

FOOD SAFETY ATTITUDES, BELIEFS, KNOWLEDGE AND SELF-REPORTED  
PRACTICES OF COLLEGE STUDENTS BEFORE AND AFTER EDUCATIONAL  
INTERVENTION

by

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B.S., Kansas State University, 1983  
M.S., Kansas State University, 1985

AN ABSTRACT OF A DISSERTATION

Submitted in partial fulfillment of the requirements for the degree

DOCTOR OF PHILOSOPHY

Department of Human Nutrition  
College of Human Ecology

KANSAS STATE UNIVERSITY  
Manhattan, Kansas

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## ABSTRACT

Preventing foodborne illness and promoting safe food practices among all age groups is a high priority, particularly for college students because little about their food safety awareness and food handling practices has been reported.

The research aim was to evaluate food safety attitudes, beliefs, knowledge, and self-reported practices of current upper-division college students, and to determine whether a three-module interactive educational intervention, developed for this study, positively influenced these variables. Comparisons between health and non-health majors were made.

Two methods of data collection were used with volunteer health and non-health majors: focused food safety discussion groups during academic year 2004-05, and a pre-experimental design. Prior to engaging in either method, students completed an on-line food safety questionnaire (FSQ), adapted from a telephone survey used at K-State with older adults. The FSQ was administered again to those in the pre-experimental design group one week after exposure to the food safety education intervention. Five weeks later, the FSQ was administered to determine whether changes in attitudes, beliefs, knowledge, and self-reported practices persisted over time. Focused food safety discussion group responses were qualitatively evaluated. Pre-experimental statistical analyses included Wilcoxin Signed Rank, Friedman, Mann-Whitney U, Chi Square tests, and Spearman rho.

Focused discussion group findings indicated that students perceived themselves at low risk for foodborne illness; few used food thermometers;

students without health backgrounds mimicked undesirable home practices; and students stated being open to changing non-recommended behaviors. Pre-experimental findings showed the effects of intervention were improved food safety attitudes, beliefs, and knowledge, with the strongest effects seen in health majors. Students' FSQ attitude scores increased from 114 to 122 ( $P \leq 0.001$ ), FSQ belief scores increased from 86 to 98 ( $P \leq 0.001$ ), and FSQ knowledge scores increased from 11 to 13 ( $P \leq 0.001$ ). Intervention resulted in some improved food safety self-reported practices for health majors but not non-health majors. Intervention module post-test scores improved significantly for all students; health majors had greater increases.

Conclusions. Focused food safety discussion groups were useful for obtaining food safety information from college students; educational intervention improved college students' food safety attitudes, beliefs, and knowledge and for health majors, some self-reported practices improved.

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Approved by:

Major Professor  
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Conclusions. Focused food safety discussion groups were useful for obtaining food safety information from college students; educational intervention improved college students' food safety attitudes, beliefs, and knowledge and for health majors, some self-reported practices improved.

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## **CHAPTER 1**

### **INTRODUCTION**

Foodborne illness is a major health threat in the United States, resulting in an economic burden for individuals and their employers, illness, and even death. It is estimated that foodborne diseases cause approximately 76 million illnesses, 325,000 hospitalizations, and 5,000 deaths annually in the United States.<sup>1</sup> The economic burden encompasses many factors including health treatment costs, costs associated with investigation of foodborne outbreaks, costs related to lost worker productivity, and food industry losses due to loss of sales.<sup>2</sup> Yet the average consumer rarely identifies foodborne illness as a serious health concern and typically downplays the role they as consumers have in preventing foodborne illness.<sup>3, 4</sup>

More than 30 million people in the United States may be particularly susceptible to foodborne illness.<sup>5</sup> Those considered at highest risk who experience the most serious foodborne illnesses are the very young, individuals with weakened immune systems, and older adults.

We are aware of over five times more foodborne pathogens than we were just 50 years ago. Food practices that were once considered safe, such as eating rare ground beef or raw eggs, are increasingly recognized as dangerous; however, it is difficult to convince consumers that practices which they have always had are no longer acceptable.<sup>6</sup> Historically, U.S. schools taught food safety in home economics courses in almost every secondary school. Over the past decade, changes in the educational system have resulted in reductions

and/or elimination of such courses. As a result, a large percentage of the population has limited food safety knowledge thus leading to a lack of critical decision-making and skills about good food safety practices.<sup>3</sup>

Surveys have shown that consumers do not think that it is common for people in the U.S. to become sick because of the way food is prepared or handled in the home.<sup>4</sup> Researchers, however, reported that food consumed in private homes is three times more likely to cause foodborne illness than food consumed in cafeterias or restaurants. Foods consumed at home contributed to approximately 87% of reported foodborne outbreaks, and restaurants and other group dining contributed approximately 28%.<sup>7</sup> Therefore, it is critical to inform consumers about their risks and effective food safety principles.

Preventing foodborne illness in older adults should be a high priority because of the rapid increase in the number of older adults. It is estimated that by 2030, the number of mature adults in the United States will double from the current 35 million to more than 71.5 million individuals.<sup>8</sup> By 2050, 20% of the world population will be 65 and older.<sup>8</sup> Adults aged 85 years and older are the fastest growing segment of the U.S. population; this segment is expected to increase from 4.6 million (2002) to 9.6 million (2030).<sup>8</sup> Older adults may become ill from smaller doses of organisms and are more likely to die from foodborne illness than others not in high risk groups.<sup>3</sup>

Current college students represent future health professionals who will serve high-risk populations, yet little is known about their own food safety behaviors. Therefore, assessing food safety attitudes, beliefs, knowledge, and food handling

practices of college students should also be a high priority. It is important to assess college students for two reasons: 1) they represent healthcare individuals who will serve and educate the increasingly aging population throughout the upcoming years and 2) they will be 65 or older by the year 2050, thus placing themselves in a high-risk category for foodborne illness. Further, by identifying possible gaps in college students' food safety knowledge, attitudes, beliefs, and/or practices, emphasis can be placed on education in the needed areas. Students will then be better prepared to limit their own food safety risks and to educate older adults on recommended food safety practices.

### **Issues of Concern**

Food safety is a health issue of particular concern in university environments because many college students are preparing meals for themselves and others for the first time.<sup>9</sup> Although limited studies exist, college students have been reported to engage in risky food consumption and handling practices<sup>9</sup>, and foodborne illness may be seriously underreported for college students. Diarrhea is a major symptom of foodborne illness, and diarrhea in college students may be attributed to other things such as excessive alcohol consumption, stress and anxiety, antibiotic use, and/or use of food additives<sup>10, 11</sup>.

Even when food safety knowledge is present, food safety researchers have found that knowledge and self-reported practices do not always correspond to observed behaviors. Observational studies on the adult population in general suggest that substantial numbers of consumers frequently implement unsafe food handling practices even with adequate knowledge.<sup>7</sup>

A review of the scientific food safety literature has revealed minimal work with college students. Only four studies in the past five years have been published.<sup>9, 10, 12, 13</sup> Two of these studies dealt with the general college population<sup>9, 10</sup>, and two others focused specifically on health majors.<sup>12, 13</sup> A 1998 study found that students in health related majors had higher food safety knowledge scores than students in other disciplines, yet they only scored an average of 74% on a food safety knowledge test.<sup>10</sup> A 2003 study determined that college students engaged in risky food consumption and handling behaviors.<sup>9</sup> A 2002 study identified that among dietetic programs 40% of the programs provided 16 or more hours of food safety education, and 38% of the programs' majors completed a food safety certification examination.<sup>12</sup> Finally, another study found that 34% of dietetics programs and 70% of hospitality programs required or offered food safety certification; educators in these programs rated food safety competencies as very important or essential.<sup>13</sup>

Colleges and universities are important settings for delivering health promotion education to young adults.<sup>11</sup> The most common health issues faced by college students are related to lifestyle and personal behavior, thus universities can promote the development and maintenance of health education and promotion programs. College students tend to be receptive to educational programs, and the university setting offers a unique opportunity to provide health education to a captive audience of young adults.<sup>14</sup> Historically, education about food safety has often been overlooked in general university health promotion classes, and the coverage in health texts is minimal.

## **Purpose**

The purpose of this study was to explore the relationships among food safety attitudes, food safety beliefs, food safety knowledge, and self-reported food safety behaviors of current college students. Assessment of attitudes included food safety practices and perceptions of food safety self-efficacy. Assessment of beliefs included attitudes toward perceived food safety incidence, perceived places of occurrence, and risks related to food safety practices. Assessment of knowledge included food safety terms, causes of foodborne illness, food safety practices, food safety standards, and aging specific topics. Assessment of self-reported practices included determination of: high-risk food consumption, hygiene practices, and food preparation and storage practices. The study sample represented future professionals who will deliver health and food safety education and services to older adults by virtue of their position, and who themselves will move into high-risk categories for foodborne illness as they mature.

## **Objectives**

The objectives of this study were as follows:

1. to evaluate the food safety attitudes of college students in health related and non-health related majors.
2. to evaluate the food safety beliefs of college students in health related and non-health related majors.
3. to evaluate the food safety knowledge of college students in health related and non-health related majors.

4. to evaluate the self-reported food safety practices of college students in health related and non-health related majors.
5. to determine if educational intervention can result in improvement in the areas of food safety attitudes, beliefs, knowledge, and self-reported practices of college students in health related and non-health related majors.

Questions investigated were 1) do college students' self-reported practices correlate with a) knowledge, and b) attitudes and beliefs about food safety; and 2) will exposure to a food safety intervention a) influence food safety attitudes and/or beliefs, b) create new food safety attitudes and/or beliefs, c) increase college students' food safety knowledge, and d) result in improved self-reported practices.

### **Hypotheses**

In order to accomplish the study objectives, the following hypotheses, previously approved by the dissertation committee, were tested:

H1: Subjects exhibit a low self-perceived risk for foodborne illness

H2: Subjects in health related majors exhibit a higher level of food safety knowledge than subjects in non-health related majors.

H3: Food safety knowledge does not correlate with self-reported practices.

H4: Subjects exhibit unsafe food safety attitudes and inaccurate beliefs.

H5: Educational intervention will positively influence food safety attitudes and beliefs.

H6: Educational intervention will positively influence food safety knowledge.

H7: Educational intervention will positively influence food safety self-reported practices.

### **Significance of this study**

Results of this study will have implications for encouraging food safety education of college students who, in their chosen fields, will interact with older adults with opportunities for health education, and who also represent 'future' older adults. Identifying possible gaps in their food safety attitudes, beliefs, knowledge, and self-reported practices is critical because the prevalence of foodborne illness is more likely to increase as the population continues to age rapidly.

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## **CHAPTER II**

### **LITERATURE REVIEW**

#### **Introduction**

Foodborne illness is a major health threat in the United States resulting in increased economic burden for individuals and their employers, illness, and even death. The average consumer however, rarely identifies foodborne illness as a serious health concern and typically downplays the role they play in preventing it.

Foodborne illness may occur through ingestion of contaminated food, with or without subsequent spread from person to person by the fecal-oral route.<sup>1</sup> Many different pathogens such as bacteria, *Salmonella* and *E. coli* for example, viruses such as caliciviruses, and/or parasites such as *Cyclospora*, are responsible for foodborne illness. New pathogens continue to emerge; an important example is multidrug-resistant *Salmonella*. While symptoms of foodborne illness vary widely, diarrhea and vomiting are the most common. Foodborne illness is very serious because in addition to causing gastrointestinal problems, it can result in septicemia, localized infection, arthritis, hemolytic uremic syndrome, Guillain-Barre syndrome, and sometimes death.

#### **Health Statistics**

Though the health threat is often unrecognized by the public, statistics from published health and research groups support the seriousness of the threat. It is estimated that each year, foodborne diseases cause approximately 76 million illnesses, 325,000 hospitalizations, and 5,000 deaths in the United States\*.<sup>2</sup> Known pathogens account for an estimated 14 million of those illnesses, 60,000

hospitalizations, and 1800 deaths. Unknown agents account for the remaining cases of illnesses, hospitalizations, and deaths.

Although the number of illnesses and deaths from foodborne illness is debatable, the economic burden is large and thus increased efforts to identify and control threats are advantageous and necessary. The economic burden encompasses many direct and indirect factors: costs for health treatment, costs associated with investigation of foodborne outbreaks, costs related to lost worker productivity, and costs to food industry from loss of sales.<sup>3</sup> Hospitalizations due to foodborne illness were estimated to cost over \$3 billion dollars per year; the cost of lost productivity is estimated to be an additional \$20-\$40 billion dollars annually.<sup>4</sup>

In the year 2001, *E. coli* food contamination alone resulted in 44 confirmed outbreaks of foodborne illness resulting in 925 illnesses, 418 culture-confirmed infections, 131 hospitalizations, 35 cases of hemolytic uremic syndrome (HUS), and two deaths.<sup>5</sup> For the year 2002, there were 1,332 identified foodborne outbreaks in the United States with 24,971 persons becoming ill.

This literature review focuses on the four areas of foodborne illness risks, food safety attitudes, food safety beliefs, food safety knowledge, and food safety practices, in three demographic groups: the population in general, college students, and older adults. Food safety education interventions for these groups were reviewed and will also be discussed. Other topics relevant to this research but not fully investigated include the role of focus groups, instructional planning,

the need for program evaluation, uses of web based surveys, and on-line curriculum instruction.

### **General Population Risks**

More than 30 million people in the United States may be particularly susceptible to foodborne illness.<sup>6</sup> Those who experience the most serious symptoms of foodborne illness are the very young, individuals who are immunocompromised, and older adults because they may become symptomatic from even small doses of organisms. Older adults are also more likely to die from foodborne disease than persons who are not in the higher risk groups.<sup>6</sup>

### **College Student Risks**

Although there is limited research reported about college students and their risks of foodborne illness, a food safety questionnaire was recently administered to 354 students at Ohio University.<sup>7</sup> Investigators there concluded that undergraduate students do engage in many behaviors that place their health at risk, including risky food handling and food consumption. Based on those questionnaire results, college students appear to be at greater risk for illness from foodborne disease than the general population.

### **Older Adult Risks**

Older adults are also at increased risk for foodborne disease because many have poor nutrition, decreased food intake, the likelihood of the effect of multiple medications, a compromised immune system, less stomach acid secretion, possibly decreased peristalsis, and concurrent chronic diseases. Older adults visit physicians' office more often, which also exposes them to a higher number

of pathogenic organisms. When older adults become ill for any reason, this increases susceptibility to foodborne illness.<sup>8-11</sup> Older adults are of increasing concern also because they are the fastest growing segment of the population and thus will be the largest population group at risk for foodborne illness. By 2030, it is estimated that 20% of the U.S. population will be 65 years of age and older, and by the year 2050, 20% of the world's population will be 65 years of age and older.<sup>12</sup>

Not only are the elderly at increased risk for getting foodborne illness, they are also more likely to die from complications. Foodborne illness can cause gastroenteritis and data from nursing homes indicate that greater than 50% of persons age 70+ with gastroenteritis died as a result of the gastroenteritis.<sup>10</sup> CDC statistics for the years 1996-1998 show that 60% of all deaths from *Salmonella* were persons aged 65 and older.<sup>13</sup> The Surveillance for Foodborne Disease Outbreaks- United States, 1993-1997, found that 40% of deaths from *Salmonella* were nursing home residents.<sup>14</sup> Although only 5% of older adults live in nursing homes, these findings reflect the seriousness of foodborne infections.

Older adults who do not routinely prepare food in the home are also at risk for foodborne illness. Incidence of foodborne illness from home-delivered meals in the United States may be underestimated at 1%.<sup>15</sup> A study examining food-handling practices among those receiving home-delivered meals revealed that those persons aged 85+ were likely to store leftover food on the counter for a time period greater than two hours, which increases the potential for foodborne illness.<sup>15</sup> In a study by Foote, 17% of home-delivered meals were not consumed

within two hours of delivery, and 25 percent of clients did not refrigerate or freeze leftovers within two hours of meal delivery.<sup>16</sup>

### **Food Safety Attitudes/Beliefs of the General Population**

Consumers do not generally believe that they are at high risk of foodborne illness from foods they prepare in their own home. Most consumers report that foodborne illness is likely to result from errors at food processing plants and restaurants rather than in their own homes.<sup>17, 18</sup> Only 15% of consumers thought that most food safety problems occurred at home.<sup>18</sup> A majority of consumers (60%) did not recognize that symptoms such as fever, chills, and nausea could be related to foodborne illness from home food preparation.<sup>19</sup>

### **Food Safety Attitudes/Beliefs of College Students**

Only one study has specifically targeted food safety attitudes of college students (n = 824). Unklesbay used a 15-item scale to assess attitudes related to food safety.<sup>20</sup> Results indicated that greater emphasis should be given to increasing college students' personal responsibility for food safety. Students indicated more strongly that it was the government's responsibility to ensure that food was safe to eat rather than indicating that it was their own personal responsibility. The college students did not strongly believe that foodborne illnesses were common. They also did not indicate a strong desire to gain additional knowledge about food safety.

### **Food Safety Attitudes/Beliefs of Older Adults**

In a study of older adults conducted at Kansas State University (KSU), it was determined that older adults felt the greatest risk to food safety occurred in food

processing plants (48%), homes (20%), and restaurants (16%).<sup>21</sup> Awareness of risks in the meat packing industry (prevalent in Kansas) was high. However, responses to a focus group follow-up question indicated that older adults were more concerned with restaurant-prepared foods than they were with foods prepared in homes. Additionally, foods identified as high risk by experts (raw oysters, raw eggs, etc.) were judged to be of only moderate risk by the KSU study participants. Due to the geographic location of this study, access to raw oysters was limited, which may have influenced attitudes and risk perception. When responding to risk perception questions, only 56% of the participants indicated contaminated foods were a 'very serious' or 'serious' problem.

