ABSTRACT

Title of Document: FACTORS INFLUENCING MARYLAND FARMERS' ON-FARM PROCESSING LICENSE APPLICATION BEHAVIOR

Meryl Brooke Lubran, Doctor of Philosophy, 2010

Directed By: Dr. Mark Kantor
Department of Nutrition and Food Science

A 2005 regulation adopted by Maryland's state health department allowed farmers to sell foods processed in their home kitchen provided they complete an 8-hour food safety education course and apply for an on-farm processing license. Although more than 100 farmers completed the course, only 25 farmers applied for and received a license. The number of licenses granted has not met expectations and the health department is continually looking for ways to improve the program.

The objective of this study was to identify factors that may influence Maryland farmers' intentions to apply for a license as well as their actual license application behavior using a model which combines two dominant theoretical paradigms – the Health Belief Model and the Theory of Planned Behavior. To test the proposed model, a mail survey was administered to farmers who completed the training, farmers who have an on-farm license, and to a systematic random sample of other Maryland farmers (n = 745).

To explore reasons why the courses may not have encouraged more farmers to apply, a content analysis of the training presentations was conducted by two trained coders.

The usable survey response rate was 15% (n = 110). Using structural equation modeling, the proposed model, predicting farmers' intentions to apply for a license, was found to have marginal fit. Significant direct relationships were found between farmers' attitudes, subjective norms, and their intentions. Significant indirect relationships were found between farmers' beliefs of perceived benefits and barriers and their attitudes. Using rare events logistic regression to predict license obtainment, and a multiple regression and two correlation analyses to test the proposed indirect relationships, the same relationships were found to predict actual behavior as behavioral intentions. An additional significant relationship was found between perceived behavioral control and behavior. Few differences were found between mean responses of farmers who did and did not attend the training. The content analysis of training materials revealed few persuasive strategies were utilized during training. These findings provide insight into factors affecting farmers' decisions to apply for an on-farm license, and suggest relevant factors, concerns, and issues to address in future educational outreach efforts.

FACTORS INFLUENCING MARYLAND FARMERS' ON-FARM PROCESSING LICENSE APPLICATION BEHAVIOR

By

Meryl Brooke Lubran

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Advisory Committee:
Professor Mark Kantor, Chair
Professor Monique Turner
Professor David Cantor
Dr. Richard Forshee
Dr. Mickey Parish

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Dedication

This dissertation is dedicated to my grandpa, Daniel Frost (1928-2009) who always believed in me and who taught me what it means to really be successful.

Success
By Ralph Waldo Emerson

To laugh often and much;
to win the respect of intelligent people
and the affection of children;
to earn the appreciation of honest critics
and endure the betrayal of false friends;
to appreciate beauty; to find the best in others;
to leave the world a bit better,
whether by a healthy child,
a garden patch
or a redeemed social condition;
to know even one life has breathed easier
because you have lived.
This is to have succeeded.

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Table of Contents

List of Tables

List of Figures

Chapter 1: Introduction

The amount of land dedicated to farming in Maryland has been steadily declining. Between 1997 and 2007, there was a decrease of almost 150,000 acres of farmland (United States Department of Agriculture [USDA], 2007). Loss of farmland contributes to a number of problems including sprawl and its related environment impacts such as air and water pollution and habitat loss (Soule & Pierce, 2007). Surprisingly, at the same time that farmland has declined, the number of farms in Maryland has been increasing. Between 2002 and 2007, the number of Maryland farms increased by 636, representing a 5% gain. This trend is seen across the United States with newer farms tending to be smaller, having a more diversified production, and lower sales. In addition, farm operators tend to be younger and also work off-farm (USDA, 2007).

Small family farms are considered key to maintaining vibrant rural economies and to a wholesome, stable way of life. As such, many initiatives have been developed to help small family farms be successful. These initiatives include community-supported agriculture programs, the development of new farmers' markets, and opportunities for farmers to produce and sell value-added food products (P. Allen, FitzSimmons, Goodman, & Warner, 2003). In an effort to preserve farmland and nurture small family farms, the Maryland Department of Health and Mental Hygiene (MDHMH) promulgated the On-Farm Home Processing regulation (Code of Maryland Regulations [COMAR] 10.15.04.19) in early 2005. This rule allows farmers in Maryland to obtain an on-farm processing license to sell food processed in their home kitchen.

Although any individual can sell home-processed non-potentially hazardous foods such as jams and jellies at farmers markets within Maryland, the on-farm processing rule

greatly expands the types of products farmers are allowed to sell and the marketing opportunities available to them. Specifically, in addition to non-potentially hazardous foods, licensed farmers are allowed to sell raw finfish (except those are associated with histamine intoxication) and raw meat from animals which have been raised on the farm and slaughtered at a USDA inspected and regulated facility. Moreover, licensed farmers are allowed to sell their products at farmers markets, retail outlets, and restaurants intra- and inter-state. Despite large initial interest in the program and the opportunity to earn supplemental income, to date, only twenty-five farmers have applied for and received an on-farm processing license.

The failure of the licensing program is not only depriving farmers of a potential source of revenue, but also may be exposing consumers to serious food safety risks. A 2006 survey of farmers markets in Maryland found that many on-farm processed foods were being produced and sold without the proper licenses. Furthermore, many of these products, which included canned vegetables and jams and jellies, were found to be either adulterated or misbranded (Glotfelty, 2007). Foods produced on-farm and sold without the proper licenses have been associated with foodborne illness outbreaks in other states. For example, contaminated candy sold by an unlicensed Amish farm in Minnesota led to a 2002 outbreak of calicivirus (Norwalk-like virus) that sickened 48 people (Minnesota Department of Health, 2002).

Several reasons for the lack of license applications in Maryland have been suggested by those familiar with the program. These reasons include perception of too many regulatory hurdles, liability issues, license fees, and negative attitudes towards government agencies. Certain requirements in the regulation may also be preventing

farmers from applying for a license. One such requirement is that farmers have to agree to allow inspections of their facilities. Although the inspections are to be limited to areas and equipment used for food processing and are to be planned in advance, farmers may be concerned that violations will be found in other areas of the farm, particularly related to the water source (Kantor, 2006). Another potentially problematic requirement is that farmers are limited to earning $40,000 per year with this type of license, which may not be enough to outweigh the production costs. Yet another requirement, which may have been problematic originally, is that farmers had to complete a course given or approved by the MDHMH that provided a minimum of 8 hours of training in sanitation, cross-contamination controls, and food defense. In March 2005, the MDHMH partnered with faculty from the University of Maryland and other agencies to offer four face-to-face food safety training courses in different locations around the state, to reach the maximum number of farmers. Although a total of about 150 farmers attended the courses, only three attendees applied for and received a license within the succeeding 12-month period. The lack of applications suggests that the training courses may have dissuaded farmers from applying for a license.

The MDHMH, along with state legislators, is continually looking for ways to encourage more farmers to apply for on-farm processing licenses. For example, in 2006, the Maryland General Assembly amended the Health-General Article, Title 21, Subtitle 3, Section 21-308 of the Maryland Code, and reduced the cost of the license from $150 to $30. In addition, following the poor response to the 2005 training courses, the MDHMH decided to no longer require the 8-hours of food safety training. Instead, each farmer interested in applying for a license receives one-on-one training which is tailored to the

types of products the farmer plans to produce (Menikheim & Elkin, 2008). Although these changes have resulted in an increase (from 3 to 25) in the number of applications received, the number of licensees still has not met expectations. To encourage further increases in applications, the behavioral science literature suggests that the psychological, cultural, social, and environmental determinants of the farmers' current behavior need to be considered in any future communications to the farmers by MDHMH or other state agencies (Coleman & Roberts, 2005). The behavioral science literature may also be useful for informing future changes in the regulations.

Theories from the behavioral sciences can provide a framework for understanding the factors which are likely to influence farmers' intentions to participate in the program. These theories also introduce constructs which might be influencing the farmers' intentions to participate, but might not normally be considered by practitioners in the field of food safety. In particular, the Theory of Planned Behavior (TPB) (Ajzen & Fishbein, 1970) and the Health Belief Model (HBM) (Rosenstock, 1974) have proposed that attitudes, beliefs that shape attitudes, subjective norms, and perceived behavioral control are good predictors of consumers' intentions to perform food safety behaviors (Hanson & Benedict, 2002; Redmond & Griffith, 2005; Rimal & Real, 2003; Roseman & Kurzynske, 2006), foodservice workers' overt performance of food safety behaviors (Clayton & Griffith, 2008), and food businesses regulatory compliance behaviors (Henson & Heasman, 1998).

Moreover, in order to best predict behavior, several authors have suggested frameworks which synthesize the Theory of Planned Behavior and the Health Belief Model (Clayton & Griffith, 2008; Tones, 1990). In addition, models such as the Food

Hygiene Training Model (2010), have expanded upon these frameworks to directly address how the communication of messages during training can influence the process of food safety behavior change. Such paradigms can help understand how the 2005 food safety training courses may have influenced farmers' decisions to apply for an on-farm processing license. Moreover, the persuasion literature suggests that the effectiveness of training, particularly for the promotion of behaviors to mitigate risk, depends on a number of features of the message such as language (McGuire, 2000), use and type of evidence (Kazoleas, 1993), how the message is framed (Salovey & Williams-Piehota, 2004), and the emotion(s) evoked by the message (Nabi, 2002). There has been limited research, however, quantifying the use of such strategies during delivery of food safety messages and/or training (J. Gordon, 2003).

Thus, the goals of this research are: (1) to evaluate the efficacy of a model which integrates the TPB and the HBM to predict farmers' intentions to participate in Maryland's on-farm processing program as well as their license application behavior, (2) to identify the factors which are related to the farmers' intentions to participate in the on-farm processing program as well as their license application behavior, (3) to explore differences in the theoretical constructs between farmers who did and did not attend one of the 2005 training courses, and (4) to identify reasons why the 2005 training courses were not as successful in generating applications for licenses as expected. To explore the predictors of farmers' intentions to participate in Maryland's on-farm processing program as well as their license application behavior a survey was administered to farmers in the state of Maryland. A content analysis of the materials from the 2005 training course was

conducted to explore reasons why the courses may have dissuaded farmers from applying for a license.

Chapter 2: Literature Review

When studying persuasion and behavior change, McGuire (2000) suggests that there are five communication variables which should be considered: the source of the message, the message itself, the channel the message is delivered in, the receiver's characteristics, and the target behavior(s) being promoted. Each of these variables will be considered within the context of the promotion of on-farm processing and the food safety behaviors related to the on-farm processing of foods as well as within the context of regulatory compliance. First, the influential characteristics of the target audience which may serve as determinants of behavior will be considered. Two models in particular, the Theory of Planned Behavior and the Health Belief Model, have been found to be good predictors of a wide range of behaviors (Armitage & Conner, 2001; Chew, Palmer, & Kim, 1998; McCaul, Sandgren, O'Neill, & Hinsz, 1993; National Institutes of Health [NIH], 2005) including food safety and regulatory compliance behaviors (Clayton & Griffith, 2008; Forsythe, McArthur, & Holbert, 2006; Hanson & Benedict, 2002; Henson & Heasman, 1998; Redmond & Griffith, 2005; Rimal & Real, 2003; Roseman & Kurzynske, 2006). Next, theories incorporating the role of food safety training and decision-making will be addressed (Rennie, 1995; Seaman, 2010; Tones, 1990). Finally, the literature regarding effective message design strategies which include considerations of the source and the content of the message itself will be reviewed (Kazoleas, 1993; McGuire, 2000; Nabi, 2002; Salovey & Williams-Piehota, 2004).

The Theory of Planned Behavior

The Theory of Planned Behavior (TPB), an extension of the Theory of Reasoned Action (TRA), serves as a basic framework to predict behavior. The TPB posits that an individual's intentions to perform a behavior, which are assumed to mediate overt behavior, are a function of the individual's attitudes towards the behavior, their subjective norms, and their perceived behavioral control (see Figure 1) (Ajzen, Brown, & Carvajal, 2004; Ajzen & Fishbein, 1970; Ajzen & Madden, 1986). The components of the TPB are equivalent to those of the TRA except for the perceived behavioral control construct, which was added so that the TPB could predict and explain behaviors not completely under the volitional control of an individual.

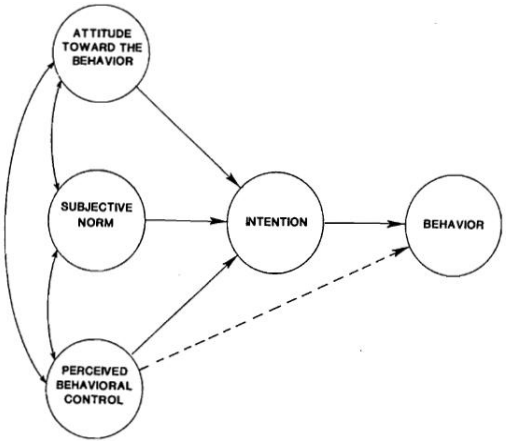

Figure 1. The Theory of Planned Behavior (Ajzen & Madden, 1986).

According to the TPB, attitudes refer to the degree to which a person has a favorable or unfavorable evaluation of the behavior in question. Furthermore, attitudes can be predicted accurately from knowledge of a person's beliefs about the behavior (termed behavioral beliefs) and their evaluation of those beliefs. Subjective norms refer

to an individual's perception of the behaviors expected of him by relevant or significant others. The reference groups or individuals whose expectations are perceived to be relevant may vary from situation to situation and may include friends, family, supervisors, or even society as a whole (Ajzen & Fishbein, 1970). Similar to attitudes, subjective norms are posited to be a function of an individual's beliefs as to the likelihood that important individuals approve or disapprove of performing the behavior (termed normative beliefs) and of the individual's motivation to comply with those beliefs. Finally, perceived behavioral control is defined as the perceived ease or difficulty of performing the behavior and is related to beliefs about the presence of factors that may further or hinder performance of the behavior (termed control beliefs) (Ajzen, 2002b; Ajzen & Madden, 1986). These factors may be internal to the individual such as skills, abilities, and knowledge, or external to the individual such as time, opportunity, or the cooperation of other people. Since these factors can interfere with the performance of a behavior regardless of an individual's intentions, perceived behavioral control is also posited to exert direct influence on behavior (Ajzen & Madden, 1986)

Reviews and meta-analyses have provided support for the TPB (Ajzen, 1991; Armitage & Conner, 2001; Hausenblas, Carron, & Mack, 1997). In a meta-analysis of 161 studies, Armitage and Conner (2001) found a strong multiple correlation between attitudes, subjective norms, and perceived behavioral control with behavioral intention, as well as a strong correlation between behavioral intention and behavior. The authors also found that the subjective norm-intention correlation was significantly weaker than the relationships between attitude and perceived behavioral control with intention, however,

Ajzen (1991) noted that the relative importance of each of the factors is expected to vary depending on the behavior and situation.

Although the TPB has been used to study many different types of behaviors (Armitage & Conner, 2001), few studies have tested it within the context of work-based food safety behaviors (Clayton & Griffith, 2008) and few, if any, have tested it within the context of regulatory compliance decisions. Clayton and Griffith (2008) used the TPB to understand hand hygiene practices of caterers in South Wales. The authors observed the hand hygiene practices of caterers and administered a survey instrument to measure the constructs in the TPB. The results of multiple regression analysis showed that intention and perceived behavioral control accounted for 34% of the variance in behavior (i.e., hand hygiene malpractices) and attitudes, subjective norms, and perceived behavioral control accounted for 24% of the variance in intentions. Furthermore, perceived behavioral control was a significant predictor of hand hygiene behavior and the construct explained more variance in behavior than intention or attitudes. These results provide support for the use of the TPB as a model for predicting work-based food safety behavior. To better understand the potential influence of each of the TPB constructs, with respect to the farmers' behavior towards the on-farm processing program, the literature associated with each construct will now be reviewed.

Attitudes

There is a large body of literature on the attitudes of farmers towards farming and the government. Although farmers tend to have positive attitudes towards supplementary income sources, including having a diversified farm, they also tend to be risk-averse and slow to accept unproven ideas and new technology. Reasons cited for farmers risk-

aversion include aversion of debt, farming succession, and having off-farm employment (Willock, Deary, Dent, & Grieve, 1999). Farmers in Europe report that the government and European Parliament interfere too much in farming (McGregor, Willock, & Deary, 1995; Willock et al., 1999). Farmers also tend to have negative attitudes towards legislation, citing that they are not equipped to deal with the administrative aspects (Willock et al., 1999).

In general, businesses tend to hold negative attitudes towards regulation. Reasons cited include cost and barriers to compliance such as increased inspections, lack of time, resources, and support (Kaplowitz & Ten Eyck, 2006; Yapp & Fairman, 2006). Some businesses do hold positive attitudes towards regulations to the extent that they can relieve consumers' concerns over safety and protect the business from legal liability and a bad public image (Kaplowitz & Ten Eyck, 2006; Robeck, 1996). Kaplowitz & Ten Eyck (2006) conducted a survey of 2,000 managers of food industry firms in Michigan (restaurants, producers, processors, wholesalers, and retailers) to determine their attitudes towards regulation and investigate factors which predict their attitudes. Of the 302 respondents, 71% felt that existing regulations addressing food safety were about right, 15% felt they were excessive, and 14% felt they were too loose. The number of employees in the business did not have a significant effect on opposition to regulation (measured by perceptions of the burden of regulations and whether the business wishes the government would do more to assure safe food); however, producers and processors were found to be substantially more opposed to regulation than other food related businesses.

With respect to farmers' and small businesses' attitudes towards food safety, the literature is more limited. One study in Canada found that farmers do not always have positive attitudes towards food safety, or think it is as important as other farming issues such as selling prices or the costs of inputs (Chapman, 2005). More research is clearly needed to better understand farmers' attitudes towards food safety and regulatory compliance related behaviors.

Subjective Norms

Subjective norms have been found to impact food choice (Vermeir & Verbeke, 2006) and the food safety behaviors of consumers (JC Gordon, 2002) and food service employees (Green & Selman, 2005). In a qualitative study of factors impacting food workers' and managers' safe food preparation practices, participants reported that management and coworker emphasis and attention towards hand-washing was a facilitator of this behavior. Participants also said that having managers and coworkers who emphasized safe food preparation practices facilitated the performance of food handling behaviors (Green & Selman, 2005).

There is limited research exploring the impact of social norms on the behavior of farmers, although results from a few studies suggest that social norms are likely to be influential. Sligo, Massey, and Lewis (2005) suggest that a shared awareness of common risk from such factors as the weather creates a unique sense of community. These authors used socio-spatial knowledge networks to create mental models of New Zealand dairy farmers' acquisition and use of information. The farmers reported having an average of 7.6 interpersonal sources (people named by respondents who were important

to them) of information, which provided such benefits as helping the farmers to look at problems from different angles, and to decide if a piece of information is trustworthy.

Additionally, Sligo and Massey (2007) found that when farmers become aware of the incompleteness of their own knowledge in situations of uncertainty, their perceived need to confer with others in similar situations is likely to be accentuated. The authors hypothesized that this tends to occur in situations where a moderate risk is increasing, and among persons who have a sense of their own self-efficacy. Finally, Maddox (2003) surveyed farmers in North Carolina and found that 83% reported family, friends, and neighbors as important sources of production related information.

Perceived Behavioral Control

The construct of perceived behavioral control has added significantly to the prediction of food choice (Sparks, Guthrie, & Shepherd, 1997; Tarkiainen & Sundqvist, 2005) and the performance of work-based food safety behaviors (Clayton & Griffith, 2008). In the study conducted by Clayton and Griffith (2008), in which they used the TPB to understand hand hygiene practices of caterers in South Wales, perceived behavioral control was found to have a direct effect on behavior as well as an indirect effect via intentions. Perceived behavioral control was considered as a composite of two measures: self-efficacy and perceived control.

There is some debate in the literature, however, as to whether the perceived behavioral control construct should be considered to be uni- or multi-dimensional. In the early tests of the TPB, which concerned students' class attendance, perceived behavioral control was measured using a series of questions such as "If I wanted to, I could easily attend this class session" (*extremely likely* to *extremely unlikely*); "For me to attend every

session of this class is" (*easy* to *difficult*); and "How much control do you have over whether you do or do not attend this class every session?" (*complete control* to *very little control*). Some scholars argue that these questions are measuring two distinct constructs such that items which measure ease or difficulty of performing a behavior measure self-efficacy, whereas items which measure perceived control measure controllability, and that these items may differentially affect dependent measures (Ajzen, 2002b; Sparks et al., 1997).

To directly test the argument that self-efficacy and controllability are distinct concepts within the perceived behavioral control construct, Sparks, Guthrie, & Shepherd (1997) applied the TPB to reducing consumption of red meat and French fries. Results of principal components analysis showed that items measuring perceived ease or difficulty and items measuring perceived controllability loaded on two different components. The authors also found that only measures of perceived ease or difficulty contributed independent predictive effects of respondents' behavioral intentions to reduce consumption of red meat and French fries.

Several other studies have provided support for the distinction of self-efficacy and controllability within the perceived behavioral control construct (Armitage & Conner, 1999; Terry & O'Leary, 1995). As a result, Ajzen (2002b) proposed a hierarchical model of the construct (see Figure 2). The hierarchical model suggests that although self-efficacy and controllability can be distinguished, they also should be correlated with each other. Although results of earlier studies suggest this relationship, the hierarchical model has yet to be tested empirically. More research is needed to understand how beliefs of

self-efficacy and control to perform a behavior are related to decision-making, particularly within the contexts of food safety and regulatory compliance.

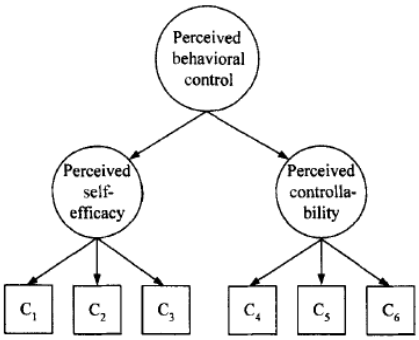

Figure 2. Hierarchical model of perceived behavioral control (Ajzen, 2002b).

