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Adeline Lum

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FOOD HANDLING PRACTICES, KNOWLEDGE AND BELIEFS OF FAMILIES
WITH YOUNG CHILDREN BASED ON THE HEALTH BELIEF MODEL

by

Adeline Lum

A THESIS

Presented to the Faculty of
The Graduate College at the University of Nebraska

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For the Degree of Master of Science

Major: Nutrition and Health Sciences

Under the Supervision of Julie A. Albrecht

Lincoln, Nebraska

July, 2010

FOOD HANDLING PRACTICES, KNOWLEDGE AND BELIEFS OF FAMILIES
WITH YOUNG CHILDREN BASED ON THE HEALTH BELIEF MODEL

Adeline Lum, M.S.

University of Nebraska, 2010

Adviser: Julie A. Albrecht

Objective: To determine current food handling practices, knowledge and beliefs of primary food handlers with children 10 years old and the relationship between these components.

Design: Surveys were developed based on FightBac!™ concepts and the Health Belief Model (HBM) construct.

Participants: The majority of participants (n= 503) were females (67%), Caucasians (80%), aged between 30 to 49 years old (83%), had one or two children (83%), prepared meals all or most of the time (76%) and consumed meals away from home three times or less per week (66%).

Analysis: Descriptive statistics and inferential statistics using Spearman's rank correlation coefficient (*rho*) ($p < 0.05$ and one-tail) and Chi-square were used to examine frequency and correlations.

Results: Few participants reached the food safety objectives of Healthy People 2010 for safe food handling practices (79%). Mixed results were reported for perceived

susceptibility. Only half of the participants (53-54%) reported high perceived severity for their children if they contracted food borne illness. Most participants were confident of their food handling practices for their children (91%) and would change their food handling practices if they or their family members previously experienced food poisoning (79%). Participants' reasons for high self-efficacy were learning from their family and independently acquiring knowledge and skills from the media, internet or job. The three main barriers to safe food handling were insufficient time, lots of distractions and lack of control of the food handling practices of other people in the household. Participants preferred to use food safety information that is easy to understand, has scientific facts, causes feelings of health-threat and has lots of pictures or visuals. Participants demonstrate high levels of knowledge in certain areas of the FightBac!TM concepts but lacked knowledge in other areas. Knowledge and cues to action were most supportive of the HBM construct, while perceived susceptibility was least supportive of the HBM construct.

Conclusions: Most participants demonstrate many areas to improve in their food handling practices, knowledge and beliefs.

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INTRODUCTION

Problem Statement

Children have a higher risk for foodborne illness compared to adults due to their less developed immune system, lower body weight and lower control over their meal preparation (Buzby, 2001). Parents or guardians are largely responsible for preparing food for their young children, which directly affects the food safety risk for children. Food safety educators should teach primary food handlers of families with young children with safe food handling practices to reduce the risk of foodborne illness in children. However, studies focusing on primary food handlers with young children 10 years old and younger are very limited.

Purpose

The purpose of this project was to examine the food handling practices, beliefs and knowledge of primary food handlers in families with young children, aged 10 years old and younger. Primary food handlers are the main food handlers in the family who prepare most of the meals in the household.

A food handling survey was developed based on the Health Belief Model (HBM). Results of the survey will be used to develop effective educational materials and intervention programs for primary food handlers for families with young children.

Research Questions

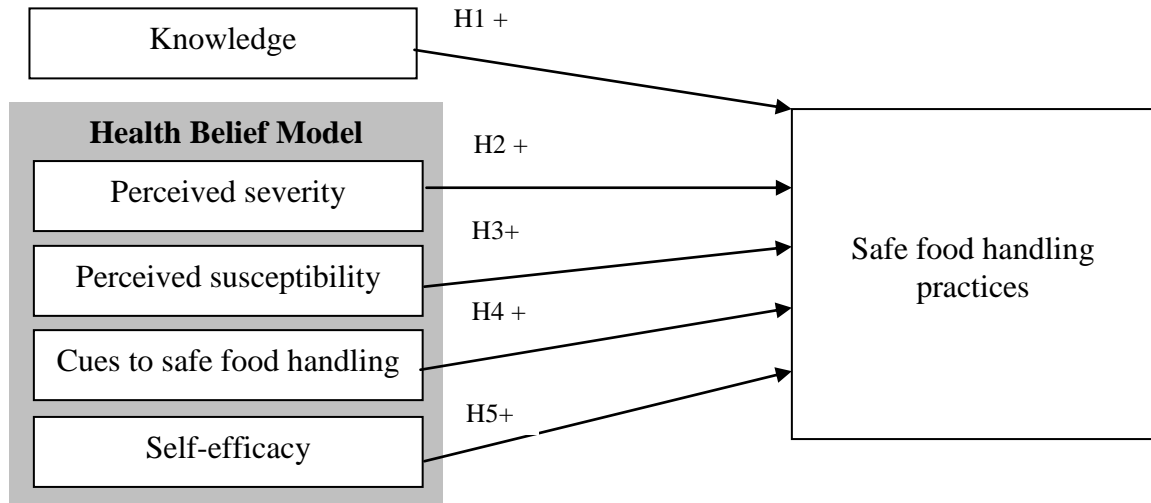
The objective of the food handling survey was to answer the following research questions relating to primary food handlers of families with young children.

1. What are the current food handling practices, knowledge and beliefs of primary food handlers?
2. What food handling practices do primary food handlers need to change to reduce the risk of foodborne illness in the family?
3. What is the relationship between food handling practices, knowledge and beliefs of primary food handlers?
4. What are the perceived barriers to safe food handling among primary food handlers?
5. What characteristics of food safety information are important to primary food handlers?
6. How do primary food handlers want to receive food handling information?

Hypotheses

All research questions, excluding the third question, can be answered by descriptive data, which does not involve testing of hypotheses. The third research question can only be answered by inferential data, which involves testing of hypotheses. The following five hypotheses were tested for the third objective.

Figure 1. Proposed Research Model Relating to Safe Food Handling Practices



Source: Riggins [dissertation] (2006)

H₁: Knowledge of foodborne illness will have a positive effect on food handling practices among primary food handlers of families with young children.

H₂: Perceived severity of foodborne illness will have a positive effect on food handling practices among primary food handlers of families with young children.

H₃: Perceived susceptibility of foodborne illness will have a positive effect on food handling practices among primary food handlers of families with young children.

H₄: Cues to safe food handling behavior will have a positive effect on food handling practices among primary food handlers of families with young children.

H₅: Self-efficacy will have a positive effect on food handling practices among primary food handlers of families with young children.

Significance of Study

Young children are more vulnerable to foodborne illness because they have immature immune system and lower body weight (Buzby, 2001). Their stomach produces less acid as well, which reduces their ability to kill bacteria (Haffajee, 1995). Hence, fewer pathogenic bacteria are required to make them sick. One report indicated that one-third of all foodborne illness in the United States consisted of children under 10 years old (FSIS, 2002). Hemolytic Uremic Syndrome (HUS) occurred in about 15 percent of children who were infected with *E.coli O157:H7* (Pew Health Group, 2010). In 2009, one-fifth of the people who were ill from consuming contaminated peanut butter with *Salmonella Typhimurium* were children younger than five years old (CDC, 2009e). The incidences of foodborne illness infection among children four years old and younger were several fold above the Healthy People 2010 Food Safety Objective: incidence of *campylobacter*, 2.3 fold; incidence of *E.coli O157:H7*, 4.2 fold; *Listeria monocytogenes*, 3.2 fold and *Salmonella*, 11 fold. Incidence of *E.coli O157:H7* among children four to 11 years old was 2.6 fold higher than the food safety objective. The health effects of these foodborne illnesses are very severe and include Guillain-Barre syndrome, reactive arthritis (ReA), kidney failure, diabetes, neurological dysfunctions and even death (Table 1) (Pew Health Group, 2010). Although young children are more susceptible to foodborne illness compared to adults, they have limited control over their foodborne illness risks because parents or guardians usually prepare their meals (Buzby, 2001).

The literature contains very limited information on the knowledge, beliefs and practices of primary food handlers for families with young children, especially those aged

10 years old and younger. Most studies evaluate one component only: knowledge, beliefs or practices. One study reported the knowledge of food handlers with children younger than five years old, specifically about their awareness level of *Salmonella*, *Listeria* and *E.coli* (Lin et al., 2004). Another study reported on the practices of food handlers in households with young children, consisting of cleaning cutting boards, properly thawing meat or poultry, reheating leftovers to proper temperature and owning a food thermometer (FSIS, 2002). Riggins and colleagues (2008) reported the beliefs and perceptions of childcare center staffs about following HACCP-based food safety guidelines. Cody and Hogue (2003) examined the relationship of food handling practices with knowledge involving children under 18 years old. Although one study evaluated the knowledge, beliefs and practices of parents or guardians as related components, the data were collected qualitatively from focus groups of parents or guardians with children older than 10 years old (11 to 14 years old) (Byrd-Bredbenner et al., 2010). Limited studies examine the quantitative relationship of knowledge and beliefs with practices of primary food handlers for families with young children 10 years old and younger. Meysenburg (2009) collected qualitative data from focus groups of parents or guardians of children 10 years old and younger relating to their food handling knowledge, beliefs and practices. Results of the focus groups (Meysenburg, 2009) were used to develop the survey in this project to examine the quantitative relationship of food handling knowledge, beliefs and practices of primary food handlers for families with young children.

Table 1. Incidence^a of Foodborne Illness among Young Children aged 11 years old and younger.

Disease	Incidence ^a (Healthy People 2010 Objective)	Age	Possible foodborne sources	Possible short- term health effects	Possible long- term effects
<i>Campylobacter</i>	28.54 (12.3)	< 4	Raw or undercooked poultry; other foods cross-contaminated by these items; unpasteurized milk; contaminated water	Diarrhea (sometimes bloody); cramping; abdominal pain; urinary tract infections; fever; meningitis; infection in bloodstream; death	Guillain-Barre syndrome; reactive arthritis (ReA); chronic arthritis
<i>E.coli O157:H7</i>	4.24 (1) 2.57 (1)	< 4 4-11	Food items contaminated with animal feces; or other foods cross-contaminated by these items; contaminated water. Common foods include ground beef and other meats; green leafy vegetables; unpasteurized juices; unpasteurized milk and soft cheese made from raw milk.	Severe stomach cramps; diarrhea (often bloody); vomiting; hospitalization; hemolytic uremic syndrome (HUS); death.	Kidney failure; chronic kidney problems; diabetes; hypertension; gallstones; irritable bowel syndrome; strictures; neurological disorders.
<i>Listeria monocytogenes</i>	0.76 (0.24)	< 4	Vegetables grown in contaminated soil or fertilizer; contaminated meat or poultry products. Common foods include uncooked meats and vegetables; cold cuts; hot dogs; smoked seafood; raw milk; soft cheeses made from raw milk.	Fever; muscle aches; nausea; diarrhea. Headache; stiff neck; confusion; loss of balance; convulsions or seizures; death (if infection spreads to nervous system).	Neurological dysfunctions or an impaired ability to see, hear, swallow or speak.

<i>Salmonella</i>	74.65 (6.8)	< 4	Meat and plant-based foods contaminated with animal feces. Common foods include those of animal origin, such as beef, poultry, milk, and eggs; or from cross-contamination of other foods by these items	Diarrhea; fever; abdominal cramps; colitis; meningitis; blood infections; heart infections; death	Reactive arthritis (ReA); chronic arthritis; eye irritation; painful urination
<i>Shigella</i>	27.86 ^b 25.67 ^b	< 4 4-11	Vegetables harvested in a field with sewage that contains <i>Shigella</i> ; flies that breed in infected feces and contaminate food	Diarrhea (often bloody); fever; stomach cramps; seizures in children less than two years old.	Reactive arthritis (ReA); chronic arthritis; post-infectious arthritis; eye irritation; painful urination.

^a Incidence per 100 000 persons

^b No national health objective for *Shigella*

^c Toxoplasmosis infection is at a rate of 7.2 percent for children aged 6 to 10 years (US Department of Health and Human Services, 2000)

Source: Pew Health Group, 2010

LITERATURE REVIEW

Overview

The Centers of Disease Control and Prevention (CDC) estimated 76 million foodborne-related illnesses occur every year. An estimated 325,000 hospitalizations and 5,000 deaths were also caused by foodborne illness (Mead et al., 1999). As many as 73 percent of food handlers recognized bacteria or germs as a serious health risk, followed by product tampering (61 percent), ingestion of pesticides (56 percent), presence of antibiotics or hormones in meat (46 percent) and eating expired food (45 percent) (US Grocery Shopping Trends, 2008). A study reported that 74 percent of food handlers perform at least one critical violation, which is a food handling practice that can cause foodborne illness by itself (Daniels et al., 2001).

FightBac!™

FightBac!™ was created by The Partnership for Food Safety Education (PFSE), a non-profit organization consisting of industry representatives, professional organizations relating to food, health and nutrition, consumer organizations and the government (Partnership for Food Safety Education, 2006). In 1997, PFSE was formed to educate people about safe food handling practices, based on an independent panel report entitled, Putting the Food Handling Issue on the Table: The Pressing Need for Food Safety Education (Partnership for Food Safety Education, 2006). FightBac!™ focuses on four main concepts, which are: clean, chill, separate, cook (Partnership for Food Safety

Education, 2006). Healthy People 2010 Food Safety Objectives include reducing foodborne illness, where safe food handling practices were measured according to the FightBac!TM concepts (USDHHS, 2000). Centers for Disease Control and Prevention (2009c) reported that 76 percent of food handlers practiced safe food handling in 2006, which was below the Healthy People 2010 food safety objective (79 percent). Survey questions were developed according to the FightBac!TM concepts to measure how food was handled according to these concepts; clean, chill, separate, cook. One study demonstrated that educational materials created based on FightBac!TM should be easy to understand (89-100%), helpful (70-72%) and enjoyable to learn (82-92%) (Dharod et al., 2004).

Food Handling Practices

CLEAN. Washing hands prior to handling food is crucial in preventing foodborne illness from pathogens such as *Norovirus* and *Salmonella*. *Norovirus* can be transmitted from touching ready-to-eat food with hands contaminated with the pathogen. The Centers for Disease Control and Prevention (2010b) recommended washing hands before, during and after food preparation to prevent the spread of *Norovirus*. Food experts also recommended washing hands after touching a pet and before preparing food to prevent *Salmonellosis* (CDC, 2009a). A study reported that only 66 percent washed their hands after handling raw meat or poultry, although 86 percent knew that hand-washing can lower the risk of foodborne illness (Altekruse et al., 1995). Another study indicated that 40 percent of the foodborne illness outbreaks in fresh produce was caused by poor personal hygiene and improper contact with sewerage (DeWaal et al., 2006).

Since most middle school children reported that they help prepare food (Bryd-Bredbenner et al., 2010; Haapala & Probart, 2004), hand washing is crucial in preventing foodborne illness. A study demonstrated that school children who washed their hands four times daily had 24 percent fewer absences caused by breathing-related problems and 51 percent fewer absences caused by stomach cramps, compared to children who did not wash their hands (Master et al., 1997).

CHILL. Mishandling of leftovers was identified as the most common cause of foodborne illness (Fein et al., 1993; Bruhn et al., 1999). Food left at room temperature for more than two hours can result in harmful bacteria, such as *Bacillus cereus* to grow in high enough numbers to cause foodborne illness (Hillers et al., 2003).

A past study found that about 45 percent of Nebraskan food handlers stated that they inappropriately leave cooked foods at room temperature (Albrecht, 1995). In the same study, 25 percent of respondents incorrectly viewed cooked chicken left out for three hours as safe to consume (Albrecht, 1995). Another 1986 statewide survey demonstrated that Oregon food handlers often leave their hard boiled eggs on the counter for more than two to three hours (Raab et al., 1997). Studies indicated about half of California and Illinois food handlers erroneously thought cooling foods at room temperature was safe (Bruhn et al., 1999; Brewer et al., 1994).

SEPARATE. Separating raw products from ready-to-eat food is important to prevent cross-contamination from bacteria such as *Campylobacter*. Ways to separate food include separating fresh produce and raw meat into different grocery bags and wrapping meat in a

container or bag to prevent dripping of raw meat's liquid residue on ready-to-eat foods. Most cases of campylobacteriosis occurred from cross-contamination or ingestion of raw meat (CDC, 2009b). A small dosage of juice from raw meat is sufficient to cause illness from *Campylobacter* (Tauxe, 1992; CDC, 2009b). Cleaning any surface or utensils after contact with raw meat or poultry is important to prevent foodborne illnesses outbreak from pathogens such as *Campylobacter jejuni* and *Salmonella spp* (Fein et al., 1995; Hillers et al., 2003). Researchers reported that only about two thirds of food handlers clean their cutting board after handling raw meat or poultry (Altekruse et al., 1995; Bruhn et al., 1999).

COOK. Inadequate cooking is a common cause of foodborne illness (Bruhn et al., 1999). Food handlers are recommended to avoid eating raw or uncooked eggs to prevent illnesses from *Salmonella enteridities* (Hillers et al., 2003). Undercooked meat could contain harmful bacteria, such as *Salmonella spp.*, *Campylobacter jejuni* and *E.coli* O157:H7 which contribute to foodborne illness outbreaks (Hillers et al., 2003). DeWaal and colleagues (2006) speculated that 43 percent of beef-associated outbreaks were caused by undercooked meat. One-fourth to three-fourth of all meat and poultry sold in 1999 was contaminated with at least one pathogen (Medeiros et al., 2004). Hence, it is important to cook food until the proper temperature to kill these pathogens. A study reported that approximately 60 to 70 percent of food handlers cooked their hamburgers to the proper temperature (Altekruse et al., 1995; Albrecht, 1995).

Health Belief Model

History, development and theory of the Health Belief Model. The Health Belief Model (HBM) was created by a group of social psychologists in the 1950's to explain the phenomenon of people rejecting screening tests and preventive health care measures for diseases without symptoms. The model was later developed to examine people's reactions to symptoms of a disease and their behavior in following medical prescription (Janz & Becker, 1984).

The HBM was most heavily investigated and cited in studies among social-psychological models (Wallston & Wallston, 1984). Based on the "value expectancy" concept, the HBM examines health-related behavioral outcome of people in unknown circumstances (Becker & Maiman, 1975). Four basic components of the HBM include perceived susceptibility, perceived severity, perceived benefits, and perceived barriers. The HBM was later expanded to include cues to action and self-efficacy. Other factors which indirectly affect behavioral outcome, such as demographic variables, health beliefs, and knowledge, are included in the HBM as well. The relationship between components of the HBM is illustrated in Figure 2.

The HBM proposes that high perceived susceptibility, high perceived severity, high perceived benefits, and low perceived barriers promote favorable health behavior.

Janz and Becker (1984) found strong empirical support for the HBM's predictability of behaviors from reviewing 46 studies which applied the HBM in studies conducted before and after 1974. The strength of the HBM's predictability level include

perceived barriers, 89 percent; perceived susceptibility, 81 percent; perceived benefits, 78 percent; and perceived severity, 65 percent.

Harrison and colleagues (1992) reported that retrospective studies have a higher significant level with “perceived barriers” and a lower significant level with “perceived severity” compared to prospective studies.

However, Harrison and colleagues (1992) reported results from 16 studies that the HBM components have poor predictability level on behavior. A small number of the HBM studies were included because only studies with reliability tests and validity of measures were examined. Harrison and colleagues (1992) proposed reliability testing and validity measures should be used to support the results of all studies utilizing HBM.

Perceived severity. Perceived severity is one’s perception of the seriousness of contracting an illness or negative health condition. This component is measured by the effect of the illness or condition socially (such as influence on work, family, and friends) and medically (such as belief on the degree of pain and disability). A combination of perceived severity and perceived susceptibility can be defined as perceived threat. Although perceived threat provides the force to act, it does not direct the path to take (Janz & Becker, 1984).

Becker (1977) and colleagues demonstrated that arousal of a high level of fear in a person directs a higher likelihood of a compliance behavior. Parents of young children suggested using “shock value” to demonstrate the severity of the disease and promote safe food handling practices (Meysenburg, 2009). However, a high level of perceived severity can hinder a compliance behavior because it results in excessive fear, which can

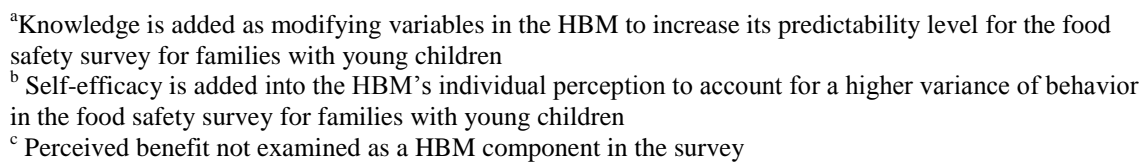
paralyze further action (Janz & Sociobehavioral determinants of compliance with health and medical care recommendations, 1984).

Consumers underestimated foodborne illness as a non-feverish illness that occurs within 24 hours of unsafe food consumption (Bruhn et al., 1999; Fein et al., 1995).

Foodborne illness originating from home-cooked meals are most likely to be under reported because they are often dismissed as a minor illness, affecting only a small group of people and happen sporadically (Redmond & Griffith, 2004c).

Perceived susceptibility. Perceived susceptibility is one's perception of personal vulnerability to getting ill or succumbing to a negative health condition. For medically-established illnesses, the HBM is modified to include perception of contracting the illness or a condition in general, perception of recontracting the illness or a condition, and the belief that one had contracted the illness or condition from looking at the symptoms. The HBM proposed low susceptibility promotes favorable behavior (Janz & Becker, 1984).

About 42 percent of food handlers indicated becoming sick from eating meals prepared at home as being very or fairly common (US Grocery Shopping Trends, 2008). Another study reported that one in three food handlers believed someone in the household experienced foodborne illness before from eating unsafe or expired food (Lin et al., 2004). In contrast, studies demonstrated that 72 to 90 percent of food handlers indicated that they have low susceptibility to foodborne illness when preparing their own food (Redmond & Griffith, 2004a; Cody & Hogue, 2003; Fein et al., 1995). Results indicated that food handlers with low susceptibility were more likely to perceive that they



are responsible for their food safety, although the data presented did not agree with their statement (Redmond & Griffith, 2004a). Their underestimation of personal susceptibility to foodborne illness, due to their perception of high concern of food safety, causes people to continue certain risky food handling behaviors. This phenomenon is widely reported as “optimism bias”, an unrealistic optimism which increases susceptibility to hazards (Weinstein & Klein, 1996).

Self-efficacy. Self-efficacy is the subjective perception on ability to perform an action. According to Rosenstock and colleagues (1988), the social learning theory by Bandura (1977) has many similarities with the HBM. Early HBM studies did not utilize the self-efficacy component of the social learning theory because most of the studies evaluate behaviors regarding screening tests or vaccine programs, which requires little to no self-efficacy by the participants. In the traditional HBM, self-efficacy was posed under perceived barriers. However, as studies utilizing the HBM diversify to issues that require a more active participation or action (such as smoking cessation, dieting, and increasing physical activity), belief in one’s competence level is needed to cause action. Hence, Rosenstock and colleagues (1988) proposed the identification of self-efficacy as an independent variable (such as susceptibility, severity, perceived barriers, and perceived benefits) in the HBM for its usefulness in accounting for variance in behavior. Schafer and colleagues (1993) reported that only a threatened person with self-efficacy can perform safe food handling practices.

