other studies such as the FDA's sponsored Utah State University observational study, that compared the accurateness of stated food practices in telephone surveys with what was physically being done in consumers' homes, suggested that consumers claimed to have improved their food safety practice.⁽⁵⁸⁾ These practices included washing hands before preparing food and keeping surfaces clean to prevent cross-contamination;⁽⁵⁸⁾ however, observational findings did not supported these claims. While overall consumer knowledge and awareness of food safety concepts increased, unsafe food practice remained evident. For example, while 87% of participants reported washing their hands all or most of the time before food preparation, only 45% were actually observed to have done so.⁽⁴⁾ "It seemed that many consumers fail to consistently and diligently apply what they know about food safety to the multiple occasions that arise during the course of a realistic food preparation."⁽⁵⁸⁾ Still, some studies show no effect from food safety interventions. For example, overall consumers have not significantly changed their

practice of eating pink steaks and, hamburgers, and raw eggs; and, more reported eating raw fish regularly in 2001 than in 1998.⁽⁴⁾

EFNEP, SNAP-Ed, WIC.

Because this research pertains to limited resource audiences, educational programs and lessons targeting this population were reviewed. However, some health professionals have reported challenges such as a deficiency in knowledge and safe food handling behaviors among the limited resource populations with whom they work.^(16-18, 20, 21, 23, 33, 59)

Limited Resource Populations' Unsafe Food Practices and Food Safety Knowledge Deficiencies

The use of unsafe food practices among America's most at-risk populations is of great concern.^(16-18, 20, 21, 23, 33, 60) Limited-resource individuals have reported that they receive food safety education from hospitals, schools, work and television, and from family members;^(20-21, 25, 33) yet, directors and health professionals from 79 Midwestern WIC clinics reported that the food safety knowledge of their clients was fair to very poor.⁽⁶¹⁾ These knowledge deficiencies have been illustrated in several studies. When Puerto Rican caretakers in Connecticut were asked what food safety meant to them, less than one quarter related the concept of "food safety" to any of the Fight BAC!® steps: Clean, Separate, Cook and Chill.⁽²¹⁾ Nineteen percent mentioned that the term "food safety" was related to refrigerating or chilling foods; five percent knew the proper definition for cross

contamination. In a focus group study with WIC clients, none of the focus group participants attributed foodborne illnesses to “at-home” practices, but rather to poor food handling at restaurants, and to products sold past their expiration dates.⁽²⁰⁾ Participants were also not aware of the risk of Listeriosis or the risk that unsafe food practices posed to pregnant women and infants (although they did recall being advised by their doctors not to eat undercooked meat or raw fish and certain types of fish during pregnancy).⁽²⁰⁾ Meer and Misner reported that out of the 75% of EFNEP participants in two Arizona counties, 32% “Hispanic” and 22% African American, approximately one third reported that taste and smell could be used to identify foods that could cause illness.⁽²³⁾ They also reported that about 56% of study participants were in disagreement with or unsure about the need to cool foods in shallow containers or about the proper depth to store food to allow for an adequate rate of cooling, although most participants knew it was best to transfer food to a different container for storage; and sixty nine percent were unable to specify the temperature of their refrigerators.⁽²³⁾ Kwon et al. reported significant differences in food safety knowledge and behavior scores among participants of different education levels and racial or ethnic groups. White respondents had significantly higher knowledge scores than did Hispanic respondents, and black respondents had significantly lower behavior scores than did members of the other three racial or ethnic groups.⁽²⁵⁾

Although improved knowledge does not always result in improved behaviors, knowledge of food safety practices may be beneficial in some cases. For example, in one study regarding food safety knowledge scores among WIC clients, diarrheal illness was more prevalent among those with lower food safety knowledge scores.⁽³³⁾ However, a greater

number of studies was identified suggesting that even when participants received food safety education resulting in higher post-education scores than those who had not received education, discrepancies between knowledge and observed behaviors was troublesome.^(20-21, 33) For all behaviors examined in a meta-analysis of twenty studies that examined food safety knowledge and behavior, consumer knowledge of safe food handling practices did not correlated with reported use of the practices.⁽³³⁾ This suggests that knowledge is a poor indicator of actual behavior.

Below is a description of studies that have examined multiple food safety practices used by limited-resource individuals, presented according to their relationship to each of the Fight BAC!® campaign components. Also examined are practices related to the consumption of high-risk foods.

Clean. The Fight BAC!® “Clean” message addresses both personal hygiene and the cleaning of surfaces that come into contact with food. These practices often fail to be used by limited-resource women, even when they report that they are compliant with safety recommendations.⁽⁵⁰⁾

Three separate studies examining insufficient levels of hand washing among low-income groups were identified.^(21, 24, 33) In a study conducted between 1999 and 2000, Bermudez-Millan et al. found that among Connecticut Puerto Rican caretakers interviewed, 97% reported that they washed their hands with soap and water before starting to cook, yet when observed only 10% actually did.⁽²¹⁾ In another study conducted in 2005 with

primarily Hispanic and African American WIC clients in Florida's Miami-Dade county, significant associations were reported between contracting diarrheal illness and four specific practices, three of which addressed hand washing.⁽³³⁾ That is: not washing hands with soap and water before preparing meals; not washing hands after changing diapers; and not washing hands with soap and water before preparing baby formula or bottled breast milk. It was also found that pregnant women tended to wash their hands less frequently before preparing meals and baby bottles, and after changing diapers than did women who were not pregnant.⁽²⁴⁾ Patil et al. revealed discrepancies between knowledge versus usage of good hygiene practices amongst those with different educational levels and ethnicities. Although those with less than a high school education reported knowing less about good hygiene practices in three studies, five studies revealed that they reported using more good hygiene practices than those with more than a high school education.⁽³³⁾

With regards to the cleansing of surfaces that come into contact with foods, it has been found that not washing all items that touched raw meat before preparing the next food item has resulted in significantly higher incidence of diarrheal illnesses.⁽⁶⁰⁾ Eighty percent of WIC participants studied reported washing their cutting boards with soap and water before placing foods on them, while only 60% were observed to do so.⁽³³⁾ Once again, in the area of "cleaning," discrepancies have been found to exist between self-reported and actual behaviors. According to the previously mentioned meta-analysis, low income individuals and those without a high school education, have reported use of good hygiene practices that exceeded their knowledge of safe practices.⁽⁶⁰⁾

Separate: The aforementioned meta-analysis reviewed 10 studies that examined behaviors to prevent cross-contamination. Findings suggested that those who identified themselves as African American, those with lower incomes, and those with less than a high school education, reported better use of behaviors to prevent cross-contamination than other populations.⁽⁶⁰⁾ Discrepancies between knowledge versus usage of this practice amongst those with different educational levels were noted. For example, those with less than a high school education reported knowing less about preventing cross-contamination, yet they reported practicing more proper techniques compared to those with more than a high school education.⁽⁶⁰⁾ In a study conducted with 100 low-income Puerto Rican caregivers (53% of whom did not have at least a high school diploma or GED, only five percent of those surveyed reported to know the meaning of cross contamination, and 71% reported using the same cutting board to cut meats and vegetables.⁽²¹⁾ Authors of the meta-analysis concluded that “the reasons for these differences or similarities can be cultural, social, and/or economical and require further research.”⁽⁶⁰⁾ Patil et al. reported that White and Hispanic populations as compared to Black populations were less likely to follow proper food handling procedures for preventing cross contamination.⁽³³⁾

Cook: Lack of food thermometer use to determine doneness in meats is another problem that has been identified. None of the Puerto Rican participants observed by Bermudez-Millan et al. used a meat thermometer to check cooking temperatures.⁽²¹⁾ Only one fourth of Hispanic and African American WIC clients in Florida, reported using a food

thermometer for cooking whole cuts or large pieces of meat. Even fewer reported owning a food thermometer.⁽²⁴⁾ Lack of available funds to purchase food thermometers was noted as an obstacle to purchasing and using them.⁽²⁰⁾ One investigation found that to determine if meats or chicken were cooked people used visual cues: 41% used the color of juices/blood, 25% used meat color, and 27% reported using both.⁽²¹⁾ Other indications of doneness were reported to be: texture, smell/odor, bone sticking out, no fat left or water leaking from the meat.⁽²¹⁾ In another investigation participants reported that using a cooking thermometer was the most difficult food safety practice to follow.⁽²⁰⁾ In another study, more Blacks (7.5%) consumed undercooked ground beef patties than did whites (4.5%) or Hispanics (2%).⁽⁶⁰⁾ Kwon et al. reported more white respondents with a high school education using a food thermometer (46.1%) than did black respondents (36.2%) or Hispanic respondents (25.4%) or those without a high school education (9.1%).⁽⁶²⁾ Additionally, more black respondents reported consuming meat with pink inside (7.5%), though the majority of respondents from all racial and ethnic groups surveyed used color as a determining factor for checking the doneness of meat items.⁽²⁵⁾

Further, almost one fourth of Florida WIC clients, predominantly whom were Hispanic and African American, 24.7% reported “usually” eating undercooked eggs; 51.6% of these participants reported eating hot dogs or deli meats without first re-heating them “sometimes” or “more frequently” since becoming pregnant.⁽²⁴⁾

Although the practices of consuming raw milk and raw or undercooked meat and eggs, has not been specifically cited under any of the 4 food safety constructs, these practices

have been reported by Latinos and African Americans, but more predominantly amongst Latinos.^(21, 59) In 1997, an FDA funded study revealed that approximately 3.2% of Low Income Hispanics residing in California admitted to having consumed raw milk in the previous year.⁽⁵⁹⁾ Patil et al. reported that Hispanics had higher consumption rates of raw or undercooked eggs, shellfish, and milk compared to African Americans and Caucasians.⁽³³⁾ Not only did race and ethnicity come into play with regards to “safe cooking,” income did, as well. Those who were considered low income had the highest consumption of raw milk and eggs compared to high income individuals.⁽³³⁾ Another study supporting this notion found that 41% of EFNEP participants consumed raw milk and raw milk products.⁽²³⁾

Patil et al.’s meta-analysis reviewed few studies with regards to cooking and heating, yet they noted a discrepancy between knowledge versus usage of proper cooking and heating techniques amongst individuals with different educational backgrounds. Those with less than a high school education reported knowing less about proper cooking and heating techniques than those with higher than a high school education.⁽³³⁾ They reported higher rates of using proper cooking and heating techniques, than their better educated counterparts,⁽³³⁾ however, based on other research it is likely that these self-reported behaviors were not necessarily reflective of actual practices.^(21, 33)

Chill: Multiple investigations with limited-resource audiences have reported temperature control abuse with respect to the proper cooling and thawing of foods.^(21, 23, 24) Meer and Misner reported that their study participants knew that bacteria responsible for causing

foodborne illnesses grew at room temperature, yet 54% reported they cooled leftovers to room temperature before refrigerating them.⁽²³⁾ In a 2004 focus group study of 75% Black and 25% Hispanic WIC clients residing in Florida's Miami-Dade county, the majority of clients reported not being aware that perishable foods should be refrigerated within 2 hours and in shallow containers.^(20, 24) In a nationwide study of WIC participants conducted in 2006, almost half of white respondents (44.8%) thawed frozen meat items in the refrigerator, whereas Black respondents (26.6%) and Hispanic respondents (22.6%) thawed meat on the counter.⁽²⁰⁾ Black respondents (31.9%) and Hispanic respondents (26.7%) also reported thawing meats in a sink filled with water.⁽²⁵⁾

With regards to defrosting meats, 61.8% of WIC clients, predominantly African American, in inner city Miami, FL reported that they thawed foods on the counter or in the sink in standing water.⁽²⁴⁾ In Patil et al's meta-analysis three of the twenty studies reviewed, that specifically dealt with adequate refrigeration, revealed that those with more than a high school education more often practiced proper defrosting techniques as compared to those with less than a high school education.⁽³³⁾ Similarly, Bermudez-Millan et al. reported that more than half of the 100 Puerto Rican Connecticut caretakers they surveyed indicated that they defrosted their meats in the sink, 19% defrosted meats under running water, and only 11% reported doing so in the refrigerator, though there is no data from household observations to show how meats were "actually" defrosted.⁽²¹⁾

Another notable practice regarding insufficient chilling has to do with formula and breast milk. WIC clients have reported leaving baby bottles with formula out in room

temperature for prolonged periods,⁽²⁴⁾ and 10.8% left formula or bottled breast milk outside the refrigerator for more than two hours “most of the time.”⁽²⁴⁾ Although it is recommended that breast milk be left at room temperature for no longer than a period of 6-8 hours, it is strongly advised that containers be covered and kept as cool as possible; covering the container with a cool towel may keep milk cool.⁽⁶³⁾ According to WIC guidelines for baby formula storage, leftover, prepared baby formula that has been warmed should be thrown out and not refrigerated for future use.⁽⁶³⁾ Ready to feed and concentrated liquid formulas should be covered in the original can in the refrigerator and used within 48 hours of opening.⁽⁶³⁾ Powdered formula, which is covered tightly with a lid, may be stored in a cool, dry place for up to 30 days.⁽⁶³⁾ A lack of refrigeration and/or electricity in their homes was an obstacle reported by these clients as reasons why they were unable to chill their groceries and baby formula.⁽²⁰⁾

Published studies evaluating consumer practices regarding proper defrosting, safe food holding, proper cold storage, proper cooking and heating techniques, and avoiding unsafe food sources were limited.