It appears that as an adult ages, self-perceived risk for foodborne illness decreases. In a study of food handling behaviors of older adults aged 50 to 96 years, the perceived susceptibility to foodborne illness decreased as age increased.<sup>22</sup>

### **Food Safety Knowledge of the General Population**

Meta-analyses of 88 food safety studies, conducted over the past 26 years, revealed that 80% of consumers think themselves to be adequately educated regarding food safety, yet 40% were not aware that they were using unsafe practices.<sup>17</sup> The analyses revealed that consumers' food safety knowledge was insufficient to ensure safe food preparation in the home as indicated in the following examples. Data suggest that most consumers know the correct procedure for washing and drying hands, yet one-fifth of those sampled in the United States and United Kingdom in past years were unfamiliar with desirable

hand-washing and –drying procedures. Cross-contamination when using raw and cooked foods during food preparation is another concern. Up to 22% of U.S. consumers did not recognize the importance of using separate or adequately cleaned cutting boards and utensils in this situation. Knowledge of temperature control is important to control food pathogens and up to 60% of consumers did not know correct food refrigeration temperatures. Twenty percent of consumers did not know what the temperature should be inside a piece of cooked meat for the meat to be considered safe to eat. All of these examples represent high-risk situations for foodborne illness.

### **Food Safety Knowledge of College Students**

A review of literature found only one research study that focused specifically on food safety knowledge of college students.<sup>20</sup> Eight hundred twenty-four students in food-related and nonfood-related disciplines, in three geographic locations, completed a food safety questionnaire. Results indicated gaps in college students' knowledge. Students scored poorly when quizzed whether unsafe foods could be identified by the way they looked and smelled. Students also incorrectly indicated that unopened processed meats could be refrigerated long term without any risk of causing foodborne illness. Only 50% of students were aware that older adults were more vulnerable to foodborne illness than teenagers.

### **Food Safety Knowledge of Older Adults**

Numerous areas of concern about food safety knowledge of older adults exist. A British study evaluated the food safety knowledge of 809 older adults living in

their own homes. A majority of respondents lacked knowledge to properly refrigerate or freeze foods because they did not know recommended storage temperatures.<sup>23</sup> Seventy percent of their refrigerators were too warm for safe storage of food, indicating their lack of safe food temperature knowledge.

Participants understood 'use-by' and 'sell-by' dates but 45% had difficulty reading the labeled food product safety information that included storage and cooking recommendations. In another study of food safety and older adults, Hudson also found that the majority of older persons (88%) were unaware of recommended temperatures for their refrigerators and had not measured refrigerator temperatures.<sup>24</sup> Further, older adults in this study judged the safety and quality of foods by either counting the numbers of days after cooking or by smelling the food item; practices once supported but now replaced with current, safer practices.

Using safe food handling label instructions on packages of uncooked meat or poultry is one method to impart reliable food safety knowledge. The 1996 Behavioral Risk Factor Surveillance System survey (BRFSS) found that only one-third of persons aged 60+ read the safe food handling instructions.<sup>25</sup> Of those who read the label information, only one-third actually changed their food preparation habits in response to printed safe food handling instructions on the packages.

In the most recent study of food safety knowledge of adults age 65 years and older, participants consistently answered incorrectly in the areas of cooking temperatures and storage of cooked foods.<sup>21</sup> Fifty-seven percent of participants

did not know the proper end-point cooking temperature for a hamburger patty. Sixty-three percent reported hamburgers were safe to eat when cooked until no pink was visible. Twenty-four percent of respondents indicated that they thought it was safe to eat meat that had been left on the counter for two hours or more. All are unsafe practices.

In a 1995 study by Altekruze, 42% of older participants did not know that cooking meat to 'well done' decreased the risk of food poisoning.<sup>26</sup> Also, 14% of older adults were unaware that washing hands before preparing foods decreased the risk of food poisoning, and 23% did not know that putting a steak on a plate that previously held raw meat increased the risk of foodborne illness. The lack of knowledge in these two areas, safe end-point temperatures and storage of cooked foods, emphasizes food safety risks for the elderly.

Gettings reported that food safety knowledge of older adults is influenced by many factors: experience over time, learning on the job, information from relatives such as mothers and grandmothers, and written materials such as newspapers, magazines, and package directions.<sup>27</sup> Older adults tended to believe that because they have not gotten sick in the past from a food practice used consistently, the practice was not harmful. Older adults also tended to cook according to how their parents taught them; information and methods, which in today's society, would likely increase food safety risk.<sup>27</sup>

### **Food Handling Practices of the General Population**

While there are government programs such as HACCP (Hazards Analysis Critical Control Points) that help protect our food supply from a commercial

standpoint, consumers too can protect themselves from foodborne illness. Since one-fifth of reported foodborne illness outbreaks result from inappropriate consumer food handling and preparation practices in the home, consumers and caregivers of older adults can protect themselves by improving the way they prepare, thaw, and store foods.<sup>3, 26</sup>

Contributing factors to recognized U.S. outbreaks of foodborne illness have been reported for the years 1993-1997.<sup>14</sup> All the factors listed were the result of improper food handling behaviors. Improper holding temperature of food was the single leading factor, with poor personal hygiene the second leading factor. Other contributing factors, in order, were inadequate cooking temperatures and contaminated cooking equipment.

In the United States, 98% of surveyed home food preparers reported at least one of the following unsafe food handling practices: failure to use safe hand-washing practices after handling raw foods, using the same utensil and/or chopping board to prepare raw meats and other foods, and failure to wash utensils between the preparation of raw foods and the preparation of cooked foods.<sup>17</sup> Poor food safety practices are common in North America. While a majority of consumers report confidence in their ability to prepare and serve foods safely, observational studies have shown that self-reported behavior and observed behaviors differ. In a recent observational study<sup>28</sup>, persons cooking meals in their homes skipped, on average, seven times when they should have washed their hands during food preparation.

Audits International <sup>29</sup> (an independent food safety firm) observed 106 households in the United States and Canada and found that less than 1% of households had acceptable food safety performance. When preparing food in their own homes, participants failed good food safety practices in the areas of hand washing, preparing and storing foods at proper temperatures, and preventing cross-contamination. Violations were defined as critical if they potentially lead to foodborne illness; at least one critical food safety violation was observed in 96% of the households observed in 1977.

### **Food Handling Practices of College Students**

While focused on the challenges of obtaining a college education, many students eat whatever and whenever it is convenient. They may be unaware of proper food handling practices needed to avoid foodborne illness.

One particularly risky practice is consumption of ground beef that is pink or red inside. Almost one-half (44%) of surveyed college students reported eating a hamburger in the past 12 months that was pink or red inside.<sup>7</sup> A significantly higher proportion of male students than female students (60% vs. 32%) reported eating undercooked hamburger.

The federal government began an aggressive labeling campaign in 1994 to educate all consumers on proper handling and consumption of raw meat and poultry. Researchers surveyed students and determined that food labels did not affect how college students prepared their foods.<sup>7</sup> The majority of students did not see the labels, and of those who did, only a very small percentage (26.4%)

recalled the label contents. Ninety-one percent of the surveyed students reported the new labeling did not change their food preparation behaviors.

Unklesbay surveyed college students and found that students rarely check temperatures of their refrigerators and freezers.<sup>20</sup> Students also exhibited risky food consumption behaviors. An alarming 7% of the college sample consumed either raw fish or raw hamburger. Additionally, students consumed raw eggs (12.7%), unpasteurized eggnog (6.4%), and cookie dough (5.8%). When asked how they determined serving temperatures of leftovers, 24.3% of students indicated they relied on touching or feeling the food. Only 6% relied on temperature readings, and another 3% relied solely on microwave settings.

A national food safety mail survey, which included college students/graduates, examined consumer handling of fresh fruits and vegetables.<sup>30</sup> Investigators concluded that college or post-college students were more likely to practice risky produce handling behavior, compared to those with less formal education. College/post-college students indicated that there were no special requirements for bagging fresh produce in the grocery store, and they were less likely to wash fresh fruits and vegetables before consumption. College/post-college students were also less likely to wash their food preparation surface before cutting produce, meat, poultry, and/or fish.

### **Food Handling Practices of Older Adults**

Published reports of unsafe consumer food handling practices by older adults are numerous. A 1996 multi-state BRFSS survey found that 13% of persons aged 60 or older did not wash their hands with soap after handling raw meat or

chicken, nor did they wash cutting surfaces with soap or bleach after exposure to raw meats.<sup>25</sup> The BRFSS survey found that 13% of older adults reported eating pink hamburgers and 49% consumed undercooked eggs. Each of these practices increases the risk of foodborne illness.

A second multi-state survey conducted in 1997 also found that many persons aged 60 and older participated in risky behaviors such as consuming raw eggs and pink hamburgers.<sup>31</sup> Twenty-one percent of them preferred pink hamburgers, which are known to be less safe because of the possible presence of harmful microorganisms such as *E. coli*. Similar results were found in 1995 with 29% of persons aged 65+ not washing their hands after handling raw meat or poultry.<sup>26</sup> In this study, older adults were also less likely than those under age 65 to serve hamburgers medium or well done.

Focus group research has also been used to determine food safety practices of older adults. Recent investigators found that some older adults used “inappropriate practices” to thaw, cook and cool foods adequately.<sup>27</sup> Inappropriate practices were defined as relying on cooking time to determine doneness, using sight alone to determine doneness, placing large quantities of food (without portioning into smaller units) directly into the refrigerator, and thawing frozen food in water that is never changed. Older adults indicated resistance to change, particularly in the areas of cooking and thawing foods, by justifying their old cooking ways and indicating a recommended change, such as using a thermometer, was inconvenient. The older adults also cited barriers such as lack of money to purchase cooking thermometers.<sup>27</sup>

A study examining food handling practices among those receiving home-delivered meals revealed that those aged 85+ were likely to store left-over food on the counter for a time period greater than two hours, which increases the potential for foodborne illness.<sup>15</sup> The investigators identified food safety concerns for 26% of all clients aged 65 years and older. Concerns were based on the clients' responses to questions concerning meal consumption and storage, interviewer observation of lack of cleanliness of the home food preparation area, and the condition of food preparation equipment in the home. Investigators also identified untimely client-meal consumption and inadequate warming or refrigeration equipment in the home.

### **Educational Interventions for the General Population**

A variety of sources have been used in an effort to educate consumers about recommended food safety behaviors. The most common sources of food safety information for consumers are product labels, television news programs, and radio news programs.<sup>18</sup> Other possible sources of food safety information include newspapers, family, friends, colleagues, cookbooks, grocery store brochures, government extension offices, and physicians. The 1996 Economic Research Service (ERS) Hamburger Preparation Quiz found that surveyed adults (n = 945) identified television, radio, and newspapers as their top sources of information. Additionally, 59% reported getting information from family, relatives, friends, and colleagues. Survey respondents listed magazines at 55%, cookbooks at 35%, grocery store brochures at 32%, government offices at 32%, and physician offices at 14%.<sup>32</sup>

The U.S. government has been active in promoting food safety education for the general public. Two examples of educational programs are *Fight Bac!*<sup>33</sup> which emphasizes the principles of clean, separate, cook and chill, and *Seniors and Food Safety*<sup>34</sup>, an educational campaign developed by the U.S. Food and Drug Administration to provide food safety information in a written publication for older adults. Both of these educational programs are readily available on the internet, yet few consumers, especially older adults, utilize the internet for food safety information.

### **Educational Interventions for College Students**

A review of literature found no studies that provided food safety educational specifically for college students. It was stated by Unklesbay that educators need to emphasize to college students that consumers play a critical role in ensuring food safety and, thus, they need to assume a significant proportion of responsibility for food safety before and after their college graduation.<sup>20</sup>

Morrone states that educational programs need to be developed that inform college students about safe food handling behaviors.<sup>7</sup> Relying on family members to educate their children about food safety is not adequate because our food supply is dynamic and different than it was 20 years ago.<sup>7</sup> Additionally, food pathogens are constantly changing and new ones are emerging that cause foodborne illness.

The food safety educational goals for dietetics and hospitality management students were identified in a 2000 study.<sup>35</sup> Directors of didactic programs in dietetics and hospitality programs were surveyed. Thirty-four percent of dietetics

programs required or offered food safety certification, as did 70% of hospitality programs. Dietetics programs were significantly less likely to require food safety certification than were hospitality programs. Twenty-nine percent of dietetics educators and 25% of hospitality educators indicated that they planned to change class courses to increase the food safety competencies of graduates, i.e. requiring food safety certification.

### **Educational Interventions for Older Adults**

Based on a search of the literature, few studies have been reported on the food safety knowledge and practices of older adults exclusively. An educational resource packet *Safe on Your Plate* was developed by Ohio extension specialists.<sup>16</sup> The goal of that program was to increase safe food handling and storage practices for home-delivered meal recipients, who are typically older adults. *Safe on Your Plate* materials consisted of food-handling and safety information distributed to meal-delivery personnel and the meal recipients. With meal delivery personnel educated, it was proposed that they would reinforce the information provided to meal recipients. The educational resource packet developed in the project included preprinted adhesive labels with information for safe food handling of meals, and proper reheating and storage of the leftovers. After the educational program implementation, 90% of participants ate or refrigerated their meals within two hours of delivery compared to 83% prior to implementation. For those who froze their meals, 70% consumed the meal within one month, a recommended practice to reduce foodborne illness risk, compared to only 18% who did so before the intervention.

A second nutrition education intervention for older adults (in Maine) provided instruction on two food safety practices: thawing food and storing foods properly.<sup>36</sup> Nutrition aides, hired through this program, provided an average of 10 monthly nutrition education contacts to low-income groups and individuals participating in Title III nutrition programs. Title III of the Elderly Nutrition Program provides daily meals and nutrition services to people age 60 or older in group settings, such as senior centers and churches, or in the home, through "meals on wheels. At completion of the intervention, post-test scores indicated that 62% of participants improved in at least one of the two targeted practices of thawing and storing.

A third intervention program for older adults was Oklahoma's *Healthy Living*, which provided food, nutrition, and food safety information.<sup>37</sup> The goal of that program was to provide older adults with knowledge and skills needed to apply nutrition and food safety information to dietary behaviors that would promote improved dietary intake and health measures. Trained county extension educators presented lessons over an eight-week period in ten Oklahoma counties. Food safety scores for the older adults, based on three food safety questions, increased from five to eight out of a highest possible score of 15.

Other investigators have studied factors that would increase older adults' desire for food safety information and what could motivate them to attend educational programs.<sup>27</sup> It was determined that older adults were interested in receiving food safety education through educational programs that provided extra

incentives for attending such as meals, bingo games and/or gifts. Written educational pieces, television, and video presentations were also seen as useful.

### **Focus Groups**

The purpose of a focus group is to listen to people and gather information about a particular or focused topic of interest.<sup>38</sup> There are five general characteristics of focus groups: 1) people are involved, 2) they possess certain characteristics that make them similar to each other, 3) they provide qualitative data that are of interest to the researcher, 4) they have a focused discussion based on carefully pre-determined questions, and 5) the discussions help researchers understand the topic of interest.<sup>38</sup> As a rule of thumb, three or four focus groups should be planned with any one type of participant. This typically results in saturation, which means that the range of ideas has been heard, and no new information is being garnered. A typical focus group consists of eight to ten persons and a trained moderator who discuss a specified topic for approximately 90 to 120 minutes.<sup>39</sup> The participants for the groups should be as homogeneous as possible in terms of age and gender.

Focus groups can be powerful tools for decision-making. The insights and data garnered by interaction of the participants in focus groups can provide feedback used to initiate change, confirm existing ideas or programs, or generate new hypotheses.

### **Instructional Planning**

Instructional planning involves a clear statement of instructional objectives. The objectives provide a focus that results in more effective teaching procedures

and learning assessment.<sup>40</sup> It is important to clearly state instructional objectives as intended learning outcomes, which lead to selection of instructional methods, and materials that are most likely to bring about desired changes. Instructional objectives provide a basis for integrating teaching, learning, and assessment, which should all be in close harmony.

### **Program Evaluation**

Program evaluation helps decision makers determine if a program accomplished its objectives, is worth funding in the future, or if a less expensive program can accomplish the same results.<sup>41</sup> Program evaluation has many purposes, one of which is to judge the quality of educational curricula in specific content areas.<sup>42</sup> Objectives-oriented evaluation is one type of program evaluation and occurs when purposes are identified and the evaluation focuses on the extent to which the purposes were achieved.<sup>42</sup>

### **Web Based Surveys**

With the number of U. S. internet users estimated at 202.5 million in 2004, representing 69% of the U.S. population<sup>43</sup>, web based surveys are an increasingly valuable survey method. Web based surveys have many potential benefits: nearly complete elimination of paper, postage, mailing, and data entry costs; potential for overcoming international boundaries as barriers to surveys; time required for survey implementation can be reduced from weeks to days or even hours; electronic surveys exponentially reduce the survey costs with each additional respondent; and they offer multiple possibilities (animation, video clips,

audio) that can not be offered within the more limited confines of paper or interview surveys.<sup>44</sup>

There are some concerns with web based surveys.<sup>45</sup> Questionnaires may not look the same in different browsers and on different monitors resulting in respondents not receiving the same visual stimulus. Respondents may also have differing levels of computer skills resulting in response error or non-response. Some respondents may be concerned about the privacy of the data they are entering thus resulting in the respondents possibly limiting or altering the information they provide.

### **Online Curriculum Instruction**

Using information technology and web based instruction to enhance teaching and learning to new populations of students is exciting; however, most institutions see new technologies as a black hole of additional expense.<sup>46</sup> Comparative research studies have shown that most technology based courses produce learning outcomes that are “as good as” their traditional counterparts and resulted in no significant improvement in student learning. As a result, colleges and universities have not yet realized the potential of technology to improve the quality of student learning and decrease instruction costs. Web-based instruction enables best practices to be captured in the form of interactive web-based materials and allows instructors to add to, correct, replace, or improve the learning materials.<sup>46</sup>

In a recent study investigating technology enhancements in lecture courses, students in the treatment group completed on-line course activities in addition to

attending standard lecture classes.<sup>47</sup> Attitudinal data suggested that students perceived the technology enhancements as a significant contributor to their overall satisfaction with the course. Ninety-eight percent of the students felt the use of technology increased availability to resources, helped them prepare for class, enhanced the course, enhanced learning and understanding of the material, and it was convenient.

### **Summary of Relevance to Research Project**

Foodborne illness is a major health threat in the United States resulting in economic burden, illness, and sometimes death. Consumers rarely identify foodborne illness as a major health threat and tend to downplay the role they have in preventing it. There is limited research available concerning college students and the risk of foodborne illness. Previous research indicates that college students engage in risky food handling behaviors and consume high-risk foods. There have been no documented efforts to increase food safety knowledge or improve food safety practices of college student. Greater emphasis should be given to increasing college students' personal responsibility for food safety, increasing their food safety knowledge, and improving their food safety practices. Colleges and universities are important settings for delivering health promotion education to young adults. Food safety is a health issue of particular concern in universities as many college students are preparing their meals for the first time.