Criticisms of the Theory of Planned Behavior

Despite the ability of the TPB, and the constructs identified in the theory, to predict food safety behaviors, a large proportion of variance in the model is often left unexplained, leaving researchers to suggest the necessity of including other variables in the model (Clayton & Griffith, 2008). Descriptive and moral norms, self-identity, affect, and constructs from the HBM such as perceived susceptibility and perceived severity have all been suggested as additional predictors of behavioral intentions (Armitage, Conner, & Norman, 1999; Clayton & Griffith, 2008; Terry, Hogg, & White, 1999). The literature is mixed in terms of the additional variance explained by these constructs for the prediction of food safety behaviors (Clayton & Griffith, 2008).

Clayton and Griffith (2008), in their application of the TPB to understand hand hygiene practices of caterers in South Wales, also included descriptive and moral norms (operationalized as perceptions of others performance of the behavior and moral obligations to perform the behavior respectively), self-identity (operationalized as concern for food safety and concern for others well-being) as additional predictors of

intentions to practice hand hygiene. In addition, they included the HBM variables - perceived susceptibility and perceived severity. Of these constructs, only descriptive norms were a significant predictor of intentions. The inability of the HBM variables to explain more variance in the model may be due to several factors. First, the authors did not include all of the six constructs in the HBM, each of which has been found to be important for predicting food safety behaviors (Forsythe et al., 2006; Hanson & Benedict, 2002). Second, the HBM constructs were posited to predict intentions. Within the TPB framework, such beliefs are proposed to act as antecedents to attitudes, subjective norms, and/or perceived behavioral control, indirectly effecting intentions (Ajzen, 1991). As a result, research is needed to test the addition of the HBM variables to the TPB as antecedents to the other constructs in the model. The literature supporting the addition of the HBM variables will now be reviewed.

The Health Belief Model

The Health Belief Model (HBM) was one of the first theories developed to predict individual response to, and utilization of, health screening and other preventative health services (Airhihenbuwa & Obregon, 2000; Janz & Becker, 1984; Rosenstock, 1974). The basic premise of the HBM was that preventative health behavior was a function of perceived threat (perceived susceptibility and perceived seriousness) and efficacy (perceived benefits and perceived barriers) of the recommended response (Chew et al., 1998; Rosenstock, 1974). Over the years the model has been expanded to include six basic factors that influence preventative behaviors (Janz & Becker, 1984; National Institutes of Health [NIH], 2005). These six factors include:

- *Perceived susceptibility*, or a person's beliefs about whether there is the possibility that one is at risk;
- *Perceived severity* of the consequences of the risk;
- *Perceived benefits* of performing the recommended behavior or preventative measure;
- *Perceived barriers* to the suggested actions such as cost, time, or inconvenience;
- *Cues to action,* such as a physician's advice, an advertisement, or a program that recommends the change in behavior; and
- *Self-efficacy,* or a person's perception of one's ability to successfully perform an action.

The model also identifies socio-demographic factors such as age, education, sex, race, and ethnicity that can affect an individual's perceptions of risk and thus influence one's health-related behaviors (Rosenstock, 1974). The HBM has been applied to many types of preventative health behaviors, including food safety practices (Airhihenbuwa & Obregon, 2000; Chew et al., 1998; Forsythe et al., 2006; Hanson & Benedict, 2002; Janz & Becker, 1984; Rimal & Real, 2003; Roseman & Kurzynske, 2006). Each of the six factors in the model has been shown to impact the performance of food safety behaviors and/or regulatory compliance.

Perceived Benefits

The perception of benefits has been found to be positively correlated with safe food-handling behaviors (Riggins, 2006) and regulatory compliance (Henson & Heasman, 1998). The benefits of utilizing food safety behaviors most frequently

mentioned by food handlers are that the food will be safer, people will be happier, and environmental conditions will be improved (Clayton, Griffith, Price, & Peters, 2002). Farmers, however, do not always recognize the benefits of food safety or think that food safety is as important as other farming issues such as selling prices or the costs of inputs (Chapman, 2005). This suggests that farmers are less likely to implement safe food-handling behaviors, particularly if they are associated with a high cost.

Henson & Heasman (1998) conducted a mail survey of technical directors from a variety of food manufacturers and retailers in the UK to understand the process by which food businesses choose to comply with legal requirements and regulations. Results of the survey suggested that food businesses also find it difficult to identify benefits to regulatory compliance. In addition, managers of food businesses, both large and small, reported that they would only comply with regulations once perceived benefits of compliance exceeded the perceived costs.

Perceived Barriers

In general, the perception of barriers tends to be negatively correlated with regulatory compliance (Henson & Heasman, 1998) as well as the performance of food safety behaviors (Clayton et al., 2002; Forsythe et al., 2006; Green & Selman, 2005). McArthur, Holbert, & Forsythe (2006) found that students who perceive fewer barriers to compliance also adopt significantly more safe handling practices for meat, fruit, and eggs. Food service workers' report a number of barriers to performing hand-washing during food preparation including sink accessibility, time pressure, worker motivation, effect on hands, and adequate resources (e.g., soap) (Green & Selman, 2005).

In terms of on-farm processing, three types of barriers to successful implementation of HACCP-based food safety programs for the on-farm processing of fruits and vegetables have been identified: (1) knowledge barriers - knowing about and understanding the program; (2) attitudinal barriers - agreeing with the principles of the program and believing their actions will have an impact on food safety; and (3) behavioral barriers such as time, resources, money and staff (Chapman, 2005; Luedtke, Chapman, & Powell, 2003; D. Powell, Bobadilla-Ruiz, Whitfield, Griffiths, & Luedtke, 2002). Time is also frequently cited as a barrier to performing food safety behaviors by food service workers (Clayton et al., 2002; Green & Selman, 2005). Yapp & Fairman (2006) identified several barriers which prevent regulatory compliance by small to medium size food enterprises. These barriers include lack of money, time, experience, support, interest, knowledge, and access to information.

Cues to Action

Cues to action have also been included as a factor in the HBM (Janz & Becker, 1984; Rosenstock, 1974). Cues may be internal to an individual such as a perception of an individual's own health, or external to an individual such as a physician's advice, an advertisement, or an educational program that recommends the change in behavior. Rosenstock (1974) notes testing the role of cues may be difficult, especially in retrospective settings outside of the laboratory, because respondents are unlikely to remember cues, particularly if exposure to the cue did not result in taking action.

Despite potential difficulties in measurement, cues to action have been found to be important motivators for food safety actions (Chapman, 2005; Hanson & Benedict, 2002; Maddox et al., 2003). For example, media cues and educational cues have been

positively correlated with safe food-handling behaviors in older adults (Hanson & Benedict, 2002). For farmers, interpersonal communication through on-site visits by food safety professions has been found to be effective in changing food safety behaviors and is a preferred channel of information delivery (Maddox et al., 2003). Chapman (2005) evaluated the Ontario Greenhouse Vegetable Growers' (OGVG) hazard analysis critical control point (HACCP)-based initiative to improve on-farm food safety and found that on-site visits by professional food safety coordinators (acting like extension resources) encouraged farmers to implement and maintain the program. The author also concluded that a variety of cues including on-site visits, phone calls, use of a website, letters, faxes and meetings should all be available to farmers to maximize the most impact of cues to action.

Perceived Susceptibility

Perceived susceptibility has been found to significantly impact the implementation of food safety behaviors. Food handlers who admit to not carrying out food safety behaviors perceive that there is a low risk of someone contracting foodborne illness from their business (Clayton et al., 2002). This lack of perceived susceptibility, or invulnerability, is termed optimistic bias and is frequently associated with the perception of food safety risks (Redmond & Griffith, 2005; Riggins, 2006; Weinstein, 1980, 1987). Often, people believe that hazards and educational messages only apply to others (Redmond & Griffith, 2005; Riggins, 2006; Shepherd, 1999). Interestingly, optimistic bias towards the safety of the food supply has also been found to correlate with opposition to food safety regulation (Kaplowitz & Ten Eyck, 2006).

Personal experience can reduce optimistic bias (Miles & Scaife, 2003; Parry, Miles, Tridente, Palmer, & South and East Wales Infectious Disease Group, 2004; Weinstein, 1987). For example, when an on-farm food safety program for Ontario greenhouse vegetable producers was evaluated, farmers who perceived their susceptibility to a foodborne illness outbreak to be low were also less likely to implement a food safety program. It was observed anecdotally that if producers had experienced incidents of foodborne illness in the past or had witnessed the effects of foodborne illness, their perceived susceptibility increased and they were more likely to implement food safety programs vigilantly (Chapman, 2005). These anecdotal reports are consistent with Weinstein's (1987) finding that the hazards that are most likely to elicit optimistic bias are those associated with the belief that if the problem has not yet appeared it is unlikely to occur in the future.

Perceived Severity

Perceived severity also impacts the implementation of food safety practices (Forsythe et al., 2006; Hanson & Benedict, 2002). One study that tested the ability of the HBM to predict safe food-handling practices of older adults found that perceived severity was one of the primary factors positively related to safe food-handling behaviors, in particular sanitation (Hanson & Benedict, 2002). The HBM has also been applied to students' food handling behaviors related to the purchase, preparation, and storage of meat, eggs, produce/juices, and dairy foods. Although the variables in the HBM did not explain a large amount of variance in students' barriers, the authors did find that students who perceived foodborne illness as more severe adopted significantly more safe handling

practices for meat than students who perceived foodborne illness as less severe (Forsythe et al., 2006; McArthur et al., 2006).

Self-efficacy

Perceived self-efficacy is believed to influence whether health behaviors will be initiated, the readiness to change, the degree of effort extended, and the persistence of the behavior (Byrd-Bredbenner et al., 2007). The construct of self-efficacy is measured by a person's beliefs as to whether or not one is capable of performing the behavior (Bandura, 1982; McCaul et al., 1993). When people feel efficacious, they are likely to perceive potential risks as challenges to be overcome, while those who lack efficacy typically interpret their vulnerability as predetermined and inevitable (Rimal & Real, 2003). This relationship has been found in the food safety literature. For example, consumers who report that they are confident in their abilities to perform food safety behaviors also report carrying out the necessary precautions during food preparation (Redmond & Griffith, 2005).

Additional Variables

More recent developments with the HBM model suggest that socio-demographic factors such as age, education, sex, race, and ethnicity have an effect on an individual's perceptions of risk and thus influence one's health-related behaviors (National Institutes of Health [NIH], 2005). In Kentucky, Roseman & Kurzynske (2006) reported differences in consumers' food safety handling practices according to gender, age, income level, education, and race. In the study, women and respondents with an advanced degree were more likely to exhibit safe food handling behaviors when handling raw meat and when using a cutting board. In another study, female undergraduate

students exhibited more safe food-handling practices for meats, raw eggs, and produce/juices compared to men (Forsythe et al., 2006). Safe food handling behaviors also have been found to vary according to socioeconomic status in South Wales (Redmond & Griffith, 2005).

The Role of Training in Behavior Change

For food handlers, training is the primary mechanism for communicating food safety risk information and is thus seen as one way to increase the performance of food safety behaviors. A review of 46 studies which investigated the effectiveness of food hygiene training, however, found mixed results in terms of improvements in behavior following food hygiene education (Egan et al., 2007). Although some studies reported improvements in inspection scores post-training (Kneller & Bierma, 1990), others found no significant improvements (Cook & Casey, 1979). In addition, Egan et al. (2007) reported that it was difficult to compare studies to identify potential moderating variables because of differences in methodologies and outcome measurements.

Traditional approaches to training have assumed that effective training should provide knowledge about food safety in order to promote behavior change. For example, the KAP model of health education posits that an individual's Practice (P) is related to their Attitudes (A) and Knowledge (K) (Rennie, 1995). Knowledge alone, however, has been found to be a poor predictor of food hygiene practice (S. C. Powell, Attwell, & Massey, 1997). As previously outlined, the TPB and HBM theorize that behavior change is influenced by a number of factors. Some theories have taken these other determinants into account when considering the role of training in behavior change. The Tones Action Model (1990), for example, conceptually incorporates the Theory of Reason Action, the

Health Belief Model, and the role of training in one framework. In this model, behavioral intentions are considered to be influenced by subjective norms, knowledge obtained from training which is mediated by the belief system (concern about adverse effects of current practices), and the motivational system (i.e., personal benefits/rewards of performing the behavior). The influence of behavioral intentions on the decision to perform the behavior is moderated by barriers (i.e., lack of skills, knowledge, and resources). This model also incorporates the role of habits in the ultimate maintenance of the behavior change.

Rennie (1995) redefined the Tones Action Model within the context of food safety education such that subjective norms (i.e., worksite norms rules) and knowledge obtained from a food hygiene training course influence beliefs about adverse effects of current food handling practices, which along with motivation to change (i.e., motivational elements in the company), influence behavioral intentions. Behavioral intentions directly influence behavior in this model, although this relationship is again considered to be moderated by barriers (i.e., skills to use cleaning equipment and workplace conditions such as availability of equipment).

Nieto-Montenegro, Brown, & LaBorde (2006) used a modified version of the Tones Action Model to develop a needs assessment for food safety educational materials for Hispanic workers in the mushroom industry in Pennsylvania. Observations, interviews, and focus groups were conducted in Spanish to better understand the factors in the model and triangulate results. Results indicated that the food workers had poor scores on a knowledge test, and that they had resentment towards restrictions on personal behaviors and misconceptions about cleaning and sanitizing, food spoilage, and foodborne illness. Although scores on interview questions indicated socially acceptable

agreement with good food safety practices, focus groups suggested that there was little social support to follow rules. In addition, most companies did not have an active incentive program to motivate employees to perform food safety behaviors and while there were physical resources available to support performance of behaviors, the degree of cleanliness of work sites varied by company. These findings highlight important factors which could be addressed in training materials to workers in the mushroom industry in order to better facilitate behavior change.

Seaman (2010) proposed an extension of the Tones Action Model in an attempt to take a more holistic approach to food hygiene training. The Food Hygiene Training Model includes three additional components - the evaluation stage, managerial components, and overall performance measures. The evaluation stage encompasses an evaluation of the needs of the food handler prior to training as well as an evaluation of the knowledge and skills gained after the training. The managerial components relate to the selection of the appropriate training for the needs of the employee and of the business, a choice which Seaman argues should take into consideration the cost, language, duration, location, style of delivery, certification, and relevance to work activities of the training program. The overall performance measures include the effect of food hygiene training on the individual food handler (which could be measured by observations of the food handler or knowledge tests) and the effect of food hygiene training on the organization (i.e., customer satisfaction surveys and laboratory bacteriological test results). These measures are considered to occur following the training, while the results are incorporated into the evaluation of the needs of the food handler.

Of the models just reviewed, the Food Hygiene Training Model is the only one to consider the role of the actual message contents when investigating factors that influence training effectiveness. Seaman (2010), suggests that the language used in the training should be at a level which facilitates understanding of the content. There are many more elements of language however, which can affect the persuasiveness of a message. As McGuire (2000) aptly points out, the style of language and in particular the use of figurative language (i.e., dramatization, imaginability, novelty, emphasis, oddity, etc.) can have an effect on the persuasiveness of communications. In fact, there are numerous persuasive message design strategies beyond the use of different styles of languages which could be used during food safety training to improve the effectiveness of the delivery of the message content. This is a factor often overlooked in the study of food safety training. Several message design strategies which have the potential to facilitate the promotion of behavior change during food safety training will now be reviewed.

Message Design Strategies

The communication strategy used to deliver persuasive content can influence its effectiveness (Kazoleas, 1993; Salovey & Williams-Piehota, 2004). Considering the behavioral determinants previously reviewed in the HBM and TPB, there are several message design strategies which could be effective at promoting food safety behaviors to food employees. These include using emotional appeals, evidence, and framing. In addition, a series of risk communication best practices have been put together which provide further guidance for communicating about risk.

Emotion

The previous discussion regarding the determinants of behavior presents a rational view of decision-making in that the Theory of Planned Behavior and Health Belief Model both suggest that individual's weigh their attitudes, beliefs, subjective norms, and perceptions of behavioral control before deciding whether or not to perform a behavior. There is another paradigm, however, which suggests that the processing of persuasive communications and decision-making also depends on the audience's affective or emotional state (Bless, Mackie, & Schwarz, 1992). Initially, research in this area focused on the influence of positive or negative affect on decision and choice. More recently, the study of the influence of discrete negative (e.g., anger, fear, sadness, and guilt) and positive (e.g., happiness, hope, pride, relief) emotions have been promoted as they have been found to have differential effects on decision making (Lerner & Keltner, 2000; Nabi, 2002).

There are different theories for how discrete emotions influence behavioral change (Lerner & Keltner, 2000; Nabi, 2002). Cognitive appraisal theories posit that a range of cognitive dimensions differentiate emotional experience and subsequent effects (Lerner & Keltner, 2000). According to cognitive appraisal theories, when a risk happens or a message about a risk is communicated, individuals appraise the risk and the patterns of appraisals elicited cause distinct emotions, which in turn cause distinct action tendencies and behaviors (Lazarus, 1991; Lerner & Keltner, 2000). Smith and Ellsworth (1985) identified six cognitive dimensions that best differentiate the distinct emotions. These dimensions are: certainty, control, responsibility, pleasantness, attentional activity, and anticipated effort.

Emotions may be intentionally evoked using messages which vary perceptions of these cognitive dimensions. Limited research, however, has addressed exactly how to design and construct emotional appeals (Nabi, 2002; O'Keefe, 2003; Witte, 1993). Furthermore, the emotion a risk communicator may choose to elicit via a message will depend on the distinct action tendencies and behaviors which would best mitigate risk. Thus, the cognitive dimensions which distinguish three negative emotions - fear, guilt, and anger, as well as the action tendencies and behaviors associated with each emotion will be reviewed.

Fear is one of the most thoroughly studied discrete emotions within the persuasion literature (Nabi, 2002). Fear is generally evoked in situations that are perceived as threatening to one's physical and psychological self and out of one's control (Lazarus, 1991; Witte, 1992). The perceived threat of a hazard generally depends on the severity of the threat as well as the susceptibility to the threat (Witte, 1993). Within the cognitive appraisal framework, fear is characterized by low certainty, low pleasantness, medium attentional activity, medium anticipated effort, low control, and medium responsibility (Lerner & Keltner, 2000). Individuals who feel fearful exhibit a tendency to escape from the threatening agent and engage in avoidance behaviors (Lazarus, 1991), unless perceptions of efficacy (self and response) are high, in which case individuals are motivated to protect themselves from the danger by performing adaptive behaviors (Witte, 1992). A meta-analysis of ninety-three fear appeal studies suggests that in general, fear is positively correlated with attitude and behavior change, although this depends on the intensity of the fear appeal (stronger fear appeals produce greater attitude and behavior change) and the presence of efficacy in the message (Witte & Allen, 2000).

Guilt, on the other hand, occurs when individuals perceive a violation of their own internal moral, ethical, or religious code (Lazarus, 1991). According to cognitive appraisal theory, guilt occurs when individuals perceive low pleasantness, moderate effort, moderate certainty, moderate attention, low situational control (vs. human control), and low other-responsibility (vs. self-responsibility) (C. A. Smith & Ellsworth, 1985). When people feel guilty, they to tend to want to make reparation of the harm and to seek punishment for their wrongdoing (Lazarus, 1991). The use of guilt appeals has been explored in the literature in the context of volunteerism and charitable contributions (Lindsey, 2005) as well as in the marketing domain for promoting the purchase of consumer items (Pinto & Priest, 1991).

The persuasiveness of guilt appeals has been found to depend on the strength of the guilt appeal itself and the strength of the emotion elicited (O'Keefe, 2002; Pinto & Priest, 1991; Turner & Underhill, 2009). The nature of this relationship is not clear, however (O'Keefe, 2002; Pinto & Priest, 1991; Turner & Underhill, 2009). Some authors, for example, have found that while moderate levels of guilt are positively correlated with attitude and behavior change, high levels of guilt may unintentionally arouse high levels of anger and, in turn, negatively correlate with attitudes and desired persuasive outcomes (Banas, Turner, & Fink, 2007; Nabi, 2002; Pinto & Priest, 1991). Other scholars have found that while high levels of guilt also arouse high levels of anger, these emotions do not always impede persuasive outcomes (Turner & Underhill, 2009). One explanation which has been posited for the differences in these findings is that persuasion may depend on whether guilt is aroused or anticipated, with aroused guilt leading having a curvilinear relationship with behavioral intention and anticipated guilt

having a linear relationship (Turner & Underhill, 2009). More research is needed to better understand the relationship between guilt appeals and the performance of health protective behaviors.

Finally, anger has been found to arise when people feel as if they are being manipulated or their rights are being limited, or when they feel that there was a "demeaning offense against me and mine" (Lazarus, 1991). According to cognitive appraisal theory, angry individuals appraise a situation as having high certainty, low pleasantness, medium intentional activity and anticipated effort, and high control and high other-responsibility (Lerner & Keltner, 2000; C. A. Smith & Ellsworth, 1985). Individuals who feel angry tend to have highly focused attention and a desire to attack or get back at anger source (Lazarus, 1991). In addition, action tendencies of those who feel angry include being motivated to remove barriers that block goal attainment or to regain or maintain control of a threatening situation.