Barriers to Following the “Clean, Cook, Chill, Separate” Food Safety Recommendations:

Only one study examined barriers to following the universal food safety recommendations.⁽²⁰⁾ These barriers included a lack of food safety knowledge, difficulty experienced in trying to change traditional routines or long established behaviors, particularly those passed down to them by mothers or that were learned as a child, and following practices perceived as inconvenient and time consuming, e.g., washing cutting

boards between foods.⁽²⁰⁾ Lack of refrigeration and no electricity in the home were obstacles reported by some clients.⁽²⁰⁾ Also reported were financial barriers that prevented ownership of multiple cutting boards, food thermometers, dishwashers, and ample containers in which to separate food or store leftovers in small quantities in shallow containers. Low incomes also resulted in hesitancy to throw away unfinished formula/leftovers (as it was costly to throw out leftover formula or to buy items to facilitate food safety).⁽²⁰⁾

Food Insecurity and the Link to Acquiring and Handling Food Safely

Since food insecurity more greatly affects impoverished minority groups in the United States, of primary interest to this investigation is the question: are their additional food safety issues among the food insecure that should be addressed in nutrition education for limited-resource audiences? Those who are food insecure have been defined as those who lack “access to sufficient, safe, nutritious food to maintain a healthy and active life. It has been said that food security is built on three pillars.⁽²⁷⁾ *Food availability*: sufficient quantities of food available on a consistent basis, *Food access*: having sufficient resources to obtain appropriate foods for a nutritious diet, and *Food use*: appropriate use based on knowledge of basic nutrition and care, as well as adequate water and sanitation.⁽²⁷⁾ Notably, food security also includes “the ability to acquire acceptable foods in socially acceptable ways.”⁽²⁷⁾ In other words, an individual is considered food insecure if he/she must resort to emergency food supplies, scavenging, stealing, or other coping strategies to survive hunger.⁽³⁴⁾

The question as to whether the food insecure employ additional unsafe coping mechanisms to have enough food is important considering that in 2010 15.1% of the US population (46.2 million individuals) were living in poverty.⁽⁶⁴⁾ Of note, this percentage has increased annually since 2007 when the rate was 12.5%. Increases have been especially evident amongst Blacks whose poverty rates increased from 25.8% in 2009 to 27.4% in 2010, and for Hispanics whose poverty rates increased from 25.3% to 26.6% during this same period.⁽⁶⁴⁾ In terms of food insecurity, the Food and Nutrition Service reports that SNAP household participation rates in New Jersey rose from 210,867 in

fiscal year 2008 to 370,887 in fiscal year 2011, representing an increase of 87% during this four year period.⁽⁶⁵⁾

As an initial attempt to discern if there were additional food safety issues among the food insecure, Kempson et.al investigated the food acquisition and food management practices of limited resource individuals in New Jersey.⁽¹⁶⁻¹⁸⁾ Findings from semi-structured interviews with 51 nutrition educators from the New Jersey Expanded Food and Nutrition Education Program (EFNEP) and Food Stamp Nutrition Education Program (FSNE), now known as SNAP-Ed, and focus groups with program participants identified sixteen coping strategies food insecure individuals used to acquire and manage food to maintain an adequate food supply that may be of concern in terms of food safety risk.⁽¹⁶⁻¹⁸⁾ Six of the practices were not discussed in food safety campaigns or on the USDA website (Figure 1); nine were touched upon on the USDA website (Figure 2); and one was discussed on other federal agency websites.^(6, 11)

Figure 1. Potentially Unsafe Food Acquisition and Management Practices Studied Which were Identified By Kempson et al, That Were Not Referenced on the USDA Website or Included in Food Safety Education/Campaigns ⁽¹¹⁾

Acquiring discarded food Seek road-kill Eat non-food items, e.g., pet food and paper Remove insects from grains Decrease expenses through activities, i.e., gardening

Figure 2. Potentially Unsafe Food Acquisition and Management Practices Identified By Kempson et al⁽¹⁶⁻¹⁸⁾ and Advice and Its Rationale Provided by USDA FSIS^(6, 8, 66)

Unsafe Practice	USDA Guidance
Shop for....foods from dented and damaged packages	Avoid containers of food that show signs of any damage including denting, rusting, or bulging ⁽⁶⁾ to prevent Botulism ⁽⁴⁾ Dents can weaken metal and allow entrance for bacteria. If canning is improperly completed, heat resistant <i>Clostridium botulinum</i> spores may develop.
Shop for/eat expired food	Products that are beyond their package “expiration” date may still be safe to eat if handled properly and stored at safe temperatures. If foods are mishandled, pathogens may result in foodborne illness. ⁽⁶⁶⁾ Since, some types of bacteria will produce heat resistant toxins, cooking does not make the food safe.
Purchase food from low-cost private individuals and vendors	To ensure food safety, information about companies and dealers that sell products (if non-traditional/questionable sources) should be stated on products. Only USDA and state inspected meats and other foods that are properly labeled with the species, cut, net weight, ingredients statement, and a safe handling statement should be consumed. ⁽⁶⁶⁾
Removing mold from cheese	Hard cheeses can still be used be with mold growth if at least 1 inch around and below the mold spot, as mold generally cannot penetrate deep into the product. After the mold is removed the cheese must be re-cover in fresh wrap. The knife used must be kept out of the mold itself so it will not cross-contaminate other parts of the cheese. Soft cheeses like Brie and Camembert and soft, shredded/crumbled cheeses made with mold like Blue and Gorgonzola may have bacteria growing throughout and should be discarded if they contain molds that are not a part of the manufacturing process.
Remove mold from grains	Molded grains should be discarded because of their high moisture content; and in the case of baked goods, the porous texture of bread and baked goods can allow for contamination below the surface.
Removing spoiled parts from fruits and vegetables	If at least 1” from the mold is removed from around firm fruits and vegetables like cabbage, peppers, and carrots with low moisture content, they can be eaten, as it is difficult for mold to penetrate dense foods. As with hard cheeses, the knife must be kept out of the mold to avoid cross-contamination. Soft fruits and vegetables, such as peaches, cucumbers, and tomatoes with high moisture content should be discarded, as they can be contaminated below the surface. Since, some types of bacteria will produce heat resistant toxins, cooking does not make the food safe.

Figure 2. Potentially Unsafe Food Acquisition and Management Practices Identified By Kempson et al⁽¹⁶⁻¹⁸⁾ and Advice and Its Rationale Provided by USDA FSIS^(6, 8, 66)	
Remove slime from lunch meat	Spoiled meat with color changes, off odors, that is sticky or tacky to the touch, or slimy may lead to foodborne illness and should not be used.
Store perishables inadequately	Food that is left too > 2 hours at unsafe temperatures is dangerous to eat, even if it smells/looks fine. When bacteria have nutrients, moisture, and favorable temperatures, they grow rapidly to levels that cause illness. Since, some types of bacteria will produce heat resistant toxins, cooking does not make the food safe.
Eat other peoples' leftovers	See explanation for "Store perishables inadequately"

While some of the aforementioned practices have been addressed in traditional food safety campaigns,⁽¹¹⁾ recommendations may not be specific enough for low-income audiences to extrapolate the information to behaviors of concern. For example, although the USDA cautions that “bacteria grow rapidly in the *"Danger Zone"*—the temperatures between 40 and 140 °F,” those who stored eggs on windowsills in the cooler months likely paid little attention to exact outdoor temperatures.^(16-18, 66) Seniors who bagged leftovers at congregate dining sites, then remained all afternoon to play Bingo may not have not have been aware of the recommendation that food left out for more than 2 hours should be discarded “even though it may look and smell good”; or may have lost track of time.⁽¹⁶⁻¹⁸⁾ Also, participants who indicated they ate leftovers offered by others were lacking specific recommendations that applicable to their situations, as USDA fails to differentiate the potential hazards of eating one’s own leftovers versus the leftovers of others.⁽¹⁶⁻¹⁸⁾

The last practice identified was hunting/fishing. USDA is not responsible for the communication of safety consideration related to the practices of eating food acquired by fishing and hunting. According to the Environmental Protection Agency (EPA), information regarding issues pertinent to fishing advisories are generally “dealt with via State and tribal environmental programs and departments of health issue fish consumption advisories for their waterbodies;” links to these advisories are available through the EPA website (Available at: <http://water.epa.gov/scitech/swguidance/fishshellfish/fishadvisories/states.cfm> 12-20-

11).⁽⁴⁶⁾ Guidelines for ensuring that game is safe for consumption are offered by the National wildlife health center and information is available at:

http://www.nwhc.usgs.gov/publications/disease_emergence/Chapter5.pdf.

The 16 unsafe practices identified by Kempson et al served as the basis for this thesis project.⁽¹⁶⁻¹⁸⁾ For although the practices were identified, the extent of risk they represent and the number of people who engage in them are unknown and are factors that should influence whether or not they need to be included in nutrition education aimed at low-income audiences. This work seeks to examine the former issue, which is, explaining the relative risk of engaging in each of these potentially unsafe practices.

CHAPTER 3

METHODOLOGY

The purpose of this research was to obtain the expert guidance and opinions of food safety and/or food science experts at American Land Grant institutions, regarding the associated risk of non-traditional food acquisition and management practices that limited resource audiences in NJ engaged in. This was accomplished through the use of two web based surveys. The original survey (Appendix 2) was created taking into account the food acquisition and management practices reported by Kempson et al. A second, subsequent survey was created and refined from the original to include any situational conditions that might cause the risk of engaging in the practice to be variable. Ultimately this study sought to provide a quantitative report describing the level of risk of these behaviors determined to be potentially unsafe.

A Summary of Methods/Work Performed Prior to the Authors Involvement

In order to recruit participants for the first survey, a list of Land Grant Institution food safety experts and specialists from all United States and territories was compiled, with the exception of some which at the time did not have a specialist working in these fields, i.e., Guam, Mississippi, Missouri, Montana, Northern Marianas, Oregon, Puerto Rico, Texas, and the Virgin Islands. Those identified were contacted by an undergraduate research student from the Department of Nutrition Sciences, Arsala Mumtaz, who was working under the direction of Dr. Palmer and her research assistant, Audrey Adler.

Survey Development and Administration

After a revised list of experts was compiled, the web based, pilot survey was developed with the help of the I.T. department at Rutgers University. Twenty-six survey questions, 21 of which focused on the previously identified behaviors of concern, and were designed to assess relative risk and any conditions that might change the risk of engaging in a given behavior of concern, were created. The survey was organized into three sections. Each section contained questions about similar practices of interest, and the division of the survey into multiple sections. Each section of the survey could be saved after completion and participants could return to complete the remaining parts at their convenience. Participants were provided with a login name and password that enabled them to access the survey.

The survey began with a series of screening questions wherein participants were asked to verify their area of expertise, official title, highest level of education, and years of experience in order to qualify for participation in the study. The participants were asked to rate the potential risk associated with each of the twenty-one food acquisition and food management practices of concern using a five point Likert type scale.(Appendix 2) If a response could not be provided because the risk varied conditionally, participants were asked to elaborate upon the conditions that would modify the response via an open ended question that followed.

Several participants had difficulty accessing the portal, in which case surveys were emailed and participant responses were faxed back to researchers. Initially, only ten specialists were contacted to participate (via an email invitation). Their responses were used to pilot the survey, i.e., to account for possible unforeseen errors in the data collection process.(Appendix 1) After three consecutive weeks, there was no response to this invitation, so a second email was sent on behalf of Dr. Palmer. After the second invitation, three respondents completed the web survey.

Since May 2006, the study was unable to be continued due to a lack of resources, but resumed in the Spring of 2007 when it was continued by the graduate student/author of this thesis, Elizabeth Nossier.

Methods

Phase I. An amendment to the study protocol was developed to clarify verbiage of the questions, and a new investigators list was developed using the previously described protocol and approved by the Rutgers University IRB, Protocol # E06-019. Upon approval, the revised web survey was uploaded onto the website.

Before initiating new invitation emails to experts, their contact information was updated. The new invitation email was sent to the potential participants to request their participation on September 21, 2007. (Appendix 1).

After a period of 10 consecutive days, food safety specialists who had not yet completed the survey (Appendix 2) were contacted via telephone by researchers to follow up with

their willingness to participate and to offer them the option of completing the survey with a researcher over the phone. In addition, researchers tended to any concerns or issues experts were experiencing that prevented them from completing the survey. A phone script was used to make these calls(Appendix 3). Callback sheets and monthly callback calendars were used to record scheduled interview callbacks. After participants were contacted a maximum number of six times, the researchers sought to attain survey responses from another expert in the same state. Several experts on the participant list were replaced with other qualified experts for being absent due to sabbatical commitments or retirement, time constraints, position/title changes, or simply not qualifying. Also, experts who did not feel qualified to complete the survey were asked within the screening portion of the survey to refer researchers to a more appropriate expert at their institution who they believed would be equally as qualified and competent to complete the survey. These referrals were required to be individuals who they felt shared similar expertise in their field, i.e., food safety or food science. Subsequently, researchers contacted referrals by sending them the original invitation email.

Phase II. Phase I results were interpreted and used to develop a revised survey to ascertain risk based on conditional responses attained.

Phase III. After the completion of the Phase I data collection, the survey was revised in response to participant input. Experts were, once again, asked to rate the level of risk associated with engaging in each of those high risk behaviors considering, the conditions under which the risk differed. The revisions made were of two types. The first were the

removal of behaviors that researchers had originally thought were a potential concern, but experts had related that they were not. Secondly some questions were revised or turned into multiple questions, in cases where conditions dictated how safe or unsafe the practice was.

The revised survey regarding potentially unsafe practices was comprised of sixteen questions, 14 of which included a list of sub-questions that addressed conditions that would vary the risk associated with enacting the behavior.(Appendix 4) This survey was, again, administered via an online portal in the same manner the original survey was administered.

Data Analysis

Only descriptive statistics, that is frequencies, means and standard deviations, were used to assess the Phase I and Phase III results. Descriptive statistics were also employed for analysis of all questions. T-tests were used with Phase III data to test for difference between responses gleaned from experts who self-identified as primarily food safety or food scientists versus those who called themselves primarily nutrition educators. Confidence levels of both 95% and 90% (to account for potential Type II error) were employed, due to the small nutrition educator sample size.

Study Limitations

There were four primary limitations in this work; two had to do with the subject pool; the third with feedback that should have been provided during Phase I but was not provided until Phase II; and finally, inconsistencies in the literature regarding a particular behavior in question. First, despite the fact that all participant responses were included in the data analysis, the research team wanted to examine if the knowledge base of the nutrition educators was equivalent to that of the food scientists who completed the survey. This evaluation was justified and supported by the variability in the experts' credentials, their research backgrounds, and their educational background. For example, while two respondents identified themselves as Food Scientists, they had widely diverse research backgrounds and projects. That is, one expert's research revolved specifically around poultry science and the use of antimicrobials in poultry feeds, while another food scientist's expertise revolved around food technology and its use for good agricultural practices and the benefits and risks of consuming genetically modified foods. One

example of experts who had expertise in food safety, but who were not food scientists were two respondents who identified themselves as experts in nutrition and food safety education. They were both Registered Dietitians, yet the one's current projects revolved around traditional nutrition education for adolescents, and interactive food safety, distance education for low literacy groups, while the other's research revolved around food safety for food delivery programs and developing healthy menu items for school food service programs.

The second issue having to do with the subject pool was that not all the experts that completed and provided feedback to the original survey completed the subsequent revised survey due to sabbatical commitments, retirement, time constraints, and position/title changes. In response to the loss of respondents, other qualified individuals completed the survey. Still, Phase II of the survey had a smaller sample size than the Phase I sample.

Another arose when some experts failed to follow directions provided in Phase I to explain any and all special conditions that would alter their rating regarding the relative risk of each behavior. Instead they provided this needed information during Phase II. For example, one expert failed to mention in Phase I of the survey that the relative risk associated with eating paper depended on how dirty the paper was and what type of ink was used on the paper. As such, the survey had been revised without this input. Two experts also failed to mention in Phase I of the survey that the relative risk of eating foods purchased after the sell by or expiration date, which were intact and not broken open, also

depended on the type of food, while another expert mentioned that it depended on the length of time after the date. Thus, these special conditions were not taken into account when the final rating assessments presented in this work were made.

Lastly, questions regarding the risks associated with the acquisition of food via hunting or fishing were excluded from the survey in Phase III due to a lack of adequate expertise amongst the experts and a lack of consistent advice in the literature. Literature provided by various state cooperative extension services and government agencies varied in terms of their recommendations regarding the safe handling of foods acquired via hunting and fishing. For example, one state cooperative extension's guidelines advised consumers, while field dressing birds, to avoid cutting the crop, gizzard, or intestines of the game they caught to avoid harmful bacteria that could be found in these organs, while another cooperative extension advised consumers that these organs may be saved for giblets and to store them in a plastic bag kept on ice. Another inconsistency revolved around temperature control and preventing foodborne illness. That is, one state cooperative extension service provided advise to hunters to cook game meats until juices run clear and there is no pinkness in the meat, while another state cooperative extension emphasized using a calibrated meat thermometer to cook game meats to 155-160° F, not relying on "color" to ensure proper cooking, and went on further to specify safe temperature ranges for stuffed meats. Also, with regards to game birds, one state cooperative extension service discussed how to age a carcass, whereas another indicated that birds generally do not require aging. Thus, one area with a number of potentially unsafe behaviors engaged in by the target audience could not be assessed.

CHAPTER 4

RESULTS

Phase I: Initial Survey Results

Nearly 100 experts from American Land Grant institutions were contacted before the web survey invitations were emailed to confirm that they were still employed at their listed institutions. Of the 100 individuals invited to complete the survey, 85 did. Seventy-nine food safety specialists completed the web survey online, and six individuals completed the survey by faxing researchers their hand written responses to survey questions. The interviews were conducted between September of 2007 and December of 2007 by the author of this thesis.