\*These numbers are estimates only and additional considerations of the statistics should be noted. Shortcomings of the Mead study have been identified <sup>48</sup>. Mead's calculations of deaths from foodborne illness were based in part on the number of deaths from gastroenteritis of unknown causes. Mead's definition of gastroenteritis was imprecise and could have included deaths related to radiation, toxic and drug-induced gastroenteritis. Mead also obtained data on deaths from the National Hospital Discharge Survey (NHDS), which has low reliability concerning estimate of deaths from gastroenteritis of unknown causes due to the small number of such deaths (average 45) per year in the NHDS sample. Finally, Mead made two implicit assumptions that could have flawed his estimate. He assumed that fatal illness attributable to unknown foodborne agents always involved gastroenteritis, and he implied that all deaths from unknown foodborne agents were attributed to gastroenteritis of unknown cause. These flaws may have resulted in omission of deaths from unknown foodborne agents that do not cause gastroenteritis and may have overestimated the number of deaths from agents that do cause gastroenteritis.

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**CHAPTER III**  
**REVIEW OF METHODOLOGY**  
**INTRODUCTION**

Approval was obtained from Kansas State University's Institutional Review Board for Research Involving Human Subjects before commencing research (Appendix A). A brief overview is presented, followed by specific detail for each type of method used. Two methods of data collection (focused food safety discussion groups and a pre-experimental component) were used in developing the educational intervention, food safety modules. A pre-experimental design does not meet the scientific standards of an experimental design. The focused discussion group students (n = 30) completed an adapted on-line web based, food safety questionnaire (FSQ) (Appendix G). Focused discussion groups of health and non-health majors in upper division college courses were utilized to determine college students' food safety awareness, food safety practices, and openness to change. During the pre-experimental component, the FSQ was administered to a convenience sample of students (n = 59) to measure the dependent variables of food safety attitudes, beliefs, knowledge, and self-reported practices. The FSQ was administered before and after completing an educational intervention requiring completion of three food safety modules. The educational modules used for this intervention were developed and then pilot tested by the pre-experimental subjects to determine whether changes in food

safety attitudes, beliefs, knowledge, and/or self-reported practices occurred.

Each module also had a pre-test, post-test, and post-post-test.

## **PART 1: DATA COLLECTION VIA FOCUSED DISCUSSION GROUPS**

### **Participants**

A total of thirty students, 19 to 23 years of age, participated in the on-line FSQ and then one of four on-campus discussion groups. The discussion groups were designed for 6-10 people plus a moderator, research project observer, and a recorder. Participants were enrolled college students with junior or senior standing who were recruited from Public Health Nutrition (HN600), Life Span Nutrition (HN610), and Public Relations Campaigns (MC645) during fall and spring semesters 2005. These classes were chosen because enrolled students represented future professionals who would be involved in providing education to the public. Fall semester students were excluded if they planned enrollment in Clinical Nutrition (HN 630) or Public Relations Campaigns (MC 645) in spring 2005, so as not to conflict with the pre-experimental data collection completed in spring 2005. Health majors were required to have completed Environmental Issues in Hospitality (HRIMD 220) and/or Science of Food (HN 413), courses that teach food safety information. Participants were paid \$15 following their participation. Researchers collected demographic information about the participants and information about their previous food safety education and/or training experiences.

## **Focused Discussion Group Meetings**

Two groups were formed at Kansas State University in the fall semester of 2004 and two groups in the spring semester 2005. To recruit participants, sessions were announced via flyers and in-class announcements (Appendix B). Flyers were distributed in three university buildings: Justin Hall (College of Human Ecology), AQ Miller School of Journalism, and Derby Dining Center (a residence hall foodservice facility). Students who indicated interest in participation received an email asking them to complete the FSQ one week in advance of the focused food safety discussion group sessions. The on-line FSQ required approximately 30 minutes and assisted the researcher in identifying possible problems with the on-line delivery system prior to being used in the pre-experimental design.

Initiating participation, all participants signed an Informed Consent Form (Appendix D) and completed an information sheet (Appendix E). Each group session lasted approximately 90 minutes, including time to establish rapport and have refreshments. Participants discussed fourteen food safety issues, exploring a) food safety concerns, b) how students protected themselves from foodborne illness, c) food safety practices including thawing, how doneness of foods was determined, sanitation practices, and refrigeration of foods, and d) how open students were to changing undesirable practices (Appendix F). Questions were presented orally and were projected onto a screen using Power Point to encourage focused discussion.

## **Analyses**

All group sessions were tape recorded and transcribed on paper. These records were studied to determine trends in responses, and the level of concern about food safety held by participants. Trends were determined by two co-researchers.

## **PART 2: PRE-EXPERIMENTAL DATA COLLECTION**

### **Subjects**

Fifty-nine participants, 38 females and 21 males, completed the food safety questionnaire (FSQ). The age range was 21 to 49 years. Students were seniors, with one graduate student. The majority of students indicated they lived in a house or apartment rather than residence halls or Greek housing. Health majors were enrolled in HN 630 (Clinical Nutrition) and non-health majors were enrolled in MC 645 (Public Relations Campaigns). Students voluntarily participated in the study.

### **Questionnaire (FSQ)**

#### FSQ Administration

A validated food safety questionnaire previously used by researchers at Kansas State University to conduct a telephone survey with older adults was adapted for use with these college students (Appendix G). The majority of questions were taken from a preexisting validated scale developed by Medeiros.<sup>1</sup> Because web-based surveys have many benefits<sup>2</sup>, the K-State Survey System, an online platform for conducting surveys, was used to administer the FSQ. Students completed the FSQ three times: pre-intervention (prior to viewing the

educational modules), post-intervention (one week after completion of modules), and post-post-intervention (five weeks after completion of modules).

Recognizing that college students have very busy schedules, students were allowed one week to complete each of the three FSQs. Students were sent an email reminder two days prior to expiration of each FSQ

### FSQ Reliability

The FSQ was tested for internal consistency reliability. It is desirable to have retest reliability on the alpha coefficients and future research should address this.

### Question Grouping

Researchers grouped survey questions by the variables evaluated: food safety attitudes, beliefs, knowledge, self-reported practices, and demographic information (Table 1). Food safety attitude questions included questions on attitudes toward food safety practices and self-efficacy. Belief questions included questions on beliefs about food safety practices and foodborne illness origin, and beliefs concerning the likelihood of foodborne illness occurrence. Knowledge questions encompassed food safety practices and standards. Self-reported practice questions included queries about hygiene, food preparation, food storage, and high-risk food consumption.

When deciding how to group survey questions, the researchers considered whether attitudes and beliefs should be interchangeable or separate. We chose to define them as two separate categories because they have distinct characteristics. Attitude represents a summary evaluation of an object, i.e., a person, behavior, or event, as negative or positive.<sup>3</sup> A Belief is a conviction to

the truth of a proposition, acquired through perception, contemplation or communication.<sup>4</sup> For this research project, two researchers evaluated each food safety survey question and subjectively determined in which category each best fit.

**Table 1: Grouping of FSQ Questions**

	Question Numbers
Attitudes (21 questions)	2.1-3.3 13.1-13.7
Beliefs (21 questions)	4.1-4.4 9.1-9.7 19.1-19.6
Knowledge (14 questions)	14-18.4
Self-reported practices (33 questions)	10.1-12.7
7 point scale (11 questions)	(10.1-10.11)
Consumption of high-risk foods (13 questions)	(11.1-11.13)
3 point scale (9 questions)	(11.14-12.7)
Not categorized for indices*	5-8
Demographics	20-26

\*Response choices were categorical and could not be analyzed as interval or ordinal for index scores

### Index Scales

The researcher developed index scales to determine a score for each area of attitudes, beliefs, and knowledge, and three self-reported practice areas. The three self-reported practice scales were 1) items indicating consumption of high-

risk foods, 2) items with a seven-point scale (food sanitation, storage, and thawing), and 3) items with a three-point scale (thermometer use, food refrigeration, and impact of diarrhea on food safety). The researcher added scores together for all the items that comprised each scale or subscale. Four survey questions (5-8) were not included in any of the indices because their response choices were categorical, not allowing them to be analyzed as interval or ordinal information; therefore, they were analyzed as individual questions. When Likert scales included a response of “not applicable”, those responses were discarded and not used in analysis. Some response scales included “don’t know” as an option. Researchers determined that a response of ‘don’t know’ on the consumption of high risk foods scale indicated some risk since, as an example, students may be eating rare hamburger, which may put them unknowingly at foodborne illness risk. A response of *yes* (example- consumes rare hamburger) was scored ‘1’, *don’t know* was scored ‘2’, and *no* was scored ‘3’ when used in index scores, indicating lowest risk with higher numbers.

### **Data Analyses**

To determine the internal consistency reliability of the FSQ, Cronbach alpha’s were determined for each of the food safety Indices: attitudes, beliefs, knowledge, high risk food consumption, seven-point self-reported practices scale, and the three-point self-reported practices scale. The Attitude scale had good internal consistency with a Cronbach alpha coefficient of .88. The Belief Scale was good with a Cronbach alpha of .8. The Self-reported Practices consisted of three scales: 1) a seven-point scale with a Cronbach alpha of .88, 2)

a high-risk food consumption scale with a Cronbach alpha of .59, and 3) a three-point scale with a Cronbach alpha of .65.

Using responses from the FSQs, various statistical tests were performed. Response frequencies were calculated resulting in non-normal distributions. The small sample size, non-normal distributions, and predominance of ordinal information supported the use of non-parametric tests. For within group differences (total group, health majors, non-health majors) the Wilcoxin Signed Rank and Friedman tests were used for interval and ordinal data, and the McNemar and Cochran Q tests were used for nominal data. For between group differences (health vs. non-health), the Mann-Whitney U test was used for interval/ordinal data and Chi-square was used for nominal data. To examine correlations among food safety Indices, Spearman's rho was used.

For students' data to be used in statistical analyses, each student had to complete all three FSQs. Results were discarded for any student who completed only one or two questionnaires. Responses from students were computer stored and tallied by the K-State Survey System. Results were exported to a comma delineated Excel file and transferred into SPSS, v. 11.

The majority of questionnaire response options were Likert scales with assigned values. In the administered on-line FSQ, answer options were ordered so that responses such as *strongly agree* received a low score (1) and responses such as *strongly disagree* received a high score (7). Scores were reversed for negatively worded questions such as "I am not interested in using a meat thermometer" so that a total score could be calculated for each index. When

appropriate, scales were reversed in statistical analyses so that all higher scores were indicative of recommended behaviors.

## **Food Safety Educational Modules**

### Development

Modules were developed using SoftChalk <sup>5</sup>, a lesson building program that allows the user to create engaging, interactive web lessons. Additionally, a K-State information technology specialist inserted flash graphics to enhance the presentations. Modules included food safety instruction with clip art, animated graphics, flash card activities, quizzes, word seek activities, crossword puzzles, drag-n-drop activities, and links to the World Wide Web. Each module was designed to require 30-60 minutes for completion.

Results obtained from the focused food safety group discussions contributed to the selection of food safety topics that were included and emphasized in the educational modules. The modules were reviewed for content and format by selected staff/faculty from the Dept. of Human Nutrition before use by students in this pilot study.

All three modules were evaluated for ease of reading and reading level using the Flesch scores generated by Microsoft Word. The Flesch Reading Ease score was 47.9 indicating the modules were suitable for 10<sup>th</sup> grade and above.

The modules were delivered on-line. Delivering the information in this mode allowed students flexibility in when and where they completed the three modules. *MODULE ONE* provided an overview of food safety, incidence and prevalence of foodborne illness in the U.S., emerging and currently important pathogens,

and recommended food handling guidelines. *MODULE TWO* presented a brief review of literature and information on food safety beliefs, knowledge, and food handling practices of college students and the general population. The use of food thermometers, attitudes about food safety, and information about the food service industry were also included. *MODULE THREE* focused on older adults, their foodborne illness risks, and preferred food safety handling practices (see Appendix H for module contents).

### Module Learning Objectives

Using expert guidelines for development of instructional objectives<sup>6</sup>, three to six student learning objectives were identified for each of the three modules. Student learning objectives reflected the content of each module and represented the desired student outcome for each module.

To evaluate student achievement of the learning objectives, an objective-oriented evaluation approach was used.<sup>7</sup> Students ranked their agreement with achievement of module objectives using a Likert scale of *Very Unlikely* (1) to *Definitely* (5). Students were asked to assess achievement of module objectives a second time with a post-post-test (five weeks after completion of modules) to determine if there was change in agreement with module objectives after a lapse of time.

### **Module Tests**

The purpose of the modules was to provide food safety intervention and to positively influence food safety attitudes, beliefs, knowledge, and self-reported practices of college students. Researchers determined that module pre- and

post-tests should assess food safety knowledge because the previously validated FSQ primarily assessed attitudes, beliefs, knowledge, and self-reported practices but with minimum evaluation of knowledge. For each module, approximately 20 test questions were developed and two co-researchers selected the 10 best knowledge questions for each module (Appendix I-K). Multiple choice or rank option questions were used.

Students completed each module's pre-test prior to the corresponding module becoming active on-line. Module pre-tests were active for two days and were then unavailable to students when the module became available for viewing. During the last two days that the module was available for viewing, the module post-test was activated via the survey system. While students could refer back to the modules while completing the post-tests, the researchers did not directly inform students of this. Many students, mostly health majors, did refer back to modules during the post-test period.

Additional module post-test questions assisted researchers in evaluating students' self-reported behavior change. For example, module one's post-test asked students how likely they were to change personal hygiene practices after completion of the module. All behavior change questions were specific to the module represented. Students answered the behavior change questions a second time when they completed a post-post-questionnaire five weeks after completion of modules.

Statistical analyses of the food safety educational modules pre- and post-test questions were also performed. Students who did not complete the tests or

indicated that they did not view the modules were eliminated from the study. All other data were utilized. A total knowledge score was calculated for each module for the total group and for health majors and non-health majors separately. Scores were converted to a 100% scale for easy comparison. Due to the small sample size and non-normal distributions, researchers used non-parametric tests.

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## **CHAPTER IV**

### **COLLEGE STUDENTS' FOOD SAFETY AWARENESS, CONCERN, PRACTICES, AND OPENNESS TO CHANGE**

#### Explanation

This manuscript will be submitted to the Journal of Nutrition Education and Behavior (JNEB). The manuscript style conforms to JNEB guidelines. The reference style conforms to the American Medical Association Manual of Style: A Guide for Authors and Editors, 9th edition, Philadelphia, PA: Lippincott, Williams, and Wilkins; 1998.

# COLLEGE STUDENTS' FOOD SAFETY AWARENESS, CONCERN, PRACTICES, AND OPENNESS TO CHANGE

## ABSTRACT

**Objective:** Determine students' food safety awareness, concerns, food practices, openness to change.

**Design:** Four structured discussion groups

**Setting:** Kansas State University Fall 2004, Spring 2005

**Participants:** Convenience sample of thirty, health/non-health majors; upperclassmen, average age 21, primarily white non-Hispanic females.

**Phenomenon of Interest:** Students' food safety awareness, concern, food handling, preparation, storage, thermometer use, risky food consumption, willingness to change undesirable practices.

**Analysis:** Sessions recorded on tape and paper; trends determined for phenomenon of interests.

**Results:** Students had low perceived risk for foodborne illness. Few students used food thermometers. Students used meat color and juices to determine doneness. Students without health majors thawed foods according to undesirable practices observed in the childhood home. "Perceived" or "stated" barriers to implementing recommended food safety procedures included cost, time, convenience.

**Conclusions and Implications:** College students, especially non-health majors, used many unsafe food handling practices. Students were open to some changes if changes were economical and time efficient.

**Key Words:** Food safety, College students, Discussion groups

**CHAPTER IV**  
**COLLEGE STUDENTS' FOOD SAFETY AWARENESS, CONCERN,  
PRACTICES, AND OPENNESS TO CHANGE**

**INTRODUCTION**

Foodborne illness is a major health threat in the United States also resulting in economic burden for individuals and their employers. Statistics support the seriousness of the threat, yet the average consumer rarely identifies foodborne illness as a serious concern and typically downplays the role he or she plays in preventing it.<sup>1-3</sup> Each year, foodborne diseases are estimated to cause approximately 76 million illnesses; 325,000 hospitalizations; and 5,000 deaths in the United States.<sup>4</sup>

While much food safety research has focused on the food industry and the general population<sup>2, 3, 5-7</sup>, research is limited concerning college students' food safety knowledge, practices, and/or risk for foodborne illness. Prior to this study, no investigators reported use of food safety discussion groups as a method of obtaining information on food safety practices from college students. The primary method of obtaining food safety information from college students has been through survey completion.

The three primary objectives of this study were to determine: 1) how concerned college students were about food safety and how they protected themselves from foodborne illness; 2) what their current practices were for food handling, food preparation, risky food consumption, sanitation, food cooling and

food storage; and 3) how open to change they were regarding changing their food safety practices.

## **DESCRIPTION OF EVALUATION**

Approval was obtained from Kansas State University's Institutional Review Board for Research Involving Human Subjects before commencing the research presented here. Health and non-health majors were recruited from upper level nutrition classes and upper level journalism classes, respectively. All subjects represented future professionals who would deliver education messages to the public. Subjects completed a consent form prior to participating in a focused food safety discussion group and all provided demographic information and information about previous food safety education and training. A convenience sample of subjects (n = 30) was recruited from college students with junior or senior standing; 86 percent were female, mean age of 21 years, with 66% living in a house, condominium, or apartment rather than in a residence hall (Table 1). Forty three percent were health majors and 57% were non-health majors. Comparable numbers of health and non-health majors indicated having previous food safety training. Training may have been informal (food server) to formal (food safety certification).

One week prior to each focused food safety discussion group, participants completed an on-line food safety questionnaire (FSQ). The purpose of the FSQ was to obtain information about consumption of risky foods and to pilot-test the FSQ with college students examining food safety attitudes, beliefs, knowledge

and self-reported practices. Researchers adapted the FSQ from a food safety questionnaire previously used at Kansas State University with older adults. Frequencies for FSQ responses about consumption of risky foods and use of food thermometers were determined.