Bandura (1986) proposed that self-efficacy can be enhanced by four sources: performance attainments, vicarious experience, verbal persuasion and physiological state

(Rosenstock et al., 1988). Performance attainment is the perfection of skills to accomplish a goal, which has the highest influence on self-efficacy. Vicarious experience is obtained from analyzing other people's consequences of actions, which accounts for many of the learning experiences. Many health educators utilize verbal persuasion, although it is not as influential as performance attainment and vicarious experience. Physiological states act as a feedback system that informs the individual as to whether he or she can cope with the changes. Successful coping strategies enhance self-efficacy while failure to cope causes self-efficacy to deteriorate.

Most food handlers (85 percent) graded themselves as "A" or "B" when rating their safe food handling practices on a scale of A to F (Cody & Hogue, 2003). In a study of adult food handlers, 83 percent of respondents indicated they had total or nearly total responsibility for food safety (Redmond & Griffith, 2004a). About two-thirds of the food handlers believed they have control over their food safety when preparing for their own foods (Redmond & Griffith, 2004a). Personal responsibility for food safety is significantly correlated with perception of personal control over food safety (Redmond & Griffith, 2004a).

Perceived benefits. Perceived benefits direct an individual who is sufficiently threatened to take a desirable path. An individual would only act if the action is perceived as doable and effective in achieving the goal (Janz & Becker, 1984). Skinner's (1938) theory, which emerged before the HBM, described the strength of perceived benefits. Behavior change is initiated by positive consequences of that behavior. However, the difference between Skinner's theory and the HBM is that Skinner believed that positive

consequences of a behavior is sufficient to account for behavioral outcome alone without any cognitive processes, while the HBM involves the cognitive process of weighing perceived benefits against perceived barriers prior to making a decision.

Perceived barriers. Perceived barriers are perceived obstacles that hinder the individual from action, which includes inconvenience, insufficient funds, and insufficient time. A high level of perceived benefit and a low level of perceived barrier predict a higher likelihood of action (Janz & Becker, 1984).

Restaurant employees indicated limitation of time, inconvenience, insufficient training, and insufficient resources as the most prevalent barriers to safe food handling practices (Howells et al., 2008). These practices include hand-washing, using thermometers and cleaning work surfaces. Additional barriers for hand-washing were: inconvenient sites of sinks and dry effect of hand-washing on skin; for using a thermometer, barriers were: lack of working thermometers, inconvenient location of thermometers and lack of enforcement by the manager; for cleaning work surfaces, barriers were: lack of space, lack of incentive, competing tasks and lack of concern by the management or other employees (Howells et al., 2008).

Cues to action. Cues to action is not one of the basic components of the HBM. Cues to action first emerged in a study done by Larson and colleagues (1979) investigating the behavior of high-risk people in contracting influenza. In this study, patients who received a reminder postcard were twice as likely to obtain a vaccination compared to those who did not obtain one. Because both groups have similar health beliefs, the postcard is

rationalized as a trigger to action. Larson and colleagues (1982) performed a consecutive study on the effect of postcards and demonstrated that people who received a “HBM” postcard were more likely to obtain influenza vaccination compared to people receiving no postcards or a postcard which proposed no actions.

According to Janz and Becker (1984), cues to action are required to initiate the decision-making process. Cues to action can be caused internally or externally. Examples of internal cues to action are symptoms to diseases, while examples of external cues to actions are mass media advertisements and postcards.

Encountering foodborne illness, either personally or through a known person’s experiences, can trigger safe food handling practices. Lin and colleagues (2004) reported that food handlers were more likely to practice safe food handling and know about foodborne pathogens if they had experienced foodborne illness at home. According to Tversky and Kahneman (1973), individuals who had preconceived knowledge or experience about a disease are more likely to believe that the possibility and frequency of the disease occurring. This phenomenon is called availability heuristics, where by individuals are more likely to make a judgment based on familiar information, than objectively weighing all existing alternatives. This phenomenon also explains why food safety information is more appealing if it personally causes the individual to feel threatened.

Critique of the Health Belief Model. The HBM can only be applied for conditions that affect an individual’s or a population’s health or well-being. For instance, the HBM

cannot be applied to the purchasing behavior of consumers because no threat is involved if the consumers decide not to purchase the item. Hence, perceived susceptibility and perceived severity of the HBM construct is not applicable to any behavior that does not involve health aspects (Janz & Becker, 1984).

The HBM is useful as a framework to help predict health-related behavior. For instance, it is logical that an individual with a higher perceived susceptibility, higher perceived severity, higher perceived benefits, and lower perceived barriers to act favorably. Becker and colleagues (1977) demonstrated that arousal of a high level of fear in a person directs a higher likelihood of a compliance behavior. However, although a lower to moderate level of perceived severity can trigger action, a higher level of perceived severity can hinder participation (Becker et al., 1975). Becker and colleagues (1975) demonstrated that participants who perceived that Tay-Sachs disease as highly severe are less likely to participate in the screening tests. An individual's high "perceived severity" is accompanied by an excessive fear of knowing about having the disease which posed a challenge to family planning; which then became a corresponding perceived barrier (Janz & Becker, 1984).

The modifying factors in the HBM (consisting of demographic variables, knowledge, health beliefs, and cues to actions) provide flexibility to the model. For example, Cummings and colleagues (1979) included intentions of obtaining flu shots in the future as a variable. Becker and colleagues (1975) included combination of husband-wife health perceptions to participating Tay-Sachs disease screening tests as a variable. These components increase the accuracy of the HBM in predicting favorable behavior.

The HBM functions on a premise that everybody is interested in their own health and welfare with the goal of attaining good health. However, some people may make health-related decision based on non-health related reasons, such as habitual practices which involves no decision-making process, performing healthy activities for work, social, beauty advancements, and external influences or barriers (Janz & Becker, 1984). Becker and colleagues (1977) postulated that obese children of older age are less compliant to diet regimens due to higher exertion of control over eating habits which may be detrimental to their weight loss regime. However, results demonstrated that obese children were, in fact, more compliant to diet regimens compared to younger children, due to peer pressure of reaching an ideal body image. This demonstrates that although obese children demonstrated the health-related action of losing weight, their motivation of losing weight may not be health-related. Such occurrence exhibits the limitation of the HBM in explaining behaviors that are outside the realm of health.

According to Janz and Becker (1984), preventive health behavior described actions taken to avoid illness, such as receiving vaccinations, screening for diseases, and reducing risk factors of succumbing to a disease. Sick-role behavior described actions taken after diagnosis of disease consisting of the healing process or prevention of health deterioration. Examples are antihypertensive regimens, diabetic regimens, and end-stage renal disease regimen. Perceived susceptibility is more relevant to preventive health behavior while perceived severity has the lowest significance levels among all the HBM components in preventive health behavior. In contrast, perceived severity is more pertinent for sick-role behavior, with the second highest significant level. For both

preventive health behavior and sick-role behavior, perceived barriers have the highest significant results. Harrison and colleagues (1992) reported that retrospective studies had a higher significant level with perceived benefits and perceived barriers and lower significant levels with perceived severity compared to prospective studies.

Knowledge

Overall, knowledge is recognized as a prerequisite to safe food handling (Daniels et al., 2001; Altekruuse et al., 1995; Lin et al., 2004). Eighty percent of all unsafe food handling practices comes from unawareness and lack of knowledge (Daniels et al., 2001). Researchers demonstrated that food handlers who know the food vehicle for *Salmonella* were more likely to wash their hands and prevent cross contamination compared to food handlers who do not know the vehicle (Altekruuse et al., 1995; Lin et al., 2004). However, a few cases demonstrated that knowledge may not result in safe food handling practices. Altekruuse and colleagues (1995) reported that food handlers who could specify a food vehicle for *Salmonella* were more likely to eat uncooked hamburgers compared to those without knowledge, possibly due to taste preference (Lin et al., 2004). Another study found that food handlers who know less about *Salmonella*, *Listeria*, and *E.coli* were more likely to practice safe food handling compared to those with knowledge (Kennedy et al., 2005). In this case, safe food handling practices may result more from a safe food handling habit rather than knowledge. Results from these studies are difficult to reconcile. However, the majority of studies support knowledge as a prerequisite to safe food handling practices (Daniels et al., 2001; Altekruuse et al., 1995; Lin et al., 2004).

Although food handlers perceived that their knowledge about food safety to be adequate, their knowledge is superficial. Four-fifth of the food handlers believed they had sufficient food safety knowledge but they lack knowledge in some areas of food safety (Bruhn et al., 1999). More than a quarter of consumers did not know cooking food can kill *Salmonella* and *E.coli* (Albrecht, 1995). One-fourth of food handlers did not understand the concept of cross contamination (Albrecht, 1995). Although 68 percent of food handlers could identify undercooked meat as a source of foodborne illness when given a range of answers, only 26 percent of food handlers gave this answer in an open-ended question via the telephone (Cody & Hogue, 2003).

A study demonstrated that those who prepared food more frequently at home were more likely to be interested in receiving food safety information (Alterkruse et al., 1995). Another study reported that about 82 percent of food handlers think it is “extremely important” or “very important” to receive information on how to prepare meals safely at home (Cody & Hogue, 2003).

METHODOLOGY

This project is part of a three-part USDA-funded project. In the first part of the project, focus groups were conducted on families with young children, targeting their food handling practices, beliefs and knowledge (Meysenburg, 2009). For the present study, information from the focus groups was used to develop survey questions, in addition to the available literature and panel of experts. Lastly, survey results will be used to develop effective educational materials for primary food handlers of families with young children.

Survey Development

The survey consisted of four components: food handling practices, beliefs, knowledge and the demographics of the participants. For the practice component of the survey, 76 questionnaire items were developed and adapted from the available literature (Albrecht; 1995, USDA; 2009; Kendall et al., 2004; Mitakakis et al., 2004; Bryd-Bredbenner et al., 2007; Kwon et al., 2008) and focus groups (Meysenberg, 2009). Practice questions were developed based on the CDC Foodborne Illness Risk Factors including food from unsafe sources, inadequate cooking, improper holding temperature, contaminated equipment and poor personal hygiene (CDC, 2010c). Questions in the survey were categorized according to themes, including high-risk foods, usage of thermometer, undercooked meat, thawing, storage of leftovers, cross-contamination and hand-washing. Expired food was added as a theme because it was a concern of focus group participants (Meysenburg, 2009). Microwaving was also added as a theme because

it was identified as a source of foodborne illness (International Food Information Council, 2009). For the belief component of the survey, 69 questionnaire items were developed and adapted from the available literature (Kendall et al., 2004; Knight, 2005; Lin et al., 2004) and focus groups (Meysenburg, 2009). The questions were developed according to the HBM constructs: beliefs, perceived barriers, perceived susceptibility, perceived severity, self-efficacy and cues to action. The knowledge and demographic components of the survey were developed based on available literature (FDA, 2009; Haapala & Probart, 2004; Medeiros et al., 2004, Unklesbay et al., 1998; Wenrich et al., 2003) and focus group data (Meysenburg, 2009).

IRB approval

The Institutional Review Board of the University of Nebraska-Lincoln approved this project.

Pilot Testing of Survey

Most food handling surveys have approximately 38 to 58 questionnaire items (Schafer et al., 1993; Wenrich et al., 2003; Kendall et al., 2003). In our project, there were a total of 145 questionnaire items in the practice and belief components of the survey. To reduce the number of questions, a pilot survey was conducted with a convenient sample of young adults aged 19 to 30 years old on October 2009, to test the internal consistency of questions (using Cronbach's Alpha) within each HBM construct or food handling practices theme.

The survey was divided into two parts to increase the response rate, consisting of 69 questionnaire items based on the HBM constructs and 76 questionnaire items based on food handling practices themes. The pilot survey yielded 208 completed surveys for the HBM constructs and 195 completed surveys for food handling practices themes.

Cronbach's Alpha can only test ordinal questions, not nominal questions. Ordinal questions were eliminated if the elimination caused an increase of Cronbach's Alpha value. Questions with a five-point Likert scale were selected for the Cronbach's Alpha analysis, which consisted of: strongly agree to strongly disagree, always to never, very likely to very unlikely, very important to not at all important and all to none. Each answer in the scale was assigned a number on a discrete scale. For example, strongly agree=1, agree=2, neutral=3, disagree=4, strongly disagree=5.

A minimum standard of 0.7 indicated acceptable internal consistency for each HBM construct and food handling practice theme. The Cronbach's Alpha values listed in Table 2 and Table 3 are the highest values (approximating 0.7) obtained from eliminating questions. A Cronbach's Alpha value of 0.9 indicated that the questions within each construct or theme were redundant. Questions were coded such that a lower score reflects a favorable behavior. A negative Cronbach's Alpha demonstrates that one of the questions was not coded following that order. For example, thawing raw meat on the countertop is not a favorable behavior; hence "always" is coded as 5 and "never" is coded as 1. In contrast, washing hands is a favorable behavior, hence "always" is coded as 1 and "never" is coded as 5. Hence, for questions that yield a negative Cronbach's Alpha value, questions were reverse coded to yield a positive Cronbach's Alpha value.

The overall internal consistency values for the HBM and food handling practices survey were acceptable (above 0.7). Only nine questions were eliminated from the survey, based on the testing of Cronbach's Alpha. The Cronbach Alpha for all individual construct under the HBM (excluding perceived barriers) was 0.713 (Table 2). Seven questions were eliminated based on the Cronbach's Alpha internal consistency. The Cronbach's Alpha for all food handling themes (excluding undercooked meat) was 0.727 (Table 3). Two questionnaire items were eliminated based on the Cronbach's Alpha internal consistency. The pilot survey yielded 136 questionnaire items.

Table 2. Cronbach's Alpha for the Health Belief Model Constructs

Themes	Cronbach's Alpha	Before elimination		After elimination	
		Questions	Items	Questions	Items
Beliefs ^a	0.682	10	14	3	7
Perceived barriers ^b	-	0	0	0	0
Perceived susceptibility	0.795	4	19	4	19
Perceived severity	0.432	2	2	2	2
Self-efficacy	0.752	3	10	3	10
Cues to action	0.685	4	15	4	15
Health Belief Model (Include all themes above excluding perceived barriers)	0.713	23	60	16	53

^a Only questions under the beliefs construct were eliminated to obtain Cronbach's Alpha level of above 0.7 (Cronbach's Alpha before elimination= 0.277). Other constructs did not require elimination of questions to reach Cronbach's Alpha level of above 0.7.

^b Cronbach's Alpha testing cannot be conducted on perceived barriers because questions under this theme were not ordinal questions.

Table 3. Cronbach's Alpha for the Food Handling Practices Themes

Themes	Cronbach's Alpha	Before elimination		After elimination	
		Questions	Items	Questions	Items
High-risk foods	0.510	2	2	2	2
Thermometer ^a	0.873	13	13	13	13
Hand-washing ^b	0.740	7	7	6	6
Cross-contamination ^c	0.121	2	2	2	2
Leftovers ^c	0.502	5	5	4	4
Undercooked meat ^d	-	1	1	1	1
Thawing ^e	0.868	1	3	1	3
Microwaving ^f	0.252	4	4	4	4
Food Handling Practices (Included all themes above excluding undercooked meat)	0.727	40	42	39	37

^a Seven-scaled questions were recoded to yield five-scaled questions (always to never). "Do not have thermometer" (code=6) is recoded to "never use a thermometer" (code=5). Participants answering more than one answer (code= 9) is recoded to "never use a thermometer" (code = 5) because most participants who selected "never use a thermometer" also chose "do not have a thermometer" in the same question. "Do not cook this item" (code = 7) is recoded to "system-missing data" to not affect the Cronbach's Alpha value.

^b A six-scaled question was recoded to yield a five scaled question, "do not have pet" (code = 6) is recoded to "system-missing data" to not affect Cronbach's Alpha value.

^c Questions were reverse recoded so that the highest value reflects the lowest value, to yield a positive value of Cronbach's Alpha. Cronbach's Alpha before recoding for the theme "cross-contamination" was - 0.203. Cronbach's Alpha before recoding for the theme "leftovers" was - 0.139 and Cronbach's Alpha before elimination of questions was 0.391

^d Cronbach's Alpha cannot be tested on one questionnaire item. This question was not included in the Health Belief Model questions because it did not contribute to the overall Cronbach's Alpha value.

^e Although the "thawing" theme has one question, it has three questionnaire components. Hence, Cronbach's Alpha can be used.

^f All questions were retained because elimination of questions did not yield value above Cronbach's Alpha of 0.6 (0.335). In the microwaving category, there is one duplicate question with thermometer use.

Instruments

Practice and knowledge questions were divided into four surveys to reduce the number of questions in the survey and to increase the response rate. Each survey has a different practice and knowledge components based on the FightBac!TM concepts, but the same HBM and demographic components.

Practice and knowledge questions were selected and developed from validated literature resources (Appendix A-1 for the clean concept, Appendix A-2 for the chill concept, Appendix A-3 for the separate concept, Appendix A-4 for the cook concept). Practice and knowledge questions were grouped under the FightBac!TM concepts, consisting of clean (Appendix A-5 for practice, Appendix A-6 for knowledge), chill (Appendix A-7 for practice, Appendix A-8 for knowledge), separate (Appendix A-9 for practice, Appendix A-10 for knowledge) and cook (Appendix A-11 for practice, Appendix A-12 for knowledge). The total number of practice questions for each survey were: nine for the clean concept, 14 for the chill concept, 10 for the separate concept and 16 for the cook concept. A five-point Likert scale (always, most of the time, some of the time, rarely, never) was assigned to all practice questions in the clean and separate concepts. For the chill concept, eight questions relating to storage of foods were assigned a five-point Likert scale (always, most of the time, some of the time, rarely, never) and six questions were assigned a categorical scale (1 to 2 days, 3 to 4 days, 5 to 7 days, more than a week). For the cook concept, one categorical question relating to awareness of microwave wattage was assigned a dichotomous scale (yes and no). The remaining 15 questions for the cook concept were assigned a five-point Likert scale (always, most of

the time, some of the time, rarely, never). Knowledge questions were developed according to the practice questions to examine the relationship between practice and knowledge of primary food handlers. The total number of knowledge questions were: six for the clean concept, 10 for the chill concept, seven for the separate concept and 10 for the cook concept. Knowledge questions consist of single-answer categorical questions and multiple-answer categorical questions.

For the HBM component, nine questions were developed (appendix A-8) based on the focus group results for primary food handlers with young children (Meysenburg, 2009). Six questions were assigned a five-point Likert scale (strongly agree, agree, neutral, disagree, strongly disagree), consisting of two questions for perceived severity, two questions for perceived susceptibility, one question for self-efficacy and one question for cues to action. One question relating to self-efficacy required food handlers to rank the reasons (1 to 5) that gave them the most confidence (1 indicates most confidence) in preparing food safely. Two questions relating to perceived barriers and cues to action require food handlers to choose the top three barriers to performing safe food handling and top three characteristics that promote use of food safety information. A Chi-square test was used to test the correlations of a specific belief question and a specific knowledge question in each concept, relating to the perceived susceptibility of children in getting sick more easily than adults.

Demographic questions (Appendix A-9) were adapted from the demographic survey used for the focus groups for primary food handlers with young children (Meysenburg, 2009). Additional answers were listed for the demographic question

relating to preferred ways to receive food safety information, based on the focus group results (Meysenburg, 2009). The additional answers included receiving information on a food label, hotline for food safety information, magazine and newspaper.

Survey Delivery

The survey was delivered to a nationwide sample of 3000 households with young children 10 years old and younger. InfoUSA® provided a list of randomly selected household addresses in the United States that fit the study criteria.

The Dillman's method was used to increase response rate (Dillman et al., 2009). The first mailing included the survey with a front cover (Appendix A-15) the IRB approved cover letter (Appendix A-16), a return stamped envelope and a form to enter a drawing for a gift card. Two weeks after the first survey mailing, postcards (Appendix A-17) were sent to non-respondents. Three weeks after sending the postcards, non-respondents were sent the same survey materials in the first mailing. Personalization of survey demonstrated a modest increase of response rate by three to 12 percent (Dillman et al., 2009). Informed consent forms were individually signed and names of non-respondents were hand-written on the postcards to increase response rate. For the third mailing, post-it notes with the hand-written messages, "Please take a few minutes to complete this for us. Thank you" were attached to each survey, to increase survey response rate (Garner, 2005).

Data Analysis

Analysis of data was conducted with SPSS (version 15.0, SPSS Inc., Chicago, IL, 2007). Descriptive statistics were obtained for the practice, beliefs, knowledge and demographic component of the survey. For the inferential statistics analysis, Spearman's rank correlation coefficient (ρ) was used to test the relationship of the HBM components and knowledge with food handling practices. A one-sided Spearman's rank correlation coefficient (ρ) was used because the hypotheses predict only positive or single-direction relationships. Statistical significance was set at $P < 0.05$. Questions were coded such that higher scores reflect safe food handling practices, favorable beliefs under the HBM component and higher knowledge about safe food handling practices. For ordinal questions in the practice and belief component, Likert scales were coded from one to five, consisting: always= 5, most of the time= 4, some of the time =3, rarely= 2, never=1 and strongly agree= 5, agree= 4, neutral= 3, disagree= 2 and strongly disagree= 1. As for categorical questions, a desirable or correct answer was coded as one and an undesirable or wrong answer was coded as zero. For example, the answer "yes" to the question of knowing the microwave wattage (cook concept) was desirable and was coded as one, while the answer "no" was undesirable and coded as zero. For the practice questions in the chill concept relating to storage of food, a desirable answer was coded as 1 and an undesirable answer was coded as zero. For example, chili, soup and stew can be stored for the maximum of four days in the refrigerator for safe consumption, according to FightBac!TM. Hence, an answer of "1-2 days" or "3-4 days" were coded as one and an answer of "5-7 days" or "more than a week" were coded as zero. Correct answers in the

knowledge component were coded as 1 and incorrect answers were coded as zero.

Categorical questions in the HBM component were exempted from Spearman's rank correlation coefficient (ρ) because these questions do not measure the degree of beliefs. For example, the categorical question relating to self-efficacy only provided the reason for high self-efficacy, but not the degree of self-efficacy. Scores for questions under the same construct were aggregated before finding the correlation. Correlations were evaluated between perceived severity and practice, perceived susceptibility and practice, self-efficacy and practice, cues to action and practice, knowledge and practice, knowledge relating to specific practice questionnaire items and practice of primary food handlers and practice of their children.

