12-2010

Developing, Refining, and Validating a Survey to Measure Adolescent Food Safety Self-Efficacy

Monica K Brandon
m.k.brandon@utk.edu

To the Graduate Council:

I am submitting herewith a thesis written by Monica K Brandon entitled "Developing, Refining, and Validating a Survey to Measure Adolescent Food Safety Self-Efficacy." I have examined the final electronic copy of this thesis for form and content and recommend that it be accepted in partial fulfillment of the requirements for the degree of Master of Science, with a major in Food Science and Technology.

P. Michael Davidson, Major Professor

We have read this thesis and recommend its acceptance:

Jennifer Richards, Gary Skolits

Accepted for the Council:
Carolyn R. Hodges

Vice Provost and Dean of the Graduate School

(Original signatures are on file with official student records.)

To the Graduate Council:

I am submitting herewith a thesis written by Monica K Brandon entitled "Developing, Refining, and Validating a Survey to Measure Adolescent Food Safety Self-Efficacy." I have examined the final electronic copy of this thesis for form and content and recommend that it be accepted in partial fulfillment of the requirements for the degree of Masters of Science, with a major in Food Science and Technology.

P. Michael Davidson, Major Professor

We have read this thesis
and recommend its acceptance:

Jennifer Richards

Gary Skolits

Accepted for the Council:

Carolyn R. Hodges
Vice Provost and Dean of the Graduate School

(Original signatures are on file with official student records.)

Developing, Refining, and Validating a Survey to Measure Adolescent Food Safety Self-Efficacy

A Thesis

Presented for the

Masters of Science

Degree

The University of Tennessee-Knoxville

Monica K Brandon

December 2010

ABSTRACT

Self-efficacy is a proven indicator of predicting risky behaviors, but without a baseline level of adolescent food safety self-efficacy to develop targeted interventions it is difficult to produce meaningful behavior change. The research question around which this study was designed is: To what extent can a validated instrument accurately capture adolescent beliefs of food safety self-efficacy. Through rigorous field testing and statistical analysis we hypothesize a valid and reliable instrument can be created for measuring adolescents' food safety self-efficacy. The purposes of this study included: (a) development of a high quality, food safety self-efficacy instrument, (b) validation of the instrument through expert review, and (c) field testing of the instrument to measure adolescent food safety self-efficacy. A field test of the instrument was conducted with adolescent students (n=91) using expert review and the following analyses: a) the normality, (b) the validity, and (c) the reliability. The final instrument yielded 16 items that were within the boundaries of normality, passed expert review, and/or had strong validity and reliability results. The results of this study indicate that an instrument accurately measuring and capturing adolescent food safety self-efficacy is possible to create by using proven valid and reliable methods.

ABREVIATIONS AND SYMBOLS

α	Cronbach's index of internal consistency (a form of reliability)
AFSSE	Adolescent Food Safety Self-Efficacy
Exp	Expert Review; experts in various fields evaluate items for subject content
p	Probability; probability of a success in a binary trial
r	Estimate of the Pearson product-moment correlation coefficient
RD	Response Distribution; frequency of responses

Table of Contents

Table of Tables

Table of Figures

Chapter 1

Foodborne illness is estimated to affect 6 to 81 million people every year (McCabe-Sellers & Beattie, 2004; Mead, et al., 1999). In 2003 and 2007, data from the Foodborne Disease Active Surveillance Network (FoodNet) indicated that the number of foodborne illness outbreaks was decreasing each year; however, outbreaks for some organisms have stopped decreasing, remained the same or may even be increasing (CDC 2003; CDC 2007). According to experts, a substantial majority of these outbreaks are preventable by consumers with proper food-handling behaviors (Bruhn & Schutz, 1999). Despite the availability of many educational materials, a majority of the public is unaware of the role they play in maintaining the safety of their own food (Bruhn & Schutz, 1999; Coulston, 2002; Williamson, Gravani, & Lawless, 1992).

To overcome the obstacles in changing people's food safety attitudes and behaviors, two issues must first be addressed: personal responsibility and personal susceptibility. Firstly, today's consumers place the responsibility of safe food upon others. Williamson et al. (1992) found that 33% of consumers thought food poisoning was associated with the food processing plant, while 65% of the surveyed consumers placed the source for food poisoning at restaurants. Only 16% of consumers thought food poisoning was more likely to occur in the home (Bruhn, 1997; Bruhn & Schutz, 1999; Williamson et al., 1992). Secondly, consumers lack the belief in their own susceptibility to food poisoning (Haapala & Probart, 2004). According to Wilcock, Pun, Khanona, & Aung (2004) the disparity between consumers' actual and perceived susceptibility to foodborne illness can be attributed to optimistic bias effect. This effect is when consumers believe that the "population" and not themselves are at risk for foodborne illness (Miles, Braxton, & Frewer, 1999). The result of this effect is thought to stem from food safety education programs targeted at susceptible populations rather than focusing on educating individuals about

their own risk (Frewer, Shepherd, & Sparks, 1994). Controlling for optimistic bias is important, because food safety education programs that do not take into account consumers perceived susceptibility are more likely to interfere with any progress made in improving risky behavior (Wilcock, et al., 2004).

One method for overcoming these two obstacles is research based upon self-efficacy. Self-efficacy may be defined as "The belief in one's capabilities to organize and execute the courses of action required to manage prospective situations." (Bandura, 1995). Research has suggested that one of the predicting factors for changing risky behavior detrimental to oneself or to others is to develop a high sense of self-efficacy (Bandura, 1993; Haapala & Probart, 2004; Schunk, 1991; Zimmerman, Bandura, & Martinez-Pons, 1992). Self-efficacy is but one of many psychosocial parameters. Individuals with high levels of self-efficacy robustly adopt and sustain positive health behavior, and refrain or abstain from negative health behaviors (Byrd-Bredbenner, et al., 2007; Medeiros, Hillers, Kendall, & Mason, 2001). Self-efficacy presumably explains and predicts an individual's thoughts, emotions, and actions (Bandura, 1982). Theorists argue that self-efficacy affects an individual by predicting subsequent motivation and performance (Bong & Skaalvik, 2003), and enhances personal accomplishment (Bandura, 1982). Therefore, if a person has low self-efficacy he/she is more likely to engage in risky behaviors involving their food safety, whereas a person with high self-efficacy believes he/she can keep their food safe and takes precautions to avoid risky behaviors.

Interventions that increase self-efficacy provide individuals with opportunities to successfully attempt and sustain new behaviors. For example, food safety interventions can provide individuals with "hands-on" experiences directly related to food safety as they pertain to their own actions and behaviors. The intervention successfully reinforces and increases an

individual's self-efficacy (Gariglietti, McDermott, Gingerich, & Hastings, 1997). According to Bandura (1993) this process is a positive feedback loop that entails positive reinforcement from others or as a result of successfully accomplishing a task. As a result, personal self-efficacy increases, and thereby, enables individuals to have a high quality of human functioning. By combining food safety interventions targeted at increasing specific population's self-efficacy, it is anticipated that meaningful behavior change can occur.

Adolescents (i.e., children between the ages of 12-17) often have notable food handling responsibilities, both in the home and in the food service sector. As such, their behaviors are essential in safeguarding the health of consumers (Byrd-Bredbenner, Maurer, et al., 2007). However, despite the potential role adolescents' play in food safety for themselves and others, little research has been done on their food safety behaviors and self-efficacy. Developing targeted interventions to produce meaningful food safety behaviors in adolescents is difficult to accomplish without an established baseline level of self-efficacy. Defining and understanding a baseline for Adolescent Food Safety Self-Efficacy (AFSSE) is essential for measuring change in adolescent food safety behavior. Enabling adolescents to appreciate their role in safe food preparation provides a significant potential benefit to the population as a whole.

Statement of the Problem

An ideal time to teach food safety is between the ages of 12-17, when adolescents are in the formative process of establishing life-long habits and are, therefore, more likely to synthesize new food safety knowledge in a way that leads to the development of positive life-long behaviors (Richards, Skolits, Burney, Pedigo, & Draughon, 2008). Very little research exists on adolescent food safety knowledge, attitudes, or behaviors and virtually none exists on AFSSE. Therefore,

establishing baseline levels of AFSSE would be a critical addition to the food safety literature in aiding developers of educational interventions to more effectively target psychological constructs that will lead to sustainable behavior change.

Purpose of the Study

Research by Richards, et al. (2008), demonstrated that the food safety knowledge of adolescents could be significantly increased, leading to improved food safety attitudes and behaviors. These results were achieved through the implementation of a food safety program that was aligned with state-mandated curriculum standards and introduced as part of regular classroom instruction. Results from the numerous research studies conducted in the field of self-efficacy support the theory that self-efficacy is an excellent predictor of risky behavior. Studies by Richards, et al. (2008) and Pedigo, Richards, Saxton, D'Souza, & Draughon (2009) revealed a need to gain a greater understanding of AFSSE and develop a method for determining baseline AFSSE levels. Future interventions could then specifically focus on adolescent food safety and self-efficacy, thereby resulting in a greater impact on life-long food safety behaviors. Therefore, the purposes of this study included: (a) development of a high quality, food safety self-efficacy instrument, (b) validation of the instrument through expert review, and (c) field testing of the instrument to measure adolescent food safety self-efficacy.

Importance of the Study

The findings of this study will help researchers in two ways. The first is to develop an instrument for measuring the impact of future educational interventions. A valid and reliable instrument for quantifying self-efficacy will provide insight for future AFSSE research and educational interventions. The second is to establish baseline AFSSE levels.

Context of the Study

This study drew upon research conducted as part of a larger project funded by the United States Department of Agriculture's (USDA) National Integrated Food Safety Initiative (NIFSI, Award Number: TEN2005-02098). The larger project evaluated the effectiveness of an integrated food safety curriculum written for seventh grade students in Tennessee and North Carolina. The current curriculum is an interdisciplinary food safety unit for seventh grade students that is correlated with State standards for mathematics, science, social studies, and language arts in eight states. In the original research project, psychological constructs of behavior change were not addressed.

Research Question and Hypothesis

To better inform future AFSSE research and educational interventions, it is important to construct a valid and reliable instrument designed to measure baseline levels of AFSSE. The overall research question to which this study was focused is, "To what extent can a validated instrument accurately capture adolescent beliefs of food safety self-efficacy?" We hypothesize that a valid and reliable instrument can be created with a high degree of accuracy that measures

the food safety self-efficacy beliefs of adolescents through rigorous field testing and statistical analysis

Assumptions

This conducted study is based upon the following assumptions: assumed the following:

1. Students in the field test replied to the instrument questions in an open and honest manner to the instrument questions.
2. The researcher's role in the larger project did not influence or bias data collection for this study.

Limitations

Previous working relationships between the middle schools, and the larger NIFSI project director and graduate assistant at the University of Tennessee, determined the field-test sites. The study participants were recruited through convenience sampling, as they were all adolescents in the project field test sites who volunteered to take part in the study. Additionally, bias could have been introduced through the use of a single time post-test case study performed at the same school or by collecting data from a racially and socioeconomically homogeneous population that lacked racial and socioeconomic diversity.

Study Methodology

New AFSSE items were first created based upon results from a previous attempt to create adolescent food safety self-efficacy items by the NIFSI project research team. Once completed, Expert Review (Gay & Airasian, 2003) was used to solicit feedback from experts on food safety, self-efficacy, assessment, and adolescents, and at the same time, establish the instrument's content validity. After revising the instrument to accommodate the suggestions made by experts, the instrument was then administered to students for field testing. The field test was conducted within a two-week time period. Statistical analyses were then performed to assess normality, stability, and internal reliability. Skewness, kurtosis, response means and standard deviations, and the response distribution of the means were all used to assess normality. T-tests, and correlations using Pearson's product moment coefficient were analyzed to establish stability while Cronbach's alpha and item total statistics were analyzed to establish internal reliability.

Definition of Terms

For the purposes of this study, the terms below shall be defined as follows:

Adolescents: Students in the age group of 12-17 years of age.

Adolescent Food-Safety Self-Efficacy (AFSSE): The degree to which a student believes they can affect the safety of their own food.

Food safety: The United States Federal Drug Administration (1999) defines safe food as a "suitable product which when consumed orally either by a human or an animal does not cause health risk to consume." In this study, food safety was defined in a broader sense. It refers to safety practices and food safety beliefs that are likely to result in a food product that is safe to consume such as: practicing proper personal hygiene, practicing proper

sanitation, avoiding cross-contamination, adhering to proper cooking and cooling temperatures, seeking education on foodborne illnesses, and understanding perceived risk of foodborne illness.

Locus of Control: The extent to which individuals believe they can control events that affect them either internally or externally (Rotter, 1966).

Self-Efficacy: The belief in one's capabilities to organize and execute the courses of action required to manage prospective situations (Bandura, 1995).

Organization of the Study

This thesis contains five chapters. Chapter 1 introduces the need for the study, its purpose, importance, context, research questions, assumptions, and limitations, as well as a list of definitions of relevant terms. Chapter 2 reviews the current food safety and self-efficacy literature focusing on: the incidence of foodborne illness, risk factors associated with foodborne illness, avoidance of foodborne illness, perceptions and risky behaviors related to foodborne illness, research on foodborne illness and adolescents, self-efficacy and adolescents, food-safety self-efficacy, and a conceptual definition of food-safety self-efficacy. Chapter 3 describes the methods and includes sections on the participants, instruments, and methods of data analysis. Chapter 4 contains a description of the data analysis and the associated results. Finally, Chapter 5 presents conclusions, of the study, implications to the field, and suggestions for future research.

Chapter 2: Review of Literature

Food Safety

The estimated number of annual foodborne illnesses ranges from 6 to 81 million cases, 325,000 hospitalizations, and 9,000 deaths (Ingham & Theis, 1997; Mead, et al., 1999). This translates to approximately one-fourth of the population of the United States being at risk for some form of foodborne illness annually (Byrd-Bredbenner, Maurer, et al., 2007). However, there are steps to ensure the safety of food. According to the Centers for Disease Control and Prevention, the key to reducing future foodborne illness outbreaks is to increase consumer education and communication.

Maintaining the safety of food is complicated by a number of factors. Regulations are in place to reduce the chances for transmission of foodborne pathogens including primarily bacteria, viruses, and parasites (Kastner, 1995). However, even though only a few microorganisms have the potential to cause illness associated with food consumption, these microorganisms are found on many raw products making them difficult to control. In addition, we are aware of more pathogens (e.g., *Escherichia coli* O157:H7, *Campylobacter jejuni*, and the Norwalk virus) than 50 years ago (Byrd-Bredbenner, Maurer, et al., 2007). Yet, obtaining accurate estimates of foodborne illness incidents is costly and difficult (Beverly, 2004). Therefore, the vast majority of foodborne illnesses remain undetected and unreported (Ingham & Theis, 1997). One of the major reasons for this is that most foodborne illnesses are mild and self-limited. Therefore, victims do not seek medical attention, cases go unreported, and consumers continue to remain unaware of the potential seriousness and causes of foodborne illness.

Potential for Increased Incidence of Foodborne Illness

Not only does the food industry face challenges in controlling foodborne illnesses, but they also face challenges created by the consumer demands. Consumers today are more interested in convenience and saving time rather than the safety of their own food (Collins, 1997; Wilcok, Pun, Khanona, & Aung, 2004). Shifts in demographics and lifestyle changes contribute to the increase in consumer mishandling of food. On average, four or more meals are prepared or eaten outside the home per week. With more meals prepared outside the home, the food service industry has a greater responsibility to keep consumers' food safe. Food service is big business and creates nearly 10 million jobs, many held by persons untrained in food safety (Collins, 1997). This increases the potential for the mishandling of food and also creates new challenges for consumers trying to keep their food safe (Collins, 1997).