As it turned out, those identified with the required expertise were located in Departments of Food Safety, Food Science, Nutrition, Home Economics, and Family and Consumer Sciences. Experts self-reported their primary area of expertise as: food safety 59% (n=50); food science 25% (n=21); and “other” 17% (n=14). All experts surveyed had, at a minimum, a Master’s degree (24%; n=20), but the majority had a PhD (66%; n=56). The mean number of years the experts had worked in their fields were 21.3 ± 9.0 .

Twenty-one behaviors were rated on a Likert type scale that ranged from 0-5, with 0 representing no risk, 1 representing little risk, 3 representing moderate risk, and 5 representing extreme risk. A separate option allowed the scientist queried to intentionally avoid rating the behavior in favor of presenting conditions under which the risk would vary. Since one of the aims of this work was to identify high risk behaviors, upon

analysis of the Original survey results, behaviors that were not rated as representing no more than moderate risk by the majority (over 50%) of experts were removed from the revised survey for Phase II. These were:

- Eating home-grown fruits and vegetables obtained from private individuals
- Eating home-grown fruits and vegetables from their own garden

As mentioned above, questions regarding the risks associated with the acquisition of food via hunting or fishing were also excluded from the survey in Phase II due to a lack of adequate expertise amongst the experts surveyed and inconsistencies in the literature. The two questions dealing with the consumption of road kill were removed on account of the same rationale.

Risk ratings attained in Phase I were of little consequence, as responses largely indicated that their risk was contingent on a variety of factors. Although experts were instructed to select “C” if they felt that the risk varied conditionally and therefore could not provide a specific rating from 0-5, many experts still chose to provide conditions, even after selecting a specific level of risk rating. The conditions associated with the behaviors that affected the development of the revised survey are shown below in Table 1.

Table 1: Food Safety Experts' Level of Food Safety Risk Rating Associated with Engaging in Each Food Acquisition and Management Practice Identified Amongst Limited Resource Populations in NJ and Conditions Which Affect the Food Safety Risk of Each Practice (N = 85) (CONTINUED)	
Survey Question. (number of respondents; mean risk ratings on a 5 Point Likert type scale*\pmstandard deviations)	Number of Experts Who Deemed the Food Safety Risk Associated with Engaging in Each Behavior to be Contingent Upon Specific Conditions, and The Nature of Said Conditions
Eating foods from dented or damaged packages. (n=77; mean=2.3 \pm 2.1)	<i>(Conditional Rating Chosen by Experts: n = 8)</i> The acidity level of the food Whether or not the package was open and exposed to the environment, versus intact and not broken If the food was exposed to flood or contaminated water If the food was canned, and if so, whether the dent was small or considered large, sharp, and severe If the food was canned, whether the small versus large dent was on the surface versus on the can's seams or rims Whether the package was swollen or bulging Whether the package was re-heated before use
Eating foods purchased after the "sell by" date, but still available for sale in a store. (n = 84; mean = 2.0 \pm 1.6)	<i>(Conditional Rating Chosen by Experts n = 0)</i> The acidity level of the food Whether or not the package was open and exposed to the environment, versus intact and not broken If the food was exposed to flood or contaminated water Whether the package was re-heated before use
Eating foods that have been kept beyond their expiration dates, either at home or at a food pantry, that would no longer be suitable or allowable for sale in a store (n = 81; mean = 1.7 \pm 1.8)	<i>(Conditional Rating Chosen by Experts: n = 3)</i> The acidity level of the food Whether or not the package was open and exposed to the environment, versus intact and not broken If the food was exposed to flood or contaminated water Whether the package was re-heated before use
Eating lunch meat after slime has been removed from it (n =48; mean = 3.7 \pm 1.8)	<i>(Conditional Rating Chosen by Experts: n = 35)</i> Whether or not the slime was removed before consumption

Table 1: Food Safety Experts' Level of Food Safety Risk Rating Associated with Engaging in Each Food Acquisition and Management Practice Identified Amongst Limited Resource Populations in NJ and Conditions Which Affect the Food Safety Risk of Each Practice (N = 85) (CONTINUED)	
Eating cheese from which mold has been removed (n = 76; mean = 2.1 \pm 1.8)	<i>(Conditional Rating Chosen by Experts: n =7)</i> Whether the cheese was considered soft or hard Whether the mold was removed or not before consumption The type of mold that was present Whether the mold was removed as well as an at least an additional ½ inch or less than ½ inch removed before consumption How the cheese was stored and the storage temperature for the cheese The susceptibility of the person to mold allergens and/or foodborne illnesses
Eating grain foods from which mold has been removed (n = 63; mean = 2.1 \pm 1.8)	<i>(Conditional Rating Chosen by Experts: n =19)</i> Whether or not the mold was removed before consumption
Eating grain foods from which insects have been removed. (n = 70; mean = 2.7 \pm 1.6)	<i>(Conditional Rating Chosen by Experts: n =10)</i> Whether or not the insects were removed before consumption Whether the insects removed were roaches and flies versus insects other than roaches or flies Whether the insects were removed and the food was cooked afterward or not
Eating fruits or vegetables from which spoiled parts have been removed (n = 80; mean = 2.2 \pm 1.6)	<i>(Conditional Rating Chosen by Experts: n =2)</i> Whether or not the fruits/vegetables were pre-cut versus whole prior to becoming spoiled Whether or not the fruits/vegetables were cooked prior to spoiling versus cooked after spoilage was removed Whether the fruits/vegetables were soft versus hard Whether the fruits/vegetables were exposed to flood or contaminated water Whether less than ¾ or ¾ and more of the fruits/vegetables were considered “furry or mushy” Whether the fruits/vegetables were considered “furry or mushy” due to bruising versus due to aging

Table 1: Food Safety Experts' Level of Food Safety Risk Rating Associated with Engaging in Each Food Acquisition and Management Practice Identified Amongst Limited Resource Populations in NJ and Conditions Which Affect the Food Safety Risk of Each Practice (N = 85) (CONTINUED)	
<p>Eating meats bought from private individuals or street vendors, like items off “meat trucks” (n = 73; mean = 2.0 \pm 2.1)</p>	<p>(Conditional Rating Chosen by Experts: n =9) Whether the meats were cooked well done or not Whether the meats were left un-refrigerated for more than 2 hours; or 1 hour if \geq 90 degrees versus refrigerated within 2 hours; or 1 hour if \geq 90 degrees Whether the meats were frozen solid versus thawed Whether the meats were tightly packed with not leaking versus not tightly packed with leaking Whether the appearance of the sales people and their operation looked clean and sanitary or not Whether the license and/or safety inspection sticker was visible or not at the sales outlet</p>
<p>Eating homegrown fruits and vegetables obtained from private individuals (n = 81; mean = 1.6 \pm 1.2)</p>	<p>(Conditional Rating Chosen by Experts: n =0) The practices used when growing fruits and vegetables <ul style="list-style-type: none"> • whether chemicals i.e. insecticides and pesticides were used, and proper procedures for usage and handling were followed • the type of fertilizer used i.e. manure • how the produce was handled and prepared for consumption i.e. if it was protected from contamination at each point from growth, harvest, to storage • whether the grower follows their GAP's The condition of the produce after it is obtained i.e. washing/sanitizing/rinsing properly and if it will be cooked</p>

Table 1: Food Safety Experts' Level of Food Safety Risk Rating Associated with Engaging in Each Food Acquisition and Management Practice Identified Amongst Limited Resource Populations in NJ and Conditions Which Affect the Food Safety Risk of Each Practice (N = 85) (CONTINUED)

<p>Eating homegrown fruits and vegetables from their own garden (n =82; mean = 1.5 \pm 1.0)</p>	<p><i>(Conditional Rating Chosen by Experts: n =0)</i> The type of practices used when growing fruits and vegetables</p> <ul style="list-style-type: none"> • whether chemicals such as insecticides and pesticides were used and whether proper procedures for usage and handling were followed • the type of fertilizer used i.e. manure • how the produce was handled and prepared for consumption i.e. if it was protected from contamination at each point from growth, harvest, to storage • whether the grower follows their GAP's <p>The produce's condition after it is obtained i.e. washing/ sanitizing/rinsing properly and if it will be cooked</p>
<p>Eating food provided in the home of a private individual you do not know, i.e., a private soup kitchen run out of someone's home (n = 80; mean =2.1 \pm 1.9)</p>	<p><i>(Conditional Rating Chosen by Experts: n =3)</i> The knowledge and practices of the food worker</p> <ul style="list-style-type: none"> • whether they were inspected and received food safety training • sanitation of those handling the food, food safety/handling measures taken, and quality of the operations <p>The time/temperature history of the food and holding methods How well the food was cooked How the food was stored and if there was cross contamination Whether the food kitchen has "legal status"</p> <ul style="list-style-type: none"> • licensed by the state • Certified • Received proper inspection from a local or state food inspection agency

Table 1: Food Safety Experts' Level of Food Safety Risk Rating Associated with Engaging in Each Food Acquisition and Management Practice Identified Amongst Limited Resource Populations in NJ and Conditions Which Affect the Food Safety Risk of Each Practice (N = 85) (CONTINUED)	
Survey Question. (number of respondents; mean risk ratings on a 5 Point Likert type scale*\pmstandard deviations)	Number of Experts Who Deemed the Food Safety Risk Associated with Engaging in Each Behavior to be Contingent Upon Specific Conditions, and The Nature of Said Conditions
Eating road kill created by running down small animals and then taking the carcass home (n = 53; mean = 2.6 \pm 2.1)	<i>(Conditional Rating Chosen by Experts: n = 29)</i> Whether it is properly handled, prepared, cooked (well done and thoroughly) Whether it is contaminated (intestinal) or diseased i.e. tuberculosis Whether it was exposed to harmful chemicals and contaminants Whether it contains parasites Whether it is intact versus with ruptured organs How long the carcass has been dead Whether there is temperature control The time and temperature during transportation Whether the brains or nerve tissue of the road kill were eaten or not The type of animal
Eating animals found already dead on the road or road side (road kill) (n = 24; mean = 3.0 \pm 2.3)	<i>(Conditional Rating Chosen by Experts: n = 58)</i> How long the animal has been dead If there is contamination, the nature of the contamination and degree of damage Whether the animal was properly dressed, handled, cooked Time/temperature control

Table 1: Food Safety Experts' Level of Food Safety Risk Rating Associated with Engaging in Each Food Acquisition and Management Practice Identified Amongst Limited Resource Populations in NJ and Conditions Which Affect the Food Safety Risk of Each Practice (N = 85) (CONTINUED)	
<p>Eating food acquired by fishing or hunting (n = 82; mean = 1.7\pm1.6)</p>	<p>(Conditional Rating Chosen by Experts: n = 0) If the fish/carcass was properly handled, prepared, and cooked after it is killed and prior to consumption How well fish/carcass is cooked Source, type, and age of fish Nature of the contamination of the food during its "killing" Mercury levels in fish If parasites or disease i.e. chronic wasting disease were present in the game Location, cleanliness, and contamination of water Environmental conditions Time lapse from when the fish/carcass was killed until cooked Knowledge and skill of person fishing/hunting regarding food safety (harvesting, preparation, storage) Temperature control</p>
<p>Eating leftovers such as from the plates of others at a soup kitchen or church function (n = 69; mean = 2.8 \pm 1.9)</p>	<p>(Conditional Rating Chosen by Experts: n = 12) Contingent upon the health condition of the person who handled or ate the food first If there is potential for the spread of disease from sick individuals i.e. from the saliva of individuals with TB, Strep, Hepatitis, or common cold Sanitation of the person making the meal Time/Temperature control history of the food i.e. length of time held before consumption The type of food i.e. perishable foods versus dry food such as bread Whether they were stored properly</p>

Table 1: Food Safety Experts' Level of Food Safety Risk Rating Associated with Engaging in Each Food Acquisition and Management Practice Identified Amongst Limited Resource Populations in NJ and Conditions Which Affect the Food Safety Risk of Each Practice (N = 85) (CONTINUED)	
Eating their own leftovers taken home from soup kitchens or church functions (n = 80; mean = 1.6 ± 1.7)	<p><i>(Conditional Rating Chosen by Experts: n = 2)</i></p> <p>How the food was handled:</p> <ul style="list-style-type: none"> • Storage condition of the leftovers • Time period it was stored for and reheated prior to consumption • Whether the food was reheated or re-cooked properly to 165° F for 15 seconds • What the food is i.e. perishable versus dry food like bread • Whether it was eaten soon after being taken home • Whether it was refrigerated or eaten within 2 hours • Whether the food was kept out of the temperature danger zone <p>How much is known about the quality of the operations\</p> <p>Sanitation of the person who made the meal</p> <p>Health condition of the person who ate from the container/plate</p>
Eating perishable foods not properly stored (n = 54; (mean = 3.4 ± 2.1)	<p><i>(Conditional Rating Chosen by Experts: n = 27)</i></p> <p>Type of food i.e. raw food, mixed dishes, dairy and meat (high risk) versus fruits and vegetables (less risk)</p> <p>Storage conditions of the food</p> <p>Length of time it was not properly stored i.e. 2 hours versus one day and at what temperature</p> <p>Whether the food was contaminated</p>

Table 1: Food Safety Experts' Level of Food Safety Risk Rating Associated with Engaging in Each Food Acquisition and Management Practice Identified Amongst Limited Resource Populations in NJ and Conditions Which Affect the Food Safety Risk of Each Practice (N = 85) (CONTINUED)	
Eating paper (n = 72; mean = 1.8 ± 1.7)	<p><i>(Conditional Rating Chosen by Experts: n = 3)</i></p> <p>Type Whether it was used or contaminated i.e. with ink, lead versus clean Type of ink and linotype used to print i.e. lead content Source i.e. handled by others/touched If it was used to wrap raw foods i.e. fish, meat, poultry Whether it was consumed accidentally for intentionally The amount consumed i.e. a pea size versus enough to block the gut</p>
Eating food intended for animals, e.g., dog food or cat food (n = 77; mean = 2.1 ± 1.6)	<p><i>(Conditional Rating Chosen by Experts: n = 3)</i></p> <p>Ingredients and whether they are contaminated with lead, toxic, or harmful Type and source of food Whether the food was handled properly and stored Whether they are canned or non-canned (non-canned may be contaminated with human food-borne pathogens)</p>

**Likert type Scale Ratings: 0 = No risk; 1 = Little Risk; 3 = Moderate Risk; 5 = Extreme Risk; C = Conditional*

Although 85 participants completed the survey, for several questions, risk ratings were not provided. Some experts noted that they did not feel qualified nor did they have the expertise to accurately provide a risk rating for some of the behaviors listed.

Phase II: Resulting Survey Revisions

The primary aim of the survey under development was to, post-development, be able to assess the prevalence of use of risky food acquisition and management practices among low-income people. Thus, those practices that were deemed risky after the Phase I

assessment; and that had conditions under which risk changed that could reasonably be assessed by the target audience were modified for inclusion in the survey revision. Only two behaviors, rated as high risk behaviors, exhibited conditions researchers believed could not reasonably be assessed by the target audience. These were: acquiring and eating discarded food, such as from the trash or dumpsters and eating paper, as the research team did not believe the target audience would typically be able to assess if the ink on the paper had lead in it, or how long food had been sitting in the dumpster. Therefore, these questions were not modified.

Six questions were deleted during survey revision for the following reasons. In the cases of: “Eating homegrown fruits and vegetables from their own garden,” and “Eating homegrown fruits and vegetables obtained from private individuals,” they were removed because responses often eluded to the fact that these practices were not exclusive to food insecure populations, and these practices were typically encouraged by nutrition professionals. Three other questions relating to the consumption of road kill and foods acquired by fishing and hunting were also removed, in these cases due to a lack of expertise on the respondents’ part. They were “Eating road kill created by running down small animals and then taking the carcass home,” “Eating animals found already dead on the road or roadside,” and “Eating food acquired by fishing or hunting.” Lastly, “Eating food intended for animals e.g. dog food or cat food” was removed because the majority of experts deemed this behavior to pose little risk to no food safety risk, since animal food must meet similar regulatory standards as human food and some respondents felt they did not have the expertise to answer this question.

