Development and assessment of a pilot food safety training for exempt home food operations and home bakeries in Iowa

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Development and assessment of a pilot food safety training for exempt home food operations and home bakeries in Iowa

by

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Shannon Coleman, Major Professor
Kathleen Hunt
Kenneth Prusa

The student author, whose presentation of the scholarship herein was approved by the program of study committee, is solely responsible for the content of this thesis. The Graduate College will ensure this thesis is globally accessible and will not permit alterations after a degree is conferred.

Iowa State University

Ames, Iowa

2018

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Abstract

The U.S. Department of Agriculture reports a 76% increase in farmers’ market locations between 2008 and 2014, indicating the increased consumer interest in local food (U.S. Department of Agriculture, 2014). Home-based food operations are producers who make and sell potentially hazardous and non-potentially hazardous products in their home kitchens. States surrounding Iowa, currently have trainings and resources available to those interested in home-based production. These trainings have been recommended to Iowa producers, but do not reflect the Iowa laws that these producers must follow. Developing a food safety training relevant for these home producers is important to increase food safety and Iowa law knowledge. A need’s assessment was developed, disseminated, and analyzed to identify needs of the target audience. A pilot training was developed and covered Iowa laws and food safety basics and application to the home kitchen, as determined from the need’s assessment. The training was taught across the state and participants completed a pre-test, post-test, and 6-8-week follow-up evaluation on seven constructs, modeled after the Theory of Planned Behavior. Results show participants had positive feelings (responses of 5.00 or higher) towards six constructs except for attitude which was slightly lower (4.00 or higher) for all testing times. Participants responses slightly increased between pre-test and post-test times, but then regressed to pre-test response levels. Significant differences were observed between pre-test and post-test times within behavior towards preparation environment and perceived behavioral control constructs for all participants. The evaluation indicates a need to affect long-term participant attitude and behavioral changes.
CHAPTER 1. INTRODUCTION: DEVELOPMENT AND ASSESSMENT OF A PILOT FOOD SAFETY TRAINING FOR EXEMPT HOME FOOD OPERATIONS AND HOME BAKERIES, IN IOWA.

Introduction

The Centers for Disease Control (CDC) estimates each year 48 million Americans become ill, 128,000 are hospitalized and 3,000 die from foodborne illness (Centers for Disease Control and Prevention, 2016b). A foodborne illness is characterized by two or more people becoming sick with similar illnesses after consuming similar foods (Centers for Disease Control and Prevention, 2000). Foodborne illness is also costly to treat, with the estimated cost of $55.5 billion dollars a year (Scharff, 2012). In the state of Iowa, however, the cost is $1,154 per case or $545 million dollars each year (Scharff, 2012). Food safety is a key element of the initiatives from the CDC is the Healthy People 2020 goals which is improving food safety philosophy and attitudes at the consumer and commercial level (Office of Disease Prevention and Health Promotion, 2018).

Food safety is a concern at all levels and sizes of operations in the food industry, from large scale production plants to local food producers and throughout the variety of commodity groups. Painter et al. 2013, found from reviewing outbreak data, that 38% of the hospitalizations and 23% of deaths due to foodborne illness were accredited to foods designated as produce (Painter et al., 2013). With this increase of outbreaks associated with produce, focus for research has centered around food safety at farmers’ market. In a microorganism analysis study of farmers’ market produce, researchers found that fecal coliforms, which can cause food borne illness, were found on all vegetable samples (Pan et al., 2015). The study also found that *Escherichia coli* was isolated from 20% of the vegetable samples that ranged from squash,
squash stems and leaves, okra, cilantro, yard long beans, and basil (Pan et al., 2015). While produce is a popular product at farmers’ market, there is an increasing interest in other fresh items such as eggs and value-added products (Govindasamy, Italia, & Adelaja, 2002). However, value-added products such as baked goods and fruit jams and jellies, can also be susceptible to contamination from pathogens such as *Escherichia coli, Clostridium Botulinum, Salmonella spp., Listeria monocytogenes*, and *Staphylococcus aureus*, through the ingredients used to make them (U.S. Food and Drug Administration, 2018c).

According to the National Restaurant Association’s culinary forecast article, locally grown and sold foods, including produce and meats, was among the top trends for 2016, illustrating the popularity in the local foods sector (National Restaurant Association, 2016). A report by the USDA’s Economic Research Service, reported in 2012, 7.8% of U.S farms were marketing their locally grown and produced food at farmers’ markets and through other channels, such as grocery stores and restaurants (Low et al., 2015). Farmers’ markets serve as a local market that consumers can obtain locally grown products. The USDA reports there was a 76% increase in the number of farmers’ market locations between 2008 and 2014, indicating the increased consumer interest in local foods (U.S. Department of Agriculture, 2014).

Many of the larger food producers are affected by the Food Safety Modernization Act (FSMA), which focuses on the prevention of food safety issues before they occur, rather than detecting and dealing with the issue later in the process, for both human and animal foods. Within the human and animal food rules, the legislation emphasizes five areas including prevention, inspection and compliance, response, imports, and enhanced partnerships. The legislation also has a strong focus specifically on the produce industry and preventing food safety hazards within that commodity, by addressing concerns during the growing, harvest, packing,
and shipping of the produce. Measures focusing on irrigation water sources, correct compost procedures, and employee hygiene are all suggestions to decrease the risk for foodborne pathogen contamination. The rules have led to a new set of trainings to help producers understand the rule, how to implement the rule into their own operations, and the potential impact that is has on the safety of their products (U.S. Food and Drug Administration, 2018a). While FSMA impacts larger producers, smaller producers who average $25,000 annually or $500,000 annually and sell product within a 275 mile radius, are exempt from the FSMA Produce Rule (U.S. Food and Drug Administration, 2018b). This provides an area for educational trainings to be aimed towards these producers who do not meet the requirements but sell the same type of products at the local scale and may need the same types of information.

Although they are not required to meet FSMA regulation standards, local food producers must meet state regulations. Each state has regulations of what can be sold at farmers’ markets and what licensing requirements there are for each type of food. In Iowa, accepted licenses include, Retail Food Service Establishment Licenses which are commonly found at grocery stores, food trucks, and restaurants, Food Processing and Warehouse license which cover large food manufacturing and production plants, Home Bakery Establishment License which covers the production and sale of baked goods out of the home, and Farmers’ Market Food License which covers products sold at the farmers’ markets that are potentially hazardous (Iowa Food Protection Task Force, 2017d, 2017b, 2017c, 2017a). Products such as fresh fruits and vegetables, baked goods that are non-potentially hazardous, fresh shell eggs, honey, and other non-potentially hazardous foods, can be sold at farmers’ markets without a license and facility inspection (Iowa Department of Inspections and Appeals, 2018).
A potentially hazardous (PH) food is defined as a food that requires temperature control or requires refrigeration to maintain the safety of the product (Institute of Food Technologists and U.S. Food and Drug Administration, 2001). This project focused on specifically Home-Based Food Operations which include exempt home food operations and home bakeries, within the local foods system. An exempt home food operation sells non-potentially hazardous foods directly to consumers, from their homes of the farmers’ market and are unregulated by the state if these requirements are met (Iowa Food Protection Task Force, 2017c). A home bakery is licensed to sell potentially hazardous and non-potentially hazardous baked goods to consumers, as well as other retail establishments (Iowa Department of Inspections and Appeals, 2016). Currently, in the state of Iowa there are no training requirements for either type of home-based food operations. The objective of this research is to develop a pilot training based on needs identified from the targeted producers, and assess the impact the training has on the participants’ attitudes, behaviors, intentions, social norms, and perceived behavioral control, using the Theory of Planned Behavior (Ajzen, 1991).

**Review of Literature**

**Farmers’ Markets**

According to the Iowa Department of Agriculture and Land Stewardship’s Farmers’ Market Directory, there are 234 farmers’ markets across the state of Iowa (Iowa Department of Agriculture and Land Stewardship, 2018). Farmers’ markets sell locally grown and produced fresh fruits and vegetables, fresh shell eggs, honey, jams and jellies, baked goods, and many other products (Iowa Department of Inspections and Appeals, 2018). There are national and state programs that are in place to encourage the purchase of locally grown and produced foods such as the Buy Fresh Buy Local campaign supports farmers in developing a network that assists in marketing their foods in retail locations such as restaurants, grocery stores, and to consumers
(Northeast Iowa - Buy Fresh Buy Local, 2018). In addition to promoting consumers to purchase local foods, there are also programs in place that promote farmers to sell their products locally. The USDA’s Farmers Market Promotion Program provides farmers and local foods producers funding to expand and grow their businesses (United State Department of Agriculture, 2018).

Food and nutrition play a major role in everyone’s lives. Within the local food programming there are many programs with a nutrition base but promote local foods to vulnerable populations. Encouraging these populations to purchase food from local foods is beneficial but can also pose a risk if the food is not safe due to these populations having weaker defenses against foodborne pathogens. The FDA defines the most at risk populations as pregnant women, young children, the elderly, and those who have weakened immune systems (U.S. Food & Drug Administration, 2017). The Women, Infants, and Children (WIC) Farmers’ Market Nutrition Program, which provides vouchers for those enrolled in WIC to purchase fruits and vegetables at farmers’ markets (United States Department of Agriculture Food and Nutrition Service, 2017). Another program is the Senior Farmers’ Market Nutrition Program which allows qualifying seniors to use vouchers to purchase products from farmers’ markets (United States Department of Agriculture Food and Nutrition Service, 2015). According to the FDA, the groups that benefit from these nutritional programs, are also the most at risk food foodborne illness (U.S. Food & Drug Administration, 2017). The SNAP (Supplemental Nutrition Assistance Program) has the Double Up Food Bucks which benefits families and allow them to use double benefits to then purchase more local foods at the farmers’ market (Fair Food Network, n.d.).

While these programs further expand the local foods market, this increases the need for safe product as it reaches more consumers.
In the state of Iowa, licenses that are accepted at farmers’ markets include Farmers’ Market Food License, Food Processing and Warehouse License, Retail Food Service Establishment License, and Home Bakery License. Under these licenses a variety of products can be sold at the farmers’ market including temperature control for safety products that require temperature control to maintain the safety of the products (Iowa Food Protection Task Force, 2017a, 2017b, 2017d, 2017c). However, there is a group of producers that can sell certain products that do not require one of the licenses above. The products that do not require licensing and inspection to sell include whole, fresh fruits and vegetables, baked goods that do not require refrigeration, fresh shell eggs, honey, and other food products that do not require time-temperature control for safety. Examples of these products include candies, dry mixes and dry seasonings, fruit jams, fruit jellies, fruit butters, dried noodles, and snack foods. In general, these products do not require refrigeration to control the safety of the product, but still need to be produced and sold with food safety in mind (Iowa Department of Inspections and Appeals, 2018).

While the safety of the products is emphasized in licensing producers that sell potentially hazardous foods and understanding the definition of Non-potentially hazardous for those that are exempt, there is an additional food safety concern at the location of sale, or point-of-sale (POS). In a study by Worsfold, Worsfold, and Griffith (Worsfold, Worsfold, & Griffith, 2004), the hygienic handling and safety of food was evaluated at farmers’ markets. In the study, the authors identified potential cross-contamination at the market due to the lack of hand washing sinks and washing sinks for food contact surfaces including utensils. Other challenges presented were maintaining correct temperatures of potentially hazardous foods at the point of sale.
Handwashing, washing utensils, and storing foods at correct temperatures are all important actions to minimize the risk for foodborne illness.

A study by Harrison, Critzer, and Harrison (2016), evaluated regulatory and food safety personnel for the popularity of risky practices and regulatory knowledge by local foods producers. It was found that 40-54% of local food producers “are selling foods without appropriate training to understand and mitigate food safety risks” (p. 424). The study also showed that 55-74% of local producers “view their products as unlikely to cause foodborne illness because they are a “small operator”, “they are organic”, or “they are local foods” (p. 425). The authors recommended training to improve knowledge about food safety and regulations due to their study showing a lack of handwashing stations and misconceptions about the safety of products (Harrison et al., 2016). While producers may view their products as safe, it is important for them to understand and apply food safety throughout the production phase to ensure the products are in fact safe.

In an observational study conducted by Behnke, Seo, and Miller (Behnke, Seo, & Miller, 2012), the researchers concluded that based on the observations and lack of handwashing among the food stand employees, premade, ready-to-eat foods are at a high risk for foodborne illness. The authors identified that employees handling contaminated objects, such as money and dirty objects, and then touching or serving the ready-to-eat food to consumers without washing their hands. It was also noted the uncontrolled environment of farmers’ markets also pose a risk to the safety of the food.

In a separate study of cheese vendor practices at farmers’ markets, Teng, Wilcock, and Aung (Teng, Wilcock, & Aung, 2004) found that 8 out of 17 vendors stored their cheese products, a potentially hazardous product, above refrigeration temperature or did not cool the
cheese at all. One of six cheese products that were purchased being measured below refrigeration temperature of 5°C. Researchers also observed the personal hygiene practices of the cheese vendors; handwashing practices, glove usage, and hair restraint. Overall, 88% of vendors did not wash their hands while serving product to customers, 94% did not use gloves to protect the cheese from bare-hand contact, and 41% of vendors did not restrain their hair. Both refrigeration and personal hygiene are important interventions in preventing pathogen growth and contamination on potentially hazardous foods.