The Food Marketing Institute (FMI; 1996) reported that 48% of 2,000 shoppers use fast food as their primary source of take-out, while 12% of consumers purchased ready-to-eat foods from grocery stores (Bruhn, 1997). In 1997, Collins reported that 85% of employed women spend less than 30 minutes every week preparing meals. These conditions result in an increased likelihood of acquiring a foodborne illness (Bruhn, 1997). It is important to note that consumers are eating more meals at home, however many of these meals are prepared by food service workers and then consumed in the home (Collins, 1997). As consumers rely on other people to help them prepare their food, they have increased reliance on food manufacturers and the food service industry and less self-reliance (Bruhn, 1997). Consumers need to understand that, even though the food service industry has the responsibility to help keep consumers' food safe, so do consumers also have the same amount of responsibility to keep their food safe.

Risk Factors Associated with Foodborne Illness

One of the easiest yet most effective precautions in reducing foodborne disease is washing your hands. Hand washing has been shown to significantly reduce infections transmitted by poor personal hygiene and was a critical step to reducing cross-contamination (Collins, 1997). After a review of 91 scientific articles published after 1986, Bryan, et al. (2007) confirmed that hand washing is an integral component of prevention practices for the spread of infection. However, consumer self-reported food safety behavior often does not match actual observed behavior. Consumers tend to rate themselves higher in correct food safety behaviors than their actual observed behaviors.

A good example about consumer behavior is a telephone survey of 7,000 consumers reported that 94% washed their hands after using the rest room. However, actual observed behaviors revealed that almost one-third failed to wash their hands after using the rest room (Collins, 1997). In actuality, consumers wash their hands 81% of the time before handling or eating food, 48% of the time after petting an animal, 33% of the time after coughing or sneezing, and only 22% of the time after handling money. While hand washing is one of the most effective methods in food safety precautions, consumers still do not practice proper hand washing behaviors. There are two reasons that are thought to explain why consumers overlook their own behaviors. One is that food safety practices are common sense, easy to do, and easy to forget. Thereby, consumers overlook this easy step when handling food. Secondly, consumers do not want to acknowledge their own poor behaviors and thereby, simply overestimate their actual abilities and behaviors (Collins, 1997).

In another study consumers were observed to determine what other types of food safety practices they used at home (Daniels, 1998). In 81 cities in the United States and Canada, 106

households were observed. The same standards used in restaurants inspections by local state health departments were used to evaluate the participants (Medeiros, Hillers, Kendall, & Mason, 2001). At least one critical violation was observed in 96% of the households, with the most frequent critical violations being cross-contamination (76%) and hand washing (57%). The more frequent major violations observed in the home were the misuse of common cloth/sponge/towel (92%) and insufficient thermometer usage (92%). Fewer than 1% of the households met the minimum criteria for acceptable performance of zero critical violations and no more than four major violations (Medeiros, et al., 2001).

The Social Learning Theory explains the change of behavior through behavioral capacity, which is defined as "a person's knowledge plus their belief in their skills at accomplishing the desired behavior" (Medeiros, et al., 2004). To change behaviors, consumers must be taught about both foodborne illness and proper food handling procedures. To affect the incidence of foodborne illness, actual and not just self-reported food-handling behaviors must change. As stated above, actual food-handling practices are known to differ from self-reported practices (Wilcock, 2004, Collins, 1997). Relationships between self-reported and actual behaviors are not well understood, however self-reported behavior is often the only data available to food safety educators (Madeiros, et al., 2001). People of all ages seem to think they know how to handle food safely, but their self-reported food-handling behaviors do not support this confidence (Haapala & Probart, 2004).

Avoidance of Foodborne Illness Through Knowledge

A survey conducted by researchers at Cornell University in 1992 (AMI, 1996) reported a substantial lack of knowledge about safe home food preparation practices (Collins, 1997). The population in general is poorly educated on basic food safety (Ingham & Thies, 1997). Although many consumers recognize the seriousness of foodborne bacteria, they lack information on safe handling and storage of food products (Bruhn, 1997). Market research indicated that gaps were present in consumers' knowledge and behaviors regarding the prevention of foodborne illness (Altekruse, et al., 1996; Coulston, 2002; Knabel, 1995; Medeiros, et. al, 2001). Even though consumers lack correct food safety knowledge, they are becoming more aware of foodborne illness prevention (FMI, 1996). From 1992 to 1996 consumers' concerns about microbiological hazards increased from 36% to 49%, more than any other potential food safety issue (Bruhn, 1997).

Still, there remains the challenge of overcoming consumers' lack of belief in their susceptibility to food poisoning. A good example was a study conducted to determine a sampling of consumer knowledge in 1993. A mail survey assessed the knowledge of 605 respondents' safe food-handling guidelines and self-reported practices. The results from the survey showed that consumers take action to prevent foodborne illness, but 20% indicated they did not know how to reduce the risk from foodborne illness (Bruhn & Schutz, 1999). Consumers were knowledgeable about appropriate safeguards in selection and cooking specific foods, but mistakes were found in temperature control and handling leftovers. Self-reported knowledge from the survey indicated that 46% of consumers defrost food on the counter top, 50% thought cooked food needed to cool to room temperature before refrigerating or freezing, and 66% used large containers to store leftovers (Bruhn & Schutz, 1999). Food safety experts identified the most common food-

handling mistakes made by consumers at home include serving contaminated, raw food, inadequate cooking and heating of food, allowing 12 hours or more between preparation and eating, having an infected person handle food, and practicing poor personal hygiene (Bruhn, 1997; Greene, 2008; Ingham & Theis 1997). A study conducted by the FMI reported what steps consumers took at home to ensure the safety of their food: 58% refrigerated food, 35% properly store food, 26% checked sell by dates, 25% washed their food, 22% properly cooked their food, and 20% wrapped their food. Interestingly though, personal hygiene (washing hands) or preventing cross-contamination were not mentioned as steps to take to prevent foodborne illness (Bruhn, 1997).

Part of the confusion about food safety might come from the sources where consumers obtain their information. Consumers indicated that media sources are their primary source of information (Ingham & Theis, 1997). The most common sources for obtaining information are newspapers and magazines (37%), television (22%), and medical physicians (7%) (McIntosh, Christensen, & Acuff, 1994). Although, an increase in the media coverage of foodborne illnesses may be beneficial in that it draws attention to a serious issue, a negative side effect is the contribution to consumer fear and misunderstanding (Ingham & Theis, 1997).

Even though consumer education levels are on the rise, there is still the belief that preventing foodborne illness is not a personal responsibility, but rather the responsibility of the food manufacturer (Williamson, et al., 1992). Bruhn (1997) reported that consumers thought that the responsibility for keeping their food safe was with restaurants (65%) or supermarkets (17%) and only 17% through food mishandled at home. In contrast, in 1995 the Institute of Food Technologists (IFT) disagreed with most consumer beliefs and stated that sporadic cases and small foodborne outbreaks are primarily the result of mishandling of food at home (Bruhn, 1997;

Knabel, 1995). Therefore, the majority of responsibility lies within the grasp of consumers and the key to changing these beliefs are greater efforts to effectively educate consumers.

Attitudes About Preventing Foodborne Illness

In a survey of 419 people from Illinois, Brewer et al. (1994) reported that, while consumers are concerned about the safety of food, they were not significantly ($p > 0.5$) concerned about their own food safety practices (Wilcock, et al., 2004). When consumers were asked on whom they rely for product safety, the percentage responding as "myself" was 48% in 1989 (Bruhn, 1997). By 1996, this percentage had decreased to 25%. These results indicate a trend among consumers to shift the responsibility of handling food safely to someone else. Furthermore, the results from these studies are in agreement with the previous studies mentioned earlier (Collins, 1997; FMI, 1996; Williamson, et al., 1992).

Complicating the understanding of consumer attitudes towards food safety are the varying attitudes by demographic and socio-economic factors such as gender, age, educational level, and economic status (Wilcock, et al., 2004). An example from an American multi-state survey conducted by Altekruse, Yang, Timbo, and Angulo (1999) found that men are more likely to report risky practices than women. The prevalence of the most risky behaviors also increased with increasing socio-economic status (Wilcock, et al., 2004). The relationship between these two factors suggests that the more money you have, the more knowledge you have about food safety. Therefore, there is an increase in the willingness to engage in risky behaviors. In a similar study, 7,493 adults from five states (California, Connecticut, Georgia, Minnesota, and Oregon were surveyed (July 1996 to June 1997) to assess consumer consumption and handling of food (Shiferaw, et al., 2000).). Participants had a median age of 41, 52% were female, 80% were

Caucasian, 34% were college graduates, 62% had an annual income less than $60,000 annually, and 41% lived in an urban area. Young adults (ages 18-25 years old) and men were more likely to eat high-risk foods and less likely to handle food safely. Although the participants were well-educated and had a higher income, they were also more likely to consume high-risk foods.

Perceptions and Risky Behaviors of Foodborne Illness

Consumers do not seem to be aware of the ubiquity of microorganisms in the environment (Bruhn, 1997). They fail to recognize the range and seriousness of symptoms likely caused by foodborne microorganisms and the long incubation periods associated with some pathogens (Medeiros, et al., 2001). The public has generally been quite complacent about the risk of foodborne illnesses, tending to think of the consequences as mild, and that the greatest risk from food is prepared outside the home (Medeiros, et al., 2001). The disparity between food safety knowledge and food-handling practices of consumers can be attributed the Social Behavior Theory, but also partly to optimistic bias effects. This effect is where people believe that they are less at risk from a hazard than other people (Wilcock, et al., 2004). In other words, consumers do not associate what they learn about food safety as a personal threat to themselves, but rather, to the "population". Where, the population are other people, who unlike themselves, practice poor food safety behaviors. This may result in a noticeable difference between people's perceived personal risk and their actual risk status (Wilcock, et al., 2004). These findings help support the belief that although knowledge may be a necessary component of behavior change, it is not always sufficient (Raab, 1997; Rennie, 1995). Schafer, et al. (1993) found that motivation for proper food handling requires viewing the mishandling of food as a direct threat to one's health, or perceived susceptibility.

To help individuals to make rational decisions about their own behavior, they must not only have sufficient knowledge, they must also be aware of the associated health problems, and have some judgment as to the level of risk involved in not changing their behavior (Wilcock, et al., 2004). Thus, the willingness to change behavior is determined by perceptions and beliefs (Wilcock, et al., 2004). Perceptions and beliefs are shaped by knowledge, which in turn is a product of exposure to information sources and personal effort in obtaining information (Wilcock, et al., 2004). Food safety education must both increase consumers' awareness about risks and motivate them to change their food handling and consumption behaviors (Medeiros et al., 2001).

A telephone survey in Texas supports this argument. 1,004 persons were surveyed to determine their level of food safety knowledge in three areas: a) awareness of danger in cooking practices, b) their efforts to keep themselves informed, and c) their willingness to change cooking practices with a focus on cooked hamburger (McIntosh, et al., 1994). When asked about safety practices and consumption of hamburger meat, respondents chose taste (37%) as the main reason for preference of doneness and only 15% chose food safety as the reason for preference. However, nearly half the respondents said they were aware of the dangers of consuming undercooked meats but less than half of this group actually identified a danger associated with consuming undercooked hamburger. Most (87%) reported a willingness to change consumption preferences if those preferences were known to cause illness. While only 40% reported making an effort to obtain food safety information themselves. The respondents most willing to change were consumers that reported consuming well-done hamburgers, indicating that the consumers who understood the risk associated with hamburger were willing to change. However,

knowledge about foodborne illness had no significant difference ($p > 0.05$) on willingness to change behavior (McIntosh, et al., 1994).

In 2008, Brewer and Rojas interviewed 450 people (18 years of age or older) regarding current food safety issues and attitudes/behavior. Data was collected during three separate scientific conventions throughout the state of Illinois, and among the respondents, women represented 75%, participants 65 and older represented 26%, and 66% had a college education. On a five point Likert scale used by the researchers nearly half of the participants considered their food safe (2.25 ± 0.96). Around half (55%) of the participants were concerned about restaurant sanitation and if the meat was thoroughly cooked. 45% of the participants were concerned about microbiological issues. However, in this same study only 15% of the consumers thought they contracted a foodborne illness within the past year, 8% thought they were likely to develop a foodborne illness from food consumed at home, and only 6% thought they were likely to develop a foodborne illness from commercially manufactured food.

In conclusion, these studies show consumers' beliefs, behaviors, attitudes, and concerns about food safety. Consumer concerns about food safety constantly change, and this implies that while general food safety education programs are effective in establishing overall baseline knowledge. However, it is more common that the food industry and regulatory agencies must respond "after the fact" to specific food safety issues (Brewer & Rojas, 2008). Even though Food safety education is most effective when messages are targeted toward changing behaviors that, if not changed, will most likely result in foodborne illness (Medeiros, et al., 2001). Interestingly, studies with adolescents in the late 1990's reported a similar gap in food safety knowledge and a disconnection between food safety knowledge and self-reported food handling practices

(Haapala & Probart, 2004). As such, the current research brings to light the importance and the need to focus on adolescents' food safety education.

Self-Efficacy

There are various psychosocial parameters that help define a person's behavior. A few examples include: self-concept, self-esteem, loci of control, and self-efficacy. All of the parameters have an important impact on whether individuals adopt recommended health behaviors and/or abstain from risky behaviors. However, self-efficacy is thought to influence which health behaviors are initiated, the degree of effort expended, and the persistence of the behavior change (Bandura, 1977). In order to understand how these psychosocial parameters affect a person's behavior, there are various theories to help explain how behavior can change. Byrd-Bredbenner, Wheately, et al. (2007) and Haapala & Probart (2004) described? The following theories: the Protection Motivation Theory, the Social Cognitive Theory (knowledge), the Health Belief Model, the Theory of Reasoned Action, the Theory of Planned Behavior, stage-based theories (i.e., transtheoretical Model), and the Precaution Adoption Process Model. The most related theories are the Protection Motivation Theory, Threat Appraisal, and Coping Appraisal, and are explained therefore explained in more detail in the next paragraph.

The Protection Motivation Theory is used to explain why people engage in preventative behaviors (Haapala & Probart, 2004). Threat Appraisal entails an assessment of an individual's personal risk of harm (susceptibility) and an assessment of the severity of the harm. Coping Appraisal is composed of individuals' perceptions of the recommended response efficacy and an assessment of their ability to carry out this response (response efficacy and self-efficacy)

(Haapala & Probart, 2004). From these known theories and psychosocial parameters, self-efficacy has been shown to be the strongest predictor of behavior change.

Self-efficacy is presumed to explain and predict one's thoughts, emotions, and actions. Efficacy in dealing with one's environment is not a fixed act or simply a matter of knowing what to do. Rather, self-efficacy is a generative learning in which cognitive, social, and behavioral skills are used to accomplish tasks. Self-efficacy beliefs are the product of a complex processes. Self-persuasion relies on cognitive processing of diverse sources of self-efficacy information. This information is conveyed by four factors: a) inactive, b) vicarious, c) social, and d) physiological (Bandura, 1986). The key to developing high self-efficacy is to understand that one's judgment is less concerned with what skills and abilities individuals possess, (Bong & Skaalvik, 2003), but rather the self opinions of what one can do with whatever skills one posseses (Maurer & Pierce, 1998). A person's self-efficacy narrowly focuses on the person's own competency to perform specific tasks in specific situations (Pajares & Urdan, 2006).