RESULTS AND DISCUSSION

Survey Demographics

The survey results represented a nationwide sample, covering 48 states (Appendix A-18). The distribution of participants from the United States was as followed: West, 18 percent; Midwest, 33 percent; South, 32 percent and Northeast, 18 percent. The overall response rate for the food safety surveys were 17 percent. The highest response rate was for surveys relating to the chill concept (21%) while the lowest response rate was surveys relating to the clean concept (14%) (Table 4). Possible reason for the low response rate may be the use of the same delivery materials for the second delivery of survey. Dillman (2009) speculated that people who did not respond in the first delivery of a survey need a different stimulus to encourage response. Our study was represented by a highly educated population with 38 percent of college graduates and 22 percent of post-college graduates.

Participant Characteristics

Most participants were females (67%), Caucasians (80%), between 30 to 49 years of age (83%), had one or two children (83%), prepare meals all or most of the time (76%) and consume meals away from home three times or less per week (66%) (Table 5). Meal preparation at home is declining. A USDHHS report (2010) indicated that 71 to 78 percent of food handlers prepare meals at home in 1999. Cody and Hogue (2003) reported that 37 percent of food handlers prepared meals every day of the week. This percentage is comparable to our study, where 33 percent of the participants reported preparing meals at home all the time.

Table 4. Response Rate for Survey Based on the FightBac!™ **COOK, CLEAN, SEPARATE and CHILL Concepts.**

	Concepts of Survey				
	Total	CLEAN	CHILL	SEPARATE	COOK
Number of surveys delivered	3000	748	751	751	750
Number of undelivered surveys	46	20	9	6	11
Number of unusable surveys	77	19	14	24	20
Number of usable surveys returned	503	98	154	136	115
Response rate (%)	17 %	14 %	21 %	19 %	16 %

Preferred Delivery Method for Food Safety Information

The food label was ranked as the most preferred delivery method for food safety information, followed by mail, television, e-mail, print media (brochure at a grocery store, cookbook, magazine, newspaper, school newsletter), telecommunication media (radio, hotline for food safety information, podcast or video and text message) and classes or workshops (Table 6). Meysenburg (2009) found similar results, where most participants preferred mail, followed by email, a brochure at the grocery store, then television. The majority of food handlers appear to prefer food safety information that appeals to their tactile perception (food label and mail) over telecommunication media (television and email). However, the results also illustrate the importance of using different forms of media to communicate food safety information.

Table 5. Demographic Characteristics of Participants Based on the FightBac!TM **COOK, CLEAN, SEPARATE and CHILL Concepts.**

Demographic Characteristics	Total n (%)	CLEAN n (%)	CHILL n (%)	SEPARATE n (%)	COOK n (%)
Gender					
Male	165 (33)	31 (32)	51 (33)	43 (32)	40 (35)
Female	338 (67)	67 (68)	103 (67)	93 (68)	75 (65)
Ethnic Background					
American Indian Or Alaska ^a	6 (1)	2 (2)	1 (1)	2 (2)	1 (1)
Asian ^a	7 (1)	1 (1)	3 (2)	3 (2)	0 (0)
Black or African American ^a	28 (6)	5 (5)	9 (6)	9 (7)	5 (4)
Caucasian or White ^a	391 (80)	70 (74)	121 (80)	106 (80)	94 (83)
Hispanic or Latino ^{a, b}	33 (7)	11 (12)	11 (7)	2 (2)	9 (8)
Native Hawaiian or other Pacific Islander ^{a, c}	1 (<1)	0 (0)	0 (0)	1 (1)	0 (0)
Other ^d	25 (5)	6 (7)	6 (5)	9 (7)	4 (3)
Age (years)					
19-29	31 (6)	6 (6)	12 (8)	8 (6)	5 (4)
30-39	220 (45)	46 (49)	69 (46)	57 (44)	48 (42)
40-49	185 (38)	34 (36)	56 (37)	45 (35)	50 (43)
≥ 50	56 (11)	11 (12)	14 (9)	19 (15)	12 (10)
Last grade completed					
Less than high school	3 (1)	2 (2)	-	1 (1)	-
Some high school	9 (2)	2 (1)	6 (4)	1 (1)	-
High school (graduate or GED)	63 (13)	10 (10)	19 (13)	14 (10)	20 (18)
Additional training beyond high school (not college)	27 (5)	7 (7)	10 (7)	6 (4)	4 (4)

Some college	95 (19)	15 (15)	24 (16)	30 (22)	26 (23)
College graduate	191 (38)	43 (44)	57 (38)	54 (40)	37 (33)
Post-graduate	111 (22)	19 (19)	36 (24)	29 (22)	27 (24)
Number of child(ren) aged 10 years old and younger					
1	213 (43)	34 (35)	71 (47)	55 (41)	53 (46)
2	202 (40)	51 (52)	57 (38)	56 (42)	38 (33)
3	57 (11)	9 (9)	15 (10)	17 (13)	16 (14)
4	23 (5)	3 (3)	7 (5)	6 (4)	7 (6)
5	4 (1)	-	2 (1)	1 (1)	1 (1)
6	1 (<1)	1 (1)	-	-	-
Frequency of meal preparation at home					
All of the time	168 (33)	33 (34)	49 (32)	47 (35)	39 (34)
Nearly all of the time	215 (43)	43 (44)	69 (45)	54 (40)	49 (43)
Some of the time	114 (23)	22 (22)	35 (23)	31 (23)	26 (23)
Never	6 (1)	-	1 (1)	4 (3)	1 (1)
Frequency of meal consumption at a restaurant, fast food, takeout, delivery, childcare or school					
0-1 meals per week	159 (32)	26 (27)	47 (31)	51 (38)	35 (30)
2-3 meals per week	171 (34)	42 (43)	54 (35)	33 (24)	42 (37)
4-5 meals per week	88 (17)	12 (12)	22 (14)	30 (22)	24 (21)
6-7 meals per week	49 (10)	12 (12)	21 (14)	8 (6)	8 (7)
More than 7 meals per week	26 (5)	4 (4)	8 (5)	10 (7)	4 (4)
My child(ren) does not eat from a restaurant, fast food, takeout, delivery, childcare or school	10 (2)	2 (2)	2 (1)	4 (3)	2 (2)

^a indicates persons belonging to one ethnic background only

^b indicates persons from Mexican, Puerto Rican, Cuban, South or Central American, or other Spanish culture or origin.

^c indicates persons from Hawaii, Guam, Samoa, or other pacific islands

^d indicates persons from two or more ethnic backgrounds including: Caucasian and Hispanic; Caucasian and American Indian; Caucasian and Asian; Black and Hispanic; Black and American Indian or Alaska; Black and Asian; Caucasian, American Indian and Hispanic, and Caucasian, American Indian and Black. For distribution of persons from two or more ethnic background in each survey, refer to Appendix A-19.

Table 6. Preferred Delivery Method for Food Safety Information based on Rank Points

Demographic Characteristics	Total	CLEAN	CHILL	SEPARATE	COOK
Top three choices of receiving food safety information ^a					
Food label	520	85	168	150	117
Mail	503	101	143	136	123
Television	293	73	82	59	79
Email	263	38	52	113	60
Brochure at grocery store	171	37	53	64	17
Cookbooks	132	21	43	44	24
Magazine	129	32	29	41	27
Newspaper	92	31	24	19	18
School newsletter	87	22	20	28	17
Radio	56	18	14	14	10
Hotline for food safety information (1-800-NUMBER)	32	9	17	3	3
Classes or workshops	27	5	11	3	8
Podcast or video	19	4	7	5	3
Text message	17	4	6	3	4

^a Rank points were calculated by attributing 1 as three points, 2 as two points and 3 as one point. Total number of usable surveys included to generate this table is 404.

Justification of Method Used in Reporting Results

The Healthy People 2010 survey contained food handling practice questions according to the concepts of FightBac!TM (clean, chill, separate, cook) to measure safe food handling practice. The food safety objective of Healthy People 2010 is to increase safe food handling practices to 79 percent (USDHHS, 2000). For each food handling practice component in our study, a benchmark of 79 percent was used to indicate a satisfactory percentage of participants who practice safe food handling within each FightBac!TM concepts. According to Healthy People 2010, only participants who always practice safe food handling are considered as safe food handlers for all concepts excluding the cook concept (specifically in using thermometers) (USDHHS, 2000). “Always” is a more accurate indicator of safe food handling practice because it indicates 100 percent of the time, while “most of the time” is difficult to quantify and depends on the subjective perception of a person. In addition, always handling food safely or handling food safely 100 percent of the time can greatly reduce the risk of a person in getting foodborne illness. LaBudde (2003) speculated that a person who eats raw eggs four times a week has a 1 in 100,000 odd of getting *Salmonella* infection in one single meal. However, if that person continues eating raw eggs four times a week for a lifetime, the person’s odds of getting *Salmonella* increases to one in six persons. This phenomenon is called as cumulative risks (LaBudde, 2003). Although many people could choose to experience one *Salmonella* infection in their lifetime, they should be aware that one experience of a foodborne illness disease can be severe enough to cause long term health effects,

such as reactive arthritis (ReA), chronic arthritis, heart and blood infection, and even death (Pew Health Group, 2010). Hence, if a person always practiced safe food handling, he or she would be completely from accumulating risk to contracting foodborne illness.

For reporting correlations in our study, we are only interested in determining whether significant correlations existed and whether these correlations are positive or negative. All significant correlations were reported, even if the correlations were low. Low correlations for food safety studies that were based on the HBM constructs were not atypical. Schaefer and colleagues (1993) who conducted a food safety study based on the HBM found low correlations for self-efficacy and perceived threat ($r=0.295$), healthy lifestyles and perceived threat ($r=0.113$) and self-efficacy and healthy lifestyles ($r=0.218$).

Food Handling Practices of Participants

Food handling practice based on the CLEAN concept. Most participants in our study (79%) were below the food safety objective of Healthy People 2010 in all areas of hand-washing (USDHHS, 2000), except for immediately washing hands after handling raw meat (93%). The results of the clean concept are listed in Table 7. According to Healthy People 2010, always washing hands before food preparation indicated safe food handling within the clean concept (USDHHS, 2000). Only 71

Table 7. Food Handling Practices Questions Based on the FightBac!TM **CLEAN** concept

Food Handling Practice Questions	n	Always n (%)	Most of the time n (%)	Some of the time n (%)	Rarely n (%)	Never n (%)
I wash my hands with soap and running water before preparing food, even snacks.	98 (100)	60 (61)	26 (27)	12 (12)	-	-
I wash my hands with warm soapy water after cracking open raw eggs.	98 (100)	70 (71)	11 (11)	10 (10)	4 (4)	3 (3)
I wash my hands immediately after handling raw meat.	97 (100)	90 (93)	5 (5)	2 (2)	-	-
When I prepare fresh fruits and vegetables for myself, I thoroughly rinse the fruits and vegetables under running tap water, including those with skins and rinds that are not eaten.	98 (100)	53 (54)	35 (36)	5 (5)	3 (3)	2 (2)
After playing with a pet, I wash my hands with soap and water before handling food.	97 (100)	74 (76)	14 (14)	8 (8)	1 (1)	-
My child(ren) wash their hands with soap and running water before helping me in the kitchen or setting the table.	98 (100)	55 (56)	35 (36)	6 (6)	2 (2)	-
My child(ren) wash their hands with soap and running water right before eating a snack or meal.	98 (100)	33 (34)	42 (43)	18 (18)	5 (5)	-
After playing with a pet, my child(ren) wash their hands with soap and water before eating.	97 (100)	45 (46)	32 (33)	14 (14)	6 (6)	-
When serving my children fresh fruits and vegetables, I thoroughly rinse fresh fruits and vegetables under running tap water, including those with skins and rinds that are not eaten.	98 (100)	54 (55)	37 (38)	5 (5)	1 (1)	1 (1)

percent of participants in our study always wash their hands with warm soapy water after cracking raw eggs, which is much lower than washing hands after handling raw meat (93%). Results in this study demonstrated participants possibly perceive eating after handling raw meat as more risky than eating after handling raw eggs.

Correlations of food handling practices between adults and children for the CLEAN Concept.

Overall, participants' self-reported food handling practices are strongly associated with how they handle food when cooking meals for their children including: washing hands with soap and running water before preparing food, even snacks, $r = 0.339$, $p < 0.01$, $n = 98$; washing hands with soap and water after playing with a pet before handling food, $r = 0.449$, $p < 0.01$, $n = 97$; and rinsing fresh fruits and vegetables under running tap water, including those with skins and rinds that are not eaten, $r = 0.804$, $p < 0.01$, $n = 98$ (Appendix A-20). However, participants generally reported safer food handling practices than their children's food handling practices. Although 61 percent of participants indicated washing their hands with soap and running water before preparing food, only third of them (34%) reported their children doing the same practice. The percentage of children who washed their hands before preparing food in our study was less than another study which reported half of the middle school children washed their hands before preparing food (Bryd-Bredbenner et al., 2010). Seventy-six percent of participants in our study reported washing their hands with soap and water after playing with a pet and before handling food; but only 46 percent of participants reported the same practice for their children. As for rinsing fruits and vegetables under running tap water including

those with skins and rinds that are not eaten, the percentage of participants (54%) who always rinse the fruits and vegetables were consistent with the percentage who reported the practice for their children (55%). This percentage is consistent with participants of another study (53%) who reported always washing their hands before handling fresh produce (Li-Cohen & Bruhn, 2002). Only half of the participants (56%) in our study reported that their children always washed their hands with soap and running water before food preparation. This percentage is higher than the percentage of children reported to wash their hands right before eating a snack or meal (34%), indicating participants assume that hand-washing before food preparation is sufficient to prevent foodborne illness until the time of meal consumption.

Food handling practices based on the CHILL concept. The chill concept in our survey was divided into several themes including temperature control of food, time between food preparation and storage, perception of food safety and duration of food storage. Throwing away expired food was added as a separate theme in the chill concept. The results of the chill concept are listed in Table 8.

Food handling practices which exceeded the food safety objective of Healthy People 2010 (79%) were always refrigerating foods within two hours of buying them from a deli, restaurant, or grocery store (87%) and not storing raw eggs at room temperature (95%). Healthy People 2010 used storing leftover food within two hours

Table 8. Food Handling Practices Based on the FightBac!™ **CHILL** Concept

Food Handling Practice Questions	n	Always n (%)	Most of the time n (%)	Some of the time n (%)	Rarely n (%)	Never n (%)
I store raw eggs at room temperature.	150 (100)	2 (1)	-	1 (1)	6 (4)	142 (95)
I thaw frozen meat on the countertop.	154 (100)	4 (3)	19 (12)	46 (30)	39 (25)	46 (30)
When storing large quantities of hot foods, I place them in shallow containers in the refrigerator.	152 (100)	20 (13)	35 (23)	34 (22)	30 (20)	33 (22)
I refrigerate leftover foods within two hours of cooking them.	154 (100)	103 (67)	40 (26)	8 (5)	2 (1)	1 (1)
I refrigerate foods within two hours of buying them from a deli, restaurant, or grocery stores.	154 (100)	134 (87)	18 (12)	-	-	2 (1)
I will eat leftover food if it looks and/or smells good.	154 (100)	13 (8)	67 (44)	58 (38)	11 (7)	5 (3)
My child(ren) eat leftovers.	154 (100)	15 (10)	35 (23)	70 (46)	26 (17)	8 (5)
I throw away foods that have passed the expiration date.	154 (100)	102 (66)	44 (29)	7 (5)	1 (1)	-

of cooking as an indicator of safe food handling practices for the chill concept

(USDHHS, 2000).

The percentage relating to storing food bought from deli, restaurant or grocery stores at room temperature was agreeable with another study which reported 84 percent of the participants stated storing cooked meat at room temperature was unacceptable (Redmond & Griffith, 2004b)

Participants demonstrated inconsistent food handling behavior in the area of temperature control of food. Although participants in our study exceeded the food safety objective of Healthy People 2010 (79%) (USDHHS, 2000) for not storing eggs at room temperature: only 30 percent of the participants never thawed frozen meat on the countertop. Even fewer participants (13%) always store large quantities of hot foods in shallow containers in the refrigerator. This percentage reported in our study is less than one-third to two-thirds of the percentage reported in other studies (Bruhn et al., 1999; Williamson et al., 1992). Participants appear to be confused with the recommended practice of storing large quantities of hot foods in shallow containers in the refrigerator, demonstrated by the uniform distribution of participants across the ordinal scale of always to never. Twenty-two percent of participants never store large quantities of hot foods in shallow containers in the refrigerator, with similar percentages in other ordinal scales: most of the time (23%), some of the time (22%) and rarely (20%). Hence, future food safety education should focus on how to refrigerate large quantities of hot foods for later use.

Participants also demonstrate inconsistent behavior in the time between food preparation and storage. More participants refrigerate food within two hours after buying them from a deli, restaurant, or grocery store (87%), compared to after cooking food (67%). One of the possible reasons is that meal preparation at home requires more time from cooking to eating then cleaning, which may exceed two hours by the time of meal completion. Other possible reasons are people in the

household eat at different times and additional time is taken to cool down food which may be done at room temperature.

More than half of the participants (8% always, 44% most of the time) will eat leftover food if it looks or smells good. Bruhn and colleagues (1999) reported similar results for participants who taste their leftover food, all and some of the time (47%), to verify if it is safe for consumption. Participants' reliance on their sensory perception is alarming, especially since one-third of the participant's children (33%) in this study eat leftover food all or most of the time.

Two-thirds of all participants (66%) in this study always throw away foods that have passed the expiration date, consistent with the results of another study (63%) in 2004 (US Grocery Shopping Trends, 2008).

Food handling practices based on the CHILL concept relating to storage of leftovers. Meysenburg (2009) found that primary food handlers for families with young children are concerned with the duration that they can store leftover food and still consume them. FightBac!TM generally recommends throwing away foods after two to four days of storage (Partnership for Food Safety Education, 2006). Participants achieved and exceeded the food safety objective of Healthy People 2010 (79%) (USDHHS, 2000), in terms of storing leftover pizza (93%), hard-cooked eggs (97%) and raw hamburger (97%) (Table 9). One of the possible reasons participants were more inclined to throw away leftover pizza after four days is the deterioration of the taste due to long periods of refrigeration. Hard-cooked eggs are safe to

Table 9. Food Handling Practices relating to Duration of Keeping Leftovers Based on the FightBac!TM CHILL Concept

Food Handling Practice Questions	n	1-2 days	3-4 days	5-7 days	More than a week
How long do you keep foods like chili, soup, and stew in the refrigerator to eat later?	153 (100)	35 (23) ^a	78 (51) ^a	38 (25)	2 (1)
How long do you keep leftover pizza in the refrigerator to eat later?	153 (100)	88 (58) ^a	54 (35) ^a	10 (7)	1 (1)
How long do you keep hard-cooked eggs in the refrigerator to eat later?	149 (100)	59 (40) ^a	54 (36) ^a	31 (21) ^a	5 (3)
How long do you keep chicken nuggets or chicken patties in the refrigerator to eat later?	146 (100)	99 (68) ^a	36 (25)	9 (6)	2 (1)
How long do you keep raw chicken in the refrigerator before cooking?	151 (100)	117 (78) ^a	30 (20)	3 (2)	1 (1)
How long do you keep raw hamburger in the refrigerator before cooking?	150 (100)	116 (77) ^a	30 (20) ^a	4 (3)	-

^a Indicates recommended number of days for storage of food by FightBac!TM

consume within a week of storage, which qualified the majority of participants (97%) who chose seven days or less for storing the eggs. As for storage of raw meat, participants were equally cautious with storage of raw chicken and raw hamburger; demonstrated by the similar proportion of participants under the one to two days category for raw chicken (78%) and raw hamburger (77%) and three to four days category for raw chicken (20%) and raw hamburger (20%). However, more

participants in our study exceeded the food safety objective of Healthy People 2010 (79%) (USDHHS, 2000) for the raw hamburger because a storage of four days was recommended for it, while only two days was recommended for storing raw chicken in the refrigerator. This discrepancy demonstrates a need to educate food handlers about the different storage durations recommended for raw hamburger versus raw chicken. Three-fourths (74%) of all participants kept foods like chili, soup, and stew in the refrigerator within the recommended storage time. One of the possible reasons participants were inclined to store chili, soup, and stew more than the recommended time is that the preservation or enhancement of taste for the food over storage. These types of food were usually made in large quantities which prolong the duration of their storage. Fewer participants (68%) keep chicken nuggets or chicken patties within the recommended time period, which demonstrates the lack of knowledge relating to storage of cooked processed food. Future studies may include other types of leftover food.

Food handling practices based on the SEPARATE concept. Results of the separate concept are provided in Table 10. The only safe food handling practice that exceeds the objective of Healthy People 2010 for food safety (USDHHS, 2000) is never placing cooked meat on the same plate where raw meat has been (93%); a higher percentage than Bruhn and colleagues (1999) reported 80 percent for the same practice. Healthy People 2010 used cleaning a cutting board with soap, bleach

Table 10. Food Handling Practices Based on the FightBac!TM **SEPARATE** Concept

Food Handling Practice Questions	n	Always n (%)	Most of the time n (%)	Some of the time n (%)	Rarely n (%)	Never n (%)
I put cooked meat on the same plate where raw meat has been.	136 (100)	-	-	1 (1)	9 (7)	126 (93)
When purchasing raw meat at the grocery store, I put it in a separate bag (from other food items) before placing it in the cart.	133 (100)	50 (37)	32 (24)	23 (17)	10 (7)	20 (15)
After cutting raw meat, I rinse the cutting board or counter with water.	133 (100)	90 (68)	10 (8)	3 (2)	4 (3)	26 (20)
After cutting raw meat, I wipe the cutting board or counter with a dishrag.	135 (100)	38 (28)	9 (7)	12 (9)	15 (11)	61 (45)
After cutting raw meat, I wash the cutting board or counter in hot soapy water only.	136 (100)	70 (52)	22 (16)	18 (13)	10 (7)	16 (12)
After cutting raw meat, I wash the cutting board or counter with hot soapy water, then rinse with bleach and water.	136 (100)	19 (14)	10 (7)	15 (11)	21 (15)	71 (52)
After cutting raw meat, I clean the cutting board or counter with disinfectant (for example, Lysol, Clorox).	134 (100)	39 (29)	18 (13)	15 (11)	20 (15)	42 (31)
After cutting raw meat, I wash the cutting board in the dishwasher.	136 (100)	44 (32)	19 (14)	21 (15)	11 (8)	41 (30)
I place raw meat above ready-to-eat foods in the refrigerator.	136 (100)	4 (3)	-	23 (17)	25 (18)	84 (62)
I put raw meat on a plate/container or into a bag/wrapper before placing it into the refrigeration.	136 (100)	90 (66)	28 (21)	11 (8)	2 (2)	5 (4)

and using a different cutting board as indicators of safe food handling practices, for the separate concept (USDHHS, 2000).

Only 37 percent of participants in our study always separate raw meat from other food items in a bag before placing it in the grocery cart. Li-Cohen and Bruhn (2002) reported similar results with only 28 percent of participants who separate fresh produce from meat, poultry and fish. This practice is crucial because children were more likely to contract foodborne illness when placed in shopping carts with raw products (CDC, 2009b), possibly due to higher likelihood of touching and ingesting raw meat juice.