**Potentially Hazardous and Non-Potentially Hazardous Foods**

According to Iowa code, Potentially Hazardous (PH) foods, also known as Temperature Control for Safety foods (TCS) and perishable foods, are foods that are “natural or synthetic and is in a form capable of supporting the rapid and progressive growth of infectious or toxigenic microorganisms, or the growth and toxin production of *Clostridium botulinum*” (The Iowa Legislature, 2018, p. 2). Products that are Non-Potentially Hazardous (Non-PH) foods include “an air cooled hardboiled egg with shell intact, a food with a water activity value of 0.85 or less, a food with a pH level of 4.6 or below when measured at 75°F, and a food in an unopened, hermetically sealed container, that is commercially processed to achieve and maintain commercial sterility under certain conditions of nonrefrigerated storage and distribution” (The Iowa Legislature, 2018, p. 2). These definitions are important to know so that producers and educators know how to determine whether a product needs to be refrigerated or not to maintain its safety.

It is also important to examine what characteristics within a product encourage or repress the rapid growth of microorganism. These characteristics are called “intrinsic factors” and can be defined as parameters that are inherently part of food (Jay, Loesser, & Golden, 2005, p. 39).
Intrinsic factors include pH, water activity, oxidation-reduction potential (Eh), nutrient content, antimicrobial constituents, and biological structures (barriers). The food’s environment also impacts the growth of microorganisms and is known as “extrinsic factors” and are factors external to the food, and include storage temperatures and relative humidity (Jay et al., 2005, p. 54). Many local food producers are not aware of the science behind their products and need to understand more about these factors to help them determine where their product lies in the spectrum of risk.

The intrinsic factor pH effects the safety of food and growth of microorganisms due to the products acidity or alkalinity. Microorganisms grow best at a pH range from 6.6-7.5 (Jay et al., 2005), which is important because the Institute of Food Technologists (IFT) defines a non-potentially hazardous food as one with a pH at or below 4.6. This means that foods with a pH higher than 4.6 or foods that are only slightly acidic, neutral, or alkaline are recognized as potentially hazardous and fall into the optimal pH range of potentially hazardous foods (Institute of Food Technologists and U.S. Food and Drug Administration, 2001).

Along with pH, most microorganisms have an ideal water activity that encourages rapid growth. The IFT also defines the water activity level of a non-potentially hazardous food at or below 0.85, meaning foods above 0.85 have the water available for “rapid” microbial growth (Institute of Food Technologists and U.S. Food and Drug Administration, 2001, p. 17). For bacteria, the optimal range for growth is from 0.91 or above, but certain microorganisms, such as *Staphylococcus aureus*, can grow at water activity levels around 0.86 (Jay et al., 2005). Water activity ranges on a scale from 0-1.0 with pure water being 1.0. Water activity and pH are both important in defining specific parameters of potentially hazardous foods, which is important for
local foods producers to understand along with understanding that these factors influence growth of microorganisms (Jay et al., 2005).

Another factor that promotes the growth of microorganisms is nutrient content. Just like humans, bacteria need nutrients to grow, and just like humans they can get these nutrients from food as well. Microbes need “source of energy, source of nitrogen, vitamins and related growth factors, and minerals” to grow which can also be found in most food systems and environments (Jay et al., 2005, p. 52). Nutrients such as carbohydrates, sugars, proteins, and alcohols are all utilized by bacteria to grow and carry out their normal functions (Jay et al., 2005). These sources of nutrients are found in a variety of products including those sold by home-based food operators.

Some foods may have natural defenses such as antimicrobials and natural structures to protect them from microbial penetration. An example of a product that has a natural defense are the shell of a fresh shell eggs, which can be sold at the farmers’ market without a license by exempt home food operations. The shell serves as an external protection for the internal content. Within the egg there are natural antimicrobials, lysozyme and conalbumin, in addition to the natural barrier, the hard shell. The combination of these barriers helps protect the egg from microorganisms (Jay et al., 2005). However, if the shell becomes cracked or damaged, this exposes the egg to microorganisms that can enter and grow inside and on the egg shell (United States Department of Agriculture: Food Safety Inspection Service, 2016). Knowing the factors that can inhibit or promote growth of potential pathogens, is important for producers to be able to understand the science behind the designation of potentially hazardous and non-potentially hazardous products.
Farmers’ markets are a unique point-of-sale due to the open environment. Farmers’ markets are commonly in parks or outdoor locations where food is exposed to fluctuating temperature, humidity, and a lack of electricity to keep food refrigerated. Storage temperature is an important extrinsic factor that can be controlled by controlling the food’s environment. Some foods, such as dairy, meats, fresh cut produce, and other TCS foods, need to be kept refrigerated or at correct temperatures to repress the growth of microorganisms (Jay et al., 2005). Pathogenic microorganisms can grow rapidly within a temperature range of 40°F -140°F, which is commonly called the “temperature danger zone” (United States Department of Agriculture Food Safety Inspection Service, 2017). Foods that are not kept cold, or not kept hot can allow for the rapid growth of microorganisms if left within this temperature range (United States Department of Agriculture Food Safety Inspection Service, 2017). This is important for home-based food operators to understand, so when they are in an uncontrolled environment, like a farmers’ market, they can control the temperature that their products are stored in to maintain their safety.

Another extrinsic factor to consider is the relative humidity of the environment. Food can pick up moisture from the air and other foods, and if the humidity is greater than the water activity of the food, moisture from outside the food can migrate into the food. This is called moisture migration and can make a dry, non-TCS food such as cracker, moist which will encourage the growth of microorganisms (Jay et al., 2005). Humidity can also spoil foods, making them unpleasant and not suitable for sale and consumption (Magoulas, 2016). Spoilage does not mean that solely the quality of the food deteriorates, but can also mean that the safety of the product in negatively impacted as well (Magoulas, 2016). Farmers’ market producers need to be aware of the impact humidity can have on the quality and safety of their products if they are exposed to humid conditions.
Understanding the concepts of intrinsic and extrinsic factors, can be beneficial to producers because they can control or change these characteristics to control the safety of their products, or the use of hurdle technology by combining one or more of the intrinsic or extrinsic factors can help reduce the growth of spoilage and pathogenic bacteria. The purpose of hurdle technology is to force microorganisms to increase the amount of “effort” to “overcome the hurdle”, and “the higher the hurdle, the greater the effort” to overcome the hurdle (Leistner & Gorris, 1995, p. 41). Examples of hurdle technology include altering the water activity of a product through adding salt or another solute that binds free water, or through reducing the pH of a product by an acidic product to the food (Scott, 1989). Hurdle technology is used in products that Exempt Home Food Operations can sell, such as fruit jams and jellies. High temperatures, sugars and other soluble solids, and high acidity are hurdles that when used in combination makes fruit jams and jellies safer and extends the shelf-life (Lee, 2004).

**Home-Based Food Operation Product Safety**

A primary product sold by Home Bakeries and Home Food Operations, in Iowa, is baked goods. The section will examine the overarching safety concerns related to baked goods and common baked good ingredients. Batz, Hoffmann, and Morris (Batz, Hoffmann, & Morris, 2012) estimated that annually, foodborne illness from baked goods costs on average $246 million dollars and attributed to 459,188 illnesses. Baked goods are not generally considered PH foods, unless they are topped or filled with potentially hazardous ingredients, such as cream fillings, custards, or whipped toppings (Bryan, 1988). When baked goods are combined with these PH fillings and toppings, they then become potential vehicles for foodborne pathogens. Bryan (Bryan, 1988) mentioned that a common pathogen associated with these types of baked goods is *Salmonella*, generally due to the use of eggs in the fillings and custards. However, glazed,
frosted, or iced baked goods occasionally can be contaminated by the food handler leading to the baked good become a vehicle for certain pathogenic viruses.

Bryan (Bryan, 1988) also reported in addition to the viral and bacterial contamination, baked goods can become reservoirs for chemical contaminants due to improper storage and handling practices. One of the primary concerns for baked good products is the risk of contamination by the food handler, after thermal processing has occurred (Stewart, Cole, & Schaffner, 2003). However, recently in 2018, there were multiple baked good recalls due to *Salmonella* spp. contamination in ingredients used to make bread, swiss rolls, Ritz ® crackers, and Goldfish ® crackers (U.S. Food and Drug Administration, 2018d, 2018e, 2018f). This illustrates that contamination and food safety risk with baked goods can happen at all points of production.

Another product that is produced among home-based food operations, is fruit jams, fruit jellies, and fruit butters (Iowa Department of Inspections and Appeals, 2018). According to the U.S. Food and Drug Administration, contamination concerns related to fruit jams, jellies, and butters come from the fruit used itself and include pathogens such as *Escherichia coli*, *Salmonella* spp. *Listeria monocytogenes*, and *Shigella* spp. In addition to the raw ingredient concerns, contamination of the processed final product can also occur through improper formulation leading to bacteria growth and toxin production, bacteria surviving the heating and processing of the product, recontamination, as well as metal and glass due to those materials being used during the processing of the product (U.S. Food and Drug Administration, 2018c).

Jams/preserves, jellies, and fruit butters can be prepared at home and sold directly to the consumer (face-to-face), or at farmers’ markets in the state of Iowa by Home Based Food Operators. Producers can do this without a food license, kitchen inspection, or annual fee, if their
products meet the Standard of Identity outlined in Food and Drug Administration Code of 
Federal Regulations, specifically 21 CFR Part 150 (Iowa Department of Inspections and 
Appeals, 2018). A Standard of Identity is a set of requirements that a food product must meet to 
be legally identified as that product. Requirements for products includes sugar content, allowed 

Within the jams/preserves Standard of Identity, there are two different groups of allowed 
fruits and thus two different fruit to sugar ratios (U.S. Government, 2018). One reason that there 
are different groups, is the amount of pectin that is naturally found in each fruit. Pectin helps 
provide the semi-solid consistency and helps bind water, which lowers the water available for 
microorganism growth. Group one fruits have a lower amount of natural pectin, and thus require 
a higher amount of sugar to help bind the water. Group two fruits have a higher amount of 
natural pectin and thus require less sugar (Baker, 1997). Another characteristic of the Standard of 
Identity is soluble solids (U.S. Government, 2018). They are defined as sugars, pectin, and other 
ingredients concentration that can be dissolved (are soluble) in liquids. Soluble Solids are 
expressed in percent (%), which indicates the % of solids that are dissolved in the Jam, Jelly, or 
Fruit Butter. Total Solids include soluble and insoluble (cannot be dissolved, such as ground 
spices like cinnamon) solids (U.S. Government, 2018). As discussed earlier free water is used by 
microorganisms to grow and reproduce, but when the soluble solids bind the free water, they 
take that water away from microorganisms, thus, reducing the chance for growth and 
reproduction (Jay et al., 2005).
Raw Ingredient Safety

Common raw ingredients used in baked goods made by home-based food operations include flour, sugar, dairy, eggs, nuts, and in some cases fresh produce, such as fruit used in fruit pies. If raw ingredients are contaminated or not handled properly, they can be a source of contamination into the products being produced (Bryan, 1988). These most common ingredients and pathogens associated with baked products are: non-typhoidal *Salmonella* in eggs, *E. coli* 0121 and 026 in milled flour, and *Listeria* in pasteurized and raw dairy products (Batz et al., 2012; Centers for Disease Control and Prevention, 2017; Centers for Disease Control and Prevention, 2016d). Recently in 2016, General Mills recalled multiple milled flour products, such as Gold Medal flour commonly bought by consumers, due to *E. coli* contamination (Centers for Disease Control and Prevention, 2016d). The flour and flour products outbreaks spread into 24 different states. Work by Martinez and others (Martinez, Stratton, Bianchini, Wegulo, & Weaver, 2015), also provided evidence that *E. coli* O157:H7 can not only survive on wheat, but can also move into the wheat seed and survive. Shell eggs can be a source of contamination if the egg in the product is not fully cooked to 71°C, eggs are not refrigerated, properly cleaned, or surfaces and hands are not washed after handling eggs (Centers for Disease Control and Prevention, 2018c). *Salmonella Braenderup* was recently isolated and responsible for a recall of shell eggs affecting 10 states across the United States (Centers for Disease Control and Prevention, 2018a).

Hazelnuts, pistachios, and coconut are also a popular ingredients in baked good products, and were recently involved in outbreaks of *E. coli, Salmonella spp.* and *Salmonella Typhimurium* respectively (Centers for Disease Control and Prevention, 2011, 2016c, 2018b). Home producers should choose reliable sources of ingredients, but also monitor recalls to know what products
may be unsafe for use. Following these best practices can ensure the producers are providing safe food items. This is also a principle that large food industries must follow and will encourage safe behaviors in small industries.

Fruits and vegetables another raw ingredient that can be used in value added products such as jams and jellies, or sold raw have been associated with outbreaks including *Campylobacter spp.*, *Clostridium perfringens*, *Cyclospora cayetanesis*, *E. coli 0157:H7*, Shiga-toxin *E. coli* (non-0157:H7), *Listeria monocytogenes*, *Norovirus*, *Salmonella* (non-typhoidal), and *Shigella spp* (Batz et al., 2012). In a review of foodborne illness outbreaks between 1998 and 2008, 46% of illnesses were attributed to produce, including fruits and vegetables (Painter et al., 2013). Hepatitis A is a viral pathogen that affects the liver and was found on frozen strawberries in 2016. The outbreak investigation determined that foods handlers that have Hepatitis A handled the strawberries causing the contamination (Centers for Disease Control and Prevention, 2016a). Understanding the correct growing and handling is important for producers to know and educators to address.