According to Bandura, there are three dimensions of self-efficacy: magnitude, strength, and generality (as cited in Maurer & Pierce, 1998). Information for shaping the three dimensions of self-efficacy beliefs comes from the following four sources: a) enactive mastery experience, b) vicarious experience, c) verbal persuasion, and d) physiological reactions (Bandura, 1986, 1997; Bong & Skaalvik, 2003). Self-efficacy beliefs influence how people feel, think, motivate themselves, and behave. Self-efficacy produces these diverse effects through four major processes: cognitive, motivational, affective, and selection processes (Bandura, 1993). A strong sense of efficacy enhances personal accomplishment in many ways and people with high self-efficacy approach difficult tasks as challenges to master rather than as avoidable threats.

Students with great self-efficacy foster a variety of factors: interest in activities, setting challenging goals and maintaining strong commitments to those goals, maintaining a task-diagnostic effective performance, heightening and sustaining efforts to face failure, attributes failure to insufficient effort or knowledge, recovering after failures or setbacks, and approaching threatening situations with assurance of control (Bandura, 1993). These beliefs produce personal accomplishments, reduce stress, and lower vulnerability to depression (Bandura, 1993). In other words, "A capability is only as good as its execution" (Bandura, 1982, p. 122).

It is important to note the difference between the psychosocial concepts to understand why self-efficacy has been shown to predict more behavioral change. Self-concept refers to specific subjects, whereas self-efficacy refers to specific tasks (Bong & Skaalvik, 2003), and self-efficacy questions may include descriptions of problems or tasks in place of actual problems (Bong & Skaalvik, 2003). Self-efficacy investigations normally include measures of goal setting, persistence, effort expenditure, and specific task performance (Bong & Skaalvik, 2003; Byrd-Bredbenner, Wheatley, et al., 2007).

Self-Efficacy and Adolescents

For the purposes of the present study, self-efficacy is defined based on specific situations (Bandura, 1982; Pajares & Urdan 2006), concerned with judgments of how well one can execute courses of action required to deal with prospective situations, and how likely people are to persist in their efforts until they succeed (Bandura, 1982). Researchers argue that self-efficacy is the most useful self-construct because it predicts subsequent motivation and performance better than other constructs (Bong & Skaalvik, 2003). Once formed, efficacy beliefs contribute significantly to the level and quality of human functioning (Bandura, 1993). Self-efficacy concentrates on

students' subjective judgments of capability to perform given academic tasks successfully at a designated level (Schunk, 1991). It is the interpretation of the mastery experiences rather than simply the experiences themselves, which have the greatest impact on self-efficacy (Bandura, 1977).

As with adults, students' self-efficacy beliefs are also multidimensional in the sense that students form differentiated perceptions of capability across diverse tasks and domains (Bong & Skaalvik, 2003). Meaning that self-efficacy is specifically targeted to the task or action one is performing and low self-efficacy in one task may not affect self-efficacy in another task. Evidence suggests that self-efficacy perceptions may also form a multidimensional and "loosely hierarchical" structure, where students make reliable differentiation between their self-efficacy judgments across different academic domains (Bong & Skaalvik, 2003). An important requirement in the self-efficacy measurement is that it should be tailored so as to directly correspond to the specific target performance (Bong & Skaalvik, 2003).

Students' self-efficacy perceptions are related to two aspects of the proposed reciprocal feedback loop: self-monitoring (Diener & Dweck, 1978: Kuhl, 1985) and students' academic motivation and achievement (Zimmerman & and Martinez-Pons, 1990). Within the reciprocal feedback loop, students continually gain self-efficacy in a continuous cycle of achievement, motivation, and self-monitoring. Therefore, developing their beliefs of personal efficacy comes from varied sources: observation of others performing similar tasks, verbal messages received from teachers, parents and classmates, and from the interpreted results of their efforts (Pajares & Valiante, 1996). Perceptions of how others see themselves, and how students see themselves directly affects self-efficacy emotional reactions as well as behavior (Bandura, 1982). Individuals with high self-efficacy expectations are more likely to attempt new behaviors, persist

in them, meet with success, and thereby increase their self-efficacy expectations (Gariglietti, et al., 1997). Research on sources of self-efficacy beliefs will provide influential adults in these young peoples' lives with information needed to support optimal development of self-efficacy beliefs (Britner & Pajares, 2006).

A problem with the existing research is the belief that self-efficacy is a more general psychosocial measure. The current research fails to test students' self-efficacy on: a) task related questions and b) isolating questions specifically to self-efficacy (Bong, 1996; Pajares, 1996). Findings on self-efficacy coincide on two points. One, when efficacy beliefs are globally assessed and/or do not correspond with the criteria tasks with which they are compared, their predictive values are diminished or can even be nullified. Two, when efficacy assessments are tailored to the criteria task, prediction is enhanced (Pajares, 1996). As a result, findings have not been as successful in clarifying the nature of the relationship between self-efficacy and beliefs (Pajares, 1996).

Research on self-efficacy beliefs in academic settings is currently abundant (Pajares, 1996). Multon, et al. (1991) reported on 36 studies from 1977 to 1988 on the relationship between self-efficacy and academic performance and determined that from the studies that efficacy beliefs were related to performance ($r_u = 0.38$) and accounted for approximately 14% of the variance in academic performance (Pajares, 1996). Researchers who compared specific efficacy judgments to measurements of basic cognitive skills obtained the strongest effects (0.52 vs. 0.36 for performance in course work and 0.13 for standardized tests). In addition, highly concordant self-efficacy/performance indexes were developed and administered at the same time (Pajares, 1996). Correlations between self-efficacy and academic performance ranged from r =

0.49 to 0.70 with results tending to be higher in mathematics than other academic areas (Pajares, 1996).

Food Safety Self-Efficacy

Byrd-Bredbenner, Wheatley, et al. (2007ab) defined food safety self-efficacy as "an individual's confidence in his or her ability to perform a particular recommended health behavior or abstain from an unhealthy behavior". Food safety self-efficacy is an undeveloped area of research with relatively few articles that study the impact of adolescent self-efficacy and adolescent food safety self-efficacy. One nationwide online survey conducted by Byrd-Bredbenner (2005) investigated two psychosocial factors (self-efficacy and locus of control) and the food safety health beliefs among 659 young adults (17-26 years of age) at 21 colleges. There were four psychosocial factors of food safety measured: beliefs, locus of control, self-efficacy, and stage of change. The strongest predictor of risky eating was self-efficacy. Self-efficacy scores (4.13 ± 0.55) indicated participants had a high level of confidence in their ability to handle food safely. The findings from this study agree with the theory that psychosocial measures of food safety are associated with behavior, attitudes, practices, and willingness to change and improve incorrect beliefs and practices (Byrd-Bredbenner, Maurer, et al., 2007). However, the key to understanding and sustaining positive behavior change is understanding and improving self-efficacy.

Food Safety Self-Efficacy and Adolescents

Adolescent food safety self-efficacy may be defined as the degree to which a student believes they can affect the safety of their own food. The limited research on AFSSE reinforces the need to conduct further research in this subject area. Food safety behaviors are essential to safeguard the health of consumers (Byrd-Bredbenner, Maurer, et al., 2007ab). Potential influences on students' academic self-beliefs are particularly important during the middle school years. As they transition from elementary to middle/junior high school, students are introduced to a larger social comparison group, a greater emphasis on grades and competition, and a larger, less personal environment (Britner & Pajares, 2006; Eccles & Wigfield, 1995; Harter, Whitesell, & Kowalski, 1992). It is important to reach young adults with food safety education, because of their current and future roles as caregivers (Byrd-Bredbenner, Maurer, et al., 2007ab).

A recent study conducted to determine the relationship between knowledge, behaviors, and demographic data (Pedigo, et al., 2009) is one of the few studies researching food safety knowledge and behaviors of adolescents. This study examined food safety knowledge and behaviors of 232 7^{th} grade students in 12 schools in East Tennessee of which 63.2% were female and 74.5% white. Students had only a fair level of food safety knowledge (48%). Similar results were found with a study conducted by Richards, et al. (2008) where a fair level of food safety knowledge (51%) was reported for 234 7^{th} grade students from five schools in Tennessee and North Carolina. Students with more food handling experience had higher self-reported attitudes/behavior scores. Also, no significant differences were found between food safety knowledge level of the participants and self-reported food safety behaviors. Students reported they understood the importance of hand washing (63%), whereas fewer students (51%) reported "always" washing their hands before preparing snacks or meals. The majority of students (79%)

reported understanding the importance of hand washing after using the restroom, but even less students (59%) reported "always" washing their hands. Students demonstrated a disconnect between knowledge of correct temperature practices and behaviors. When asked if they followed temperature directions, half reported "always"; however, overwhelming, 85% of the students incorrectly said the correct way to tell if a hamburger was thoroughly cooked was by "color" and not a thermometer. Females correctly answered 55% (out of 100 total possible points) on the personal hygiene knowledge question, and were significantly ($p = 0.0006$) better than the male participants. Overall, the females reported better personal hygiene behavior ($p = 0.0134$). Even though females prepared more meals and snack than males, no significant gender differences were observed in the frequency of their food preparation or handling experience and no significant difference ($p = 0.0805$) was found between genders and their knowledge level.

Haapala and Probart (2004) conducted a similar study with 178 7^{th}- and 8^{th}-grade students from four schools in Pennsylvania to assess adolescent food safety knowledge, behaviors, and self-efficacy. The results from a 10-item instrument indicated a fair amount of food safety knowledge (72%) with no significant differences between genders. Students' self-reported food-handling behavior indicated they safely handled food "almost every time" (3.9 ± 0.6; 4 point possible). However, students reported risky food-handling behavior by "seldom" washing their hands before eating, "often" tasting their food to see if it was safe to eat, and consuming food with raw eggs. 20% reported taking risks in food handling and another 20% reported having been sick because of something they ate. This study found that females prepared the majority of snacks and meals (52%). As a result, females reported higher self-efficacy and severity of foodborne illness ($p < 0.01$) than males.

Both males and females had a low perception of perceived susceptibility (2.2 ± 0.70), but reported fairly high perceptions of severity (3.6 ± 0.6) of a foodborne illness. Even though self-efficacy correlated positively with knowledge ($r = 0.32$, $p < .0001$), overall students reported fair amount of self-efficacy (3.4 ± 0.6). A positive correlation also existed between self-efficacy and behavior ($r = 0.36$, $p = 0.0001$), and between self-efficacy and severity ($r = 0.21$, $p < 0.01$). However, a weaker correlation existed between knowledge and behavior ($r = 0.18$, $p = 0.05$).

Conclusion

The first line of defense against foodborne illness is consumer awareness of high-risk foods, understanding of safe food-handling practices (Shiferaw, et al., 2000), and understanding the important role they play in keeping their own food safe (Bruhn, 1997; Collins, 1997; FMI, 1996). Consumers are an essential link in the chain to prevent foodborne illness (Medeiros, et al., 2001) and should take certain precautions at each culinary step, including when food is purchased, stored, prepared, cooked, and cleaned-up (Schiffman, 1995).

Consumers' attitudes toward food safety are not an independent issue, rather they are linked to demographic and socio-economic status, culture, personal preferences, experience (Wilcock, et al., 2004), and of course, psychosocial parameters. Self-efficacy has been shown to be a powerful predictor of health behavior (Medeiros, et al., 2001), and key to understanding, predicting, and producing sustainable behavior change. Students with a strong sense of self-efficacy are motivated to engage in challenging tasks, invest greater effort in assigned task, set higher goals, persist longer in the face of occasional setbacks, express lower levels of anxiety, use more effective learning strategies, and achieve at higher levels compared to those with low self-efficacy (Pajares & Urdan, 2006). The primary reason why so many educators and

researchers are interested in adolescents' self-efficacy is its proven effect on diverse spheres of academic functioning (Pajares & Urdan). Research on adolescents' self-efficacy, therefore, must start by asking the right question: "How confident are you that you can successfully perform these tasks?" (Pajares & Urdan, 2006).

In general, there is ample reason to believe that self-efficacy is a powerful motivation construct that works well to predict academic self-beliefs and performances at varying levels, but works best when theoretical guidelines and procedures regarding specificity and correspondence are adhered to (Pajares, 1996).Educational programs geared toward teaching the general population often does not work (Haapala & Probart, 2004). However, there is still limited research and education geared toward young adolescents. Self-efficacy research has improved academic success in adolescents as demonstrated in the previous studies. Therefore, understanding adolescents' food safety self-efficacy may have a similar impact on increasing adolescents' food handling behaviors (Byrd-Bredbenner, Wheatley, et al., 2007).

Chapter 3: Method

A robust survey instrument must be shown to be both valid and reliable. According to the newest addition of the Standards for Educational and Psychological Testing (Standards; American Educational Research Association [AERA], American Psychological Association [APA], & National Council on Measurement in Education [NCME]), validity "refers to the degree to which evidence and theory support the interpretations of test scores entailed by proposed uses of test" (AERA, APA, & MCME, 1999, p. 9; Goodwin & Leech, 2003, p. 183). Simply put, validity is how appropriately participants interpret items on a survey (Gay & Airasian, 2003). While, reliability refers to the extent to which an instrument repeatedly gives consistent results. According to Gay & Airasian (2003) there are four types of validity (content, criterion-related, construct, and consequential) and five types of reliability (stability, equivalence, equivalence and stability, internal consistency, and scorer/rater). For the purposes of this research content validity, stability, and internal consistency were assessed.

While some of the literature suggests that a 100-point scale is best for determining self-efficacy (Pajares & Urban, 2006), there is still some discussion on the appropriateness of a 100-point scale for use with adolescents. Within the scope of the larger USDA NIFSI project, a small pilot test concluded that, within the targeted population, no significant difference ($p > 0.05$) was observed between 5-, 10-, or 100-point scales when used in a beta version of the instrument validated in this study. Therefore, a 5-point Likert scale was used in this study. The main objectives of this study sought to establish the content validity, stability and internal reliability of the AFFSE instrument as the initial steps in validating the instrument. Figure 1 below shows the process involved in developing, refining, and validating the instrument.