Invoking anger in an audience can be constructive (Turner, 2007), although there has been limited research of message-relevant anger in the persuasion and risk communication literature (Nabi, 2002). The Anger Activism Model posits that the extent to which people will process an anger-appeal depends on their perception of response and self-efficacy regarding the risk and the strength of their angry feelings (Turner, 2007). The model proposes four quadrants of outcomes as a result of the interaction between levels of perceived efficacy and levels of anger. According to the model, individuals who experience low levels of anger and low levels of efficacy will be "disinterested" and will engage in the least amount of cognitive processing and will not perform the behaviors being promoted. Individuals who experience low levels of anger and high levels of

efficacy will be "empowered", such that they will feel that something can be done to remedy the situation but they will not be willing to engage in behaviors because they do not perceive the situation to be of high importance. Individuals who experience high levels of anger and low levels of efficacy will be "angry" about the situation but will not perceive that anything can be done. As such, "angry" people will be unlikely to engage in high commitment behaviors. Finally, individuals who experience high levels of anger and high levels of efficacy will exhibit "activist" tendencies and will be the most likely to engage in high commitment behaviors.

Despite the recognition of the role of emotion in attitude and behavior change, there is little research investigating the role of affect or distinct emotions on the performance of food safety behaviors (Fischer, de Jong, de Jong, Frewer, & Nauta, 2005) and little, if any, on their role in regulatory compliance. Research is needed to understand whether fear, guilt, and/or anger may be effective at promoting the performance of food safety behaviors to food employees. An understanding of the emotions elicited by specific components of food safety messages is also needed.

Evidence

In general, the use of evidence, or information which can prove the message claim, has been found to increase the persuasiveness of messages when compared to messages with no evidence (Reinard, 1988). Evidence can be presented in many different ways. The two main types are quantitative evidence such as numbers or statistics and qualitative evidence such as narratives, personal anecdotes, analogies, case histories, or testimonials (Kazoleas, 1993).

The literature is mixed as to whether quantitative or qualitative evidence is more persuasive. Some authors have found that quantitative evidence is more persuasive (M. Allen et al., 2000; M. Allen & Preiss, 1997), while others have found that qualitative evidence is more effective (Borgida & Nisbett, 1977). For food safety behaviors, qualitative evidence in the form of personal experiences or anecdotes about others' experiences have been found to reduce beliefs of optimistic bias (Chapman, 2005; Parry et al., 2004). Comparisons with individuated others (i.e., a specific employee), as opposed to non-individuated others (i.e., a collective group of employees), has also been shown to reduce optimistic bias (Miles & Scaife, 2003). Therefore, it is likely that the use of qualitative evidence, such as narratives of individual employees who have experienced the consequences of the advocated behavior, will be most effective at increasing food employees' beliefs of perceived susceptibility and, in turn, their performance of proper food safety and regulatory behaviors.

Evidence has been used in food safety training. For example, the Michigan Restaurant Association, in its food safety training, uses several types of evidence to illustrate why food employees need to follow food safety practices. The messages in the training contain stories about specific employees who have been implicated in foodborne illness outbreaks as well as statistics of the number of people who became ill at each outbreak. In one story, an outbreak of *Shigella* which sickened fifteen people was traced back to a specific restaurant employee who came to work sick. As a result of the outbreak, the restaurant went out of business and the employee lost his job (Jankowski, 2004). Statistics such as "1 foodborne illness can affect 1 person or hundreds" were presented along with the story (Michigan Restaurant Association, 2007). Research is

needed to directly test whether the qualitative or quantitative evidence would be more persuasive; however, the literature suggests that the stories (qualitative evidence) would be more effective with food safety employees for the reasons previously outlined (Miles & Scaife, 2003).

The evidence used in the Michigan Restaurant Association's food safety training presents the negative consequences that can occur when food employees do not perform the advocated food safety behaviors, a strategy known as loss-framing. Evidence can also be presented in a gain-frame by illustrating the positive consequences that occur when food employees do perform proper food safety behaviors (Rothman & Salovey, 1997). Whether an appeal presents, or frames, the negative consequences of engaging in a health-damaging behavior (e.g., "customers became ill because a food employee did not wash his/her hands") or the positive consequences of engaging in a health-promoting behavior (e.g., "customers have not gotten sick because a food employee washed his/her hands") should influence the persuasiveness of the appeal (Block & Keller, 1995a; Meyerowitz & Chaiken, 1987; Salovey & Williams-Piehota, 2004).

Message Framing

How persuasive messages are presented, or framed, influences their effectiveness (Kahneman & Tversky, 1979). Persuasive messages can frame behavioral alternatives in terms of their associated costs (loss-frame) or benefits (gain-frame) (Meyerowitz & Chaiken, 1987; Rothman & Salovey, 1997). Research in message framing has applied Kahneman and Tversky's (1979) Prospect Theory to make predictions regarding the influence of these different presentations on decisions about personal health. Prospect Theory proposes that people are more willing to accept risks when they evaluate options

in terms of losses but act to avoid risks when the same options are described in terms of gains. In the original theory, risk was defined as the likelihood or probability associated with the attainment of a particular outcome (Kahneman & Tversky, 1979; Rothman & Salovey, 1997), and it was manipulated by varying the degree of certainty of losses or gains that would result from a decision (Kahneman & Tversky, 1979).

The research is mixed in terms of whether gain- or loss-framed messages are more effective for promoting health-behaviors (Block & Keller, 1995b; Meyerowitz & Chaiken, 1987; Rothman & Salovey, 1997). Several moderating variables have been identified which may account for some of the varied results (Rothman & Salovey, 1997). The moderators most likely to be influential for messages promoting food safety behaviors include the context of the behavior and the perceived response efficacy (Block, 2005; Block & Keller, 1995b; Lee, Aaker, & Gardner, 2000; Nan, 2007; Rothman & Salovey, 1997).

Context. One reason for the mixed results in the literature may be because the concept of risk is not as easily operationalized when applied to health decisions. Rothman and Salovey (1997) suggest that predictions of whether gain- or loss-framed messages will be more effective for promoting health behaviors using Prospect Theory should depend on the perceived degree of risk associated with the behavior and the certainty of obtaining the behavioral outcome. The authors argue that for behaviors which entail some risk to their performance or for which the outcome is uncertain, loss-framed messages will be more effective because, according to Prospect Theory, people are risk-seeking when they evaluate options in terms of losses. Behaviors in this context are generally detection-oriented (e.g., breast-self exams), because individuals perceive

that there is a risk to performing the behavior of finding a negative result (e.g., a lump). This hypothesis has been supported by the literature. Meyerowitz and Chaiken (1987), for example, found that messages presenting the consequences of not performing breast self-exams (BSE's) increased intentions to perform BSE's more than messages presenting the benefits of performing BSE's. The authors concluded that the participants perceived performing a BSE as risky because there was the possibility of finding a lump and, as a result, they were more likely to take the risk when the consequences were framed in terms of losses. Interestingly, they did not find that gain-framed messages resulted in risk-averse behavior as would have been expected by Prospect Theory.

In contrast, for behaviors which are less risky and where the outcome is more certain, Rothman and Salovey (1997) argue that gain-framed messages should be more effective because, according to Prospect Theory, people are less likely to take risks when the benefits are certain. Behaviors in this context are generally prevention-oriented, because the risk to an individual from using preventative measures is generally low and the outcomes are fairly certain. As a result, not performing the behavior is the risky option. Rothman and Salovey's (1997) hypothesis has also been supported in the literature. In one study, Salovey and Williams-Piehota (2004) found that gain-framed pamphlets about skin cancer and sunscreen use resulted in more requests for samples of sunscreen than loss-framed pamphlets. It should be noted that for behaviors such as the application of sunscreen, the benefits are generally well known and certain. For other preventative behaviors, however, the benefits may be less well known and more uncertain. In these cases, response efficacy may moderate the effectiveness of gain- and loss-framed messages.

Response efficacy. As just discussed, one important assumption when making predictions for preventative behaviors based on Prospect Theory is that people perceive that the benefits from performing the behavior are likely to be obtained; that the response is effective. For behaviors where the benefits are perceived to be certain, and response efficacy is high, the behaviors are generally perceived as safe. To the extent that a behavior is perceived as unlikely to prevent a threat and response efficacy is low, however, performance of the behavior may be perceived as risky rather than safe. In the latter instance, according to Prospect Theory, loss-framed messages should be more effective at promoting preventative behaviors than gain-framed messages because such messages will encourage risk-seeking.

This hypothesis has not been directly tested in the literature, although Block and Keller (1995a) did explore the interaction between level of efficacy and framing on intentions to perform a preventative behavior while studying the mediating effect of depth of processing. In the experiment, the authors manipulated response efficacy by presenting loss- and gain-framed messages promoting behaviors which would prevent Human Papillomavirus (HPV) in which the probability that adherence to recommendations would prevent HPV (i.e., response efficacy) was varied. When efficacy was low, loss-framed messages resulted in greater intentions to perform the preventative behaviors. When efficacy was high, there was no difference between the loss- and gain-framed pamphlets.

Risk Communication Best Practices

The final message design strategies that will be reviewed are a list of best practices for crisis communication which were first developed and published in 2006 by

an expert crisis communication panel at the National Center for Food Safety and Defense (NCFPD) (Seeger, 2006). After they were introduced, the risk communication team at the NCFPD conducted a series of case studies and message testing experiments to clarify, validate, and refine the best practices (Sellnow & Vidoloff, 2009). Although the goal of the best practices is to help an organization effectively and appropriately respond to a crisis within any context, they can also be applied to risk communication and several have application within the context of food safety message design. The four best practices which are relevant to the design of effective food safety messages are:

- Forming partnerships with the public
- Collaborating and coordinating with credible sources
- Accepting uncertainty and ambiguity
- Providing messages of self-efficacy

Forming partnerships with the public is one important risk communication best practice which is relevant to the design of food safety messages. This practice includes seeking opinions from the public through ongoing dialogues about risk issues (Seeger, 2006). Engaging the public early and often fosters trust in an organization and allows the public to serve as a resource in risk and crisis situations (Sellnow & Vidoloff, 2009).

In addition to forming ongoing partnerships with the public, it is also important for risk communicators to collaborate and coordinate with credible sources. This may include collaborating with other relevant sources of risk messages so that the audience hears a consistent message, working with relevant subject matter experts to increase credibility of the organizations message (Seeger, 2006), or even citing sources while

delivering a message. It is important that the audience perceives communicators and messages as credible because this can moderate perceptions of risk (Covello, 1992).

Accepting uncertainty and ambiguity is another important risk communication best practice identified by the NCFPD. Although this best practice was designed to address organizations' lack of knowledge as crises are discovered and evolve, all risks always include some level of uncertainty and ambiguity (Seeger, 2006). Indeed, it is often the case that organizations do not have all of the information regarding risks and it is important to communicate this uncertainty to the audience. This strategy allows the organization the ability to adjust their messaging as more information becomes available.

Finally, the health and risk communication literature emphasizes the importance of delivering messages which foster perceptions of self-efficacy (Seeger, 2006; Sellnow & Vidoloff, 2009; Witte & Allen, 2000). As previously reviewed, self-efficacy is an important determinant of behavior and as such, it is included as a determinant of behavior in several theories including the Health Belief Model and Theory of Planned Behavior (National Institutes of Health [NIH], 2005). Messages which foster self-efficacy generally provide steps that the audience can perform to avoid or minimize the risk. These messages may be very simple, but it should be clear that the recommended action will reduce the risk, and it should be clear why the audience is being told to perform the behavior. Importantly, messages of self-efficacy are most effective when they are specific and are matched to the situation in question (Seeger, 2006).

Summary

The processes of risk communication and risk perception are complex. Although best practices are available, numerous message design strategies may also be effectively

used to communicate messages which promote food safety behaviors. The use (or lack thereof) of message design strategies likely to promote food safety behaviors among farmers - such as gained framed messages and narrative appeals - may provide an explanation for why the 2005 training courses dissuaded farmers from applying for an on-farm processing license. Research is needed, however, to explore this idea.

Theoretical models are available which consider the communication of messages promoting food safety via training on behavior change. Models such as the Food Hygiene Training Model posit that food safety training can influence behavior via beliefs about food safety risks. Furthermore, the Health Belief Model suggests an individual's beliefs of perceived severity, susceptibility, benefits, barriers, self-efficacy, and cues to action influence one's performance of health promoting behaviors. As outlined in the TPB, these different types of beliefs are likely to influence behavior indirectly by serving as antecedents to attitudes, subjective norms, and perceived behavioral control. Few studies, however, have integrated these two theories. Even fewer, if any, have tested them within the context of farmers' regulatory compliance. Research is needed to empirically test a model which integrates the TPB and HBM within the context of the on-farm processing regulation to determine the efficacy of the model and to identify which factors may be responsible for the farmers' intentions to apply for an on-farm processing license and their actual license application behavior. Research is also needed to test whether the perceived behavioral control construct in the TPB is best measured with a hierarchical model.

Chapter 3: Hypotheses and Research Question

As previously reviewed, the TPB and the HBM provide useful theoretical frameworks for understanding the determinants of regulatory compliance and food safety behaviors, including those that are work-based (Clayton & Griffith, 2008). According to the TPB, an individual's intentions to perform a behavior, which are assumed to mediate overt behavior, are a function of the individual's attitudes towards the behavior, one's subjective norms, and one's perceived behavioral control (Ajzen & Fishbein, 1970; Ajzen & Madden, 1986). According to the HBM, behavior is a function of beliefs of perceived susceptibility, perceived severity, perceived barriers, perceived benefits, perceived self-efficacy, and cues to action (Rosenstock, 1974). In order to explain the largest amount of variance in Maryland farmers' intentions to apply for an on-farm processing license as well as their actual license behavior, it is proposed that these two theories be integrated. Since this research was conducted after some farmers had already received on-farm processing licenses, the model of predictors of Maryland farmers' intentions to apply for a license was tested separately from the model of predictors of actual license application. The rationale for the proposed models as well as several research hypotheses and a research question will be outlined in this section.

The a priori model in which factors in the HBM and TPB are posited to predict behavioral intentions is shown in Figure 3.

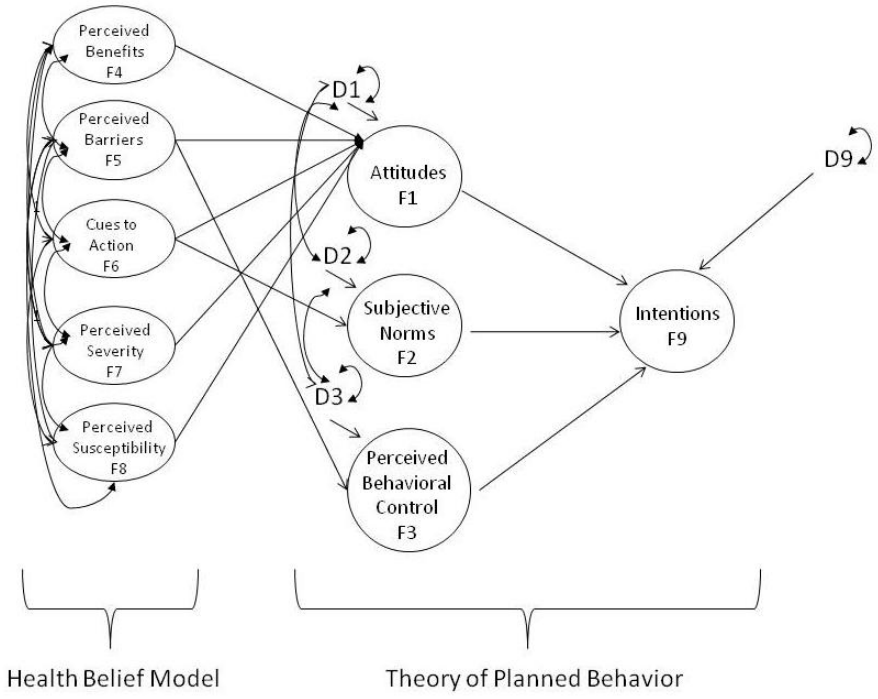

Figure 3. A priori structural model in which factors in the HBM and TPB predict behavioral intentions.

Given this model, the current study posits that:

H1: The causal model depicted in Figure 3 has plausible model fit.

Specifically, attitudes, subjective norms, and perceived behavioral control are proposed to influence intentions to apply for an on-farm processing license as predicted in the TPB (Ajzen & Fishbein, 1970; Ajzen & Madden, 1986). These relationships are predicted in the following hypotheses:

H2: Attitudes will be positively and linearly related to farmers' intentions to participate in on-farm processing.

H3: Subjective norms will be positively and linearly related to farmers' intentions to participate in on-farm processing.

H4: Perceived behavioral control will be positively and linearly related to farmers' intentions to participate in on-farm processing.

The beliefs identified in the HBM are proposed to act as antecedents to attitudes, subjective norms, and perceived behavioral control in accordance with the TPB, which postulates that each of these three constructs is influenced by underlying belief constructs. In particular, the TPB posits that attitudes are influenced by behavioral beliefs (i.e., the undesirable or desirable consequences of performing the behavior), subjective norms are influenced by normative beliefs (i.e., the likelihood that important individuals approve or disapprove of performing the behavior), and perceived behavioral control is influenced by control beliefs (i.e., the absence of requisite resources and opportunities). In this study, beliefs of perceived benefits, perceived barriers, perceived cues to action, susceptibility, and perceived severity are proposed to act as antecedents to attitudes because beliefs such as whether the license will be a good way to earn extra income (a perceived benefit) are thought to be related to behavioral beliefs. Cues to action are proposed to also influence subjective norms because recommendations of the program by others, such as extension educators, are considered to be related to normative beliefs. Finally, perceived barriers are proposed to also influence perceived behavioral control because beliefs of the presence or absence of skills and resources (to formulate a product for example) are thought to be related to control beliefs (Ajzen, 2002b). Given this rationale, the following hypotheses are proposed:

H5: Perceived benefits will be positively and linearly related to farmers' attitudes towards on-farm processing.

H6: Perceived barriers will be negatively and linearly related to farmers' attitudes and perceived behavioral control towards on-farm processing.

H7: Cues to action will be positively and linearly related to farmers' attitudes and subjective norms towards on-farm processing

H8: Perceived susceptibility will be positively and linearly related to farmers' attitudes towards on-farm processing.

H9: Perceived severity will be positively and linearly related to farmers' attitudes towards on-farm processing.

Of note in these predictions is the omission of self-efficacy as a distinct construct which influences intentions; this is because perceived behavioral control is operationalized to include perceptions of an individual's confidence in their own ability to perform the behavior, perceived ease or difficulty of performing the behavior, and perceptions of perceived control over performing the behavior (Ajzen, 2002a). Consistent with Bandura's use of the term, self-efficacy is considered to be measured by perceptions of an individual's confidence in their own ability to perform the behavior and their perceived ease or difficulty of performing the behavior, and as a result is not proposed as a distinct construct in this model (Ajzen, 2002a; Bandura, 1982).

Some scholars argue, however, that the proposed operationalization of perceived behavioral control measures two distinct constructs, self-efficacy and perceived control (Ajzen, 2002b; Armitage & Conner, 1999). In the case of the on-farm processing regulation, it can be argued that farmers require certain skills and resources to apply for a license in addition to the actual granting of the license by the MDHMH which is

conceivably outside of their own control. Given this rationale, an alternative model will also be explored (see Figure 4).

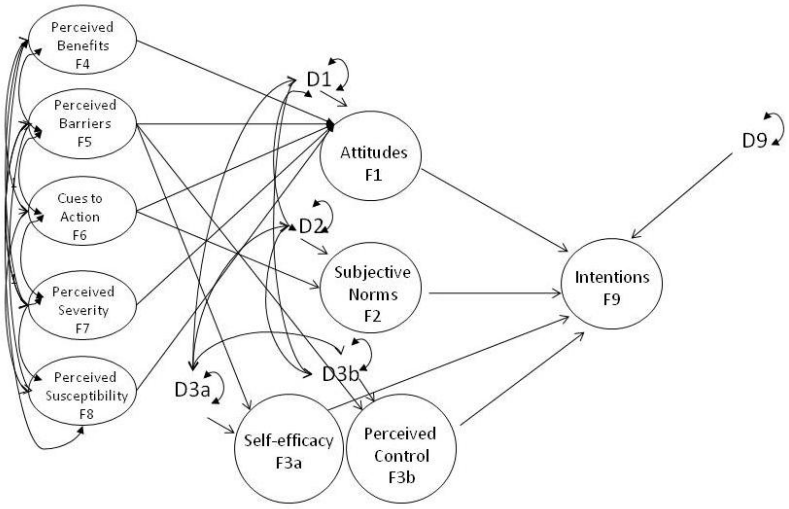

Figure 4. A priori structural model in which factors in the HBM and TPB predict behavioral intentions with perceived behavioral control is represented as two distinct constructs: self-efficacy and perceived control.

Using this model as a framework, the following hypotheses are proposed:

H10: The proposed causal model in Figure 4 has plausible model fit.

H11: The proposed causal model in Figure 4 has significantly better fit than the alternative model shown in Figure 3.