Sixty-two percent of participants in our study never place raw meat above ready-to-eat foods in the refrigerator. This percentage is comparable with another study which demonstrated that 67 percent of participants placed raw meat on the bottom shelf or meat-poultry drawer in the refrigerator (Li-Cohen & Bruhn, 2002). Two-thirds of the participants (66%) in our study always placed their raw meat on a plate or container or into a bag or wrapper before refrigeration. If raw meat is not placed in a container or bag, the liquid residue of raw meat can drip and contaminate ready-to-eat foods.

The majority of participants always washed their counter or cutting board with water only (68%), followed by hot soapy water (52%), dishwasher (32%), disinfectant (29%), dishrag (28%) and bleach in addition to hot soapy water (14%)

(Table 10). Bruhn and colleagues (1999) reported a higher percentage of participants who always clean their working surface with hot soapy water (63%).

Redmond and Griffith (2004b) reported that approximately one-fifth of their participants (18%) strongly agreed that using disinfectant is important in cleaning a work station. The reason a majority of participants always rinsed their cutting board or counter with water only after cutting raw meat (68%) is difficult to explain. This percentage is almost three times higher than that of participants in another study who clean their work area with water only (24%) in another study (Li-Cohen & Bruhn, 2002). The possible reason may be the unclear wording of the question that led participants to think rinsing the cutting board or counter with water is one of the processes of cleaning, instead of being the only process of cleaning. Addition of “before continuing cooking” and or “between uses” after the question relating to washing cutting board may increase the clarity of the question based on other literature (Mitakakis et al., 2004; Medeiros et al., 2004). Another reason is the possible existence of a real discrepancy of practice between participants in both studies. Li-Cohen and Bruhn (2002) study was largely represented by participants aged 55 and above (47%), while our study largely consisted of participants between 30 to 49 years old (83%). The same study found that younger participants in their thirties and forties performed riskier food handling practices than older participants (Li-Cohen & Bruhn, 2002). Even so, the percentage of participants who wash their cutting boards with hot soapy water is still low (52%). Li-Cohen and Bruhn (2002) reported that 70 percent of participants used dishwashing liquid to clean their kitchen

work area. Less than one-third of participants always wiped their cutting boards or counter with a dishrag (28%), a percentage that is much higher than participants (5%) in another study who dry wipe their kitchen work area (Li-Cohen & Bruhn, 2002).

Food handling practices based on the COOK concept. The results of the cook concept are listed in Table 11. Participants in our study only exceeded the food safety objective of Healthy People 2010 for food safety (USDHHS, 2000), for always stirring and rotating food in the microwave or having a microwave with an automatic turntable (82%). Healthy People 2010 use degree of doneness of hamburger, consumption of raw eggs and use of a meat thermometer, as indicators of safe food handling practices within the cook concept (USDHHS, 2000). Our study applied the same criteria used by Healthy People 2010 Food Safety; all participants who used a thermometer some of the time, most of the time and all the time were considered safe food handlers. Nonetheless, use of thermometer in our study was well below the objective for the use of thermometer for chicken (17%), use of thermometer for hamburger (7%), use of thermometer when cooking chicken for children (20%) and use of a thermometer when cooking hamburger for children (9%). A study reported that 33 percent of participants always use a food thermometer to cook food to the proper temperature, though no particular food was specified (US Grocery Shopping Trends, 2008). More than half of the participants always rely on the physical appearance of the meat to check degree of doneness;

Table 11. Food Handling Practices Based on the FightBac!™ **COOK** Concept

Food Handling Practice Questions	n	Always n (%)	Most of the time n (%)	Some of the time n (%)	Rarely n (%)	Never n (%)
I use a thermometer to test the doneness of chicken.	113 (100)	3 (3)	5 (4)	11 (10)	34 (30)	60 (53)
I use a thermometer to test the doneness of hamburger.	113 (100)	-	3 (3)	5 (4)	24 (21)	81 (72)
To test the doneness of chicken, I look at the juices, cut open the meat, or see if meat falls off the bones.	114 (100)	64 (56)	33 (29)	12 (11)	1 (1)	4 (4)
To test the doneness of hamburger, I cut the meat open or look at the color of the meat and its juices.	114 (100)	60 (53)	30 (26)	11 (10)	5 (4)	8 (7)
I eat hamburger that is pink in the middle.	114 (100)	3 (3)	13 (11)	25 (22)	28 (25)	45 (40)
I eat food containing raw eggs (for example, cookie dough, cake batter).	113 (100)	-	7 (6)	35 (31)	31 (27)	40 (35)
I reheat leftover food until steaming or boiling	114 (100)	40 (35)	32 (28)	30 (26)	10 (9)	2 (2)
I follow the manufacturer's instructions when microwaving foods (for example, length of microwaving time).	113 (100)	54 (48)	43 (38)	7 (6)	4 (4)	5 (4)
I use microwave-safe containers to microwave foods.	113 (100)	72 (64)	24 (21)	11 (10)	4 (4)	2 (2)
I stir and rotate food in the microwave of my microwave has an automatic turntable.	113 (100)	93 (82)	11 (10)	5 (4)	-	4 (4)
I know my microwave wattage.	112 (100)	50 (45)	62 (55)			

Table 11 (continued). Food Handling Practices Based on the FightBac!TM **COOK** Concept

Food Handling Practice Questions	n	Always n (%)	Most of the time n (%)	Some of the time n (%)	Rarely n (%)	Never n (%)
I use a thermometer to test the doneness of chicken when preparing chicken for my child(ren).	114 (100)	9 (8)	5 (4)	9 (8)	29 (25)	62 (54)
I use a thermometer to test the doneness of hamburger when preparing hamburger for my child(ren).	114 (100)	1 (1)	3 (3)	6 (5)	30 (26)	74 (65)
My child(ren) eat hamburger that is pink in the middle.	114 (100)	1 (1)	7 (6)	9 (8)	17 (15)	80 (70)
My child(ren) eat food containing raw eggs (for example, cookie dough, cake batter).	114 (100)	1 (1)	2 (2)	24 (21)	36 (32)	51 (45)
My child(ren) eat leftover foods.	114 (100)	16 (14)	18 (16)	65 (57)	11 (10)	4 (4)

56% for testing chicken, and 53% for testing hamburger.

Fourteen percent of participants (3% always, 11% most of the time) eat hamburger that are pink in the middle. This percentage is comparable with another study which reported eight percent of participants (1% strongly disagree, 7% disagree) perceived ground beef should be cooked until it is no longer pink (Bruhn et al., 1999). Six percent eat food containing raw eggs (zero percent always, 6% most of the time). This percentage is comparable with another study which reported that

10 percent of the participants always or sometimes use raw eggs in their foods (Bruhn et al., 1999).

Since about one-third of all participants' children (30%) eat leftovers, always reheating leftover food until steaming or boiling is important to prevent foodborne illness, as demonstrated by 35% of participants in our study.

The Centers for Disease Control and Prevention (2010a) reported a *Salmonella* outbreak across states for insufficient cooking of food in a microwave. The time to sufficiently cook food depends on the varying wattage of microwaves. Less than half of participants know their microwave wattage (45%) and always follow the manufacturer's instructions when microwaving (48%). Only 64% of participants use microwave-safe containers to microwave foods.

Correlations of food handling practices between adults and children for the COOK concept. Overall, participants' self-reported food handling practices are strongly associated with how they handle food when cooking meals for their children. Participants are more likely to use a meat thermometer when cooking for their children (Appendix A-21), if they use the thermometer when cooking for themselves; use of meat thermometer for chicken, $r = 0.840$, $n = 113$, $p < 0.01$; use of meat thermometer for hamburger, $r = 0.714$, $n = 114$, $p < 0.01$. This association demonstrates children most probably eat from the same dish that participants cooked. Hence, participants need to first adopt using a meat thermometer to cook their own food, for their children to benefit from having a thermometer used in cooking meals for them. Children are also more likely to eat undercooked hamburger; if adult participants do, $r = 0.663$, $n = 114$, $p < 0.01$. Seven

percent of children eat undercooked hamburgers all and most of the time, half of the percentage of adult participants. Children are more likely to eat raw eggs, if adult participants eat them, $r = 0.618$, $n = 113$, $p < 0.01$. Three percent of children eat raw eggs all or most of the time, half of the percentage of adult participants. The strong association of participant's food handling practices when preparing food for themselves and for their children demonstrates the need to educate primary food handlers of families with young children, for their children to benefit from their safe food handling practices.

Beliefs of Participants based on the Health Belief Model

Perceived Susceptibility and Perceived Severity of Participants

Perceived severity. The results of perceived severity are listed in Table 12. Only 44 percent of the participants disagreed that their children will be healed in one day or less following food poisoning. This percentage is about half of the percentage of participants (82%) who believe their children could die from food poisoning. These results are difficult to interpret. One possible reason is that although parents acknowledge the possibility that their children may die from food poisoning, they have low perceived susceptibility of their children actually experiencing severe consequences from food poisoning. Their low perceived susceptibility is also demonstrated by the substantial percentage of participants who were ambivalent as to whether their children can heal in one day or less following food poisoning (32% neutral).

Table 12. Health Belief Model Constructs relating to Perceived Severity based on FightBAC!TM **CLEAN, CHILL, SEPARATE and COOK** concepts.

Questions based on Health Belief Model Constructs	Total	Strongly agree n (%)	Agree n (%)	Neutral n (%)	Disagree n (%)	Strongly Disagree n (%)
Perceived Severity						
If my child(ren) got sick from food poisoning, they will be well in one day or less.						
Clean	97 (100)	8 (8)	17 (18)	28 (29)	39 (40) ^a	5 (5) ^a
Chill	150 (100)	12 (8)	37 (25)	43 (29)	49 (33) ^a	9 (6) ^a
Separate	136 (100)	3 (2)	16 (12)	54 (40)	42 (31) ^a	21 (15) ^a
Cook	113 (100)	4 (4)	24 (21)	34 (30)	42 (37) ^a	9 (8) ^a
Total	496 (100)	27 (5)	94 (19)	159 (32)	172 (35) ^a	44 (9) ^a
My child(ren) could die from food poisoning.						
Clean	98 (100)	37 (38) ^a	47 (48) ^a	10 (10)	2 (2)	2 (2)
Chill	151 (100)	50 (33) ^a	72 (48) ^a	22 (15)	6 (4)	1 (1)
Separate	135 (100)	53 (39) ^a	62 (46) ^a	12 (9)	7 (5)	1 (1)
Cook	114 (100)	37 (33) ^a	49 (43) ^a	15 (13)	7 (6)	6 (5)
Total	498 (100)	177 (36) ^a	230 (46) ^a	59 (12)	22 (4)	10 (2)

^a Indicated favorable answer in the Health Belief Model Construct

Table 13. Health Belief Model Constructs relating to Perceived Susceptibility based on FightBAC!TM **CLEAN, CHILL, SEPARATE and COOK** concepts

Questions based on Health Belief Model Constructs	n	Strongly agree n (%)	Agree n (%)	Neutral n (%)	Disagree n (%)	Strongly Disagree n (%)
Perceived Susceptibility						
My child(ren) can get sick from food poisoning more easily than me.						
Clean	98 (100)	13 (13) ^a	43 (44) ^a	25 (26)	13 (13)	4 (4)
Chill	152 (100)	33 (22) ^a	53 (35) ^a	39 (26)	19 (13)	8 (5)
Separate	136 (100)	22 (16) ^a	46 (34) ^a	36 (27)	19 (14)	13 (10)
Cook	112 (100)	20 (18) ^a	37 (33) ^a	27 (24)	22 (20)	6 (5)
Total	498 (100)	88 (18) ^a	179 (36) ^a	127 (26)	73 (15)	31 (6)
When I prepare food for my child(ren), I am more careful than when I am preparing food just for myself.						
Clean	98 (100)	28 (29) ^a	30 (31) ^a	19 (19)	14 (14)	7 (7)
Chill	153 (100)	33 (22) ^a	47 (31) ^a	22 (14)	33 (22)	18 (12)
Separate	136 (100)	22 (16) ^a	40 (29) ^a	21 (15)	29 (21)	24 (18)
Cook	114 (100)	27 (24) ^a	38 (33) ^a	14 (12)	24 (21)	11 (10)
Total	501 (100)	110 (22) ^a	155 (31) ^a	76 (15)	100 (20)	60 (12)

^a Indicated favorable answer in the Health Belief Model Construct

Perceived susceptibility. The results for perceived susceptibility are listed in Table 13.

Fifty-four percent of the participants perceived that their children could get sick more easily than they do, which is similar to participants who reported (53%) being more careful when preparing foods for their children than for themselves. These percentages are low, especially when children are more susceptible to foodborne illness than adults. Their low perceived susceptibility may be caused by lack of knowledge. Participants who demonstrated knowledge that children are more susceptible to food poisoning than adults were more likely to believe that their children could get sick from food poisoning more easily than themselves: clean concept, $\chi^2(8, n = 97) = 34.34, p < 0.01$; chill concept, $\chi^2(8, n = 152) = 54.64, p < 0.01$; separate concept, $\chi^2(8, n = 135) = 41, p < 0.01$; and cook concept, $\chi^2(8, n = 111) = 31.86, p < 0.01$.

Correlation of Perceived Susceptibility and Perceived Severity with Safe Food Handling Practices

CLEAN. Participants who perceived that their children were more susceptible to food poisoning reported being less likely to perform safe food handling practices ($r = -0.233, n = 98, p < 0.05$) especially when preparing food for themselves ($r = -0.245, n = 98, p < 0.05$), but not for their children ($r = -0.159, n = 98, p = 0.06$) (Appendix A-22).

CHILL. Participants who perceived that their children could experience severe health effects from food poisoning were more likely to perform safe food handling

practices for all questions within the chill concept except for the duration of storage for leftover foods, $r = 0.276$, $n = 148$, $p < 0.01$ (Appendix A-23).

SEPARATE. Participants who perceived that their children could experience severe health effects from food poisoning were more likely to perform safe food handling practices, $r = 0.227$, $n = 136$, $p < 0.01$ (Appendix A-24).

COOK. Participants who perceived that their children are susceptible to food poisoning were more likely to perform safe food handling practices ($r = 0.213$, $n = 115$, $p < 0.05$) especially when preparing food for their children ($r = 0.239$, $p < 0.01$, $n = 115$), but not for themselves ($r = 0.140$, $n = 115$, $p = 0.07$) (Appendix A-25).

Most of our survey results support the hypothesis of the HBM where high perceived severity and high perceived susceptibility promotes safe food handling practices. Participants within the chill and separate concept supports the HBM construct which hypothesized that high perceived severity is positively associated with safe food handling practices. Participants within the cook concept also support the HBM construct which hypothesized that high perceived susceptibility predict safe food handling practices. However, this relationship is not supported by participants within the clean concept. Contradicting results were also found as to whether participants who have high perceived susceptibility for their children were more likely to practice safe food handling for themselves or for their children.

Self-efficacy of participants

The majority of participants (91%) were confident of their food handling practices in preventing their children from getting food poisoning.

Correlation of Self-efficacy with Safe Food Handling Practices

CLEAN. Participants who have confidence in preparing food safely for their children were more likely to practice safe food handling practices ($r = 0.333$, $n = 98$, $p < 0.01$), whether for themselves ($r = 0.371$, $p < 0.01$, $n = 98$) or for their children ($r = 0.270$, $p < 0.01$, $n = 98$) (Appendix A-22).

CHILL. Participants who have confidence in preparing food safely for their children were more likely to perform all safe food handling practices for all practice questions excluding duration of storage for leftover food, $r = 0.182$, $p < 0.05$, $n = 148$. However, participants who have confidence in preparing food safely were less likely to perform safe food handling practices relating to duration of storage for leftover foods, $r = -0.157$, $p < 0.05$, $n = 154$ (Appendix A-23).

SEPARATE. Participants who had confidence in preparing food safely for their children were more likely to perform safe food handling practices, $r = 0.187$, $n = 136$, $p < 0.05$ (Appendix A-24)

COOK. No significant correlations were found between participants who have confidence in preparing food safely for their children and practicing safe food handling.

Table 14. Health Belief Model Constructs relating to Self-efficacy based on the FightBac!TM **CLEAN, CHILL, SEPARATE and COOK** concepts

Questions based on Health Belief Model Constructs	n	Strongly agree n (%)	Agree n (%)	Neutral n (%)	Disagree n (%)	Strongly Disagree n (%)
I am confident that my food handling practices at home can prevent my child(ren) from getting food poisoning.						
CLEAN	98 (100)	42 (43) ^a	45 (46) ^a	9 (9)	1 (1)	1 (1)
CHILL	154 (100)	70 (46) ^a	74 (48) ^a	8 (5)	1 (1)	1 (1)
SEPARATE	136 (100)	62 (46) ^a	63 (46) ^a	8 (6)	3 (2)	-
COOK	114 (100)	48 (42) ^a	56 (49) ^a	7 (6)	3 (3)	-
Total	502 (100)	222 (44) ^a	238 (47) ^a	32 (6)	8 (2)	2 (1)

^a Indicated favorable answers in the Health Belief Model Construct

In general, participants who had high self-efficacy relating to clean, chill and separate concepts were more likely to practice safe food handling although safe food handling practice relating to duration of storage for leftovers was negatively associated with high self-efficacy (Appendix A-25)

Reasons for Self-efficacy of participants

Participants in our study ranked family as the main source for confidence of safe food handling practices, followed by learning to prepare food safely themselves, receiving food handling training, not making other people sick from food and lastly,

Table 15. Reasons for Self-efficacy based on Rank Points relating to the FightBac!TM **CLEAN, CHILL, SEPARATE and COOK** concepts

Please rank (1-5) the reasons that give you the confidence to prepare food safely.	Rank Points ^a				
	Total rank points	CLEAN	CHILL	SEPARATE	COOK
n (%) ^b	419 (100)	85 (100)	126 (100)	115 (100)	93 (100)
My family taught me (for example, mother, grandmother, mother-in-law)	1282	257	393	349	283
I learned to prepare food safely myself (for example, media, internet)	1055	213	308	283	251
I had food handling training (for example, job, workshop, classes)	736	182	218	201	135
I did not make anyone sick from food before	702	125	207	209	161
My friends taught me	414	73	134	108	99

^a The first reason that give participants most confidence is assigned 4 points, followed by 3 points for the second reason, 2 points for the third reason, 1 point for the fourth reason, and zero points for the fifth reason. Refer to tables in Appendices for frequency distribution of participants (Appendix A-26 for clean concept, Appendix A-27 for chill concept, Appendix A-28 for separate concept, and Appendix A-29 for cook concept)

^b Scores indicate total number of participants in each survey

friends (Table 15). Bryd-Bredbenner and colleagues (2010) reported that children learned safe food handling practices by observing how their parents prepare food. Focus group participants in a study by Koepl (1998) reported that they used a thermometer because they watched their mothers using it when they were younger. From our study, people were speculated to have first learned and developed confidence in handling food safely from their parents. Hence, primary food handlers of families with young children should be made aware of their influential role to

model safe food handling practices for their children. The second and third reason which gave participants the most confidence in safe food handling is learning to prepare food themselves and having taken a food handling training or workshop. Participants in our study characterized an adult learning style, as reported by Collins (2004). An adult learning style involves more self-direction and self-initiated learning had been shown to be most lasting and effective (Collins, 2004). Friends are least influential in increasing the participants' confidence in safe food handling. One of the possible reasons is that participants viewed their food handling practices as superior to their peers. Not making anyone sick in the past received a low rank as well. This result contradicts the result found by Meysenburg (2009) who reported participants in her study often cited not making anyone sick in the past as a reason for their confidence in safe food handling practices.

Perceived Barriers of Participants

Results of perceived barriers are listed in Table 16. Participants indicated insufficient time as the most prevalent barrier to safe food handling practices, which is consistent with another study with restaurant employees (Howells et al., 2008). This result demonstrates that participants were willing to compensate safe food handling practices for quick meal preparation. Participants also perceived safe food handling practices as time consuming. Hence, food safety educators should aim to teach food handlers on how to prepare meals safely yet allowing them to save time. Encountering distractions was ranked as the second most common barrier to handle food safely in our study (Table 16). Focus groups of primary food handlers with

Table 16. Health Belief Model Constructs relating to Perceived Barriers based on the FightBac!™ **CLEAN, CHILL, SEPARATE and COOK** concepts

Please check the top three challenges that prevent you from handling food safety	Total ^a	CLEAN ^a	CHILL ^a	SEPARATE ^a	COOK ^a
n (%)	503 (100)	98 (100)	154 (100)	136 (100)	115 (100)
I need to prepare meals quickly.	417	80	126	118	93
I have a lot of distractions (for example, phone ringing, watching children).	387	81	112	109	85
I cannot control the food handling practice of other people at home.	309	70	91	88	60
Safe food handling practices requires too much work	79	11	29	11	28
I have little cooking skills.	69	6	21	20	22
I lack information on safe food handling.	60	13	13	22	12

^a Scores include participants who check one or more answers for this question

young children in another study cited children as one of the major distractions during meal preparation (Meysenburg, 2009). The third most common barrier to safe food handling practices was lack of control of other people's practices in the household. Possible reasons were uncertainty of how to enforce rules on other adults at home, inability to have constant vigilance of other people's practices or lack of cooperation from other people in the household.

Hence, food safety educators can offer food handlers tips on how to communicate safe food handling practices to other people in the household or minimize the foodborne risk caused by other people in the house. Too much work in

safe food handling was perceived as less of a barrier by participants in our study compared to a study conducted by Koepl (1998). Focus group participants in that study (Koepl, 1998) reported inconvenience and laziness as a reason for not using a thermometer. Few cooking skills were also perceived as less of a barrier by participants in our study, which is consistent with their reported high-self efficacy in preparing foods. Few participants (n=60, 11%) perceived lack of information as a barrier to handle food safely. This result is consistent with another study which reported less than one-fifth of participants (19%) cited lack of information as a barrier to safe food handling (IFIC, 2009). About seven percent of the participants skipped the question relating to perceived barriers, demonstrating that they may not perceive any barriers in performing safe food handling practices. This finding is much less than another study which reported more than half of the participants (58%) did not find any barriers to safe food handling (IFIC, 2009). Addition of the answer for “do not perceive any barrier” in our survey may have significantly changed the frequency distribution of responses in our survey. However, not having that answer available motivates ambivalent participants to think and choose a barrier that most closely resembled their barriers to safe food handling practices. Although the list for perceived barriers was exhaustive, the answers for this question was formulated based on focus groups of primary food handlers for families with young children (Meysenburg, 2009).

Cues to Action for Participants

About four-fifth of the participants (79%) reported changing their food handling practices if their family or they experienced food poisoning previously. In one study, parents with young children reported that they altered their food handling practices, such as wiping the counter, for the safety of their children (Koepl, 1998). However, 18 percent of participants in our study demonstrated ambivalence towards changing their food handling practices, even if they or their family fall sick. This result demonstrates that experiencing symptoms of an illness does not always lead to favorable behavior. A study revealed that food handlers who reported experiences of foodborne illness were less likely to practice safe food handling compared to those without experience (Fein et al., 1995). About 85 percent of consumers reported still eating ground beef even though they had experienced contracting *Salmonella* previously (Raab et al., 1997). Two studies reported that people who had experienced *Campylobacter jejuni/coli* and *Escherichia coli* 0157:H7 were less likely to practice safe food handling compared to people who have not experienced foodborne illness (Harris et al., 1986; Mead et al., 1995).