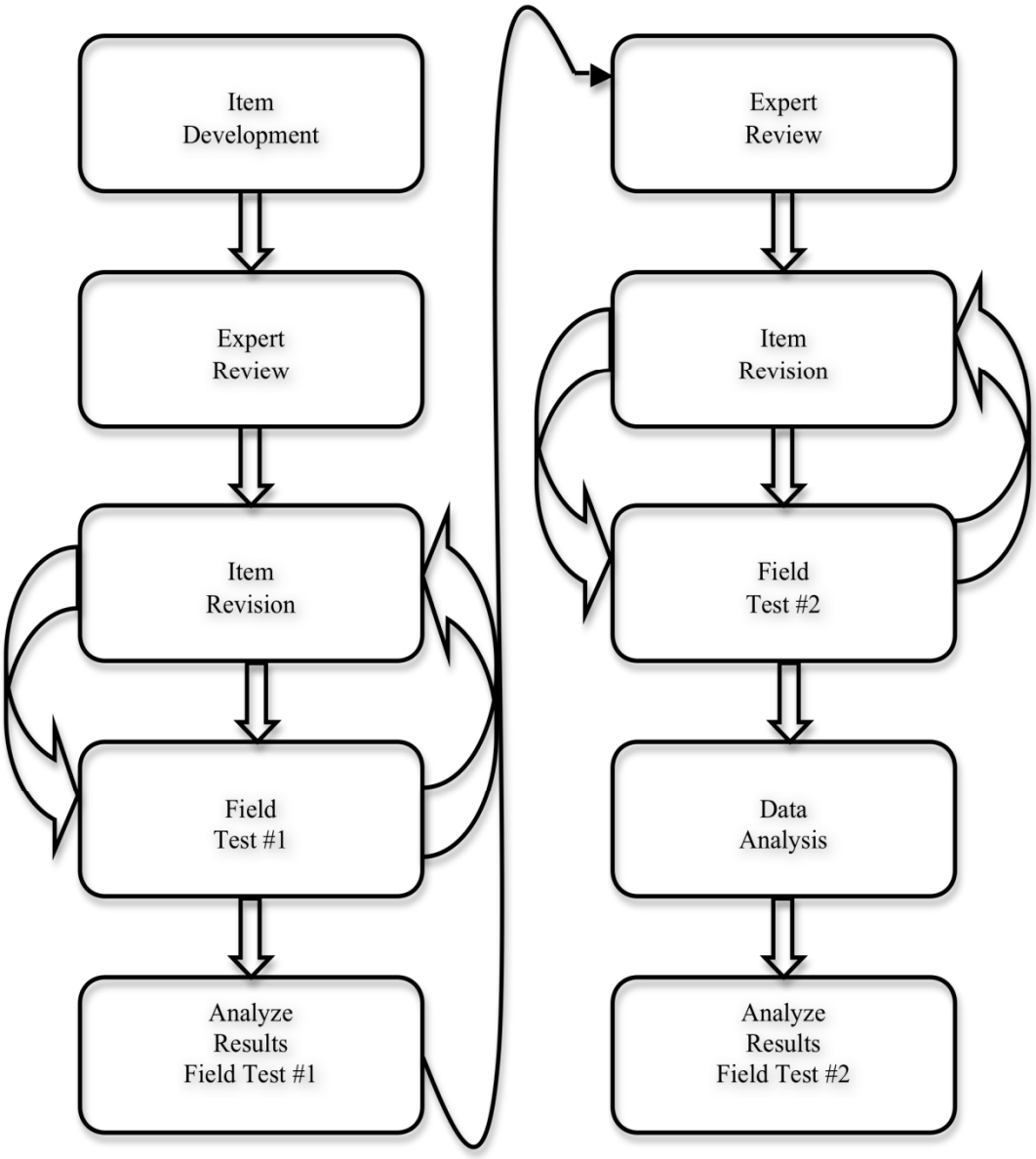

Figure 1. *Flow Diagram for the Process of Developing, Refining, and Validating an Instrument for Measuring Adolescent Food Safety Self-Efficacy*

Participants

The University of Tennessee's Internal Review Board (UT IRB) granted approval for this research. The participants in the study were a convenience sample as they were selected on a volunteer basis. Two middle schools in the southeastern region of Tennessee were chosen based on previous working relationships with the NIFSI grant staff. From these schools, one teacher was selected by the school administration to test the students in his/her classes. Table 1 listed below gives a more detailed description of the demographic characteristics of the adolescent students in this study.

Table 1. *Demographic Characteristics of Adolescent Students from Two Middle Schools in Southeastern Tennessee*

Demographic Characteristics		Schools #1 & #2 % 7th & 8th grade (n=91)	School #1 % 8th grade (n=37)	School #2 % 7th grade (n=54)
Gender	Female	47.3	43.2	50
	Male	52.7	56.8	50
Race	American Indian or Native Alaskan	-	-	-
	Black or African American	8.8	8.7	9.3
	Asian	2.2	2.7	3.7
	Hispanic	7.7	-	11.0
	Native Hawaiian or Other Pacific Islander	-	-	-
	White	75.8	83.0	70.4
	Other	4.4	2.7	5.6
Age	10	-	-	-
	11	1.1	-	1.9
	12	35.2	-	59.3
	13	42.9	56.8	33.3
	14	20.9	33.2	5.6

- = No demographic results

Instrument and Data Collection

The AFSSE questions were created based upon the researcher's previous culinary knowledge, using the ServeSafe (2009) course book as a reference, previous food science knowledge, and the current research in both food safety and self-efficacy. The development of six food safety topics to encompass all areas of food safety was created based upon previous food safety knowledge along with the study conducted by Medeiros, et al. (2001). Based upon the recommended formatting guidelines given by Byrd-Bredbenner, Wheatley, et al. (2007ab), a total of four item stems were used to ask the food safety self-efficacy items. Thereby, making the instrument easier for students to read and breaking up the monotony of using repeated stems for each item on the instrument. As no difference was found according to Maurer and Pierce (1998) when using a 100-point scale vs. a 5-point scale, a Likert 5-point response scale was determined to be the choice for this instrument.

The first instrument had 36 questions, which included eight demographic and 28 food safety self-efficacy questions. The surveys were coded and numbered to distinguish between the pre- and post-test. The questions varied by stem and included four stand-alone behavior questions. The various stems included: "I feel that" (n = 7), "I often" (n = 5), "I can positively impact the safety of my food by" (n = 6), and "I am confident that" (n = 6). Along with the four stems, the questions were developed using six food-safety constructs: personal hygiene, sanitation, cross-contamination, cooking/cooling temperatures, foodborne illness knowledge, and responsibility/risk. A 5-point Likert response scale was used for both the self-efficacy (1 = strongly disagree, 2 = disagree, 3 = neither disagree nor agree, 4 = agree, and 5 = strongly agree) and behavior (1 = never, 2 = rarely, 3 = usually, 4 = sometimes, and 5 = always) questions.

Once the food safety self-efficacy questions were developed, a panel of experts (n=4) in food safety, microbiology, and adolescent education reviewed the questions appropriateness and scope, and thereby, established content validity. A field-test was performed to determine if there were any significant differences in the stability of the instrument using a pre to post-test administration of the survey within a two week timeframe. A lack of stability in the instrument would mean the instrument was unreliable and could not consistently measure adolescent food safety self-efficacy. Both administrations of the field test were performed in order to also determine the reliability along with the stability of the instrument. Reliability was determined by assessing the instrument's internal consistency. Cronbach's alphas were calculated in order to determine how well each item related to all of the other items on the instrument (Gay & Airasian, 2000).

The Cronbach's alpha for the overall survey was moderately strong ($\alpha = 0.76$) indicating the instrument only moderately measured internal consistency. In other words, the items asked on the instrument were only moderately capable of assessing the same construct. In examining the Cronbach's alpha for the four stems ("I feel that", $\alpha = 0.18$, "I can positively impact the safety of my food by", $\alpha = 0.47$, "I am confident that", $\alpha = 0.47$, "I often", $\alpha = 0.57$, and behavior questions, $\alpha = 0.78$), weak to moderately strong alpha coefficients were observed. The results from the pre- and post-test means (pre-test = 91.57 ± 10.15, post-test = 91.75 ± 8.44) and insufficient coefficient alphas led to further review by measurement and self-efficacy experts (n=4). Based on statistical analysis for validity and reliability (Cronbach's alpha, T-tests, and Correlational analysis) and a thorough review of the items, it was determined that the instrument did not measure food safety task targeted toward adolescents. Therefore, the instrument was not accurately measuring AFSSE. The items did not measure AFSSE, but rather, food safety

knowledge and behavior. After experts in assessment and self-efficacy further reviewed the instrument (n=4), the decision was made to create a new AFSSE instrument.

Upon completion of the expert review and further review of the current research, the self-efficacy questions were revised by: a) dropping the four stems, b) shortening sentence length, c) adjusting readability level, and d) creating items that addressed performing specific food safety actions. The newly developed instrument had a total of 78 items vs. the original instrument that only had 28 items. The increase in the amount of questions on the instrument was decided upon to further explore food safety topics. The original six topics were modified slightly to more accurately represent food-safety concepts. The final instrument's sub-topics included: personal hygiene, sanitation, cross-contamination, cooking/cooling temperatures, foodborne illness, and risk. Respondents rated their ability to complete each food safety behavior (i.e., their self-efficacy) using a 5-point Likert scale with the following response choices: 1 = can't do at all, 2 = can do a little, 3 = can do some, 4 = can do mostly, and 5 = can do for sure. . All questions included the stem "I can".

The newly developed instrument was then reviewed by a panel of food safety experts (*n* = 4) for food safety content in November 2009. Upon the completion of the first revisions, the instrument was then sent to a panel of experts in assessment, adolescents, and self-efficacy (*n* = 5) for a review of the self-efficacy content and readability in December 2009. The finalized instrument was then field-tested at two Southeastern Tennessee middle schools. At School 1 the pre-test (*n* = 37) and post-test (*n* = 30) were administered in January 2010 within two weeks of each other. School 2 also administered the pre-test (*n* = 54) during January 2010, and the post-test (*n* = 53) two weeks later in February 2010. The surveys were coded and numbered to

distinguish between the pre and post-test, thereby, providing the ability to match the same student in the second administration.

Data Analysis

All data analysis was performed using SPSS (version 18). Before performing any statistical analysis, the data was checked for any coding problems, and *cleaned* and reviewed for the following: omitting any invalid data, checking responses for unusual data, checking for missing data, reverse scoring negatively worded items, and deleting inadvertently duplicate items. Next, normality was determined by analyzing the skewness, standard error of skewness, kurtosis, standard error of kurtosis, and range of responses. Validity was performed using expert panels to determine content validity. Stability was established using test/re-test, and internal consistency was verified using Cronbach's alpha. While descriptive analysis was performed on the demographic data to determine frequencies, and on the self-efficacy questions to determine means, standard deviations, and response distribution.

Chapter 4: Results

.

Assumptions to Determine Normality

The data were cleaned by checking for any invalid data, unusual data, negatively worded items, and duplicated items. Then the items were assessed for any coding problems. Next, normality was assessed. It is important to understand that for any of the statistical results to be valid and considered trustworthy, normality of the data needed to be assessed first before any other statistical analysis was performed. Normality is not a straightforward statistical process, but rather, it is assumed assessed through various statistical procedural steps. For any statistical results to be valid and considered trustworthy, normality was assessed on the data. The data were cleaned by checking for any invalid data, unusual data, negatively worded items, coding problems, and duplicated items. For the purposes of this research a table was created to show the calculated means, standard deviations, skewness, kurtosis, and responses distribution (see Appendix B). The data were reviewed and cleaned for any invalid or unusual data, and negatively worded items. All of the items were coded by six food safety topics, and checked to make sure no coding problems occurred. Any data above or below the predetermined boundaries set for each statistical analysis would indicate non-normal data. The boundaries for each statistical analysis and are listed in more detailed further in Chapter 4.

The results of the data cleaning revealed no invalid data, nor unusual data, and no negatively worded items or coding problems, thus indicating all the data were normal. Out of the original 78 questions, there were four inadvertently duplicated questions which were omitted (SECC 10, SEFI 13, SEFI 14, SERK 14). After deleting the four duplicated items a total of 74 items remained. The decision not to replace missing data was based upon the assumption that,

typically, during instrument construction the instrument is not established, and to maintain the integrity of the data missing data is not replaced (Gay & Airasion, 2003).

The means and standard deviations of each items' responses were reviewed along with skewness, kurtosis, and response distributions to determine normality. Large standard deviations were observed, which may be explained by the fact that students were asked about what they could and could not do to handle food safely. This would create a large deviation among the answers, because students would have varying beliefs about their capabilities in performing food safety tasks based on their own personal food handling experiences.

Various theories exist about the specific cut-off point to use when addressing kurtotic values should be in analyzing data. For this research, +/-1 was used to designate items as being non-normally distributed (Saxton, 2008). A cut-off point of +/-1 was also used to assess data for skewed values. The majority of items were flagged for skewness or kurtosis, or for both factors (see Appendix A). However, the variability in student responses was taken into consideration when examining skewness and kurtosis.

For each item in the response distribution, items with a 40% response rate or higher were flagged (see Appendix B). Higher response rates indicated a similar belief among students in their capability to perform a food safety task. If the students answered, "can do for sure" with a greater than a 40% response rate this indicated that the students felt comfortable with this food safety task. Thereby, suggesting that this food safety task was not a needed focus for future research. After assessing normality, the data were deemed normally distributed and additional statistical analyses were performed (see Table A1).

Content Validity Analysis

Content validity is established through expert review and can be defined as the degree to which an instrument represents the at-risk behaviors and operationalizes the construct (Colton, 2007). For this research, experts analyzed the content of food safety and self-efficacy as it pertained to adolescents 11-14 years of age. Meidros (2001) suggests six topical areas for food safety constructs: practicing proper personal hygiene, practicing proper sanitation, avoiding cross-contamination, adhering to proper cooking and cooling temperatures, seeking education on foodborne illnesses, and understanding perceived risk of foodborne illness. The six constructs along with the concept of the "Fight Bac" program (clean, separate, cook, and chill) were the basis for the newly developed six food safety topics. In order to have a refined, validated, and established instrument, the original instrument comprised multiple wordings of the same basic items to methodically and systematically determine which items were most valid. Developing, refining, and validating all 74 questions was a continuous process completed in three stages throughout the development of the instrument (Refer to Chapter 3 for detailed methods).

For the first expert review, only experts in food safety and self-efficacy were consulted to determine if the instrument accurately reflected the constructs of adolescent food safety and self-efficacy. Experts in food safety commented and made suggestions to expand the food safety content. One concern was that some areas of food safety were left out within the scope of a food safety topic. Experts made suggestions for topics/tasks to include, such as questions pertaining to specific foods (i.e., raw meats) or situations (i.e., time constraints). Example questions added to the food safety topic of cross contamination included: "I can tell you why wearing jewelry can contaminate food." and "I can tell you why I should remove jewelry when preparing food." For the food safety topic, cooking/cooling temperatures, food safety experts suggested adding, "I can

tell you why foods should be cooled in shallow containers." Self-efficacy experts made revisions to the response scale, reading level, and sentence length. Suggestions were made that to accurately capture self-efficacy, words that assessed the food safety performance level of a task (i.e., I can/cannot do this task) needed to be used. For example self-efficacy experts changed the wording from "I know the proper way to wash my hands." to "I can tell you how to properly wash my hands." to more accurately capture self-efficacy. Experts in all areas suggested lowering the 6th grade reading level to a 4th grade reading level. More complex words were reworded for ease of understanding, and sentenced length was shortened to help keep students' attention, thereby creating less confusion from long-winded sentences. For example, the word "prepare" was changed to "make" and the question "I wash my hands after touching my face or hair, blowing my nose, and coughing or sneezing when preparing foods." was separated into three questions.

For the second expert review, a new panel of experts in food safety, self-efficacy, adolescents, and measurement provided feedback for the food safety topics and questions that pertained to their area of expertise. Experts flagged questions that were in their opinions, ambiguous or irrelevant. For the food safety concepts experts identified the appropriateness of the food safety topic as they related to adolescents. A majority of the feedback from food safety experts included adding more food safety tasks (i.e., concerns about wearing jewelry or using dirty dish cloths to wash dishes) and deleting irrelevant food safety tasks for adolescents. For example, deleting the question "I can prevent cross-contamination of raw chicken when using a cutting board". Self-efficacy, adolescent, and measurement experts refined the self-efficacy content, reading level, and sentence structure. Measurement experts suggested rearranging the

questions from each food safety topic by random assignment. Thereby eliminating food safety sub-topics and creating one AFSSE instrument instead of a multi-scale instrument.