*Toxoplasma gondii* (*T. gondii*) is an increasing concern with fresh fruits and vegetables as well (Jones & Dubey, 2012). Contamination of fruits and vegetables occurs from soil and contaminated water, and a common source of contamination is oocytes from feline feces (Jones & Dubey, 2012). According to the Centers for Disease Control (CDC), ingestion of contaminated soil can happen by “not washing hands after gardening or eating unwashed fruits or vegetables from a garden” (Centers for Disease Control and Prevention, 2017). *Cyclospora* is another parasite that is becoming increasingly more frequent in foodborne illness outbreaks. Like *Toxoplasma gondii*, *Cyclospora* is found on fresh produce and is caused by contaminated water. Between 2018 and 2013 there were seven *Cyclopsora* foodborne illness cases from fresh produce.
products and unknown sources (Centers for Disease Control and Prevention, 2018). With the concerns for bacterial and parasitic contamination in fruits and vegetables, educating farmers on proper fruit and vegetable handling practices will be important for educators to do, to ensure the raw ingredients are not affecting the final product safety.

**Food Safety Concerns with Home Kitchens**

In Iowa, farmers’ market vendors can sell fruit, vegetables, potentially hazardous baked goods and non-potentially hazardous baked goods, jams and jellies, and other products to direct to consumers, which is unique for these producers (Iowa Department of Inspections and Appeals, 2012). Such products can legally be produced in a vendor’s home kitchen and some may not require licensing and inspection. The concerns with home kitchen production is outlined in the following section.

Byrd-Bredbenner and others, 2013 (Byrd-Bredbenner et al., 2013) described the home kitchen as a “multipurpose space” which is also used for family and household activities many Home-Based Food Operations, such as those allowed in Iowa, are producing products in such a place (p. 4063). The authors also mentioned that home kitchens, unlike commercial operations, are exposed to a wide array of potential contaminants, from in and outside of the home. It was also noted some of those sources in the kitchen including; women’s purses that were previously on the floor at a public restroom, pets, dirty dishes and laundry, and cross contamination of fresh produce and raw meat in the refrigerator. Introducing contaminates into the home-based food operations kitchen/processing area can then cross-contaminate food, surfaces, and utensils used to produce food in a home, introducing the potential for pathogens to contaminate the food (Byrd-Bredbenner et al., 2013).
Cross-contamination in the home was also seen in a study by Cogan, Bloomfield, and Humphrey, (1999). Researchers studied cross-contamination in homes, during the preparation of poultry and the effectiveness of cleaning. It was found that pathogens from the poultry was spread easily throughout the kitchen and found that 15.4% sites within the kitchens, cleaned with conventional methods (soap and water), were positive for either *Salmonella* or *Campylobacter*. The researchers also cited door handles, dish cloths, and cutting boards were contaminated with the pathogens as well. In a separate study by Redmond & Griffith (2003) cross-contamination in consumer refrigerator and other consumer behaviors were observed. Results showed that 48% of consumers in the study stored raw meat above other foods in their personal refrigerators, which could lead to cross-contamination in the refrigerator. The study also found that 76% of consumers did not separate raw foods from cooked foods during their preparation (Redmond & Griffith, 2003). From these studies it is important to note that educating about issues concerning the home kitchens will help home-based food operations understand the wide variety of ways kitchens can be sources of contamination to their products. It is also important to note that producers should take precaution when preparing food for their families to ensure that they are not contaminating the products intended for their customers.

Contact between a contaminated surface to a food is another area for concern in home kitchens. Kusumaningrum, Riboldi, Hazeleger, and Beumer, 2003 (Kusumaningrum, Riboldi, Hazeleger, & Beumer, 2003) studied the ability of pathogens to remain on dry stainless-steel surfaces and the ability of pathogens to spread from sponges, to surfaces, to food. The results show that high initial numbers (about $10^7$ CFU/100 cm$^2$) of pathogens led to better and longer survival (4 days) survival on dry stainless-steel surfaces versus when initial numbers were low (about $10^3$ CFU/100 cm$^2$). The transfer of pathogens from sponges, to stainless steel surfaces and
then to food was varied, but had the potential to be high, with transfer rates ranging from 20-100%. This illustrates the critical issue of cross-contact from source to carrier to food within the home kitchen setting that many home-based food operations prepare product in.

In addition to introducing contamination into the processing area, proper storing practices, specifically when refrigerating can impact the safety of the home kitchen. Participants in a study by Byrd-Bredbenner, Maurer, Wheatley, Cottone, and Clancy, 2007 (Byrd-Bredbenner, Maurer, Wheatley, Cottone, & Clancy, 2007), scored less than 60% on cleaning appliances and storing refrigerated food properly, and less than 7% of households had a thermometer for taking the temperature of foods. Godwin, Chen, Chambers, Coppings, & Chambers 2007, studied temperature control in consumer refrigerators and discussed the importance of controlling microbial growth using refrigeration. They found however, that food was exposed to the temperature danger zone or above refrigeration temperatures, particularly in the door of the refrigerator 40% of time. Researchers stated that this is important because the design of the refrigerator encourages consumers to store dairy and eggs in the door, exposing them to dangerous temperatures. It was also found that only 9% of consumer refrigerators contained an in-unit thermometer that measures the actual temperature of the refrigerator (Godwin, Chen, Chambers, Coppings, & Chambers, 2007). This is important research for educators to understand what information is needed and for producers on the importance of correct storage areas for food and the correct way to monitor in-refrigerator temperatures.

Other concerns with home kitchens include the incorrect cleaning and sanitizing of equipment, utensils, and kitchen surfaces. Mattick and others, 2003 studied the ability of common pathogens, *C. jejuni*, *E. coli* O157, and *Salmonella Typhimurium* DT104 to survive hand dish washing and drying. Results from the study show that pathogens can survive in the
washing water used to clean utensils and other dishes. The study also indicated the lower the washing temperature reached and the higher the debris in the water, the better the pathogens were able to survive (Mattick et al., 2003). Unlike in commercial operations where high temperature and steam dish washers are used or three compartment sinks are used to wash, rinse, and sanitize (Schmidt, 1997), washing dishes by hand in lacking facilities is commonly used at home. If improper washing of utensils occurs, or the sanitizing step is not followed, pathogens can spread from dish to dish and become a source of contamination.

Other concerns with cleaning procedures in the home include the types of cleaners used. In commercial operations, sanitizers are used to clean all food contact surfaces including dishes, utensils, and surfaces. However, in homes, soap and water are commonly used for washings. Humphrey, Martin, Slader, and Durham, 2001, reviewed if soap and water could adequately clean kitchen surfaces of *Campylobacter spp.* and other pathogenic microorganisms versus a biocide detergent. Biocides are defined by the National Agriculture Library as “natural or chemical substances used to kill living organisms” (United States Department of Agriculture, n.d.). The authors connected that with the proper amounts of detergent and the correct water temperature, *Campylobacter spp.* can be removed from kitchen surfaces, but soap and water was inadequate for the removal of other pathogens (Humphrey, Martin, Slader, & Durham, 2001). Educating producers on the correct detergents and water temperatures to clean and sanitize their processing areas can help ensure a clean environment before, during, and after the production of food.

Bloomfield (2001) mentioned that home and family hygiene is a critical issue when it comes to the preparation of foods that can be sold to consumers. In the article “Home Hygiene” is described not only as everyday cleaning, but also good hygienic practices between people and
food. This indicates home producers are not only the person who directly prepares the food, but anyone that enters the family home (Bloomfield, 2001, p. 207). Coates, Hutchinson, and Bolton, 1987 (Coates, Hutchinson, & Bolton, 1987) also confirmed the another important factor for the home is practicing proper handwashing. In his research he demonstrated proper handwashing and drying was able to remove Campylobacter jejuni NCTC 11392 from fingertips, but the organisms were able to survive on wet hands. These results illustrate the importance of proper handwashing procedures and hygienic practices by all household members to prevent cross-contamination.

**Outcomes of Food Safety Trainings**

Trainings are commonly used to educate producers from farm-to-table. Food safety trainings have been shown to be beneficial in commercial and food service settings, at reducing the number of critical food safety violations found during inspection (Cotterchio et al., 1998; Kassa, Silverman, & Baroudi, 2010; Murphy, DiPietro, Kock, & Lee, 2010). Food handlers that received food safety trainings also scored higher on knowledge tests than those that have no formal food safety training (Lynch, Elledge, Griffith, & Boatright, 2005; Park, Kwak, & Chang, 2010). In addition to knowledge, researchers have found that mandatory food safety trainings were also observed at improving employee attitudes when concerning proper food handling practice, such as hand washing, leading to better food safety in restaurant settings (Mcintyre, Vallaster, Wilcott, Henderson, & Kosatsky, 2013; Pilling et al., 2008). It was also found that an increase in food safety knowledge also equates to improved attitudes toward food safety principles and guidelines, which may lead to better inspection scores in restaurant settings (Pilling et al., 2008).
However, there is conflicting research on whether food handler knowledge can be relied on solely to improve food handling practices. For example, in a review by Pilling and others 2008, it was observed there was no significant difference in inspection scores between establishments that had a trained manager versus all food handlers being trained. In the same study the behaviors of the trained groups were only different on five out of thirty-one food safety actions including handwashing, thermometer use, and food handling, showing that the knowledge of the trained group did not overwhelming influence their food safety actions (Pilling et al., 2008). The research of Garayoa, Cordoba, Garcia-Jalon, Sanchez-Villegas, and Vitas, 2005, also found that while participants in a survey had a high level of food safety knowledge, the level of self-reported behavior was lower that the knowledge scores indicating that participants know what to do but perform those behaviors at a lower rate. For example, while 85.1% of participants had the correct answer for a question on preventing cross-contamination through handwashing, only 13.5% reported washing their hands as a form of preventing cross-contamination (Garayoa, Cordoba, Garcia-Jalon, Sanchez-Villegas, & Vitas, 2005). Research by Powell, Attwell, & Massey also showed that there were no differences in knowledge score between people that were trained and un-trained. The same research study showed there was no difference in inspection scores between establishments with a training program for employees and those without (Powell, Attwell, & Massey, 1997). Research has shown that while knowledge is important for food safety, it cannot be solely relied on to influence the attitude and behaviors of food handlers.

In a study by Robertson, Boyer, Chapman, Eifert, and Franz, 2013, twenty grocery store locations were evaluated on food handler’s knowledge and actions. The participants generally knew the accurate temperature range to cook poultry, when to not work due to illness, and how to properly wash hands, with accurate responses totaling 87%, 92%, and 99% respectively.
However, when researchers observed actual food handler actions and found that in practice, 29% of food handlers failed to wash their hands and 15% of the participants did not use soap. The researchers also found there were 13 infractions of touching ready-to-eat (RTE) foods with bare hands and 5 infractions each of touching a contaminated surface followed by touching a RTE food, for both hands/gloves and utensils. Three of the cross-contamination infractions came from handling raw poultry with the same gloves that were later used to handle the RTE product. Of the participants, 78% had prior food safety training (Robertson, Boyer, Chapman, Eifert, & Franz, 2013). Researchers have found that attitude may help predict behavioral changes or future actions (Ajzen & Fishbein, 1977; Maio & Haddock, 2015, p. 68). If food handler attitude does not change, there will be no change in how that person handles the food in a safe manner. This illustrates the need to not only measure participant knowledge pre- and post-training, but to also measure attitude and behavior change among the participants.

The purposed way to measure changes in participants attitude is through the Theory of Planned Behavior (TPB) (Ajzen, 1991). This theory measures a person’s intention to behave by looking at the attitude toward the behavior, personal control over the behavior, and the social pressure to conform to the performing a behavior. As stated earlier, knowledge does not always lead to a change in attitude and behavior, so evaluating the effectiveness of the training by measuring behavior using the Theory of Planned, Table 1. Figure 1 shows the interactions of the base principles and how those can interact to lead to behavior being impacted. The figure shows that perceived behavioral control, subjective norms, and attitudes all influence each other and combined “motivate” intention (p.181). A “strong intention” generally leads to towards the behavior being performed (Ajzen, 1991).
**Table 1.** Key principles and descriptions in the Theory of Planned Behavior (Ajzen, 1991).

<table>
<thead>
<tr>
<th>Principle</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Attitude toward the behavior</td>
<td>Participants attitude toward the behavior, which means whether the person has a positive or negative opinion of the behavior or not. If they do not, they are less likely to partake in the behavior.</td>
</tr>
<tr>
<td>Subjective Norms</td>
<td>Subjective norms or “social pressure” and opinion to “conform to the behavior” (Ajzen, 1991, p. 188)</td>
</tr>
<tr>
<td>Perceived Behavioral Control</td>
<td>Perceived behavioral control which means whether a person has control over the behavior. A person is less likely to perform a behavior if they feel they have no control over it. This theory was selected based on its core components making it applicable to food safety and food safety trainings.</td>
</tr>
</tbody>
</table>

**Figure 1.** A pictorial representation of the interaction of each principle within the Theory of Planned Behavior (Ajzen, 1991).
The Theory of Planned Behavior has been used in food safety applications to predict intentions, attitudes, and actions. The Theory of Planned Behavior was used as an evaluation of attitudes and behaviors or predictor of intentions, in food safety trainings. A study by Shapiro, Porticella, Jiang, & Gravani, 2011, used the Theory of Planned Behavior for “predicting intentions” for handwashing and thermometer use (p.96). The study found that the Theory of Planned Behavior was able to predict participants attitudes, subjective norms, perceived behavior control, and behavioral intent. Handwashing overall had a higher positive behavioral intention than thermometer use, and the Theory of Planned Behavior was able to predict this based on the positive attitudes, social pressure to wash ones’ hands, and control of washing their own hands, through a survey (Shapiro, Porticella, Jiang, & Gravani, 2011). Mullan & Wong, 2009 (Mullan & Wong, 2009), used the Theory of Planned Behavior to assess the attitude, subjective norms, and perceived behavioral control on food handling. The results of the research found that attitudes and social norms were valuable in predicting participants behavioral intention, however perceived behavior control was a more “significant predictor of intention” (Mullan & Wong, 2009, p. 759). Results from both studies indicate that the application of the Theory of Planned Behavior can help researchers predict the intentions of food handlers and understand what specific factors weigh more on the participants behavior towards a task, such as perceived behavioral control, that the other factors (Mullan & Wong, 2009; Shapiro et al., 2011).