Four focused food safety discussion groups were held at Kansas State University during academic year fall 2004 and spring 2005. For each semester, one group consisted of health majors and one of non-health majors. The primary researcher led the discussions. Following expert recommendations<sup>8,9</sup>, each session lasted approximately 90 minutes, including time for rapport to be established. Groups included 6-10 participants plus a moderator, research project observer, and a recorder. All sessions were tape recorded and transcribed on paper. Participants discussed fourteen food safety issues, exploring a) food safety concerns, b) how students protected themselves from foodborne illness, c) food safety practices including thawing, how doneness of foods was determined, sanitation practices, and refrigeration of foods, and d) how open students were to changing undesirable practices (see Table 2). Questions were presented orally and were projected onto a screen using Power Point to encourage focused discussion.

## FSQ RESPONSES

### RISKY FOOD CONSUMPTION

Ninety-four percent of students indicated they did not eat rare hamburger meat. Thirty-eight percent indicated they ate eggs with runny yolks or whites. Seventy-five percent of students indicated they ate home made cookie dough.

### THERMOMETER USE

Forty-seven percent of students indicated they were not interested in using a meat thermometer. Only 13% used a thermometer to check doneness of hamburger patties, 9% for reheating of leftovers, and 31% for checking refrigerator temperatures. Most students (69%) were unaware of the correct cooked end-point temperature for hamburger, and 38% believed that if you couldn't see pink in a hamburger, it was safe to eat.

### FOCUSED FOOD SAFETY DISCUSSION GROUP RESPONSES

#### FOOD SAFETY CONCERNS AND PROTECTION

**Concern and personal control.** Two discussion questions dealt with how concerned college students were about food safety and whether they perceived risk when preparing food in their homes. Students indicated very little concern about home food safety. They were more concerned with food safety issues when eating in restaurants. One student stated, *"You have to put your trust in the cook and the server"*. While they don't specifically look for food safety problems at restaurants, they are more aware of it there than at home. Students indicated that they had control over food safety when they prepared the food

themselves. Participants stated that students who lived in group housing, such as residence halls and sororities, had very little control over food safety issues but also felt that their food was safe to eat because they trusted the food preparers. Some students who lived independently were not concerned about food safety issues because they cooked very little and felt no need for food safety control.

**Food safety protection.** Previously, college students have indicated that it is the government's responsibility to protect them from foodborne illness <sup>10</sup>, so we asked students how they could protect themselves from foodborne illness. Their strategies for protection included not buying dented cans, checking expiration dates or use-by dates, keeping themselves healthy, washing hands frequently, checking high risk foods with a thermometer, keeping counters clean, avoiding pink meat, and looking for health inspection signs in restaurants and public food serving establishments. When eating restaurant foods, students based 'safeness' on the cleanliness of the restaurant and on trust in the cooks because they assumed the cooks had received food safety training.

## **CURRENT PRACTICES**

**Food handling.** Students were asked how they thaw their foods, specifically meat, prior to preparation. Techniques for thawing foods varied. Those with food safety training, primarily health majors, were more likely to state that they thawed food in the refrigerator in original packaging, the recommended way. Those without previous food safety training indicated they thawed foods the same way their mother did while they were growing up. Examples from students

were, *“Mom would put meat on the counter in the morning”*, and *“My mother puts meat in a bowl with water on the counter for the day”*. Many students indicated that they thawed their food items in the microwave, an acceptable practice only if the food is to be cooked immediately.

**Preparation.** When preparing foods, accurate methods for determining doneness of foods are important to prevent foodborne illness.<sup>11</sup> Most students indicated that they looked at the color of the meat item and color of the meat juices to determine doneness, a method not recommended because it is unreliable. Very few students used a thermometer, the recommended method, to check end-point cooking temperatures of meat items. Reasons given for non-use were cost of thermometers and lack of knowledge concerning recommended temperatures. One student stated, *“I would use a thermometer if I were given a sheet to tell correct temperatures”*.

**Risky food consumption.** Students were asked how likely specific food items (eggs without firm yolks, pink hamburger meat, raw or uncooked seafood, homemade cookie dough, and unpasteurized milk or juice) might cause foodborne illness and whether or not they consumed those items. Foods items were chosen for group discussion based on the FSQ responses and/or previous research indicating which foods college students were likely to consume. Students were concerned if hamburger meat was still pink and tried to avoid it but were not as concerned if steaks were still pink. Students who ate eggs that did not have firm yolks stated they were unlikely to change this behavior because of their enjoyment of the food item. Students also ate raw homemade cookie

dough and even after discussion of foodborne illness risk from raw eggs, students indicated that the enjoyment of eating raw homemade cookie dough outweighed the risks, and they were not likely to change this risky behavior. One student stated, *"Taste outweighs risk. Taking a little seems okay"*. Students need enhanced awareness that foods that may cause foodborne illness do not always look, smell, or taste bad. Many students were unaware that not all fruit juices were pasteurized and assumed they were always drinking pasteurized juices. By law fruit juices that are not pasteurized must clearly state so on the label.<sup>12</sup>

**Sanitation.** Students were asked to discuss the importance of hand washing during meal preparation. Many frequently washed their hands while cooking. Convenience was a factor for some. One student stated, *"I'm always in a rush and may not use soap if none is available"*. Students indicated they were most likely to wash their hands frequently when handling raw meats.

Inaccurate perceptions were voiced by some. Raw vegetables were not viewed as high risk. Therefore, the need to wash hands after handling raw vegetables was not as important to many students.

**Cooling and storage of foods.** Students were asked how they cool and store foods after cooking. Discussions with students with previous food safety training (health majors) indicated that they stored foods immediately after cooking, as recommended, and stored foods in recommended portions of no more than two inches deep. Those without previous food safety training (non-health majors) stated that they stored foods in the refrigerator within one hour of cooking, a safe

food handling practice. Students often stored foods in smaller portions because they only needed single servings for future meals.

## **OPENNESS TO CHANGE**

**Willingness to change.** After each discussion of a food safety topic, education on the recommended food safety guidelines was provided to students. After discussion of hand washing and washing of cutting boards during preparation of food items, students indicated they would be open to change if soap and water were easily available. After discussion of the proper way to thaw, cool, and store foods, students stated that they would be willing to make the recommended changes because they were simple and inexpensive. When asked how willing they would be to use food thermometers, students mentioned cost. Students reported that they might be willing to use food thermometers if the thermometer cost was low, if they were shown the correct way to use the thermometer, and if correct cooking temperatures were listed for them. Students stated a resistance to changing behaviors regarding intake of homemade cookie dough and eggs without firm yolks.

**Barriers to change.** Students were queried regarding barriers that might prevent them from using recommended practices. Cost was mentioned often because students believed it could be expensive to invest in food and refrigerator/freezer thermometers. Many students stated that it was hard to change old habits. Students frequently indicated that time was a factor. For example, one student stated that if she had to constantly wash her cutting board between foods, she probably wouldn't do so because of time constraints. If

recommended changes could be implemented quickly and did not significantly increase cooking time, students indicated they would be more likely to make the changes.

## **DISCUSSION**

The intent of this research was to determine college students' food safety awareness, concerns, practices, and openness to change.

Previous research indicated that college students did not feel a personal responsibility for food safety.<sup>10</sup> We found that students were mildly concerned about food safety, particularly at restaurants. However, students may not adequately recognize potential food safety risks in restaurants because they incorrectly assumed that all restaurant personnel were trained in food safety. Students should be made aware that food safety regulations vary by state, that people in charge of food service establishments may not have received formal food safety training, and they may not be food safety certified. Students were less concerned about food safety in their own homes, especially if they were the person responsible for meal preparation, because they trusted their personal practices.

Research has also shown that college students place themselves at increased risk for foodborne illness because they are not aware of, and/or do not adhere to food safety guidelines, including safe food handling and storage.<sup>10, 13</sup> In this study, food safety practices varied depending in part on whether the student had previous food safety training. Practices also varied according to the

type of food safety practices observed in the students' childhood homes. By mimicking unsafe practices observed in their childhood homes, many students are placing themselves at risk for foodborne illness.

Students often relied on visual indicators to determine if foods were safe to eat, particularly in the case of hamburger meat. Students must be trained to use food thermometers appropriately because that is the only accurate way to determine safe doneness of foods. Students also need to learn correct end-point cooking temperatures if they are to use food thermometers properly to reduce their risk of foodborne illness.

This research agrees with previous work that has shown college students consume high-risk foods.<sup>10, 13</sup> We found that students need enhanced knowledge of high-risk foods. They considered raw meats to be high risk, but not pink meats such as undercooked steaks, which are risky even if partially cooked. Students did not consider raw vegetables to be risky at all; they did not consider the possible contaminants from soil or contact with other foods. Students need to learn that frequent handwashing is vital in all steps of food preparation, even when they consider the food to be low risk, such as raw vegetables.

When provided the recommended guidelines for safe food handling, students were open to change only if the changes were low cost and required little time. Students were resistant to change regarding consumption of some high-risk foods because of their enjoyment of the food items. They need reinforcement that the pleasing tastes of some foods should not outweigh their potential

foodborne risks. Students indicated that they enjoyed learning new information about food safety practices and recognized that the information was important.

### **IMPLICATIONS FOR RESEARCH AND PRACTICE**

The findings from these focused food safety discussion groups may not represent all college students. However, the findings are valuable in evaluating food safety awareness and practices of college students because the findings provide insight on their perceptions of food safety behaviors. Potential weaknesses of discussion groups include moderator influenced discussions, discussions influenced by dominant members, and the desire to conform with acceptable answers.<sup>14, 15</sup> To help overcome these potential weaknesses, our food safety discussions were structured to focus on the pre-determined questions, students were called upon individually to elicit each person's responses, and students were encouraged to express viewpoints that may not have conformed with the majority. Even when presented with recommended food safety behaviors, students had low inhibition about revealing their personal food safety behaviors.

Efforts to positively impact college students' food safety behaviors should include consideration of the monetary costs associated with recommended changes and the amount of time involved, because students were only receptive to changes that were low cost and quick to implement. Since time and convenience were important, efforts to increase food thermometer use should

also include easily read and accessible temperature charts. Students suggested a magnetized temperature chart.

For this research project, college students were interested and uninhibited when discussing their own food safety behaviors. Additionally, these groups provided a method to educate college students. We found group participants, especially non-health majors without food safety training, to be interested in recommended procedures for food safety practices. Students indicated that they learned from the focused food safety discussion groups, and would be implementing the recommended food safety changes immediately or would consider changes in the future.

The insights and information gathered by focused food safety discussion group interactions can provide feedback for recommendations for food safety education of college students. The focused discussion group method was a valuable tool for gaining insight on food safety issues of college students.

**Table 1**  
**Demographic Characteristics of Participants**

	Health Majors (n=13)	Non-health Majors (n=17)
<b>Age, year</b>		
Average	21 (range 20-23)	21 (range 19-23)
<b>College Status</b>		
Junior	3	11
Senior	10	6
<b>Sex</b>		
Male	1	3
Female	12	14
<b>Previous Food Safety Training</b>	5	6
<b>Residence</b>		
House or condo	6	5
Apartment	5	4
Residence Hall	0	2
Fraternity/Sorority	2	6
Other	0	0
<b>Ethnicity</b>		
White, non-Hispanic	9	15
Hispanic	2	1
Asian	1	1
African American	1	0
American Indian or Alaskan Native	0	0
Other	0	0

**Table 2**  
**Focused Food Safety Discussion Group Questions**

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**Food Safety Concern and Personal Control**

How concerned are you about food safety, and what is your biggest food safety concern?

How much control do you have over the food prepared in your home?

**Food Safety Protection**

How do you protect yourself from foodborne illness?

How do you know that your food is safe to eat?

**Food Handling**

How do you thaw different meats such as turkey, ground beef, or steak?

**Preparation**

When you are cooking food, how do you determine doneness of meat?

**Risky Food Consumption**

How likely are you to eat foods such as runny eggs, pink hamburger meat, raw or uncooked seafood, and unpasteurized milk or fruit juice? If you eat them, will you continue to eat them in the future?

**Sanitation**

Do you follow the recommended practice to wash in hot water and soap the cutting board, knife, and your hands after cutting meat and before handling other foods?

How frequently do you wash your hands when preparing food? How important is that to you?

**Cooling and Storage of Foods**

After you cook foods, how quickly do you refrigerate them and in what portions do you refrigerate?

How do you respond to the recommendations that food be cooled in the refrigerator immediately after cooking or eating and that portions should be divided so that food cools more quickly and thoroughly?

**Openness to Change**

If you learned of new or different food preparation or storage practices, how likely would you be to make changes to use those practices? What would prevent you from using those practices?

After learning correct thawing principles, would you change any of your thawing practices?

After learning that temperature is the best measure of doneness, would you use temperature as a determinant?

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## CHAPTER V

### **ASSESSMENT OF COLLEGE STUDENTS' FOOD SAFETY ATTITUDES, BELIEFS, KNOWLEDGE, AND SELF-REPORTED PRACTICES, BEFORE AND AFTER EDUCATIONAL INTERVENTION**

#### Explanation

This manuscript was formatted for publication. The reference style conforms to the American Medical Association Manual of Style: A Guide for Authors and Editors, 9th edition, Philadelphia, PA: Lippincott, Williams, and Wilkins; 1998.

**ASSESSMENT OF COLLEGE STUDENTS' FOOD SAFETY ATTITUDES, BELIEFS, KNOWLEDGE, AND SELF-REPORTED PRACTICES, BEFORE AND AFTER EDUCATIONAL INTERVENTION**

**ABSTRACT**

Preventing foodborne illness and promoting safe food practices among all age groups is a high priority. Little has been reported about college students' food safety awareness and/or food handling practices.

The research aim was to evaluate current college students' food safety attitudes, beliefs, knowledge, and self-reported practices, as measured by a questionnaire, and to determine whether a three-module interactive educational intervention, developed for this study, positively influenced these variables. Comparisons were made between health and non-health majors.

A pre-experimental design was used during spring semester 2005 with a population of 59 college seniors categorized as health or non-health majors who were responsible for preparing their own meals. Subjects completed a food safety questionnaire (FSQ) administered on-line prior to intervention. The food safety education intervention consisted of three interactive modules on various food safety topics. Subjects completed module pre-tests, post-tests, and post-post-tests. The FSQ was administered again after exposure to the food safety education intervention. Five weeks later, the FSQ was administered to determine if changes in attitudes, beliefs, knowledge, and self-reported practices persisted over time. Statistical tests used for data analyses were Wilcoxin Signed Rank, Friedman, Mann-Whitney U, and Chi Square tests.

Findings indicated that the educational intervention developed for this study improved food safety attitudes, beliefs, and knowledge, with the strongest effects seen in health majors. Students' FSQ attitude scores increased from 114 to 122 ( $P \leq 0.001$ ), FSQ belief scores increased from 86 to 98 ( $P \leq 0.001$ ), and FSQ knowledge scores increased from 11 to 13 ( $P \leq 0.001$ ). Food safety knowledge, as measured with three module pre- and post-tests, improved significantly after educational intervention for all students, with health majors having a greater increase. Intervention also resulted in improved food safety self-reported practices for health majors but not non-health majors.

The newly developed educational intervention appeared to be effective in improving college students' food safety attitudes, beliefs, and knowledge, and for health majors, some self-reported practices.

## CHAPTER V

### ASSESSMENT OF COLLEGE STUDENTS' FOOD SAFETY ATTITUDES, BELIEFS, KNOWLEDGE, AND SELF-REPORTED PRACTICES BEFORE AND AFTER EDUCATIONAL INTERVENTION

#### INTRODUCTION

Foodborne illness is a major health threat in the United States, also resulting in economic burden for individuals and their employers, illness, and possibly death. Statistics support the seriousness of the threat. It has been estimated that each year, foodborne diseases cause approximately 76 million illnesses, 325,000 hospitalizations, and 5,000 deaths in the United States.<sup>1</sup>

Limited research about college students has been published describing their risk of foodborne illness. Research has primarily focused on the general population and food industry.<sup>2-6</sup> Food safety researchers concluded that undergraduate students engage in unsafe practices, including risky food handling and food consumption.<sup>7-9</sup> A search of the scientific literature found no studies that provided food safety education intervention for improving food safety behaviors of college students.

One purpose of this study was to explore the relationships among food safety attitudes, beliefs, knowledge, and self-reported food safety practices of current college students in health and non-health majors. Additionally, three food safety interactive educational modules were developed to determine whether such an educational intervention could result in improvement in the above variables.

## **METHODS**

### **Subjects**

Approval was obtained from Kansas State University's Institutional Review Board for Research Involving Human Subjects before commencing the research. Fifty-nine college students, 38 females and 21 males, ranging in age from 21-49 years, voluntarily participated in this research. Students were recruited by in-class invitations. The students were seniors, plus one graduate student, living in a house or apartment rather than residence halls or Greek housing. Health majors were enrolled in HN 630 (Clinical Nutrition) and non-health majors were enrolled in MC 645 (Public Relations Campaigns).

### **Questionnaire Administration**

A food safety questionnaire (FSQ) previously used by researchers at Kansas State University to conduct a telephone survey with older adults was adapted for use with these college students. The FSQ was tested for internal consistency reliability using Cronbach's alpha. The majority of questions were taken from a preexisting validated scale developed by Medeiros.<sup>10</sup> The K-State Survey System, an on-line platform for conducting surveys, was used to administer the food safety questionnaire. Prior to administration of the FSQ to study participants, students with similar backgrounds (n=30) completed the FSQ in Fall 2004 and early 2005 to test the on-line delivery for possible problems.

Study participants completed the FSQ three times: pre-intervention (prior to viewing educational food safety modules), post-intervention (up to one week after

module completion), and post-post-intervention (five weeks after module completion).

FSQ survey questions were grouped by the dependent variables evaluated: food safety attitudes, beliefs, knowledge, and self-reported practices. *Attitude* questions (n=21) included questions on attitudes toward food safety practices and self-efficacy. *Belief* questions (n=21) included questions on beliefs toward food safety practices, foodborne illness origin, and likelihood of foodborne illness occurrence. *Knowledge* questions (n=14) encompassed food safety practices and standards. *Self-reported practice* questions (n=33) included queries about hygiene, food preparation, food storage, use of thermometers, and consumption of high-risk foods.