For the third and final review, experts on food safety, self-efficacy, adolescents, and measurement were asked to mark the questions they would delete and explain why (see Appendix A). Experts were not allowed to change the format of the sentence, only to delete questions. The majority of suggestions for item deletions came from food safety experts. For example, the item "I can keep myself from getting sick by washing my hands." was deleted based upon the comment "You can't prevent yourself from getting sick only by washing your hands." Another item, "I can tell you why I should correctly measure the temperature of my food." was deleted because an expert made the following comment, "not specific enough; are you talking refrigerated, cooked, dry, frozen?". This item lacked the food safety details necessary to ensure that all participants would interpret the item the way it was intended to be interpreted. Overall, experts suggested a shorter version of the instrument could still accurately capture the food safety topics.

Stability and Internal Reliability Analysis

Reliability is the extent to which an instrument produces the same results over a given period of time (Colton, 2007), and is important, because strong reliability means that students answer the questions the same way in the future. For the purposes of this research only two forms of reliability were analyzed: stability and internal reliability. Stability is performed using the test-retest method and is the degree to which an individual's score remains consistent over time (Gay & Airaisian, 2003). Person's product moment correlation is used to determine the strength of a relationship among variables (Colton, 2007) and was used in conjunction with

stability analysis to aid in understanding any abnormal results. Internal reliability is assessed by calculating Cronbach's alpha for dichotomous questions in order to determine how well each item relates to each of the other items and to the instrument as a whole (Gay & Airaisan, 2003). Cronbach's alpha, t-test, Pearson's correlation coefficient statistical analyses were performed on individual items and Cronbach's alpha was performed for each food safety topic. Refer to Appendix A for a review of the results from the statistical analyses listed above.

Items with *p*-values from the t-test equal to or less than 0.05 were considered significant and flagged to be examined through test-retest analysis. As a result, 22 of the items were flagged suggesting students did not understand these questions. The other 54 items adequately assessed students' food safety self-efficacy over time. Table 2 gives the p-values from the test retest analyzed for the 17 final items.

Table 2. *Adolescent Food Safety Self-Efficacy Items Flagged for Test-Retest Stability Analysis*

Self-Efficacy Items	Item number	*p*
Personal hygiene		
I can wash my hands in a way that removes germs.	SEPH3	.036
I can tell you when it's important to wash my hands.	SEPH4	.014
I can tell you when I should wash my hands before I handle food.	SEPH9	.000
I can tell you why I should wash my hands after picking my nose.	SEPH12	.037
Sanitation		
I can tell you what the word sanitation means.	SEST3	.028
I can practice correct sanitation behavior.	SEST4	.017
Cross contamination		
I can tell you what the term "cross contamination" means.	SECC3	.025
I can tell you why I should avoid cross contamination of food.	SECC7	.004
I can prevent cross contamination.	SECC8	.036
I can tell you why wearing jewelry can contaminate food.	SECC9	.010
Cooking/cooling temperatures		
I can tell you the right temperatures to store food.	SECT3	.014
I can show you how to correctly measure the temperature of food.	SECT5	.037
I can tell you why foods should be cooled in shallow containers.	SECT6	.001
Foodborne illness		
I can tell you what germs are most likely to be in my foods.	SEFI4	.011
I can tell you what the term "foodborne pathogen" means.	SEFI7	.011
Risk		
I can tell you which foods are more likely to cause food poisoning.	SERK5	.031
I can tell you which foods are high-risk foods.	SERK6	.005

Pearson's product moment correlations were evaluated on a +1/-1 scale, with a cut-off value of 0.7 or higher indicating a strong relationship among variables. Only two of the correlations were above 0.7. Therefore, in correlation analysis, items below the cut-off point of 0.4 are typically flagged as weak correlations. Out of the 74 items, 17 items were flagged as having weak relationship among variables (see Table 3). The rest of the 57 items were moderately correlated. Any value of the Cronbach's coefficient equal to or greater than 0.8, is typically considered a strong indicator of internal reliability (Colton, 2007). The results from the statistical analysis of Cronbach's alpha indicated strong internal consistency for the whole instrument ($\alpha = 0.984$). However, higher larger numbers of items can influence the coefficient alphas and can result in an overinflated figure (Colton, 2007). As there were 74 items on the instrument this suggests that the instrument's overall Cronbach's alpha is questionable.

To better capture internal reliability of the instrument coefficient alphas were analyzed for each food safety topic and the item total statistics were analyzed for each individual question. All of the food safety topics achieved Cronbach's alphas of 0.864 or higher: personal hygiene ($n = 12$, $\alpha = 0.864$), sanitation ($n = 14$, $\alpha = 0.919$), cross-contamination ($n = 09$, $\alpha = 0.917$), cooking/cooling temperatures ($n = 14$, $\alpha = 0.942$), foodborne illness ($n = 12$, $\alpha = 0.895$), and risk ($n = 13$, $\alpha = 0.937$) (see Table 3).

Running Total Item Statistical analysis accomplished two functions. The first was to determine the correlation among the food safety topics. The second function was to determine if specific item were to be deleted would the instrument be stronger if specific items were deleted without that item. If, the Cronbach's alpha was raised increased with the deletion of a specific item, then that meant the item needed to be deleted should be considered for deletion. Out of the

74 questions, only three items were flagged for possible deletion. The other 71 items strengthened the internal reliability (see Table 4).

Table 3. *Correlations Flagged for the Adolescent Food Safety Self-Efficacy Instrument*

Self-Efficacy Items	Item number	*r*	*p*
Personal Hygiene			
I can tell you when it's important to wash my hands.	SEPH4	0.364	0.001
I can show you how to properly wash my hands.	SEPH5	0.397	0.000
I can tell you why I should wash my hands after picking my nose.	SEPH12	0.378	0.001
Foodborne Illness			
I can tell you what the term "foodborne pathogen" means.	SEFI7	0.178	0.116
I can tell you what the term "food safety" means.	SEFI11	0.296	0.007

Table *4. Items Flagged Using Total Item Statistical Analysis For The Adolescent Food Safety Self-Efficacy Instrument*

Self-Efficacy Item	α	Item Number	CITC	α, if item deleted
Personal hygiene	0.864			
I can define personal hygiene.		SEPH1	0.315	0.871
Sanitation	0.919			
I can tell you what the word sanitation means.		SEST3	0.471	0.919
Risk	0.937			
I can tell you what are high-risk behaviors when handling food.		SERK1	0.527	0.937

Note. CITC = corrected item total correlation.

Chapter 5: Conclusions, Discussion, and Future Recommendations

Currently, adolescents are entering the food service industry in great numbers (Byrd-Bredbenner, 2008). However, they still represent an understudied population regarding their food safety behaviors, and little if any research exists on adolescents' food safety risky behaviors or adolescent food safety self-efficacy (AFSSE). Self-efficacy is a psychosocial parameter that has repeatedly been used to predict risky behaviors, and is thought to help understand and predict risky adolescent food safety behaviors. To understand AFFSE, a survey instrument was developed and validated through field testing. Data were collected from 91 adolescent students from two Southeastern Tennessee schools using a 78-item AFSSE survey instrument. Therefore, the purposes of this study were to: a) develop a high quality, food safety self-efficacy instrument, b) validate the instrument through expert review, and c) field-test the instrument's ability to measure adolescent students' food safety self-efficacy. This chapter contains the justification for retaining survey items, description of the final survey instrument items, implications for future research, and conclusions and discussion.

Justification for Retaining Survey Items

The justification for keeping items was based upon a methodological process of item deletion including statistical analysis and expert review. When determining whether or not to keep an item, priority was given to the following deciding factors ranked from highest to lowest: expert review, internal reliability, total item statistics, test-retest reliability, Pearson's product moment correlations, and normality.

Items marked by expert review were given the highest priority for deletion. If the expert felt that the item did not represent the concepts of either food safety or self-efficacy as they pertain to adolescents, then statistical analyses were not performed. According to Gay and Airasian (1996), an instrument is reliable if first proven valid. Therefore, higher priority was placed on assessing the strength of content validity. Next, internal reliability was given a higher ranking than p-values from test-retest or Pearson's r correlations results. According to Bandura (2006), self-efficacy will not ultimately change either positively or negatively simply by answering items on an instrument (Pajares, 2006). However, the researchers in this study placed less emphasis on the results from the post-test instrument. The thought being that self-efficacy would be reflected through personal bias in the post-test administration. Students would become more familiar with the survey, and become better capable at responding to the questions. Therefore, the thought was that self-efficacy was only truly accurately captured the first time it was measured. Therefore, less emphasis was placed on test-retest reliability and Pearson's product moment correlations. Even though 62 of the items were flagged for the assumptions in normality, priority was given to validity and reliability. The thought was that self-efficacy is based upon individuals' personal beliefs about their ability to accomplish a specific task (Bandura, 1993), and natural variations would occur in skewness, kurtosis, and the response distribution.

Expert reviewers marked 40 items to delete, with only one (SEPH 05) flagged for further analysis. No other statistical findings supported the decision to delete these items. The response distribution, food safety concept, item wording, age appropriateness, and sentence length were all taken into consideration in when determining whether or not to keep items. Based upon these standards, three of the items (SEPH 07, SECT 12, and SERK 08) marked for deletion, and the

one item flagged for correlational analysis were kept based upon the parameters previously mentioned and the following guidelines. The items were kept because they were a) highly relevant to food safety, b) the task strongly applied to adolescents, and c) the items addressed the purpose of the larger USDA NIFSI project. Any item not flagged for statistical analysis (excluding the four items previously mentioned) was kept for use in the final instrument leaving 16 items remaining to include in the final instrument (see Table 5).

Table 5. *Assumptions for Normality, Reliability, and Validity Statistical Analysis of the Final Adolescent Food Safety Self-Efficacy Instrument Items*

Item	*M*/*SD*	SK	KR	RD	Item Code
Personal Hygiene					
I can practice good personal hygiene.	-	X	-	X	SEPH2
I can show you how to properly wash my hands.	-	X	X	X	SEPH5
I can tell you why washing my hands helps keep me from getting sick.	-	X	-	X	SEPH7
Sanitation					
I can tell you the difference between cleaning and sanitizing.	-	-	-	-	SEST6
I can tell you how to clean a kitchen to remove germs.	-	-	X	X	SEST12
Cross Contamination					
I can show you how to prevent cross contamination.	-	-	X	-	SECC1
I can tell you why it is important to keep cooked foods and raw foods away from each other.	-	-	-	X	SECC5
Cooking and Cooling Temperatures					
I can tell you the right temperature to cook ground beef (to make sure that all the harmful germs are killed).	-	-	X	-	SECT4
I can tell you why I should cook foods to the proper temperature.	-	-	-	X	SECT7
I can explain why it is important to reheat food to the right temperature.	-	-	-	-	SECT9
I can tell you how to correctly measure the temperature of my food.	-	-	X	-	SECT12
I can show you how to store food properly.	-	-	-	-	SECT13
I can tell you when to refrigerate food.	-	-	-	X	SECT14
Foodborne Illness					
I can tell you why food safety is important.	-	-	-	X	SEFI12
Risk					
I can reduce the risk of food poisoning.	-	-	X	-	SERK2
I know how to reduce the amount of germs in my food.	-	-	X	-	SERK8

Note. SK = Skewness, KR = Kurtosis.; X = Items flagged outside the boundaries of the statistical analysis for normality; - = Items within the boundaries of the statistical analysis for normality.

Table 5 continued. *Assumptions for Normality, Reliability, and Validity Statistical Analysis of the Final Adolescent Food Safety Self-Efficacy Instrument Items*

Item	*r*	α	ITS	TRT	Exp	Item Code
Personal Hygiene						
I can practice good personal hygiene.	-	-	-	-	-	SEPH2
I can show you how to properly wash my hands.	X	-	-	-	-	SEPH5
I can tell you why washing my hands helps keep me from getting sick.	-	-	-	-	X	SEPH7
Sanitation						
I can tell you the difference between cleaning and sanitizing.	-	-	-	-	-	SEST6
I can tell you how to clean a kitchen to remove germs.	-	-	-	-	-	SEST12
Cross Contamination						
I can show you how to prevent cross contamination.	-	-	-	-	-	SECC1
I can tell you why it is important to keep cooked foods and raw foods away from each other.	-	-	-	-	-	SECC5
Cooking and Cooling Temperatures						
I can tell you the right temperature to cook ground beef (to make sure that all the harmful germs are killed).	-	-	-	-	-	SECT4
I can tell you why I should cook foods to the proper temperature.	-	-	-	-	-	SECT7
I can explain why it is important to reheat food to the right temperature.	-	-	-	-	-	SECT9
I can tell you how to correctly measure the temperature of my food.	-	-	-	-	X	SECT12
I can show you how to store food properly.	-	-	-	-	-	SECT13
I can tell you when to refrigerate food.	-	-	-	-	-	SECT14
Foodborne Illness						
I can tell you why food safety is important.	-	-	-	-	-	SEFI12
Risk						
I can reduce the risk of food poisoning.	-	-	-	-	-	SERK2
I know how to reduce the amount of germs in my food.	-	-	-	-	X	SERK8

X = Items flagged outside the boundaries of the statistical analysis; - = Items within the boundaries of the statistical analysis.

Final Survey Instrument Items

As this survey instrument contained 74 items to review, the following section addresses the items to keep, rather than the items to delete, for use in the final instrument. The following is a list of the 16 items suggested to keep as well as a brief description of why each item was kept.

SEPH2. *I can practice good personal hygiene*. The only statistical analyses flagged for this item related to normality issues for skewness and the response distribution. The item tested well in both validity and reliability, and therefore, kept.

SEPH5. *I can show you how to properly wash my hands*. Even though statistical analysis indicated weak correlation with the measure as a whole, the decision was made to keep this item. The question performed well in the other statistical analysis, and more importantly represented an important food safety topic for adolescent students. However, one expert also suggested another expert review be performed in the future to determine whether or not to keep this item.

SEPH7. I can tell you why washing my hands helps keep me from getting sick. Based upon expert review alone this question should be deleted. However, the question was strongly related to an important food safety topic for students, and the larger NIFSI research project. More importantly, it was thought students could strongly identify with the question and what the question was asking. As all other statistical analyses indicated it was a reliable item, the item was kept.

SEST6. *I can tell you the difference between cleaning and sanitizing*. All statistical analysis provided evidence of strong validity, reliability, and normality. Therefore, the decision was made to keep this item. However, one expert also suggested another expert review to be performed in the future to determine whether or not to keep this item.

SEST12. *I can tell you how to clean a kitchen to remove germs*. Only kurtosis and the response distribution were flagged for possible normality issues. The item tested well in both validity and reliability, and therefore, kept.

SECC1. *I can show you how to prevent cross contamination.* Only kurtosis was flagged for possible normality issues. The item tested well in both validity and reliability, and therefore, the item was kept.

SECC5. *I can tell you why it is important to keep cooked foods and raw foods away from each other.* Only the response distribution for possible normality issues was flagged. The item tested well in both validity and reliability, and therefore, the item was kept.

SECT4. *I can tell you the right temperature to cook ground beef (to make sure that all the harmful germs are killed).* Only kurtosis was flagged for possible normality issues. The item tested well in both validity and reliability, and therefore, kept. There is concern that the question is too wordy; therefore, further expert review should be performed before deleting or revising the question.