Correlation of Cues to Action with Food Handling Practices

CLEAN. Participants who changed their food handling practices after encountering food poisoning were more likely to have safer food handling practices ($r = 0.193$, $n = 98$, $p < 0.05$), especially when preparing food for their children ($r = 0.226$, $n = 98$, $p < 0.05$), but not for themselves ($r = 0.124$, $n = 98$, $p = 0.11$) (Appendix A-22).

Table 17. Health Belief Model Constructs relating to Cues to Action based on the FightBac!TM **CLEAN, CHILL, SEPARATE and COOK** concepts

Questions based on Health Belief Model Constructs	n	Strongly agree n (%)	Agree n (%)	Neutral n (%)	Disagree n (%)	Strongly Disagree n (%)
I change my food handling practices if my family or I had food poisoning.						
CLEAN	97 (100)	53 (55) ^a	27 (28) ^a	14 (14)	3 (3)	-
CHILL	152 (100)	86 (57) ^a	42 (28) ^a	18 (12)	4 (3)	2 (1)
SEPARATE	135 (100)	61 (45) ^a	36 (27) ^a	29 (22)	6 (4)	3 (2)
COOK	113 (100)	52 (46) ^a	32 (28) ^a	26 (23)	3 (3)	-
Total	497 (100)	252 (51) ^a	137 (28) ^a	87 (18)	16 (3)	5 (1)

^a Indicated favorable answer in the Health Belief Model Construct

CHILL. No significant results were found between cues to action and safe food handling practices within this concept (Appendix A-23).

SEPARATE. Participants who change their food handling practices after encountering food poisoning were more likely to have safer food handling practices, $r = 0.157$, $n = 136$, $p < 0.05$ (Appendix A-24).

COOK. Participants who change their food handling practices after encountering food poisoning were more likely to have safer food handling practices, ($r = 0.257$, $n = 115$, $p < 0.01$), whether preparing food for themselves ($r = 0.237$, $n = 115$, $p < 0.01$) or preparing food for their children ($r = 0.228$, $n = 115$, $p < 0.01$) (Appendix A-25).

Overall, participants who responded to cues of action (symptoms of foodborne illness) were more likely to perform safe food handling practices.

Preferred Characteristics of Food Safety Information

Participants were most likely to use food safety information, if the information was easy to understand, followed by having scientific facts, causing feelings of health-threat and having lots of pictures or visuals (Table 18). Meysenburg (2009) reported that some participants emphasized the importance of “shock-value” to motivate them to feel threatened enough to act. Koepl (1998) also reported that some participants agreed that they would use a meat thermometer if the media emphasized detrimental health effects for not using it. However, LaBudde (2003) warned that over-using scare tactics could, in turn, cause consumers to be apathetic about reducing their food handling risk, especially when every food handling practice or food is risky. The report recommended targeting or limiting food safety messages to one or a few messages to encourage change of behavior (LaBudde, 2003). Hence, scare tactics should be used cautiously to sufficiently prompt safe food handling practices. Participants in our study are representative of a more educated audience, with about four-fifths of participants (79%) completing at least some college. This demographic characteristic may be a reason why scientific facts were valued in food safety information. However, although participants appreciate scientific explanations of food handling practices, they find information presented in graphs or charts as less appealing, possibly because graphs and charts

Table 18. Preferred Characteristics of Food Safety Information based on the FightBac!™ **CLEAN, CHILL, SEPARATE and COOK** concepts

Please check the top three qualities that get your attention to use a food safety information.	n	CLEAN	CHILL	SEPARATE	COOK
N	503 (100)	98 (100)	154 (100)	136 (100)	115 (100)
Easy to understand	398	73	122	113	90
Has scientific facts	334	65	107	94	68
Makes me feel my health is in danger	272	59	84	66	63
Has lots of pictures or visuals	218	45	61	63	49
Has statistics with charts and graphs	169	35	60	43	31
Interactive (for example, hotline)	65	9	14	24	18

^a Scores include participants who choose more or less than three challenges

appear more complicated and intimidating to participants. Pictures and visuals were ranked higher than graphs and charts, possibly because of a higher aesthetic appeal and the impression of being less intimidating or complicated. Hence, safe food handling materials or programs may be effective if food safety educators use simple scientific messages accompanied with pictures or visuals that sufficiently threaten their health. Few participants (n=65,13%) chose interactivity of food safety information as a criteria for using the food safety information being presented.

Knowledge of Participants for the CLEAN Concept

Overall, participants demonstrated a reasonable knowledge level for the clean concept, including hand washing before meal preparation (95%), washing hands after touching raw meat (95%) and rinsing fruits and vegetables under tap water (87%); they perceived that these safe food handling practices can reduce the risk of food poisoning (Table 19). However, more than a third of the participants (37%) did not know a child could become sick from food poisoning more easily than an adult and perceived the statement to be incorrect. A number of participants did not know that washing hands can reduce the risk of foodborne illness, specifically after cracking raw eggs (11%) and after changing a diaper (10%). **Correlation of**

Knowledge and Safe Food Handling Practices for the CLEAN Concept

No significant correlation was found between knowledge and practicing safe food handling (Appendix A-30).

Knowledge of Participants for the CHILL Concept

Knowledge scores of participants are listed in Table 20. Participants generally demonstrated a fair knowledge about proper temperature control of food. More than four-fifths of the participants know about not feeding infant baby formula that has been at room temperature for more than two hours (88%) and dividing hot foods into shallow containers (86%). However, a number of participants did not know about following the proper food handling practices: 11 percent did not know that infant formula left at room temperature for more than two hours was safe to consume, 16 percent of participants did

Table 19. Knowledge Questions Based on the FightBac!TM **CLEAN** Concept

Knowledge questions	n	n (%)
Hand washing with soap and water before preparing food, including snacks:		
Increases the chance of food poisoning	97 (100)	1 (1)
Decreases the chance of food poisoning +		92 (95)
Makes no difference regarding food poisoning		4 (4)
After cracking raw eggs, hand washing with soap and water decreases the chance of getting a food poisoning.		
True +	97 (100)	85 (88)
False		1 (1)
I don't know		11 (11)
Washing my hands immediately after handling raw meat decreases the chance of getting a food poisoning.		
True +	96 (100)	91 (95)
False		-
I don't know		5 (5)
Rinsing fruits and vegetables under running tap water thoroughly can decrease the chance of food poisoning.		
True +	97 (100)	84 (87)
False		1 (1)
I don't know		12 (12)

A child is more likely than an adult to become sick from food poisoning		
True +	97 (100)	61 (63)
False		10 (10)
I don't know		26 (27)
Washing hands after changing a diaper		
Increases the chance of food poisoning	97 (100)	4 (4)
Decreases the chance of food poisoning +		83 (86)
Makes no difference regarding food poisoning		10 (10)

Table 20. Knowledge Questions Based on the FightBac!TM **CHILL** Concept

Knowledge questions	n	n (%)
It is safe to store raw eggs at room temperature		
True	154 (100)	10 (7)
False +		120 (78)
I don't know		24 (16)
If a leftover food looks and/or smells good, it is still safe to eat.		
True	151 (100)	18 (12)
False +		111 (74)
I don't know		22 (15)
What is the best way to handle leftover food? (Choose one)		
Leave on the countertop to cool for longer than 2 hours	153 (100)	4 (3)
Put in refrigerator within 2 hours of cooking it +		147 (96)

Put it in the refrigerator within 4 hours of cooking it	2 (1)	
It makes no difference	-	
<hr/>		
What is the best way to handle large quantities of hot foods before refrigeration? (Choose one)		
Store hot foods in the same cookware in which they were cooked or one deep container	153 (100)	8 (5)
Divide hot foods into shallow containers +		131 (86)
It makes no difference		14 (9)
<hr/>		
In general, how long can you store cooked hamburger and chicken in the refrigerator to eat later?		
1-2 days +	152 (100)	65 (43)
3-4 days +		77 (51)
5-7 days		10 (7)
More than a week		-
<hr/>		
In general, how long can you store raw hamburger and chicken in the refrigerator before cooking?		
1-2 days +	153 (100)	114 (75)
3-4 days +		36 (24)
5-7 days		2 (1)
More than a week		1 (1)
<hr/>		
Deli foods or luncheon meat kept beyond the expiration date are safe.		
True	154 (100)	7 (5)
False +		135 (88)
I don't know		12 (8)
<hr/>		

Is it safe or okay to give an infant a bottle of baby formula that has been out of the refrigerator for longer than 2 hours.		
True	154 (100)	1 (1)
False +		136 (88)
I don't know		17 (11)

Check the correct way(s) to thaw frozen meat? (Choose ALL that apply)		
In the refrigerator +	154 (100)	143
In the microwave +		92
On the countertop		27
Under running water +		62
In the sink of water +		47

Check the correct way(s) to thaw frozen meat? (Choose ALL that apply)		
Participants who selected all four correct answers	153 (100)	10 (7)
Participants who selected three correct answers		44 (29)
Participants who selected two correct answers		43 (28)
Participants who selected one correct answer		29 (19)
Participants who selected countertop		27 (18)

A child is more likely than an adult to become sick from food poisoning.		
True +	154 (100)	89 (58)
False		29 (19)
I don't know		36 (23)

not know that keeping raw eggs at room temperature was not safe and 18 percent incorrectly perceived that thawing meat on the counter was acceptable. Only seven percent of the participants chose all three correct ways to thaw frozen meat (the refrigerator, the microwave, and under running water).

The majority of participants (96%) demonstrated knowledge about storing food for refrigerating leftover food within two hours of cooking it.

Twelve percent of participants would eat a leftover food if it looked or smelled good and 15 percent did not know whether eating a leftover food based on looks and smells is safe. Their superficial judgment on food safety is a concern, since one third of participants' children (30%) eat leftovers all and most of the time.

For duration of food storage, the general rule for keeping leftover food to consume later was three to four days. Participants demonstrated a high level of knowledge for the duration of meat storage; 94 percent answered storing cooked hamburger and chicken correctly, and 99 percent answered storing raw hamburger and chicken correctly.

Eighty-eight percent of the participants perceived deli foods or luncheon meat kept beyond expiration date as unsafe. This percentage is higher than the percentage of participants in another study which reported that 48 percent of participants do not use expired luncheon meat (Bruhn et al., 1999).

A quarter of participants (23%) did not know if their child can get sick more easily than an adult, and 19 percent perceived the statement to be incorrect. Their lack of

knowledge demonstrates a need to educate primary food handlers about the vulnerability of their children.

Correlation of Knowledge with Food Handling Practices for the CHILL Concept

Participants who have a higher knowledge for safe food handling practices (for all practice questions for the chill concept except for questions relating to duration of storage for leftovers) in the chill concept were more likely to practice safe food handling, $r=0.279$, $p<0.01$, $n=154$. No significant correlations were found between having high knowledge and safe food practices for the duration of storage for leftovers (Appendix A-31).

Knowledge of Participants for the SEPARATE Concept

Overall, participants demonstrated a high level of knowledge for the separate concept for: not placing cooked meat on the same plate where raw meat has been (100%), not storing meat on the top shelf (90%), keeping raw meat and its juices away from other foods (94%) and placing raw meat in a separate bag from other food items before placing it in a grocery cart (92%) (Table 21). However, about one-fifth of participants (19%) erroneously perceived wiping the cutting board or counter with a dishrag or rinsing it with water, are acceptable ways of cleaning a cutting board or counter. One-fifth of the participants (20%) did not know that children have a higher likelihood of getting food poisoning compared to adults and a similar percentage of participants (18%) thought that children and adults have similar risks of food poisoning.

Table 21. Knowledge Questions Based on the FightBac!™ **SEPARATE** Concept

Knowledge questions	n	n (%)
It is safe to place cooked meat on the same plate where raw meat has been.		
True	136 (100)	-
False +		136 (100)
I don't know		-
Which is an acceptable way to clean a cutting board or counter after it is used for raw meat? (Choose ALL that apply)		
Rinse it well with water	136 (100)	26
Wipe it off with a dishrag		6
Wash with hot soapy water only +		60
Wash with hot soapy water, then rinse with bleach and water +		107
Clean with disinfectant (for example, Lysol, Clorox) +		75
Wash cutting board with dishwasher +		87
I don't know		2
Which is an acceptable way to clean a cutting board or counter after it is used for raw meat? (Choose ALL that apply)		
Participants who selected all four correct answers	136 (100)	16 (12)
Participants who selected three correct answers		48 (35)
Participants who selected two correct answers		17 (13)
Participants who selected one correct answer		27 (20)
Participants who selected "rinse is well with water" and "wipe it off with a dishrag"		26 (19)
I don't know		2 (1)

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After cutting raw meat, washing the cutting board with soap and hot water lowers the chance of food poisoning		
True +	136 (100)	119 (88)
False		5 (4)
I don't know		12 (9)
<hr/>		
Where is the best place to store raw meat in the refrigerator? (Choose ALL that apply)		
On the top shelf	136 (100)	8
On the bottom shelf +		74
In the drawer labeled "meat" +		72
Below ready-to-eat foods +		65
It makes no difference		6
<hr/>		
Where is the best place to store raw meat in the refrigerator? (Choose ALL that apply)		
Participants who selected all three correct answers	136 (100)	24 (18)
Participants who selected two correct answers		36 (26)
Participants who selected one correct answer		62 (46)
Participants who selected "on the top shelf"		8 (6)
Participants who selected "it makes no difference"		6 (4)
<hr/>		
Keeping raw meat and its juices away from other foods can decrease the chance food poisoning.		
True +	135 (100)	127 (94)
False		3 (2)
I don't know		5 (4)
<hr/>		

<hr/>		
Putting raw meat in a separate bag (from other food items) before placing it in the grocery cart:		
Increases the chance of food poisoning	135 (100)	-
Decreases the chance of food poisoning +		124 (92)
Makes no difference regarding food poisoning		11 (8)
<hr/>		
A child is more likely than an adult to become sick from food poisoning		
True +	135 (100)	84 (62)
False		24 (18)
I don't know		27 (20)
<hr/>		

Correlations of Knowledge with Safe Food Handling Practices for the SEPARATE Concept

Overall, participants who knew about safe food handling practices, were more likely to practice safe food handling practices, $r = 0.227$, $n = 136$, $p < 0.01$ (Appendix A-32). However, a contradicting relationship was observed between knowledge and practice of participants relating to cleaning a cutting board or counter. Among the recommended ways of cleaning cutting boards or counters, the majority of participants (52%) always use hot soapy water, in contrast with using bleach and hot soapy water (14%). However, among the correct methods to clean the cutting boards or counters, using bleach and hot soapy water ($n = 107$) was considered as the most acceptable way of cleaning, while using hot soapy water ($n = 60$, 11%) was the least acceptable way of cleaning, among the recommended ways of cleaning a counter or cutting board.

Knowledge of Participants for the COOK Concept

Overall, participants demonstrated a fair knowledge level for the cook concept, including: the food carrier for *Salmonella* (98%), improper use of microwave resulting in undercooked food (94%), decrease of food poisoning risk by reheating food until steaming or boiling (88%) and decrease of food poisoning risk by using a meat thermometer (86-87%) (Table 22). Although the majority of participants (98%) know undercooked chicken and raw eggs can carry *Salmonella*, 15 percent of participants perceived that consuming raw eggs as safe or did not know the risk of eating raw eggs. Half of the participants (50%) did not know *E.coli* in undercooked hamburger can cause kidney failure in children or perceived that the statement was incorrect. About one-third of participants perceived judging the degree of doneness by the appearance of hamburger (36%) and chicken (30%) as acceptable. A study demonstrated that although participants agreed that a thermometer is used to check the doneness of meat, they did not think that a thermometer is used to ensure the safety of food (Koepl, 1998). Their perception is incorrect because more than a quarter of hamburgers brown first, before reaching its safe internal temperature of 160° F (FSIS, 1998). One-third of participants did not know that a child has a higher food poisoning risk than an adult (19%) and perceived the statement was incorrect (14%).

Correlation of Knowledge and Safe Food Handling Practice for the COOK Concept

Participants who have higher knowledge in safe food handling practices were more likely to practice safe food handling, $r= 0.242$, $p<0.01$, $n=11$ (Appendix A-33).

Table 22. Knowledge questions Based on the FightBac!™ **COOK** Concept

Knowledge questions	n	n (%)
<i>E.coli</i> (a harmful bacteria) in undercooked hamburger causes kidney failure in children		
True +	112 (100)	56 (50)
False		4 (4)
I don't know		52 (46)
Undercooked chicken and raw eggs can carry <i>Salmonella</i> (a harmful bacteria)		
True +	114 (100)	112 (98)
False		-
I don't know		2 (2)
It is safe to use raw eggs in recipes that will not be cooked		
True	114 (100)	6 (5)
False +		97 (85)
I don't know		11 (10)
A child is more likely than an adult to become sick from food poisoning.		
True +	113 (100)	76 (67)
False		16 (14)
I don't know		21 (19)

What is the best way to tell when chicken has cooked long enough? (Choose one)		
The juices run clear	112 (100)	8 (7)
Cut open the meat		19 (17)
The meat falls off the bone		7 (6)
Test with meat thermometer +		77 (69)
I don't know		1 (1)

What is the best way to tell when hamburger has cooked long enough? (Choose one)		
The juices run clear	114 (100)	7 (6)
Cut open the meat		9 (8)
The meat is brown in the middle (no pink)		25 (22)
Test with a meat thermometer +		71 (62)
I don't know		2 (2)

Using a thermometer when testing the doneness of chicken:		
Increases the chance of food poisoning	113 (100)	2 (2)
Decreases the chance of food poisoning +		97 (86)
Makes no difference regarding food poisoning		14 (12)

Using a thermometer when testing the doneness of hamburger:		
Increases the chance of food poisoning	113 (100)	2 (2)
Decreases the chance of food poisoning +		98 (87)
Makes no difference regarding food poisoning		13 (12)

Reheating food until steaming or boiling:		
Increases the chance of food poisoning	114 (100)	2 (2)
Decreases the chance of food poisoning +		100 (88)
Makes no difference regarding food poisoning		12 (11)

Improper use of your microwave oven can results in undercooked food.		
True +	114 (100)	107 (94)
False		2 (2)
I don't know		5 (4)

Limitations

The self-reported results of consumer surveys may not truly reflect the actual practices of consumers due to the desire to appear more favorable or choosing the “right” answer. Wide interpretations of a term used in a survey may lead to inaccurate answers. For example, “adequate hand-washing or drying” may be interpreted as rinsing under water (Redmond & Griffith, 2003). In our study, “food poisoning” and “foodborne illness” is used interchangeably. The range of answers provided for the close-ended questions were not exhaustive in a survey. For example, only five answers were provided for the reasons that give food handlers the confidence to prepare food safely. However, answers were formulated to adequately reflect the possible answers given by the general population of primary food handlers for families with young children, based on the focus group results of the same demographic population (Meysenburg, 2009).

CONCLUSION

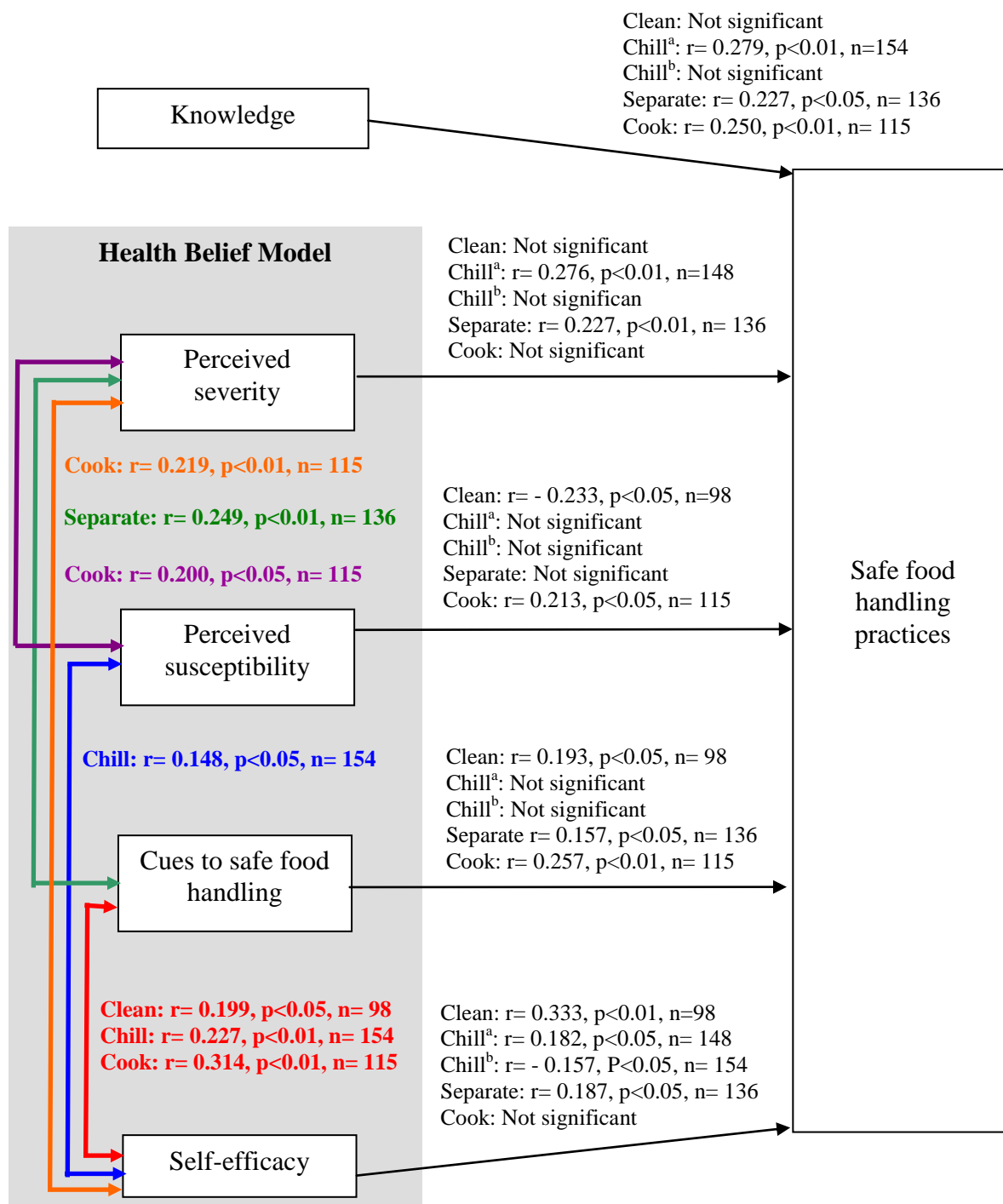
Food Handling Practices of Participants

Few participants in our study reached the food safety objective of Healthy People 2010 (79%) (USDHHS, 2000). For the clean concept, only washing hands after contact with raw meat (93%) exceeded the food safety objective for Healthy People 2010 (79%). For the chill concept, only refrigerating foods within two hours of buying them from a deli, restaurant, or grocery store (87%) and not storing raw eggs at room temperature (95%) exceeded the food safety objective of Healthy People 2010. As for the chill concept relating to the duration of storage for leftover food, only proper storage of leftover pizza (92%), hard cooked eggs (97%) and raw hamburger (97%) exceeded the food safety objective of Healthy People 2010. For the separate concept, only never placing cooked meat on the same plate where raw meat has been (93%) exceeded the food safety objective for Healthy People 2010. For the cook concept, only always stirring and rotating food in the microwave or having a microwave with an automatic turntable (82%) exceeded the food safety objective of Healthy People 2010. These results demonstrate that participants do not practice safe food handling in many areas within the FightBac!TM concepts.