### **Index Scales**

Index scales were developed to determine a score for attitudes, beliefs, knowledge, and three self-reported practice areas. The three self-reported practice scales were 1) FSQ items with a seven-point response option (food sanitation, hygiene, storage, and thawing) n=11, 2) items indicating consumption of high-risk foods n= 13, and 3) FSQ items with a three-point response option (thermometer use, food refrigeration, and impact of diarrhea on food safety), n=9. Scores were reversed for negatively worded questions such as “I am not interested in using a meat thermometer” so that a total score for recommended behaviors could be calculated for each index. Scores were added together for all the survey questions that comprised each scale, resulting in a total score for each index.

## Intervention

Interactive instructional materials were developed using SoftChalk<sup>11</sup>, a lesson building program that lets the user create engaging, interactive web lessons. The three food safety educational modules included food safety instruction with clip art, animated graphics, flash card activities, quizzes, word seek activities, crossword puzzles, drag-n-drop activities, audio clips, and links to the World Wide Web. Each module was designed to require 30-60 minutes for completion, followed by a post-test of 10-15 minutes duration.

During fall semester 2004 and early spring semester 2005, focused food safety discussions held with junior and senior level college students contributed to food safety topics included and emphasized in the educational modules.

Delivering the instruction in an on-line format allowed students flexibility for when and where they completed the modules. *MODULE ONE* provided a food safety overview with incidence and prevalence of foodborne illnesses in the U.S., emerging and important pathogens, and recommended food handling guidelines. *MODULE TWO* presented a brief review of food safety literature and information on common food safety beliefs, knowledge, and food handling practices by college students and the general population. The use of food thermometers, attitudes about food safety, and information about the food service industry were also included. *MODULE THREE* focused on older adults, their foodborne illness risks, and preferred food safety handling practices.

Students completed a pre-test (active on-line for two days) prior to viewing each on-line module, which was active for one week. During the last two days

that the module was available for viewing, a post-test was activated via the survey system. These tests assessed food safety knowledge, using multiple choice or rank option questions.

Additional module post-test questions assisted researchers in evaluating students' self-reported behavior. Students answered behavior change questions during the post-test and a second time with the post-post-questionnaire (five weeks after completion of modules).

### **Statistical Analyses**

The majority of FSQ response options were seven-point Likert scales with assigned values. When Likert scales included a response of “not applicable”, those responses were discarded and not used in analysis. Some response scales included “*don't know*” as an option. Researchers determined that a response of ‘don't know’ on the consumption of high risk foods scale indicated some risk since, as an example, students may be eating rare hamburger, which may put them unknowingly at foodborne illness risk. A response of “yes” was scored ‘1’, “*don't know*” was scored ‘2’, and “no” was scored ‘3’ when used in index scale scores, indicating lowest risk with higher numbers.

Analyses of the FSQ responses were performed for each administration: Time 1 (pre-intervention), Time 2 (post-intervention), and Time 3 (five week post-post-intervention). Statistical analyses of the intervention pre- and post-tests were also performed. Data were eliminated for the few students who did not view the educational modules (planned intervention). Response frequencies resulted in non-normal distributions. The small sample size, non-normal distributions, and

high predominance of ordinal information supported the use of non-parametric testing. Statistical analyses used Wilcoxin Signed Rank, Friedman, Mann-Whitney U, McNemar, Cochran Q, Chi-square, and Spearman's rho tests. To test internal consistency reliability of the FSQ, Cronbach's alpha was performed for each index.

## **FINDINGS**

The FSQ had internal consistency with Cronbach alpha coefficients of 0.88 for the Attitude scale, 0.80 for the Beliefs scale, 0.88 for the seven-point Self-reported Practices scale, 0.65 for the three-point Self-reported Practices scale, and 0.59 for the Self-reported Practices scale for high-risk food consumption. An acceptable alpha coefficient is 0.70, but for measures with fewer items, such as in the Self-reported Practices Scales, a smaller coefficient may be acceptable.

Characteristics of the subjects are presented in Table 1. A statistically significant difference was found for the number of participants who held food safety certification. Fifty-eight percent of health majors were certified compared to 29% of the non-health students. These differences were not surprising since, for the health majors, food safety certification was required in at least one of their previous classes. Health majors prepared more meals per week (6-10 meals) than non-health majors(1-5 meals).

**Table 1**  
**Characteristics of Subjects**

	Health Majors (n=38)	Non-Health Majors (n=21)	$\chi^2$	<i>P</i>
Held job as a Food Server such as waiter or waitress	29	15	0.17	0.68
Held job as a Food Preparer (cook)	24	8	3.42	0.064
Food Safety Certification	22	6	4.66	0.031
Average # meals prepared/week	6-10 (n=16)	1-5 (n=13)		
Average # college nutrition courses	2 or more (n=36)	0 (n=14)		
Average # college food science courses completed	1 (n=17)	0 (n=18)		
Average # college microbiology courses completed	0 (n=31)	0 (n=20)		

### **Food Safety Attitudes, Total Group**

To determine changes in students' FSQ attitude index (a tallied score of all attitude questions) from pre-test (Time 1) to post-post-test (Time 3), the Friedman test was used. Students' food safety attitudes improved (from 114.5 to 122.2 out of 147 possible) ( $P \leq 0.001$ ),

Attitude questions were also examined individually. The most significant changes occurred between pre- and post-intervention. Students became more concerned about thawing perishable foods on the counter ( $P=0.001$ ), cooking and eating eggs that did not have firm yolks ( $P \leq 0.001$ ), drinking unpasteurized apple juice ( $P \leq 0.001$ ), eating alfalfa sprouts ( $P \leq 0.001$ ), eating hotdogs right out

of the package ( $P \leq 0.001$ ), and not refrigerating foods such as rice and beans ( $P = 0.007$ ).

### **Food Safety Beliefs, Total Group**

Students' FSQ belief index scores increased from 85.8 to 97.6 of 119 ( $P \leq 0.001$ ), representing more positive food safety beliefs after intervention.

When belief questions were examined individually, three beliefs had the strongest change. Students' mean rating of the statement, "If I follow safe food handling practices, my chances of sickness would decrease", increased from 1.4 (strongly disagree) to 6.7 (strongly agree) ( $P \leq 0.001$ ). After intervention, students also indicated they were more likely to get sick if they did not wash their hands prior to cooking ( $P \leq 0.001$ ) and if they left cooked food out of the refrigerator for more than two hours ( $P = 0.005$ ).

Students were more likely to believe that "certain foods could make you sick". Students exhibited increased concern for eating or handling raw chicken ( $P = 0.035$ ), raw beef ( $P = 0.011$ ), raw sprouts ( $P \leq 0.001$ ), raw vegetables ( $P \leq 0.001$ ), and raw shellfish ( $P = 0.049$ ). Students became less concerned with risks associated with raw fruits ( $P = 0.004$ ).

Students increased in the belief that it was common for people in the U.S. to become sick because of the way that food is prepared or handled in the home ( $P = 0.001$ ). Students also increased in their belief that contamination of food by microorganisms was a greater problem than previously recognized ( $P \leq 0.001$ ).

### **Food Safety Knowledge, Total Group**

Students' FSQ score for total knowledge increased ( $P \leq 0.001$ ), with scores changing from 11.2 (pre-intervention) to 12.6 (post-intervention) out of 14 possible points. The most statistically significant changes were found in responses to four questions. Students improved in recognizing that hamburger patties should be cooked to an internal temperature of 160° F, with 39% answering correctly on pre-intervention and 64% answering correctly post-intervention. Students became aware that they should not prepare food for others if they have diarrhea; correct responses increased from 49% (pre-intervention) to 88% (post-intervention). The number of students who knew that non-pink hamburger meat does not guarantee safeness to eat increased from 75% to 93%. Finally, the number of students who knew that cooking egg yolks and whites until firm killed the harmful organisms increased from 61% to 81%. Most percentages dropped slightly at post-post-intervention.

### **Food Safety Self-reported Practices, Total Group**

No significant change occurred in food sanitation, hygiene, storage, and thawing practices. For thermometer use, food refrigeration, and the impact of diarrhea on food handling, scores increased from 19 to 21 of 27 possible points ( $P=0.001$ ), indicating more positive self-reported practices. Specifically, students became less likely to prepare food for others if they had diarrhea ( $P \leq 0.001$ ), and more likely to use food thermometers ( $P=0.01$ ).

### **Food Safety Indices, Health Students**

Index scores were analyzed for comparison within and between groups, i.e., health majors and non-health majors. Health majors' FSQ scores increased for attitudes ( $P \leq 0.001$ ), beliefs ( $P \leq 0.001$ ), and knowledge ( $P \leq 0.001$ ) from pre-intervention to post-post-intervention. Health majors also improved in self-reported practices for thermometer use ( $P = 0.006$ ), not leaving cooked meat items out for use later in the day ( $P = 0.046$ ), and not preparing food for others if they had diarrhea ( $P = 0.002$ ).

### **Food Safety Indices, Non-health Students**

Non-health majors' FSQ scores improved for beliefs toward food safety ( $P = 0.018$ ) and knowledge about food safety ( $P \leq 0.001$ ) from pre-intervention to post-post-intervention. No improvements were found for non-health majors' scores on attitudes or self-reported practices.

### **Food Safety Indices, Differences Between Groups**

To determine differences between index scores of health and non-health majors for each time period, the Mann-Whitney U statistic was performed. Health majors scored higher than non-health majors for all indices for each time period (Table 2). The strongest difference was for food safety attitudes, with health majors scoring much higher for all three time periods ( $P \leq 0.001$ ), and for thermometer use, not leaving cooked meat items out for later use, and not preparing food for others if they had diarrhea.

**Table 2**  
**Comparison of Health and Non-Health Students' Index Scores\* for Time 1, Time 2, and Time 3 (N = 38 Health and 21 Non-health)**

	Mean* (SD)			P		
	Time 1	Time 2	Time 3	Time 1	Time 2	Time 3
Food safety attitude				≤0.001	≤0.001	≤0.001
Health	120.3 (11.4)	128.7 (14.9)	130.8 (9.0)			
Non-health	104.0 (13.8)	108.8 (16.5)	106.6 (21.9)			
Food safety beliefs				0.030	0.004	0.003
Health	87.9 (10.5)	100.3 (9.3)	100.8 (9.9)			
Non-health	82.1 (7.4)	88.7 (15.8)	92.0 (11.8)			
Knowledge						
Health	11.8 (1.9)	13.1 (1.0)	13.1 (0.9)	0.001	0.002	≤0.001
Non-health	10.2 (1.7)	11.6 (2.3)	11.7 (1.6)			
SRP** 3 pt scale				0.001	≤0.001	≤0.001
Health	20.2 (3.0)	21.9 (2.7)	22.9 (2.7)			
Non-health	109.87 (9.1)	107.86 (10.7)	104.29 (18.1)			
High-risk food intake				0.146	0.086	0.101
Health	33.4 (3.8)	34.2 (3.9)	34.5 (3.7)			
Non-health	31.9 (4.5)	32.6 (4.0)	33.0 (3.7)			

\*Possible score range: attitude (21-147), beliefs (17-119), Knowledge (0-14), SRP 3 pt (9-27)

High-risk foods (13-39)

\*\*SRP = Self-reported Practices

### Index Correlations, Total Group

To determine the relationships among the indices of attitudes, beliefs, knowledge, and self-reported practices, the Spearman rho statistic was used to report results for the total group because these results were the most consistent among all correlations tested. The strongest correlations were between Time 2 and Time 3 FSQ attitudes and beliefs. For Time 2,  $r(39) = 0.63$ ,  $P \leq 0.001$ , with the direction of the correlation being positive, meaning that those students who had more positive food safety beliefs also had more positive food safety attitudes. Using Cohen's (1988) guidelines, the effect size is larger to much larger than typical. The  $r$  squared indicates that 43% of the variance in food

safety beliefs at Time 2 can be predicted by food safety attitudes. For Time 3,  $r(42) = 0.74$ ,  $P \leq 0.001$ , with effect size being much larger than typical. The correlation direction was again positive, and the  $r$  squared indicates that food safety attitudes can predict 55% of the variance in food safety beliefs at Time 3.

### **Module Test Scores, Total Group**

To determine pre- and post-intervention changes in the educational module knowledge score, the Friedman test was used. Differences were found for all modules across each time period. On a scale of 1-100, MODULE 1 mean scores increased from 40.1 to 66.5 ( $P \leq 0.001$ ). For MODULE 2, mean scores increased from 41.0 to 69.8 ( $P \leq 0.001$ ). For MODULE 3, students' mean scores increased from 53.2 to 72.3 ( $P < 0.001$ ). While all mean scores dropped at the post-post-intervention measurement, they were still higher than the pre-intervention scores ( $P \leq 0.001$ ).

### **Module Test Scores, By Group**

Changes in module test scores for both health and non-health majors were examined. Health majors' food safety knowledge increased for all modules. All post-post-intervention scores dropped but were still higher than pre-intervention scores. Non-health majors improved their test scores for all modules also; however, their knowledge dropped at post-post-intervention, with no scores higher than pre-intervention scores, indicating they did not retain the newly acquired information. Health majors more strongly indicated that the module information was important to their future profession (74%) compared to non-health majors (9.5%).

## Module Test Scores, Between Group

To determine differences in the means for module test scores between health and non-health majors, the Mann-Whitney U test was performed (Table 3). Health majors had significantly higher module test scores than non-health majors, except for MODULE 1 pre-test and MODULE 3 post-test.

**Table 3**  
**Comparison of Health Majors' and Non-Health Majors'**  
**Average Module Test Score\* (n = 38 Health, 21 Non-health)**

	Health	Non-Health	P
	Mean (SD)	Mean (SD)	
<b>Module 1 average score:</b>			
Time 1	39.7 (13.5)	40.8 (12.9)	0.854
Time 2	77.4 (18.2)	46.9 (17.5)	≤0.001
Time 3	55.5 (14.9)	40.9 (13.7)	≤0.001
<b>Module 2 average score:</b>			
Time 1	44.3 (12.6)	35.0 (9.1)	0.025
Time 2	82.5 (14.5)	46.8 (19.0)	≤0.001
Time 3	55.9 (13.6)	38.1 (13.8)	≤0.001
<b>Module 3 average score:</b>			
Time 1	55.0 (12.3)	49.9 (16.9)	0.587
Time 2	78.0 (10.7)	62.1 (44.3)	0.021
Time 3	64.4 (13.6)	52.8 (14.8)	0.009

\*Time 1 (pre-intervention), Time 2 (1 week post-intervention),  
Time 3 (5 weeks post-intervention)

A notable distinction between the groups was the amount of time students spent completing the modules. Approximately three-fourths of non-health majors spent 30 minutes or less on each educational module, compared to health majors, who spent thirty minutes to two hours. Health majors also referred back to the educational materials while completing post-tests, unlike non-health majors. Both groups had equal access to materials during post-tests.

## **DISCUSSION**

One purpose of this research, to explore relationships among attitudes, beliefs, knowledge, and self-reported practices of college students before and after food safety education intervention, was accomplished in a non-representative small sample of college students. Contrasting health and non-health majors was informative and encourages further work with both groups, particularly non-health students who had more limited food safety information.

### **Attitudes**

The educational intervention led students to more positive attitudes concerning food safety practices. Measuring food safety attitudes is important, as indicated in the Theory of Planned Behavior.<sup>12</sup> According to this theory, people act in accordance with their intentions, and intentions are influenced by attitudes. Thus, measuring college students' attitudes about food safety may be an important first step to possibly influencing their food safety behaviors.

### **Beliefs**

As a total group, students also showed improvement in food safety beliefs. After educational intervention, students increased in their belief that home prepared foods may be a significant source of foodborne illness. While health majors initially recognized that the home was a primary source of foodborne illness, non-health majors significantly increased in this perception. If individuals are made aware of places where foodborne illnesses are most likely to originate, hopefully they will take more precaution in those environments.

Recognition that contamination of food by microorganisms is a serious food safety problem should help students make change to decrease risk. Overall, students increased in their belief that contamination of food by microorganisms is a serious issue, but the change was primarily found among health majors.

### **Knowledge**

A review of literature found only one study that focused specifically on food safety knowledge of college students.<sup>7</sup> In that study, health majors scored higher than non-health majors, a finding that was supported in this research. Health majors scored higher on FSQ food safety knowledge for each time period and for seven of nine module tests.

### **Self-reported Practices**

Previous food safety research has indicated that knowledge does not always correspond to behaviors.<sup>2</sup> Even after exposure to the study's educational intervention (which emphasized importance of checking end-point temperatures of leftovers and meat items in particular), and even though their food safety knowledge and attitudes improved, non-health majors were not more inclined to use thermometers or decrease consumption of risky foods. However, health majors became less likely to report consuming high-risk foods and more likely to use thermometers, both of which are important practices to prevent foodborne illness.<sup>13</sup>

Several theoretical frameworks addressing the relationships between attitudes and behaviors have been described.<sup>12, 14, 15</sup> Resistance to change could be related to attitude strength or attitude ambivalence. While food safety attitudes

became more positive, they may not have become strong enough to facilitate behavior change. Even when attitudes change, the new attitude overrides but may not replace the old attitude, which is habitual.<sup>12</sup>

### **Food Safety Education Intervention May Be Needed**

Although health majors had received food safety information in previous college courses, FSQ and pre-module test scores indicated that information was not retained. Consideration should be given to providing a review of food safety information in upper-level nutrition courses.

The educational modules had a positive impact on module test scores, as all scores increased immediately after intervention. Students were asked to rate their ability to achieve module objectives developed by the researcher. Students indicated they could *likely* achieve most module objectives, which supports effectiveness of the educational content. Students indicated the interactive educational programs and variety of learning activities enhanced their learning and understanding. Students also indicated the web-based delivery was convenient and that they would recommend this type of course material presentation to other students. This type of educational program should be considered a valuable tool for food safety education of college students.

Potential weaknesses of the study include internal validity threats related to testing and mortality. Students may have become sensitized to food safety issues due to repeated multiple testing (although both groups had the same exposures), and the non-health majors had a higher drop out rate. Possible external validity threats include interaction of testing and treatment (intervention).

All subjects received intervention in the same order but performance from earlier treatment could have affected test performance from later treatment. Reactivity could also pose a threat because incentive to complete all required steps may have differed between health and non-health majors.