In this research project researchers assess the needs of the local food producers, evaluate their knowledge and confidence, and the take those results and develop a training. An evaluation will be given to the training participants to determine the impact the training had on participant intention, attitude, and behavior.
Research Objectives

1. Develop and administer a needs assessment to examine the current knowledge of Iowa home-based food operations, focusing on areas including stage of producing products, types of products produced, Iowa Policy knowledge, personal confidence in following Iowa policy, general food safety knowledge, and prior food safety training.

2. Develop a training and training materials over topics decided by gaps in producer knowledge from needs assessment analysis. Focus on home producer food safety and point-of-sale challenges. Present pilot training at five locations around the state of Iowa (Cass county, Buena Vista county, Washington county, Blackhawk county, and Story county). Assess the training by using a pretest-posttest evaluation tool modeled after the Theory of Planned Behavior.

Hypotheses

1. Home-based food operations in the state of Iowa will show a need for a food safety and Iowa regulations training, based on food safety knowledge scores averaging below 75% correct and self-efficacy scores averaging below 4.00.

2. The Exempt Home Food Operations and Home Bakeries training will increase attitude and behaviors scores, across all constructs, at post and 6-8-week follow-up testing times.
References


NEEDS ASSESSMENT FOR EXEMPT HOME FOOD OPERATIONS AND HOME BAKERIES IN IOWA

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IRB ID: 17-555, Determination: Exempt (See Appendix A)
Abstract

The objective of this study is to assess the food safety knowledge, self-efficacy, and background information, among Exempt Home Food Operations and Home Bakers. A need’s assessment was distributed to the target audience and asked questions on knowledge of food safety practices and definitions of food safety concepts. Self-efficacy questions focused on Iowa laws, shelf-life, and point-of-sale practices. The Transtheoretical Model was used to describe and compare background information. A level of 75.0% modeled after ServSafe® certification requirements and self-efficacy of 4.00, was set as the requirement to determine the need. Descriptive statistical analysis shows that 61.5% of participants in the assessment (n=78), have already started selling foods that are produced out of their homes. Participants indicate high self-efficacy on questions related to their products (4.36 on a 5.00-point scale). Overall food safety knowledge among the home kitchen producers had a mean of 73.4% correct answers. The results show that producers have a high level of confidence in their personal ability to follow Iowa regulations, however most producers barely passed the questions on key food safety concepts. A training designed for these producers, would be beneficial to increase food safety and Iowa regulation knowledge, making products safer for the public.

Keywords

Farmers’ markets, local foods, food safety, needs assessment, Transtheoretical Model
Introduction and Literature Review

The USDA reports a 76% increase in the number of farmers’ market locations between 2008 and 2014, indicating the increased consumer interest in local foods (U.S. Department of Agriculture, 2014). With an increase in the popularity of buying food from local sources, the increase in potential food safety issues and outbreaks could arise. This study aimed to collect and assess producer’s current food safety knowledge, personal confidence, and background information. Within the group of producers in the state of Iowa, there are two subgroups referred to as Exempt Home Food Operations and Home Bakeries. These producers were the target group for the need’s assessment tool.

According to Iowa’s Department of Inspections and Appeals, a Home Bakeries are licensed and inspected home facilities that can produce Temperature Control for Safety (TCS) and Non-TCS baked goods only (Iowa Food Protection Task Force, 2017). Temperature Control for Safety also known as Potentially Hazardous Foods (PHF) are defined as foods that are “capable of supporting the rapid and progressive growth of infectious or toxigenic microorganisms” (The Iowa Legislature, 2018). The state of Iowa also defines what a baked good is as “breads, cakes, doughnuts, pastries, buns, rolls, cookies, biscuits and pies (except meat pies)” (Iowa Food Protection Task Force, 2017).

Iowa’s Department of Inspection and Appeals define Exempt Home Food Operations as a largely unregulated and can make and sell a variety of products of their homes and at farmers’ markets. Products produced by these operations include fresh fruits and vegetables, fruit jams, fruit jellies, fruit butters, honey, fresh shell eggs, Non-Temperature Control for Safety (Non-TCS) baked goods such as breads, biscuits, pies, cookies, and doughnuts, dry mixes, candy, and any product that is Non-TCS (Iowa Department of Inspections and Appeals, 2018).
Similar products, like those that can legally sold by these groups of producers, have recently been associated with foodborne outbreaks. Between 2018 and 2013 there were seven foodborne illness cases from fresh produce products and unknown sources, associated with the parasite *Cyclospora* (Centers for Disease Control and Prevention, 2018). Fruits and vegetables another raw ingredient that can be used in value added products such as jams and jellies, or sold raw have been associated with outbreaks including *Campylobacter* spp., *Clostridium perfringens*, *Cyclospora* cayetanesis, *E. coli* 0157:H7, Shiga-toxin *E. coli* (non-0157:H7), *Listeria monocytogenes*, *Norovirus*, *Salmonella* (non-typhoidal), and *Shigella* spp. (Batz, Hoffmann, & Morris, 2012). In addition to produce sources being linked to foodborne illness outbreaks, multiple baked goods have recently been recalled due to *Salmonella* spp. contamination in ingredients used to make bread, swiss rolls, Ritz® crackers, and Goldfish® crackers (U.S. Food and Drug Administration, 2018a, 2018b, 2018c).

Developing a food safety training relevant for these home producers is important to increase food safety and Iowa law knowledge. States surrounding Iowa at present have a variety of training and resources available to those interested in home-based production and home-based preserving. The University of Wisconsin has a variety of trainings on “Preserving Wisconsin’s Harvest” (University of Wisconsin-Extension, 2018), while states like Minnesota, Nebraska, and Illinois have trainings and resources available that focus on the cottage-foods industries within their respective states through Extension and Outreach (University of Illinois Extension, 2016; University of Minnesota Extension, 2018; University of Nebraska-Lincoln, 2018).

To make the training relevant for Iowa producers, a needs assessment was used to determine the gaps in food safety knowledge, ability to follow Iowa law, and background information. A needs assessment, used as the first step in the training development, can help
program developers “identify program focus” (Caravella, 2006). Grant 2002, discussed similar practical uses for needs assessments within the medical field as identifying areas for “curriculum planning”, “assess student learning”, and “offer individual feedback and educational intervention” (Grant, 2002). A needs assessment was choose as the method of initial data collection because it provides four key items including “identification of specific problem areas”, impact and need for support from stake holders, data both prior to the program and for comparison to after the training, and finally to help developers understand the “cost and benefits” associated with training development and dissemination (Brown, 2002). The needs assessment for this study, focused on the first two key items, identifying potential training topics and data to show impact to stakeholders.

Other research has used needs assessments for determining educational needs. In a study by Kwon, Roberts, Shanklin, Liu, and Yen 2010, researchers used a needs assessment to review inspection scores and identify food safety concepts should be the focus of additional food safety education for ethnic restaurants (Kwon, Roberts, Shanklin, Liu, & Yen, 2010). In Pennsylvania, researchers used needs assessment with dairy manufacturers to gather background information, food safety knowledge, and interest in trainings and resources (Syrko & Kaylegian, 2015). In a separate study on farmers’ market poultry vendors, researchers used a needs assessment to determine the “knowledge and attitude” towards “food safety, regulation, and poultry production” (Scheinberg, Redhakrishna, & Cutter, 2013).

In Iowa, important aspect of determining the need was also understanding the current landscape of the home-based food operation sector within local foods producers in Iowa. To understand this and understand these producers’ current actions, researchers used the Transtheoretical Model. The Transtheoretical Model identifies stages of change in behavior or
actions (Prochaska, Redding, & Evers, 2008). Understanding the stage of change is important in the needs assessment to be able to identify and compare the results to the current or future actions of the participants. To do the comparison researchers focused on three specific stages of change within the model, including “contemplation, preparation and action” (Prochaska et al., 2008, p. 98). A similar approach was taken by researchers evaluating the use of thermometers among consumers at different stages. These researchers found that using the Transtheoretical model to compare consumers at different stages of thermometer use adaptation was a “useful” method for comparison (Takeuchi, Edlefsen, Mccurdy, & Hillers, 2005). In another food safety application, the Transtheoretical Model has been used to ask survey participants to describe their future, present, and past food preparation intentions in relation to food safety (Byrd-Bredbenner et al., 2007). This research outlines the benefit of using a model to describe and compare producers in different stages of production.

**Applied Research Methods**

**Needs Assessment Development**

A needs assessment was developed to analyze the food safety knowledge, self-efficacy in following Iowa law, and background information (See Appendix B). Knowledge was assessed based on correct and incorrect answers from true/false, multiple choice and select all that apply food safety questions from the 2013 Food and Drug Administration (FDA) Food Code and from guidance document found on the Iowa Department of Inspections and Appeals website. Knowledge questions on refrigeration temperatures, identification of major allergens, identification of products that need licensing, definitions of potentially hazardous products, labeling and display requirements, food storage off the ground, and handwashing procedures. To
determine if there is a need for a food safety and Iowa regulation training, researchers set a level of participants needing a score at 75% or above correct food safety questions, which is the score required by the National Restaurant Association’s to pass the ServSafe® Food Manager Training. This training and score were select as the model because it is required to be taken by at least one employee at every retail food establishment, and requires a high standard for food safety understanding, which was the goal to be mimicked by this analysis.

Self-efficacy questions were assessed using a modified Likert scale using the responses: 1-I am sure I could not do it, 2-I could not do it, 3-I do not know if I could do it, 4-I could do this, 5-I am sure I could do this, and an additional option for not applicable was also included. The self-efficacy questions asked their perceived ability to follow Iowa laws based on their type of home-based food operation, their ability to label their product according to Iowa Law, determine the shelf-life of their products, their confidence in applying for a water test for their kitchen inspection, and their ability to arrange the point-of-sale to protect the safety of their products. An average score of below four (“I could do this”) was needed in the self-efficacy portion of the need’s assessment. This level was set because a score of less than four would indicate that producers are unsure if they could perform the question and therefore would need educational guidance to raise their confidence towards performing the question.

For demographic information to determine the stage of production the participants were asked to categorize the stage of their operation. These categories were applied to the three stages of change outlined in the Transtheoretical model (see table 1), as contemplation, preparation, and action.
Table 1. Adapted Stages of change with description and example of background question from needs assessment, based on the Transtheoretical Model (Prochaska, Redding, & Evers, 2008, p.98).

<table>
<thead>
<tr>
<th>Stage of Change</th>
<th>Description</th>
<th>Background Question</th>
<th>Key Word</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contemplation</td>
<td>Intends to act within 6 months</td>
<td>I am thinking about starting to sell foods produced at home but have not yet decided if I will.</td>
<td></td>
</tr>
<tr>
<td>Preparation</td>
<td>Intends to act in the immediate future</td>
<td>I am planning to start selling foods produced at home but have not yet begun.</td>
<td></td>
</tr>
<tr>
<td>Action</td>
<td>People have made specific and overt modifications to their behavior within the past 6 months</td>
<td>I have already started selling foods produced at home.</td>
<td></td>
</tr>
</tbody>
</table>

Contemplation is described as intending to act within 6 months, and for the need’s assessment description producers are “thinking about starting to sell foods produced at home but have not yet decided if I will”. The next stage is preparation described as intends to act in the immediate future and for the need’s assessment described as “I am planning to start selling foods
produced at home but have not yet begun”. Finally, the action stage is described as those who have already made “modifications to their behavior” and described in the need’s assessment as “I have already started selling foods produced at home”. Additionally, open ended questions were asked to participants to list the types of products that the participants are currently making or are thinking about making was also collected to allow producers to list multiple products and specific products.

Identification and Dissemination of Needs Assessment to Farmers’ Market Vendors

Farmers’ market producers and managers were identified through attending the Annual State of Iowa Farmers’ Market meeting, attending regional farmers market meetings, personal contact at farmers’ market locations, Iowa State Extension and Outreach Nutrition and Wellness Specialist contacts, the Iowa Department of Inspections and Appeals contacts, and through the Iowa Department of Agriculture and Land Stewardship’s Farmers’ Market Directory. Participants were asked voluntarily, to complete the survey in either electronically through an online survey tool Qualtrics® or through a printed copy of the survey that was sent via mail to participants. Participants were given from February 1, 2017 until March 20, 2017 to complete the needs assessment. Descriptive statistical analysis was ran using Predictive Analytics Software and ANOVA data was ran using SPSS version 25.
Results

Figure 1. shows the breakdown in percent of participants, based on the Transtheoretical Model stages of change. Producers in the action stage of change were the most prominent in the pool of participants, with 61.54% of the participants already producing foods. Producers in the contemplation stage of change accounted for 24.36% and producers in the preparation stage comprised 14.1% of the participants. Figure 2 shows the types of products that participants are interested in producing or are already producing. Baked goods overwhelmingly are among the most popular products with...