In order to explore the predictors of farmers' license application behavior, a separate set of hypotheses is proposed. Given that behavioral intentions are assumed to mediate overt behavior (Ajzen, 1991), it is proposed that the same set of relationships hold for the predictors of farmers' license application behavior as for their intentions to apply for a license. The same structural model, however, cannot be tested because of the small number of farmers who have actually applied for and received a license. In order to account for the fact that the number of actual licenses granted is a rare event (.2% of

all farmers in Maryland have a license), a correction must be applied to limit bias in the coefficients; a procedure which could not be performed using structural equation modeling. Instead, the predicted relationships will be modeled as two multiple regressions and two correlations as recommended by Hankins, French, & Horne (2000), with the regression of behavior on attitudes, subjective norms, and perceived behavioral control modeled as a rare event logistic regression to account for the low frequency of licensees in the population (King & Zeng, 2001):

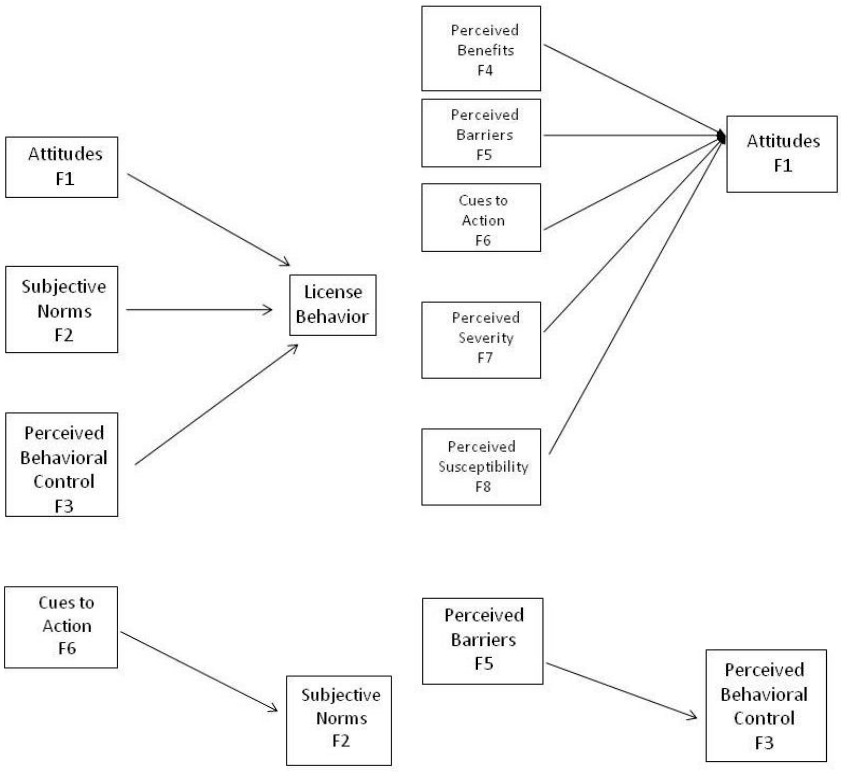

Figure 5. Proposed theoretical model as applied to prediction of license application behavior: modeled as two multiple regressions and two correlations.

Thus, it is proposed that attitudes, subjective norms, and perceived behavioral control directly influence behavior as predicted in the TPB (Ajzen & Fishbein, 1970; Ajzen & Madden, 1986). Given that license application behavior is measured as a dichotomous variable (i.e., either a farmer has a license or not), it cannot be assumed that the relationship between the variables is linear. These relationships are predicted in the following hypotheses:

H12: Attitudes will be positively related to farmers' license application behavior.

H13: Subjective norms will be positively related to farmers' license application behavior.

H14: Perceived behavioral control will be positively related to farmers' license application behavior.

Moreover, the beliefs identified in the HBM are proposed to act as antecedents to attitudes, subjective norms, and perceived behavioral control in accordance with the TPB, as was previously outlined:

H15: Perceived benefits will be positively and linearly related to farmers' attitudes towards on-farm processing.

H16: Perceived barriers will be negatively and linearly related to farmers' attitudes and perceived behavioral control towards on-farm processing.

H17: Cues to action will be positively and linearly related to farmers' attitudes towards on-farm processing.

H18: Perceived susceptibility will be positively and linearly related to farmers' attitudes towards on-farm processing.

H19: Perceived severity will be positively and linearly related to farmers' license attitudes towards on-farm processing.

Correlation analysis will be used to test two additional relationships between the HBM and TPB variables, such that:

H20: Cues to action will be positively and linearly related to farmers' subjective norms towards on-farm processing.

H21: Perceived susceptibility will be positively and linearly related to farmers' perceived behavioral control towards on-farm processing.

Additionally, because it is possible that the training itself might have influenced the farmers' perceptions of the requirements of the regulation and subsequently their intentions to participate in on-farm processing, the following hypothesis is proposed:

H22: The proposed model structures are non-invariant between farmers who did and did not attend the 2005 training courses.

Furthermore, since there is no literature or previous studies assessing the training courses themselves, a research question is proposed:

RQ1: Why were the training courses ineffective in generating applications for licenses?

Chapter 4: Study 1: On-Farm Processing Survey

To test the proposed theoretical models of the predictors of farmers' intentions to apply for an on-farm processing license and of their license application behavior, a survey instrument was administered to farmers in the state of Maryland. Prior to the survey development, cognitive interviews were conducted to ensure that the survey was understood by the target audience. While the data from the interviews were qualitative and could only be used as a guide, listening to what people have to say broadens a researcher's perspective regarding how people think about what is being studied (Fowler, 1995). The research protocol and data collection tools for the pilot study and survey were reviewed and approved by the Institutional Review Board at the University of Maryland.

Traditional tests of the Theory of Planned Behavior typically measure an individual's intentions to perform a behavior followed by a measure of one's actual performance of the behavior (either through a self-report or an observational design weeks or months later) (Ajzen, 2002a). Since this study was begun after farmers had already applied for and received on-farm processing licenses, the traditional test of the theory could not be performed. Instead, two separate analyses of the survey data were performed. First the data were analyzed to determine the predictors of farmers' intentions to apply for an on-farm processing license using data from respondents who had not yet applied for a license. Second, data from all respondents were combined to test the predictors of actual license application behavior.

Methods

Pilot Study

Cognitive interview participants were recruited through contact with county extension educators in Maryland. The participants consisted of farmers who did (*n*=2) and did not (*n*=2) have on-farm processing licenses. Due to budgetary and time constraints, two of the interviews were conducted face-to-face and two interviews were conducted over the telephone. Of the face-to-face interviews, one was conducted at a county extension office convenient to the participant and one was conducted at the participant's home.

At the beginning of each interview, the farmer was briefly told the purpose of the research and was assured that all responses would be confidential. Where applicable, the interviewer either provided the participant a copy of the consent form or the consent form was read to the participant in order to receive permission to conduct and record the interview. The researcher developed an interview guide (see Appendix A for Cognitive Interview Protocol) to ensure that certain questions were covered during the interview. Although the same set of questions was used for each interview, the order of the questions and the probes used to follow up on the interviewee's responses depended upon the narration of each farmer. The majority of the interviews lasted approximately one hour, with the exception of one interview in which the participant was interested in on-farm processing but had not heard of the on-farm processing license; as a result no further questions were asked of the participant. The interviews which were conducted in-person were audio-recorded for transcription while those which were conducted over the telephone were recorded using handwritten notes.

As a result of the pilot study, several wording changes were made to the survey questionnaire and additional barriers to license application were added. In addition, the interview with the participant who was interested in on-farm processing but had not heard of the on-farm processing license highlighted the need for a series of screening questions to screen out participants who either had no interest in applying for the license (for reasons other than the license program) or who had never heard of the on-farm processing license.

Participants

Farmers that attended the training courses (*n*=125) and a stratified systematic random sample of farmers who did not attend the training courses (*n*=598) were surveyed. In addition, all of the farmers who had an on-farm processing license as of March 2009 were mailed a survey, with the exception of two licensees who had participated in the cognitive interviews and one licensee who had consulted on the study (*n*=22). Although 148 farmers attended the training courses, 125 surveys were mailed because nine of the farmers received a license following the training and thus, received the survey for licensees, and/or they resided at the same address as another training participant. Only one of each of the participants at the address was randomly selected to receive a survey to ensure independence of survey results. The farmers who did not attend the training courses were selected from a database which contained the names and contact information of farmers in Maryland (*n*=5,957) that own livestock, poultry, organic, and/or "other" operations. Farmers were stratified by county so that 1 in every 10 names within each county was systematically selected.

Survey Instrument

In the development of the survey instrument, previously tested instruments were relied on whenever possible (Ajzen, 2002a; Clayton & Griffith, 2008; Forsythe et al., 2006; Hanson & Benedict, 2002). Wording changes were made to reflect the behavior of interest where applicable. Farmers who had an on-farm processing license received a survey with minor wording changes to reflect the fact that they had already performed the behavior of interest.

Prior to measuring the theoretical constructs, survey respondents were first asked a series of questions about the types of products (if any) they were currently processing, as well as where they were selling and processing their products. Farmers who indicated that they were not currently processing value-added food products were asked if they were interested in doing so and where they would be interested in selling and processing their products. Both groups of these farmers were then asked if they intended to apply for an on-farm processing license and, if so, how likely they were to apply for a license, how likely they were to request information about the license, and how likely they were to attend an information session about the license. Respondents were asked to indicate their response on a five-point scale (1="very unlikely", 5="very likely"). In addition to measuring intentions of the farmers towards applying for the on-farm processing license and discerning and learning their processing interest(s), these questions also served as a mechanism to screen out respondents who were not interested in on-farm processing for reasons other than the license-application process (e.g., because they primarily sold horses or did not have interest in processing food) or had not heard about the on-farm

processing license. A sample of the survey showing how respondents were routed through the questionnaire is found in Appendix B.

Following the set of screening questions, the survey instrument consisted of a series of questions designed to measure the constructs in the Health Belief Model and the Theory of Planned Behavior. The questions used to measure each construct and the corresponding response options are provided below.

Attitudes. Attitudes were measured using a series of questions (Q16-Q18): the on-farm processing license is valuable; having an on-farm processing license is worthwhile; the on-farm processing license is useless. Participants were asked to indicate their response on a five-point Likert-type scale (1="completely disagree", 5="completely agree").

Subjective Norms. Subjective norms were measured using a series of questions (Q19-Q21) (Ajzen, 2002a): other producers that I know think that getting an on-farm processing license is a good idea; other producers that I know think getting an on-farm processing license is a bad idea; the people in my life whose opinions I value would approve of me getting the on-farm processing license. Participants were asked to indicate their response on a five-point Likert-type scale (1="completely disagree", 5="completely agree").

Cues to Action. Cues to action were measured using a series of questions (Q22-Q24): I receive information in the mail about the license; my extension agent gives me information about the license; at professional/association meetings, the speakers talk about the license. Participants were asked to indicate their response on a five-point Likert-type scale (1="never", 5="very often").

Perceived Barriers. Perceived barriers were measured using a series of questions (Q25-Q37) (Clayton et al., 2002; Kantor, 2006): there are too many steps I have to take in order to get a license; the steps to get a license are not clearly outlined; I don't have the time to process my products during the peak season; I have heard conflicting information about the license; there are too many regulations I have to follow in order to get a license; getting a license will take too long; I do not trust the Department of Health and Mental Hygiene; there is too much liability if I get the license; retail outlets are reluctant to carry on-farm processed products; with the $40,000 limit, the profit margin is not there; there is not enough technical assistance to help me develop recipes for products that I would like to sell; if the Maryland Department of Health and Mental Hygiene comes to inspect my kitchen for the license, I am worried they will find some kind of violation. Participants were asked to indicate their response on a five-point Likert-type scale (1="completely disagree", 5="completely agree"). Participants also had an opportunity to list any other barriers that they were concerned about in an open-ended question.

Perceived Benefits. Perceived benefits were measured using a series of questions (Q38-Q41): getting the license would be a good way for me to earn extra income; getting the license would be a good way for me to diversify the types of products I sell; getting the license would allow me to sell more products at farmer's markets; if I intend to process and sell my own food products, getting a license would help me to abide by the law. Participants were asked to indicate their response on a five-point Likert-type scale (1="completely disagree", 5="completely agree").

Perceived Susceptibility. Perceived susceptibility was measured using a series of questions (Q42-43 and Q50-52) (Clayton et al., 2002): if I were to sell meat at a farmer's

market without a license, no one will know; if I processed food on my farm, it is unlikely that customers would get sick from my food; if I processed food on my farm, the food I prepare for my farm-based business will likely be safer than the food I prepare for my family; if I processed food on my farm, the food that I prepare for sale will likely be safer than the food prepared for sale by other farmers. Participants were asked to indicate their response on a five-point Likert-type scale (1="completely disagree", 5="completely agree").

Perceived Behavioral Control. Perceived behavioral control was measured using a series of questions which were designed to measure two components of the construct (Ajzen, 2002a, 2002b): (1) self-efficacy (Q44-Q46) - If I were to process food on my farm, producing a safe product would be easy; I am confident in my ability to produce safe food; I think that applying for a license is easy; and (2) perceived control (Q47-Q49) - I have control over the safety of the food I sell; I have control over whether or not I get a license; whether or not I apply for a license is mostly up to me. Participants were asked to indicate their response on a five-point Likert-type scale (1="completely disagree", 5="completely agree").

Perceived Severity. Perceived severity was measured using a series of questions (Q53-Q55): if food I produced caused a foodborne illness in my family, the illness would likely be…; if food I produced caused a foodborne illness in my customers, the illness would likely be…; if I developed a foodborne illness it would likely be…; if my customers became ill from the food I sold, the damage to my business would be.... Participants were asked to indicate their response to these statements on a five-point Likert-type scale (1="not at all serious," 5="very serious"). In addition, participants were

also asked to indicate their agreement with the following statement: if I sell raw meat at a farmer's market without a license, the consequences would be very serious. Responses to this statement were on a five-point Likert-type scale (1="completely disagree", 5="completely agree").

Demographics. Data on age, gender, race, and ethnicity were collected, along with information about the participant's attendance at one of the 2005 training courses, ownership in the farm, the farm size and farm location, and the primary source of the farm's income. Due to their sensitive nature, demographics questions were included at the end of the questionnaire to maximize responses (Tourangeau, Rips, & Rasinski, 2000).

Procedure

Dillman's (2009) Tailored Design Method was applied for the implementation of the survey mailing. Survey materials were mailed to participants in three rounds during March 2009. First, a pre-notice letter was mailed alerting participants that a survey was coming (see Appendix C). Then, one week later, the survey was mailed along with a cover letter (see Appendix D) and pre-addressed return envelope. Finally, one week after the survey was mailed, a follow-up postcard was mailed to remind participants that if they hadn't already done so to mail in their response (see Appendix E). Surveys were anonymous and participants were asked to return surveys without any identifying information. Prior to the initial mailing a notification e-mail was sent to county agriculture extension educators, campus-based extension specialists, and regional extension specialists to increase awareness of the survey (see Appendix F).

Data Analysis

General Results. Prior to the analysis, the data characteristics of all responses (*n*=110) were examined.

Predictors of Intentions to Apply for a License. Prior to the analysis, the data characteristics were examined for those respondents who did not have an on-farm processing license (*n*=95). The variables, associated factors, and descriptive statistics are shown in Table 1. Twenty-four surveys were missing data for the independent variables. Sixty-four missing data items associated with the independent variables were imputed using the expectation maximization (EM) algorithm in SPSS 17.0 (SPSS Inc., Chicago, IL). Where appropriate, indicator variables were reverse-coded so that the given responses all indicated a favorable response (see Table 1). For example, a response of complete agreement (i.e., a scale score of "5") with the statement A1: "the on-farm processing license is valuable" would represent a favorable rating while a response of complete agreement with the statement A3: "the on-farm processing license is useless" would represent an unfavorable rating. In order to aggregate or compare these survey responses the inconsistent questions (in this case A3) were reverse-scored (i.e., a "5" was assigned a "1" and vice versa) so that higher values always indicated favorable responses.

In order to explore the predictors of farmers' intentions to apply for an on-farm processing license (see Figure 3), latent variable path analysis was conducted using EQS 6.1 (Multivariate Software, Inc., Encino, CA). The method of estimation used was maximum likelihood. The robust correction was applied because the assumption of multivariate normality was violated. A variety of fit indices are available for assessing fit of structural equation models. In addition to the Sartorra-Bentler χ^2, two fit indices were

Table 1. Factors, variables, scales, and descriptive statistics (*n*=95).

Factor	Variable and Survey Question	Scale	Mean	S.D.	Coefficient H
F1: Attitude	A1: The on-farm processing license is valuable.	1=Completely Disagree to 5=Completely Agree	3.41	1.06	.97
	A2: Having an on-farm processing license is worthwhile.	1=Completely Disagree to 5=Completely Agree	3.41	1.07	
	A3 (R): The on-farm processing license is useless.	1=Completely Disagree to 5=Completely Agree	3.55	1.09	
F2: Subjective Norm	SN1: Other producers that I know think getting an on-farm processing license is a <u>good</u> idea.	1=Completely Disagree to 5=Completely Agree	2.96	0.89	.96
	SN2 (R): Other producers that I know think getting an on-farm processing license is a <u>bad</u> idea.	1=Completely Disagree to 5=Completely Agree	3.01	0.83	
	SN3: The people in my life whose opinions I value would approve of me getting the on-farm processing license.	1=Completely Disagree to 5=Completely Agree	3.32	0.90	
F3: Perceived Behavioral Control	PBC1 (EFF1): I think that applying for a license is easy.	1=Completely Disagree to 5=Completely Agree	2.54	0.77	.94
	PBC2 (EFF2)*: I think that producing a safe product would be easy.	1=Completely Disagree to 5=Completely Agree	3.72	0.91	
	PBC3 (EFF3)*: I am confident in my ability to produce safe food.	1=Completely Disagree to 5=Completely Agree	4.20	0.72	
	PBC4 (CON1)*: I have control over the safety of the food I sell.	1=Completely Disagree to 5=Completely Agree	4.12	0.73	
	PBC5 (CON2): I have control over whether or not I get a license.	1=Completely Disagree to 5=Completely Agree	3.07	1.02	
	PBC6 (CON3): Whether or not I apply for a license is mostly up to me.	1=Completely Disagree to 5=Completely Agree	3.66	1.04	

Note: Variables denoted with an * were dropped from the analyses. Variables denoted with an (R) were reverse-coded for all model testing.

Table 1. Factors, variables, scales, and descriptive statistics (*n*=95).

Factor	Variable and Survey Question	Scale	Mean	S.D.	Coefficient H
F4: Benefits	BEN1: Getting the license would be a good way for me to earn extra income.	1=Completely Disagree to 5=Completely Agree	3.47	0.86	.91
	BEN2: Getting the license would be a good way for me to diversify the types of products I sell.	1=Completely Disagree to 5=Completely Agree	3.29	0.89	
	BEN3: Getting the license would allow me to sell more products at farmer's markets.	1=Completely Disagree to 5=Completely Agree	3.48	0.94	
	BEN4*: If I intend to process and sell my own food products, getting a license would help me to abide by the law.	1=Completely Disagree to 5=Completely Agree	3.88	0.73	

Note: Variables denoted with an * were dropped from the analyses. Variables denoted with an (R) were reverse-coded for all model testing.

Table 1. Factors, variables, scales, and descriptive statistics (*n*=95) continued…

Factor	Variable and Survey Question	Scale	Mean	S.D.	Coefficient H
F5: Barriers	BAR1: There are too many steps I have to take in order to get a license.	1=Completely Disagree to 5=Completely Agree	3.55	0.84	.91
	BAR2: The steps to get a license are not clearly outlined.	1=Completely Disagree to 5=Completely Agree	3.30	0.80	
	BAR3: There are too many regulations I have to follow in order to get a license.	1=Completely Disagree to 5=Completely Agree	3.71	0.96	
	BAR4*: I don't have the time to process my products during the peak season.	1=Completely Disagree to 5=Completely Agree	3.11	1.05	
	BAR5*: I have heard conflicting information about the license.	1=Completely Disagree to 5=Completely Agree	3.32	0.95	
	BAR6*: Getting a license will take too long.	1=Completely Disagree to 5=Completely Agree	3.27	0.79	
	BAR7*: I do not trust the Maryland Department of Health and Mental Hygiene.	1=Completely Disagree to 5=Completely Agree	2.97	1.12	
	BAR8*: There is too much liability if I get the license.	1=Completely Disagree to 5=Completely Agree	3.19	0.88	
	BAR9*: Retail outlets are reluctant to carry on-farm processed products.	1=Completely Disagree to 5=Completely Agree	3.02	0.80	
	BAR10*: With the $40,000 limit, the profit margin is not there.	1=Completely Disagree to 5=Completely Agree	3.20	0.96	
	BAR11*: There is not enough technical assistance to help me develop recipes for food products that I would like to sell.	1=Completely Disagree to 5=Completely Agree	3.08	0.80	
	BAR12*: If the Maryland Department of Health and Mental Hygiene comes to inspect my kitchen for the license; I am worried they will find some kind of violation.	1=Completely Disagree to 5=Completely Agree	3.40	1.04	

Note: Variables denoted with an * were dropped from the analyses. Variables denoted with an (R) were reverse-coded for all model testing.

Table 1. Factors, variables, scales, and descriptive statistics (*n*=95) continued…

Factor	Variable and Survey Question	Scale	Mean	S.D.	Coefficient H
F6: Cues to Action	C1. I receive information about the license in the mail.	1=Never to 5=Very Often	1.46	0.77	.76
	C2. My county extension agent gives me information about the license.	1=Never to 5=Very Often	1.46	0.80	
	C3. At professional/association meetings, the speakers talk about the license.	1=Never to 5=Very Often	1.90	1.00	
F7: Susceptibility	SUS1 (R): If I sell meat at a farmer's market without a license, no one will know.	1=Completely Disagree to 5=Completely Agree	3.99	0.89	-
	SUS2*: If I processed food on my farm, it is unlikely that customers would get sick from my food.	1=Completely Disagree to 5=Completely Agree	1.88	0.80	
	SUS3*: If I processed food on my farm, the food I prepare for my farm-based business will likely be safer than the food I prepare for my family.	1=Completely Disagree to 5=Completely Agree	3.07	1.25	
	SUS4*: If I processed food on my farm, the food that I prepare for sale will likely be safer than the food prepared for sale by other farmers.	1=Completely Disagree to 5=Completely Agree	2.88	0.83	
F8: Severity	SEV1: If I sell meat at a farmer's market without a license, the consequences would be very serious.	1=Completely Disagree to 5=Completely Agree	3.85	0.93	-
	SEV2*: If food I produced caused a foodborne illness in my <u>family</u>, the illness would likely be …	1=Not At All Serious to 5=Very Serious	2.62	1.10	
	SEV3*: If food I produced caused a foodborne illness in my <u>customers</u>, the illness would likely be …	1=Not At All Serious to 5=Very Serious	2.80	1.22	
	SEV4: If my <u>customers</u> became ill from the food I sold, the damage to my business would be…	1=Not At All Serious to 5=Very Serious	4.07	0.93	

Note: Variables denoted with an * were dropped from the analyses. Variables denoted with an (R) were reverse-coded for all model testing.