The remaining questions were modified. Some were merged, and some were expanded upon to address a variety of conditions under which their level of risk varied. Changes made to questions that were modified in the revised survey are described in Table 2.

Table 2: Rationale for Changes Made to the Original Survey Questions and the Revised Questions (Part 1)		
Original Behavior Assessed	Change Rationale	Revised Behavior(s) to be Assessed
Acquiring and eating discarded foods such as from the “trash” or dumpsters.	Reworded to add any food found “outside”	Acquiring and eating discarded food from a trash can, a dumpster, or that was found outside
Eating foods from dented or damaged packages.	Divided into two questions to address high vs. low acid foods and other conditions under which experts indicated risk might vary	<p>Eating foods from dented or damaged packages that contain low-acid foods, like milk, red meats, seafood, poultry, and vegetables except tomatoes</p> <p>Eating foods from dented or damaged packages containing high-acid foods, like fruits, tomatoes, pickles, sauerkraut, jams, jellies, and marmalades when:</p> <ul style="list-style-type: none"> • Broken open and exposed to the environment • Intact and not broken open • Exposed to flood or contaminated water • Not exposed to flood or contaminated water • Small Dent on the surface, not on the can’s seams or rims • Large, sharp, or severe dent on the surface, not on the can’s seams or rims

Table 2: Rationale for Changes Made to the Original Survey Questions and the Revised Questions (Part 1) (CONTINUED)		
<p>Eating foods: purchased after the “sell by” date, but still available for sale in a store</p> <p>that were kept beyond the expiration dates either at home or at a food pantry , that would no longer be suitable or allowed for sale in a store.</p>	<p>Merged into one question, since the experts’ ratings and the majority of conditional responses given by them were comparable; also these food product dating terms are very similar</p>	<p>Eating foods purchased after the sell by or the expiration date when:</p> <ul style="list-style-type: none"> • Broken open and exposed to the environment • Intact and not broken open • Exposed to flood or contaminated water • Not exposed to flood or contaminated water • Containing low acid foods, e.g., milk, red meats, seafood, poultry, and vegetables except tomatoes • Containing high acid foods, e.g., fruits, tomatoes, pickles, sauerkraut, jams, jellies, and marmalades • Re-heated before use • Not re-heated before use
<p>Eating lunch meat after slime has been removed from it.</p>	<p>Consumption of slime on luncheon meats could pose little to extreme risk depending on the type and amount of slime.</p>	<p>Eating lunch meats or deli meats/cold cuts that have become slimy</p> <ul style="list-style-type: none"> • Slime Removed • Slime Not Removed

Table 2: Rationale for Changes Made to the Original Survey Questions and the Revised Questions (Part 1) (CONTINUED)		
Eating cheese from which mold has been removed	Consumption of cheeses of various textures and the amount of visible mold/cheese present that is removed affect risk level	<p>Eating cheese that has become moldy</p> <ul style="list-style-type: none"> • Soft cheese (like brie, Camembert, cottage, cream cheese, ricotta and feta) with mold removed • Soft cheese (like brie, camembert, cottage, cream cheese, ricotta and feta) with mold not removed • Semi-soft cheese (like Blue, brick, Havarti, Monterey Jack, mozzarella, Muenster, provolone) with the mold and at least an additional ½ inch removed • Semi-soft cheese (like Blue, brick, Havarti, Monterey Jack, mozzarella, Muenster, provolone) with the mold and at least an additional ½ inch removed • Semi-soft cheese (like Blue, brick, Havarti, Monterey Jack, mozzarella, Muenster, provolone) with the mold and less than an additional ½ inch removed • Hard cheese (like Cheddar, Colby, Gouda, Edam, Swiss) with the mold and at least an additional ½ inch removed • Hard cheese (like Cheddar, Colby, Gouda, Edam, Swiss) with the mold and < an additional ½ inch removed • Very hard cheese (like Parmesan, Romano) with the mold and at least an additional ½ inch removed • Very hard cheese (like Parmesan, Romano) with the mold and < an additional ½ inch removed • Processed cheese with the mold and at least an additional ½ inch removed • Processed cheese with the mold and < an additional ½ inch removed
Eating grain foods from which mold has been removed	Consumption of processed grain foods with mold or with it removed may affect risk depending on type of mold and amount removed.	<p>Eating processed grain foods (like breads, muffins, cakes, etc.) that have become moldy.</p> <ul style="list-style-type: none"> • With mold removed • With mold not removed

Table 2: Rationale for Changes Made to the Original Survey Questions and the Revised Questions (Part 1) (CONTINUED)		
Eating grain foods from which insects have been removed.	Insect types (roaches and flies vs. insects other than roaches and flies) and whether or not they were removed and/or cooked affect risk levels	Eating grain foods with insects on them. <ul style="list-style-type: none"> • Roaches and flies that were removed, but the food was not cooked • Roaches and flies that were removed and the food was cooked afterward • Insects other than roaches and flies that have not been removed • Insects other than roaches and flies that have been removed, but the food was not cooked • Insects other than roaches and flies that have been removed, and the food was cooked afterward
Eating fruits or vegetables from which spoiled parts have been removed	Texture, possible contamination, visible damage and its expression, e.g., fuzzy, whether it was cooked before or after spoiled, and whether it was pre-cut vs. whole affect risk level	Eating fruits or vegetables from which spoiled parts have been removed. The spoiled parts referred to, unless specified, are not parts spoiled from bruising, but instead from microbial spoilage. <ul style="list-style-type: none"> • Pre-cut prior to becoming spoiled • Whole prior to becoming spoiled • Cooked prior to becoming spoiled • Cooked after spoilage is removed • Soft fruits/vegetables, like cucumbers, tomatoes • Hard fruits/vegetables, like carrots or potatoes • Exposed to flood or contaminated water • Not exposed to flood or contaminated water • $\frac{3}{4}$ or more furry or mushy • Less than $\frac{3}{4}$ furry or mushy • Mushy and dark due to bruising • Mushy and dark look due to aging, rather than bruising, i.e., bananas (same texture all over)
Eating road kill created by running down small animals and then taking the carcass home	This question was not added to Phase II because the food science/safety experts interviewed did not have enough expertise in this area to rate the level of risk involved in consuming road-kill.	Not included in Revised survey

Table 2: Rationale for Changes Made to the Original Survey Questions and the Revised Questions (Part 1) (CONTINUED)		
Original Behavior Assessed	Change Rationale	Revised Behavior(s) to be Assessed
Eating meats bought from private individuals or street vendors, like items off “meat trucks.”	Temperature control, whether it was cooked or not cooked well done, frozen vs. thawed, tightly packaged vs. leaking, and with or without a safety certification) affect risk level.	<p>Eating meats bought from private individuals, street vendors, or “meat trucks”</p> <ul style="list-style-type: none"> • Cooked well done • Not cooked well done • Left un-refrigerated for more than 2 hours; or, 1 if ≥ 90 degrees • Refrigerated within 2 hours; or, 1 if ≥ 90 degrees • Frozen solid • Not frozen solid and/or thawed • Tightly packaged with no leaking • Not tightly packaged and/or leaking • Appearance of the sales people and their operation does not look clean and sanitary • License and/or safety inspection sticker is visible at the sales outlet • No license and/or safety inspection sticker is visible at the sales outlet • Appearance of the sales people/the operation looks clean and sanitary
<p>Eating homegrown fruits and vegetables obtained from private individuals and</p> <p>Eating home grown fruits and vegetables from their own garden</p>	<p>These were removed from Phase II because the same level of risk would be involved whether it was their own fruits and vegetables or a private individual’s and because these behaviors were not considered unique among food insecure populations</p>	

Table 2: Rationale for Changes Made to the Original Survey Questions and the Revised Questions (Part 1) (CONTINUED)		
Original Behavior Assessed	Change Rationale	Revised Behavior(s) to be Assessed
Eating food provided in the home of a private individual you do not know, i.e., a private soup kitchen run out of someone's home	This was not added to Phase II because the same level of risk would be involved whether it was a private individual or someone they knew.	Not included in Revised survey
Eating road kill created by running down small animals and then taking the carcass home	This question was not added to Phase II because the food science/safety experts interviewed did not have enough expertise in this area to rate the level of risk involved in consuming road-kill.	Not included in Revised survey
Eating foods found already dead on the road or roadside (roadkill)	This question was not added to Phase II because the food science/safety experts interviewed did not have enough expertise in this area to rate the level of risk involved in consuming road-kill.	Not included in Revised survey

Table 2: Rationale for Changes Made to the Original Survey Questions and the Revised Questions (Part 1) (CONTINUED)		
Eating food acquired by fishing or hunting	This question was not added to Phase II because food science/safety experts claimed inadequate expertise.	Not included in Revised survey
<p>Eating leftovers such as from the plates of others at a soup kitchen or church function and</p> <p>Eating perishable foods not properly stored</p>	<p>Merged into one question to include various conditions under which leftovers and perishable food would be consumed (unopened vs. opened packages, from someone who was sick vs. healthy, under tight temperature control vs. not, and whether it was re-heated or not) to be rated in Phase II.</p>	<p>Eating leftovers that should be refrigerated, that were left behind on the plates of others (Note: it is impossible for anyone to know how long they have been sitting out, just do your best (this is one of our many struggle in doing this type of work)</p> <ul style="list-style-type: none"> • The foods were unopened, and in their original wrappers/boxes or, were whole fresh fruits/vegetables, or were foods that didn't require cooking before eating, e.g., crackers • From someone who was sick with a cold, infection, or disease • From someone who was healthy • Previously cooked then left unrefrigerated for more than 2 hours; or, 1 if ≥ 90 degrees • Previously cooked and refrigerated within 2 hours; or, 1 if ≥ 90 degrees • Re-heated • Not Re-heated <p>Eating leftovers that are not foods that need to be refrigerated, that were left behind on the plates of others (Note: it is impossible for anyone to know how long they have been sitting out, just do your best (this is one of our many struggle in doing this type of work)</p> <ul style="list-style-type: none"> • The foods were unopened, and in their original wrappers/boxes or, were whole fresh fruits/vegetables, or were foods that didn't require cooking before eating, e.g., crackers • From someone who was sick with a cold, infection, or disease • From someone who was healthy • Previously cooked then left unrefrigerated for more than 2 hours; or, 1 if ≥ 90 degrees • Previously cooked and refrigerated within 2 hours; or, 1 if ≥ 90 degrees • Re-heated • Not Re-heated

Table 2: Rationale for Changes Made to the Original Survey Questions and the Revised Questions (Part 1) (CONTINUED)		
Original Behavior Assessed	Change Rationale	Revised Behavior(s) to be Assessed
<p>Eating their own leftovers taken home from soup kitchens or church functions <u>and</u></p> <p>Eating perishable foods not properly stored</p>	<p>Reworded into 2 separate questions to address various conditions that affect risk level, of leftovers and perishable food which need to be refrigerated vs. not need to be refrigerated, would be consumed (unopened vs. opened packages, under tight temperature control vs. not, and whether it was re-heated or not)</p>	<p>Eating one's own foods, that should be refrigerated, that have been taken home from places like soup kitchens or church functions (Note: it is impossible for anyone to know how long they have been sitting out, just do your best (this is one of our many struggle in doing this type of work)</p> <ul style="list-style-type: none"> • The foods were unopened, and in their original wrappers/boxes or, were whole fresh fruits/vegetables, or were foods that didn't require cooking before eating, e.g., crackers • Previously cooked then left unrefrigerated for more than 2 hours; or, 1 if ≥ 90 degrees • Previously cooked and refrigerated within 2 hours; or, 1 if ≥ 90 degrees • Re-heated • Not Re-heated <p>Eating one's own foods, that not require refrigeration, taken home from places like soup kitchens or church functions (Note: it is impossible for anyone to know how long they have been sitting out, just do your best, this is one of our many struggles in doing this type of work)</p> <ul style="list-style-type: none"> • The foods were unopened, and in their original wrappers/boxes or, were whole fresh fruits/vegetables, or foods that didn't require cooking before eating, e.g., crackers • Previously cooked then left unrefrigerated for more than 2 hours; or, 1 if ≥ 90 degrees • Previously cooked and refrigerated within 2 hours; or, 1 if ≥ 90 degrees • Re-heated • Not Re-heated
Eating paper	This question was not altered.	Eating Paper

Table 2: Rationale for Changes Made to the Original Survey Questions and the Revised Questions (Part 1) (CONTINUED)		
Eating food intended for animals	This question was not included in Phase II as animal food undergoes rigorous inspection similar to that of human food and it was deemed to be relatively low risk	Not included in Revised survey

Phase III: Final Survey Results

Sixty seven participants completed Phase III of the online survey. The interviews were conducted from September of 2007 to December of 2007 by the author of this thesis.

Again, the experts were found in Departments of Food Safety, Food Science, Nutrition, Home Economics, and Family and Consumer Sciences. Experts self-reported their primary area of expertise as: food safety 75% (n=48); food science 20% (n=13); and “other” 5% (n=3). Twenty two experts worked in nutrition education. Thirteen experts (20%) had a Master’s degree, and 51 (80%) had a PhD. The mean number of years the experts had worked in their fields were 22.0 ± 9.8 .

Food acquisition and management practices of concern were again rated on a 5-point Likert-type scale, with 1 indicating the lowest level of risk and 5 indicating the highest level of risk. Means and standard deviations were rounded for each of the behaviors and additional conditions that might affect their risk level appear below (Table 3). Final survey results suggested that out of 105 practices, 54 practices were determined to be minimally risky, 29 were moderately risky, and 22 were highly risky. “Minimally risky”

were defined as those behaviors with mean risk ratings ranging from 1.00- 2.50, “moderately risky” behaviors were those with mean ratings of 2.51-3.50, or “highly risky behaviors were those with mean risk ratings ≥ 3.51 .