SECT7. *I can tell you why I should cook foods to the proper temperature*. Only the response distribution was flagged for possible normality issues. The item tested well in both validity and reliability, and therefore, the item was kept.

SECT9. I *can explain why it is important to reheat food to the right temperature.* All statistical analyses provided evidence of validity, reliability, and normality.

SECT12. *I can tell you how to correctly measure the temperature of my food.* Based upon expert review alone this item should be deleted. However, the item strongly related to an important food safety topic for students, and the larger NIFSI research project. Only skewness

was flagged for possible normality issues, but, as all other statistical analyses indicated a reliable item, the item was kept.

SECT13. I can show you how to store food properly. All statistical analyses provided evidence of validity, reliability, and normality.

SECT14. *I can tell you when to refrigerate food.* Only the response distribution was flagged for possible normality issues. The item tested well in both valid and reliable, and therefore, the item was kept.

SEFI12. *I can tell you why food safety is important.* Only the response distribution for possible normality issues was flagged. The item was both valid and reliable, so the item was kept.

SERK2. *I can reduce the risk of food poisoning.* Only kurtosis was flagged for possible normality issues. The item was deemed both valid and reliable, and therefore, the item was kept.

SERK8. *I know how to reduce the amount of germs in my food.* Based upon expert review alone this question should be deleted. However, the question strongly related to an important food safety topic for students, and the larger NIFSI research project. Only skewness was flagged as a possible normality issue, but as all other statistical analyses indicated a reliable item the item was kept. There is concern the wording "I know" should be changed to "I can", to more accurately capture self-efficacy. However, further expert review needs to be performed before revising the question.

Recommendations for Future Research

This study represents only a portion in the validation process of a new survey instrument. Thereby, the ability of this study to fully answer the research question "to what extent can a validated instrument accurately capture an adolescents' food safety self-efficacy" is limited. Future research would benefit from the following recommendations.

1. *Conduct further, more complex statistical analysis.*

Research suggests there are various areas or topics that define food safety (i.e., personal hygiene, cleaning, cook, chill etc.) (Medeiros, Hillers, et al., 2001b). However, there is no evidence to suggest whether or not common themes in food safety are separate constructs or if they all fall under the general construct of food safety. Factor analysis would provide the statistical analysis to answer the question "Are food safety constructs indeed separate constructs or are any of the constructs correlated?"

2. *Rerun statistical analysis on the final survey instrument.* Normality, validity, test-retest, and Pearson's r would all stay the same for the final instrument. However, Cronbach's alpha and the total item statistics could be analyzed on the 16 items chosen for the final instrument. It would be important to see if any changes occurred in strength of the selected items as a result from shortening the final instrument. The results for Cronbach's alphas overinflate when the instrument is greater than 15 items (Lounsbury, Gibson, & Saudargas, 2005). Based upon the suggestion to shorten the numbers of items from 74 to 16 items rerunning Cronbach's alpha on the final instrument gives a better representation of the internal reliability. These results would aid in the justification in keeping items on the final instrument.

3. *Conduct a small field test to assess the validity and reliability of the final instrument.* Conducting a small field test with only the final recommended items would provide further

insight into the credibility and validation of the final instrument. It would be useful to see if a 16-item self-efficacy survey instrument would vary in the statistical analysis as compared to a 78-item survey instrument. The following bullet points are a list of questions that might be asked upon completion of the field test.

- Would the Cronbach's alpha remain strong?
- Would any of the questions need to be deleted in order to strengthen the survey?
- Would the test-retest scores improve?
- Would Pearson's r show stronger bivariate correlations?
- Would normality still show large amount of variation?
- Would students find the shorter survey instrument easier to complete and therefore exhibit less exhaustion or boredom in answering the questions?

Conclusions and Discussion:

Only 16 of the total items (n=74) field tested passed normality, validity, and/or reliability analyses. A majority of the remaining items had issues with normality. However, due to the wide range of personal self-efficacy beliefs, the decision was made put less emphasis on these results. A stronger emphasis was placed the results from expert review, and validity and reliability analyses on whether or not to keep items. Experts did mark three of the final 16 items (see Table 5) for deletion; while only one of the remaining items (see Table 3) had a low Pearson's correlations score less than 0.40 ($r = 0.397$). Even though these four items did not fair well in expert review or reliability, the decision was made to keep these items.

The general descriptions given as to why keep these 16 items were based upon the results in expert review, validity, and reliability. However, there were four items that experts suggested

be kept for now, but further review is needed to determine whether or not to keep, revise, or delete the items (SEPH5, SEST6, SECT4, &SEK8). There were three items (SEPH7, SECT12, & SERK8) where experts suggested deleting the items, but as the items highly related to an important food safety topic for students, the decision was made to keep these items on the final instrument. For future recommendations, the overall trend pertained to the need to conduct further, more complex, statistical analysis on the remaining items to better determine each item's capability at capturing AFSSE. However, with the rigorous and proven research methods used in this study, it is possible to say that the final 16 items did measure AFSSE. Therefore, based upon the results from this study, an instrument was created that accurately measures AFSSE.

References

Altekruse, S. F., Street, D. A., Fein, S. B., & Levy, A. S. (1996). Putting the food handling issue on the table: The pressing need for food safety education. Washington, DC: AMI, FMI.

American Educational Research Association, American Psychological Association, & National Council on Measurement in Education. (1999). *Standards for educational and psychological testing*. Washington, DC: American Educational Research Association. p. 9.

American Meat Institute (1996). Putting the food-handling issue on the table: The pressing need for food safety education. Washing (DC): American Meat Institute and Food Marketing Institute.

American Society for Microbiology. (1996). Americans get caught dirty handed. Fact Sheets. Washington (DC): The Society.

Bandura, A. (1977). Self-efficacy-toward a unifying theory of behavioral change. *Psychological Review, 84*(2), 191-215.

Bandura, A. (1982). Self-efficacy mechanism in human agency. *American Psychologist, 37*(2), 122-147.

Bandura, A. (1986). Social foundations of thoughts and actions: A social cognitive theory. Englewood Cliffs, New Jersey: Prentice Hall, Press.

Bandura, A. (1993). Perceived self-efficacy in cognitive development and functioning. *Educational Psychologist, 28*(2), 117-148.

Bandura, A. (1995). Self-efficacy in changing societies. New York: Cambridge University, Press.

Bandura, A. (1997). Self-efficacy: The exercise of control. New York: Freeman, Press.

Bong, M., & Skaalvik, E. M. (2003). Academic self-concept and self-efficacy: How different are they really? *Journal of Educational Psychology Review, 15*(1), 1-40.

Brewer, M. S., & Rojas, M. (2008). Consumer attitudes toward issues in food safety. *Journal of Food Safety, 28*(1), 1-22.

Britner, S. L., & Pajares, F. (2006). Sources of science self-efficacy beliefs of middle school students. *Journal of Research in Science Teaching, 43*(5), 485-499.

Bruhn, C. M. (1997). Consumer concerns: Motivating to action. *Emerging Infectious Diseases, 3*(4), 511-515.

Bruhn, C. M., & Schutz, H. G. (1999). Consumer food safety knowledge and practices. *Journal of Food Safety, 19*(1), 73-87.

Byrd-Bredbenner, C. (2005). Food preparation knowledge and confidence of young adults. *Journal of Nutrition in Recipe & Menu Development*, *3*(34), 37-50.

Byrd-Bredbenner, C., Maurer, J., Wheatley, V., Schaffner, D., Bruhn, C., & Blalock, L. (2007). Food safety self-reported behaviors and cognitions of young adults: Results of a national study. *Journal of Food Protection, 70*(8), 1917-1926.

Byrd-Bredbenner, C., Wheatley, V., Schaffner, D., Bruhn, C., Blalock, L., & Maurer, J. (2007a). Development and implementation of a food safety knowledge instrument. *Journal of Food Science Education, 6*(1), 46-55.

Byrd-Bredbenner, C., Wheatley, V., Schaffner, D., Bruhn, C., Blalock, L., & Maurer, J. (2007b). Development of food safety psychosocial questionnaires for young adults. *Journal of Food Science Education, 6*(2), 30-37.

Byrd-Bredbenner, C., Abbot, J., Wheatley, V., Schaffer, D., Bruhn, C., & Blalock, L. (2008). Risky eating behaviors of young adults-Implications for food safety education. *Journal of the American Dietetic Association, 8*(103), 549-552.

Center for Disease Control and Prevention. US Foodborne Disease Outbreaks. Vugia, D., Hadler, J., Chaves, S., Blythe, D., Smith, K., Morse, D., Dieslak, P., Jones, D., Cronquist, A., Goldman, D., Guzewich, J., Angulo, F., & Tauxe R. (2003). Preliminary FoodNet data on the incidence of foodborne illnesses-selected sites, United States. *MMWR Morbid Mortal Wkly Rep*. 52, 340-343. Available at: http://www.cdc.gov/mmwr/preview/mmwrhtml/mm5215a4.htm. Accessed March 23, 2008.

Center for Disease Control and Prevention. US FoodBorne Disease Outbreaks. Vugia, D., Cronquist, A., Hadler, J., Tobin-D'Angelo, M., Blyth, D., Smith, K., Lathrop, S., Morse, D., Cieslak, P., White, P.L., Guzewich, JJ., Hena, O.l., Scallan, E., Griffin, P.M., Tauxe, R.V., & Barton, C.B. (2007). Prelimary FoodNet data on the incidence of infection with pathogens transmitted commonly through food---10 states. *MMWR Morbid Mortal Wkly Rep, 57(14): 336-370*. Available at: http://www.cdc.gov/mmwr/preview/mmwrhtml/mm5714a2.htm. Accessed March 23, 2008.

Collins, J. E. (1997). Impact of changing consumer lifestyles on the emergence/reemergence of foodborne pathogens. *Emerging Infectious Diseases, 3*(4), 471-479.

Colton, D., & Covert, R. (2007). Designing and constructing instruments for social research and evaluation. San Francisco, CA: Jossey-Bass Publishing.

Coulston, A. M. (2002). President's page: Personal responsibility and food safety. *Journal of the American Dietetic Association, 99*(2), 236-236.

Daniels, R. (1998). Home food safety. *Food Technology*. 52, 54-56.

Diener, C., & Dweck, C. (1978). An analysis of learned helplessness: continuous changes in performance, strategy, and achievement cognitions following failure. *Journal of Personality and Social Psychology, 36*(5), 451-462.

Eccles, J.S., & Wigfield, A. (1995). In the mind of the actor. The structure of adolescents' achievement task values and expectancy-related beliefs. *Pers. Soc. Psychol. Bull*., *3*: 215-225.

Food Marketing Institute (1996). Consumer knowledge of foodborne microbial hazards and f food-handling practices. *Journal of Food Protection, 59*(3), 287-294.

Frewer, L.J., Shepherd, R., & Sparks, P. (1994). The inter-relationship between perceived knowledge, control and risk associated with a range of food-related hazards targeted at the individual, other people and society. *Journal of Food Safety, 14*, 19-40.

Gariglietti, K. P., McDermott, D., Gingerich, K., & Hastings, S. (1997). Hope and its relationship to self-efficacy in adolescent girls: Educational Resources Information Center. *Non-Journal.*

Gay, L.R., & Airasian, P. (2003). Educational research: competencies for analysis and application. (7th Ed.) New Jersey: Prentence-Hall.

Goodwin, L.D, & Leech, N.L. (2003). The meaning of validity in the New Standards for Educational and Psychological Testing: Implications for measurement courses. *Measurement and Evaluation in Counseling and Development, 36*, 181-191.

Green, L. R. (2008). Behavioral science and food safety. *Journal of Environmental Health, 71*(2), 47-49.

Harter, S., & Whitesall, N.R., & Kowalski, P. (1992). Individual differences in the effects of educational transitions on young adolescents' perceptions of competence and motivational orientation. *American Education Research Journal, 29*, 777-807.

Haapala, I., & Probart, C. (2004). Food safety knowledge, perceptions, and behaviors among middle school students. *Journal of Nutrition Education and Behavior, 36*(2), 71-76.

Harter, S., Whitesell, N. R., & Kowalski, P. (1992). Individual differences in the effects of educational transitions on young adolescents' perceptions of competence and motivational orientation. *American Educational Research Journal*, 29, 777-808.

Hedberg, C. (1999). Food-related illness and death in the United States. *Emerging Infectious Diseases, 5*(6), 840-841.

Ingham, S., & Thies, M. L. (1997). Position of The American Dietetic Association: Food and water safety. *Journal of the American Dietetic Association, 97*(2), 184-189.

Kastner, C. L. (1995). The real story about food safety. *Journal of Animal Science, 73*(9), 2741-2743.

Knabel, S. J. (1995). Foodbourne illness - Role of home food handling practices. *Food Technology, 49*(4), 119-131.

Kuhl J., (1985). Volitional mediators of cognitive-behavior consistency: Self-regulatory processes and action versus state orientation. In Kuhl & J. Beckman (Eds.), Action control: From cognition to behavior, 101-128. New York: Springer-Verlag.

Lounsbury, J.W., Gibson, L.W., & Saudargas, R.A. (2005). *Scale Development.* In Leong, F.T.L., & Austin, J.T. (2nd Ed), *The Psychology Research Handbook: A Guide for Graduate Students and Research Assistants*. Thousand Oaks, CA: Sage Publications, Inc. 339-367.

Maurer, T. J., & Pierce, H. R. (1998). A comparison of Likert scale and traditional measures of self-efficacy. *Journal of Applied Psychology, 83*(2), 324-329.

McIntosh, W. A., Christensen, L. B., & Acuff, G. R. (1994). Perceptions of risks of eating undercooked meat and willingness to change cooking practices. *Appetite, 22*(1), 83-96.

Mead, P. S., Slutsker, L., Dietz, V., McCaig, L. F., Bresee, J. S., & Shapiro, C., et al. (1999). Food-related illness and death in the United States. *Emerging Infectious Diseases, 5*(5), 607-625.

Medeiros, L. C., Hillers, V. N., Chen, G., Bergmann, V., Kendall, P., & Schroeder, M. (2004). Design and development of food safety knowledge and attitude scales for consumer food safety education. *Journal of the American Dietetic Association, 104*(11), 1671-1677.

Medeiros, L., Hillers, V., Kendall, P., & Mason, A. (2001a). Evaluation of food safety education for consumers. *Journal of Nutrition Education, 33*, S27-S34.

Medeiros, L. C., Hillers, V. N., Kendall, P. A., & Mason, A. (2001b). Food safety education: What should we be teaching to consumers? *Journal of Nutrition Education, 33*(2), 108-113.

Miles, S., Braxton, D.S., & Frewer, L.J. (1999). Public perceptions about microbiological hazards in food. *British Food Journal, 101*, 744-762.

Multon, K.D., Brown, S.D., & Lent, R.W. (1991). Relation of self-efficacy beliefs to academic outcomes-a meta-analytic investigation. *Journal of Counseling Psychology, 38*(1), 30-38.

Pajares, F., & Urdan, T. (2006). *Self-Efficacy Beliefs of Adolescents.* In F. Pajares & T. Urdan (Ed), *Adolescence and Education* (Vol. A). Greenwich, CT: Information Age Publishing. 339-367.

Pajares, F., & Valiante, G. (1996, April). *Predictive utility and causal influence of the writing self-efficacy beliefs of elementary students*. Paper presented at the Annual Meeting of the American Educational Research Association, New York, NY.