Table 1. Factors, variables, scales, and descriptive statistics (*n*=95) continued…

Factor	Variable and Survey Question	Scale	Mean	S.D.	Coefficient H
F9: Intentions	I1: How likely are you to apply for an on-farm processing license?	1=Very Unlikely to 5=Very Likely	1.96	1.97	.99
	I2: How likely are you to request information about the on-farm processing license?	1=Very Unlikely to 5=Very Likely	2.23	2.18	
	I3: How likely are you to attend an information session about the on-farm processing license?	1=Very Unlikely to 5=Very Likely	2.30	2.23	

Note: Variables denoted with an * were dropped from the analyses. Variables denoted with an (R) were reverse coded for all model testing.

used: the comparative fit index (*CFI*) and root mean square error of approximation (*RMSEA*). The standardized root mean residual (*SRMR*), another commonly used fit index, is not calculated with the robust correction. Hu and Bentler (1999) recommend joint criteria to retain a model of $CFI \geq .95$, $RMSEA \leq .06$ and $SRMR \leq .10$.

Due to the small sample size the number of variables per factor was initially reduced to a maximum of three per factor (i.e., a locally just-identified model). Only variables which related to applying for an on-farm processing license (as opposed to those related to food safety behaviors) were included in this analysis. Ajzen (2002a) notes the importance of compatibility between the predictors and the behavior of interest. Confirmatory factor analysis models were run for each of the factors with more than three variables. For each of these factors, the three variables with the highest factor loadings were chosen to be used in the measurement model. Of the 33 initial scale items, 23 were retained in the measurement model (see Table 1). The reliability of each construct was assessed by use of the component loadings to calculate coefficient H (Hancock & Mueller, 2001). Hancock and Mueller (2001) argue that coefficient H is an improvement over other measures of construct reliability because its value is not affected by loading signs, it is not decreased by additional indicators if those have small loadings, and it can't be smaller than the reliability (squared loading) of the best indicator.

Using the two-step approach proposed by Byrne (2006), the measurement model was tested first, followed by a test of the proposed structural model (see Figure 3). This model will be referred to as Model 1. The Lagrange Multiplier test was used to respecify Model 1 and improve model fit. Significant improvements in model fit were determined by comparing the respecified model with the original using the χ^2 difference test as these

models were nested/hierarchically related. The corrected Sartorra-Bentler χ^2 was used. Significance of the χ^2 difference value was determined using a χ^2 table of statistics.

Perceived Behavioral Control Construct. In order to explore whether the alternative model proposed in Figure 4, in which perceived behavioral control is considered as a multi-dimensional construct that directly affects self-efficacy and perceived control, is a better fit than the initial model, a latent variable path analysis was conducted using EQS 6.1 (Multivariate Software, Inc., Encino, CA). This model will be referred to as Model 2. The method of estimation used was maximum likelihood. The robust correction was applied because the assumption of multivariate normality was violated. A variety of fit indices are available for assessing fit of structural equation models. In addition to the Sartorra-Bentler χ^2, two fit indices were used: the comparative fit index (*CFI*) and root mean square error of approximation (*RMSEA*). The standardized root mean residual (*SRMR*), another commonly used fit index, is not calculated with the robust correction. Hu and Bentler (1999) recommend joint criteria to retain a model of $CFI \geq .95$, $RMSEA \leq .06$ and $SRMR \leq .10$.

The scale items initially retained in the measurement model for Model 1 were also retained in this model. To test the alternative model, two constructs: self-efficacy and perceived control were used in place of the perceived behavioral control construct. The self-efficacy construct was modeled with one indicator (PBC1/EFF1) and perceived control was modeled with two indicators (PBC5/CON2, PBC6/CON3).

Second, using the two-step approach proposed by Byrne (2006), the measurement model was tested, followed by the proposed structural model. The Lagrange Multiplier test was used to respecify Model 2 and improve model fit. To determine if this model

(Model 2) had significantly better fit than the alternative representation in Model 1, the χ^2 difference test was used as these models were nested/hierarchically related. The corrected Sartorra-Bentler χ^2 was used. Significance of the χ^2 difference value was determined using a χ^2 table of statistics.

Predictors of License Behavior. In order to explore the predictors of farmers' actual license behavior (i.e., whether or not they applied for and received a license), the theory proposed in Figure 3 was modified to predict behavior and modeled using two regressions and two correlations (see Figure 5) (Hankins et al., 2000). Initially, the farmers' license application behavior was regressed on their attitudes, subjective norms, and perceived behavioral control. Since the outcome variable (whether a farmer has a license or not) is a binary outcome, structural equation modeling could not be applied. Instead, binary logistic regression was conducted. Since the number of farmers who have a license (n=25) is much smaller than the number of farmers who do not (n=12,834), a correction for rare events was applied to the regression procedure.

Rare events logistic regression is recommended to describe binary dependent variables with dozens to thousands of times fewer 1's than 0's. In addition, rare events logistic regression is recommended for studies with case control designs similar to the current study, where all of the 1's (cases) have been sampled along with a random sample of the 0's (controls) . When data contain rare events, many statistical procedures including logistic regression can underestimate the probability of occurrence of the event (King & Zeng, 2001). To avoid these problems, King and Zeng (2001) incorporated several corrections into ordinal logistic regression. These corrections result in the calculation of unbiased logit coefficients.

The rare events logistic regression was computed using the ReLogit software (http://gking.harvard.edu/stats.shtml) developed by King and Zeng (1999) which works with Small Stata 11 (StataCorp, College Station, TX). Thirty surveys had missing data for the independent variables. One-hundred-four missing data items associated with the independent variables were imputed using the expectation maximization (EM) algorithm in SPSS 17.0 (SPSS Inc., Chicago, IL). Composite mean scores of the attitude, subjective norm, and perceived behavioral control constructs were calculated using the scale items retained in the measurement model for Model 1 and were utilized as the independent variables. The dependent variable, whether a farmer has a license or not, was dummy coded such that 0=does not have a license, 1=has a license. Selection on the dependent variable was made using the method of prior correction (King & Zeng, 2001); this value was set to .002 since the proportion of 1's to 0's in the population was known (i.e., 25 licensees vs. 12,834 total farmers). The ReLogit command does not provide standardized regression coefficients in the output, so these were calculated by standardizing the independent variables and re-running the rare events logistic regression (Bring, 1994). Since the dependent variable was dummy coded, it could not be standardized. As such, the semi-standardized coefficients do not have the same interpretation as fully standardized coefficients although they do reflect the relative importance of the variables within the equation (Pampel, 2000). In logistic regression, the significance of the coefficients is tested with the Wald test (z^2), which is obtained by comparing the maximum likelihood estimate of every coefficient with its estimated standard error. A coefficient is significant if the tested null hypothesis that the estimated coefficient is 0 can be rejected at a .05 significance level (Hosmer & Lemeshow, 1989).

Model fit was assessed by comparing the observed and predicted successes for license attainment using the ReLogit model via a classification table (Peng, Lee, & Ingersoll, 2002). Since Relogit is an unbiased estimator, unlike ordinary logit, it is not a likelihood technique. For this reason, R^2 is not recommended to assess model fit. To construct the classification table, first, probabilities of license attainment were predicted using the ReLogit model previously fit to the data in Small Stata 11 (StataCorp, College Station, TX). Predicted probabilities greater than 0.5 were considered as successes (received license), and predicted probabilities less than 0.5 were considered as failures (did not receive license). The overall % success, specificity, sensitivity, % false positives, and % false negatives were calculated by comparing the observed to predicted failures and successes (Peng et al., 2002).

Following the rare events logistic regression, a forced-entry multiple regression was performed in which attitudes were regressed on perceived benefits, barriers, cues to action, perceived severity and perceived susceptibility using Small Stata 11 (StataCorp, College Station, TX). Composite mean scores of the perceived benefits, barriers, cues to action, perceived severity and perceived susceptibility constructs were calculated using the scale items retained in the measurement model for Model 1 and were utilized as the independent variables. The composite mean score of the attitude construct was calculated using the scale items retained in the measurement model for Model 1 and was utilized as the dependent variable. The significance of the coefficients β_i is tested with the *t*-test, which is obtained by comparing the least squares estimate of every β_i with its estimated standard error. A coefficient is significant if the tested null hypothesis that the

estimated coefficient is 0 can be rejected at a .05 significance level (Hosmer & Lemeshow, 1989).

Finally, the bivariate correlation between perceived susceptibility and perceived behavioral control as well as the bivariate correlation between cues to action and subjective norms was performed using Small Stata 11 (StataCorp, College Station, TX). Composite mean scores of the perceived susceptibility, perceived behavioral control, cues to action, and subjective norms constructs were calculated using the scale items retained in the measurement model for Model 1 and were utilized in the bivariate correlation calculations. Significance of the Pearson correlation coefficient was tested with a one-tailed *t*-test because the hypotheses tested were in a pre-specified direction. Alpha levels of $\leq .05$ were considered significant.

Effect of training. Differences in intentions to apply for a license as well as the theoretical predictors of license application between farmers who did and did not attend the training courses were explored using two-tailed independent *t*-tests conducted using SPSS 18.0. Levene's test was used to test the assumption that the variances between the two groups were equal; *p*-levels of ≤ 0.05 were considered significant. Ideally, multi-group latent variable path analysis would have been used to answer H22, and explore differences between these two groups of respondents, by determining if the model structure tested in Figure 3 was non-invariant between farmers who did and did not attend the 2005 training courses. The sample size of each group (attended training: n=33, had not attended training: n=56), however, was too small to conduct this type of test.

Results

Sample Characteristics

Of the 745 farmers contacted, 295 surveys were received for a response rate of 40% (for the survey response rate by county see Table 2). In addition to the 295 surveys received, five surveys were returned from farmers who had attended the training because of a change in address and 27 surveys were returned for this reason from the general survey mailing. Two surveys were not returned because the recipient was deceased. Of the 295 surveys received, 110 were completed by farmers who were either interested in on-farm processing or who were not interested due to problems with the on-farm processing program, for a usable response rate of 15%. This response rate was comparable to that of other surveys of food businesses. Kaplowitz & Ten Eyck (2006), for example, sent a mail survey about food safety regulations to restaurants and other food businesses (including producers) using licensing data from the Michigan Department of Agriculture and reported a response rate of 15.1%.

The 185 unusable surveys were returned by farmers who indicated that they had either not heard of the license program (n=21), were not interested in processing for reasons other than the on-farm processing program (n=144), had concerns about the confidentiality of the survey (n=1), or were excluded because their surveys were incomplete (n=19). One returned survey was excluded due to a lack of dependent data as recommended by Hair, Anderson, Tatham, & Black (1998). The primary reasons respondents gave for why they were not interested in applying for the on-farm processing license can be seen in Table 3. Of the twenty-one respondents that had not heard of the license, fourteen of those indicated that they were interested in processing food on-farm.

Table 2. Survey response rate by county (*n*=110).

County	Total number farmers per county	Number of surveys mailed at random per county	Number of surveys mailed to course participants per county	Number of surveys mailed to licensees per county	Total number of surveys mailed per county	Total Responses per county	Response rate per county (%)
Allegany	165	17	1	1	19	3	15.8
Anne Arundel	173	17	9	0	26	2	7.7
Baltimore	245	25	7	0	32	4	12.5
Calvert	67	7	6	0	13	3	23.1
Caroline	343	34	3	1	37	7	18.4
Caroll	577	58	4	4	66	9	13.4
Cecil	263	26	1	1	28	2	7.1
Charles	127	13	7	0	20	2	10.0
Dorchester	180	18	2	1	21	2	9.5
Frederick	679	68	17	2	87	11	12.6
Garrett	320	32	7	0	39	7	17.9
Harford	328	33	13	1	47	11	23.4
Howard	139	14	9	0	23	2	8.7
Kent	145	15	0	1	16	4	25.0
Montgomery	220	22	2	2	26	3	11.5
Prince George's	82	8	1	0	9	4	44.4
Queen Anne's	190	19	6	1	26	2	7.7
Saint Mary's	200	20	15	1	36	4	11.1
Somerset	182	18	0	0	18	2	11.1
Talbot	121	12	2	3	17	3	17.6
Washington	647	65	9	3	77	12	15.2
Wicomico	329	33	4	0	37	2	5.4
Worcester	235	24	0	0	24	1	4.2
Unknown	--	--	--	--	--	8	--
Total	5957	598	125	22	745	110	--

Table 3. Reasons for lack of interest in on-farm processing (*n*=144).

Reason	*N*
Did not provide a reason	43
Horse farmer	32
Not interested	15
Time and/or resources	12
Not in business plan/doesn't fit operation	10
Age/retired/no longer own farm	19
Need additional management/labor/expertise	3
Have enough to do	3
Not financially viable	1
Concerns with the health department	1
Too many regulations	1
Should be the right of anyone engaged in farming	1
Why do we need a license to sell raw milk?	1
No reason to when small, excellent slaughter facility available	1
Too much hassle	1

Demographics. Table 4 provides a summary of the demographics of all of the respondents (*n*=110). Demographics indicated that the gender of respondents was almost evenly split between males and females, with slightly more male respondents. In addition, the majority of respondents were between the ages of 45 to 64 and most of the respondents were owner/operators of the farms at which they were employed.

For comparison, Table 5 provides a summary of the demographics of Maryland farmers from the 2007 Census of Agriculture (USDA, 2007). The age, race, and ethnicity of survey respondents were found to closely match that of the general population of Maryland farmers. Differences were observed between the gender, farm size, and primary farm income of survey respondents and the general population of Maryland farmers. In particular, there were more female survey respondents as compared to the general population and there were less survey respondents from very small farms (1 to 99 acres) than in the general population. In addition, there were more

Table 4. Demographics of respondents (*n*=110).

Demographic	N	%	Demographic	N	%
Age			*Attend Course*		
Under 30	3	2.7	Yes	36	32.1
30 to 44	18	16.1	No	67	59.8
45 to 64	69	61.6	Unsure	6	5.4
65 or older	18	16.1			
Gender			*Farm Size*		
Male	60	53.6	1 to 99 acres	46	41.1
Female	48	42.9	100 to 499 acres	49	43.8
			500 to 999 acres	9	8.0
Race			1,000 or more acres	4	3.6
African American	1	0.9	*Farm Income*		
American Indian	0	0			
Asian	2	1.8	Beef cattle	27	24.1
White	104	92.9	Tobacco	0	0
Pacific Islander	0	0	Grains	18	16.1
Other	2	1.8	Poultry	4	3.6
			Vegetables	18	16.1
Ethnicity			Fruit trees	3	2.7
			Dairy	15	13.4
Hispanic	1	0.9	Aquaculture	0	0
Non-hispanic	105	93.8	Hogs	0	0
			Other	20	17.9
Job Responsibility			Prefer not to answer	5	4.5
Owner/Operator	88	78.6			
Hired Manager	2	1.8			
Partner	13	11.6			
Other	7	6.3			

survey respondents who reported that their primary income was from vegetables and dairy and less respondents who reported that their primary income was from aquaculture than in the general population.

Table 5. Demographics of Maryland farmers as reported in the 2007 Census of Agriculture.

Demographic	N	%	Demographic	N	%
*Age**			*Farm Size*		
Under 25	465	2.4	1 to 99 acres	8,393	65.4
25 to 44	3,963	20.0	100 to 499 acres	3,536	27.6
45 to 64	10,517	53.2	500 to 999 acres	539	4.2
65 or older	4,828	24.4	1,000 or more acres	366	2.9
Gender					
			Farm Income		
Male	10,618	82.7			
Female	2,216	17.3	Beef cattle	1,582	12.3
			Tobacco	39	0.3
*Race**			Grains and oilseeds	2,049	16.0
			Poultry and eggs	1,001	7.8
African American	223	1.1	Vegetables and melons	518	4.0
American Indian	90	0.5	Fruit and tree nuts	390	3.0
Asian	139	0.7	Dairy cattle and milk	565	4.4
White	19,190	97.1	Aquaculture and other animal	1,070	16.1
Pacific Islander	10	0.1	Hogs and pigs	109	0.8
More than one race	121	0.6	Greenhouse	673	5.2
			Sugarcane, hay, and other crops	3,055	23.8
			Other	783	6.1
*Ethnicity**					
Hispanic	144	0.7			
Non-hispanic	19,733	99.3			
Job Responsibility					
Full owner	9,035	70.4			
Part owner	2,763	21.5			
Tenant	1,036	8.1			

Processing interests. Table 6 provides a summary of the respondents processing interests. Of the respondents with an on-farm processing license, the majority were processing meat products, followed by "other" (e.g., baked goods, fruit pies, acidified foods, and candy), canned acid foods, and dairy. The primary location of sale reported was at farmers markets, followed by at retail, restaurants, and "other" (e.g., directly on the farm).

Table 6. Processing interests of respondents (*n*=110).

	Currently processing with on-farm processing license (*n*=15)	Currently processing without on-farm processing license (*n*=39)	Not currently processing but interested Yes (*n*=20) Maybe (*n*=28)
Types of Products			
Dairy	1	6	12
Meat	10	18	13
Canned acid foods	3	10	14
Other	4	8	15
Don't know	-	-	7
Location of Sale			
Restaurants	7	9	12
Retail	7	12	15
Farmers Markets	10	23	28
Other	5	21	22
Don't know	-	-	7
Processing Location			
On-Farm	5	16	33
Through a MD processor	3	16	17
Through a processor in another state	7	9	4
Other	0	1	2
Don't know	-	-	1

Of those respondents without an on-farm processing license, 39 (41%) were currently processing (either on-farm or through a processor) value-added food products. The majority of those currently processing food for sale were processing meat, followed by canned acid foods, "other", and dairy products. "Other" products being processed included baked goods, jams, acidified foods, juice, fruit pies, maple syrup, herbal teas and seasonings, dried herbs, apple sauce, apple butter, and pear butter. The primary location of sale for farmers' currently processing food was at farmers markets followed by "other" locations. "Other" locations of sale included roadside stands, through community-supported agriculture (CSA) programs, on the farm, and directly to individuals.

Of those respondents not currently processing food for sale, 20 (21%) indicated that they would be interested in processing in the future, and 28 (30%) farmers indicated that they *may be* interested in processing in the future. Of those farmers, the majority indicated that they would be interested in processing "other" foods, followed by canned acid foods, meat, and dairy. Examples of "other" foods listed were pickles, pesto, wine, dehydrated fruits, fruit pies, and baked goods. The majority of farmers indicated they would be interested in selling their products at farmers markets, followed by "other" locations, at retail, and at restaurants.

General Results

The following summary of results relates to data collected for all respondents (n=110), with the exception of the results for the intentions variables which only apply to those farmers who did not have an on-farm processing license (n=95). Results related to the theoretical constructs identified in the Theory of Planned Behavior will be reviewed

first, followed by those from the Health Belief Model. Results related to respondents' intentions to participate in on-farm processing will be described last.

In general, farmers had positive attitudes towards the on-farm processing license. Figure 6 shows the distribution of response options for the three attitude indicator variables. More than half of all respondents agreed or completely agreed that the on-farm processing license is valuable (52%) and that having an on-farm processing license is worthwhile (51%). More than half (54%) of all respondents disagreed or completely disagreed with the statement that the on-farm processing license is useless. Almost one-third of respondents, however, responded that they were uncertain about their attitudes towards these statements.

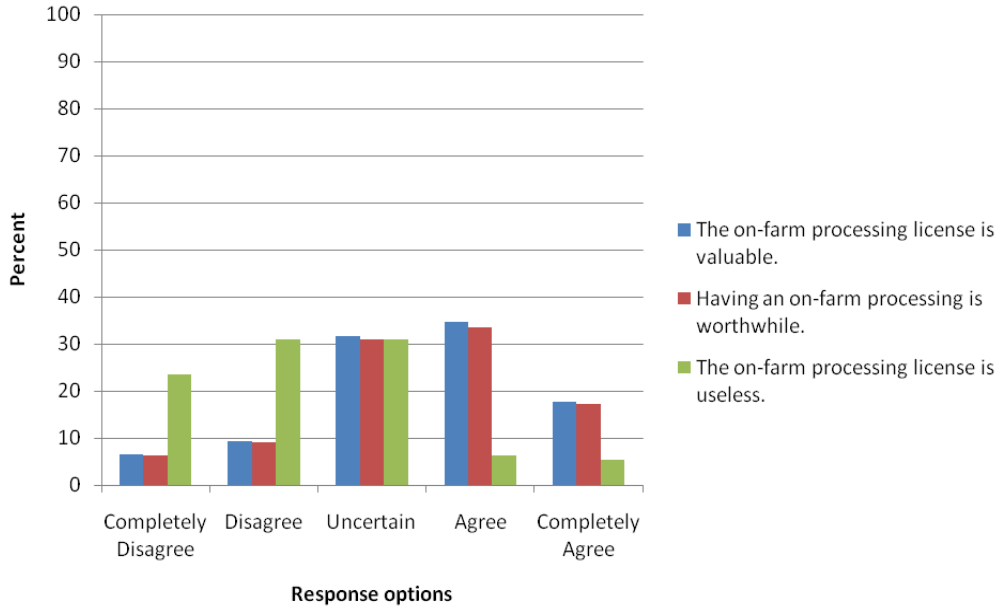

Figure 6. Distribution of response options for attitude indicator variables (*n*=110).

Although almost one-third of respondents were uncertain about their own attitudes towards the license, even more respondents were uncertain as to the opinion of other producers towards the license. See Figure 7 for the distribution of response options

for the three subjective norms indicator variables. Also of interest, about 10% of respondents completely disagreed with the statement that other producers they knew thought that getting an on-farm processing license is a good idea and completely agreed with the statement that other producers that they know think that getting an on-farm processing license is a bad idea.