Beliefs of Participants based on the Health Belief Model

A summary of our results are provided in Figure 3. Mixed results were reported for perceived severity of participants. Although many participants reported high half of them (56%) believed that their children could be healed from perceived severity (82%)

Figure 3. Research Model of the Relationship between Knowledge and Health Belief Model Constructs with Safe Food Handling Practices based on Spearman's rank correlation coefficient (ρ)



Source: Riggins [dissertation] (2006)

^aindicates all food handling practice questions within chill concept, excluding practice questions relating to duration of storage for leftover food

^bindicates food handling practices questions within chill concept, relating to duration of storage for leftover food

that their children can die from food poisoning, approximately food poisoning in one day or less (24%) and one-third of the participants (32%) were ambivalent about whether their children would heal in one day or less. These answers indirectly indicated their low perceived susceptibility for their children to experience severe health effects of foodborne illness. Only half of the participants (53-54%) reported high perceived susceptibility for their children in experiencing severe foodborne illness. The majority of participants (91%) were confident of their food handling practices in preventing their children from getting food poisoning by learning safe food handling practices from their family and independently acquiring knowledge and skills from the media, internet or their job. The three main barriers of participants were insufficient time, many distractions and lack of control of other people in the household. About four-fifth of the participants (79%) changed their food handling practices if their family or they experienced food poisoning previously. Participants are most likely to use food safety information if the information is easy to understand, followed by having scientific facts causing feelings of a health-threat and having lots of pictures or visuals.

Knowledge of Participants

Participants demonstrated high levels of knowledge in certain areas of the FightBac!TM concepts but appear to lack knowledge in other areas. Food handling practices that participants excelled in are as followed: 95 percent of participants knew washing their hands before meal preparation and after touching raw meat reduces the risk of foodborne illness (clean concept); 96 percent of participants knew about storing leftover food within two hours of cooking (chill concept); 94 percent answered storing cooked hamburger and

chicken correctly and 99 percent answered storing raw hamburger and chicken correctly (chill concept); 100 percent knew about not placing cooked meat and raw meat on the same plate, 94 percent knew about keeping raw meat and juices away from food, 92 percent knew about placing raw meat in separate bags before placing into the grocery cart and 90 percent knew about not storing meat on the top shelf of the refrigerator (separate concept); 98 percent knew the food carrier for *Salmonella* and 94 percent knew that improper use of the microwave result in undercooked food (cook concept).

However, 33 to 42 percent of participants in all concepts did not know that children have a higher likelihood of foodborne illness compared to adults, or perceived that the statement was incorrect. Mothers with infants were of particular concern because 14 percent of the participants (clean concept) did not know that washing hands after changing a diaper can decrease the risk of food poisoning or thought that the practice can increase the risk of food poisoning. Eleven percent did not know that infant formula left at room temperature for more than two hours is unsafe to consume.

Mishandling raw eggs appear to be a common unsafe food handling practice. Approximately a quarter of participants (23%) did not know that storing raw eggs at room temperature is unsafe or think storing eggs at room temperature is safe (chill concept) and 11 percent of participants did not know that washing hands after handling raw eggs can decrease the risk foodborne illness.

Half of the participants (50%) did not know that *E.coli* may cause kidney failure for their children, demonstrating a need to educate food handlers of the severity of foodborne illness for their children.

Many participants judged the safety of a food by its superficial appearance. About one third of participants judged whether hamburger (36%) or chicken (33%) is safe to eat by outward appearance (cook concept) and 15 percent would eat a leftover food if it looks or smells good.

Approximately one-fifth of participants (19%) wiped a cutting board or counter with a dishrag after contact with raw meat. This action promotes bacterial growth in the dishrag under its moist environment (Redmond & Griffith, 2004c). If food handlers were to wipe their hands on that dishrag at some point during meal preparation, bacteria can transfer to their hands and increase five fold (Redmond & Griffith, 2004c). These results demonstrate that participants are still lacking knowledge in multiple areas within the FightBac!TM concepts.

Correlation of Knowledge and Beliefs of Participants with Safe Food Handling Practices

Participants who have a high knowledge of safe food handling practices were more likely to have safe food handling practices. For the chill concept, (relating to all food handling practices excluding duration of storage for leftovers), separate concept, and cook concept participants demonstrated a positive relationship between knowledge and safe food handling practices.

Participants who have a high perceived severity, generally have a higher likelihood of performing safe food handling practices. Although only two concepts (chill concept relating to all food handling practices excluding duration of storage for leftovers,

and separate concept) demonstrated a significant positive relationship. Other surveys do not demonstrate any significant relationship between perceived severity and safe food handling practices.

Contradicting results were demonstrated for the relationship between perceived susceptibility and safe food handling practices. Although the cook concept demonstrates a positive relationship between perceived susceptibility and safe food handling practice, the clean concept demonstrates a negative relationship.

Participants who rated high for the cues to action construct demonstrated a positive relationship with safe food handling practices, specifically in the clean, separate and cook concepts.

Overall, participants who have high self-efficacy were more likely to practice safe food handling practices, although for the chill concept relating to duration of storage for leftovers, participants demonstrated a negative relationship between self-efficacy and safe food handling practices.

In conclusion, knowledge and cues to action have the highest number of significant and consistent positive correlations with safe food handling practices. Janz and Becker (1984) reported perceived susceptibility as a more relevant predictor of preventive health behavior while perceived severity has the lowest significance levels among all the HBM components in a preventative health behavior, which are actions taken to prevent illness. However, our study reported perceived susceptibility were least supportive of the HBM construct because only two concepts (cook and clean concept) demonstrated a significant relationship of perceived susceptibility with safe food

handling practice, where one relationship was positive (cook concept; $r = 0.213$, $p < 0.05$, $n = 115$) and the other relationship was negative (clean concept; $r = -0.233$, $p < 0.05$, $n = 98$).

Perceived severity demonstrated positive relationships with safe food handling practices, but only with the separate concept and chill concept including all practice questions except for duration of storage for leftover foods. Hence, knowledge and cues to action were better predictors of safe food handling practices than other constructs in the HBM.

Food safety practice questions relating to duration of storage for leftover food were least supportive of the HBM construct because no significant positive relationship was found between any HBM construct and the safe food handling practice for storage of leftover food. Food safety practice questions relating to the separate concept was most supportive of the HBM, demonstrating a positive relationship between safe food handling practices with knowledge, perceived severity, cues to action and self-efficacy. The chill concept (all practice questions except for questions relating to duration of storage for leftovers) was supportive of the HBM, demonstrating a positive relationship between safe food handling practices with knowledge, perceived severity and self-efficacy. Similarly, the cook concept was also supportive of the HBM, demonstrating a positive relationship between safe food handling practices and knowledge, perceived susceptibility and cues to action. The clean concept was fair in supporting the HBM, with a positive relationship between safe food handling practices and cues to action and self-efficacy, but a negative relationship between safe food handling practices and perceived susceptibility.

Correlation of Beliefs of Participants within Health Belief Model Construct

Harrison (1992) and colleagues noted that the importance of expressing relationships between components of the HBM to validate its role as a model. If there were no interactions between the components, the HBM cannot sustain its role as a model. Relationships of the HBM components with safe food handling practices in the food safety survey for families with young children are demonstrated in Figure 3.

A positive relationship was observed between all components of the HBM. Most food safety concepts demonstrated a positive relationship between self-efficacy and cues to action for: clean, $r = 0.199$, $p < 0.05$, $n = 98$; chill: $r = 0.227$, $p < 0.01$, $n = 154$; and cook: $r = 0.314$, $p < 0.01$, $n = 115$. This relationship indicates that a person who feels confident in safe food handling is more likely to be interested in changing their food handling practices when prompted by cues to safe food handling practices.

The results of the chill concept also demonstrated a positive relationship between self-efficacy and perceived susceptibility, $r = 0.148$, $p < 0.05$, $n = 154$. This relationship is difficult to explain because a person who feels more susceptible to foodborne illness should feel less confident of his or her food safety practices. A possible reason is that although participants may feel confident with their practices, they did not think they were in control of their children's risk of foodborne illness due to other factors not explored in our study. Studies have demonstrated that only 16 to 17 percent of consumers viewed that foodborne illness is caused by the consumption of food at home (Bruhn et al., 1999). Redmond and colleagues (2003) reported that the perception of home-cooked meals as being safer was consistent for the past 15 years. Hence, by attributing the cause of

foodborne illness to meals eaten away from home, participants may feel that their children were susceptible to foodborne illness, although they are confident of their safe food handling practices at home.

For the cook concept, a positive relationship was demonstrated between perceived severity and self-efficacy, $r = 0.219$, $p < 0.01$, $n = 115$. Participants, who perceived the high likelihood of their children in experiencing severe consequences from foodborne illness, may feel more motivated to learn about safe food handling practices, which contributed to their high perceived self-efficacy.

For the separate concept, a positive relationship was observed between perceived severity and cues to safe food handling, $r = 0.249$, $p < 0.01$, $n = 136$. This result demonstrates that participants with high perceived severity were more likely to respond to cues to safe food handling.

For the cook concept, participants who feel susceptible to foodborne illnesses were more likely to feel that the foodborne illness is severe as well, $r = 0.200$, $p < 0.05$, $n = 115$.

Application of the Social Marketing Method to Initiate Behavior Change

Results of our project will be used to initiate behavior change of primary food handlers for families with young children. We will be using the social marketing model, consisting of four components: product, price, place and promotion.

The product we want to initiate from our social marketing efforts is safe food handling practices among primary food handlers for families with young children.

The price is the exchange that one is required to pay to obtain the product. A person is more likely to initiate behavior with higher benefits and lower barriers. Safe food handling practice is a challenging behavior to promote because no apparent or immediate benefits are associated with safe food handling practices. The main benefit of safe food handling is the maintenance of a healthy and high quality life without the complications of foodborne illness. Because safe food handling practices do not visibly improve the quality of life, enticing food handlers to practice safe food handling is a challenge. Hence, evaluating the benefits of safe food handling is important to cause behavior change of primary food handlers.

One of the benefits of safe food handling is demonstrated by a common theme of family as a strong influencer of food handling practices and beliefs. Participants were significantly more likely to change their food handling practices if they or their family member fall sick. Family is also ranked as the main source of self-efficacy in safe food handling. Hence, a powerful though intangible benefit of safe food handling for primary food handlers would be to protect their family, especially their young children. Social marketing efforts should focus on the welfare of the family to initiate safe food handling among primary food handlers.

Another benefit of safe food handling is that parents or guardians play significant roles in affecting the food handling practices of their children. For example, children are more likely to eat undercooked hamburger if their parents were to eat undercooked hamburger. Hence, being role models for their children to practice safe food handling is another benefit of practicing safe food handling among primary food handlers.

In contrast to benefits, barriers to safe food handling are easier to identify including lack of time, distractions and practices of other people in the household, as reported in our study. Reducing these barriers can promote safe food handling. For example, messages relating to how quick safe food handling practices can be may appeal to food handlers.

In addition, their high self-efficacy (91%) and low perceived susceptibility (46-47%) are barriers to safe food handling as well. One-third of participants (32%) were ambivalent to whether their children will heal within one day of contracting the foodborne illness. Their lack of concern demonstrates that they may not be aware of the symptoms of foodborne illnesses, hence they could not identify a foodborne illness even if the participants or their children had previously experienced it. Hence, food handlers should be educated on the symptoms of foodborne illness to increase their perceived susceptibility. Our study also demonstrated that only 54 percent of participants believe and 58 to 67 percent knew that children are more vulnerable to foodborne illness compared to adults. Hence, educating food handlers about the symptoms for foodborne illness and the vulnerability of children to foodborne illness compared to adults can increase their perceived susceptibility for foodborne illness and increase likelihood of safe food handling practices.

In promoting safe food handling practices, the food safety messages need to be easy to understand, contain scientific information, cause a health-threatening feeling and have many visuals. For example, since half of the participants (50%) did not know that *E.coli* can cause kidney failure in children, a brief and simple explanation can be

provided for how and why kidney failure is more prevalent among young children with *E.coli* infection. To increase health threat, the prevalence of the disease can be included with a personal story of a mother who had a child experiencing *E.coli* infection, accompanied with a picture of failed kidney. By including all these components, one is more likely to perform safe food handling for their children.

As for places to promote safe food handling practices, food label, mailing, television and electronic mail are the most preferred ways in receiving information, based on our study. The goal of using these places is to minimize competing elements to increase likelihood of capturing the attention of food handlers to change behavior.

Hence, by integrating the product, price, place and promotion element in social marketing, primary food handlers are more likely to practice safe food handling.

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APPENDIX A-1.

LITERATURE SOURCES FOR FOOD HANDLING PRACTICES FOR THE
FIGHTBAC!TM **CLEAN** CONCEPTTable A-1. Literature Sources of Food Handling Practice for the FightBAC!TM **CLEAN** Concept.

Questions	Sources
I wash my hands with soap and running water before preparing food, even snacks.	Mitakakis et al., 2004; Unklesbay et al., 1998; Medeiros et al., 2004; Trepka et al., 2007
I wash my hands with warm soapy water after cracking open raw eggs.	Fein et al., 1995
I wash my hands immediately after handling raw meat.	Kendall et al., 2004,; Mitakakis et al., 2004; Fein et al., 1995; Medeiros et al., 2004
When I prepare fresh fruits and vegetables for myself, I thoroughly rinse the fruits and vegetables under running tap water, including those with skins and rinds that are not eaten.	Unklesbay et al., 1998; Mitakakis et al., 2004; Kendall et al., 2004; Trepka et al., 2007
After playing with a pet, I wash my hands with soap and water before handling food.	Kendall et al., 2004

APPENDIX A-2.

LITERATURE SOURCES FOR FOOD HANDLING PRACTICES FOR THE
FIGHTBAC!TM CHILL CONCEPT (FOR ALL FOOD HANDLING PRACTICES
 EXCLUDING QUESTIONS RELATING TO DURATION FOR STORAGE OF
 LEFTOVER FOODS)

Table A-2. Literature Sources of Food Handling Practice for rhw FightBAC!TM **CHILL** Concept (for all food handling practices excluding questions relating to duration for storage of leftover foods).

Questions	Sources
I store raw eggs at room temperature	Mitakakis et al., 2004
I thaw frozen meat on the countertop	Kwon et al., 2008; Medeiros et al., 2004; Trepka et al., 2007
When storing large quantities of hot foods, I place them in shallow containers in the refrigerator	EFNEP, 2009; Trepka et al., 2007
I refrigerate leftover foods within two hours of buying them from a deli, restaurant, or grocery store	Mitakakis et al., 2004; EFNEP, 2009; Unklesbay et al., 1998; Kwon et al., 2008; Trepka et al., 2007
How long do you keep foods like chili, soup, and stew in the refrigerator to eat later?	Trepka et al., 2007
How long do you keep hard-cooked eggs in the refrigerator to eat later?	Kendall et al., 2004
How long do you keep chicken nuggets or chicken patties in the refrigerator to eat later?	Medeiros et al., 2004; Kendall et al., 2004
I will eat leftover food if it looks and/or smells good.	Unklesbay et al., 1998
I throw away foods that have passed the expiration date	Unklesbay et al., 1998

APPENDIX A-3

LITERATURE SOURCES FOR FOOD HANDLING PRACTICES FOR THE
FIGHTBAC!TM **SEPARATE** CONCEPTTable A-3. Literature Sources of Food Handling Practice for the FightBAC!TM
SEPARATE Concept

Questions	Sources
I put cooked meat on the same plate where raw meat has been.	Mitakakis et al., 2004; Unklesbay et al., 1998; Kendall et al., 2004; Trepka et al., 2007
When purchasing raw meat at the grocery store, I put it in a separate bag (from other food items) before placing it in the cart.	Bryd-Bredbenner et al., 2007
After cutting raw meat, I rinse the cutting board or counter with water.	Fein et al., 1995
After cutting raw meat, I wipe the cutting board or counter with a dishrag.	Fein et al., 1995; Medeiros et al., 2004
After cutting raw meat, I wash the cutting board or counter in hot soapy water only.	Li-Cohen & Bruhn, 2002; Kendall et al., 2004; Fein et al., 1995; Trepka et al., 2007
After cutting raw meat, I wash the cutting board or counter with hot soapy water, then rinse with bleach and water.	Trepka et al., 2007

APPENDIX A-4

LITERATURE SOURCES FOR FOOD HANDLING PRACTICES FOR THE
FIGHTBAC!TM **COOK** CONCEPTTable A-4. Literature Sources of Food Handling Practice for the FightBAC!TM **COOK** Concept

Questions	Sources
I use a thermometer to test the doneness of chicken.	FDA, 2009; Kendall et al., 2004
I use a thermometer to test the doneness of hamburger.	EFNEP, 2009; Byrd-Bredbenner et al., 2007; Medeiros et al., 2004; Kendall et al., 2004
To test the doneness of hamburger, I cut the meat open or look at the color of the meat and its juices.	Kwon et al., 2008
I eat hamburger that is pink in the middle.	Unklesbay et al., 1998; Kendall et al., 2004; Trepka et al., 2007
I eat food containing raw eggs (for example, cookie dough, cake batter).	Unklesbay et al., 1998; Medeiros et al., 2004; Kendall et al., 2004; Trepka et al., 2007
I reheat leftover food until steaming or boiling.	Kwon et al., 2008; Unklesbay et al., 1998

APPENDIX A-5
PRACTICE QUESTIONS RELATING TO THE FIGHTBAC!™
CLEAN CONCEPT

1 | Choose the best answer that describes what *you* do

- | | |
|--|--|
| <p>1. I wash my hands with soap and running water before preparing food, even snacks.</p> <p><input type="checkbox"/> ALWAYS</p> <p><input type="checkbox"/> MOST OF THE TIME</p> <p><input type="checkbox"/> SOME OF THE TIME</p> <p><input type="checkbox"/> RARELY</p> <p><input type="checkbox"/> NEVER</p> <p>2. I wash my hands with warm soapy water after cracking open raw eggs.</p> <p><input type="checkbox"/> ALWAYS</p> <p><input type="checkbox"/> MOST OF THE TIME</p> <p><input type="checkbox"/> SOME OF THE TIME</p> <p><input type="checkbox"/> RARELY</p> <p><input type="checkbox"/> NEVER</p> <p>3. I wash my hands immediately after handling raw meat.</p> <p><input type="checkbox"/> ALWAYS</p> <p><input type="checkbox"/> MOST OF THE TIME</p> <p><input type="checkbox"/> SOME OF THE TIME</p> <p><input type="checkbox"/> RARELY</p> <p><input type="checkbox"/> NEVER</p> <p>4. When I prepare fresh fruits and vegetables for myself, I thoroughly rinse the fruits and vegetables under running tap water, including those with skins and rinds that are not eaten.</p> <p><input type="checkbox"/> ALWAYS</p> <p><input type="checkbox"/> MOST OF THE TIME</p> <p><input type="checkbox"/> SOME OF THE TIME</p> <p><input type="checkbox"/> RARELY</p> <p><input type="checkbox"/> NEVER</p> <p>5. After playing with a pet, I wash my hands with soap and water before handling food.</p> <p><input type="checkbox"/> ALWAYS</p> <p><input type="checkbox"/> MOST OF THE TIME</p> <p><input type="checkbox"/> SOME OF THE TIME</p> <p><input type="checkbox"/> RARELY</p> <p><input type="checkbox"/> NEVER</p> | <p>6. My child(ren) wash their hands with soap and running water before helping me in the kitchen or setting the table.</p> <p><input type="checkbox"/> ALWAYS</p> <p><input type="checkbox"/> MOST OF THE TIME</p> <p><input type="checkbox"/> SOME OF THE TIME</p> <p><input type="checkbox"/> RARELY</p> <p><input type="checkbox"/> NEVER</p> <p>7. My child(ren) wash their hands with soap and running water right before eating a snack or meal.</p> <p><input type="checkbox"/> ALWAYS</p> <p><input type="checkbox"/> MOST OF THE TIME</p> <p><input type="checkbox"/> SOME OF THE TIME</p> <p><input type="checkbox"/> RARELY</p> <p><input type="checkbox"/> NEVER</p> <p>8. After playing with a pet, my child(ren) wash their hands with soap and water before eating.</p> <p><input type="checkbox"/> ALWAYS</p> <p><input type="checkbox"/> MOST OF THE TIME</p> <p><input type="checkbox"/> SOME OF THE TIME</p> <p><input type="checkbox"/> RARELY</p> <p><input type="checkbox"/> NEVER</p> <p>9. When serving my children fresh fruits and vegetables, I thoroughly rinse fresh fruits and vegetables under running tap water, including those with skins and rinds that are not eaten.</p> <p><input type="checkbox"/> ALWAYS</p> <p><input type="checkbox"/> MOST OF THE TIME</p> <p><input type="checkbox"/> SOME OF THE TIME</p> <p><input type="checkbox"/> RARELY</p> <p><input type="checkbox"/> NEVER</p> |
|--|--|

APPENDIX A-6
KNOWLEDGE QUESTIONS RELATING TO THE FIGHTBAC!TM
CLEAN CONCEPT

3 | Choose the correct answer

1. Hand washing with soap and water before preparing food, including snacks:
☐ Increases the chance of food poisoning
☐ Decreases the chance of food poisoning
☐ Makes no difference regarding food poisoning
2. After cracking raw eggs, hand washing with soap and water decreases the chance of getting a food poisoning.
☐ TRUE
☐ FALSE
☐ I DON'T KNOW
3. Washing my hands immediately after handling raw meat decreases the chance of getting a food poisoning.
☐ TRUE
☐ FALSE
☐ I DON'T KNOW
4. Rinsing fruits and vegetables under running tap water thoroughly can decrease the chance of food poisoning.
☐ TRUE
☐ FALSE
☐ I DON'T KNOW
5. A child is more likely than an adult to become sick from food poisoning.
☐ TRUE
☐ FALSE
☐ I DON'T KNOW
6. Washing hands after changing a diaper:
☐ Increases the chance of food poisoning
☐ Decreases the chance of food poisoning
☐ Makes no difference regarding food poisoning