Other possible validity threats were assessed and found to not be a concern. There were no significant outbreaks of foodborne illness reported nationally or locally during the study, and there were no major local news articles discussing food safety issues. The subjects did not mature at different rates, were not exposed to different historical events, and were not tested differently. A recommendation for future research is to establish a verifiable user name and password for each student to assure effective tracking of intervention completion.

## **CONCLUSION**

This research has demonstrated that the newly developed interactive food safety education intervention resulted in improved attitudes and beliefs toward food safety. The strongest effects were seen in students who described that food safety principles were important to their future professions, i.e., health majors. Both health and non-health majors lacked food safety knowledge initially, especially the non-health majors. However, educational intervention resulted in improved food safety knowledge, particularly for health majors. Health majors also improved in self-reported thermometer use, consuming fewer high-risk foods, and did not prepare food for others when diarrhea was present.

Future research is needed to better examine specific barriers to changing food safety behaviors of college students who have accurate food safety

knowledge. Because college students' behaviors place them at increased risk for foodborne illness, educational interventions, such as the one developed for this study, are needed. College students will benefit from exposures to safe food handling instruction and accurate methods for preventing foodborne illnesses.

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## CHAPTER VI

### SUMMARY

The purpose of this study was to explore the relationships among food safety attitudes, beliefs, knowledge, and self-reported practices of current college students, and to assess whether a newly developed educational intervention positively influenced those variables

#### **SUPPORT OF HYPOTHESES**

To accomplish the research aims, seven hypotheses were tested.

**H1:** Subjects exhibit a low self-perceived risk for foodborne illness.

This hypothesis was supported by focused food safety discussion group findings. Participants had low self-perceived risk, particularly in the home. Participants expressed slightly more concern for restaurant foods.

**H2:** Subjects in health related majors exhibit a higher level of food safety knowledge than subjects in non-health related majors.

FSQ knowledge scores and educational intervention post-test scores supported this hypothesis with health majors scoring higher than non-health majors.

**H3:** Food safety knowledge does not correlate with self-reported practices.

This hypothesis was partially supported. After demonstrated increases in food safety knowledge scores, food safety self-reported practices for the total group did not improve, although there were some improvements for health majors.

**H4:** Subjects exhibit unsafe food safety attitudes and inaccurate beliefs.

This hypothesis was supported. After intervention, students increased in positive attitudes and beliefs towards food safety, which better represent recommended practices.

**H5:** Educational intervention will positively influence food safety attitudes and beliefs.

This hypothesis was supported. Students showed positive increases in food safety attitudes and food safety beliefs after educational intervention.

**H6:** Educational intervention will positively influence food safety knowledge.

This hypothesis was supported. Students showed positive increases in food safety knowledge after educational intervention.

**H7:** Educational intervention will positively influence food safety self-reported practices.

This hypothesis was partially supported. Food safety self-reported practices improved after intervention for health majors but not the non-health majors.

## **CONCLUSIONS**

A newly developed interactive food safety educational intervention resulted in improved attitudes and beliefs towards food safety. The strongest effects were seen in students who described that food safety principles were important to their future professions, i.e., health majors. Both health and non-health majors lacked food safety knowledge initially, especially the non-health majors. However, educational intervention resulted in statistically significant improvements in food

safety knowledge, particularly for health majors. Health majors also improved in self-reported thermometer use, consumed fewer high-risk foods, and did not prepare food for others when diarrhea was present.

Future studies should examine barriers to changing unsafe food handling practices because while students increased in knowledge, food safety practice changes were limited. College students place themselves at risk for foodborne illness and their lack of knowledge about recommended food safety practices remains a concern. Results from this study can be used to emphasize that food safety education needs to be expanded to include all college disciplines. Educational programs, such as the one developed for this study, are needed because students should be empowered with knowledge in order to make informed food safety decisions.

## APPENDICES

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**Approval for Research Involving Human Subjects**

Kansas State University  
University Research Compliance Office  
1 Fairchild Hall  
Manhattan, Ks 66506-1107

To: Joye Gordon  
JMC  
Kedzie Hall

Proposal Number: 2965

FROM: Rick Scheidt, Chair  
Committee on Research Involving Human Subjects

DATE: November 14, 2003

RE: Proposal Entitled, "Food Safety Education for the Prevention of  
Foodborne Illness Among US Residents 65 and Older"

The Institutional Review Board (IRB) for Kansas State University has reviewed the proposal identified above and has determined that it is exempt from further review.

This exemption applies only to the proposal currently on file with the IRB. Any change affecting human subjects must be approved by the IRB prior to implementation and may disqualify the proposal from exemption.

Exemption from review does not release the investigator from statutory responsibility for obtaining the informed consent of subjects or their authorized representatives, as appropriate, either orally or in writing, prior to involving the subjects in research. The general requirements for informed consent and its documentation are set forth in the Federal Policy Compliance Office and online at <http://orhrp.osophs.dhhs.gov/humansubjects/guidance/45cfr46.htm#46.116>. In cases of remote oral data collection, as in telephone interviews, oral consent is sufficient and the researcher is required to provide the respondent with a copy of the consent statement only if the respondent requests one. The researcher must, however, ask the respondent whether he or she wishes to have a copy. The initiative in requesting a copy must not be left to the respondent. Regardless of whether the informed consent is written oral, the investigator must keep a written record of the informed consent statement, not merely of the fact that it was presented, and must save this documentation for 3 years after completing the research.

The identification of a human subject in any publication constitutes an invasion of privacy and requires a separate informed consent.

Injuries or any unanticipated problems involving risk to subjects or to others must be reported immediately to the Chair of the Committee on Research Involving Human Subjects, the University Research Compliance Office, and if the subjects are KSU students, to the Director of the Student Health Center.

**FOCUSED FOOD SAFETY DISCUSSION GROUP FLYERS**



## Are you interested in \$15 and free pizza?



**We are looking for a few great students to participate in one focus group meeting on food safety. Get paid and eat free for expressing your opinion.**

Criteria: must be juniors and seniors who are not health and/or nutrition majors.

Date and time:

Monday, November 22<sup>nd</sup> 6:00-7:30 PM

146 Justin Hall

If you can come, please contact Linda Yarrow **no later than** noon, Friday, November 19<sup>th</sup>. Contact information:

[yarrowjd@flinthills.com](mailto:yarrowjd@flinthills.com) or Dr. Tina Remig 532-0172.



This project is being conducted in the Department of Human Nutrition and supports doctoral research. You may contact Dr. Tina Remig for additional information or questions.



## Are you interested in \$15 and free pizza?



**We are looking for a few great students to participate in one focus group meeting on food safety. Get paid and eat free for expressing your opinion.**

Criteria: juniors and seniors who are health and/or nutrition majors; not currently enrolled in Clinical Nutrition (HN 630); and completion of Environmental Issues in Hospitality (HRIMD 220) or Science of Food (HN 413).

Date and time:

Monday, January 31st, 6:00-7:30 PM  
146 Justin Hall

If you can come, please contact Linda Yarrow **no later than** noon, Friday, January 28th. Contact information:  
[yarrowjd@flinthills.com](mailto:yarrowjd@flinthills.com) or Dr. Tina Remig 532-0172.



This project is being conducted in the Department of Human Nutrition and supports doctoral research. You may contact Dr. Tina Remig for additional information or questions.

**FOCUSED FOOD SAFETY DISCUSSION GROUP LETTERS**

September \_\_\_\_, 2004

A few days from now, you will receive a request to fill out a questionnaire and participate in a focus group for an important research project being conducted at Kansas State University. It concerns the food safety experiences of college students at Kansas State University.

I am writing to you in advance because many people like to know ahead of time that they will be contacted. This study is an important one that will help us identify the food safety concerns of college students.

Thank you for your time and consideration. It's only with the generous help of people like you that our research can be successful.

Sincerely,

Dr. Tina Remig, PhD, Asst. Professor  
Kansas State University

Linda Yarrow, MS, RD/LD  
Kansas State University

P.S. We will be offering a small token of appreciation as a way of saying thanks.

October 25th, 2004

You are being invited to join in a preliminary part of our food safety study being conducted at Kansas State University. Participation is voluntary. This study will determine the food safety practices, attitudes, and knowledge of college students. You were selected because you are enrolled in courses with a health and/or communication focus. By completing a brief on-line survey and participating in one focus group session lasting approximately 90 minutes, you can influence the future food safety education of college students.

Based on the responses you and similar students provide, an electronic food safety curriculum will be developed to reflect important issues in food safety. You are part of a carefully selected sample and as a result, your responses are essential to having good representation of college students. Please read the enclosed Informed Consent for additional information about each part of your participation. Your answers are completely confidential and will be used only as summaries; no individual names will be identified.

Please let us know of your intent to participate by contacting me at [yarrowjd@flinthills.com](mailto:yarrowjd@flinthills.com) by Friday, October 29<sup>th</sup>.

Although participation is voluntary, we hope that you will join us. As a way of saying thanks for your help, all focus group/survey participants will receive a \$15 KSU gift card.

If you have any questions or comments about this study, we would be happy to talk with you. Our phone numbers are 785/210-7580 (L. Yarrow) and 532-0172 (Dr. Remig), or you can write to the above e-mail address.

Thank you very much for helping us with this important study that will have a direct influence on the future of food safety education.

Sincerely,

Linda Yarrow, MS, RD/LD  
Kansas State University

Dr. Valentina Remig, Ph.D.  
Assistant Professor, Kansas State University

November 1, 2004

Last week, a letter asking for your participation in a food safety focus group and on-line survey was given to you.

If you have already contacted us about your desire to participate, please accept our sincere thanks. If not, please do so today. We are especially grateful for your help because it is only by asking people like you to share your experiences that we are able to understand the food safety characteristics of college students.

If you lost your packet of materials or it was misplaced, please call us (532-0172 or 785/210-7580) or e-mail ([yarrowjd@flinthills.com](mailto:yarrowjd@flinthills.com)) and we will get another one to you immediately.

Thank you.

Linda Yarrow, MS, RD/LD  
Doctoral Candidate  
Dept. of Human Nutrition

Valentina Remig, Ph.D., RD, FADA  
Assistant Professor  
Kansas State University

January 12, 2005

You are being invited to join in a preliminary part of our food safety study being conducted at Kansas State University. Participation is voluntary. This study will determine the food safety practices, attitudes, and knowledge of college students. You were selected because you are enrolled in courses with a health and/or communication focus and you will not be enrolled in HN 630 or MC 645 in Spring 2005. Additional selection criteria are: junior or senior standing and completion of either HRIMD 220, Environmental Issues in Hospitality, or HN 413, Science of Food.

By completing a brief on-line survey and participating in one focus group session lasting approximately 90 minutes, you can influence the future food safety education of college students. The total time commitment you will be making to this part of the study is no longer than two hours. You are part of a carefully selected sample and as a result, your responses are essential to having good representation of college students.

Based on the responses you and similar students provide, an electronic food safety curriculum will be developed to reflect important issues in food safety. Please read the enclosed Informed Consent for additional information about each part of your participation. Your answers are completely confidential and will be used only as summaries; no individual names will be identified.

The focus group is scheduled for Monday, January 31<sup>st</sup>, from 6:00-7:30 p.m., in Justin 146. We will provide complimentary pizza and beverages for the group.

Please let us know of your willingness to participate by contacting me or e-mailing me at [yarrowjd@flinthills.com](mailto:yarrowjd@flinthills.com) by Friday, January 21<sup>st</sup>. Please let me know either way of your intent to participate. Although participation is voluntary, we hope that you will join us. As a way of saying thanks for your help, all focus group/survey participants will receive \$15 after data is collected.

If you have any questions or comments about this study, we would be happy to talk with you. You may call Dr. Remig at 532-0172 or you can write to the above e-mail address.

Thank you very much for helping us.

Sincerely,

Linda Yarrow, MS, RD/LD  
Doctoral Candidate  
Dept. of Human Nutrition

Valentina Remig, Ph.D., RD, FADA  
Assistant Professor  
Kansas State University

**FOCUSED FOOD SAFETY DISCUSSION GROUP INFORMED CONSENT**

## KANSAS STATE UNIVERSITY

### INFORMED CONSENT

**Project Title:** Food Safety Education for the Prevention of Foodborne Illness Among U.S. Residents 65 and Older.

**Approval Date of Project:** 9/02      **Expiration Date of Project:** 9/05

**Principal Investigator: Co-Investigators:** Dr. Valentina Remig, Ph.D.; Dr. Joye Gordon, Ph.D.

**Contact** and phone for any problems/questions: [yarrowjd@flinthills.com](mailto:yarrowjd@flinthills.com), Dr. Remig 532-0172

**IRB Chair** contact/phone information: Dr. Rick Scheidt, Chair, Committee on Research Involving Human Subjects, 1 Fairchild Hall, Kansas State University, Manhattan, KS 66506 (785) 532-3224

**Sponsor of Project:** USDA (United States Department of Agriculture), CREES (Cooperative State Research, Education, and Extension Service)

**Purpose of the Research:** Foodborne illness is a major threat in the United States. Very little is known about food safety characteristics of college students. The purpose of this research is to determine food safety attitudes, self-reported practices, and knowledge of college students majoring in health and non-health fields.

**Procedures or Methods to be Used:** Participants will complete an electronic food safety survey prior to focus group participation. College student focus groups, lasting approximately 90 minutes, will be conducted in the fall of 2004 and spring of 2005. Focus groups are small groups of 6-10 persons where informal discussions will be used to gather information about food safety. Focus group sessions will be audio taped and transcribed. Focus group participants will receive \$15.

**Length of study:** Focus group participation: 90 minutes. Electronic survey completion: 15-20 minutes.

**Risks anticipated:** None

**Benefits anticipated:** The information gathered will contribute to the development of an electronic food safety curriculum to be used with college students who will work with older adults.

**Extent of confidentiality:** Results will be stored in a locked file cabinet and all identifying information will be removed before data entry. Only the researchers will have access to the file cabinet.

**Terms of participation:** I understand this project is research, and that my participation is completely *voluntary*. I also understand that if I decide to participate in this study, I may withdraw my consent at any time, and stop participating at any time without explanation, penalty, or loss of benefits, or academic standing to which I may otherwise be entitled.

I verify that my signature below indicates that I have read and understood this consent form, and willingly agree to participate in this study under the terms described, and that my signature acknowledges that I have received a signed and dated copy of this consent form.

Participant Name: \_\_\_\_\_

Participant Signature: \_\_\_\_\_ Date: \_\_\_\_\_

Witness to Signature  
(Project Staff): \_\_\_\_\_ Date: \_\_\_\_\_

**FOCUSED DISCUSSION GROUP INFORMATION SHEET**

## Focus Group Information Sheet

ID (last 6 digits of SS#): \_\_\_\_\_

Phone #: \_\_\_\_\_

e-mail: \_\_\_\_\_

1. College Major: \_\_\_\_\_

2. Student classification (please circle one): Junior    Senior    Other (identify)

3. Date of Birth:

4. Gender (please circle one): Male    Female

5. Place of residence: (please circle one)

a. house or condo

b. apartment

c. residence hall

d. fraternity/sorority

e. other (please specify) \_\_\_\_\_

6. How many people, including yourself, live in your household? \_\_\_\_\_

7. On average, how many 'cooked' meals do you prepare per week? \_\_\_\_\_

8. What is your ethnicity? (please circle one)

a. White, non-Hispanic

b. Hispanic

c. Black or African American

d. Asian

e. Native Hawaiian or Pacific Islander

f. American Indian or Alaskan Native

g. Other (please specify) \_\_\_\_\_

Continued on Back

9. Have you taken any of the following courses? (please circle)

a. HRIMD 220 Environmental Issues in Hospitality

b. HRIMD 342 Food Production Management

c. HN 413 Science of Food

10. Have you had exposure to food safety training in any other setting? (please circle)

Yes      No

11. If yes, please describe.

12. Do you believe that you have ever experienced foodborne illness? (please circle)

Yes      No

13. If yes, what led you to believe this?

**FOCUSED FOOD SAFETY DISCUSSION GROUP SCRIPT**

## Focused Food Safety Discussion Group Guide/Script

Thank you so much for attending today. Please make yourself comfortable and feel free to enjoy the food and drinks as we get started. My name is Linda Yarrow and I will be moderating this session. \_\_\_\_\_ will be taking notes and recording the session using a tape recorder.

We've asked you here to learn more from you about your thoughts on food safety and safe food handling. This discussion is part of a larger study funded by the USDA to look at ways to communicate about safe food handling.

What we are doing today is called a focus group and will last approximately 90 minutes. This is one of 4 focus groups that we are conducting. I will summarize the comments from all groups but no individual names will be divulged nor will you be identifiable by your comments. You have the right to stop participating at any time without penalty or hard feelings, but of course, we hope you're here for the duration tonight.

The informed consent that you received and completed describes this portion of the study and provides you with contact information. You may take a copy home with you. By signing, you agree to participate in this research project. Please read the form carefully and sign both copies. You will keep one copy for your own records and return the other to me.

There are a few procedures that will make this focus group go a little smoother. I am recording so please speak clearly and keep responses to one at a time. We will start the focus group with one question that everyone will answer. May we begin with you \_\_\_\_\_ and work our way around the table? After that, you are free to answer when you want. If you are quiet for a time, I may call on you specifically. If at any time you are uncomfortable with the questions, you may choose to not answer. As the moderator, my job is to ask questions and probe when needed, but I will neither agree nor disagree with your answer. Feel free to say what you think, even if it differs from what others may say. Does anyone have any questions before we begin?

We need to first take a few minutes to complete the student information sheet and informed consent.

Our agenda for today is: 1) completion of the consent form and information sheet, 2) answer 14 specific, directed questions about food safety, and 3) discuss the on-line questionnaire.

Let's get started with introductions. Please state your name and how many times you have washed your hands today.

Our first few questions deal with how concerned you are about food safety, how much food safety control you feel you have, and how willing you would be to change food preparation habits.

Beginning with XXXX, tell me how concerned are you about food safety and what is your biggest food safety concern?

How much control do you have over the food prepared in your home?

If you learned of new or different food preparation or storage practices, how likely would you be to make changes to use those practices? What would prevent you from using those practices?

Our next set of questions deal with thawing, cooking, cooling, and storage of foods.

Please describe how you thaw different meats such as turkey, ground beef, or steak.