Table 3: Minimally Risky Behaviors (Those whose ratings rounded to a 1 or 2)			
Food Acquisition/Management Practice	n	Range	Mean±SD
Foods From Damaged Packaging Containing Low Acid Foods			
Intact and not broken open.	64	0-5	2.34±1.42
Not exposed to flood or contaminated water	63	0-5	2.39±1.45
Small dent on the can's surface (not on the seams or rims)	64	0-5	1.51±1.22
Not swollen or bulging	64	0-5	2.01±1.39
Reheated before use	64	0-5	2.17±1.21
Foods From Damaged Packaging Containing High Acid Foods			
Intact and not broken open.	64	0-4	1.29±1.00
Not exposed to flood or contaminated water	64	0-4	1.39±1.01
Small dent on the can's surface (not on the seams or rims)	64	0-4	1.25±1.02
Large/sharp/severe dent on the can's surface (not on the seams or rims)	64	0-5	2.35±1.31
Not swollen or bulging	64	0-4	1.60±1.25
Reheated before use	64	0-9	1.82±1.51
Not reheated before use	64	0-5	2.43±1.36
After Sell By Or Expiration Date			
Intact and not broken open	64	0-5	1.78±1.24
Containing high-acid foods	64	0-5	1.78±1.27
Reheated before use	63	0-5	1.85±1.22
Exposed to flood or contaminated water	64	0-5	1.96±1.30
Eating Animal Food			
Dry food	64	0-5	1.85±1.41
Vacuum-packed pouch	64	0-5	1.82±1.40
Canned food	64	0-5	1.67±1.42
Eating Moldy Cheese			
Semi-soft cheese with mold +1/2 inch removed	63	0-5	2.34±1.34
Hard cheese with mold +1/2 inch removed	64	0-5	1.53±1.16
Hard cheese without mold and less than 1/2 inch removed	64	0-4	2.03±1.18
Very hard cheese with mold +1/2 inch removed	64	0-5	1.28±1.16
Very hard cheese without mold and less than 1/2 inch removed	64	0-4	1.67±1.09
Eating Grain Foods Containing Insects			
Roaches and flies, removed, food cooked after	64	0-5	2.37±1.40
Insects other than roaches and flies, removed, food cooked	64	0-5	2.25±1.39

Table 3: Minimally Risky Behaviors (Those whose ratings rounded to a 1 or 2) (CONTINUED)			
Food Acquisition/Management Practice	n	Range	Mean±SD
Eating Fruits and Vegetables With Spoiled Parts Removed			
Whole prior to spoilage	64	0-5	2.37±1.33
Cooked after spoilage was removed	64	0-5	1.90±1.28
Hard fruits/veggies	64	0-5	2.04±1.25
Not exposed to flood or contaminated water	63	0-5	2.20±1.35
Mushy and dark due to bruising	64	0-9	2.40±1.50
Mushy and dark look due to aging, not bruising	64	0-5	1.73±1.30
Eating Meats Bought From Private Individuals, Street Vendors, Or "Meat Trucks"			
Cooked well done	64	0-5	1.60±1.22
Refrigerated within 2 hrs; or 1 if more than or equal to 90 degrees	64	0-5	2.15±1.22
Frozen solid	64	0-5	1.51±1.27
Tightly packaged with no leaking	64	0-5	1.93±1.24
License and/or safety inspection sticker is visible at sales outlet	64	0-5	2.20±1.27
Appearance of sales people and their operation does look clean and sanitary	64	0-5	2.48±1.16
Eating Perishable Leftovers That Were Left Behind On The Plates Of Others			
The foods were unopened, and in their original wrappers/boxes or, were whole fresh fruits/vegetables, or were foods that didn't require cooking before eating, e.g., crackers	64	0-5	1.57±1.17
From someone who was healthy	64	0-5	2.31±1.42
Previously cooked and refrigerated within 2 hours; or, 1 if ≥ 90 degrees	64	0-5	2.18±1.30
Re-heated	64	0-5	2.12±1.33
Eating Non-Perishable Leftovers That Were Left Behind On The Plates Of Others			
The foods were unopened, and in their original wrappers/boxes or, were whole fresh fruits/vegetables, or were foods that didn't require cooking before eating, e.g., crackers	63	0-5	1.20±1.10
From someone who was healthy	64	0-5	1.84±1.23
Previously cooked and refrigerated within 2 hours; or, 1 if ≥ 90 degrees	64	0-5	1.96±1.28
Re-heated	64	0-5	1.79±1.31

Table 3: Minimally Risky Behaviors (Those whose ratings rounded to a 1 or 2) (CONTINUED)			
Food Acquisition/Management Practice	n	Range	Mean±SD
Eating one's own foods, that should be refrigerated, that have been taken home from places like soup kitchens or church functions: The foods were unopened, and in their original wrappers/boxes or, were whole fresh fruits/vegetables, or were foods that didn't require cooking before eating, e.g., crackers	64	0-4	1.43±1.06
Previously cooked and refrigerated within 2 hours; or, 1 if ≥ 90 degrees	64	0-5	1.93±1.16
Re-heated	64	0-5	1.95±1.23
Eating Non-Perishable Foods That Have Been Taken Home From Places Like Soup Kitchens Or Church Functions			
The foods were unopened, and in their original wrappers/boxes or, were whole fresh fruits/vegetables, or were foods that didn't require cooking before eating, e.g., crackers	64	0-4	1.01±0.96
Previously cooked and refrigerated within 2 hours; or, 1 if ≥ 90 degrees	64	0-4	1.53±0.99
Re-heated	63	0-4	1.57±1.17
Not Re-heated	64	0-5	2.31±1.43
Eating Paper	64	0-9	2.03±1.37

Table 4: Moderately Risky Behaviors (Those whose ratings rounded to a 3)			
Food Acquisition/Management Practice	n	Range	Means±SD
Foods from damaged packaging containing low acid foods: Small dent on the can's seams, or rims	64	0-5	3.03±1.23
Large/sharp/severe dent on the can's surface (not on the seams or rims)	64	0-5	2.98±1.40
Not reheated before use	64	0-5	3.26±1.51
Foods from damaged packaging containing high acid foods: Small dent on the can's seams, or rims	64	0-5	2.51±1.25
Large/sharp/severe dent on the can's seams, or rims	64	1-5	3.48±1.25
After sell by or expiration date Containing low-acid foods	64	0-5	3.10±1.57
Not reheated before use	62	0-5	2.66±1.50
Eating moldy cheese Soft cheese with mold removed	64	0-5	3.10±1.31
Semi-soft cheese without mold and less than 1/2 inch removed	64	0-5	2.79±1.26
Processed cheese with mold +1/2 inch removed	61	0-9	2.57±1.82
Processed cheese without mold and less than 1/2 inch removed	61	0-9	2.80±1.71
Eating grains with mold removed	64	0-5	2.90±1.44
Eating grain foods containing insects Insects other than roaches and flies, not removed	64	1-5	3.43±1.18
Insects other than roaches and flies, removed, food not cooked	64	1-5	3.34±1.18
Eating fruits & veggies with spoiled parts removed Pre-cut prior to spoilage	64	0-5	2.82±1.40
Cooked prior to spoilage	64	0-5	2.67±1.49
Soft fruits/veggies	63	0-5	2.69±1.26
Less than ¾ more furry or mushy	64	1-5	3.15±1.22
Eating meats bought from private individuals, street vendors, or "meat trucks" Not cooked well done	64	1-5	3.23±1.17
Not Frozen solid and/or thawed	64	1-5	2.70±1.10
Not tightly packaged and/or leaking	63	0-5	3.11±1.28
Appearance of sales people and their operation does not look clean and sanitary	64	0-5	3.07±1.31
No License and/or safety inspection sticker is visible at sales outlet	64	1-5	2.82±1.32
Eating leftovers that should be refrigerated that were left behind on the plates of others Not Re-heated	64	0-5	3.37±1.29

Table 4: Moderately Risky Behaviors (Those whose ratings rounded to a 3) (CONTINUED)			
Food Acquisition/Management Practice	n	Range	Means±SD
Eating leftovers that are not foods that need to be refrigerated, that were left behind on the plates of others Previously cooked then left unrefrigerated for more than 2 hours; or, 1 if ≥ 90 degrees	64	0-5	2.93±1.45
Not Re-heated	63	0-5	2.55±1.51
From someone who was sick with a cold, infection, or disease	64	0-5	2.75±1.54
Eating one's own foods, that are not foods that need to be refrigerated, that have been taken home from places like soup kitchens or church functions Previously cooked then left unrefrigerated for more than 2 hours; or, 1 if ≥ 90 degrees			2.75±1.54

Table 5: High Risk Behaviors (Those whose ratings rounded to a 4 or 5)			
Food Acquisition/Management Practice	n	Range	Means±SD
Eating discarded food from trash cans/dumpsters/found outside	64	1-5	4.46±0.87
Foods from damaged packaging containing low acid food: Broken open and exposed to environment	64	1-5	4.42±0.86
Exposed to flood or contaminated water	64	1-5	4.20±1.05
Large/sharp/severe dent on the can's seams, or rims	64	1-5	4.20±0.89
Swollen or Bulging	64	3-5	4.90±0.34
Foods from damaged packaging containing high acid foods: Broken open and exposed to environment	64	1-5	3.53±1.30
Swollen or bulging	64	1-5	4.34±1.05
Exposed to flood or contaminated water	64	1-5	3.90±1.26
After sell by or expiration date Broken open and exposed to the environment	64	1-5	3.89±1.23
Exposed to flood or contaminated water	64	1-5	4.10±1.04
Eating slimy deli meats Slime removed	64	1-5	3.89±1.16
Slime not removed	64	1-5	4.06±1.05
Eating moldy cheese Soft cheese without mold removed	64	1-5	3.53±1.24
Eating moldy grain foods without mold removed	64	1-5	3.59±1.28
Eating grain foods containing insects Roaches and flies, removed, uncooked foods	64	1-5	3.65±1.11
Eating fruits & veggies with spoiled parts removed Exposed to flood or contaminated water	64	1-5	4.43±0.90
$\frac{3}{4}$ or more furry or mushy	64	1-5	3.65±1.21
Eating meats bought from private individuals, street vendors, or "meat trucks" Left unrefrigerated for more than 2 hrs or 1 hr if > or equal to 90 degrees	64	2-5	3.85±0.88
Eating leftovers that should be refrigerated that were left behind on the plates of others From someone who was sick with a cold, infection, or disease	64	1-5	4.09±1.01
Previously cooked then left unrefrigerated for more than 2 hours; or, 1 if \geq 90 degrees	64	1-5	3.67±1.06
Eating leftovers that are not foods that need to be refrigerated, that were left behind on the plates of others From someone who was sick with a cold, infection, or disease	64	1-9	4.00±1.19
Eating one's own foods, that should be refrigerated, that have been taken home from places like soup kitchens or church functions Previously cooked then left unrefrigerated for more than 2 hours; or, 1 if \geq 90 degrees	64	1-5	3.62±1.00

To examine whether a difference existed between the nutrition educators (n=22) versus the food scientists surveyed (n=39) regarding the levels of risk they associated with the practices, t-tests were performed on mean responses. The behaviors for which a significant difference at the .05 level was found are listed below in Table 6.

Table 6: T-test Differences in Risk Level Ratings between Food Science Experts and Nutrition Educators for Behaviors Listed in Revised survey (.05 significance level)			
Food Acquisition/Management Practice	Food Scientists' Ratings n= 39	Nutritionists' Ratings n=22	Difference in Ratings
Eating foods from damaged packaging: that is swollen or bulging and contains high acid foods	4.00 \pm 1.21	4.91 \pm 0.29	0.9
Eating slimy deli meats after the slime has been removed	3.64 \pm 1.30	4.31 \pm 0.77	0.7
Eating Slimy deli meats: without the slime removed	3.82 \pm 1.21	4.45 \pm 0.59	0.6
Eating animal food: that was canned	1.43 \pm 1.35	2.22 \pm 1.47	0.8
Eating soft cheese after the mold has been removed	2.85 \pm 1.18	3.59 \pm 1.51	0.7
Eating semi soft cheese with mold and ½ inch mold removed	2.13 \pm 1.24	2.86 \pm 1.49	0.7
Eating meats bought from private individuals, street vendors, or "meat trucks": left unrefrigerated for more than 2 hrs or 1 hr if $\geq 90^\circ$	3.69 \pm 0.97	4.22 \pm 0.61	0.5
Eating leftovers that should be refrigerated that were left behind on the plates of others: from someone who was healthy	2.02 \pm 1.36	3.04 \pm 1.25	1.0
Eating leftovers that should be refrigerated that were left behind on the plates of others: previously cooked and refrigerated within 2 hours or 1 hr if $\geq 90^\circ$	1.97 \pm 1.20	2.72 \pm 1.38	0.8
Eating leftovers that are NOT foods that need to be refrigerated, that were left behind on the plates of others and: re-heated	1.53 \pm 1.14	2.36 \pm 1.49	0.8
Eating leftovers that are NOT foods that need to be refrigerated, that were left behind on the plates of others: NOT re-heated	2.28 \pm 1.33	3.23 \pm 1.65	1.0
Eating one's own foods, that should be refrigerated, that have been taken home from places like soup kitchens or church functions and re-heated	1.74 \pm 1.11	2.41 \pm 1.41	0.7
Eating one's own foods, that are not foods that need to be refrigerated, that have been taken home from places like soup kitchens or church functions and re-heated	1.33 \pm 1.03	2.09 \pm 1.34	0.8
Eating one's own foods, that are not foods that need to be refrigerated, that have been taken home from places like soup kitchens or church functions and not re-heated	2.10 \pm 1.37	2.86 \pm 1.46	0.8
Eating Paper.	1.58 \pm 0.99	2.41 \pm 1.00	0.8

CHAPTER 5

DISCUSSION

Most of the risk levels assigned by experts to the food acquisition and management practices studied varied from low to high, depending on the conditions under which the practices were performed. Only four were not. Notably, USDA guidance was apropos regarding some practices, and not for others; in other cases it was incomplete in terms of the conditions under which practices were performed. This discussion will examine the factors associated with the practices' varying degrees of risk and the degree to which USDA provides consumer guidance on these food acquisition practices used by limited-resource individuals. Furthermore, this discussion will identify the differences in risk level ratings between experts with a strong educational background in food science versus those with a strong nutrition education background. Potential explanations for the differences are also proposed.

Temperature's Effect on Risk Variation of Food Acquisition and Management Practices

Fifty of the food acquisition and management practices studied varied from minimal to high risk, depending on the conditions surrounding their performance. The degree of risk that was associated with their use could most often be attributed to the manner in which foods were prepared/cooked and/or maintained/chilled. These concepts are covered both in the general guidance provided on USDA websites, as well as via two of the four steps outlined in the *Be Food Safe* campaign, i.e., Cook and Chill.^(8, 11, 50)

In most cases, if cooked to proper internal temperatures, the following practices were considered to be minimally risky, but if they were not, the risk increased to moderate or high:

- eating low or high acid foods from damaged packaging,
- eating foods after the sell by or expiration date,
- eating grain foods with insects removed,
- eating fruits and vegetables with spoiled parts removed,
- eating meats from private individuals, street vendors, or meat trucks,
- eating perishable and non-perishable foods left behind on others' plates, and
- eating one's own perishable or non-perishable foods taken home from soup kitchens or church functions.

Again, with regards to maintaining foods at appropriate temperatures, i.e., the USDA's "Chill" guidance,⁽⁸⁾ the following practices were deemed minimally risky if this guidance was followed, but if it was not, the risk associated with engaging in the practice increased. For example, minimal risk was associated with eating perishable foods and leftovers that had been refrigerated within two hours, but when meats bought from private individuals, street vendors, or meat trucks sat out for more than two hours, risk was said to increase substantially. USDA guidelines concur.⁽⁸⁾ Similarly, meats purchased from private individuals/vendors or meat trucks that were frozen solid and had not begun to thaw were considered minimally risky by experts, whereas they were rated moderately risky if the situation was such that they had begun to thaw. This mimics

USDA guidance that “food that is left for more than two hours is dangerous to eat, even if it smells or looks fine.”^(6, 8)

With regards to consuming foods after the sell by or expiration date, the USDA advises that if these foods are consumed, to prevent foodborne illness, they must be handled properly and stored at safe temperatures.⁽⁸⁾ The USDA goes on to advise that cooking these foods may not be enough to destroy heat resistant toxins.⁽⁶⁶⁾ This advice is contrary to expert opinions obtained in this study, which indicated that if reheated before use the consumption of these foods presented minimal risk. USDA advice appears incomplete regarding the consumption of these foods, as there is no mention of the condition of the package (intact vs. broken open), acidity of the food, or exposure to the environment or contaminated waters which were important food safety considerations according to the experts who participated in this study.⁽⁸⁾

Other Factors’ Associated Risk Variation for Food Acquisition and Management Practices

Although most practices’ risks were associated with the degree of adherence to the “Cook” and “Chill” guidelines, some practices’ risks varied due to other factors. These factors were associated with the foods’ degree of exposure to contaminants and/or pathogens, certain food characteristic differences, and the cleanliness of the environment in which the food was stored, prepared, or served.