APPENDIX A-7
PRACTICE QUESTIONS RELATING TO THE FIGHTBAC!™
CHILL CONCEPT

1 | Choose the best answer that describes what *you* do

1. I store raw eggs at room temperature.
 - ☐ ALWAYS
 - ☐ MOST OF THE TIME
 - ☐ SOME OF THE TIME
 - ☐ RARELY
 - ☐ NEVER
2. I thaw frozen meat on the countertop.
 - ☐ ALWAYS
 - ☐ MOST OF THE TIME
 - ☐ SOME OF THE TIME
 - ☐ RARELY
 - ☐ NEVER
3. When storing large quantities of hot foods, I place them in shallow containers in the refrigerator.
 - ☐ ALWAYS
 - ☐ MOST OF THE TIME
 - ☐ SOME OF THE TIME
 - ☐ RARELY
 - ☐ NEVER
4. I refrigerate leftover foods within two hours of cooking them.
 - ☐ ALWAYS
 - ☐ MOST OF THE TIME
 - ☐ SOME OF THE TIME
 - ☐ RARELY
 - ☐ NEVER
5. I refrigerate foods within two hours of buying them from a deli, restaurant, or grocery store.
 - ☐ ALWAYS
 - ☐ MOST OF THE TIME
 - ☐ SOME OF THE TIME
 - ☐ RARELY
 - ☐ NEVER
6. How long do you keep foods like chili, soup, and stew in the refrigerator to eat later?
 - ☐ 1-2 DAYS
 - ☐ 3-4 DAYS
 - ☐ 5-7 DAYS
 - ☐ MORE THAN A WEEK
7. How long do you keep leftover pizza in the refrigerator to eat later?
 - ☐ 1-2 DAYS
 - ☐ 3-4 DAYS
 - ☐ 5-7 DAYS
 - ☐ MORE THAN A WEEK
8. How long do you keep hard-cooked eggs in the refrigerator to eat later?
 - ☐ 1-2 DAYS
 - ☐ 3-4 DAYS
 - ☐ 5-7 DAYS
 - ☐ MORE THAN A WEEK
9. How long do you keep chicken nuggets or chicken patties in the refrigerator to eat later?
 - ☐ 1-2 DAYS
 - ☐ 3-4 DAYS
 - ☐ 5-7 DAYS
 - ☐ MORE THAN A WEEK
10. How long do you keep raw chicken in the refrigerator before cooking?
 - ☐ 1-2 DAYS
 - ☐ 3-4 DAYS
 - ☐ 5-7 DAYS
 - ☐ MORE THAN A WEEK

APPENDIX A-7 (continued)
PRACTICE QUESTIONS RELATING TO THE FIGHTBAC!TM
CHILL CONCEPT

Choose the best answer that describes what *you* do | 2

11. How long do you keep raw hamburger in the refrigerator before cooking?

- ☐ 1-2 DAYS
- ☐ 3-4 DAYS
- ☐ 5-7 DAYS
- ☐ MORE THAN A WEEK

12. I will eat leftover food if it looks and/or smells good.

- ☐ ALWAYS
- ☐ MOST OF THE TIME
- ☐ SOME OF THE TIME
- ☐ RARELY
- ☐ NEVER

13. My child(ren) eat leftovers.

- ☐ ALWAYS
- ☐ MOST OF THE TIME
- ☐ SOME OF THE TIME
- ☐ RARELY
- ☐ NEVER

14. I throw away foods that have passed the expiration date.

- ☐ ALWAYS
- ☐ MOST OF THE TIME
- ☐ SOME OF THE TIME
- ☐ RARELY
- ☐ NEVER

APPENDIX A-8
KNOWLEDGE QUESTIONS RELATING TO THE FIGHTBAC!TM
CHILL CONCEPT

Choose the correct answer

4

1. It is safe to store raw eggs at room temperature.
☐ TRUE
☐ FALSE
☐ I DON'T KNOW
2. If a leftover food looks and/or smells good, it is still safe to eat.
☐ TRUE
☐ FALSE
☐ I DON'T KNOW
3. What is the best way to handle leftover food? (Choose one)
☐ Leave on the countertop to cool for longer than 2 hours
☐ Put in the refrigerator within 2 hours of cooking it
☐ Put in the refrigerator within 4 hours of cooking it
☐ It makes no difference
4. What is the best way to handle large quantities of hot foods before refrigeration? (Choose one)
☐ Store hot foods in the same cookware in which they were cooked or one deep container
☐ Divide hot foods into shallow containers
☐ It makes no difference
5. In general, how long can you store cooked hamburger and chicken in the refrigerator to eat later?
☐ 1-2 DAYS
☐ 3-4 DAYS
☐ 5-7 DAYS
☐ MORE THAN A WEEK
6. In general, how long can you store raw hamburger and chicken in the refrigerator before cooking?
☐ 1-2 DAYS
☐ 3-4 DAYS
☐ 5-7 DAYS
☐ MORE THAN A WEEK
7. Deli foods or luncheon meat kept beyond the expiration date are safe.
☐ TRUE
☐ FALSE
☐ I DON'T KNOW
8. Is it safe or okay to give an infant a bottle of baby formula that has been out of the refrigerator for longer than 2 hours.
☐ TRUE
☐ FALSE
☐ I DON'T KNOW
9. Check the correct way(s) to thaw frozen meat? (Choose **ALL** that apply)
☐ In the refrigerator
☐ In the microwave
☐ On the countertop
☐ Under running water
☐ In the sink of water
10. A child is more likely than an adult to become sick from food poisoning.
☐ TRUE
☐ FALSE
☐ I DON'T KNOW

APPENDIX A-9
PRACTICE QUESTIONS RELATING TO THE FIGHTBAC!™
SEPARATE CONCEPT

1 | Choose the best answer that describes what *you* do

- | | |
|--|---|
| <p>1. I put cooked meat on the same plate where raw meat has been.</p> <p><input type="checkbox"/> ALWAYS</p> <p><input type="checkbox"/> MOST OF THE TIME</p> <p><input type="checkbox"/> SOME OF THE TIME</p> <p><input type="checkbox"/> RARELY</p> <p><input type="checkbox"/> NEVER</p> | <p>6. After cutting raw meat, I wash the cutting board or counter with hot soapy water, then rinse with bleach and water.</p> <p><input type="checkbox"/> ALWAYS</p> <p><input type="checkbox"/> MOST OF THE TIME</p> <p><input type="checkbox"/> SOME OF THE TIME</p> <p><input type="checkbox"/> RARELY</p> <p><input type="checkbox"/> NEVER</p> |
| <p>2. When purchasing raw meat at the grocery store, I put it in a separate bag (from other food items) before placing it in the cart.</p> <p><input type="checkbox"/> ALWAYS</p> <p><input type="checkbox"/> MOST OF THE TIME</p> <p><input type="checkbox"/> SOME OF THE TIME</p> <p><input type="checkbox"/> RARELY</p> <p><input type="checkbox"/> NEVER</p> | <p>7. After cutting raw meat, I clean the cutting board or counter with disinfectant (for example, Lysol, Clorox).</p> <p><input type="checkbox"/> ALWAYS</p> <p><input type="checkbox"/> MOST OF THE TIME</p> <p><input type="checkbox"/> SOME OF THE TIME</p> <p><input type="checkbox"/> RARELY</p> <p><input type="checkbox"/> NEVER</p> |
| <p>3. After cutting raw meat, I rinse the cutting board or counter with water.</p> <p><input type="checkbox"/> ALWAYS</p> <p><input type="checkbox"/> MOST OF THE TIME</p> <p><input type="checkbox"/> SOME OF THE TIME</p> <p><input type="checkbox"/> RARELY</p> <p><input type="checkbox"/> NEVER</p> | <p>8. After cutting raw meat, I wash the cutting board in the dishwasher.</p> <p><input type="checkbox"/> ALWAYS</p> <p><input type="checkbox"/> MOST OF THE TIME</p> <p><input type="checkbox"/> SOME OF THE TIME</p> <p><input type="checkbox"/> RARELY</p> <p><input type="checkbox"/> NEVER</p> |
| <p>4. After cutting raw meat, I wipe the cutting board or counter with a dishrag.</p> <p><input type="checkbox"/> ALWAYS</p> <p><input type="checkbox"/> MOST OF THE TIME</p> <p><input type="checkbox"/> SOME OF THE TIME</p> <p><input type="checkbox"/> RARELY</p> <p><input type="checkbox"/> NEVER</p> | <p>9. I place raw meat above ready-to-eat foods in the refrigerator.</p> <p><input type="checkbox"/> ALWAYS</p> <p><input type="checkbox"/> MOST OF THE TIME</p> <p><input type="checkbox"/> SOME OF THE TIME</p> <p><input type="checkbox"/> RARELY</p> <p><input type="checkbox"/> NEVER</p> |
| <p>5. After cutting raw meat, I wash the cutting board or counter in hot soapy water only.</p> <p><input type="checkbox"/> ALWAYS</p> <p><input type="checkbox"/> MOST OF THE TIME</p> <p><input type="checkbox"/> SOME OF THE TIME</p> <p><input type="checkbox"/> RARELY</p> <p><input type="checkbox"/> NEVER</p> | <p>10. I put raw meat on a plate/container or into a bag/wrapper before placing it into the refrigerator.</p> <p><input type="checkbox"/> ALWAYS</p> <p><input type="checkbox"/> MOST OF THE TIME</p> <p><input type="checkbox"/> SOME OF THE TIME</p> <p><input type="checkbox"/> RARELY</p> <p><input type="checkbox"/> NEVER</p> |

APPENDIX A-10
KNOWLEDGE QUESTIONS RELATING TO THE FIGHTBAC!TM
SEPARATE CONCEPT

3 | Choose the correct answer

1. It is safe to place cooked meat on the same plate where raw meat has been.
☐ TRUE
☐ FALSE
☐ I DON'T KNOW
2. Which is an acceptable way to clean a cutting board or counter after it is used for raw meat? (Choose **ALL** that apply)
☐ Rinse it well with water
☐ Wipe it off with a dishrag
☐ Wash with hot soapy water only
☐ Wash with hot soapy water, then rinse with bleach and water
☐ Clean with disinfectant (for example, Lysol, Clorox)
☐ Wash cutting board in dishwasher
☐ I don't know
3. After cutting raw meat, washing the cutting board with soap and hot water lowers the chance of food poisoning.
☐ TRUE
☐ FALSE
☐ I DON'T KNOW
4. Where is the best place to store raw meat in the refrigerator? (Choose **ALL** that apply)
☐ On the top shelf
☐ On the bottom shelf
☐ In the drawer labeled "meat"
☐ Below ready-to-eat foods
☐ It makes no difference
5. Keeping raw meat and its juices away from other foods can decrease the chance food poisoning.
☐ TRUE
☐ FALSE
☐ I DON'T KNOW
6. Putting raw meat in a separate bag (from other food items) before placing it in the grocery cart:
☐ Increases the chance of food poisoning
☐ Decreases the chance of food poisoning
☐ Makes no difference regarding food poisoning
7. A child is more likely than an adult to become sick from food poisoning.
☐ TRUE
☐ FALSE
☐ I DON'T KNOW

APPENDIX A-11
PRACTICE QUESTIONS RELATING TO FIGHTBAC!™
COOK CONCEPT

1 | Choose the best answer that describes what *you* do

1. I use a thermometer to test the doneness of chicken.
☐ ALWAYS
☐ MOST OF THE TIME
☐ SOME OF THE TIME
☐ RARELY
☐ NEVER
2. I use a thermometer to test the doneness of hamburger.
☐ ALWAYS
☐ MOST OF THE TIME
☐ SOME OF THE TIME
☐ RARELY
☐ NEVER
3. To test the doneness of chicken, I look at the juices, cut open the meat, or see if meat falls off the bones.
☐ ALWAYS
☐ MOST OF THE TIME
☐ SOME OF THE TIME
☐ RARELY
☐ NEVER
4. To test the doneness of hamburger, I cut the meat open or look at the color of the meat and its juices.
☐ ALWAYS
☐ MOST OF THE TIME
☐ SOME OF THE TIME
☐ RARELY
☐ NEVER
5. I eat hamburger that is pink in the middle.
☐ ALWAYS
☐ MOST OF THE TIME
☐ SOME OF THE TIME
☐ RARELY
☐ NEVER
6. I eat food containing raw eggs (for example, cookie dough, cake batter).
☐ ALWAYS
☐ MOST OF THE TIME
☐ SOME OF THE TIME
☐ RARELY
☐ NEVER
7. I reheat leftover food until steaming or boiling.
☐ ALWAYS
☐ MOST OF THE TIME
☐ SOME OF THE TIME
☐ RARELY
☐ NEVER
8. I follow the manufacturer's instructions when microwaving foods (for example, length of microwaving time).
☐ ALWAYS
☐ MOST OF THE TIME
☐ SOME OF THE TIME
☐ RARELY
☐ NEVER
9. I use microwave-safe containers to microwave foods.
☐ ALWAYS
☐ MOST OF THE TIME
☐ SOME OF THE TIME
☐ RARELY
☐ NEVER
10. I stir and rotate food in the microwave or my microwave has an automatic turntable.
☐ ALWAYS
☐ MOST OF THE TIME
☐ SOME OF THE TIME
☐ RARELY
☐ NEVER
11. I know my microwave wattage.
☐ YES
☐ NO

APPENDIX A-11
PRACTICE QUESTIONS RELATING TO THE FIGHTBAC!TM
COOK CONCEPT (CONTINUE)

Choose the best answer that describes what *you* do | 2

- | | |
|---|--|
| <p>1. I use a thermometer to test the doneness of chicken when preparing chicken for my child(ren).</p> <p><input type="checkbox"/> ALWAYS</p> <p><input type="checkbox"/> MOST OF THE TIME</p> <p><input type="checkbox"/> SOME OF THE TIME</p> <p><input type="checkbox"/> RARELY</p> <p><input type="checkbox"/> NEVER</p> | <p>4. My child(ren) eat food containing raw eggs (for example, cookie dough, cake batter).</p> <p><input type="checkbox"/> ALWAYS</p> <p><input type="checkbox"/> MOST OF THE TIME</p> <p><input type="checkbox"/> SOME OF THE TIME</p> <p><input type="checkbox"/> RARELY</p> <p><input type="checkbox"/> NEVER</p> |
| <p>2. I use a thermometer to test the doneness of hamburger when preparing hamburger for my child(ren).</p> <p><input type="checkbox"/> ALWAYS</p> <p><input type="checkbox"/> MOST OF THE TIME</p> <p><input type="checkbox"/> SOME OF THE TIME</p> <p><input type="checkbox"/> RARELY</p> <p><input type="checkbox"/> NEVER</p> | <p>5. My child(ren) eat leftover foods.</p> <p><input type="checkbox"/> ALWAYS</p> <p><input type="checkbox"/> MOST OF THE TIME</p> <p><input type="checkbox"/> SOME OF THE TIME</p> <p><input type="checkbox"/> RARELY</p> <p><input type="checkbox"/> NEVER</p> |
| <p>3. My child(ren) eat hamburger that is pink in the middle.</p> <p><input type="checkbox"/> ALWAYS</p> <p><input type="checkbox"/> MOST OF THE TIME</p> <p><input type="checkbox"/> SOME OF THE TIME</p> <p><input type="checkbox"/> RARELY</p> <p><input type="checkbox"/> NEVER</p> | |

APPENDIX A-12
KNOWLEDGE QUESTIONS RELATING TO THE FIGHTBAC!TM
COOK CONCEPT

Choose the correct answer | 4

1. *E. coli* (a harmful bacteria) in undercooked hamburger causes kidney failure in children.
☐ TRUE
☐ FALSE
☐ I DON'T KNOW
2. Undercooked chicken and raw eggs can carry *Salmonella* (a harmful bacteria).
☐ TRUE
☐ FALSE
☐ I DON'T KNOW
3. It is safe to use raw eggs in recipes that will not be cooked.
☐ TRUE
☐ FALSE
☐ I DON'T KNOW
4. A child is more likely than an adult to become sick from food poisoning.
☐ TRUE
☐ FALSE
☐ I DON'T KNOW
5. What is the best way to tell when chicken has cooked long enough? (Choose one)
☐ The juices run clear
☐ Cut open the meat
☐ The meat falls off the bone
☐ Test with a meat thermometer
☐ I don't know
6. What is the best way to tell when hamburger has cooked long enough? (Choose one)
☐ The juices run clear
☐ Cut open the meat
☐ The meat is brown in the middle (no pink)
☐ Test with a meat thermometer
☐ I don't know
7. Using a thermometer when testing the doneness of chicken:
☐ Increases the chance of food poisoning
☐ Decreases the chance of food poisoning
☐ Makes no difference regarding food poisoning
8. Using a thermometer when testing the doneness of hamburger:
☐ Increases the chance of food poisoning
☐ Decreases the chance of food poisoning
☐ Makes no difference regarding food poisoning
9. Reheating food until steaming or boiling:
☐ Increases the chance of food poisoning
☐ Decreases the chance of food poisoning
☐ Makes no difference regarding food poisoning
10. Improper use of your microwave oven can result in undercooked food.
☐ TRUE
☐ FALSE
☐ I DON'T KNOW

APPENDIX A-13
BELIEF QUESTIONS BASED ON THE HEALTH BELIEF MODEL CONSTRUCTS

3 | Choose the best answer that describes *your* beliefs

1. I change my food handling practices if my family or I had food poisoning.
☐ STRONGLY AGREE
☐ AGREE
☐ NEUTRAL
☐ DISAGREE
☐ STRONGLY DISAGREE
2. If my child(ren) got sick from food poisoning, they will be well in one day or less.
☐ STRONGLY AGREE
☐ AGREE
☐ NEUTRAL
☐ DISAGREE
☐ STRONGLY DISAGREE
3. My child(ren) can get sick from food poisoning more easily than me.
☐ STRONGLY AGREE
☐ AGREE
☐ NEUTRAL
☐ DISAGREE
☐ STRONGLY DISAGREE
4. When I prepare food for my child(ren), I am more careful than when I am preparing food just for myself.
☐ STRONGLY AGREE
☐ AGREE
☐ NEUTRAL
☐ DISAGREE
☐ STRONGLY DISAGREE
5. I am confident that my food handling practices at home can prevent my child(ren) from getting food poisoning.
☐ STRONGLY AGREE
☐ AGREE
☐ NEUTRAL
☐ DISAGREE
☐ STRONGLY DISAGREE
6. Please rank (1-5) the reasons that give you the confidence to prepare food safely. (1= give most confidence).
___ My family taught me (for example, mother, grandmother, mother-in-law)
___ My friends taught me
___ I had food handling training (for example, job, workshop, classes)
___ I did not make anyone sick from food before
___ I learned to prepare food safely myself (for example, media, internet)
7. Please check the top three challenges that prevent you from handling food safely.
☐ I need to prepare meals quickly
☐ I have a lot of distractions [for example, phone ringing, watching child(ren)]
☐ I cannot control the food handling practice of other people at home
☐ I have little cooking skills
☐ I lack information on safe food handling
☐ Safe food handling practices requires too much work
8. Please check the top three qualities that get your attention to use a food safety information.
☐ Easy to understand
☐ Has lots of pictures or visuals
☐ Has scientific facts
☐ Has statistics with charts and graphs
☐ Interactive (for example, hotline)
☐ Makes me feel my health is in danger
9. My child(ren) could die from food poisoning.
☐ STRONGLY AGREE
☐ AGREE
☐ NEUTRAL
☐ DISAGREE
☐ STRONGLY DISAGREE

APPENDIX A-14

DEMOGRAPHIC QUESTIONS

1. What is your gender?
 - ☐ MALE
 - ☐ FEMALE
2. What is your ethnic background(s)?
(Choose **ALL** that apply)
 - ☐ American Indian or Alaska
 - ☐ Asian
 - ☐ Black or African American
 - ☐ Caucasian or White
 - ☐ Hispanic or Latino
(A person of Mexican, Puerto Rican, Cuban, South or Central American, or other Spanish culture or origin)
 - ☐ Native Hawaiian or other Pacific Islander
(A person from Hawaii, Guam, Samoa, or other Pacific islands)
 - ☐ Other, please specify _____
3. In what year were you born? _____
4. What is the last grade or year of school that you have completed?
 - ☐ Less than high school
 - ☐ Some high school
 - ☐ High school (graduate or GED)
 - ☐ Additional training beyond high school (not college)
 - ☐ Some college
 - ☐ College graduate
 - ☐ Post-graduate
5. How many child(ren) aged 10 years or younger are currently living in your household? _____
6. Please list the year and month your child(ren) were born (for example, May 2009):

FIRST CHILD _____	FOURTH CHILD _____
SECOND CHILD _____	FIFTH CHILD _____
THIRD CHILD _____	SIXTH CHILD _____
7. How often do you prepare the main meal in your household?
 - ☐ ALL OF THE TIME
 - ☐ NEARLY ALL OF THE TIME
 - ☐ SOME OF THE TIME
 - ☐ NEVER
8. How many meals per week does your child(ren) eat that come from a restaurant, fast food, takeout, delivery, childcare or school?
 - ☐ 0-1 meals per week
 - ☐ 2-3 meals per week
 - ☐ 4-5 meals per week
 - ☐ 6-7 meals per week
 - ☐ More than 7 meals per week
 - ☐ My child(ren) does not eat from a restaurant, fast food, takeout, delivery, childcare or school
9. Please select and rank the top 3 (1-3) choices for how you would like to receive food safety information in the future? (1= top choice)
 - ____ Mail
 - ____ E-mail
 - ____ Television
 - ____ Radio
 - ____ Text message
 - ____ Podcast or video
 - ____ Food label
 - ____ Brochure at grocery store
 - ____ Hotline for food safety information (1-800-NUMBER)
 - ____ Magazine
 - ____ Cookbooks
 - ____ Newspaper
 - ____ School newsletter
 - ____ Classes or workshops
 - Other, please list: _____
 - ☐ I would **NOT** be interested to receive information about food safety.



FOOD HANDLING SURVEY

for families with young children

APPENDIX A-16
IRB APPROVED COVER LETTER



College of Education and Human Sciences
Department of Nutrition and Health Sciences



Dear Parent or Guardian,

Are you the main food preparer in your family? Your input is important to us!

You are selected to complete the Food Handling Survey for Families with Young Children because you have child(ren) ten years old or under.

The survey will take about 20 minutes to complete.

We are conducting this survey for a research project. You must be 19 years or older to participate in this survey. Your responses will be confidential and will be kept for two years before being discarded. All results will be reported in a group format and not individually. Combined results will be published in scientific journals or presented at scientific meetings.

We strongly urge you to complete the survey although you can stop at any time and return the survey to us. Your participation is voluntary, and there are no known risks in completing this survey.

We will randomly select three participants to receive a Wal-mart® gift card worth \$50 each. Please fill the enclosed card to be eligible for the drawing. Return it with your survey. The card will be separated from your survey so that your survey responses remain anonymous.

Completing this survey will indicate your consent to include your responses in our data. We ask that you return the survey within *10 days in the stamped addressed envelope* provided. Please try to complete all the questions.