Thawing should occur in either a refrigerator, in a microwave oven followed by complete cooking, in water that is frequently changed, and in ovens followed by immediate and complete cooking. Knowing this, would you change any of your thawing practices? Why or why not?

When you are cooking food, how do you determine doneness of meat?

With meats, including poultry, the best measure of doneness is temperature. Knowing that, would you use temperature as a determinant and why or why not?

After you cook foods, how quickly do you refrigerate them? In what portions do you refrigerate?

Food safety specialists recommend cooling food in the refrigerator immediately after cooking or eating. They also recommend that portions should be divided so that the food cools more quickly and thoroughly. How do you respond to these recommendations?

Our next set of questions pertain to hand washing and consumption of high-risk foods.

When you are cutting meat, it is recommended that you wash in hot water and soap, the cutting board, knife, and your hands before handling other foods. Do you follow this practice? Why or why not?

How frequently do you wash your hands when preparing food? How important is that to you?

Certain foods have a greater likelihood of causing foodborne illness such as runny eggs, pink hamburger, raw or uncooked seafood, unpasteurized milk or fruit juice. How likely are you to eat these types of food? If you eat them, would you continue to eat them in the future? Why or why not?

Next, we would like to get some thoughts from you on foodborne illness.

How do you protect yourself from foodborne illness?

How do you know that your food is safe to eat?

Finally, we would like to hear your thoughts on the on-line food safety questionnaire that you completed before coming tonight. Please share your thoughts on 1) the length of the survey, 2) the ease of completing it, 3) troubling questions, and 4) any other comments you would like to share.

We've met our objectives for this evening and we thank you for your time and participation. Your comments and discussion have been very helpful. These discussions will influence development of a food safety curriculum for college students. You will receive your \$15 as soon as we can process the paperwork. If you have questions or would like to see the findings of the study, please let me know.

This concludes our meeting and we hope you are no longer starved, that you feel good for having contributed to science, and that you are safe in your travel home. Enjoy the rest of your evening.

**FOOD SAFETY QUESTIONNAIRE (FSQ)**

## Food Safety Education on Foodborne Illness

### Survey Description

The purpose of this survey is to collect information on food safety knowledge, self-reported food safety practices, and food safety attitudes of junior and senior level college students.

### Opening Instructions

This is a pre-test to be completed prior to participating in the Food Safety Education curriculum. Instructions are given at the beginning of each question segment. Please read and answer all questions to the best of your ability.

#### Question 1 *\*\* required \*\**

Please enter the **last 6 digits** of your social security number.

(maximum of 6 characters)

#### Question 2 *\*\* required \*\**

Please read each question. Mark the circle that is the closest match to your own opinion.

1 - Strongly agree | 2 - . | 3 - . | 4 - Agree | 5 - . | 6 - .  
7 - Strongly disagree

	1	2	3	4	5	6	7
2.1 I am <b><u>not concerned</u></b> if I thaw perishable food on the kitchen counter.	<input type="radio"/>						
2.2 Cooking and eating eggs that have firm yolks and whites <b><u>is important</u></b> to me for safety.	<input type="radio"/>						
2.3 Drinking pasteurized apple juice or cider <b><u>is important</u></b> to me for safety.	<input type="radio"/>						
2.4 After cutting raw meat or chicken, I like to wash the cutting board, knife, and counter top with hot soapy water before continuing cooking.	<input type="radio"/>						
2.5 I am <b><u>not interested</u></b> in using a meat thermometer.	<input type="radio"/>						
2.6 I <b><u>don't worry</u></b> that I may get sick if I eat alfalfa and other raw sprouts.	<input type="radio"/>						
2.7 I <b><u>am worried</u></b> that I may get sick if I eat hot	<input type="radio"/>						

dogs right out of the package.							
<b>2.8</b> Using cheese and yogurt made only from pasteurized milk <b>is important</b> to me.	<input type="radio"/>						
<b>2.9</b> I <b>am concerned</b> that I may get sick if I eat raw oysters.	<input type="radio"/>						
<b>2.10</b> I <b>don't worry</b> about keeping the refrigerator at or below 40 degrees Fahrenheit.	<input type="radio"/>						
<b>2.11</b> I <b>don't worry</b> about washing my hands after playing with my pets.	<input type="radio"/>						

**Question 3** *\*\* required \*\**

Please read each question. Mark the circle that is the closest match to your own opinion.

1 - Strongly agree | 2 - . | 3 - . | 4 - Agree | 5 - . | 6 - .  
7 - Strongly disagree

	1	2	3	4	5	6	7
<b>3.1</b> It is not important to cover a cut or sore on my hand before I prepare food.	<input type="radio"/>						
<b>3.2</b> Refrigerating food such as rice and beans overnight before serving them the following day is not a priority for me.	<input type="radio"/>						
<b>3.3</b> There is no need to store eggs in a refrigerator; room temperature is just fine.	<input type="radio"/>						

**Question 4** *\*\* required \*\**

Please read each question. Mark the circle that is the closest match to your own opinion.

1 - Very likely | 2 - . | 3 - . | 4 - Likely | 5 - . | 6 - .  
7 - Not at all likely

	1	2	3	4	5	6	7
<b>4.1</b> If you forget to wash your hands before you begin cooking, how likely are you to get sick?	<input type="radio"/>						
<b>4.2</b> If vegetables you will eat raw happen to touch raw meat or chicken, how likely are you to get sick?	<input type="radio"/>						

<p><b>4.3</b> If you eat meat or chicken that is not thoroughly cooked, how likely are you to get sick?</p>	<input type="radio"/>						
<p><b>4.4</b> If you happen to have cooked food out of the refrigerator for more than 2 hours after it has finished cooking, how likely are you to get sick?</p>	<input type="radio"/>						

**Question 5** *\*\* required \*\**

Please read each question. Mark the circle that indicates your answer.

Where do you think food safety problems are most likely to occur?

- Farms
- food processing plants
- warehouses
- supermarkets
- restaurants
- homes
- don't know

**Question 6** *\*\* required \*\**

Mark the circle that indicates your answer.

How common do you think it is for people in the United States to become sick (food poisoning) because of the way food is handled or prepared in their **home**?

- very common
- somewhat common
- not very common
- don't know

**Question 7** *\*\* required \*\**

Mark the circle that indicates your answer.

How common do you think it is for people in the United States to become sick (food poisoning) because of the way food is handled or prepared in **restaurants**?

- more common than from food prepared at home
- less common than from food prepared at home
- about the same as from food prepared at home
- don't know

**Question 8** *\*\* required \*\**

Please mark the circle that indicates your answer.

How much of a food safety problem do you think contamination of food by micro-organisms is?

- a very serious food safety problem
- a serious food safety problem
- somewhat of a food safety problem
- not a food safety problem at all
- don't know

**Question 9** *\*\* required \*\**

Mark the circle that is the closest match to your own opinion. How likely do you think the following foods contain germs or other microorganisms that could make you sick?

1 - Very likely | 2 - . | 3 - . | 4 - Likely | 5 - . | 6 - .  
7 - Not at all likely

	1	2	3	4	5	6	7
9.1 raw chicken	<input type="radio"/>						
9.2 raw beef	<input type="radio"/>						
9.3 raw fruits	<input type="radio"/>						
9.4 raw sprouts such as alfalfa sprouts	<input type="radio"/>						
9.5 raw vegetables	<input type="radio"/>						

9.6 raw shellfish	<input type="radio"/>						
9.7 raw eggs	<input type="radio"/>						

**Question 10** *\*\* required \*\**

These next questions refer to foods you prepare in your own home. Mark the circle that indicates your answer.

1 - Always | 2 - . | 3 - . | 4 - Sometimes | 5 - . | 6 - .  
7 - Never | 8 - not applicable

	1	2	3	4	5	6	7	8
10.1 Before preparing or handling food, I wash my hands with soap and warm running water.	<input type="radio"/>							
10.2 After playing with a pet and before getting a snack, I wash my hands with soap and warm running water.	<input type="radio"/>							
10.3 If I have a cut or sore on my hand, I cover it before preparing food.	<input type="radio"/>							
10.4 I discard shellfish, such as mussels or clams, if the shellfish has not opened during cooking.	<input type="radio"/>							
10.5 I wash the plate used to hold raw meat, poultry, or seafood with hot, soapy water before returning cooked food to the plate OR I use a clean plate.	<input type="radio"/>							
10.6 I wash my hands with soap and warm running water after working with raw meat, poultry, or seafood and before I continue cooking.	<input type="radio"/>							
10.7 I clean countertops with hot soapy water after preparing food.	<input type="radio"/>							
10.8 I leave cooked foods, such as rice or beans, on the stovetop overnight to be used the next day.	<input type="radio"/>							
10.9 I put frozen meat and poultry on the counter in the morning so it will be thawed and ready to cook in the evening.	<input type="radio"/>							

<b>10.10</b> I store my eggs at room temperature.	<input type="radio"/>							
<b>10.11</b> I never eat raw vegetables if they have come in contact with raw meat or chicken.	<input type="radio"/>							

**Question 11** *\*\* required \*\**

Please mark the circle that indicates your answer.

1 - Yes | 2 - No | 3 - Don't Know

	1	2	3
<b>11.1</b> Do you eat rare hamburger?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
<b>11.2</b> Do you eat eggs with runny yolks?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
<b>11.3</b> Do you eat eggs with firm yolks?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
<b>11.4</b> Do you drink untreated water from a stream?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
<b>11.5</b> Do you eat raw oysters or oysters on the half shell?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
<b>11.6</b> Do you eat raw fish?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
<b>11.7</b> Do you eat homemade cookie dough?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
<b>11.8</b> Do you eat alfalfa or other raw sprouts?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
<b>11.9</b> Do you eat ceviche (marinated raw fish)?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
<b>11.10</b> Do you eat sushi (made with raw fish)?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
<b>11.11</b> Do you drink raw (unpasteurized) milk?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
<b>11.12</b> Do you drink raw (unpasteurized) juice or cider?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
<b>11.13</b> Do you eat hot dogs right out of the package?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
<b>11.14</b> Do you refrigerate cooked rice within 2 hours of preparing and serving?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
<b>11.15</b> Do you refrigerate fried chicken within 2 hours of preparing and serving?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

**Question 12** *\*\* required \*\**

Please mark the circle that indicates your answer.

1 - Yes | 2 - No | 3 - Don't know

	1	2	3
12.1 Do you refrigerate refried or cooked beans within 2 hours of preparing and serving?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
12.2 If you have diarrhea, do you prepare food for <b>yourself</b> ?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
12.3 If you have diarrhea, do you prepare food for <b>others</b> ?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
12.4 After a large family dinner, do you leave large meat items, like turkey, out to be used for sandwiches with the evening meal?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
12.5 Do you use a thermometer to check the temperature of your refrigerator?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
12.6 Do you use a thermometer to determine if hamburger patties have been cooked enough?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
12.7 Do you use a thermometer to determine if leftovers have been reheated enough?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

**Question 13** *\*\* required \*\**

Please read each question. Mark the circle that is the closest match to your own opinion.

1 - Strongly agree | 2 - . | 3 - . | 4 - Agree | 5 - . | 6 - .  
7 - Strongly disagree

	1	2	3	4	5	6	7
13.1 I have little control over the food that I serve in my home.	<input type="radio"/>						
13.2 There is really no way I can prevent someone who's eaten food I prepared from getting food poisoning.	<input type="radio"/>						
13.3 There is little I can do to change many of my food preparation habits.	<input type="radio"/>						
13.4 I often feel helpless if myself or someone I know gets food poisoning from restaurant food.	<input type="radio"/>						
13.5 Sometimes I feel that if I or someone I know gets sick from food I cooked, life just has it in for me.	<input type="radio"/>						

13.6 Whether or not food is handled safely in my home in the future mostly depends on me.

<input type="radio"/>						
-----------------------	-----------------------	-----------------------	-----------------------	-----------------------	-----------------------	-----------------------

13.7 When it comes to safe food preparation, I can do just about anything I really set my mind to.

<input type="radio"/>						
-----------------------	-----------------------	-----------------------	-----------------------	-----------------------	-----------------------	-----------------------

**Question 14** *\*\* required \*\**

Please mark the circle that indicates your answer.

The best way to clean your hands before preparing food is:

- wipe them with a wet cloth or towel
- wipe them on your clothes
- rinse them under running water
- wash them with soap and warm running water
- don't know

**Question 15** *\*\* required \*\**

Please mark the circle that indicates your answer.

Hamburger patties should be cooked until the temperature in the middle is:

- 130 degrees F
- 140 degrees F
- 150 degrees F
- 160 degrees F
- don't know

**Question 16** *\*\* required \*\**

Please mark the circle that indicates your answer.

After you have shaped ground beef patties with your hands, which of the following best describes what you should do next before continuing cooking?

- wipe your hands on a towel or cloth
- rinse your hands under warm running water
- wash your hands with soap and warm running water
- continue to cook without washing hands
- don't know

**Question 17** *\*\* required \*\**

Please read each question. Mark the circle that is the closest match to your own opinion.

1 - yes | 2 - no | 3 - don't know

	1	2	3
<b>17.1</b> If you have diarrhea, it's okay to prepare food for others in the family if you wash your hands first.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
<b>17.2</b> When you can't see any pink color inside a cooked hamburger patty, you know all of the harmful germs have been killed and the hamburger is safe to eat.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
<b>17.3</b> Cooking eggs until both the yolk and white are firm will kill harmful germs.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
<b>17.4</b> Is using the same cutting board to cut up raw chicken and then vegetables for a salad safe as long as you wipe the board off with a clean cloth between different foods?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
<b>17.5</b> If you use a dishcloth to wipe up liquid from meat or chicken, can you safely continue to use the cloth for washing dishes if you rinse the dishcloth in hot water?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
<b>17.6</b> Pasteurization of milk and juices helps prevent foodborne illness.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
<b>17.7</b> It is safe to use raw eggs in recipes that will not be cooked.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

**Question 18** *\*\* required \*\**

If the following food items are left out at room temperature for more than 2 hours, are they safe to eat or should they be thrown away?

1 - safe to eat | 2 - thrown away | 3 - don't know

	1	2	3
18.1 cooked rice	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
18.2 cooked meat	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
18.3 a whole apple	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
18.4 a baked potato	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

**Question 19** *\*\* required \*\**

Please read each question. Mark the circle that is the closest match to your own opinion.

1 - Strongly agree | 2 - . | 3 - . | 4 - Agree | 5 - . | 6 - .  
7 - Strongly disagree

	1	2	3	4	5	6	7
19.1 If I follow safe food handling practices, my chances of sickness would <b>decrease</b> .	<input type="radio"/>						
19.2 If I wash my hands before preparing a meal, my chances of getting sick <b>increase</b> .	<input type="radio"/>						
19.3 If my refrigerator is set at the right temperature, the chances <b>decrease</b> that I would become sick from a foodborne illness.	<input type="radio"/>						
19.4 If I cook hamburger meat to the recommended temperature, my chance of getting sick <b>decreases</b> .	<input type="radio"/>						
19.5 If I drink unpasteurized milk or juice, my chance of getting sick <b>increases</b> .	<input type="radio"/>						
19.6 If I forget to wash the countertops in my kitchen with soap and warm water, my chances of getting sick <b>increase</b> .	<input type="radio"/>						

**Question 20** *\*\* required \*\**

How many people, including yourself, live in your household?

(maximum of 200 characters)

**Question 21** *\*\* required \*\**

Please indicate your gender.

male

female

**Question 22** *\*\* required \*\**

Do you live in a(an):

house or condo

apartment

residence hall

fraternity/sorority

other

**Fill out this page only if you answered:**

- *other* on question **22. Do you live in a(an):** on *page 1* .

Please indicate your type of housing:

**Question 23** *\*\* required \*\**

What is your current type of housing?

(maximum of 200 characters)

**Fill out this page only if you answered:**

- [house or condo](#) OR [apartment](#) OR [residence hall](#) OR [fraternity/sorority](#) OR [other](#) on question [22. Do you live in a\(an\):](#) on [page 1](#) .

Please continue with the remainder of the questionnaire.

**Question 24 *\*\* required \*\****

Please enter the month, day, and year you were born (in that order).

(maximum of 200 characters)

**Question 25 *\*\* required \*\****

What is your ethnicity?

- White, non-Hispanic
- Hispanic
- Black or African American
- Asian
- Native Hawaiian or Pacific Islander
- American Indian or Alaskan Native
- Other

**Fill out this page only if you answered:**

- [Other](#) on question [25. What is your ethnicity?](#) on [page 4](#) .

If you chose "other", please indicate your ethnicity.

**Question 26 *\*\* required \*\****

What is your ethnicity?

(maximum of 200 characters)

**Closing Message**

Thank you for completing the Pre-test. Your input is valuable to us!

**FOOD SAFETY MODULES CONTENT**

## MODULE 1: OVERVIEW OF FOOD SAFETY

- I. Foodborne Illness
- II. Foodborne Illness in the United States
- III. Who Is At Risk
- IV. CDC Estimates of Cases of Foodborne Illness
- V. Emerging Pathogens
- VI. Symptoms of Foodborne Illness
- VII. Resulting Chronic Sequelae
- VIII. Pathogens of Concern
  - A. *Campylobacter jejuni*
  - B. *Salmonella* spp.
  - C. *E. coli* O157:H7
  - D. Norwalk Virus
  - E. *Listeria monocytogenes*
  - F. *Cryptosporidium parvum*
  - G. *Vibrio*
  - H. *Clostridium botulinum*
  - I. *Clostridium perfringens*
  - J. *Staphylococcus aureus*
- IX. Food Safety Guidelines
  - A. Thaw correctly
  - B. Cook thoroughly
  - C. Separate/Avoid cross-contamination
  - D. Chill
  - E. Safe Temperatures
  - F. Personal Hygiene
- X. Specific Food Guidelines
  - A. Hamburger
  - B. Eggs
  - C. Rice/Beans cooked
  - D. Raw sprouts

## **MODULE 2: FOOD SAFETY BELIEFS, KNOWLEDGE, AND FOOD HANDLING PRACTICES OF THE GENERAL POPULATION**

- I. Food Safety Beliefs
- II. Food Safety Knowledge
- III. Food Handling Practices
- IV. Do people really 'do' what they say they 'do'?
- V. What are the contaminated areas in your home?
- VI. Correct use and types of thermometers
  - A. Why use a food thermometer?
  - B. Color is not a reliable indicator
  - C. Types of thermometers
  - D. Where to place a thermometer
  - E. Calibrating a thermometer
- XI. Food Service Industry Food Safety
- XII. Healthy People 2010 Food Safety Goals
- XIII. 2005 Dietary Guidelines on Food Safety

## **MODULE 3: FOOD SAFETY FOR OLDER ADULTS**

- I. Older Adults
- II. Changes associated with aging
- III. Immune function changes
- IV. The gastrointestinal tract and aging
- V. Nutrition and aging
- VI. Exercise and aging
- VII. Additional factors that can affect risk
  - A. Lifestyles
  - B. Nursing home placement
- VIII. Pathogens of concern for older adults
  - A. Campylobacter jejuni
  - B. E. coli O157:H7
  - C. Listeria monocytogenes
  - D. Salmonella spp.
  - E. Vibrio
- IX. Food safety knowledge of older adults
- X. Food handling practices of older adults
- XI. Beliefs of older adults
- XII. Food safety recommendation for older adults
  - A. Hygiene
  - B. Cook to proper temperature
  - C. Separate: Don't cross-contaminate
  - D. Refrigerate Promptly
- XIII. Risky foods for older adults

**MODULE 1 POST-TEST**

## Module 1 Post-test: Overview of Food Safety

### Survey Description

The purpose of this survey is to collect information from you after you have completed Module 1: Overview of Food Safety.