Degree of exposure to contaminants and/or pathogens caused the engagement in some practices to be rated anywhere from minimal to high risk. Purchasing foods in dented or damaged packages, especially those that are in cans which are dented, rusted or bulging, is discouraged by the USDA due to the potential risk of consumers' becoming infected with botulism.^(66, 67) This advice varies from this study's findings. In fact, the risk associated with this practice was considered to be minimal if the package contained a high-acid food, like tomatoes, so long as the package:

- is intact (not broken open),
- has not been exposed to flood or contaminated water, and
- (if canned) has only a small dent on the surface (not on the seams or rim), and is not swollen or bulging.

The same minimal risk was associated with the consumption of packaged low-acid foods, so long as they are reheated prior to consumption. This investigation's experts agreed with USDA that eating from damaged packages carries at least moderate risk when cans are dented along the seams or rims, regardless of the food's acidity, and that eating from punctured packages that were swollen or bulging, or that were exposed to contamination or flood water was highly risky, i.e., the food should be discarded.^(66, 67)

Food characteristics that resulted in variable risk, other than the foods' acidity which is discussed above, included: the food's degree of permeability and its moisture content.

Variation in risk according to foods' degrees of permeability is exemplified by the consumption of moldy bread and different types of moldy cheeses. Because of the porous nature of bread and baked goods, the USDA specifically states that moldy grains

should be discarded because contamination below the surface may be present.⁽⁶⁶⁾ While the experts that participated in this investigation agreed that eating moldy bread was a high risk behavior, they suggested that the risk was moderate if the mold was removed. With regards to consuming moldy cheese, the USDA⁽⁶⁶⁾ specifically makes mention that if one inch of mold is removed around and below the mold on hard cheeses, it is safe to consume; experts seemed to concur, as they rated this practice as minimally risky. Similarly, the USDA makes mention that for soft cheeses or shredded/crumbled cheeses, in which mold could more easily permeate it, the cheese should be discarded if it contains molds that were not part of the manufacturing process, however, guidance on how to differentiate between molds that were part of the manufacturing process.⁽⁶⁶⁾ Experts also rated the practice of consuming soft cheese without mold removed to be highly risky.

The practice of consuming fruits and vegetables from which spoiled parts are removed is mentioned in USDA food safety guidelines as safe, so long as at least one inch is removed from firm (low-moisture content) fruits and vegetables; however, USDA cautions that softer varieties (higher moisture content) should be discarded.⁽⁶⁶⁾ Some of the experts' surveyed indicated that in the case of softer varieties, risk was moderate if the produce was bruised vs. spoiling, if the degree of decay was not significant (less than $\frac{3}{4}$), if the majority of the spoilage was removed, and if the produce was cooked. Contrary to some of the experts' comments, the USDA advises consumers that cooking spoiled fruits and vegetables may not be enough to destroy heat resistant toxins that have developed.⁽⁶⁶⁾ The USDA guidelines also make no mention of whether cooking (hard or soft produce) after spoilage has been removed changes the level of risk involved.⁽⁶⁶⁾

The Core food safety step “Clean” specifically focuses on practicing proper hand hygiene, washing produce and surfaces that foods contact, and using cleaners that are able to fight bacteria and provide protection to the consumer against foodborne illnesses.⁽⁸⁾ Although the practice of eating meats from private vendors or meat trucks was not directly relevant to this core step, the importance and degree of cleanliness of the environment in which meats were acquired was mentioned by experts to be a condition that would cause this method of food acquisition to vary from minimal to high risk. If the appearance of the sales people and the operation did not look clean and sanitary, experts deemed this practice to be high risk. USDA guidance recommends consumers only purchase USDA and state inspected meats that are properly labeled with species, cut, net weight, ingredients, and a safe handling statement, with no reference to the cleanliness of the environment or vendor from which it was purchased, although the staff and purchasing environment would have to pass a safety inspection which evaluates and requires a certain degree of cleanliness.⁽⁴⁹⁾

Again, most practices were associated with widely varied risk, but four were not. Two were exclusively associated with minimal risk (eating animal food and paper), and two were associated with only high risk (eating slimy meats and eating discarded food). Several experts pointed out that animal food is subject to strict quality assurance and food safety processing regulations and is often made alongside human food, deeming it a minimally risky behavior. The majority of experts rated eating paper as minimally risky unless a large quantity is consumed or it is contaminated, e.g. with ink or raw food. The

review of the literature showed that guidance regarding the safety of eating paper or animal food is absent from the USDA website. Since these practices carry little risk, this work suggests that their absence is not a problem.

Lunch meat that is slimy may lead to foodborne illness and should not be used per USDA guidelines, with no mention of a change in risk level if the slime is removed or not removed.⁽⁶⁶⁾ All experts agreed, rating this practice as exclusively high risk. On the other hand, acquiring discarded food and eating slimy deli meats (whether the slime was removed or not) were considered exclusively high risk behaviors. Experts reported that discarded food could be opened and exposed to contamination by other materials in the dumpsters, sitting out for long periods of time in temperatures conducive for rapid bacterial growth, and had begun spoiling. As for eating slimy meats or removing the slime and eating it, some experts reported that luncheon meats have the highest risk for transmission of *Listeria monocytogenes* among various ready to eat foods and this would be a high risk practice if that was the organism producing the slime. USDA guidance specifically advises consumers that spoiled meat with color changes, off odors, that is sticky or tacky to the touch, or slimy may lead to foodborne illness and should not be used.⁽⁶⁶⁾

No mention of practice at all in any guidance

Removing insects from grains was the only practice that ranged from minimal to high risk that is not at least alluded to in the USDA Food Safety campaigns, or their websites' consumer guidance.^(8, 11) Whereas whether or not the food was cooked after the insects were removed "is" dependent on the cooking process, scientists indicated risk was also dependent on: 1) the type of insect in the food, and 2) whether or not the insects were removed prior to cooking and/or consumption. It would appear that the absence of information regarding eating foods in which insects are found would be of value to consumers and their safety, and should be addressed.

Differences in Risk Level Ratings Between Food Science Experts and Nutrition Educators Regarding Food Acquisition and Management Practices

Of the 105 food acquisition and management practices studied in this research, 15 (about 14%) were significantly different in risk level ratings between Food Science experts and Nutrition Educators. For all 15 practices, nutrition educators responded with a higher risk level rating, suggesting a more conservative perspective. One possible explanation for the more conservative responses of nutrition educators may be their foundational knowledge and training, or lack thereof.

The national ACEND (Accreditation Council for Education in Nutrition and Dietetics of the Academy of Nutrition and Dietetics) accreditation requirements for Didactic and Dietetic Internship programs, i.e., specific program goals, objectives, and curriculum,

vary from program to program.⁽⁶⁸⁾ Although guidelines for the development of these goals, objectives, and curriculum are provided for program directors and faculty, specifics are essentially left to their discretion. For example, curriculum requirements for students enrolled in didactic programs that prepare students for supervised practice must include content related to “the role of environment, food, nutrition and lifestyle choices in health promotion and disease prevention.” For example, Scheule found that 53% of dietetics educators included food safety education in three to four of their program courses, and only about 34% of dietetics programs required or offered food safety certification.⁽⁶⁹⁾ Either way, the food safety content of these courses typically reflects the guidelines and recommendations included in the SERVSAFE[®] program,⁽⁵⁶⁾ as well as public health government campaigns which emphasize the core food safety steps outlined above.⁽¹¹⁾ Students are provided with knowledge and training in the areas of:

- The Importance of Food Safety
- Good Personal Hygiene
- Time and Temperature Control
- Preventing Cross-Contamination
- Cleaning and Sanitizing
- Safe Food Preparation
- Receiving and Storing Food
- Methods of Thawing, Cooking, Cooling and Reheating Food
- HACCP (Hazard Analysis and Critical Control Points)
- Food Safety Regulations

But again, many educators do not undergo this training, and even if they do, many of the practices examined in this study, e.g. consuming discarded food or moldy grains are not addressed.

The potential that lack of previous training may have led to the more conservative responses made by the nutrition educators is supported by comments made on some surveys wherein nutrition educators noted that they felt “under qualified” and lacked the extensive background and experience required to accurately rate the safety level of each practice. For example, when asked to rate the level of risk involved with consuming paper, several experts said they did not know and/or had no experience dealing with this situation.

This research revealed that multiple factors or conditions, including temperature control during food processing, exposure to environmental contaminants as well as the cleanliness of the environment which surrounds the food, and food characteristics e.g. degree of permeability, and moisture content led to the majority of the variation in risk level noted by experts amongst the food acquisition and management practices studied. The USDA and other governmental resources have addressed some of these practices, indicating concretely whether they are safe to practice or should be avoided;^(8, 11) however, as examined above there are still gaps in terms of consumer guidance regarding the safety of engaging in other practices. This research also revealed significant differences between the Food Science Experts versus Nutrition Educators’ perception of

the safety and risk levels associated with engaging in some of these food acquisition and management practices.

CHAPTER 6

CONCLUSIONS

The purpose of this research was to assess the relative food safety risk associated with non-traditional food acquisition and management practices. Expert guidance obtained from food safety and/or food science experts, provided needed insight regarding specific conditions that influence the safety risk associated with engaging in the aforementioned practices, as well as their overall risk. Based on the expert ratings, practices were categorized into minimal, moderate, and high risk groups, with many practices varying in risk depending on the conditions under which they were performed. This chapter reviews the major findings of this research and their implication on current food safety messages disseminated to consumers, particularly limited resource populations. It follows with reflections regarding the significant differences that were revealed between food scientists and nutrition educators' perceptions regarding the safety risks of engaging in these practices. Lastly, recommendations for future research are discussed.

Risks Posed When Limited Resource Populations Engage in Particular Non-traditional Food Acquisition and Food Management Practices

The high risk practices identified in this research are particularly important because engaging in them has been strongly associated with increased likelihood of falling victim to some of the most common foodborne illnesses reported by the FDA and USDA.^(9, 66)

For example:

- Consuming food that has been discarded, contaminated by the environment or an ill food handler, consumed after its expiration date, or acquired from damaged packages

- such as cans may put consumers at high risk for acquiring illnesses from organisms such as *Clostridium botulinum*, *Salmonella*, *Listeria*, *E.coli*, and *Campylobacter*.⁽³⁷⁾
- Consuming moldy cheese, especially soft cheeses through which mold can easily penetrate with “root” threads containing poisonous substances (even if mold is removed) can cause harmful bacteria such as *Listeria*, *Brucella*, *Salmonella* and *E. coli* to grow along with the mold.⁽³⁷⁾
 - Consuming slimy deli meats can put a consumer at high risk for developing food borne illnesses caused by *Listeria*.⁽³⁷⁾
 - Depending on the type of mold growing on the grain, consuming moldy grain products such as bread can put a consumer at high risk for acquiring gangrenous ergotisms, alimentary toxic aleukia, *Stachybotrys chartarum* or aflatoxicosis. These are just a few examples of the types of bacterium or fungi that can grow on bread.⁽³⁷⁾
 - Consuming produce that is spoiled or contaminated by the environment or an ill food handler can lead to *E.coli*, *Norovirus*, and *Salmonella infections*.⁽³⁷⁾
 - Consuming foods e.g. meats or leftovers containing meat that have undergone time/temperature abuse before and after cooking or that were contaminated by the environment or an ill food handler can lead to *Listeria*, *E.coli*, *Campylobacter*, and *Salmonella* foodborne illnesses.⁽³⁷⁾

As noted, many of the limited resource individuals engaging in these practices have displayed deficiencies in knowledge and food safety behaviors that can counter risk for acquiring these illnesses.^(16-18, 20, 21, 23, 33, 60)

For consumers considered to be food secure, the four core food safety steps highlighted in campaigns such as Fight BAC![®] may be sufficient educational aids in preventing food borne illness. However, the findings from this investigation, coupled with the audience's lack of food safety knowledge that has been documented in the literature, suggest that additional consumer food safety education messages that are culturally sensitive, contain content with a low grade level reading, and that are relevant to the high risk food practices identified in this study, may need to be developed.

With regards to the “clean” step of the Fight BAC![®] campaign, words such as “wash” and “rinse” are used to instruct consumers on proper hand washing techniques, and to indicate that surfaces having contact with foods need to also be cleaned to prevent bacteria from spreading throughout the kitchen.⁽⁵⁰⁾ Perhaps messages conveying the importance of eating only food items that are considered “clean” or with minimal amounts of harmful bacteria are safe to eat should be added. The following guidelines are examples of messages that could supplement the “clean” step to aid consumers in determining whether a food item is completely clean and safe for consumption:

- free of debris
- without contamination from unclean water, debris or discarded garbage, insects, or ill persons
- not slimy, especially deli meats
- no appearance of mold, especially in soft and processed cheeses, like Ricotta and Cottage cheese (hard cheeses like Parmesan, with mold may have the mold and ½ in around the mold removed safely)

- not having been exposed to outside elements
- not from damaged packages that appear swollen or bulging, or canned foods from cans with large dents on the seams or rims.

Perhaps both written and visual guidelines could be developed to aid consumers in determining whether foods contained in packages would be safe for consumption.

In addition to cleaning cutting boards and kitchen surfaces, consumers should be instructed to clean, rinse, and dry the inside of the refrigerator every few months to prevent mold growth. Supplementary messages with regards to produce, especially soft fruits and vegetables with a high moisture content and high permeability, should make clear that these foods should not be consumed if they appear to be spoiled and not just bruised. Perhaps written and visual guidelines to aid in recognizing the difference between bruised versus spoiled produce could be developed.

Regarding the “separate” step,⁽⁵⁰⁾ messages emphasizing the importance of avoiding the consumption of food that has not been separated from contaminants is vital. For example, food should not be consumed if, again, it has had contact with discarded food, the environment (flood water), an ill person or food handler. Avoiding the consumption of others’ leftovers is especially crucial, as the consumer is not likely to be aware of the health status of the person who had contact with the food initially, nor is it clear whether the leftovers were previously exposed to time/temperature abuse.

While guidelines regarding the “cook” portion of the “cook and chill” step,⁽⁵⁰⁾ i.e., the emphasis on the use of a food thermometer to check for doneness when cooking, appears to be clear, the use of a thermometer by low-income people is not always practical. Studies have shown that consumers with more education and higher incomes had food thermometers in their homes ($\geq 40\%$).⁽²⁵⁾ On the other hand, food insecure, limited income individuals are not likely to own thermometers due to reasons such as financial constraints.⁽²⁰⁾ One study suggests the distribution of inexpensive food thermometers and instructions on how to use them correctly should accompany “cook” messages.⁽⁶²⁾ In considering the chill portion of the guideline, this study points to issues beyond the notion that frozen meats are thawed in unsafe ways, such as in the sink or on the kitchen counter at room temperature. Based on these findings, purchases from mobile food/meat trucks deserve additional messages to accompany this step. Limited-resource individuals should be discouraged from making purchases from mobile operations, such as food trucks, unless satisfactory refrigeration is evident and/or there is a valid safety inspection certificate available is posted for viewing (and the operation appears to be sanitary).

In the state of New Jersey, mobile food operations that are granted certificates for posting must comply with safe food storage and handling procedures in accordance with New Jersey Department of Health regulations.⁽⁷⁰⁾ Licenses to operate mobile food units are only provided after the facility has earned a "satisfactory" grade from the inspector.⁽⁷⁰⁾ Safety inspections may give the consumer both some assurance that foods are cooked to proper internal temperatures, and that they are kept in a clean and sanitary environment. However, while safe conditions may be optimal at the time of inspection (usually when a

license is requested) inspections to ensure conditions remain safe may only reoccur one to two times per year or when a complaint is made to the Department of Health,⁽⁷⁰⁾ so some degree of observation and attention should be encouraged for those who shop in such venues.