Pajares, F. (1996). Self-efficacy beliefs in academic settings. *Review of Educational Research, 66*(4), 543-578.

Pedigo, A.S., Richards, J.K., Saxton, A.M., D'Souza, D.H., & Draughon. (2009). Characterization of food safety knowledge, attitudes, and behaviors of adolescents in East Tennessee. *Journal of Food Protection. 29*(10), 626-641.

Pearl (2009). Characterization of food safety knowledge, attitudes, and behaviors of adolescents in East Tennessee. *Journal of Food Protection. 29*(10), 626-641.

Raab, C.A., & Woodburn, M.J. (1977). Changing risk perceptions and food handling practices of Oregon household food prepares. *Journal of Consumer Studies & Home Economics*, 21, 117-130.

Rennie, D. (1995). Health education models and food safety education. *Journal of Royal Society of Health*, 115, 75-79.

Richards, J., Skolits, G., Burney, J., Pedigo, A., & Draughon, F. A. (2008). Validation of an interdisciplinary food safety curriculum targeted at middle school students and correlated to state educational standards. *Food Science Education,7(3), 54-61*.

Rotter, J. (1966). Generalized expectations for internal vs. external control of reinforcements. *Psychological Monographs*, 80, Whole No. 609.

Schafer, R., Schafer, E., & Bultena, G.L. (1993). Food safety: an application of the health belief model. *Journal of Nutrition Education, 25, 17-24.*

Schiffman, C. B. (1995). *Consumer control points: Creating a visual food safety education model for consumers*. Paper presented at the Annual Conference of the International Visual Literac Association, Chicago, IL.

Schunk, D. H. (1991). Self-efficacy and academic motivation. *Educational Psychologist, 26*(3 & 4), 207-231.

ServSafe Coursebook. (2009). 2nd ed. Chicago, IL: National Restaurant Association Educational Foundation: 2002.

Shiferaw, B., Yang, S., Cieslak, P., Vugia, D., Marcus, R., & Koehler, J., et al. (2000). Prevalence of high-risk food consumption and food-handling practices among adults: A multistate survey, 1996 to 1997. *Journal of Food Protection, 63*(11), 1538-1543.

Unklesbay, N., Sneed, J., & Toma, R. (1998). College students' attitudes, practices, and knowledge of food safety. *Journal of Food Protection, 61*(9), 1175-1180.

Wilcock, A., Pun, M., Khanona, J., & Aung, M. (2004). Consumer attitudes, knowledge and behaviour: A review of food safety issues. *Trends in Food Science & Technology, 15*(2), 56-66.

Williamson, D.M., Gravani, R.B., & Lawless, H.T. (1992). Correlating food safety knowledge with home food-preparation. *Journal of Food Technology, 46*(5), 94.

Zimmerman, B. J., & Martinez-Pons, M. (1990). Student differences in self-regulated learning: Relating grade, sex, and differences to self-efficacy and strategy use. *Journal of Educational Psychology, 82*(1), 51-59.

Zimmerman, B. J., Bandura, A., & Martinez-Pons, M. (1992). Self-motivation for academic attainment: The role of self-efficacy beliefs and personal goal setting. *American Education Research Journal, 29*(3), 663-676.

Appendices

Appendix A

Table A1

Descriptive Statistics Calculated per Adolescent Food Safety Self-Efficacy Instrument Item and Flagged for any Item Outside the Boundaries of Normality for Personal Hygiene

Item	*M*/*SD*	SK	KR	RD	Item Code
Personal Hygiene					
I can define personal hygiene.	-	-	-	-	SEPH1
I can practice good personal hygiene.	-	X	-	X	SEPH2
I can wash my hands in a way that removes germs.	-	X	X	X	SEPH3
I can tell you when it's important to wash my hands.	X	X	X	X	SEPH4
I can show you how to properly wash my hands.	-	X	X	X	SEPH5
I can tell you why I should wash my hands after washing my hair.	-	-	-	-	SEPH6
I can tell you why washing my hands helps keep me from getting sick.	-	X	-	X	SEPH7
I can keep myself from getting sick by washing my hands.	-	X	X	X	SEPH8
I can tell you when I should wash my hands before I handle food.	-	X	X	X	SEPH9
I can tell you why I should wash my hands after petting an animal.	-	X	X	X	SEPH10
I can tell you why I should wash my hands after touching a pimple.	-	X	-	X	SEPH11
I can tell you why I should wash my hands after picking my nose.	-	X	X	X	SEPH12

Note. SK = Skewness, KR = Kurtosis.
X = Items flagged outside the boundaries of the statistical analysis for normality.
- = Items within the boundaries of the statistical analysis for normality.

Table A2

Descriptive Analyses Used for Adolescent Food Safety Self-Efficacy Instrument by Item and Flagged for any Item Outside the Boundaries of Normality for Sanitation

Item	*M*/*SD*	SK	KR	RD	Item Code
Sanitation					
I can tell you what the word "disinfecting" means.	-	-	-	X	SEST1
I can tell you why I should clean my utensils (for example forks, knives, spoons etc.) to remove germs.	-	X	X	X	SEST2
I can tell you what the word sanitation means.	-	-	-	X	SEST3
I can practice correct sanitation behavior.	-	X	X	X	SEST4
I can tell you the difference between dirt and germs.	-	-	-	-	SEST5
I can tell you the difference between cleaning and sanitizing.	-	-	-	-	SEST6
I can clean dishes to remove germs.	-	X	X	X	SEST7
I can tell you why I should clean my dishes to remove germs.	-	X	-	X	SEST8
I can tell you how to clean dishes.	-	X	-	X	SEST9
I can show you how to clean dishes.	-	X	-	X	SEST10
I can tell you why I should clean my kitchen to remove germs.	-	-	-	X	SEST11
I can tell you how to clean a kitchen to remove germs.	-	-	X	-	SEST12
I can clean utensils (for example forks, knives, spoons, etc.) to remove germs.	-	X	-	X	SEST13
I can tell you the difference between cleaning and disinfecting.	-	-	-	X	SEST14

Note. SK = Skewness, KR = Kurtosis.
X = Items flagged outside the boundaries of the statistical analysis for normality.
- = Items within the boundaries of the statistical analysis for normality.

Table A3

Descriptive Analyses Used for Adolescent Food Safety Self-Efficacy Instrument by Item and Flagged for any Item Outside the Boundaries of Normality for Cross Contamination

Item	*M*/*SD*	SK	KR	RD	Item Code
Cross Contamination					
I can show you how to prevent cross contamination.	-	-	X	-	SECC1
I can tell you when cross contamination occurs.	-	-	X	-	SECC2
I can tell you what the term "cross contamination" means.	-	-	X	-	SECC3
I can prevent the spread of germs into my food.	-	-	-	-	SECC4
I can tell you why it is important to keep cooked foods and raw foods away from each other.	-	-	-	X	SECC5
I can tell you why I should remove jewelry when preparing food.	-	-	-	X	SECC6
I can tell you why I should avoid cross contamination of food.	-	-	X	-	SECC7
I can prevent cross contamination.	-	-	X	-	SECC8
I can tell you why wearing jewelry can contaminate food.	-	-	X	-	SECC9

Note. SK = Skewness, KR = Kurtosis.
X = Items flagged outside the boundaries of the statistical analysis for normality.
- = Items within the boundaries of the statistical analysis for normality.

Table A4

Descriptive Analyses Used for Adolescent Food Safety Self-Efficacy Instrument by Item and Flagged for any Item Outside the Boundaries of Normality for Cooking/Cooling Temperatures

Item	*M*/*SD*	SK	KR	RD	Item Code
Cooking/Cooling Temperatures					
I can delay food spoilage.	-	X	-	-	SECT1
I can tell you why I should correctly measure the temperature of my food.	-	X	-	-	SECT2
I can tell you the right temperatures to store food.	-	X	-	-	SECT3
I can tell you the right temperature to cook ground beef (to make sure that all the harmful germs are killed).	-	X	-	-	SECT4
I can show you how to correctly measure the temperature of food.	-	X	-	-	SECT5
I can tell you why foods should be cooled in shallow containers.	-	X	-	-	SECT6
I can tell you why I should cook foods to the proper temperature.	-	-	X	-	SECT7
I can tell you the right temperatures to cook chicken (to make sure all the harmful germs are killed).	-	X	-	-	SECT8
I can explain why it is important to reheat food to the right temperature.	-	-	-	-	SECT9
I can tell you why I should reheat food.	-	-	X	-	SECT10
I can tell you when I should reheat food.	-	-	-	-	SECT11
I can tell you how to correctly measure the temperature of my food.	-	X	-	-	SECT12
I can show you how to store food properly.	-	-	-	-	SECT13
I can tell you when to refrigerate food.	-	-	X	-	SECT14

Note. SK = Skewness, KR = Kurtosis.
X = Items flagged outside the boundaries of the statistical analysis for normality.
- = Items within the boundaries of the statistical analysis for normality.

Table A5

Descriptive Analyses Used for Adolescent Food Safety Self-Efficacy Instrument by Item and Flagged for any Item Outside the Boundaries of Normality for Foodborne Illness

Item	*M*/*SD*	SK	KR	RD	Item Code
Foodborne Illness					
I can tell you why germs make me sick.	-	-	X	-	SEFI1
I can tell you what it means when food spoils.	-	-	-	X	SEFI2
I can tell you when germs are more likely to make me sick.	-	-	X	-	SEFI3
I can tell you what germs are most likely to be in my foods.	-	-	X	-	SEFI4
I can tell when I am sick from food poisoning.	-	-	X	-	SEFI5
I can tell you why I should learn about food safety.	-	-	-	X	SEFI6
I can tell you what the term "foodborne pathogen" means.	-	X	-	-	SEFI7
I can tell you what the word "microorganism" means.	-	-	X	-	SEFI8
I can tell you what the word "germ" means.	-	-	-	-	SEFI9
I can tell you why I should learn about food poisoning.	-	-	-	X	SEFI10
I can tell you what the term "food safety" means.	-	-	X	-	SEFI11
I can tell you why food safety is important.	-	-	-	X	SEFI12

Note. SK = Skewness, KR = Kurtosis.
X = Items flagged outside the boundaries of the statistical analysis for normality.
- = Items within the boundaries of the statistical analysis for normality.

Table A6

Descriptive Analyses Used for Adolescent Food Safety Self-Efficacy Instrument by Item and Flagged for any Item Outside the Boundaries of Normality for Risk

Item	*M*/*SD*	SK	KR	RD	Item Code
Risk					
I can tell you what are high-risk behaviors when handling food.	-	-	-	-	SERK1
I can reduce the risk of food poisoning.	-	-	X	-	SERK2
I can tell you when food is more likely to make me sick.	-	-	-	-	SERK3
I can tell you why I can get food poisoning.	-	-	X	-	SERK4
I can tell you which foods are more likely to cause food poisoning.	-	-	X	-	SERK5
I can tell you which foods are high-risk foods.	-	-	X	-	SERK6
I can reduce the amount of germs in my food.	-	-	X	-	SERK7
I know how to reduce the amount of germs in my food.	-	-	X	-	SERK8
I can tell you why eating spoiled foods might make me sick.	-	X	-	X	SERK9
I can tell you why I should avoid high-risk behavior when handling food.	-	-	-	-	SERK10
I can tell you which foods are more likely to make me sick.	-	-	X	-	SERK11
I can tell you why I am responsible for the safety of my food.	-	-	-	-	SERK12
I can tell you how I can get food poisoning.	-	-	X	-	SERK13

Note. SK = Skewness, KR = Kurtosis.
X = Items flagged outside the boundaries of the statistical analysis for normality.
- = Items within the boundaries of the statistical analysis for normality.

Table A7

Descriptive Analyses Used for Adolescent Food Safety Self-Efficacy Instrument by Item and Flagged for any Item Outside the Boundaries of Normality for Personal Hygiene

Item	*r*	α	ITS	TRT	Exp	Item Code
Personal Hygiene						
I can define personal hygiene.	-	-	X	-	-	SEPH1
I can practice good personal hygiene.	-	-	-	-	-	SEPH2
I can wash my hands in a way that removes germs.	-	-	-	X	X	SEPH3
I can tell you when it's important to wash my hands.	X	-	-	X	-	SEPH4
I can show you how to properly wash my hands.	X	-	-	-	-	SEPH5
I can tell you why I should wash my hands after washing my hair.	-	-	-	-	X	SEPH6
I can tell you why washing my hands helps keep me from getting sick.	-	-	-	-	X	SEPH7
I can keep myself from getting sick by washing my hands.	-	-	-	-	X	SEPH8
I can tell you when I should wash my hands before I handle food.	-	-	-	X	-	SEPH9
I can tell you why I should wash my hands after petting an animal.	-	-	-	-	X	SEPH10
I can tell you why I should wash my hands after touching a pimple.	-	-	-	-	X	SEPH11
I can tell you why I should wash my hands after picking my nose.	X	-	-	X	X	SEPH12

Note. SK = Skewness, KR = Kurtosis.
X = Items flagged outside the boundaries of the statistical analysis.
- = Items within the boundaries of the statistical analysis.

Table A8

Descriptive Analyses Used for Adolescent Food Safety Self-Efficacy Instrument by Item and Flagged for any Item Outside the Boundaries of Normality for Sanitation

Item	*r*	α	ITS	TRT	Exp	Item Code
Sanitation						
I can tell you what the word "disinfecting" means.	-	-	-	-	X	SEST1
I can tell you why I should clean my utensils (for example forks, knives, spoons etc.) to remove germs.	-	-	-	-	X	SEST2
I can tell you what the word sanitation means.	-	-	X	X	-	SEST3
I can practice correct sanitation behavior.	-	-	-	X	X	SEST4
I can tell you the difference between dirt and germs.	-	-	-	-	X	SEST5
I can tell you the difference between cleaning and sanitizing.	-	-	-	-	-	SEST6
I can clean dishes to remove germs.	-	-	-	-	X	SEST7
I can tell you why I should clean my dishes to remove germs.	-	-	-	-	X	SEST8
I can tell you how to clean dishes.	-	-	-	-	X	SEST9
I can show you how to clean dishes.	-	-	-	-	X	SEST10
I can tell you why I should clean my kitchen to remove germs.	-	-	-	-	X	SEST11
I can tell you how to clean a kitchen to remove germs.	-	-	-	-	-	SEST12
I can clean utensils (for example forks, knives, spoons, etc.) to remove germs.	-	-	-	-	X	SEST13
I can tell you the difference between cleaning and disinfecting.	-	-	-	-	X	SEST14

Note. SK = Skewness, KR = Kurtosis.
X = Items flagged outside the boundaries of the statistical analysis.
- = Items within the boundaries of the statistical analysis.

Table A9

Descriptive Analyses Used for Adolescent Food Safety Self-Efficacy Instrument by Item and Flagged for any Item Outside the Boundaries of Normality for Cross Contamination

Item	*r*	α	ITS	TRT	Exp	Item Code
Cross Contamination						
I can show you how to prevent cross contamination.	-	-	-	-	-	SECC1
I can tell you when cross contamination occurs.	-	-	-	-	X	SECC2
I can tell you what the term "cross contamination" means.	-	-	-	X	X	SECC3
I can prevent the spread of germs into my food.	-	-	-	-	X	SECC4
I can tell you why it is important to keep cooked foods and raw foods away from each other.	-	-	-	-	-	SECC5
I can tell you why I should remove jewelry when preparing food.	-	-	-	-	X	SECC6
I can tell you why I should avoid cross contamination of food.	-	-	-	X	-	SECC7
I can prevent cross contamination.	-	-	-	X	-	SECC8
I can tell you why wearing jewelry can contaminate food.	-	-	-	X	-	SECC9

Note. SK = Skewness, KR = Kurtosis.
X = Items flagged outside the boundaries of the statistical analysis.
- = Items within the boundaries of the statistical analysis.