**Figure 1.** Analysis (in percent) of the participants who completed the survey, based on their stage of change (n=78).

**Figure 2.** Product types that participants are interested in producing or are currently producing in percent (n=76).
75% of participants indicating they are interested in or are already making baked good including potentially hazardous goods. Non-potentially hazardous foods were the second most popular product with 54% of participants interested or are already producing these types of products. Lightly processed vegetables, jams and jellies, and other products each had 8% popularity among participants. Sauces and salsas, gluten-free baked goods, and processed grains has 7%, 4%, and 3% popularity, respectively.

Table 2 shows the percent correct answers from 88 participants for each of the individual food safety knowledge questions. Questions with percentages above 75% (ServSafe® benchmark) were determined to be proficient. In total 5 out of the possible 8 questions had a high enough “passing rating”. In general, the questions pertaining to Iowa law and allergen identification had a high percent of correct answers. Allergen identification had a correct answer percentage of 98.8%, refrigerated baked good and licensing had a percentage of 96.3%, defining potentially hazardous had a percentage of 89.2%, identifying exempt products had a percentage of 79.5%, and finally declaring allergens on or near products had a percentage of 81.9%. However, questions of food safety principles such as refrigeration temperature identification, handwashing procedures, and proper food storage were below the benchmark of 75% with correct answers only reaching 69.5%, 52.6%, and 26.5% respectively.
Table 2. Percent correct answers for each food safety knowledge question (n=88).

<table>
<thead>
<tr>
<th>Food Safety Knowledge Question</th>
<th>Percent of correct answers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Foods that need to be refrigerated should be kept at or below what temperature</td>
<td>69.5%</td>
</tr>
<tr>
<td>The following are all considered major allergens; Peanuts, Soybeans, Milk, Eggs, Fish, Shellfish, Tree Nuts, and Wheat.</td>
<td>98.8%</td>
</tr>
<tr>
<td>To sell a refrigerated baked good, such as a cheesecake, at a farmers’ market, the vendor needs a food license and inspection.</td>
<td>96.3%</td>
</tr>
<tr>
<td>Potentially hazardous food products are defined as foods that require temperature control.</td>
<td>89.2%</td>
</tr>
<tr>
<td>Whole, uncut fruits and vegetables, baked goods (non-potentially hazardous), honey, fresh shell eggs and other non-potentially hazardous foods can be sold at farmers’ markets without a food license.</td>
<td>79.5%</td>
</tr>
<tr>
<td>Only licensed vendors are required to display food allergen information on/near products.</td>
<td>81.9%</td>
</tr>
<tr>
<td>Food should be stored at least _______ inches off the floor?</td>
<td>52.6%</td>
</tr>
<tr>
<td>Proper hand washing procedures include using clean running warm water, soap, rubbing hands together for _______ seconds, rinsing, and drying thoroughly.</td>
<td>25.6%</td>
</tr>
</tbody>
</table>
Figure 3 shows that participant mean self-efficacy scores were above the pre-determined need level of 4.00 for all questions except for the participants ability to accurately determine the shelf-life of their products (3.97). Participants felt that they “did not know if they could do this” as compared to all other questions getting a mean score of 4.00 or higher indicating that “they could do this”.

![Figure 3. Mean self-efficacy question scores for all participants (scale 1-5).](image)

Analysis of Variance (ANOVA) and multiple comparison tests were completed on the participants answers to the food safety questions and the self-efficacy responses, as seen in Table 3. No significant difference was observed between the stage of change of the producer and their food safety knowledge. However, participants in the preparation stage of change had the highest food safety knowledge score (79.55%), followed by the contemplation participants (77.63%), and finally the action stage (70.31%). Overall, participants averaged below the benchmark set by researchers of 75%, with an average overall food safety knowledge score of (73.4%). Confidence
scores show that participants that are already making and selling food have a higher self-efficacy (4.52), than the participants that are in the preparation stage (4.15) and the contemplation stage (4.07). A significant difference was observed in self-efficacy scores between those participants in the action stage versus those in the contemplation stage (p=.045). Overall, participants rated their personal confidence at an average score of 4.36 which corresponds to “I could do this”.

Table 3. Results (mean ± standard deviation) of correct food safety answers (%) and attitude answers (Likert scale 1-5) based on the producers’ stage of change.

<table>
<thead>
<tr>
<th>Stage of Change</th>
<th>Correct Food Safety Answers (%)</th>
<th>Confidence Answers (Likert Scale 1-5)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contemplation (n=19)</td>
<td>77.63 ± 14.18</td>
<td>4.07 ± .737*</td>
</tr>
<tr>
<td>Preparation (n=11)</td>
<td>79.55 ± 11.56</td>
<td>4.15 ± .614</td>
</tr>
<tr>
<td>Action (n=48)</td>
<td>70.31 ± 13.05</td>
<td>4.52 ± .666*</td>
</tr>
<tr>
<td>Total</td>
<td>73.4 ± 13.57</td>
<td>4.36 ± .700</td>
</tr>
</tbody>
</table>

* p < 0.05

Discussion

Most of the participants in the need’s assessment were already making and selling foods out of their homes and at farmers’ markets (Figure 1). This is important in understanding the needs assessment by also understanding the stage of change in the Transtheoretical model, which provides researchers with an idea of the current landscape of these producers in the state of Iowa. This also provides good insight in to how to approach the development of the training, for
example if a high proportion are only in the contemplation stage, or unfamiliar with the laws and food safety, researchers would take a different approach then if most participants were in the action stage or exposed to the laws and food safety practices.

Product types (Figure 2) that these producers are already making or thinking about making was important to collect so researchers understood what type of products are being produced and how that effects topics that will be included into the education program. Producers show a large popularity in baked goods, both temperature control for safety and non-temperature control for safety. However, the results also show there is interest in making products that fall outside of the allowed products for this group. These products should be addressed in the training to educate producers that they are not allowed and to explain the reasoning behind the rule. For example, while baked goods, jams and jellies, and gluten free baked goods are acceptable products to sell at the farmers’ market without a license. Lightly processed vegetables, drinks, salsa, and sauces are all unacceptable products to be produced within a residential kitchen without a Food Establishment or Food Processing License, proper laboratory testing to prove the products are non-TCS, and further training (Iowa Food Protection Task Force, 2017). Thus, it was important to know the products producers are interested in producing to inform researchers on potential issue that should be addressed in the training.

Individual food safety results (Table 2) help researchers identify what food safety topics may need to be covered in an education program. While participants had satisfactory scores in the Iowa food safety, definition, and allergen questions, scores in basic food safety question were below the satisfactory level of 75%. These questions include correct refrigeration temperature, proper food storage, and proper handwashing length. These questions show that food safety basics are the weakest area among participants and could impact the products they produce from
a safety standpoint. Products that need require refrigeration can be sold by this group and if they are unaware of the correct temperature to store products, food may be stored in warm conditions that allow microorganisms to grow. Food storage is also important especially at the farmers’ market, where food is exposed to bugs, dirt and dust. Keeping food on the ground allows for these sources of contamination to easily access the food. Thus, food safety principles focused on refrigeration temperature, food storage, and handwashing should be incorporated into the program. Studies examining the food safety practices among farmers’ market vendors also show a lack of food safety knowledge being practiced. In a study by Harrison, Critzer, and Harrison, 2016, food safety practices such as storing fruits and vegetable on the ground, not refrigerating temperature control for safety produce, and the lack of handwashing stations, had ratings of “slightly prevalent (10-24% of owner operators), somewhat prevalent (25-39% owner/operators), and moderately prevalent (40-54% owner operator)” respectively (Harrison, Critzer, & Harrison, 2016). This reflects what is observed in our knowledge results with ground storage, refrigeration temperatures, and handwashing all having 25% or greater of participants answering incorrectly, Table 2.

Overall, participants had high self-efficacy scores (figure 3), with only one question’s average falling below the predetermined level of 4.00. This helps educators identify that shelf-life determination of their products is something that the participants are either unfamiliar with or do not know how to do. From this results, educators and researchers know to include shelf-life determination into the training, to help participants feel more comfortable doing this on their own products.

No significant differences were observed between the food safety scores between each group of participants, in Table 3. However, scores between the action and preparation stages
were approaching significance. Participants in the preparation stage had an average score of 79.55%, which is above the predetermined benchmark, versus those in the action stage had an average score of 70.31%, which is slightly below the benchmark. The Transtheoretical Model describes those in the preparation stage as having a plan of action and “some behavioral steps have been taken” (Prochaska et al., 2008, p. 98). Relating to this project, our data indicated that this may indicate that while participants in the preparation stage are not making products yet, they may be researching information on products and food safety, leading to higher food safety knowledge scores. Overall, mean food safety knowledge scores for all participants were below the 75% benchmark. This implies that food safety principles need to be incorporated into the training due to the insufficient scores of the participants.

Significant differences were seen in self-efficacy scores between participants in the action stage and participants in the contemplation stage, Table 3. Participants in the action stage of change had the highest personal confidence in following Iowa code. This result could be attributed to the fact that since these participants have more experience producing foods out of their homes, and believe that because so, they have a higher perceived ability to follow Iowa code. Exposure to Iowa laws through experiencing them first hand can lead to a positive behavior towards the law, due to familiarity, and thus a higher confidence. This is supported by the “subliminal exposure effect” described by Maio and Haddock, 2015, which describes the effect of seeing or being familiar with something leads to less uncertainty about it (Maio & Haddock, 2015, p. 135). This theory helps researchers to infer that since producers in the action stage have already experienced Iowa laws, they feel they are more familiar with them and that is reflected in the results. It is also important to understand the impact high self-efficacy may have on delivering educational messages. In a study by Richards and Beavers 2014, researchers
discussed the impacts that high self-efficacy has on food safety education and acknowledged that while a high confidence may be good, the participants may not be “receptive” to the educational messages presented (Richards & Beavers, 2014).

However, the participants in the contemplation and preparation stage of change had a lower self-efficacy, Table 3. When considering the description for both the preparation and contemplation stages, they are making changes within the immediate future or thinking about making changes in the next 6 months respectively, and do not have the experience of making and selling products (Prochaska et al., 2008). According to Maio and Haddock 2015, participants similar to these rate their confidence lower due to the lack of exposure (Maio & Haddock, 2015), and an uncertainty about the laws. This indicates to researchers that perhaps with more experience and exposure through education, these participants may be more confident in their personal ability within Iowa laws and food safety.

Conclusion

The results show that producers have a high level of confidence in their personal ability to follow Iowa regulations, however most producers slightly passed the knowledge questions on key food safety concepts. The training should focus on Iowa laws directed towards Exempt Home Food Operations and Home Bakeries in Iowa, as well as food safety basics, and the unique location and food safety implications of the residential kitchen. A training designed for these producers, would be beneficial to increase food safety and Iowa regulation knowledge, potentially making products safer for Iowans. Due to other state already having programs and resources in their respective states, the growing interest in home-based food operations, and the results from this needs assessment, the program proposed by researchers will be a priority
program in the state of Iowa, through collaboration with the Iowa Department of Inspections and
Appeals and Iowa State University Extension and Outreach.
References


DEVELOPMENT AND EVALUATION OF A FOOD SAFETY TRAINING FOR EXEMPT HOME FOOD OPERATIONS AND HOME BAKERIES IN IOWA.

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IRB ID: 18-014, Determination: Exempt (See Appendix C)
Abstract

The objective of this study was to develop a pilot food safety training for home-based food operations in Iowa, and to evaluate seven constructs including participants’ attitude, behaviors towards three food safety areas, intention, perceived behavioral control, and willingness to conform to social pressures related to food safety. A pilot training was developed and covered topics including Iowa laws, food safety basics and application to the home kitchen, production, and at the point-of-sale. The training was taught at five locations around the state and participants were asked to complete a pre-test, post-test, and 6-8-week follow-up evaluation, modeled after the Theory of Planned Behavior. Results from the evaluation show that participants had positive feelings (responses of 5.00 or higher) for six constructs except for attitude which was slightly lower (4.00 or higher) for all testing times. Participants responses slightly increased between pre-test and post-test times, but then returned to levels close to the original responses 6-8-weeks following the training. Significant differences were observed between pre-test and post-test times within behavior towards preparation environment and perceived behavioral control constructs for all participants. The evaluation indicates a need to affect long-term participant attitude and behavioral changes within all constructs measured from the training.

Keywords

Training, Food Safety, Theory of Planned Behavior, Farmers’ Markets
Introduction and Literature Review

Food safety trainings have been shown to be beneficial in commercial and food service settings, at reducing the number of critical food safety violations found during inspection (Cotterchio et al., 1998; Kassa, Silverman, & Baroudi, 2010; Murphy, DiPietro, Kock, & Lee, 2010). Food handlers that received food safety trainings also scored higher on knowledge tests than those that have no formal food safety training (Lynch, Elledge, Griffith, & Boatright, 2005; Park, Kwak, & Chang, 2010). In addition to knowledge, researchers have found that mandatory food safety trainings were also observed at improving some employee attitudes when concerning proper food handling practice, such as hand washing, leading to better food safety in restaurant settings (Mcintyre, Vallaster, Wilcott, Henderson, & Kosatsky, 2013; Pilling et al., 2008). It was also found that an increase in food safety knowledge also equates to improved attitudes toward food safety principles and guidelines, which may lead to better inspection scores in restaurant settings (Pilling et al., 2008).