In summary, additional food safety education content should be developed that continues to be consistent with the four core food safety steps, but that includes supplementary messages that take into consideration the high risk food acquisition and management practices identified in this research. In addition to the creation of these audience-specific messages, adequate message dissemination channels should be used. Message developers should consider that the most predominant sources of food safety information that high risk populations report receiving information from are: food assistance programs e.g. WIC and their family members.⁽⁶²⁾ These communication venues should be used to reach a broader spectrum of individuals at risk for engaging in these risky practices.

Nutrition Educators Rate Untraditional Food Acquisition and Food Management Practices More Conservatively

As previously discussed, the food acquisition and management practices studied were rated significantly different between Nutrition Educators and Food Scientists, with Educators choosing higher risk levels and displaying more conservative perspectives. As previously noted, the likely source of these discrepancies might be that ACEND has charged the Dietetics Program Directors with the task of arranging goals and experiences

for students that align with their guidelines, and consequently, much variation in students' knowledge and experiences exists.⁽⁶⁸⁾ Perhaps students enrolled in programs whose concentrations are in community dietetics or health promotion should be offered more extensive training in the areas of food safety and food science, and those who enter Community Nutrition positions post-graduation should be encouraged to seek such training. This is critical in order to bring value to the clients served by nutrition educators and to provide communities with the tools they need to help prevent and reduce the occurrence of food borne illness.

Suggestions for Future Research Endeavors

This preliminary work has the potential to inform nutrition education offerings for limited-resource individuals, however, it is far from complete in terms of the work that should be done regarding the risks associated with some food acquisition and management practices employed by this audience. For example, with regards to practices associated with hunting and fishing that have been reported, a lack of adequate expertise amongst the experts surveyed and a lack of consistent advice throughout the available literature on these subjects led to the exclusion of such practices from being rated for risk levels in this work. Surveys focusing on these food handling practices should be developed in order to obtain risk level ratings from food science and food safety experts specializing in the areas of hunting wild game and fishing.

Additionally, geographical differences in food handling practices amongst various low-income populations should be identified on a national level.

Lastly, while this study revealed that engaging in some food handling practices posed a serious health risk to individuals, the prevalence of limited resource individuals engaging in these practices is unknown. Future research should examine the prevalence of limited resource individuals engaging in the practices identified as moderate to high risk, how frequently they are engaging in them, and whether they were significant enough to additionally warrant supplementary food safety education messages targeting this population.

Appendix 1: Phase I - Email Invitation to Complete Survey

Good evening Dr.

My name is Elizabeth Nossier and I am a graduate student at Rutgers University, working with Dr. Debra Palmer and the Food Stamp Nutrition Education Program (FSNE). We have chosen to contact you personally to ask for your much needed assistance in completing a food safety related web survey (using the login name: *fsurvey* and password: *Food2007*) located at the following URL: [Available at: http://nutrisci.rutgers.edu/surveys/foodsurvey/part1/](http://nutrisci.rutgers.edu/surveys/foodsurvey/part1/)

This web survey will help us identify and rank the risks associated with potentially unsafe, non-traditional ways in which low income people acquire food. As you know, evaluating these risks requires expertise and experience in the study of food safety. We believe that you and your colleagues in this field would be the most appropriate sources from which to gather this necessary data. We are sure that you have a full and busy schedule, but would truly appreciate it if you would take some time to lend us a helping hand. The results of this survey will enable nutrition educators and counselors across the nation to better serve and help protect the vulnerable populations we interact with on a daily basis. Thank you for your time and consideration into this very important matter.

If we do not hear from you in the next week to ten days, our research team members, Kirsten Corda, Audrey Adler, or I will call you to ensure you received this email and to assist in any way we can.

Please note: The above URL is the first part of a three part web survey. For your convenience, we have given you the option of completing one part at a time. You may login at another time (with the same login and password above) to complete the remaining parts if you choose not to complete the survey continuously. Also, please remember to fill in your name at the end of each survey part.

The second part of the survey is located at: [Available at: http://nutrisci.rutgers.edu/surveys/foodsurvey/part2/](http://nutrisci.rutgers.edu/surveys/foodsurvey/part2/)

The third and last part of the survey is located at: [Available at: http://nutrisci.rutgers.edu/surveys/foodsurvey/part3/](http://nutrisci.rutgers.edu/surveys/foodsurvey/part3/)

Feel free to contact us with any questions or concerns by replying to this message.

Appendix 2: Phase I- Original Web Based Survey

Safety Risk of Food Acquisition and Management Practices

Web-Based Survey

Part 1

Hello, we are researchers from the Department of Nutritional Sciences at Rutgers, The State University of New Jersey. Several years ago we did a study to see what food acquisition and food management practices low-income people used to ensure they could keep their families from going hungry. Some of the things they said they did may be unsafe. However, so is not eating. To that end, we seek to learn:

- the extent of risk people confront when engaging in these practices, and
- if there are particular conditions under which the practices may be safer or less safe.

We have developed a survey to help us determine the degree of risk individuals are exposed to when using these practices, as well as any conditions that may affect the degree of risk incurred when engaging in the behavior.

Your responses to our survey will be confidential, and will be used to educate professionals who work with this audience. Your valuable inputs are very crucial to our research due to the fact that there really is no information currently available on this topic. Your answers will enable us to provide these individuals with some helpful information. For your convenience in scheduling your time, we will be sending it out in three parts, which can be completed separately. We ask that you complete all three parts within ten days of receipt. We anticipate that completing all three parts of the survey will take less than 45 minutes of your time. We strongly urge you to complete all of the survey questions so that you provide us with a full understanding of the safety risks associated with these food practices; however, you may stop at any time.

The three parts of your survey answers will be matched up by your name (last name, first initial).

Please enter your name the same way on each part of the survey. We would also appreciate your providing us with a telephone number at which you can be reached in the event we need to contact you for clarification of your comments. Space has been provided at the end of the survey for you to enter both your name and telephone number.

All responses to this survey will be analyzed and reported so that sources will be anonymous to anyone reading them. Results will be presented as part of a group analysis. Completing this survey will indicate your consent for us to include your responses in our compiled analysis. Any question about this survey may be directed to: Dr. Debra Palmer Kempson, Associate Professor at 732-932-9853 (Kempson@aesop.rutgers.edu), Audrey Adler, Sr. Program Coordinator for Research and Development at 732-932-0532 (adler@aesop.rutgers.edu), Elizabeth Nossier, Graduate Investigator at 732-932-3779 (nossier@eden.rutgers.edu), Kirsten Corda, Graduate Investigator kcorda@eden.rutgers.edu or the Office of Research and Sponsored Programs at 732-932-0150, ext 2104 (humansubjects@orsp.rutgers.edu).

Thank you for participating in this project.

Survey Questions

Please complete the following information. You may either submit it electronically or print the survey and fax it to Dr. Kempson at 732-932-6522. Please fax any supplemental information you think may be of assistance with this project to Dr. Kempson as well.

All survey responses will be kept confidential.

Would you say food safety or food science is your primary area of expertise?

☐ Food Safety ☐ Food Science ☐ Other

(If other is selected, open a new window: In this study we are seeking the advice of individuals who are experts in the topic of Food Safety. Please recommend someone from your University who has expertise in this field.

_____)

What is your official title? _____

What is your highest level of education?

☐ Bachelors ☐ Masters ☐ PhD ☐ Postdoctoral

How many years have you been practicing in this field? _____

Please rate the following food acquisition and food management practices according to the risk scale below. If a number can not be provided because the risk varies conditionally, then select the letter C. If you select "C" please explain the conditions that would modify your response. Regardless of response, explanatory comments are welcome. Please provide as much detail as possible. Also, if you can suggest any references that would help us understand why and under what conditions the risk varies, we would appreciate your including these references in your response.

0	1	2	3	4	5	C
No Risk	Little Risk		Moderate Risk		Extreme Risk	Conditional

1. Acquiring and eating discarded foods such as from the "trash" or dumpsters.

0	1	2	3	4	5	C
No	Little		Moderate		Extreme	Conditional
Risk	Risk		Risk		Risk	

Comment: _____

2. Eating foods from dented or damaged packages.

0	1	2	3	4	5	C
No	Little		Moderate		Extreme	Conditional
Risk	Risk		Risk		Risk	

Comment: _____

3. Eating foods purchased after the "sell by" date, but still available for sale in a store.

0	1	2	3	4	5	C
No	Little		Moderate		Extreme	Conditional
Risk	Risk		Risk		Risk	

Comment: _____

4. Eating foods that have been kept beyond their expiration dates, either at home or at a food pantry, that would no longer be suitable or allowable for sale in a store.

0	1	2	3	4	5	C
No	Little		Moderate		Extreme	Conditional
Risk	Risk		Risk		Risk	

Comment: _____

Please provide us with:

Last Name, First Initial: _____

Telephone Number at which you can be reached: () - _____

The time you spent on this portion of the survey is much appreciated! To complete the survey, please follow the instructions for the second and third segments of the questionnaire. Thank you for your help.

Safety Risk of Food Acquisition and Management Practices

Web-Based Survey

Part 2

Welcome back!

This is the continuation of the survey being conducted by researchers from the Department of Nutritional Sciences at Rutgers, The State University of New Jersey. By now, you have completed the first segment of this survey on the safety risks of the food acquisition and management practices used by low-income people. This is part two of the survey.

As in the first part of the survey, your responses to our survey will be confidential. We ask that you complete all three parts within ten days of receipt. We strongly urge you to complete all of the survey questions so that you provide us with a full understanding of the safety risks associated with these food practices; however, you may stop at any time.

Completing this survey will indicate your consent for us to include your responses in our compiled analysis. Any question about this survey may be directed to: Dr. Debra Palmer Kempson, Associate Professor at 732-932-9853 (Kempson@aesop.rutgers.edu), Audrey Adler, Sr. Program Coordinator for Research and Development at 732-932-0532 (adler@aesop.rutgers.edu), Elizabeth Nossier, Graduate Investigator at 732-932-3779 (nossier@eden.rutgers.edu), Kirsten Corda, Graduate Investigator kcorda@eden.rutgers.edu or the Office of Research and Sponsored Programs at 732-932-0150, ext 2104 (humansubjects@orsp.rutgers.edu).

Thank you for participating in this project.

Please complete the following information. You may either submit it electronically or print the survey and fax it to Dr. Kempson at 732-932-6522. Please fax any supplemental information you think may be of assistance with this project to Dr. Kempson as well.

All survey responses will be kept confidential.

Please rate the following food acquisition and food management practices according to the risk scale below. If a number can not be provided because the risk varies conditionally, then select the letter C. If you select "C" please explain the conditions that would modify your response. Regardless of response, explanatory comments are welcome. Please provide as much detail as possible. Also, if you can suggest any references that would help us understand why and under what conditions the risk varies, we would appreciate your including these references in your response.

0	1	2	3	4	5	C
No	Little		Moderate		Extreme	Conditional
Risk	Risk		Risk		Risk	

5. Eating lunch meat after slime has been removed from it.

0	1	2	3	4	5	C
No	Little		Moderate		Extreme	Conditional
Risk	Risk		Risk		Risk	

Comment:

6. Eating cheese from which mold has been removed.

0	1	2	3	4	5	C
No	Little		Moderate		Extreme	Conditional
Risk	Risk		Risk		Risk	

Comment:

7. Eating grain foods from which mold has been removed.

0	1	2	3	4	5	C
No	Little		Moderate		Extreme	Conditional
Risk	Risk		Risk		Risk	

Comment:

8. Eating grain foods from which insects have been removed.

0	1	2	3	4	5	C
No	Little		Moderate		Extreme	Conditional
Risk	Risk		Risk		Risk	

Comment: _____

9. Eating fruits or vegetables from which spoiled parts have been removed.

0	1	2	3	4	5	C
No	Little		Moderate		Extreme	Conditional
Risk	Risk		Risk		Risk	

Comment: _____

10. Eating meats bought from private individuals or street vendors, like items off “meat trucks”.

0	1	2	3	4	5	C
No	Little		Moderate		Extreme	Conditional
Risk	Risk		Risk		Risk	

Comment: _____

11. Eating homegrown fruits and vegetables obtained from private individuals.

0	1	2	3	4	5	C
No	Little		Moderate		Extreme	Conditional
Risk	Risk		Risk		Risk	

Comment: _____

12. Eating home-grown fruits and vegetables from their own garden.

0	1	2	3	4	5	C
No Risk	Little Risk		Moderate Risk		Extreme Risk	Conditional

Comment: _____

13. Eating food provided in the home of a private individual you do not know, i.e., a private soup kitchen run out of someone's home.

0	1	2	3	4	5	C
No Risk	Little Risk		Moderate Risk		Extreme Risk	Conditional

Comment: _____

Please provide us with:

Last Name, First Initial: _____

The time you spent on this portion of the survey is much appreciated! To complete the survey, please follow the instructions for the third segment of the questionnaire. Thank you for your help.

Safety Risk of Food Acquisition and Management Practices

Web-Based Survey

Part 3

Welcome back!

This is the continuation of the survey being conducted by researchers from the Department of Nutritional Sciences at Rutgers, The State University of New Jersey. By now, you have completed the first and second segments of this survey on the safety risks of the food acquisition and management practices used by low-income people. This is part three of the survey.

As in the previous parts of the survey, your responses to our survey will be confidential. We ask that you complete all three parts within ten days of receipt. We strongly urge you to complete all of the survey questions so that you provide us with a full understanding of the safety risks associated with these food practices; however, you may stop at any time.

Completing this survey will indicate your consent for us to include your responses in our compiled analysis. Any question about this survey may be directed to: Dr. Debra Palmer Kempson, Associate Professor at 732-932-9853 (Kempson@aesop.rutgers.edu), Audrey Adler, Sr. Program Coordinator for Research and Development at 732-932-0532 (adler@aesop.rutgers.edu), Elizabeth Nossier, Graduate Investigator at 732-932-3779 (nossier@eden.rutgers.edu), Kirsten Corda, Graduate Investigator kcorda@eden.rutgers.edu or the Office of Research and Sponsored Programs at 732-932-0150, ext 2104 (humansubjects@orsp.rutgers.edu).

Thank you for participating in this project.

Please complete the following information. You may either submit it electronically or print the survey and fax it to Dr. Kempson at 732-932-6522. Please fax any supplemental information you think may be of assistance with this project to Dr. Kempson as well.

All survey responses will be kept confidential.

Please rate the following food acquisition and food management practices according to the risk scale below. If a number can not be provided because the risk varies conditionally, then select the letter C. If you select "C" please explain the conditions that would modify your response. Regardless of response, explanatory comments are welcome. Please provide as much detail as possible. Also, if you can suggest any references that would help us understand why and under what conditions the risk varies, we would appreciate your including these references in your response.

0	1	2	3	4	5	C
No Risk	Little Risk		Moderate Risk		Extreme Risk	Conditional

14. Eating roadkill created by running down small animals and then taking the carcass home.

0	1	2	3	4	5	C
No	Little		Moderate		Extreme	Conditional
Risk	Risk		Risk		Risk	

Comment: _____

15. Eating animals found already dead on the road or roadside (roadkill).

0	1	2	3	4	5	C
No	Little		Moderate		Extreme	Conditional
Risk	Risk		Risk		Risk	

Comment: _____

16. Eating food acquired by fishing or hunting.

0	1	2	3	4	5	C
No	Little		Moderate		Extreme	Conditional
Risk	Risk		Risk		Risk	

Comment: _____

17. Eating leftovers such as from the plates of others at a soup kitchen or church function

0	1	2	3	4	5	C
No	Little		Moderate		Extreme	Conditional
Risk	Risk		Risk		Risk	

Comment: _____

18. Eating their own leftovers taken home from soup kitchens or church functions.

0	1	2	3	4	5	C
No	Little		Moderate		Extreme	Conditional
Risk	Risk		Risk		Risk	

Comment: _____

19. Eating perishable foods not properly stored.

0	1	2	3	4	5	C
No Risk	Little Risk		Moderate Risk		Extreme Risk	Conditional

Comment: _____

20. Eating paper.

0	1	2	3	4	5	C
No Risk	Little Risk		Moderate Risk		Extreme Risk	Conditional

Comment: _____

21. Eating food intended for animals, e.g., dog food or cat food.

0	1	2	3	4	5	C
No Risk	Little Risk		Moderate Risk		Extreme Risk	Conditional

Comment: _____

Please provide us with:

Last Name, First Initial: _____

The time you spent on this survey is much appreciated! Thank you for your help.