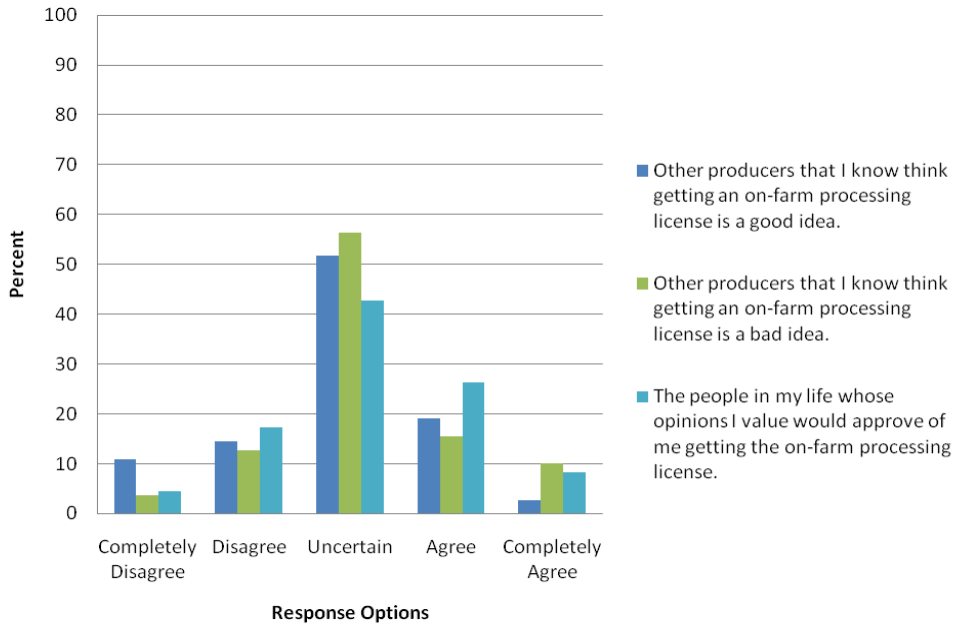

Figure 7. Distribution of response options for subjective norms indicator variables (*n*=110).

In terms of perceived behavioral control, the pattern of results suggests that farmers' perceived behavioral control differs for food safety and license application behaviors and for the different measures of self-efficacy and control. The distribution of responses for the efficacy indicators, shown in Figure 8, can be compared with those of the control indicators, shown in Figure 9. Respondents tended to report higher levels of self-efficacy and perceived control for food safety behaviors than for those related to

license application. In addition, respondents tended to report higher levels of perceived control than self-efficacy for both behaviors.

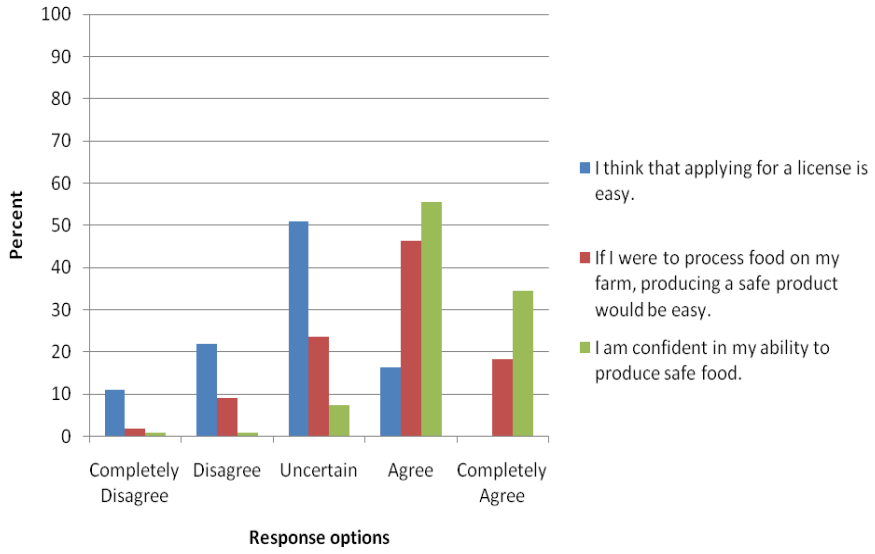

Figure 8. Distribution of response options for perceived behavioral control – self-efficacy indicator variables (*n*=110).

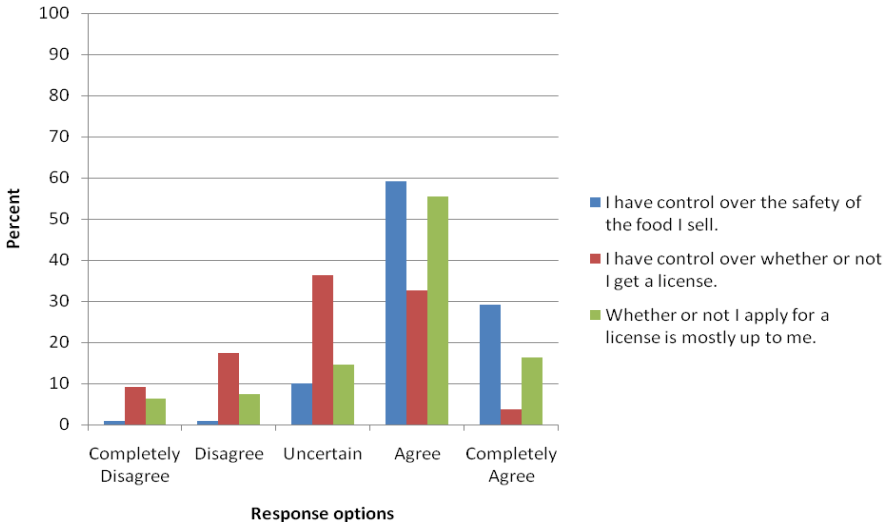

Figure 9. Distribution of response options for perceived behavioral control – perceived control indicator variables (*n*=110).

In terms of benefits, most farmers seemed to agree that the on-farm processing license offers a variety of benefits. The distribution of response options for the four benefits indicator variables can be found in Figure 10. The majority of farmers agreed or completely agreed that the license would be a good way to earn extra income (60%), diversify the types of products they sell (65%), and would allow them to sell more products at farmer's markets (62%). Over 80% of respondents agreed or completely agreed that if they intended to process and sell their own food products that getting a license would help them to abide by the law.

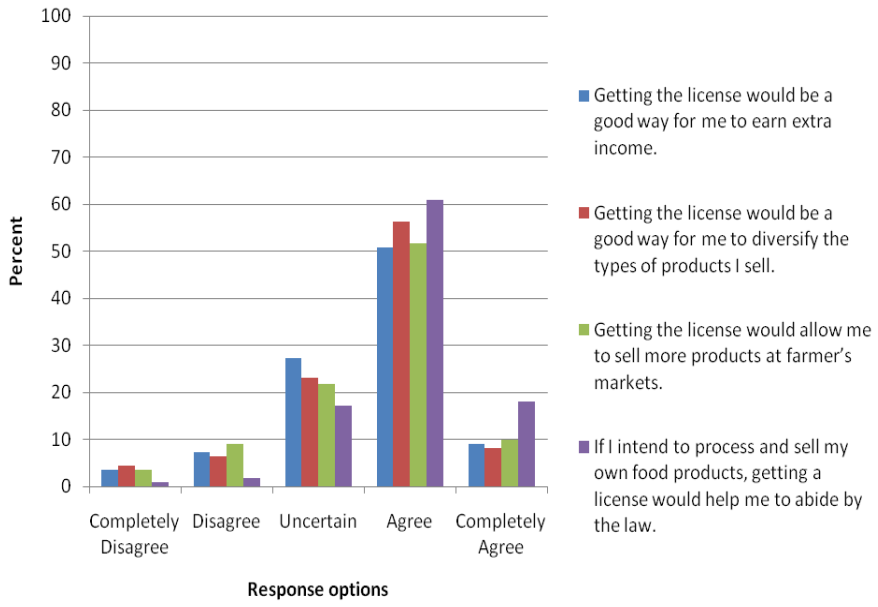

Figure 10. Distribution of response options for perceived benefits indicator variables (*n*=110).

In addition to the benefits of applying for a license, respondents also indicated agreement with a number of barriers. Figures 11 and 12 show the distribution of response options for the eleven different potential barriers to license application asked of

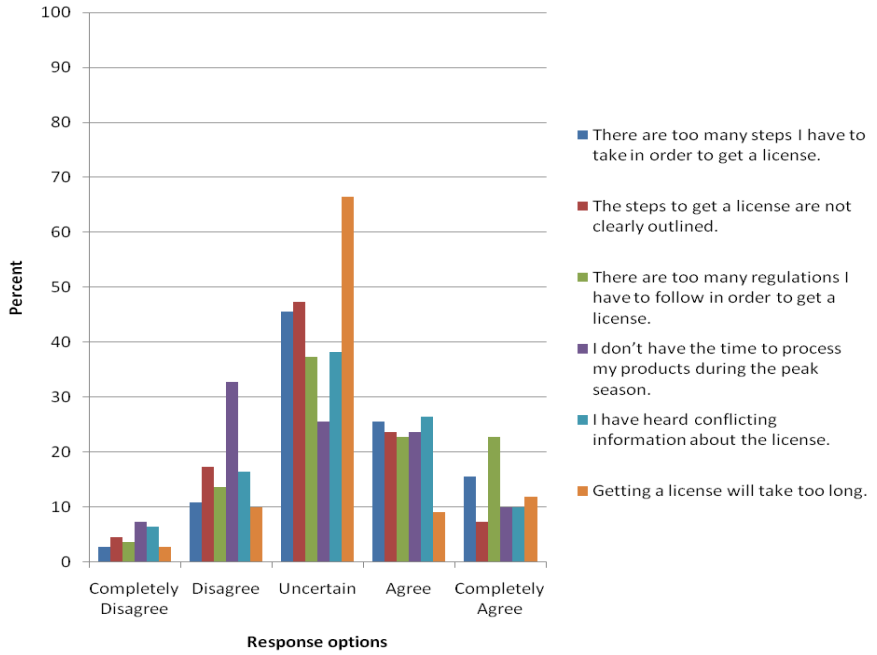

Figure 11. Distribution of response options for perceived barriers variables (*n*=110).

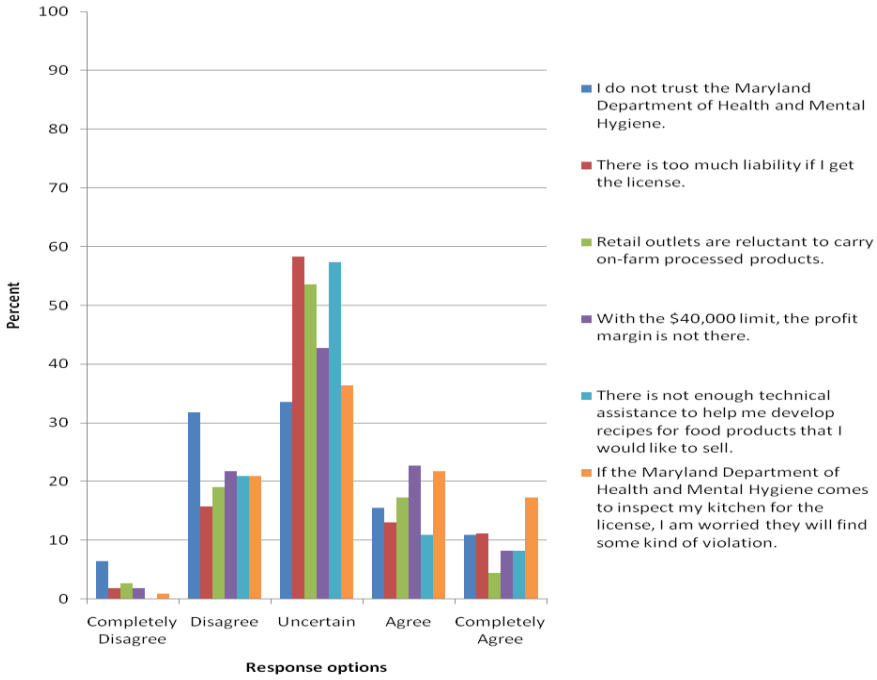

Figure 12. Distribution of response options for perceived barriers variables continued (*n*=110).

respondents. The barriers which farmers agreed or completely agreed most strongly with were that: there are too many regulations I have to follow in order to get a license (45%) and there are too many steps I have to take in order to get a license (41%). In addition, when reverse-scored, the following statement also had one of the highest agreements: if the Maryland Department of Health and Mental Hygiene comes to inspect my kitchen for the license, I am worried they will find some kind of violation (39%). Respondents were most unsure about the length of time it would take to get a license, whether there is enough technical assistance to help them develop recipes, and whether there is too much liability if they get the license. Also of interest is the large number of respondents that disagreed or completely disagreed with the statement that they do not trust the Maryland Department of Health and Mental Hygiene (38%), although slightly more than 25% of respondents agreed or completely agreed with the statement.

The distribution of response options for cues to action indicator variables can be seen in Figure 13. This figure clearly shows that the majority of respondents do not receive information about the license either in the mail, through their county extension agent, or at professional/association meetings.

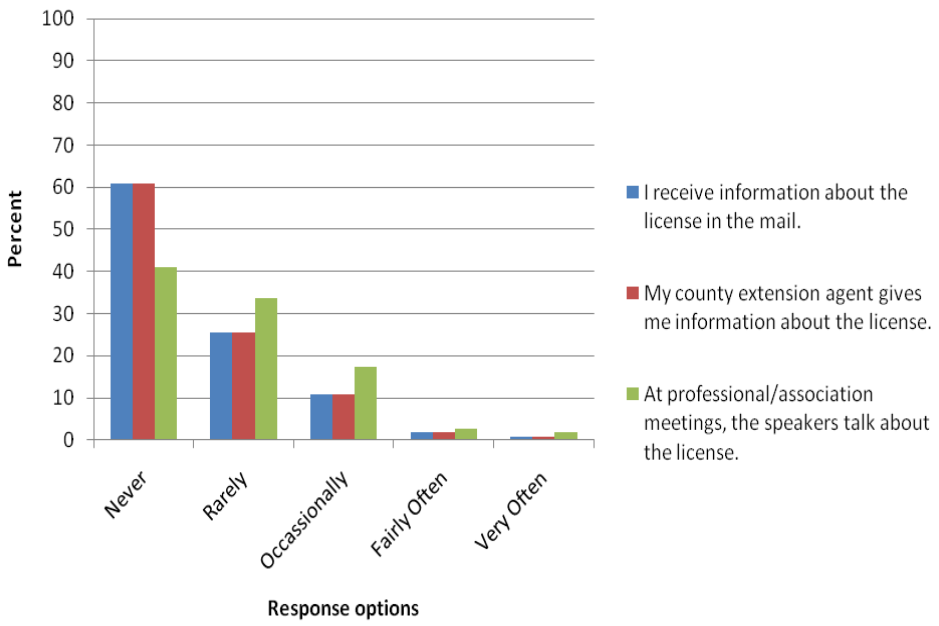

Figure 13. Distribution of response options for cues to action indicator variables (*n*=110).

When asked about their perceived susceptibility, the majority of respondents (69%) disagreed or completely disagreed with the statement that if they sell food at a farmer's market without a license no one will know, while only a small portion (6%) agreed or completely agreed. In contrast, over 80% of respondents agreed or completely agreed with the statement that if I processed food on my farm, it is unlikely that customers would get sick from my food. In addition, 46% disagreed or completely disagreed that the food they prepare for their farm-based business would be safer than the food they prepare for their family. Farmers were more uncertain (50%) as to whether the food they produce would be safer than food produced by other farmers. The distribution of response options for these variables can be found in Figure 14.

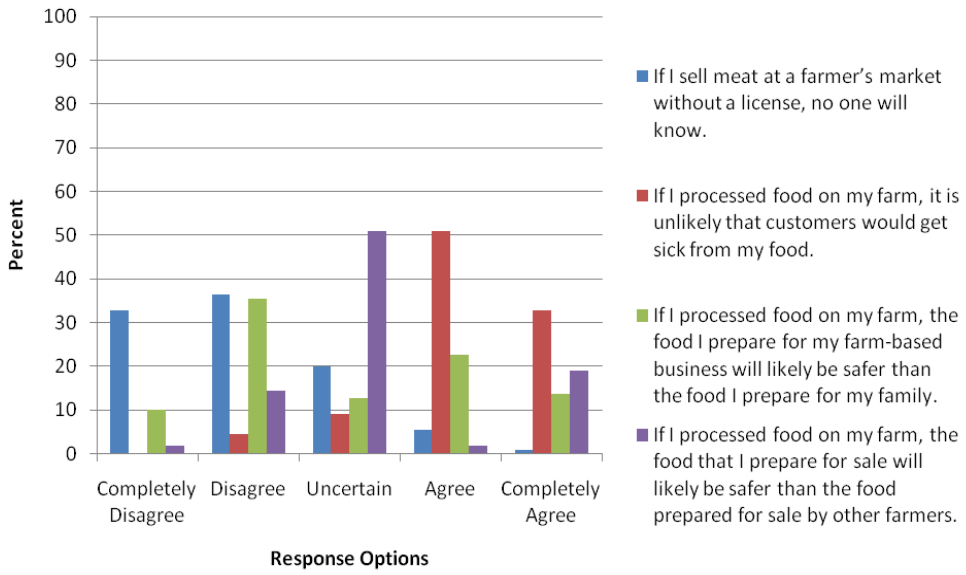

Figure 14. Distribution of response options for perceived susceptibility indicator variables continued (n=110).

Responses to the variables measuring perceived severity showed a similar pattern to those measuring susceptibility. Since two different scales were used for these measures, the results for the license indicator variables are shown in Figure 15 and the results for the food safety variables are shown in Figure 16. In general, respondents tended to understand the severity of the consequences for their business should they not follow the promoted license and food safety behaviors. Indeed, the majority of respondents agreed that the consequences of selling meat at a farmer's market without a license would be very serious and more than 70% reported that if customers became ill from food that they sold that the damage to their business would be either "severe" or "very severe". In contrast, 38% of respondents reported that a foodborne illness in their family would be "not at all serious" to "not serious," while 31% of respondents reported that a foodborne illness in their customers would likely be "not at all serious" to "not serious".

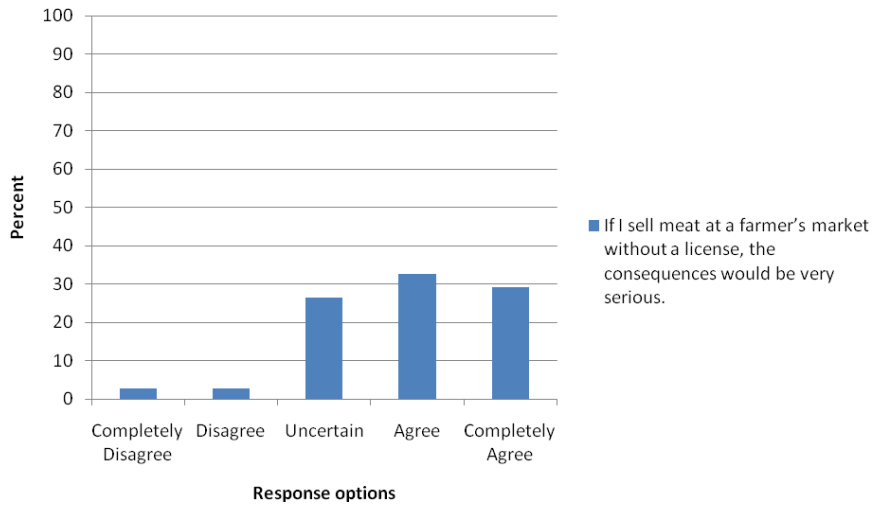

Figure 15. Distribution of response options for perceived severity - license indicator variables (*n*=110).

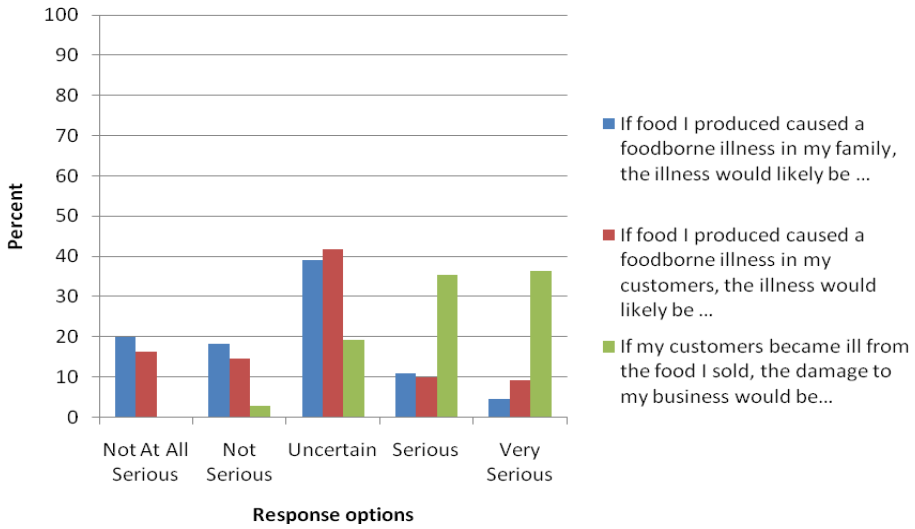

Figure 16. Distribution of response options for perceived severity – food safety indicator variables (*n*=110).