However, there is conflicting research on whether food handler knowledge can be relied on solely to improve food handling practices. For example, in a review by Pilling and others 2008, it was observed there was no significant difference in inspection scores between establishments that had a trained manager versus all food handlers being trained. In the same study, the behaviors of the trained groups were only different on 16.1% food safety actions including handwashing, thermometer use, and food handling, showing that the knowledge of the trained group did not overwhelming influence their food safety actions (Pilling et al., 2008). The research of Garayoa, Cordoba, Gacia-Jalon, Sanchez-Villegas, and Vitas, 2005, also found that while participants in a survey had a high level of food safety knowledge, the level of self-reported behavior was lower that the knowledge scores indicating that participants know what to
do but perform those behaviors at a lower rate. For example, while 85.1% of participants had the correct answer for a question on preventing cross-contamination through handwashing, only 13.5% reported washing their hands as a form of preventing cross-contamination (Garayoa, Cordoba, Garci´a-Jalon, Sanchez-Villegas, & Vitas, 2005). Research by Powell, Attwell, & Massey also showed that there were no differences in knowledge score between people that were trained and un-trained. The same research study showed there was no difference in inspection scores between establishments with a training program for employees and those without (Powell, Attwell, & Massey, 1997). Research has shown that while knowledge is important for food safety, it cannot be solely relied on to influence the attitude and behaviors of food handlers.

In a study by Robertson, Boyer, Chapman, Eifert, and Franz, 2013, twenty grocery store locations were evaluated on food handler’s knowledge and actions. The participants generally knew the accurate temperature range to cook poultry, when to not work due to illness, and how to properly wash hands, with accurate responses totaling 87%, 92%, and 99% respectively. However, when researchers observed actual food handler actions and found that in practice, 29% of food handlers failed to wash their hands and 15% of the participants did not use soap. The researchers also found there were 13 infractions of touching ready-to-eat (RTE) foods with bare hands and 5 infractions each of touching a contaminated surface followed by touching a RTE food, for both hands/gloves and utensils. Three of the cross-contamination infractions came from handling raw poultry with the same gloves that were later used to handle the RTE product. Of the participants, 78% had prior food safety training (Robertson, Boyer, Chapman, Eifert, & Franz, 2013). Researchers have found that attitude may help predict behavioral changes or future actions (Ajzen & Fishbein, 1977; Maio & Haddock, 2015, p. 68). If food handler attitude does not change, there will be no change in how that person handles the food in a safe manner. This
illustrates the need to not only provide participants a training, but to also evaluate their attitude and behavior changes pre-, post-, and 6-8 weeks after the training, to measure the long-term impact.

The purposed way to measure changes in attitude is through the Theory of Planned Behavior (TPB). This theory measures a person’s intention to behave a certain way, by looking at the attitude toward the behavior, personal control over the behavior, and the social pressure to conform to the performing a behavior (Ajzen, 1991). As stated earlier, knowledge does not always lead to a change in attitude and behavior, so evaluating the participants in the training by measuring intention, attitude, and behavior using the Theory of Planned Behavior, will allow researchers to draw conclusions about the effect the training had on the participants. Theory of Planned Behavior has been used as an evaluation of attitudes and behaviors or predictor of intentions, in food safety trainings. A study by Shapiro, Porticella, Jiang, & Gravani, used the Theory of Planned Behavior for “predicting intentions” for handwashing and thermometer use. The study found that the Theory of Planned Behavior was able to predict participants attitudes, subjective norms, perceived behavior control, and behavioral intent. Specifically, handwashing overall had a higher positive behavioral intention than thermometer use, and the Theory of Planned Behavior was able to predict this based on the positive attitudes, social pressure to wash ones’ hands, and control of washing their own hands, through a survey (Shapiro, Porticella, Jiang, & Gravani, 2011).

Mullan & Wong (2009), used the Theory of Planned Behavior to assess the attitude, subjective norms, and perceived behavioral control on food handling. The results of the research found that attitudes and social norms were valuable in predicting participants behavioral intention, however perceived behavior control was a more “significant predictor of intention” (p.
Results from both studies indicate that the application of the Theory of Planned Behavior can help researchers predict the intentions of food handlers and understand what specific factors weigh more on the participants behavior towards a task, such as perceived behavioral control, than other factors (Mullan & Wong, 2009; Shapiro et al., 2011). Evaluating participants that complete a food safety and Iowa law training, using the Theory of Planned Behavior will help to understand the changes in participant attitude and the effects that the training may have had on the participants attitude and behavior.

**Applied Research Methods**

**Program Design and Development**

A needs assessment was distributed to producers in the state of Iowa that were identified as Exempt Home Food Operators, Home Bakers, or farmers’ market managers. From the results of the needs assessment key areas in food safety and Iowa law were identified as areas that should be covered in the food safety training. The areas covered include food safety basics, Iowa laws and policies, and application of both food safety and Iowa law to the producer’s own operations. A lecture style course was offered which included a Microsoft @PowerPoint presentation, interactive activities, discussions, and question and answer activities throughout the lecture. Chapters developed and covered in the lecture can be seen in table 1.

**Table 1.** Chapters and corresponding subject matter covered in the pilot food safety training for exempt home food operations and home bakeries in Iowa.

<table>
<thead>
<tr>
<th>Chapter</th>
<th>Chapter Subject Matter</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chapter 1</td>
<td>Iowa policies and regulations</td>
</tr>
<tr>
<td>Chapter 2</td>
<td>Food safety basics</td>
</tr>
<tr>
<td>Chapter 3</td>
<td>Foodborne pathogens</td>
</tr>
</tbody>
</table>
Table 1 (Continued).

<table>
<thead>
<tr>
<th>Chapter</th>
<th>Non-temperature and temperature control for safety</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chapter 4</td>
<td>Non-temperature and temperature control for safety</td>
</tr>
<tr>
<td>Chapter 5</td>
<td>Kitchen: production area safe food practices</td>
</tr>
<tr>
<td>Chapter 6</td>
<td>Preparation: safe food practices</td>
</tr>
<tr>
<td>Chapter 7</td>
<td>Sourcing ingredients, packaging, shelf-life, and point-of-sale: safe food practices</td>
</tr>
</tbody>
</table>

Chapters were developed by using resources from The National Restaurant Association ServSafe® materials, Iowa State University Extension and Outreach, the Food and Drug Administration, the United States Department of Agriculture, the Iowa Department of Inspections and Appeals and the Iowa Department of Agriculture and Land Stewardship. At completion of the training, participants receive a certificate of completion, but were not certified in any recognized program. Bloom’s Taxonomy was used to develop the learning objectives and activities used in the training. Researchers focused on the first three levels of remembering, understanding, and applying concepts taught on during the program (Iowa State University Center for Excellence in Learning and Teaching, n.d.). Turn-to-your-partner exercises were developed to challenge participants to not only recall information but apply the concepts to their own operations.

Program Recruitment and Dissemination

Recruitment through multiple organizations and groups was used to collect interest in the training and potential participants. Researchers presented at meetings such as the Iowa Annual Farmers’ Market Meeting, local farmers’ market meetings, Iowa State University Extension and Outreach (ISUEO) Nutrition and Wellness Specialist meetings, Iowa Small Business Development Center and Iowa Center for Economic Success. Researchers also relied on State and local governments to disseminate information about the training. The Iowa Department of
Inspections and Appeals and the Iowa Department of Agriculture and Land Stewardship allowed researchers to use farmers’ market databases and local inspectors, to recruit potential participants.

**Program Evaluation**

To measure the impact of the training, researchers developed an evaluation (Appendix D) to measure seven constructs, including participants attitude, behaviors towards three food safety areas, intention, perceived behavioral control, and willingness to conform to social pressures related to food safety. Researchers also evaluated the training between three groups of participants that were matched by location. The Theory of Planned Behavior was selected as the theory to model the evaluation. This theory was selected due to it applicability to food safety trainings and attitude/behavioral change. Figure 1. shows the model that was developed by researchers in application of the Theory of Planned Behavior to the food safety training. Researchers developed questions that focused on each aspect of the model above. Questions used phrases or key words that were linked back to the model to ensure that researchers were

![Figure 1. Model of food safety training evaluation adapted from the Theory of Planned Behavior (Ajzen, 1991).](image-url)
assessing every area of the proposed model (Ajzen, 1991). The knowledge portion of the model was delivered during the training. The focus of this evaluation was on the attitude, intention, and behaviors of the participants.

All evaluation questions focused on three general themes that were incorporated throughout the training. Those three themes included the food, the preparation environment, and the personal hygiene of the preparer. Questions in the attitude towards food safety focused on the personal choices of the three areas listed above. The subjective norm questions asked whether the participant agreed that co-workers, family, friends, health inspectors, and their customers expected them to use safe food practices. The perceived behavioral control questions evaluated the participants personal ability to follow certain food safety tasks that were recommended in the training based on their own personal operations. The final section of the evaluation focused on the actual attitude of the participant. Evaluations were given to each participant after they signed a consent form before the training (pre-evaluation), immediately after the training (post-evaluation), and 6-8 weeks after the training (6-8-week follow-up evaluation). Participants used a Likert scale to respond to the questions in the survey (see Appendix D). Participants had the option to answer, “strongly disagree, disagree, slightly disagree, slightly agree, agree, or strongly agree”.

The objectives used to analyze the results of the evaluation can be seen in table 2. Answers were coded by response option with strongly disagree being coded as 1, disagree-2, slightly disagree-3, slightly agree-4, agree-5, and strongly agree-6. Results were statistically analyzed (descriptive and ANOVA) using SPSS version 25.
Table 2. Objectives for the evaluation analysis.

<table>
<thead>
<tr>
<th>Objective 1: To describe food safety training participants’</th>
<th>Objective 2: To determine if differences exist in groups pre and post test scores on</th>
</tr>
</thead>
<tbody>
<tr>
<td>Personal hygiene behavior</td>
<td>Personal hygiene behavior</td>
</tr>
<tr>
<td>Home kitchen production area food safety behavior</td>
<td>Home kitchen production area food safety behavior</td>
</tr>
<tr>
<td>Food ingredients selection, storage, and preparation behavior</td>
<td>Food ingredients selection, storage, and preparation behavior</td>
</tr>
<tr>
<td>Intention to use safe food practices</td>
<td>Intention to use safe food practices</td>
</tr>
<tr>
<td>Perceived behavioral control of the food preparation and storage environment</td>
<td>Perceived behavioral control of the food preparation and storage environment</td>
</tr>
<tr>
<td>Perceived social pressures to use safe food practices</td>
<td>Perceived social pressure to use safe food practices</td>
</tr>
<tr>
<td>Attitude towards food safety before and after participating in the training</td>
<td>Attitude toward food safety</td>
</tr>
</tbody>
</table>

Results

Descriptive statistics for pre-test, post-test, and 6-8 week follow up can be seen in tables 3, 4, and 5 respectively. In all series of surveys, all constructs except for attitude had a mean of 5 or higher, indicating that participants had positive feelings of identifying with the “agree”
response. The questions asked were within the constructs of behavior towards food ingredients, preparation environment, and personal preparation, intention, perceived behavioral control, and social norms. Attitude scores for all surveys had a mean score of 4 or higher, indicating that participants had slightly less positive attitude, responding to the attitude question as “slightly agree”.

**Table 3.** Mean ± Standard Deviation (scale 1-6) for seven constructs modeled after the Theory of Planned Behavior, used to evaluate participants prior (pre-test) to the food safety training.

<table>
<thead>
<tr>
<th>Construct Evaluated</th>
<th>Mean ± Standard Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Behaviors Towards- Food Ingredients (n=49)</td>
<td>5.66 ± 0.70</td>
</tr>
<tr>
<td>Behaviors Towards- Preparation Environment (n=49)</td>
<td>5.63 ± 0.46</td>
</tr>
<tr>
<td>Behaviors Towards- Personal Preparation (n=49)</td>
<td>5.49 ± 0.75</td>
</tr>
<tr>
<td>Intention (n=49)</td>
<td>5.71 ± 0.84</td>
</tr>
<tr>
<td>Perceived Behavioral Control (n=49)</td>
<td>5.40 ± 0.52</td>
</tr>
<tr>
<td>Social Norms (n=48)</td>
<td>5.80 ± 0.38</td>
</tr>
<tr>
<td>Attitude (n=49)</td>
<td>4.57 ± 0.60</td>
</tr>
</tbody>
</table>
Table 4. Mean ± Standard Deviation (scale 1-6) for seven constructs modeled after the Theory of Planned Behavior, used to evaluate participants immediately after (post-test) to the food safety training (n=51).

<table>
<thead>
<tr>
<th>Construct Evaluated</th>
<th>Mean ± Standard Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Behaviors Towards- Food Ingredients</td>
<td>5.91 ± 0.22</td>
</tr>
<tr>
<td>Behaviors Towards- Preparation Environment</td>
<td>5.84 ± 0.34</td>
</tr>
<tr>
<td>Behaviors Towards- Personal Preparation</td>
<td>5.76 ± 0.52</td>
</tr>
<tr>
<td>Intention</td>
<td>5.81 ± 0.63</td>
</tr>
<tr>
<td>Perceived Behavioral Control</td>
<td>5.71 ± 0.43</td>
</tr>
<tr>
<td>Social Norms</td>
<td>5.91 ± 0.24</td>
</tr>
<tr>
<td>Attitude</td>
<td>4.66 ± 0.69</td>
</tr>
</tbody>
</table>
Table 5. Mean ± Standard Deviation (scale 1-6) for seven constructs modeled after the Theory of Planned Behavior, used to evaluate participants 6-8 weeks after (6-8-week follow-up) to the food safety training.