### Opening Instructions

Please answer the following post-test questions. Do not seek outside help or use resources other than information presented in Module 1: Overview of Food Safety. Answer all questions as honestly as you can. The questions are designed to be answered after completing the first food safety curriculum module. Your instructor will be notified when you have completed the questionnaire.

### Question 1

Please enter the **last 6 digits** of your social security number. (not just four)

(maximum of 200 characters)

### Question 2 **\*\* required \*\***

Foodborne illness in the United States is **most often** caused by which of the following :  
(please RANK in order of most often (#1) to least often (#4))

--  Bacteria

--  Parasites

--  Viruses

--  Mold

**Question 3** *\*\* required \*\**

Which of the following pathogens found in contaminated lunch meat is most likely to cause foodborne illness?

- Listeria
- E. coli O157:H7
- Salmonella
- Clostridium perfringens

**Question 4** *\*\* required \*\**

Fresh produce can be contaminated with many pathogens. The best method to reduce pathogen levels on fresh produce is to:

- wash produce only if visible dirt is present
- wash produce with soap and water before eating
- wash produce with running tap water before eating

**Question 5** *\*\* required \*\**

Infections caused by the pathogens Norovirus and Staphylococcus are most closely related to:

- cross-contamination
- inadequate refrigeration
- improper cooking temperatures
- poor personal hygiene
- all of the above

**Question 6** *\*\* required \*\**

Which of the following pathogen(s) can grow on non-living surfaces and contain(s) all of the machinery needed for growth and multiplication?

- parasites
- viruses
- bacteria
- all of the above
- none of the above

**Question 7** *\*\* required \*\**

The two most common diagnostic symptoms of foodborne illness are:

- diarrhea and abdominal pain/cramping
- vomiting and fever/chills
- headache/muscle pain and fever/chills
- diarrhea and vomiting
- none are the results of foodborne illness

**Question 8** *\*\* required \*\**

Effective handwashing may eliminate approximately what percentage of foodborne illness cases?

- 10%
- 25%
- 50%
- 75%
- 100%

**Question 9** *\*\* required \*\**

Refrigeration prevents bacterial growth.

- True
- False

**Question 10** *\*\* required \*\**

Which foods are likely to cause foodborne illness?

- chicken breast
- alfalfa sprouts
- ground beef
- A & B
- A & C
- all of the above

**Question 11** *\*\* required \*\**

Should you prepare food if you have diarrhea?

- No, you shouldn't prepare food for anyone
- Yes, you may prepare food for only yourself
- Yes, you may prepare food for yourself and others

**Question 12** *\*\* required \*\**

Cooking eggs until both the yolk and white are firm will kill harmful bacteria.

- True
- False

Please rate the following statements.

**Question 13** *\*\* required \*\**

1 - Very unlikely | 2 - Unlikely | 3 - Maybe | 4 - Likely  
5 - Definitely

	1	2	3	4	5
13.1 I can recognize pathogens of concern for foodborne illness.	<input type="checkbox"/>				
13.2 I can recognize symptoms of foodborne illness.	<input type="checkbox"/>				
13.3 I can identify key food safety guidelines that reduce the risk of foodborne illness.	<input type="checkbox"/>				
13.4 How likely will you be to use the information from this module?	<input type="checkbox"/>				
13.5 After today, how likely are you to change personal hygiene practices?	<input type="checkbox"/>				
13.6 After today, how likely are you to change food preparation practices?	<input type="checkbox"/>				
13.7 After today, how likely are you to change food storage practices?	<input type="checkbox"/>				

**Closing Message**

Thank you for completing this post-test questionnaire! You will receive pre-test questions for Module 2 on Sunday, February 27th.

**MODULE 2 POST-TEST**

## Module 2 Post-test: Food Safety Beliefs, Knowledge, and Food Handling Practices of the General Population

### Survey Description

The purpose of this survey is to collect information from you after you have completed Module 2: Food safety beliefs, knowledge, and food handling practices of the general population.

### Opening Instructions

Please answer the following post-test questions. Do not seek outside help or use resources other than information presented in Module 2. Answer all questions as honestly as you can. The questions are designed to be answered after completing the second food safety curriculum module. Your instructor will be notified when you have completed the questionnaire.

### Question 1 **\*\* required \*\***

Please enter the **last 6 digits** of your social security number. (not only four)

(maximum of 200 characters)

### Question 2 **\*\* required \*\***

In a survey of college students by Unklesbay, students believed:

- foodborne illness was a personal responsibility
- foodborne illness was not common
- food safety knowledge was desirable
- a & b
- a & c
- all of the above

**Question 3** *\*\* required \*\**

According to the Food Safety and Inspection Service, consumers have a high awareness of which two pathogens?

- Salmonella and Listeria
- Salmonella and E. coli
- E. coli and Listeria
- Listeria and Campylobacter
- Campylobacter and Salmonella

**Question 4** *\*\* required \*\**

Rank the following from **highest (1) to lowest (4)** in terms of contributing factors to foodborne illness in the United States.

- inadequate cooking
- poor personal hygiene
- contaminated cooking equipment
- improper holding temperatures of food

**Question 5** *\*\* required \*\**

In the FDA/Utah State study, the most common source of cross-contamination was:

- contaminated cooking equipment
- poor personal hygiene
- not using separate cutting boards
- reusing dish towels

**Question 6** *\*\* required \*\**

The most frequently reported unsafe food practice of college students (Morrone, 2003) was:

- consuming raw fish or hamburger
- consuming home-made cookie dough
- consuming hamburgers that were pink or red inside
- consuming raw/undercooked eggs

**Question 7** *\*\* required \*\**

If a hamburger patty is brown throughout and the juices run clear, it is safe to eat.

- True  
 False

**Question 8** *\*\* required \*\**

Where should a thermometer be placed in a roast?

- thickest part avoiding bone  
 thickest part next to the bone  
 in the thickest fat portion  
 in the side of the roast

**Question 9** *\*\* required \*\**

All food service managers are required to have food safety training.

- True  
 False

**Question 10** *\*\* required \*\**

Of the following, which two are the two most common practices of food service establishments that contribute to foodborne illness?

1. improper holding and storage temperatures
2. contaminated cooking equipment
3. inadequate use of thermometers
4. failing to calibrate thermometers
5. poor personal hygiene

- 1 & 2  
 2 & 3  
 1 & 3  
 1 & 5  
 3 & 5

**Question 11** *\*\* required \*\**

How long should leftovers be stored in the refrigerator?

- 1-2 days
- 3-4 days
- up to 7 days
- base on look, smell, and taste of food

**Question 12** *\*\* required \*\**

Which characteristic(s) allow pathogens to survive and multiply?

- a) moisture
- b) acidity
- c) oxygen
- d) protein
- a & d
- all the above

**Question 13** *\*\* required \*\**

Please rate the following statements.

1 - Very unlikely | 2 - Unlikely | 3 - Maybe | 4 - Likely  
5 - Definitely

	1	2	3	4	5
<b>13.1</b> I can describe food preparation behaviors of the general population.	<input type="checkbox"/>				
<b>13.2</b> I can summarize food safety beliefs and awareness of the general population.	<input type="checkbox"/>				
<b>13.3</b> I can describe food safety beliefs and consumption behaviors of college students.	<input type="checkbox"/>				
<b>13.4</b> I can identify contributing factors to foodborne illness in the United States.	<input type="checkbox"/>				
<b>13.5</b> I can describe factors that contribute to foodborne illness in the <b>food service industry</b> .	<input type="checkbox"/>				
<b>13.6</b> I can differentiate among types of thermometers and their uses.	<input type="checkbox"/>				

13.7 How likely will you be to use the information from this module?	<input type="radio"/>				
13.8 After today, how likely are you to wash your hands more often during food preparation?	<input type="radio"/>				
13.9 After today, how likely are you to use a refrigerator or freezer thermometer?	<input type="radio"/>				
13.10 After today, how likely are you to use a thermometer to check for doneness of foods?	<input type="radio"/>				

**Question 14** *\*\* required \*\**

How long did you spend reviewing information in Module 2?

- 1/2 hr or less
- 1/2 - 1 hour
- 1 - 2 hours
- 2 or more hours

**Closing Message**

Thank you for completing this post-test questionnaire! Module 3 will be active on Tuesday morning.

**MODULE 3 POST-TEST**

## Module 3 Post-test: Food Safety for Older Adults

### Survey Description

The purpose of this survey is to collect information from you after you have completed Module 3: Food Safety for Older Adults.

### Opening Instructions

Please answer the following post-test questions. Do not seek outside help or use resources other than information in Module 3 and answer all questions as honestly as you can. The questions are designed to be answered after completing the third and final food safety curriculum module. Your instructor will be notified when you have completed the questionnaire. This questionnaire will be available Friday (March 11th) through Sunday (March 13th). Thank you!

### Question 1 **\*\* required \*\***

Please enter the **last 6 digits** of your social security number. (not just four)

(maximum of 200 characters)

### Question 2 **\*\* required \*\***

Currently, one in \_\_\_\_\_ adults in the United States is 65 years of age and older.

- 4
- 8
- 10
- 15

### Question 3 **\*\* required \*\***

As aging occurs:

- T cell function increases and B cell function decreases
- T cell function decreases and B cell function decreases
- T cell function increases and B cell function increases
- T cell function decreases and B cell function increases

**Question 4 *\*\* required \*\****

Which group of older adults is most likely to die from foodborne infections?

- independent living older adults
- assisted living residents
- hospitalized older adults
- nursing home residents

**Question 5 *\*\* required \*\****

When eating hotdogs, which practice(s) is(are) recommended for older adults?

- eat them cold from the package
- heat them in the microwave
- eat them cold if they were previously cooked
- eat them after cooking on the stove top
- all of the above

**Question 6 *\*\* required \*\****

According to the Behavioral Risk Factor Surveillance Survey, almost half of older adults (49%) consumed:

- pink hamburgers
- undercooked chicken
- undercooked eggs
- home-made cookie dough

**Question 7 *\*\* required \*\****

A KSU study found that older adults feel the greatest risk to food safety occurs in:

- food processing plants
- homes
- restaurants
- farms

**Question 8** *\*\* required \*\**

Which of the following foods should older adults avoid?

- a) alfalfa sprouts
- b) unpasteurized fruit juice
- c) soft cheeses
- d) raw oysters
- e) a, b, & d
- f) all of the above

**Question 9** *\*\* required \*\**

As a person ages, the immune system:

- doesn't change
- increases in efficiency
- decreases in efficiency
- fluctuates in efficiency

**Question 10** *\*\* required \*\**

Which of the following contributes to increased risk of foodborne infections in older adults?

- malnutrition
- inactivity
- chronic illness
- loneliness
- all of the above

**Question 11** *\*\* required \*\**

Long term exercise appears to improve age-related T cell function.

- True
- False

**Question 12** *\*\* required \*\**

Which of the following activities can place an older adult at increased risk for foodborne illness?

- a) walking outdoors
- b) traveling
- c) gardening
- d) b & c
- e) all of the above

**Question 13** *\*\* required \*\**

1 - Very unlikely | 2 - Unlikely | 3 - Maybe | 4 - Likely  
5 - Definitely

	1	2	3	4	5
<b>13.1</b> I can summarize changes that occur in the immune system as people age.	<input type="checkbox"/>				
<b>13.2</b> I can characterize aging adults in the U.S. population (numbers, percentage of population, etc.)	<input type="checkbox"/>				
<b>13.3</b> I can describe factors that increase risk for foodborne illness for older adults.	<input type="checkbox"/>				
<b>13.4</b> I can describe food safety beliefs and consumption behaviors common in older adults.	<input type="checkbox"/>				
<b>13.5</b> How likely will you be to use the information from this module?	<input type="checkbox"/>				

**Question 14** *\*\* required \*\**

How long did you spend reviewing information in Module 3?

- 1/2 hr or less
- 1/2 - 1 hour
- 1 - 2 hours
- 2 or more hours

**Question 15** *\*\* required \*\**

The following questions pertain to the **process of learning** using an interactive web-based curriculum.

1 - Yes | 2 - No | 3 - Not sure

	1	2	3
<b>15.1</b> Did the use of interactive web-based delivery promote your learning and understanding of the material?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
<b>15.2</b> Did the use of a variety of learning activities promote your learning and understanding of the material?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

**Question 16** *\*\* required \*\**

The following questions pertain to the effectiveness of the food safety modules.

How effective were the following in enhancing your **understanding** of the food safety information?

1 - Not helpful | 2 - Slightly helpful | 3 - Helpful  
4 - Mostly helpful | 5 - Very helpful

	1	2	3	4	5
<b>16.1</b> text poppers (high-lighted words that provided additional information)	<input type="radio"/>				
<b>16.2</b> animated quiz me questions	<input type="radio"/>				
<b>16.3</b> non-animated quiz me questions	<input type="radio"/>				
<b>16.4</b> flash cards	<input type="radio"/>				
<b>16.5</b> dragndrop activities	<input type="radio"/>				
<b>16.6</b> crossword puzzles	<input type="radio"/>				
<b>16.7</b> word find activities	<input type="radio"/>				
<b>16.8</b> audio clips	<input type="radio"/>				
<b>16.9</b> pictures	<input type="radio"/>				
<b>16.10</b> charts/tables	<input type="radio"/>				

**Question 17** *\*\* required \*\**

The following questions pertain to your enjoyment of the food safety module activities.

How much did you **enjoy** completing the following activities?

1 - Did not enjoy | 2 - Slightly enjoyed | 3 - Enjoyed  
4 - Mostly enjoyed | 5 - Enjoyed a lot

	1	2	3	4	5
17.1 text poppers (high-lighted words that provide additional information)	<input type="checkbox"/>				
17.2 animated quiz me questions	<input type="checkbox"/>				
17.3 non-animated quiz me questions	<input type="checkbox"/>				
17.4 flash cards	<input type="checkbox"/>				
17.5 dragndrop activities	<input type="checkbox"/>				
17.6 crossword puzzles	<input type="checkbox"/>				
17.7 word find activities	<input type="checkbox"/>				
17.8 audio clips	<input type="checkbox"/>				

**Question 18** *\*\* required \*\**

Was the web-based delivery convenient?

- Yes
- No
- Not sure

**Question 19** *\*\* required \*\**

Please identify any barriers that you encountered to using this web-based delivery.  
(choose as many as apply)

- time was too limited for completion of pre-tests
- time was too limited for completion of post-tests
- time was too limited for viewing of modules
- no internet access on weekends
- no internet access at current place of residence
- no computer speakers to listen to audio clips
- slow **internet connection** delayed timely presentation of activities
- slow **computer** delayed timely presentation of activities
- activities did not load

Further comments about your response:



**Question 20** *\*\* required \*\**

The relationship of the pre- and post-tests to the modules was:

- too close in timing
- about right in timing
- too far apart in timing

Further comments about your response:



**Question 21** *\*\* required \*\**

The three modules were spaced one week apart. Was this timing:

- too close together
- about right
- too far apart

Further comments about your response:

**Question 22** *\*\* required \*\**

The volume of material in the modules was:

- not enough
- about right
- too excessive

**Question 23** *\*\* required \*\**

Would you want other assignments/learning activities delivered in a web-based format?

- Yes
- No
- Not sure

**Question 24**

Please offer suggestions for where these assignments/learning activities would be well-suited (e.g. specific courses where web-based assignments would be helpful).

(maximum of 200 characters)

**Question 25** *\*\* required \*\**

Would you recommend this type of course material presentation to other students?

- Yes
- No
- Not sure

**Question 26** *\*\* required \*\**

How many times have you participated in an interactive web-based delivery (similar to this one) in other college courses?

- 0
- 1-2
- 3-4
- 4+

**Question 27** *\*\* required \*\**

1 - Yes | 2 - No | 3 - Not sure

	1	2	3
<b>27.1</b> After today, do you have increased awareness of the foodborne risks for older adults?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
<b>27.2</b> After today, do you feel it is more important to educate older adults on food safety than you did previously?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
<b>27.3</b> After today, do you feel a responsibility to educate older adults on food safety risks?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

**Question 28** *\*\* required \*\**

How would you rate the specific overall effectiveness of:

1 - Poor | 2 - . | 3 - Average | 4 - . | 5 - Excellent

	1	2	3	4	5
<b>28.1</b> Module 1: Overview of Food Safety	<input type="radio"/>				
<b>28.2</b> Module 2: Food Safety Knowledge, Beliefs, and Practices of the General Population	<input type="radio"/>				
<b>28.3</b> Module 3: Food Safety for Older Adults	<input type="radio"/>				

**Question 29** *\*\* required \*\**

Do you feel the information in the three modules helped prepare you for your chosen profession?

Yes

No

Not sure

**Closing Message**

Thank you for completing this post-test questionnaire. You will have only 2 more requests from us during this process. Next week, you will be receiving a survey very similar to the very first one you submitted. About 5 weeks after that, we will ask your help in completing the survey one final time. Your participation in this project has been very valuable and we very much appreciate it!