Finally, of those farmers that responded to the survey who did not have an on-farm processing license (*n*=95), almost half (45%) indicated that they were not interested in applying for an on-farm processing license as a result of problems with the on-farm processing program. In order to consider these farmers in subsequent data analyses, their

response options for the intentions questions were assigned a "0" (vs. "1"=very unlikely, "5" very likely). Of the remaining respondents who indicated some degree of interest in applying for the on-farm processing license, the most likely behavior they were willing to perform was to attend an information session, followed by applying for a license, and lastly requesting information about the license. Figure 17 shows the distribution of response options for the intentions variables.

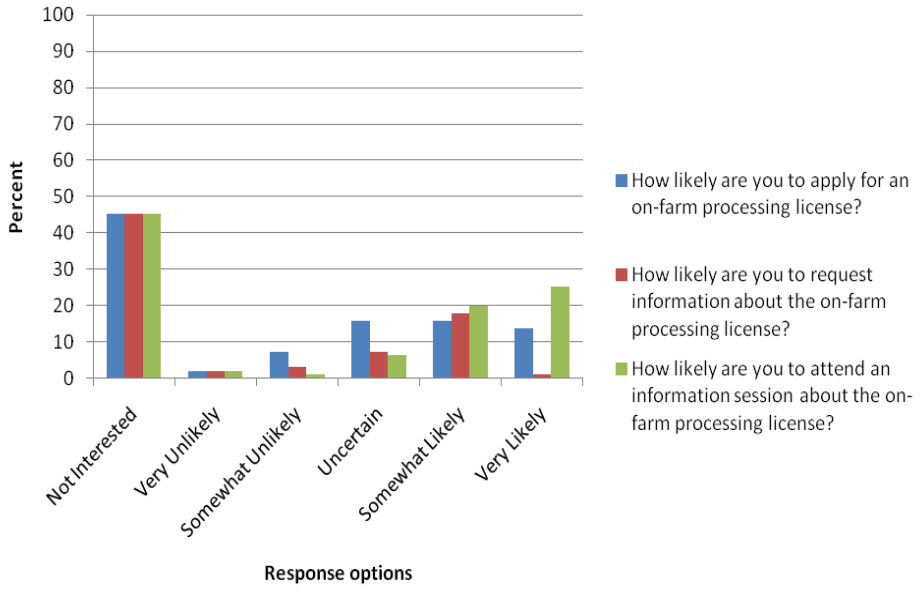

Figure 17. Distribution of response options for intentions indicator variables (*n*=110).

Predictors of Intentions to Apply for a License

In order to better understand how the theoretical constructs measured in this study affected farmers' intentions to apply for an on-farm processing license, latent variable path analysis was conducted. Of the 110 usable surveys received, 95 surveys were received from farmers who were either interested in on-farm processing or who were not interested as a result of the on-farm processing program. These responses were used to test the hypothesized relationships and the proposed model in Figure 3 in which factors in

the Health Belief Model and Theory of Planned Behavior were posited to predict behavioral intentions. The remaining 15 responses were from farmers who already had an on-farm processing license and thus were included in a separate analysis investigating the predictors of actual license application behavior. The results of the two-step latent variable path analysis are presented below.

Measurement model. Please refer to Table 7 for the normal and corrected fit statistics for the initial measurement model. The corrected fit indices indicated acceptable fit for the initial measurement model [*CFI*=.97, *RMSEA*=.04, 90% *CI*(.01,.06)]. No respecifications were made to the initial measurement model. The calculated construct reliability values (coefficient H) ranged from .76 to .99 indicating good construct reliability (Hancock & Mueller, 2001). See Table 1 for coefficient H values.

Structural Model. Please refer to Table 7 for the normal and corrected fit statistics for the proposed structural model and Figure 18 for the standardized path coefficients. The proposed structural model had marginal fit [*CFI*=.81, *RMSEA*=.06, 90% *CI*(.04,.08)], providing partial support for H1. The proportion of variance explained by the model was as follows: intentions (R^2=.14), attitudes (R^2=.26), subjective norms (R^2=.05), and perceived behavioral control (R^2=.03).

Table 7. Fit statistics for Predictors of Intentions to Apply for a License Model (Model 1).

	Desirable Range	Model 1: Initial Measurement Model	Model 1: Initial Structural Model	Model 1a: Respecified Structural Model EPBC5, EPBC6	Model 1b: Respecified Structural Model F4 →F9
Fit Statistics					
Df		196	210	209	208
χ^2 statistic		259.38	316.19	285.20	276.44
χ^2 /df		1.32	1.51	1.37	1.33
Comparative Fit Index	≥.95	.95	.96	.97	.97
SRMR	≤.08	.09	.13	.13	.13
RMSEA	≤.06	.06	.07	.06	.06
RMSEA Confidence Interval		(.04,.08)	(.06,.09)	(.04,.08)	(.04,.08)
Corrected Statistics					
S-Bχ^2 statistic		230.96	282.08	257.64	248.83
Comparative Fit Index	≥.95	.97	.81	.87	.89
RMSEA	≤.06	.04	.06	.05	.05
RMSEA Confidence Interval		(.01,.06)	(.04,.08)	(.03,.07)	(.02,.07)
Model Comparison				1a vs. 1	1b vs. 1a
Δ S-Bχ^{2**}		--	--	24.44	8.81
Δdf		--	--	1	1
Significance Level		--	--	<.001	<.01

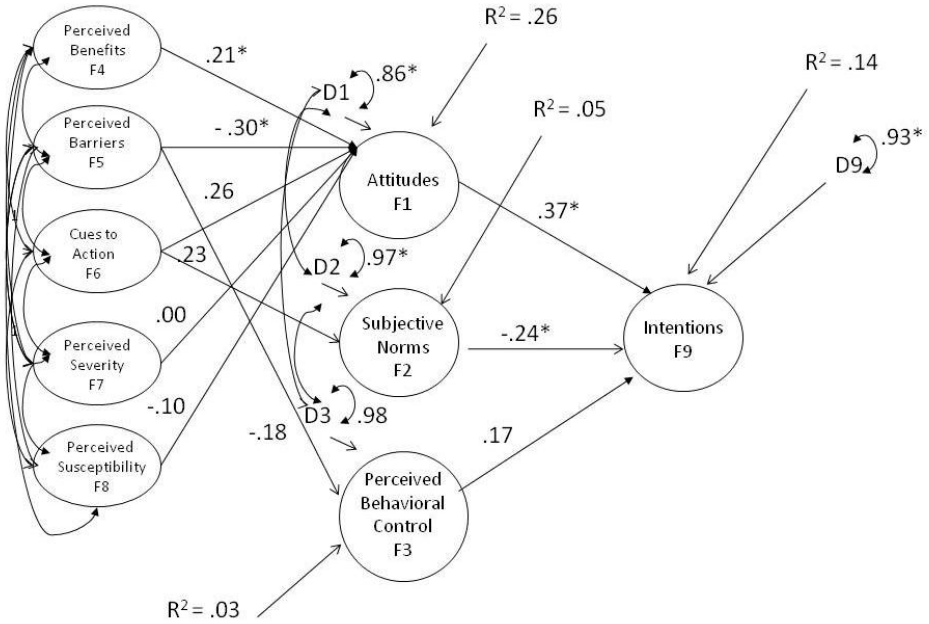

Figure 18. Standardized path coefficients for Predictors of Intentions to Apply for a License Model (Model 1). *Note:* Ovals represent latent constructs. *Represents a significant causal relationship (p<.05).

Support was found for several of the hypotheses related to the Theory of Planned Behavior constructs included in the proposed model. In hypothesis 2 it was proposed that attitudes would be positively and linearly related to intentions. Attitudes were positively and linearly related to intentions (p<.05), providing strong support for H2. In addition, the results indicate that farmers' attitudes regarding the on-farm processing license were the strongest predictors of intentions. In hypothesis 3 it was proposed that subjective norms would be positively and linearly related to intentions. Subjective norms were negatively and linearly related to intentions (p<.05), providing partial support for H3. Finally, in hypothesis 4 it was proposed that perceived behavioral control would be positively and linearly related to intentions. Perceived behavioral control was not significantly related to intentions, disconfirming H4 (p>.05).

Support was also found for several of the hypotheses for the proposed model related to the Health Belief Model constructs. In hypothesis 5 it was proposed that perceived benefits would be positively and linearly related to farmers' attitudes towards on-farm processing. Perceived benefits were positively and linearly related to farmers' attitudes towards on-farm processing ($p<.05$), providing strong support for H5. In hypothesis 6 it was proposed that perceived barriers would be negatively and linearly related to farmers' attitudes and perceived behavioral control towards on-farm processing. Perceived barriers were negatively and linearly related to farmers' attitudes ($p<.05$), but were not related to perceived behavioral control towards on-farm processing, providing mixed support for H6. In hypothesis 7 it was proposed that cues to action would be positively and linearly related to farmers' attitudes and subjective norms towards on-farm processing. Cues to action were not related to attitudes nor subjective norms towards on-farm processing ($p>.05$), disconfirming H7. In hypothesis 8 it was proposed that perceived susceptibility would be positively and linearly related to farmers' attitudes towards on-farm processing. Perceived susceptibility was not related to farmers' attitudes, disconfirming H8 ($p>.05$). Finally, in hypothesis 9 it was proposed that perceived severity would be positively and linearly related to farmers' attitudes towards on-farm processing. Perceived severity was not related to farmers' attitudes ($p>.05$), disconfirming H9.

In order to see whether any additional and theoretically relevant relationships should be considered, respecifications to the model were explored using the Lagrange Multiplier Test. Since the proposed model tested in the study had not been previously tested, respecifications should be considered as exploratory and part of model

development. Respecifications of the model suggested that the error terms for PBC5 (I have control over whether or not I get a license) and PBC6 (Whether or not I apply for a license is mostly up to me) should be correlated (Model 1a S-Bχ^2 statistic: 257.64 vs. Model 1 S-Bχ^2 statistic: 282.02, p<.001) and that perceived benefits has a direct effect on intentions (Model 1b *S-Bχ^2 statistic*: 248.83 vs. Model 1a *S-Bχ^2 statistic*: 257.64, p<.001).

Perceived Behavioral Control as a Multi-dimensional Construct

In addition to investigating the indicators of license application intentions, it was also of interest to explore whether perceived behavioral control is best measured as a multi-dimensional construct. Thus, the results from the 95 surveys received from farmers who were either interested in on-farm processing or who were not interested as a result of the on-farm processing program were used to test the hypothesized relationships in the alternative proposed model (see Figure 4). In this model, referred to as Model 2, the same relationships between the factors in the Health Belief Model and Theory of Planned Behavior and behavioral intentions were posited as in Model 1, with the exception of perceived behavioral control which was modeled as two distinct constructs: self-efficacy and perceived control. The results of the two-step latent variable path analysis for the alternative model tested are presented below.

Measurement model. Please refer to Table 8 for the normal and corrected fit statistics for the initial measurement model. Corrected fit indices indicated acceptable fit for the initial measurement model [*CFI*=.99, *RMSEA*=.05, 90% *CI*(.01,.07)].

Structural Model. Please refer to Table 8 for the normal and corrected fit statistics for the proposed structural model and Figure 19 for the standardized path

Table 8. Fit statistics for model with perceived behavioral control modeled as two distinct constructs: self-efficacy and perceived control (Model 2).

	Desirable Range	Model 2: Initial Measurement Model	Model 2: Initial Structural Model	Model 1: Initial Structural Model
Fit Statistics				
Df		188	210	210
χ^2 statistic		223.40	286.44	315.36
χ^2 /df		1.19	1.36	1.50
Comparative Fit Index	≥.95	.97	.97	.96
SRMR	≤.08	.08	.13	.13
RMSEA	≤.06	.05	.06	.07
RMSEA Confidence Interval		(.01,.07)	(.04,.08)	(.06,.09)
Corrected Statistics				
S-Bχ^2 statistic		202.67	257.90	281.54
Comparative Fit Index	≥.95	.99	.87	.81
RMSEA	≤.06	.03	.05	.06
RMSEA Confidence Interval		(.00,.06)	(.02,.07)	(.04,.08)
Model Comparison				2 vs. 1
Δ S-Bχ^{2**}		--	--	24.36
Δdf		--	--	1
Significance Level		--	--	<.001

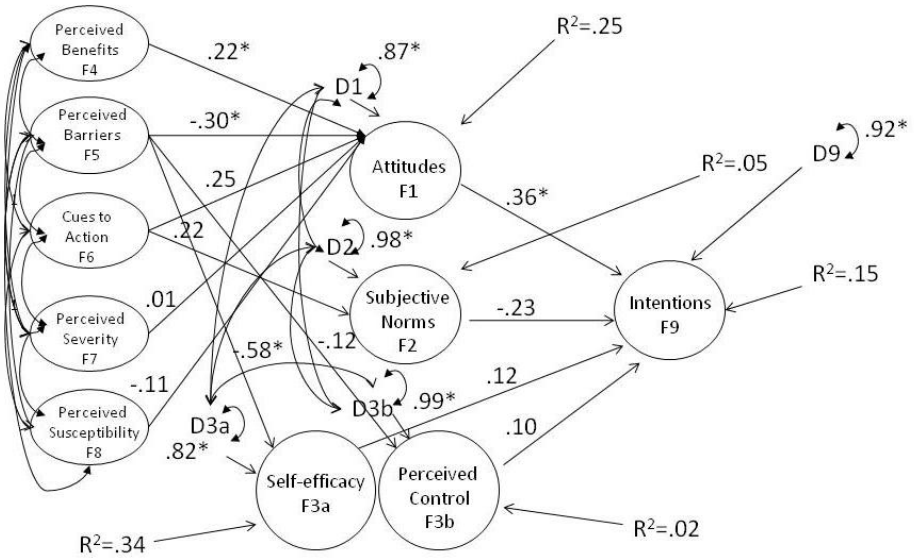

Figure 19. Standardized path coefficients for initial structural model with perceived behavioral control modeled by two distinct constructs: self-efficacy and perceived control (Model 2). *Note:* Ovals represent latent constructs. *Represents a significant causal relationship (p<.05).

coefficients. The proposed initial structural model had marginal fit [*CFI*=0.87, *RMSEA*=.05, 90% *CI*(.02,07)], partially supporting H10. None of the respecifications suggested by the Lagrange Multiplier Test made theoretical sense. The proportion of variance explained by the model was as follows: intentions (R^2=.15), attitudes (R^2=.25), subjective norms (R^2=.05), self-efficacy (R^2=.34), and perceived control (R^2=.02). The χ^2 difference test revealed that the alternative model in which perceived behavioral control was modeled by two distinct constructs was a significantly better fit than the alternative representation (p<.001), supporting H11.

Predictors of License Application

In addition to exploring the predictors of farmers' intentions to apply for a license, it was also an objective of this study to explore predictors of actual license application behavior. All of the responses (n=110) were used to test the hypothesized relationships and the proposed model in Figure 5 in which factors in the Health Belief Model and Theory of Planned Behavior were posited to predict behavior. Results related to the Theory of Planned Behavior constructs will be presented first, followed by those related to the Health Belief Model.

As with intentions, license application behavior was thought to be directly predicted by attitudes, subjective norms, and perceived behavioral control. The rare events logistic regression is presented in Table 9. The classification table, provided in Table 10, suggests the predicted probabilities agreed highly with the actual outcomes and correspondingly, that the model had good fit. Indeed, the overall % correct classification for the predicted and observed successes and failures was 90%. According to the classification table, the predictions were more accurate for failures (i.e., the farmers predicted to not receive a license) than for successes (i.e., the farmers predicted to receive a license). This finding is supported by the magnitude of sensitivity (36%) compared to that of specificity (100%). Sensitivity measures the proportion of correctly classified events, while specificity measures the proportion of correctly classified nonevents (Peng et al., 2002).

Table 9. Corrected logistic regression of license application behavior on attitudes, subjective norms, and perceived behavioral control (*n*=110).

Predictor (Mean)	B	Robust S.E.	β	Z	Wald χ^2	P>|z|	95% Confidence Interval		Odds ratio e^B
Constant	-7.12	2.19	-7.55	-2.97	8.82	.001	[-11.49	-2.91]	
Attitude	1.31	0.68	1.44	1.92	3.70	.05	[-.02	2.64]	3.71
Subjective Norm	-3.38	1.07	-3.26	-3.17	10.02	.002	[-5.48	-1.29]	.034
Perceived Behavioral Control	1.62	0.64	1.76	2.55	6.48	.01	[.37	2.86]	5.05

Table 10. Observed and predicted successes and failures for license attainment by rare events logistic regression with the cutoff of 0.50.

Observed	Predicted		% Correct
	Success	Failure	
Success	4	11	36%
Failure	0	95	100%
Overall % Correct			90%

Note: Sensitivity = 36%, Specificity = 100%. False positive = 0%, False negative = 10%.

Significant effects for attitude (β=1.44, 95% *CI*(-0.02, 2.64), *p*=0.05), subjective norms (β=-3.26, 95% *CI*(-5.48, 1.29), *p*=0.002), and perceived behavioral control (β=1.76, 95% *CI*(-0.37, 2.86), *p*=0.01) were found. Attitudes were found to be positively related to farmers' license application behavior providing support for H12, while subjective norms were found to have a negative relationship providing only partial support for H13. Perceived behavioral control was found to have a positive relationship with farmers' behavior as expected providing support for H14. See Figure 20 for the regression coefficients.

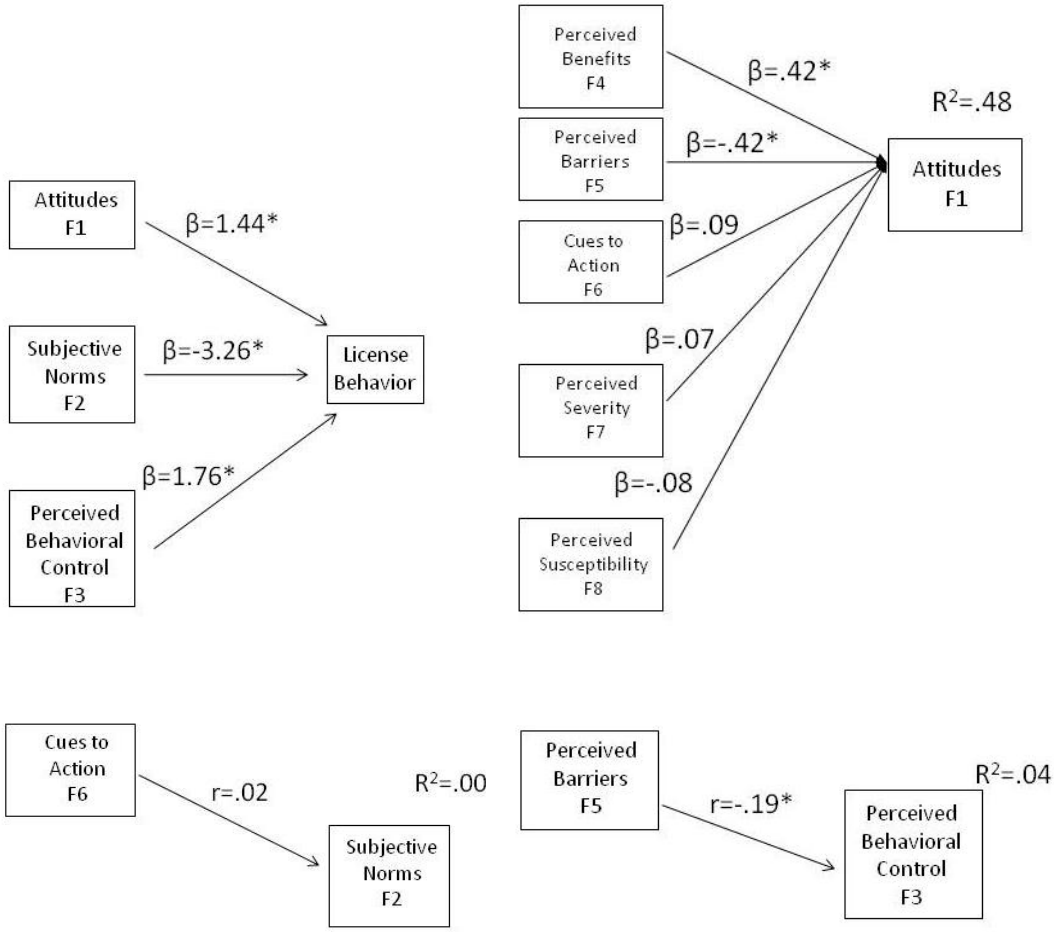

Figure 20. Standardized regression and correlation coefficients for proposed theoretical model as applied to prediction of license application behavior modeled as two multiple regressions and two correlations. *Note:* Boxes represent mean composite score variables. *Represents significant coefficients $p<.05$.

Since only the independent variables were standardized before using them in the rare events logistic regression, the coefficients for that model are considered semi-standardized (as opposed to standardized). Semi-standardized coefficients show the change in the logged odds of applying for a license due to a one standard deviation change in each of the independent variables. An odds ratio (e^B) of 3.71 for the continuous independent variable attitudes indicates that when a farmer's attitudes

increase by one unit, the odds that the farmer applies for a license increases by a factor of 3.71, when all other variables are controlled. In contrast, an odds ratio of 0.03 for subjective norms indicates that when a farmers subjective norms increase by one unit, the odds that the farmer applies for a license increases by a factor of 0.03, when all other variables are controlled.

Attitudes were also thought to be directly predicted by perceived benefits, barriers, cues to action, susceptibility, and severity in the behavior model. The multiple regression model is shown in Table 11. R was significantly different from zero $F(5,104)=19.02$, $p<.05$, $R^2=.48$, Adjusted $R^2=.45$, $RMSE=.75$. Significant effects for perceived benefits ($\beta=.42$, $p=.00$) and perceived barriers ($\beta=-.42$, $p=.00$) were found, supporting H15 and H16. No other significant effects were found, disconfirming H17, H18, and H19. See Figure 20 for the standardized regression coefficients.