<table>
<thead>
<tr>
<th>Construct Evaluated</th>
<th>Mean ± Standard Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Behaviors Towards- Food Ingredients (n=29)</td>
<td>5.85 ± 0.31</td>
</tr>
<tr>
<td>Behaviors Towards- Preparation Environment (n=28)</td>
<td>5.70 ± 0.42</td>
</tr>
<tr>
<td>Behaviors Towards- Personal Preparation (n=28)</td>
<td>5.71 ± 0.44</td>
</tr>
<tr>
<td>Intention (n=28)</td>
<td>5.84 ± 0.36</td>
</tr>
<tr>
<td>Perceived Behavioral Control (n=28)</td>
<td>5.46 ± 0.50</td>
</tr>
<tr>
<td>Social Norms (n=28)</td>
<td>5.75 ± 0.37</td>
</tr>
<tr>
<td>Attitude (n=28)</td>
<td>4.39 ± 0.48</td>
</tr>
</tbody>
</table>

Participants were divided into groups based on the location that they attended the training. Results in table 6 show the mean ± the standard deviation for group one responses between the pre-test and post-test. Participants in group one showed no significant differences between any testing time responses, except in behaviors towards personal preparation between the pre-test and post-test time, \( F=3.71, \text{df}_{\text{between}}= 2, \text{df}_{\text{within}}= 40 \). In this construct between the pre-test and post-test, participants mean response in group one increased by 0.35, \( p = 0.03 \). All other construct for group one participants were not significantly different. Mean responses, although
not significant, did increase in all constructs between the pre-test and post-test periods. Due to low response rates, no 6-8-week follow-up data was analyzed for variation between groups one, two, and three but was analyzed for all participants.

**Table 6.** Mean ± Standard Deviation (scale 1-6) based on participant location (designated as group one) between pre-test and post-test within constructs of the evaluation (p < 0.05).

<table>
<thead>
<tr>
<th></th>
<th>Pre-test (n=17)</th>
<th>Post-test (n=16)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Behaviors Towards Food Ingredients</td>
<td>5.79 ± 0.31</td>
<td>5.97 ± 0.09</td>
</tr>
<tr>
<td>Behaviors Towards Preparation</td>
<td>5.74 ± 0.36</td>
<td>5.95 ± 0.14</td>
</tr>
<tr>
<td>Environment</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Behaviors Towards Personal Preparation*</td>
<td>5.55 ± 0.49</td>
<td>5.90 ± 0.20</td>
</tr>
<tr>
<td>Intention</td>
<td>5.76 ± 0.97</td>
<td>6.00 ± 0.00</td>
</tr>
<tr>
<td>Perceived Behavioral Control</td>
<td>5.58 ± 0.43</td>
<td>5.84 ± 0.46</td>
</tr>
<tr>
<td>Social Norms</td>
<td>5.79 ± 0.42</td>
<td>6.00 ± 0.00</td>
</tr>
<tr>
<td>Attitude</td>
<td>4.81 ± 0.69</td>
<td>4.85 ± 0.91</td>
</tr>
</tbody>
</table>

*p < 0.05

Results in table 7 show the mean ± standard deviation for group two responses between the pre-test and post-test. Participants in group two showed no significant differences between any testing time responses or constructs, however the mean response did increase from pre-test to post-test, except for intention and attitude constructs.
Table 7. Mean ± Standard Deviation (scale 1-6) based on participant location (designated as group two) between pre-test and post-test, within constructs of the evaluation, p < 0.05.

<table>
<thead>
<tr>
<th></th>
<th>Pre-test (n=15)</th>
<th>Post-test (n=16)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Behaviors Towards-</td>
<td>5.36 ± 1.15</td>
<td>5.84 ± 0.31</td>
</tr>
<tr>
<td>Food Ingredients</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Behaviors Towards-</td>
<td>5.47 ± 0.62</td>
<td>5.83 ± 0.30</td>
</tr>
<tr>
<td>Preparation Environment</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Behaviors Towards-</td>
<td>5.27 ± 1.09</td>
<td>5.69 ± 0.48</td>
</tr>
<tr>
<td>Personal Preparation</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Intention</td>
<td>5.81 ± 0.39</td>
<td>5.76 ± 0.41</td>
</tr>
<tr>
<td>Perceived Behavioral</td>
<td>5.20 ± 0.58</td>
<td>5.52 ± 0.52</td>
</tr>
<tr>
<td>Control</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Social Norms</td>
<td>5.76 ± 0.41 (n=14)</td>
<td>5.86 ± 0.31</td>
</tr>
<tr>
<td>Attitude</td>
<td>4.40 ± 0.43</td>
<td>4.36 ± 0.33</td>
</tr>
</tbody>
</table>

Results in table 8 show the mean ± the standard deviation for group three responses between the pre-test and post-test. Participants in group three showed significant differences in mean response between the pre-test and post-test testing time and within the construct of perceived behavioral control, F=3.87, df\text{between}= 2, df\text{within}= 46. Scores in this construct increased by 0.38, p = 0.03 All other construct were not significantly different between the pre-test or post-test, but mean responses did increase between the two testing times.
Table 8. Mean ± Standard Deviation (scale 1-6) based on participant location (designated as group three) between pre-test and post-test, within constructs of the evaluation, \( p < 0.05 \).

<table>
<thead>
<tr>
<th></th>
<th>Pre-test (n=15)</th>
<th>Post-test (n=16)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Behaviors Towards Food Ingredients</strong></td>
<td>5.78 ± 0.34</td>
<td>5.91 ± 0.19</td>
</tr>
<tr>
<td><strong>Behaviors Towards Preparation Environment</strong></td>
<td>5.68 ±0.37</td>
<td>5.76 ± 0.47</td>
</tr>
<tr>
<td><strong>Behaviors Towards Personal Preparation</strong></td>
<td>5.63 ± 0.60</td>
<td>5.70 ± 0.70</td>
</tr>
<tr>
<td><strong>Intention</strong></td>
<td>5.56 ± 1.00</td>
<td>5.69 ± 0.95</td>
</tr>
<tr>
<td><strong>Perceived Behavioral Control</strong></td>
<td>5.39 ± 0.52</td>
<td>5.78 ± 0.23</td>
</tr>
<tr>
<td><strong>Social Norms</strong></td>
<td>5.82 ± 0.34</td>
<td>5.87 ± 0.28</td>
</tr>
<tr>
<td><strong>Attitude</strong></td>
<td>4.47 ± 0.58</td>
<td>4.74 ± 0.65</td>
</tr>
</tbody>
</table>

\( *p <0.05 \)

Results in table 9 show the mean response ± standard deviation for all the participants. Significant differences were observed between pre-test and post-test within the constructs of behaviors towards preparation environment, \( (F=3.45, \text{df}_{\text{between}}=2, \text{df}_{\text{within}}=125) \) and perceived behavioral control \( (F=5.74, \text{df}_{\text{between}}=2, \text{df}_{\text{within}}=125) \). Mean responses rose by 0.21 \( (p=0.03) \) for the behaviors towards preparation environment, and by 0.31\( (p=0.00) \) for perceived behavioral control, between the pre-test and post-test. All other constructs and testing time responses were not significantly different.
Table 9. Mean ± Standard Deviation (scale 1-6) based on all participant answers between pre-test, post-test, and 6-8-week follow-up, with in constructs of the evaluation, p < 0.05.

<table>
<thead>
<tr>
<th></th>
<th>Pre-test (n=49)</th>
<th>Post-test (n=51)</th>
<th>6-8-week follow-up (n=28)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Behaviors Towards Food Ingredients</td>
<td>5.66 ± 0.70</td>
<td>5.91 ± 0.22</td>
<td>5.85 ± 0.31 (n=29)</td>
</tr>
<tr>
<td>Behaviors Towards Preparation Environment</td>
<td>5.63 ± 0.46 *</td>
<td>5.84 ± 0.34 *</td>
<td>5.70 ± 0.42</td>
</tr>
<tr>
<td>Behaviors Towards Personal Preparation</td>
<td>5.49 ± 0.75</td>
<td>5.76 ± 0.52</td>
<td>5.71 ± 0.44</td>
</tr>
<tr>
<td>Intention</td>
<td>5.71 ± 0.84</td>
<td>5.81 ± 0.63</td>
<td>5.84 ± 0.36</td>
</tr>
<tr>
<td>Perceived Behavioral Control</td>
<td>5.40 ± 0.52 *</td>
<td>5.71 ± 0.43 *</td>
<td>5.46 ± 0.50</td>
</tr>
<tr>
<td>Social Norms</td>
<td>5.80 ± 0.39</td>
<td>5.91 ± 0.24</td>
<td>5.75 ± 0.37</td>
</tr>
<tr>
<td>Attitude</td>
<td>4.57 ± 0.60 (n=48)</td>
<td>4.66 ± 0.69</td>
<td>4.39 ± 0.48</td>
</tr>
</tbody>
</table>

*p <0.05

Discussion

The results in table 3, 4, and 5 show that overall all participants have a high mean response to the constructs with all questions except attitude having a mean of 5 or higher and attitude having a mean of 4 or higher for all testing times. This means that participants have positive feelings towards the constructs including the behaviors towards food ingredients, the preparation environment, and personal preparation, intentions, perceived behavior control, social norms, and attitude. Between testing times (pre-test and post-test) mean scores increased over all constructs, all though the increases are not significant, this does tell researchers that the training
may have helped participants felt more positive about food safety and Iowa laws, leading to their attitudes in the post-test (immediately after the training) to be higher than their pre-test responses.

Although the training had a seemingly (not significant) positive impact of participants (table 4), after time has passed (table 5) the responses returned to the initial levels like those seen prior to the training (table 3), or slightly lower than at the post-test testing time. This shows researchers that although the training had good short-term effects on the participants, the long-term effects were not observed. This type of effect could be due to the strength of attitudes. Maio and Haddock 2015, discuss the importance that the strength of attitudes has on the longevity of the attitude. The authors state that strong attitudes are “persistent over time, resistant to change, likely to influence information processing, and likely to predict behavior” (Maio & Haddock, 2015, p. 9). Throughout the evaluation, mean attitude responses averaged no higher than 4.66 (table 4), indicating to researchers that while the attitudes were positive, they were not strong such as a mean response of 5.00 to 6.00 may have reflected. The strength of attitudes or lack thereof, may reflect why there was not a long-term effect of behaviors (Maio & Haddock, 2015).

The results in table 6 show the response means within in group one for all constructs and all testing times. The results show a significant difference in the scores between the pre-test and post-test scores with in the construct of behaviors towards personal preparation behavior which are like personal hygiene. This significant difference in scores would suggest that the training had a positive immediate impact on participants personal preparation behavior. The results in table 7 show that there is no significant difference in any of the constructs measured at any of the times for the participants in group 2. Responses within this group are like those of the other two groups, there was just no significant difference observed between the testing times. This tells
researchers that although the responses are positive (mean of 5 or higher and 4 or higher for attitude) there were no changes in the participants from before the training or immediately after the training.

Participants in group 3 (table 8) showed significant differences in responses between the pre-test and the post-test, in the perceived behavioral control. This indicates that participants felt more positive after the training then before the training, about being able to achieve some food safety practices. For example, participants were asked if “using a three compartment sink to wash, rinse, and sanitize my [their] dishes and utensils is possible for me [them] to do.” While some participants may have a three-compartment sink, others may not and understanding their control on achieving this practice is important to consider. Participants may have felt that prior to the training, using a three-compartment sink was not possible for them to use, due to space concerns or since their kitchens may only have 1 or 2 sink compartments currently. However, after the training where educators discuss alternative options to “create your own three-compartment sink”, participants may have felt that using an alternative was something that they could achieve and control.

For all participant responses (table 9), there were significant differences observed within the constructs of preparation environment and perceived behavioral control. Preparation environment refers to sanitizing, cleaning, using food grade materials, excluding pets, and the overall state of the kitchen where food is being prepared. These differences again suggest that participants had an increase in positive responses to the construct after receiving the training. These results are not surprising due to the focus and amount of material presented to participants on these areas. Several chapter (modules) of the training program were dedicated to the proper methods to prepare the kitchen for making food. The training identified practices within
commercial and retail food manufacturing facilities that are difficult for home-based food operators to achieve in the home setting and provide alternatives or a solution to incorporate those same large-scale practices, into the home operation, such as the three-compartment sink example listed above.

However, all other constructs displayed no significant differences and there were no differences between the 6-8-week follow-up and the pre-test and post-test responses in the constructs that did have significant differences (table 9). This suggests that once again the long-term positive outlook that the participants had immediately after the trainings, is not maintained for a longer period after the training. This could once again be due to the lack of strong attitudes within participants, but could also be caused by an effect called “persuasion appeal” where attitude change is observed “immediately after message presentation” (Maio & Haddock, 2015, p. 273). This reflects what the results indicate, that immediately after the information was presented in the training, the responses increased.

**Conclusion**

The results show researchers that while there are some significant differences in the responses of participants between groups and all participants from before the training to immediately after the training, many of the changes were not long-term and across many of the constructs. Educators and researchers should aim to make the positive behaviors, intentions, attitudes, perceived behavioral control, and social norms increase not only immediately after the training but long-term, through altering the training to focus more on behavioral and attitude change. Participants did have overwhelming positive views of all constructs throughout all evaluations, but observational data may need to be collected to determine if in fact the participants positive views carry-over into positive food safety actions.
References


CHAPTER 4. CONCLUSION: DEVELOPMENT AND ASSESSMENT OF A PILOT FOOD SAFETY TRAINING FOR EXEMPT HOME FOOD OPERATIONS AND HOME BAKERIES, IN IOWA.