You can remove this page for your records. If you have any questions about the survey, please contact the primary investigator, Dr Julie Albrecht at 402-472-8884 (jalbrecht1@unl.edu), the secondary investigator, Adeline Lum at 316-737-0299 (adeline_lkm@hotmail.com), or University of Nebraska-Lincoln Institutional Review Board, at telephone 402-472-6965.

Thank you,

Julie A. Albrecht, Ph.D., R.D.
Professor/ Extension Food Specialist
Department of Nutrition and Health Sciences

Adeline Lum
Graduate student
Department of Nutrition and Health Science

APPENDIX A-17
POSTCARD REMINDER



College of Education and Human Sciences
Department of Nutrition and Health Sciences

Food Handling Survey for Families with Young Children

Thank you for returning your food handling survey for families with young children.

We have sent a food handling survey to you two weeks ago. You were selected because you have at least one child ten years old and below.

If you have not returned your survey, please take 20 of your time to complete the survey.

If by some chance you did not receive the survey, or it got misplaced, please contact the primary investigator, Dr Julie A. Albrecht at 402-472-8884 (jalbrecht1@unl.edu), the secondary investigator, Adeline Lum K at 402-472-3717 (adeline_lkm@hotmail.com) and we will get another one in the mail to you today.

Sincerely,

Julie A. Albrecht, Ph.D., R.D.
Professor/ Extension Food Specialist
Department of Nutrition and Health Sciences

Adeline Lum
Graduate student
Department of Nutrition and Health Science

APPENDIX A-18
RESPONSE RATE OF SURVEY FROM EACH STATE IN THE UNITED STATES

State	n	Percent
CALIFORNIA	42	8%
OHIO	33	6%
TEXAS	31	6%
NEW YORK	28	5%
ILLINOIS	26	5%
PENNSYLVANIA	24	4%
MISSOURI	23	4%
FLORIDA	22	4%
MICHIGAN	22	4%
GEORGIA	19	3%
WISCONSIN	19	3%
MASSACHUSETTS	17	3%
NORTH CAROLINA	17	3%
VIRGINIA	17	3%
INDIANA	15	3%
MINNESOTA	15	3%
NEW JERSEY	15	3%
MARYLAND	12	2%
TENNESSEE	12	2%
UTAH	12	2%
SOUTH CAROLINA	10	2%
ARIZONA	9	2%
IOWA	9	2%
ALABAMA	8	1%
COLORADO	8	1%
NEBRASKA	8	1%
OREGON	8	1%
KANSAS	6	1%
KENTUCKY	6	1%
LOUISIANA	6	1%
WASHINGTON	6	1%
ARKANSAS	5	1%
NEVADA	5	1%
CONNECTICUT	4	1%
MONTANA	4	1%
OKLAHOMA	4	1%
NEW HAMPSHIRE	3	1%
NORTH DAKOTA	3	1%
RHODE ISLAND	3	1%
SOUTH DAKOTA	3	1%

State	n	Percent
MAINE	2	0%
MISSISSIPPI	2	0%
NEW MEXICO	2	0%
DELAWARE	1	0%
DISTRICT OF COLUMBIA	1	0%
IDAHO	1	0%
VERMONT	1	0%
WEST VIRGINIA	1	0%
ALASKA	0	0%
AMERICAN SAMOA	0	0%
FEDERATED STATES OF MICRONESIA	0	0%
GUAM	0	0%
HAWAII	0	0%
MARSHALL ISLANDS	0	0%
NORTHERN MARIANA ISLANDS	0	0%
PALAU	0	0%
PUERTO RICO	0	0%
VIRGIN ISLANDS	0	0%
WYOMING	0	0%

APPENDIX A-19
DEMOGRAPHIC CHARACTERISTICS OF PERSONS WITH TWO OR MORE
ETHNIC BACKGROUNDS

Table A-19: Demographic characteristics of persons with two or more ethnic backgrounds

Demographic Characteristics	Total n (%)	Clean n (%)	Chill n (%)	Separate n (%)	Cook n (%)
Other					
Caucasian and Hispanic	8 (2)	1 (1)	3 (2)	2 (2)	2 (2)
Caucasian and American Indian	10 (2)	3 (3)	2 (1)	3 (2)	2 (2)
Caucasian and Asian	2 (<1)	1 (1)	0 (0)	1 (1)	0 (0)
Black and Hispanic	1 (<1)	0 (0)	1 (1)	0 (0)	0 (0)
Black and American Indian or Alaska	1 (<1)	0 (0)	0 (0)	1 (1)	0 (0)
Black and Asian	1 (<1)	0 (0)	0 (0)	1 (1)	0 (0)
Caucasian, American Indian and Hispanic	1 (<1)	1 (1)	0 (0)	0 (0)	0 (0)
Caucasian, American Indian and Black	1 (<1)	0 (0)	0 (0)	1 (1)	0 (0)

APPENDIX A-20
CORRELATIONS BETWEEN FOOD HANDLING PRACTICES OF PARTICIPANTS
FOR THEMSELVES AND FOR THEIR CHILDREN FOR THE FIGHTBAC!™
CLEAN CONCEPT

Table A-20. Correlations between food handling practices of participants for themselves and for their children for the FightBac!™ CLEAN concept.							
Spearman's rho	Wash hands before snacks ^a	Correlation Coefficient Sig. (1-tailed) N	Wash hands before snacks ^b	Wash hands after playing with pet ^a	Wash hands after playing with pet ^b	Wash fresh fruits and vegetables ^a	Wash fresh fruits and vegetables ^b
			.339**	.390**	.253**	.374**	.382**
			.000	.000	.006	.000	.000
			98	97	97	98	98
	Wash hands before snacks ^b	Correlation Coefficient Sig. (1-tailed) N		.220*	.497**	.485**	.481**
				.015	.000	.000	.000
				97	97	98	98
	Wash hands after playing with pet ^a	Correlation Coefficient Sig. (1-tailed) N			.449**	.348**	.314**
					.000	.000	.001
					97	97	97
	Wash hands after playing with pet ^b	Correlation Coefficient Sig. (1-tailed) N				.347**	.410**
						.000	.000
						97	97
	Wash fresh fruits and vegetables ^a	Correlation Coefficient Sig. (1-tailed) N					.804**
							.000
							98

*, Correlation is significant at the 0.05 level (1-tailed).

**, Correlation is significant at the 0.01 level (1-tailed).

^a indicates food handling practices of participants for themselves

^b indicates food handling practices of participants for their children

APPENDIX A-21
CORRELATIONS BETWEEN FOOD HANDLING PRACTICES OF PARTICIPANTS
FOR THEMSELVES AND FOR THEIR CHILDREN FOR THE FIGHTBAC!™
COOK CONCEPT

Table A-21. Correlations between food handling practices of participants for themselves and for their children for the FightBac!™ COOK concept.

Spearman's rho	Use thermometer for chicken ^a	Correlation Coefficient	Use thermometer for chicken ^b		Use thermometer for hamburger ^a		Use thermometer for hamburger ^b		Eat pink hamburger ^a	Eat pink hamburger ^b	Eat raw eggs ^a	Eat raw eggs ^b
			Use thermometer for chicken ^b	Sig. (1-tailed)	Use thermometer for hamburger ^a	Sig. (1-tailed)	Use thermometer for hamburger ^b	Sig. (1-tailed)				
			.840^{**}		.689^{**}		.689^{**}		-.031	-.009	.047	.014
			.000		.000		.000		.371	.462	.310	.441
			113		113		113		113	113	113	113
	Use thermometer for chicken ^b	Correlation Coefficient	.608^{**}		.771^{**}		.771^{**}		-.116	-.089	-.002	.039
		Sig. (1-tailed)	.000		.000		.000		.109	.173	.491	.341
		N	114		114		114		114	114	113	114
	Use thermometer for hamburger ^a	Correlation Coefficient	.714^{**}		.714^{**}		.714^{**}		.033	.019	.011	.032
		Sig. (1-tailed)	.000		.000		.000		.363	.422	.453	.368
		N	114		114		114		114	114	113	114
	Use thermometer for hamburger ^a	Correlation Coefficient							-.138	-.110	-.094	.028
		Sig. (1-tailed)							.072	.122	.161	.384
		N							114	114	113	114
	Eat pink hamburger ^a	Correlation Coefficient							.663^{**}	.663^{**}	.228^{**}	.236^{**}
		Sig. (1-tailed)							.000	.000	.008	.006
		N							114	114	113	114
	Eat pink hamburger ^b	Correlation Coefficient							.198[*]	.198[*]	.241^{**}	.241^{**}
		Sig. (1-tailed)							.018	.018	.005	.005
		N							113	113	114	114
	Eat raw eggs ^a	Correlation Coefficient							.618^{**}	.618^{**}	.000	.000
		Sig. (1-tailed)										
		N										113

*. Correlation is significant at the 0.05 level (1-tailed).

**. Correlation is significant at the 0.01 level (1-tailed).

^a indicates food handling practices of participants for themselves

^b indicates food handling practices of participants for their children

APPENDIX A-22
CORRELATIONS BETWEEN FOOD HANDLING PRACTICES AND BELIEFS OF
PARTICIPANTS FOR THE FIGHTBAC!™ CLEAN CONCEPT

Table A-22. Correlations between Food Handling Practices and Beliefs of Participants for the FightBac!™ CLEAN Concept

Spearman's rho	Total Practice	Total		Correlation Coefficient	Practice for		Perceived Severity	Perceived Susceptibility	Cues to Action	Self-Efficacy
		Adults	Children		Adults	Children				
Total Practice	Correlation Coefficient	.877**	.890**				.111	-.233*	.193*	.333**
	Sig. (1-tailed)	.000	.000				.138	.010	.028	.000
	N	98	98				98	98	98	98
Total Practice for Adults	Correlation Coefficient		.592**				.119	-.245**	.124	.371**
	Sig. (1-tailed)		.000				.121	.008	.111	.000
	N		98				98	98	98	98
Total Practice for Children	Correlation Coefficient						.106	-.159	.226*	.270**
	Sig. (1-tailed)						.150	.059	.013	.004
	N						98	98	98	98
Perceived Severity	Correlation Coefficient							-.002	.031	.003
	Sig. (1-tailed)							.494	.381	.489
	N							98	98	98
Perceived Susceptibility	Correlation Coefficient								.162	-.019
	Sig. (1-tailed)								.055	.425
	N								98	98
Cues to Action	Correlation Coefficient									.199*
	Sig. (1-tailed)									.025
	N									98

*. Correlation is significant at the 0.05 level (1-tailed).

**. Correlation is significant at the 0.01 level (1-tailed).

APPENDIX A-23
CORRELATIONS BETWEEN FOOD HANDLING PRACTICES AND BELIEFS OF
PARTICIPANTS FOR THE FIGHTBAC!™ **CHILL** CONCEPT

Table A-23. Correlations between Food Handling Practices and Beliefs of Participants for the FightBac!™ **CHILL** Concept

Spearman's rho	Total Practice ^a	Correlation Coefficient	Perceived			Cues to	
			Total Practice ^b	Severity	Susceptibility	Action	Self-efficacy
			-.059	.276**	.075	.012	.182*
		Sig. (1-tailed)	.240	.000	.182	.444	.013
		N	148	148	148	148	148
	Total Practice ^b	Correlation Coefficient		-.002	-.090	.105	-.157*
		Sig. (1-tailed)		.491	.132	.098	.026
		N		154	154	154	154
	Perceived	Correlation Coefficient			.084	.068	.120
	Severity	Sig. (1-tailed)			.151	.202	.069
		N			154	154	154
	Perceived	Correlation Coefficient				.094	.148*
	Susceptibility	Sig. (1-tailed)				.122	.034
		N				154	154
	Cues to Action	Correlation Coefficient					.227**
		Sig. (1-tailed)					.002
		N					154

*, Correlation is significant at the 0.05 level (1-tailed).

**, Correlation is significant at the 0.01 level (1-tailed).

^a Include all practice questions excluding questions relating to duration for storage of leftover food. Question relating to whether children eat leftovers is excluded too because the question does not indicate safe food handling practices, whether participant indicated always or never.

^b Include all practice questions relating to duration for storage of leftover food. Questions relating to duration for storage of leftover food were analyzed as a separate group because the questions have different ordinal scales (1-2 days, 3-4 days, 5-7 days, more than a week) from other question in the chill concept (always, most of the time, some of the time, rarely, never).

APPENDIX A-25
CORRELATIONS BETWEEN FOOD HANDLING PRACTICES AND BELIEFS OF
PARTICIPANTS FOR THE FIGHTBAC!™ COOK CONCEPT

Table A-25. Correlations between Food Handling Practices and Beliefs of Participants for the FightBac!™ COOK Concept^a

Spearman's rho	Total Practice for Adults		Total Practice for Children		Perceived Severity	Perceived Susceptibility	Cues to Action	Self-efficacy
	Total Practice	Correlation Coefficient	Adults	Children	Severity	Susceptibility	Action	efficacy
	Sig. (1-tailed)	N						
Total Practice for Adults			.943**	.816**	.004	.213*	.257**	.027
			.000	.000	.481	.011	.003	.389
			115	115	114	115	115	115
Total Practice for Children				.621**	.044	.140	.237**	.013
				.000	.322	.068	.005	.446
				115	114	115	115	115
Perceived Severity					-.029	.239**	.228**	.056
					.378	.005	.007	.277
					114	115	115	115
Perceived Susceptibility						.200*	-.002	.219**
						.016	.491	.009
						115	115	115
Cues to Action							.066	.136
							.243	.074
							115	115
Self-efficacy								.314**
								.000
								115

*. Correlation is significant at the 0.05 level (1-tailed).

**. Correlation is significant at the 0.01 level (1-tailed).

^a Exclude question relating to microwave wattage because scale of question is dichotomous (Yes=1; No=0), which is different from other questions a five-point scale (always, most of the time, some of the time, rarely never). Question relating to whether children eat leftovers is excluded too because the question does not indicate safe food handling practices, whether participant indicated always or never.

APPENDIX A-26
FREQUENCY DISTRIBUTION OF PARTICIPANTS FOR QUESTION RELATING
TO SELF-EFFICACY BASED ON THE FIGHTBAC!TM CLEAN CONCEPT

Table A-26: Health Belief Model Constructs relating to Self-efficacy based on the FightBac!TM CLEAN Concept

Please rank (1-5) the reasons that give you the confidence to prepare food safely.	n	5^a n (%)	4 n (%)	3 n (%)	2 n (%)	1^b n (%)	Rank Points^c
My family taught me (for example, mother, grandmother, mother-in-law)	85 (100)	40 (47)	22 (26)	12 (14)	7 (8)	4 (5)	257
My friends taught me	85 (100)	1 (1)	2 (2)	18 (21)	27 (32)	37 (44)	73
I had food handling training (for example, job, workshop, classes)	85 (100)	26 (31)	15 (18)	10 (12)	13 (15)	21 (25)	182
I did not make anyone sick from food before	85 (100)	4 (5)	13 (15)	21 (25)	28 (33)	19 (22)	125
I learned to prepare food safely myself (for example, media, internet)	85 (100)	15 (18)	32 (38)	24 (28)	9 (11)	5 (6)	213

^a indicates give most confidence

^b indicates give least confidence

^c Rank points were calculated by attributing 5 as four points, 4 as three points, 3 as two points, 2 as one point and 1 as zero point. Maximum point value is 340 and minimum point value is zero.

APPENDIX A-27
FREQUENCY DISTRIBUTION OF PARTICIPANTS FOR QUESTION RELATING
TO SELF-EFFICACY BASED ON THE FIGHTBAC!TM **CHILL** CONCEPT

Table A-27. Health Belief Model Constructs relating to Self-efficacy based on the FightBac!TM **CHILL** Concept

Please rank (1-5) the reasons that give you the confidence to prepare food safely.	n	5^a n (%)	4 n (%)	3 n (%)	2 n (%)	1^b n (%)	Rank points^c
My family taught me (for example, mother, grandmother, mother-in-law)	126 (100)	63 (50)	30 (24)	19 (15)	13 (10)	1 (1)	393
My friends taught me	126 (100)	1 (1)	8 (6)	26 (21)	53 (43)	37 (29)	134
I had food handling training (for example, job, workshop, classes)	126 (100)	30 (24)	17 (14)	17 (14)	13 (10)	49 (39)	218
I did not make anyone sick from food before	126 (100)	10 (8)	26 (21)	33 (26)	23 (18)	34 (27)	207
I learned to prepare food safely myself (for example, media, internet)	126 (100)	23 (18)	44 (35)	31 (25)	22 (18)	6 (5)	308

^a indicates give most confidence

^b indicates give least confidence

^c rank points were calculated by attributing 5 as four points, 4 as three points, 3 as two points, 2 as one point and 1 as zero point. Maximum point value is 504 and minimum point value is zero.

APPENDIX A-28
FREQUENCY DISTRIBUTION OF PARTICIPANTS FOR QUESTION RELATING
TO SELF-EFFICACY BASED ON THE FIGHTBAC!TM **SEPARATE** CONCEPT

Table A-28. Health Belief Model Constructs relating to Self-efficacy based the FightBac!TM **SEPARATE** Concept

Please rank (1-5) the reasons that give you the confidence to prepare food safely.	n	5^a n (%)	4 n (%)	3 n (%)	2 n (%)	1^b n (%)	Rank points^c
My family taught me (for example, mother, grandmother, mother-in-law)	115 (100)	50 (44)	35 (30)	17 (15)	10 (9)	3 (3)	349
My friends taught me	115 (100)	-	7 (6)	22 (19)	43 (37)	43 (37)	108
I had food handling training (for example, job, workshop, classes)	115 (100)	28 (24)	17 (15)	13 (11)	12 (10)	45 (39)	201
I did not make anyone sick from food before	115 (100)	11 (10)	25 (22)	29 (25)	32 (28)	18 (16)	209
I learned to prepare food safely myself (for example, media, internet)	115 (100)	26 (23)	32 (28)	33 (29)	17 (15)	7 (6)	283

^a indicates give most confidence

^b indicates give least confidence

^c Rank points were calculated by attributing 5 as four points, 4 as three points, 3 as two points, 2 as one point and 1 as zero point. Maximum value point is 452 and minimum value point is zero.

APPENDIX A-29
FREQUENCY DISTRIBUTION OF PARTICIPANTS FOR QUESTION RELATING
TO SELF-EFFICACY BASED ON THE FIGHTBAC!TM **COOK** CONCEPT

Table A-29. Health Belief Model Constructs relating to Self-efficacy based on FightBac!TM **COOK** Concept

Please rank (1-5) the reasons that give you the confidence to prepare food safely.	n	5^a n (%)	4 n (%)	3 n (%)	2 n (%)	1^b n (%)	Rank points^c
My family taught me (for example, mother, grandmother, mother-in-law)	93 (100)	46 (50)	20 (22)	16 (17)	7 (8)	4 (4)	283
My friends taught me	93 (100)	-	10 (11)	17 (18)	35 (38)	31 (33)	99
I had food handling training (for example, job, workshop, classes)	93 (100)	18 (19)	9 (10)	11 (12)	14 (15)	41 (44)	135
I did not make anyone sick from food before	93 (100)	4 (4)	23 (25)	25 (27)	26 (28)	15 (16)	161
I learned to prepare food safely myself (for example, media, internet)	93 (100)	25 (27)	31 (33)	24 (26)	10 (11)	3 (3)	251

^a indicates give most confidence

^b indicates give least confidence

^c Rank points were calculated by attributing 5 as four points, 4 as three points, 3 as two points, 2 as one point and 1 as zero point. Maximum point value is 352 and minimum point value is zero.

APPENDIX A-30
CORRELATIONS BETWEEN FOOD HANDLING PRACTICES AND KNOWLEDGE
OF PARTICIPANTS FOR THE FIGHTBAC!TM **CLEAN** CONCEPT

Table A-30. Correlations between Food Handling Practices and Knowledge of Participants for the FightBac!TM **CLEAN** Concept

			Total Practice Score	Total Practice Score for Adults	Total Practice Score for Children
Spearman's rho	Total	Correlation Coefficient	-.083	-.049	-.130
	Knowledge	Sig. (1-tailed)	.209	.314	.101
	Score	N	98	98	98
	Total Practice	Correlation Coefficient		.877**	.888**
	Score	Sig. (1-tailed)		.000	.000
		N		98	98
	Total Practice	Correlation Coefficient			.586**
	Score for	Sig. (1-tailed)			.000
	Adults	N			98

*. Correlation is significant at the 0.05 level (1-tailed).

**. Correlation is significant at the 0.01 level (1-tailed).

APPENDIX A-31
CORRELATIONS BETWEEN FOOD HANDLING PRACTICES AND KNOWLEDGE
OF PARTICIPANTS FOR THE FIGHTBAC!TM **CHILL** CONCEPT

Table A-31. Correlations between Food Handling Practices and Knowledge of Participants for the FightBac!TM **CHILL** Concept

			Total Practice ^b	Total Knowledge
Spearman's rho	Total Practice ^a	Correlation Coefficient	.080	.279^{**}
		Sig. (1-tailed)	.161	.000
		N	154	154
	Total Practice ^b	Correlation Coefficient		-.024
		Sig. (1-tailed)		.382
		N		154

*. Correlation is significant at the 0.05 level (1-tailed).

**. Correlation is significant at the 0.01 level (1-tailed).

^a Include all practice questions excluding questions relating to duration for storage of leftover food.

^b Include all practice questions relating to duration for storage of leftover food.

APPENDIX A-32
CORRELATIONS BETWEEN FOOD HANDLING PRACTICES AND KNOWLEDGE
OF PARTICIPANTS FOR THE FIGHTBAC!TM **SEPARATE** CONCEPT

Table A-32. Correlations between Food Handling Practices and Knowledge of
Participants for the FightBac!TM **SEPARATE** Concept

			Total Knowledge
Spearman's rho	Practice	Correlation Coefficient	.227^{**}
		Sig. (1-tailed)	.004
		N	136

*. Correlation is significant at the 0.05 level (1-tailed).

**. Correlation is significant at the 0.01 level (1-tailed).

APPENDIX A-33
CORRELATIONS BETWEEN FOOD HANDLING PRACTICES AND KNOWLEDGE
OF PARTICIPANTS FOR THE FIGHTBAC!TM **COOK** CONCEPT

Table A-33. Correlations between Food Handling Practices and Knowledge of Participants for the FightBac!TM **COOK** Concept

			Total Practice Score	Total Practice Score for Adults	Total Practice Score for Children
Spearman's rho	Total Knowledge	Correlation Coefficient	.250**	.242**	.192*
	Score	Sig. (1-tailed)	.004	.005	.020
		N	115	115	115
	Total Practice	Correlation Coefficient		.947**	.808**
	Score	Sig. (1-tailed)		.000	.000
		N		115	115
	Total Practice	Correlation Coefficient			.622**
	Score for Adults	Sig. (1-tailed)			.000
		N			115

*. Correlation is significant at the 0.05 level (1-tailed).

**. Correlation is significant at the 0.01 level (1-tailed).