Appendix 3: Phase I- Phone Script

Hello, may I please speak with Dr. _____? Hello, Dr. _____ My name is _____ and I'm a graduate student calling on behalf of Dr. Debra Palmer who is an associate extension specialist for the Rutgers Coop Extension Program and who works for the Food Stamp Program at Rutgers University, here in NJ. We had sent you an email recently asking for your assistance in completing a very important survey about the possibly unsafe food practices that low income or food insecure families engage in. As you know, these practices could put them at risk for a variety of food-borne illnesses. Do you remember receiving this survey? Well, we understand that you have a very busy schedule, but we were hoping that you would take some time to lend us your expertise in this matter to help us identify and rank the risk of behaviors associated with these practices. That is why we are offering to complete the survey with you online. We will enter your responses as you provide them to us. We would greatly appreciate it if you would help us complete this survey, because your knowledge and experience regarding this subject will help us help the vulnerable populations that we serve through the FSNEP program.

If “I can’t right now”: I understand, but would I be able to contact you another time that would be more convenient? Like I said, we are very desperate and would really appreciate your help with our research. We haven’t been able to reach very many people thus far, so your answers would be very valuable to us. Great, what would be the best way to contact you (phone, email, etc.) and when?

If “I’m never around”: Ok, well, we do have this survey set up on our website for you to complete; its broken down into three parts that can be saved, so you can login after completing one part and finish the rest at another time; would that be a better option you? Great, thank you. Just one more thing; being that we are under a time constraint to complete this survey with all our participants, would you be able to give me a time frame of when you can expect to have it completed by?

If, “I will do it when I get a chance.” Thank you for your time and please feel free to call us with any questions or concerns.

If “sure, I can help or ok”: Thank you, just for the record, all of your responses will be kept completely confidential. Also, if you have any concerns or questions, I can provide you with Dr. Palmer’s contact as well as our contact information. Would you like to write it down or would you like me to email it to you? Finally, I need to say that completing this survey will indicate your consent for us to include your responses in our compiled analysis. Also, we may need to contact you for follow up if necessary.

Appendix 4: Phase III- Revised Survey

REVISED 2nd: Safety Risk of Food Acquisition and Management Practices Survey

Hello, we are researchers from the Department of Nutritional Sciences at Rutgers, The State University of New Jersey. Several years ago we did a study to see what conditions affected food acquisition and food management practices low-income people used to ensure that they could keep their families from going hungry. Food scientists, of who you may have been one, confirmed that some of the things they said they did were unsafe. However, so is not eating. To that end, we seek to learn: the extent of risk people confront when engaging in these practices.

We have developed a survey to help us determine the degree of risk individuals are exposed to when using these practices. We understand that there are many factors that affect the level of risk people incur; many of those factors have been taken into account in this revised survey, according to input received after it was piloted. However, in cases where there were a large number of conditions that caused an act to be unsafe and the majority of respondents indicated that (no matter what) the practice was very risky we have not modified the survey question. In other cases, where during the pilot, responses indicated that the level of risk associated with the behavior varied radically depending on the conditions under which it was performed, we have added questions to address each of the conditions specified.

Even having expanded on our original survey, we are aware that each response remains dependent on a number of factors, but at this point we would like you to consider the following when making your response. Imagine that you are talking to people who are experiencing extreme hunger. They ask you which of these means of acquiring or maintaining their food supply, under the conditions listed, are the “safest” vs. the “least safe” to do because they have no other means of ameliorating their hunger. In other words, we are asking you to rate the “relative” risk of each of the following behaviors. Some may be difficult to respond to, but please do your best. That is what educators are called upon to do each day when working this vulnerable population. Also, we know from previously collected data that the risk for each of these behaviors is worse for people who are ill, very young, elderly, pregnant, etc. That is an educational message we already provide. Therefore, presume that the people performing the behaviors below are healthy and do not fall into one of the aforementioned “high risk” populations.

We anticipate that the completion of the survey will take less than 45 minutes of your time. Your responses will be confidential, and will be used to educate professionals who work with this audience. Your valuable inputs are very crucial to our research due to the fact that there really is no information currently available on this topic. Your answers will enable us to provide these individuals with some helpful information. We ask that

you complete all the questions, such that we have no missing responses. Although we strongly urge you to complete the survey, you may stop at any time. Please enter your name and telephone number at which you can be reached in the event we need to contact you for clarification of your responses. Space has been provided at the end of the survey for you to enter both your name and telephone number. All responses to this survey will be analyzed and reported so that sources will be anonymous to anyone reading them. Results will be presented as part of a group analysis. Completing this survey will indicate your consent for us to include your responses in our compiled analysis. Any question about this survey may be directed to: Dr. Debra Palmer, Associate Professor at 732-932-9853 (dpalmer@aesop.rutgers.edu), Audrey Adler, Sr. Project Administrator for Research and Development at 732-932-0532 (adler@aesop.rutgers.edu), Elizabeth Nossier, Graduate Investigator at 732-932-3779 (nossier@eden.rutgers.edu), or the Office of Research and Sponsored Programs at 732-932-0150, ext 2104 (humansubjects@orsp.rutgers.edu). Thank you for participating in this project

REVISED SURVEY: Please complete the following information. You may either submit it electronically at nossier@eden.rutgers.edu or print the survey and fax it to Dr. Kempson at 732-932-7779. Please fax any supplemental information you think may be of assistance with this project to Dr. Kempson as well.

Would you say food safety or food science is your primary area of expertise?

☐ Food Safety

☐ Food Science

☐ Other

(If other is selected, open a new window: In this study we are seeking the advice of individuals who are experts in the topic of Food Safety. Please recommend someone from your University who has expertise in this field.

What is your official title? _____

What is your highest level of education? ☐ Bachelors ☐ Masters ☐ PhD
☐ Postdoctoral

How many years have you been practicing in this field? _____

Please rate the following food acquisition and food management practices according to the risk scale below. For each of the conditions you are asked to rate below, do not worry that the conditions below might be combined. For example, when considering your response for how risky a dented can is, consider that is the only thing wrong with it.

1. Acquiring and eating discarded food from a trash can, a dumpster, or that was found outside	0	1	2	3	4	5
	No Risk	Little Risk		Moderate Risk		Extreme Risk

2a. Eating foods from dented or damaged	0	1	2	3	4	5
	No	Little		Moderate		Extreme

packages that contain low-acid foods, like milk, red meats, seafood, poultry, and vegetables except tomatoes	Risk	Risk		Risk		Risk
Broken open and exposed to the environment						
Intact and not broken open						
Exposed to flood or contaminated water						
Not exposed to flood or contaminated water						
Small Dent on the surface, not on the can's seams or rims						
Large, sharp, or severe dent on the surface, not on the can's seams or rims						
Small dent on the can's seams and/or rims						
Large, sharp, or severe dent on the can's seams and/or rims						
Swollen or bulging						
Not swollen or bulging						
Re-heated before use						
Not re-heated before use						

2b. Eating foods from dented or damaged packages containing high-acid foods, like fruits, tomatoes, pickles, sauerkraut, jams, jellies, and marmalades	0	1	2	3	4	5
	No Risk	Little Risk		Moderate Risk		Extreme Risk
Broken open and exposed to the environment						
Intact and not broken open						
Exposed to flood or contaminated water						
Not exposed to flood or contaminated water						
Small Dent on the surface, not on the can's seams or rims						
Large, sharp, or severe dent on the surface, not on the can's seams or rims						
Small dent on the can's seams and/or rims						
Large, sharp, or severe dent on the can's seams and/or rims						
Swollen or bulging						
Not swollen or bulging						
Re-heated before use						
Not re-heated before use						

3. Eating foods purchased after the sell by or the expiration date	0	1	2	3	4	5
	No Risk	Little Risk		Moderate Risk		Extreme Risk
Broken open and exposed to the environment						
Intact and not broken open						
Exposed to flood or contaminated water						
Not exposed to flood or contaminated water						
Containing low acid foods, e.g., milk, red meats, seafood, poultry, and vegetables except tomatoes						
Containing high acid foods, e.g., fruits, tomatoes, pickles, sauerkraut, jams, jellies, and marmalades						

Re-heated before use						
Not re-heated before use						

4. Eating lunch meats or deli meats/cold cuts that have become slimy	0	1	2	3	4	5
	No Risk	Little Risk		Moderate Risk		Extreme Risk
Slime removed						
Slime not removed						

5. Eating food intended for animals, e.g., dog food or cat food	0	1	2	3	4	5
	No Risk	Little Risk		Moderate Risk		Extreme Risk
Dry Food						
From a vacuum-packed pouch						
Canned food						

6. Eating cheese that has become moldy	0	1	2	3	4	5
	No Risk	Little Risk		Moderate Risk		Extreme Risk
Soft cheese (like brie, Camembert, cottage, cream cheese, ricotta and feta) with mold removed						
Soft cheese (like brie, camembert, cottage, cream cheese, ricotta and feta) with mold not removed						
Semi-soft cheese (like Blue, brick, Havarti, Monterey Jack, mozzarella, Muenster, provolone) with the mold and at least an additional ½ inch removed						
Semi-soft cheese (like Blue, brick, Havarti, Monterey Jack, mozzarella, Muenster, provolone) with the mold and less than an additional ½ inch removed						
Hard cheese (like Cheddar, Colby, Gouda, Edam, Swiss) with the mold and at least an additional ½ inch removed						
Hard cheese (like Cheddar, Colby, Gouda, Edam, Swiss) with the mold and < an additional ½ inch removed						
Very hard cheese (like Parmesan, Romano) with the mold and at least an additional ½ inch removed						
Very hard cheese (like Parmesan, Romano) with the mold and < an additional ½ inch removed						
Processed cheese with the mold and at least an additional ½ inch removed						
Processed cheese with the mold and < an additional ½ inch removed						

7. Eating processed grain foods (like breads, muffins, cakes, etc.) that have become moldy	0	1	2	3	4	5
	No Risk	Little Risk		Moderate Risk		Extreme Risk
With mold removed						
With mold not removed						

8. Eating grain foods with insects on them	0	1	2	3	4	5
	No Risk	Little Risk		Moderate Risk		Extreme Risk
Roaches and flies that were removed, but the food was not cooked						
Roaches and flies that were removed and the food was cooked afterward						
Insects other than roaches and flies that have not been removed						
Insects other than roaches and flies that have been removed, but the food was not cooked						
Insects other than roaches and flies that have been removed, and the food was cooked afterward						

9. Eating fruits or vegetables from which spoiled parts have been removed. The spoiled parts referred to, unless specified, are not parts spoiled from bruising, but instead from microbial spoilage.	0	1	2	3	4	5
	No Risk	Little Risk		Moderate Risk		Extreme Risk
Pre-cut prior to becoming spoiled						
Whole prior to becoming spoiled						
Cooked prior to becoming spoiled						
Cooked after spoilage is removed						
Soft fruits/vegetables, like cucumbers, tomatoes						
Hard fruits/vegetables, like carrots or potatoes						
Exposed to flood or contaminated water						
Not exposed to flood or contaminated water						
$\frac{3}{4}$ or more furry or mushy						
Less than $\frac{3}{4}$ furry or mushy						
Mushy and dark due to bruising						
Mushy and dark look due to aging, rather than bruising, i.e., bananas (same texture all over)						

10. Eating meats bought from private individuals, street vendors, or “meat trucks”	0	1	2	3	4	5
	No Risk	Little Risk		Moderate Risk		Extreme Risk
Cooked well done						
Not cooked well done						
Left un-refrigerated for more than 2 hours; or, 1 if ≥ 90 degrees						
Refrigerated within 2 hours; or, 1 if ≥ 90 degrees						
Frozen solid						
Not frozen solid and/or thawed						
Tightly packaged with no leaking						
Not tightly packaged and/or leaking						
Appearance of the sales people and their operation does not look clean and sanitary						
License and/or safety inspection sticker is visible at the sales outlet						
No license and/or safety inspection sticker is visible at the sales outlet						
Appearance of the sales people/the operation looks clean and sanitary						

11a. Eating leftovers that should be refrigerated, that were left behind on the plates of others (Note: it is impossible for anyone to know how long they have been sitting out, just do your best (this is one of our many struggle in doing this type of work))	0	1	2	3	4	5
	No Risk	Little Risk		Moderate Risk		Extreme Risk
The foods were unopened, and in their original						

wrappers/boxes or, were whole fresh fruits/vegetables, or were foods that didn't require cooking before eating, e.g., crackers						
From someone who was sick with a cold, infection, or disease						
From someone who was healthy						
Previously cooked then left unrefrigerated for more than 2 hours; or, 1 if ≥ 90 degrees						
Previously cooked and refrigerated within 2 hours; or, 1 if ≥ 90 degrees						
Re-heated						
Not re-heated						

11b. Eating leftovers that are not foods that need to be refrigerated, that were left behind on the plates of others (Note: it is impossible for anyone to know how long they have been sitting out, just do your best (this is one of our many struggle in doing this type of work))	0 No Risk	1 Little Risk	2	3 Moderate Risk	4	5 Extreme Risk
The foods were unopened, and in their original wrappers/boxes or, were whole fresh fruits/vegetables, or were foods that didn't require cooking before eating, e.g., crackers						
From someone who was sick with a cold, infection, or disease						
From someone who was healthy						
Previously cooked then left unrefrigerated for more than 2 hours; or, 1 if ≥ 90 degrees						
Previously cooked and refrigerated within 2 hours; or, 1 if ≥ 90 degrees						
Re-heated						
Not re-heated						

12a. Eating one's own foods, that should be refrigerated, that have been taken home from places like soup kitchens or church functions (Note: it is impossible for anyone to know how long they have been sitting out, just do your best (this is one of our many struggle in doing this type of work))	0 No Risk	1 Little Risk	2	3 Moderate Risk	4	5 Extreme Risk
The foods were unopened, and in their original wrappers/boxes or, were whole fresh fruits/vegetables, or were foods that didn't require cooking before eating, e.g., crackers						
Previously cooked then left unrefrigerated for more than 2 hours; or, 1 if ≥ 90 degrees						
Previously cooked and refrigerated within 2 hours;						

or, 1 if ≥ 90 degrees						
Re-heated						
Not re-heated						

12b. Eating one's own foods, that are not foods that need to be refrigerated, that have been taken home from places like soup kitchens or church functions (Note: it is impossible for anyone to know how long they have been sitting out, just do your best (this is one of our many struggle in doing this type of work))	0 No Risk	1 Little Risk	2	3 Moderate Risk	4	5 Extreme Risk
The foods were unopened, and in their original wrappers/boxes or, were whole fresh fruits/vegetables, or were foods that didn't require cooking before eating, e.g., crackers						
Previously cooked then left unrefrigerated for more than 2 hours; or, 1 if ≥ 90 degrees						
Previously cooked and refrigerated within 2 hours; or, 1 if ≥ 90 degrees						
Re-heated						
Not re-heated						

13. Eating paper	0 No Risk	1 Little Risk	2	3 Moderate Risk	4	5 Extreme Risk

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