Throughout the need’s assessment evaluation and the program development and evaluation, the goal for this project was to disseminate research-based information to home-based food operations in the state of Iowa and to determine if the participant’s behaviors and attitudes would be positively changed. The needs assessment was developed and used to give researchers a starting point to design a curriculum that was specifically targeted to the home-based food operations. The evaluation tool was effective in allowing researchers to identify areas within the training that were successful and the areas that need to be strengthened or re-evaluated to improve the training and improve participant behavior and attitude towards food safety and Iowa laws. The evaluation also showed that participants initially had positive views of food safety behaviors, intentions, social norms, and attitudes and those positive views were maintained throughout the evaluation period.

Changes to the curriculum and to the approach of delivery of the training need to be considered to improve participant behavior and attitude in the areas identified in the Theory of Planned behavior. An online format or a hybrid style, online modules and traditional in class modules, assessment tools, and activities should be considered to improve the training. The target audience of home bakers and exempt home food operations should be expanded to include farmers’ market managers to incorporate all types of people within the trainings. The evaluation proves to be an effective tool to determine the behaviors, intentions, and attitudes of the participants in relation to what is covered in the training.
APPENDIX A. NEEDS ASSESSMENT IRB DETERMINATION

Date: 12/8/2017
To: Leah Gilman
2312 Food Sciences

From: Office for Responsible Research

Project Title: Evaluation of Needs Assessment for Exempt Home Food Operations and Home Bakeries in Iowa

The Co-Chair of the ISU Institutional Review Board (IRB) has reviewed the project noted above and determined that the project:

☑ Does not meet the definition of research according to federal regulations.

☐ Is research that does not involve human subjects according to federal regulations.

Accordingly, this project does not need IRB approval and you may proceed at any time. We do, however, urge you to protect the rights of your participants in the same ways you would if IRB approval were required. For example, best practices include informing participants that involvement in the project is voluntary and maintaining confidentiality as appropriate.

If you modify the project, we recommend communicating with the IRB staff to ensure that the modifications do not change this determination such that IRB approval is required.
Iowa State University Extension and Outreach (ISUEO) hired Dr. Shannon Coleman to provide education to home food operation owners. These are individuals who prepare foods to sell from their homes or at farmers’ markets. Part of her work is to help them understand Iowa’s laws and regulations regarding sales and food safety practices for foods produced at home.

We invite you to take this survey to help ISUEO better understand your needs as a current or potential home food operation owner. The survey will take 5 to 10 minutes to complete. Your answers will be confidential, meaning we will report only aggregated results and will not share your individual answers. You may skip any question you do not want to answer. At the end of the survey we invite you to enter a drawing for 4, $25 gift cards. The contact information you share will not be linked to the answers you gave on the survey.

Please choose the statement that best describes the stage of your Home Food Operation:

I am thinking about starting to sell foods produced at home but have not yet decided if I will.

I am planning to start selling foods produced at home but have not yet begun.

I have already started selling foods produced at home.

What foods are you considering making, planning to make, or already making?

What do you think? These questions help us measure your knowledge of food safety and related regulations.

Foods that need to be refrigerated should be kept at or below what temperature? (Please choose one.)
Please answer true or false for the following statements to the best of your ability:

<table>
<thead>
<tr>
<th>Statement</th>
<th>True</th>
<th>False</th>
</tr>
</thead>
<tbody>
<tr>
<td>The following are all considered major allergens: Peanuts, Soybeans, Milk, Eggs, Fish, Shellfish, Tree Nuts, and Wheat.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>To sell a refrigerated baked goods, such as a cheesecake, at a farmers’ market, the vendor needs a food license and inspection.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Potentially hazardous food products are defined as foods that require temperature control.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Whole, uncut fruits and vegetables, baked goods (non-potentially hazardous), honey, fresh shell eggs and other non-potentially hazardous foods can be sold at farmers’ markets without a food license.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Only licensed vendors are required to display food allergen information on/near products.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Please rate how confident you feel regarding the following statements, where 1= I am sure I could NOT do it and 5= I am sure I could do this. (Circle one answer in each line.)

<table>
<thead>
<tr>
<th>Statement</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>Not Applicable</th>
</tr>
</thead>
<tbody>
<tr>
<td>I can follow the laws and regulations required by the State of Iowa for my home food operation.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>N/A</td>
</tr>
<tr>
<td>I can label food products that I sell in accordance with what is required by the law.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>N/A</td>
</tr>
<tr>
<td>I can accurately determine the shelf-life of my product(s).</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>N/A</td>
</tr>
<tr>
<td>I can fill out the application and obtain water tests to apply for a license for my kitchen, if required.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>N/A</td>
</tr>
<tr>
<td>I can arrange my point of sale in a way that will protect the safety of foods I have made.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>N/A</td>
</tr>
</tbody>
</table>

Food should be stored at least ____________ inches off the floor? (Please choose one answer.)
Proper hand washing procedures include using clean running warm water, soap, rubbing hands together for _______ seconds, rinsing, and drying thoroughly. (Please select the correct answer to fill in the blank.)

- 5-10 seconds
- 10-15 seconds
- 15-20 seconds
- 20-25 seconds
- 25-30 seconds

Food safety trainings

Which, if any, ISU Extension and Outreach food safety trainings have you taken? (Choose all that apply.)

- ServSafe®
- Farmers’ Market Food Safety Training
- Market Ready
- None
- Other (please specify) ___________________

Demographics The following information will help us determine if we are reaching a diversity of people.

What is your age? _______ years

What is your ethnic background?

- African American or Black
- American Indian or Alaska Native
- Asian and Pacific American
- White
- Islander
- Other (please specify)
- Hispanic or Latino/a
- Multi-ethnic
- Prefer not to answer

Final Questions

In the winter of 2017-18, Dr. Coleman will launch a pilot Home Food Operation short course on food safety and Iowa’s regulations regarding home food operations. Based on the outcomes of the pilot course, she will later launch a course open to everyone. Are you interested in participating in the pilot phase of the course?

Yes. IF YES, please provide your contact information below.

No.
Would you like to be entered the drawing for one of the 4, $25 gift cards?
Yes. If YES, please provide your contact information below.
No.

Optional: Please share your name and contact information below. (If you share this information, we will protect your confidentiality by not sharing your individual answers to the survey. We will not share your contact information with anyone else.)

Name: __________________________________________________________

Email: __________________________________________________________

Phone: _________________________________________________________

Alternatively, you can enter the drawing online at: https://iastate.qualtrics.com/SE/?SID=SV_by28dxAG9uRt9ad
APPENDIX C. TRAINING EVALUATION IRB DETERMINATION

IOWA STATE UNIVERSITY
OF SCIENCE AND TECHNOLOGY

Date: 1/29/2018
To: Leah Gilman
2312 Food Sciences

CC: Dr. Shannon Coleman
2545 Food Sciences Building

Dr. Melissa Cater
125 JC Miller, Baton Rouge, LA 70830

From: Office for Responsible Research

Title: Exempt Home Food Operation and Home Bakery Pilot Workshop Evaluation

IRB ID: 18-014

Study Review Date: 1/29/2018

The project referenced above has been declared exempt from the requirements of the human subject protections regulations as described in 45 CFR 46.101(b) because it meets the following federal requirements for exemption:

- (2) Research involving the use of educational tests (cognitive, diagnostic, aptitude, achievement), survey or interview procedures with adults or observation of public behavior where
  - Information obtained is recorded in such a manner that human subjects cannot be identified directly or through identifiers linked to the subjects; or
  - Any disclosure of the human subjects' responses outside the research could not reasonably place the subject at risk of criminal or civil liability or be damaging to their financial standing, employability, or reputation.

The determination of exemption means that:

- You do not need to submit an application for annual continuing review.
- You must carry out the research as described in the IRB application. Review by IRB staff is required prior to implementing modifications that may change the exempt status of the research. In general, review is required for any modifications to the research procedures (e.g., method of data collection, nature or scope of information to be collected, changes in confidentiality measures, etc.), modifications that result in the inclusion of participants from vulnerable populations, and/or any change that may increase the risk or discomfort to participants. Changes to key personnel must also be approved. The purpose of review is to determine if the project still meets the federal criteria for exemption.

Non-exempt research is subject to many regulatory requirements that must be addressed prior to implementation of the study. Conducting non-exempt research without IRB review and approval may constitute non-compliance with federal regulations and/or academic misconduct according to ISU policy.

Detailed information about requirements for submission of modifications can be found on the Exempt Study Modification Form. A Personnel Change Form may be submitted when the only
APPENDIX D. PRE, POST, AND 6-8 WEEK FOLLOW-UP EVALUATION SURVEY

**Instructions:** Please complete the following survey and consider each question in relation to selling food to the public.

<table>
<thead>
<tr>
<th>Food Ingredients Items</th>
<th>Strongly Disagree</th>
<th>Disagree</th>
<th>Slightly Disagree</th>
<th>Slightly Agree</th>
<th>Agree</th>
<th>Strongly Agree</th>
</tr>
</thead>
<tbody>
<tr>
<td>I choose high quality sources of ingredients.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I store perishable ingredients in the refrigerator.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I store non-perishable ingredients in a cupboard or pantry.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I wash produce before using it.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Preparation Environment Items</td>
<td>Strongly Disagree</td>
<td>Disagree</td>
<td>Slightly Disagree</td>
<td>Slightly Agree</td>
<td>Agree</td>
<td>Strongly Agree</td>
</tr>
<tr>
<td>I clean surfaces with a sanitizer before preparing foods.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I do not allow pets in the food production area (kitchen).</td>
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<tr>
<td>I do not allow sick people in the food production area (kitchen).</td>
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<tr>
<td>I prevent contamination of foods with allergens.</td>
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</tr>
<tr>
<td>Personal Preparation Items</td>
<td>Strongly Disagree</td>
<td>Disagree</td>
<td>Slightly Disagree</td>
<td>Slightly Agree</td>
<td>Agree</td>
<td>Strongly Agree</td>
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<tr>
<td>I wash my hands when changing food preparation tasks.</td>
<td>Strongly Disagree</td>
<td>Disagree</td>
<td>Slightly Disagree</td>
<td>Slightly Agree</td>
<td>Agree</td>
<td>Strongly Agree</td>
</tr>
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<td>-----------------------------------------------------</td>
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<tr>
<td>I pull back or restrain my hair when preparing food.</td>
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<tr>
<td>I do not wear jewelry when preparing food.</td>
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</tr>
</tbody>
</table>

**Intention Items**

<table>
<thead>
<tr>
<th>I will use safe food practices.</th>
<th>Strongly Disagree</th>
<th>Disagree</th>
<th>Slightly Disagree</th>
<th>Slightly Agree</th>
<th>Agree</th>
<th>Strongly Agree</th>
</tr>
</thead>
<tbody>
<tr>
<td>I intend to use safe food practices.</td>
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<tr>
<td>I expect to use safe food practices.</td>
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<tr>
<td>I plan to use safe food practices.</td>
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<tr>
<td>I try to use safe food practices.</td>
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</tbody>
</table>

**PBC Items**

<table>
<thead>
<tr>
<th>Keeping pets out of the food production area (kitchen) is possible for me to do.</th>
<th>Strongly Disagree</th>
<th>Disagree</th>
<th>Slightly Disagree</th>
<th>Slightly Agree</th>
<th>Agree</th>
<th>Strongly Agree</th>
</tr>
</thead>
<tbody>
<tr>
<td>Keeping sick people from entering the food production area (kitchen) is possible for me to do.</td>
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<tr>
<td>Using a three compartment sink to</td>
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<tr>
<td>Wash, rinse, and sanitize my dishes and utensils is possible for me to do.</td>
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<tr>
<td>Having adequate space to safely prepare food is possible for me to do.</td>
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<tr>
<td>Having adequate storage space to store perishable products in the refrigerator is possible for me to do.</td>
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<tr>
<td>Having adequate storage space to store non-perishable products in the cupboard or pantry is possible for me to do.</td>
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<tr>
<td>Cleaning with a sanitizer before and after preparation is possible for me to do.</td>
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</tr>
</tbody>
</table>

**Subjective Norms**

<table>
<thead>
<tr>
<th>Strongly Disagree</th>
<th>Disagree</th>
<th>Slightly Disagree</th>
<th>Slightly Agree</th>
<th>Agree</th>
<th>Strongly Agree</th>
</tr>
</thead>
</table>

My colleagues expect me to use safe food practices.

My family expects me to use safe food practices.
<table>
<thead>
<tr>
<th>Attitude Items</th>
<th>Strongly Disagree</th>
<th>Disagree</th>
<th>Slightly Disagree</th>
<th>Slightly Agree</th>
<th>Agree</th>
<th>Strongly Agree</th>
</tr>
</thead>
<tbody>
<tr>
<td>Choosing high quality ingredients is important to me.</td>
<td></td>
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<tr>
<td>I like storing perishable ingredients in the refrigerator.</td>
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</tr>
<tr>
<td>I like storing non-perishable ingredients in a cupboard or pantry.</td>
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</tr>
<tr>
<td>Washing produce before using it is unnecessary.</td>
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</tr>
<tr>
<td>Sanitizing before preparation is time consuming.</td>
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</tr>
<tr>
<td>Not allowing pets into the food production area (kitchen) is beneficial.</td>
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</tr>
<tr>
<td>Not allowing sick people into the food production area</td>
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</tbody>
</table>
(kitchen) is beneficial.

Preventing contamination of foods with allergens is important to me.

Handwashing is useful.

Pulling back or restraining my hair when preparing food is unnecessary.

Not wearing jewelry when preparing food is unnecessary.

Thank you!