Table A10

Descriptive Analyses Used for Adolescent Food Safety Self-Efficacy Instrument by Item and Flagged for any Item Outside the Boundaries of Normality for Cooking/Cooling Temperatures

Item	*r*	α	ITS	TRT	Exp	Item Code
Cooking/Cooling Temperatures						
I can delay food spoilage.	-	-	-	-	X	SECT1
I can tell you why I should correctly measure the temperature of my food.	-	-	-	-	X	SECT2
I can tell you the right temperatures to store food.	-	-	-	X	-	SECT3
I can tell you the right temperature to cook ground beef (to make sure that all the harmful germs are killed).	-	-	-	-	-	SECT4
I can show you how to correctly measure the temperature of food.	-	-	-	X	X	SECT5
I can tell you why foods should be cooled in shallow containers.	-	-	-	X	X	SECT6
I can tell you why I should cook foods to the proper temperature.	-	-	-	-	-	SECT7
I can tell you the right temperatures to cook chicken (to make sure all the harmful germs are killed).	-	-	-	-	-	SECT8
I can explain why it is important to reheat food to the right temperature.	-	-	-	-	-	SECT9
I can tell you why I should reheat food.	-	-	-	-	X	SECT10
I can tell you when I should reheat food.	-	-	-	-	X	SECT11
I can tell you how to correctly measure the temperature of my food.	-	-	-	-	X	SECT12
I can show you how to store food properly.	-	-	-	-	-	SECT13
I can tell you when to refrigerate food.	-	-	-	-	-	SECT14

Note. SK = Skewness, KR = Kurtosis.
X = Items flagged outside the boundaries of the statistical analysis.
- = Items within the boundaries of the statistical analysis.

Table A11

Descriptive Analyses Used for Adolescent Food Safety Self-Efficacy Instrument by Item and Flagged for any Item Outside the Boundaries of Normality for Foodborne Illness

Item	*r*	α	ITS	TRT	Exp	Item Code
Foodborne Illness						
I can tell you why germs make me sick.	-	-	-	-	X	SEFI1
I can tell you what it means when food spoils.	-	-	-	-	X	SEFI2
I can tell you when germs are more likely to make me sick.	-	-	-	-	X	SEFI3
I can tell you what germs are most likely to be in my foods.	-	-	-	X	-	SEFI4
I can tell when I am sick from food poisoning.	-	-	-	-	X	SEFI5
I can tell you why I should learn about food safety.	-	-	-	-	X	SEFI6
I can tell you what the term "foodborne pathogen" means.	-	-	-	X	-	SEFI7
I can tell you what the word "microorganism" means.	-	-	-	-	X	SEFI8
I can tell you what the word "germ" means.	-	-	-	-	X	SEFI9
I can tell you why I should learn about food poisoning.	-	-	-	-	X	SEFI10
I can tell you what the term "food safety" means.	-	-	-	-	X	SEFI11
I can tell you why food safety is important.	-	-	-	-	-	SEFI12

Note. SK = Skewness, KR = Kurtosis.
X = Items flagged outside the boundaries of the statistical analysis.
- = Items within the boundaries of the statistical analysis.

Table A12

Descriptive Analyses Used for Adolescent Food Safety Self-Efficacy Instrument by Item and Flagged for any Item Outside the Boundaries of Normality for Risk

Item	*r*	α	ITS	TRT	Exp	Item Code
Risk						
I can tell you what are high-risk behaviors when handling food.	-	-	X	-	X	SERK1
I can reduce the risk of food poisoning.	-	-	-	-	-	SERK2
I can tell you when food is more likely to make me sick.	-	-	-	-	X	SERK3
I can tell you why I can get food poisoning.	-	-	-	-	X	SERK4
I can tell you which foods are more likely to cause food poisoning.	-	-	-	X	-	SERK5
I can tell you which foods are high-risk foods.	-	-	-	X	X	SERK6
I can reduce the amount of germs in my food.	-	-	-	-	X	SERK7
I know how to reduce the amount of germs in my food.	-	-	-	-	X	SERK8
I can tell you why eating spoiled foods might make me sick.	-	-	-	-	X	SERK9
I can tell you why I should avoid high-risk behavior when handling food.	-	-	-	-	X	SERK10
I can tell you which foods are more likely to make me sick.	-	-	-	-	X	SERK11
I can tell you why I am responsible for the safety of my food.	-	-	-	-	X	SERK12
I can tell you how I can get food poisoning.	-	-	-	-	X	SERK13

Note. SK = Skewness, KR = Kurtosis.
X = Items flagged outside the boundaries of the statistical analysis.
- = Items within the boundaries of the statistical analysis.

Appendix B

Table B1

Descriptive Statistics for Personal Hygiene Items

Item	*M* ± *SD*	SK	KR	Response Distribution				
				Can't Do at All (%)	Can Do a Little (%)	Can Do Some (%)	Can Do Mostly (%)	Can Do for Sure (%)
SEPH1	3.69 ± 1.27	-.518	-.701	5.5	11	27.5	20.9	35.2
SEPH2	4.13 ± 1.07	-1.087	.093	1.1	12.1	8.8	28.6	49.5
SEPH3	4.51 ± 1.91	-2.268	5.490	3.3	-	8.8	18.7	69.2
SEPH4	4.67 ± .731	-2.185	3.816	-	2.2	8.8	8.8	80.2
SEPH5	4.56 ± .897	-2.216	4.293	1.1	5.5	4.4	14.3	74.7
SEPH6	3.58 ± 1.36	-.511	-1.001	9.9	14.3	19.8	19.8	36.3
SEPH7	4.34 ± 1.01	-1.256	.165	-	8.8	13.2	13.2	64.8
SEPH8	4.51 ± .861	-1.618	1.511	-	4.4	11	14.3	70.3
SEPH9	4.58 ± .761	-1.754	2.172	-	2.2	9.9	15.4	72.5
SEPH10	4.34 ± 1.05	-1.824	2.286	4.4	3.3	7.7	23.1	61.5
SEPH11	3.85 ± 1.35	-.913	-.428	9.9	8.8	14.3	20.9	46.2
SEPH12	4.48 ± 1.02	-2.101	3.635	3.3	4.4	6.6	12.1	73.6

Note. SK = Skewness, KR = Kurtosis.
- = No results for the item.

Table B2

Descriptive Statistics for Sanitation Items

Item	*M* ± *SD*	SK	KR	Response Distribution				
				Can't Do at All (%)	Can Do a Little (%)	Can Do Some (%)	Can Do Mostly (%)	Can Do for Sure (%)
SEST1	3.87 ± 1.17	-.703	-.567	3.3	12.1	19.8	24.2	40.7
SEST2	4.56 ± .885	-2.059	3.619	1.1	3.3	9.9	9.9	75.8
SEST3	3.87 ± 1.26	-.834	-.388	6.6	8.8	19.8	19.8	44.0
SEST4	4.29 ± 1.00	-1.348	.954	1.1	7.7	9.9	24.2	57.1
SEST5	3.60 ± 1.23	-.497	-.744	6.6	13.2	24.2	25.3	30.8
SEST6	3.74 ± 1.18	-.686	-.381	5.5	9.9	22.0	28.6	33.0
SEST7	4.33 ± 1.02	-1.406	.939	1.1	7.7	11.0	17.6	62.6
SEST8	4.35 ± .893	-1.144	.226	4.4	14.3	22.0	57.1	97.8
SEST9	4.28 ± 1.07	-1.198	-.038	-	12.1	9.9	15.4	61.5
SEST10	4.24 ± 1.04	-1.275	.826	2.2	5.5	15.4	19.8	57.1
SEST11	4.04 ± 1.15	-.842	-.646	1.1	14.3	14.3	19.8	50.5
SEST12	3.73 ± 1.30	-.481	-1.142	4.4	17.6	20.9	13.2	42.9
SEST13	4.22 ± 1.07	-1.227	.556	2.2	6.6	15.4	17.6	57.1
SEST14	3.75 ± 1.33	-.738	-.654	8.8	11.0	17.6	22.0	40.7

Note. SK = Skewness, KR = Kurtosis.
- = No results for the item.

Table B3

Descriptive Statistics for Cross-Contamination Items

Item	*M* ± *SD*	SK	KR	Response Distribution				
				Can't Do at All (%)	Can Do a Little (%)	Can Do Some (%)	Can Do Mostly (%)	Can Do for Sure (%)
SECC1	2.68 ± 1.45	.268	-1.278	30.8	16.5	20.9	15.4	15.4
SECC2	2.46 ± 1.43	.479	-1.153	37.4	16.5	17.6	14.3	12.1
SECC3	2.44 ± 1.51	.589	-1.150	40.7	18.7	13.2	11.0	16.5
SECC4	3.54 ± 1.25	-.430	-.813	7.7	13.2	26.4	23.1	29.7
SECC5	3.79 ± 1.36	-.825	-.503	11.0	5.5	22.0	16.5	45.1
SECC6	3.74 ± 1.38	-.707	-.835	9.9	12.1	16.5	17.6	44.0
SECC7	2.74 ± 1.56	.186	-1.529	34.1	13.2	13.2	18.7	18.7
SECC8	2.81 ± 1.50	.128	-1.424	29.7	14.3	18.7	17.6	18.7
SECC9	3.51 ± 1.43	-.556	-.989	15.4	8.8	19.8	22.0	34.1

Note. SK = Skewness, KR = Kurtosis.
- = No results for the item.

Table B4

Descriptive Statistics for Cooking and Cooling Temperatures Items

Item	$M \pm SD$	SK	KR	Response Distribution				
				Can't Do at All (%)	Can Do a Little (%)	Can Do Some (%)	Can Do Mostly (%)	Can Do for Sure (%)
SECT1	3.40 ± 1.49	-.406	-1.282	16.5	14.3	14.3	20.9	33.0
SECT2	3.19 ± 1.38	-.276	-1.191	16.5	15.4	17.6	27.5	19.8
SECT3	2.74 ± 1.33	.240	-1.036	23.1	22.0	26.4	15.4	13.2
SECT4	2.91 ± 1.41	.014	-1.263	231	15.4	23.1	19.8	16.5
SECT5	2.78 ± 1.44	.304	-1.221	24.2	24.2	20.9	11.0	19.8
SECT6	2.62 ± 1.51	.347	-1.370	35.2	17.6	14.3	16.5	16.5
SECT7	3.93 ± 1.26	-.964	-.189	6.6	8.8	15.4	20.9	46.2
SECT8	2.84 ± 1.42	.162	-1.298	23.1	22.0	18.7	17.6	17.6
SECT9	3.61 ± 1.41	-.673	-.854	13.2	9.9	15.4	24.2	36.3
SECT10	3.70 ± 1.37	-.748	-.644	12.1	6.6	20.9	19.8	40.7
SECT11	3.65 ± 1.36	-.631	-.778	11.0	8.8	23.1	18.7	38.5
SECT12	3.13 ± 1.51	-.092	-1.420	20.9	15.4	20.9	13.2	28.6
SECT13	3.70 ± 1.20	-.505	-.773	4.4	13.2	24.2	23.1	34.1
SECT14	3.82 ± 1.27	-.817	-.487	6.6	12.1	14.3	25.3	40.7

Note. SK = Skewness, KR = Kurtosis.
- = No results for the item.

Table B5

Descriptive Statistics for Foodborne Illness Items

Item	*M* ± *SD*	SK	KR	Response Distribution				
				Can't Do at All (%)	Can Do a Little (%)	Can Do Some (%)	Can Do Mostly (%)	Can Do for Sure (%)
SEFI1	3.55 ± 1.31	-.362	-1.152	6.6	19.8	19.8	19.8	34.1
SEFI2	3.91 ± 1.27	-.842	-.537	5.5	12.1	6.5	17.6	48.4
SEFI3	3.36 ± 1.37	-.246	-1.221	11.0	19.8	1.8	19.8	28.6
SEFI4	2.47 ± 1.38	.481	-1.063	34.1	22.0	17.6	15.4	11.0
SEFI5	3.01 ± 1.43	-.066	-1	22.0	5.4	22.0	20.9	19.8
SEFI6	3.81 ± 1.39	-.791	-.728	9.9	9.9	17.6	13.2	48.4
SEFI7	1.73 ± 1.19	1.458	.892	65.9	9.9	11.0	7.7	4.4
SEFI8	2.92 ± 1.56	-.069	-1.576	30.8	8.8	12.1	25.3	17.0
SEFI9	3.77 ± 1.27	-.800	-.394	7.7	8.8	17.6	25.3	36.3
SEFI10	3.91 ± 1.37	-.888	-.653	7.7	13.2	12.1	13.2	52.7
SEFI11	3.51 ± 1.40	-.470	-1.153	11.0	18.7	12.1	25.3	33.0
SEFI12	3.79 ± 1.33	-.844	-.542	8.8	12.1	11.0	26.4	40.7

Note. SK = Skewness, KR = Kurtosis.
- = No results for the item.

Table B6

Descriptive Statistics for Risk Items

Item	*M* ± *SD*	SK	KR	Response Distribution				
				Can't Do at All (%)	Can Do a Little (%)	Can Do Some (%)	Can Do Mostly (%)	Can Do for Sure (%)
SERK1	3.44 ± 1.24	-.405	-.643	9.9	8.8	33.0	22.0	25.3
SERK2	3.19 ± 1.39	-.191	-1.173	16.5	15.4	24.2	20.9	23.1
SERK3	3.63 ± 1.32	-.545	-.853	8.8	12.1	23.1	19.8	36.3
SERK4	3.14 ± 1.39	-.035	-1.207	15.4	18.7	27.5	13.2	25.3
SERK5	2.69 ± 1.38	.295	-1.128	26.4	20.9	23.1	14.3	14.3
SERK6	2.89 ± 1.35	.066	-1.219	19.8	23.1	19.8	23.1	14.3
SERK7	3.49 ± 1.36	-.461	-1.040	11.0	15.4	17.6	24.2	30.8
SERK8	3.25 ± 1.26	-.260	-1.029	13.2	15.4	24.2	24.2	20.9
SERK9	4.01 ± 1.26	-1.154	.238	7.7	6.6	3.2	22.0	50.5
SERK10	3.46 ± 1.33	-.426	-.946	11.0	13.2	23.1	23.1	28.6
SERK11	3.52 ± 1.30	-.372	-1.037	7.7	16.5	23.1	19.8	31.9
SERK12	3.76 ± 1.26	-.714	-.589	6.6	12.1	17.6	25.3	37.4
SERK13	3.52 ± 1.44	-.500	-1.146	13.2	14.3	15.4	19.8	36.3

Note. SK = Skewness, KR = Kurtosis.
- = No results for the item.

VITA

Monica Brandon was born in Simpsonville, South Carolina. She completed her culinary degree in 2005, and then continued on to complete her Bachelors degree in Food Science in the spring of 2007. Monica is currently pursuing her passion for food science, and gaining valuable experience as a food scientist at a local food company. Monica is continuing to follow her dreams, plans to learn as much as she can and travel everywhere she can.