The standardized β values indicate that perceived benefits and perceived barriers have a comparable (and opposite) degree of importance in the model. They also indicate that a one standard deviation change in perceived benefits will result in a 0.42 standard deviation increase in attitudes and that a one standard deviation change in perceived barriers will result in a -0.42 standard deviation decrease in attitudes, holding all other variables constant. Perceived benefits, barriers, cues to action, susceptibility, and severity explained 48% (45% adjusted) of the variance in attitudes.

Table 11. Multiple regression of attitudes on perceived benefits, barriers, cues to action, susceptibility and severity (*n*=110).

Predictor (Mean)	B	S.E.	*B*	T	P>|z|	95% Confidence Interval	
Constant	3.21	0.57	-	5.59	.00	[2.07	4.35]
Benefits	0.51	0.10	.42	5.35	.00	[-0.32	-0.70]
Barriers	-0.49	0.09	-.42	-5.53	.00	[-0.66	-0.34]
Cues to Action	0.13	0.10	.09	1.25	.21	[-0.08	2.86]
Susceptibility	0.07	0.09	.07	0.79	.43	[-0.10	0.24]
Severity	-0.08	0.57	-.08	-0.98	.33	[-0.25	0.08]

Note: R^2=.48, Adjusted R^2=.45.

Finally, cues to action were thought to be positively and directly related to subjective norms (H20) and perceived barriers were thought to be negatively and linearly related to farmers' perceived behavioral control towards on-farm processing (H21). Correlation analysis revealed that the relationship between perceptions of cues to action and subjective norms was not significant, *r*=.02, *p*(one-tailed)=.40, disconfirming H20. Perceived barriers were, however, found to be negatively and linearly related to farmers' perceived behavioral control, *r*=-.19, *p*(one-tailed)=.02 as predicted, confirming H21. The R^2 revealed that 4% of the variance in farmers' perceived behavioral control could be explained by their perception of barriers.

Effect of Training

Differences in the predictors of farmers' intentions to participate in on-farm processing between those respondents that did and did not attend one of the 2005 training courses were also explored. The initial hypothesis (H22), that the proposed model structure was non-invariant between farmers who did and did not attend the 2005 training

courses could not be tested, however, because the sample size was too small to conduct a multiple-group latent variable path analysis. Instead, two-tailed independent *t*-tests were conducted for each of the indicator variables. Of the 95 respondents who reported that they were either interested in on-farm processing or were not interested as a result of the on-farm processing program, 33 had attended one of the 2005 training courses and 56 did not attend a course. Six respondents indicated that they were unsure as to whether they attended one of the courses, and as a result, were not included in the following analyses. In addition, it should be noted that differences between respondents who did and did not attend the training courses were explored for all of the variables included in the survey. Only a sub-set of these variables, however, were included in the model testing. Table 12 shows the mean values of the indicator variables for course and non-course respondents, *p*-values < .05 were considered significant.

Comparison between the mean responses of farmers that did and did not attend one of the 2005 training courses revealed few significant differences. The majority of differences found were related to the perceived behavioral control variables. More specifically, on average, respondents who did not attend training perceived that applying for a license was easier (M=2.68, SE=.09) than those that did attend the training (M=2.30, SE=.15). This difference was significant $t(55.03)=2.09$, p=.04 (equal variances could not be assumed) and it represented a medium effect size r = .28. In addition, respondents who did not attend the training perceived that if they were to process food on their farm, producing a safe product would be less easy (M=3.59, SE=.11) than those that did attend the training (M=4.09, SE=.17). This difference was significant $t(87)=-2.62$, p=.01) and

Table 12. Factors, variables, and descriptive statistics for course (*n*=33) and non-course (*n*=56) respondents.

Factor	Variable and Survey Question	Course Mean (±S.D.)	Non-course Mean (±S.D.)	*t*-value	*p*-value
F1: Attitude	A1: The on-farm processing license is valuable.	3.57(1.14)	3.38 (0.96)	0.86	.40
	A2: Having an on-farm processing license is worthwhile.	3.60(1.11)	3.36(1.0)	1.08	.28
	A3 (R): The on-farm processing license is useless.	3.55(1.18)	3.57(0.99)	0.12	.91
F2: Subjective Norm	SN1: Other producers that I know think getting an on-farm processing license is a good idea.	3.18(0.95)	2.88(0.79)	1.64	.11
	SN2 (R): Other producers that I know think getting an on-farm processing license is a bad idea.	3.22(0.83)	2.96(0.79)	1.46	.15
	SN3: The people in my life whose opinions I value would approve of me getting the on-farm processing license.	3.47(0.88)	3.27(0.86)	1.07	.29
F3: Perceived Behavioral Control	PBC1 (EFF1): I think that applying for a license is easy.	2.30(0.88)	2.68(0.69)	2.23	.03
	PBC2 (EFF2)*: If I were to process food on my farm, producing a safe product would be easy.	4.09(0.95)	3.59(0.83)	2.53	.01†
	PBC3 (EFF3)*: I am confident in my ability to produce safe food.	4.46(0.51)	3.88(0.76)	3.88	.00
	PBC4 (CON1)*: I have control over the safety of the food that I sell.	4.52(0.57)	4.02(0.75)	3.54	.00†
	PBC5 (CON2): I have control over whether or not I get a license.	3.03(1.19)	3.00(0.92)	0.14	.89
	PBC6 (CON3): Whether or not I apply for a license is mostly up to me.	3.70(1.10)	3.62(1.04)	0.34	.73†
F4: Benefits	BEN1: Getting the license would be a good way for me to earn extra income.	3.40(0.90)	3.53(0.86)	0.68	.50
	BEN2: Getting the license would be a good way for me to diversify the types of products I sell.	3.61(0.85)	3.48(0.85)	0.71	.48
	BEN3: Getting the license would allow me to sell more products at farmer's markets.	3.69(0.96)	3.43(0.85)	1.35	.18
	BEN4*: If I intend to process and sell my own food products, getting a license would help me to abide by the law.	4.02(0.73)	3.79(0.73)	1.46	.15

Note: Variables denoted with an * were dropped from model analyses. Variables denoted with an (R) were reverse coded for all analyses. †Equal variances could not be assumed.

Table 12. Factors, variables, and descriptive statistics for course (*n*=33) and non-course (*n*=56) respondents continued.

Factor	Variable and Survey Question	Course Mean (±S.D.)	Non-Course Mean (±S.D.)	*t*-value	*p*-value
F5: Barriers	BAR1: There are too many steps I have to take in order to get a license.	3.61(0.97)	3.46(0.74)	0.73	.47†
	BAR2: The steps to get a license are not clearly outlined.	3.36(1.06)	3.21(0.59)	0.75	.46†
	BAR3: There are too many regulations I have to follow in order to get a license.	3.85(1.09)	3.61(0.89)	1.08	.29†
	BAR4*: I don't have the time to process my products during the peak season.	2.90(1.16)	3.23(0.97)	1.47	.15
	BAR5*: I have heard conflicting information about the license.	3.62(0.94)	3.13(0.92)	2.42	.02
	BAR6*: Getting a license will take too long.	3.39(0.97)	3.18(0.66)	1.25	.22
	BAR7*: I do not trust the Maryland Department of Health and Mental Hygiene.	3.17(1.25)	2.88(1.01)	1.13	.26†
	BAR8*: There is too much liability if I get the license.	2.88(0.78)	3.32(0.86)	2.41	.02
	BAR9*: Retail outlets are reluctant to carry on-farm processed products.	2.81(0.85)	3.11(0.73)	1.73	.09
	BAR10*: With the $40,000 limit, the profit margin is not there.	3.18(1.17)	3.16(0.83)	0.06	.95†
	BAR11*: There is not enough technical assistance to help me develop recipes for food products that I would like to sell.	3.06(0.83)	3.05(0.72)	0.04	.97
	BAR12*: If the Maryland Department of Health and Mental Hygiene comes to inspect my kitchen for the license; I am worried they will find some kind of violation.	3.49(1.10)	3.38(0.96)	0.51	.61

Note: Variables denoted with an * were dropped from model analyses. Variables denoted with an (R) were reverse coded for all analyses. †Equal variances could not be assumed.

Table 12. Factors, variables, and descriptive statistics for course (*n*=33) and non-course (*n*=56) respondents continued.

Factor	Variable and Survey Question	Course Mean (±S.D.)	Non-Course Mean (±S.D.)	*t*-value	*p*-value
F6: Cues to Action	C1. I receive information about the license in the mail.	1.73(0.88)	1.36(0.70)	2.19	.04†
	C2. My county extension agent gives me information about the license.	1.55(0.90)	1.45(0.76)	0.55	.58
	C3. At professional/association meetings, the speakers talk about the license.	2.34(1.11)	1.69(0.90)	3.00	.00
F7: Susceptibility	SUS1 (R): If I sell meat at a farmer's market without a license, no one will know.	4.02(0.96)	3.98(0.85)	0.18	.78
	SUS2*: If I processed food on my farm, it is unlikely that customers would get sick from my food.	4.26(0.90)	4.07(0.76)	1.06	.29
	SUS3*: If I processed food on my farm, the food I prepare for my farm-based business will likely be safer than the food I prepare for my family.	3.01(1.29)	2.87(1.25)	0.53	.60
	SUS4*: If I processed food on my farm, the food that I prepare for sale will likely be safer than the food prepared for sale by other farmers.	3.18(0.95)	3.09(0.72)	0.50	.66
F8: Severity	SEV1: If I sell meat at a farmer's market without a license, the consequences would be very serious.	3.85(1.01)	3.83(0.90)	0.06	.95
	SEV2*: If food I produced caused a foodborne illness in my family, the illness would likely be …	2.38(0.99)	2.67(1.13)	1.22	.23
	SEV3*: If food I produced caused a foodborne illness in my customers, the illness would likely be …	2.52(1.40)	2.90(1.10)	1.42	.16
	SEV4*: If my customers became ill from the food I sold, the damage to my business would be…	4.14(1.08)	4.00(0.88)	0.64	.52

Note: Variables denoted with an * were dropped from model analyses. Variables denoted with an (R) were reverse coded for all analyses. †Equal variances could not be assumed.

Table 12. Factors, variables, and descriptive statistics for course (*n*=33) and non-course (*n*=56) respondents continued.

Factor	Variable and Survey Question	Course Mean (±S.D.)	Non-Course Mean (±S.D.)	*t*-value	*p*-value
F9: Intentions	I1: How likely are you to apply for an on-farm processing license?	2.12(2.03)	1.80(1.87)	0.75	.46
	I2: How likely are you to request information about the on-farm processing license?	2.33(2.19)	2.13(2.16)	0.42	.68
	I3: How likely are you to attend an information session about the on-farm processing license?	2.49(2.29)	2.19(2.18)	0.61	.54

Note: Variables denoted with an * were dropped from model analyses. Variables denoted with an (R) were reverse coded for all analyses. †Equal variances could not be assumed.

represented a medium effect size r = .29. Respondents who did not attend the training also reported that they were less confident in their ability to produce safe food (M=3.88, SE=.10) than those that did attend the training (M=4.45, SE=.09). This difference was significant $t(87)$=-3.88, p=.00 and represented a medium effect size r = .43. Furthermore, on average, respondents who did not attend the training perceived that they had less control over the safety of the food that they sell (M=4.02, SE=.10) than those that did attend the training (M=4.52, SE=.10). This difference was significant $t(87)$=-3.29, p=.001 and represented a medium effect size, r = .36.

Differences were found between respondents for two of the barriers variables. On average, respondents who did not attend the training agreed less with the statement that they have heard conflicting information about the license (M=3.13, SE=.12) than those that did attend the training (M=3.62, SE=.16). This difference was significant $t(87)$=-2.42, p=.02 and represented a medium effect size, r = .26. In addition, on average, respondents who did not attend the training perceived there was more liability if they got the license (M=3.32, SE=.11) than those that did attend the training (M=2.88, SE=.14). This difference was significant $t(87)$=2.41, p=.02 and represented a medium effect size, r = .25.

Not surprisingly, on average, respondents who did not attend the training reported that they receive less information about the license in the mail (M=1.36, SE=.09) than those that did attend the training (M=1.73, SE=.15). This difference was significant $t(55.93)$=-2.07, p=.03 (equal variances was not assumed) and represented a medium effect size r = .28. Furthermore, on average, respondents who did not attend training agreed less with the statement that at professional/association meetings, the speakers talk

about the license (M=1.69, SE=.12) than those that did attend the training (M=2.34, SE=.19). This difference was significant $t(87)$=-3.00, p=.004 and represented a medium effect size r = .33. Attendance at the training was not a significant predictor of any of the other variables or factors (i.e., attitudes, subjective norms, perceived benefits, perceived susceptibility, or intentions to apply for a license).

Discussion

Very little attention has been given in the literature to the reasons why farmers' choose or don't choose to comply with regulatory requirements and recommended food safety behaviors. In this study, a mail survey was administered to farmers in the state of Maryland to explore the predictors of farmers' intentions to participate in Maryland's on-farm processing program as well as their license application behavior. In addition, survey results provide general insight as to farmers' processing interests and their food safety perceptions as well as the role a food safety training course played in affecting these perceptions.

Sample Characteristics

Results from the mail survey provide great insight as to general interest in on-farm processing in the state of Maryland as well as the demographic characteristics and processing interests of farmers considering participation in the program. Primarily, the results indicated that the majority of farmers in Maryland are not interested in on-farm processing. This is not surprising given the variety of commodity groups farmed in Maryland, many of which are not conducive for producing on-farm processed foods such as Christmas trees, cotton, hay, and horses (USDA, 2007). Indeed, the primary reason

given for lack of interest in on-farm processing by respondents (other than because of problems with the licensing program), was that their main income was from horse farming. Although this finding is likely a function of the types of farms in Maryland, it also highlights a limitation of the sampling frame. In order to obtain a random sample of farmers in Maryland, so that generalizations could be made beyond the survey sample, a random sample was systematically selected from a database which contained the names and contact information of farmers in Maryland that own livestock, poultry, organic, and/or "other" operations. Unfortunately, farmers whose primary income was horse farming (among other non-food commodities) were included in the "other" category along with farmers whose primary income was from fruit trees, vegetables, and other food related categories. This result highlights the trade-off made between obtaining a random sample and maximizing the number of usable responses.

The second most common reason provided for a lack of interest in on-farm processing was age. The aging of U.S. farm operators was reported in the 2007 U.S. Census for Agriculture. According to the Census, the average age of farmers in Maryland increased from 55.9 years in 2002 to 57.3 years in 2007. In general, the number of operators 75 years and older in the U.S. grew by 20% between 2002 and 2007. Although this result was not surprising given the general ageing of U.S. and Maryland farm operators, it is possible that the database used was outdated and that some surveys were sent to farmers who are no longer operating farms while they were not sent to newer farmers. This is another potential limitation of the sampling frame which will be discussed later.

Another reason for lack of interest in the on-farm processing program given was lack of awareness of the program. Importantly, fourteen respondents indicated that they were interested in processing food on-farm, yet they had not heard of the on-farm processing license. The pilot study also highlighted that there may be farmers who have considered processing food on-farm without any knowledge of the on-farm processing license or even more general licensing requirements. This result suggests there is a need for more effective communication regarding license requirements. Moreover, the demographics of the survey respondents suggest that such communication needs to reach a wide and diverse audience. In general, the demographics of farm operators continue to become more diverse in the U.S., particularly for those interested in producing a greater variety of products (USDA, 2007). Demographics of the survey respondents revealed that the number of female respondents interested in on-farm processing (23 women vs. 52 total, 44%), for example, is much higher than the proportion of female farmers in Maryland (2,216 women vs. 12,198 total, 17%). In addition, more than half (14 women vs. 25 total, 56%) of the farmers with on-farm processing licenses are women.

Importantly, previous research suggests that women are an underserved population in agricultural extension programs and that female farmers may have different needs in terms of information delivery than male farmers (Barbercheck et al., 2009; Liepins & Schick, 1998; Trauger et al., 2008). Focus groups and surveys of female farmers, for example, suggest that women would prefer more interactive, hands-on trainings as opposed to sessions which consist of PowerPoint presentations (Barbercheck et al., 2009; Trauger et al., 2008). Female farmers in other states also report not feeling welcome in many agricultural groups (Barbercheck et al., 2009). As a result, extension

educators have suggested that women farmers should be invited to help plan events, speak at training courses, or that some events should be held specifically for women (Barbercheck et al., 2009). The consideration of such demographic variables during training design will be discussed more in the following chapter.

Processing interests. Survey results regarding farmers processing interests suggest that there are a number of farmers currently processing food on-farm both with and without a license (those without a license reported selling products within the legal channels, i.e., at farmers markets or through a licensed processor), as well as a number of farmers interested in processing food on-farm. In general, meat appeared to be the product that is most often processed by farmers both with and without an on-farm processing license. Reasons for processing interests were not included in the survey; however, discussions with former regulators at the Maryland Department of Health and Mental Hygiene suggest that there has been such a large interest in processing meat because it is more profitable than other products, especially if it is organic and free range, which is in demand by restaurants. The regulators added that some meat processors initially had on-farm processing licenses but started earning over $40,000 and so they became full processers (Menikheim & Elkin, 2008).

Less than half of the survey responses (48 farmers vs. 110 total, 44%) were from farmers who are currently not processing on-farm but who indicated that they may be interested in the future. This result, although small compared to the total number of farmers in the state, suggests that there is still a significant amount of interest from farmers to process on-farm. The farmers' interests were almost evenly spread across the different product categories of dairy, meat, canned acid foods, and other, although the

majority indicated that there were considering processing "other" foods such as pickles, pesto, wine, dehydrated fruits, fruit pies, and baked goods.

Farmers markets were the most commonly reported location of sale for farmers with and without on-farm processing licenses, as well as for those farmers who are not currently processing but who indicated they may be interested in the future. There was also a lot of interest in selling to restaurants and retail as well as "other" outlets which included roadside farm stands and community supported agriculture (CSA) programs. Such direct market venues as farmers' markets and roadside stands have proliferated in the past few decades and have become an increasingly popular and profitable strategy for farmers in the U.S. (Hinrichs, 2000; Montri, Kelley, & Sanchez, 2006). As previously mentioned, direct marketing to restaurants has also become a popular strategy for small family farms as consumers have become more interested in local and organic foods and restaurants have begun to offer a premium for such products. In addition, retailers are increasingly reporting that locally grown or produced foods are important to their customers and their organizations and as such, are making more of an effort to stock such products (Guptill & Wilkins, 2002). Through these direct marketing channels, farmers receive a larger proportion of the income generated by their crops and consumers can obtain local, seasonal, high-quality farm goods, all while strengthening ties to the community (Montri et al., 2006). Such information regarding Maryland farmers processing interests may help the MDHMH better address the needs of the target audience.

Predictors of Intentions to Apply for a License

Despite the variety of processing interests reported, as previously discussed, farmers' intentions to participate in on-farm processing were rather low overall. The present study aimed to determine if a model which integrated the Theory of Planned Behavior and the Health Belief Model is a useful framework for understanding and predicting Maryland farmers' intentions to apply for an on-farm processing license. Results provide mixed support for the proposed model. The proposed structural model had marginal fit and overall, the model accounted for 14% of the variance in intentions. Armitage and Conner (2001), in a meta-analysis of 161 studies using the TPB, found that the average proportion of variance in behavioral intentions explained by attitudes, subjective norms, and perceived behavioral control in the studies was 39%. The relatively small amount of variance explained by the model proposed in this study suggests there may be other variables which were not accounted for by the theories. Interestingly, adding the direct path from benefits to intentions, which was suggested as a model respecification, more than doubled the amount of variance explained in intentions (R^2=.30). The effect of this additional relationship and other potential predictors will be discussed in more detail later.

In terms of the Theory of Planned Behavior constructs, as hypothesized, significant direct relationships were found between farmers' attitudes and subjective norms and their intentions. Attitudes were found to have the greatest influence on intentions, when comparing the standardized path coefficients. The strong role of attitudes is a common finding in studies of the Theory of Planned Behavior (Armitage & Conner, 2001). Armitage and Conner (2001), for example, reported attitudes to have the

strongest average correlation of all of the three Theory of Planned Behavior constructs across 161 studies.

In contrast, the subjective norm component is generally found to be the weakest predictor of intentions (Armitage & Conner, 2001). Interestingly, in this study, subjective norms had a strong direct effect on intentions when compared to the other predictors. Although subjective norms were found to have a significant direct effect on intentions as hypothesized, the relationship was in the opposite direction of what was predicted. The negative relationship between subjective norms and intentions was surprising given that the opinions of others are very important for farmers decision-making processes (Maddox et al., 2003; Sligo & Massey, 2007; Sligo et al., 2005).

Reasons for the negative relationship between subjective norms and intentions to apply for a license are not clear. Sligo & Massey (2007) concluded that while farmers consult multiple layers of information sources ranging from friends, associations, lobbying groups, extension agents, veterinarians, and merchants, they also model the "cliché of the rugged individualist" and that they are often attracted to the farming lifestyle for the ability to make their own decisions. This individuality is thought to be tempered by their sense of responsibility to the collective. Thus, it is possible that Maryland farmers' sense of individuality and their own attitudes outweigh the opinions of others who are important to them.

Moreover, this sense of individuality may have led the farmers to feel that their behavioral freedom was being reduced by positive and/or negative opinions of their significant others towards the license. In this case, farmers would be expected to exhibit reactance or a counterforce which is experienced when an individual's behavioral

freedom is reduced or threatened with reduction (Brehm, 1966). Individuals who experience reactance tend to feel self-direction in terms of their own behavior and want to reestablish their freedom by doing the opposite of what the institution or relevant other(s) recommended (Brehm, 1966). Such reasoning would support the negative relationship found, although more research is needed to explore this reasoning.

Another reason for this finding could be that the farmers' motivation to comply with the opinions of others, whether strongly positive or negative, was low. Although studies of farmers interpersonal relationships have suggested that farmers give a lot of weight to the opinion of referent others (Maddox et al., 2003; Sligo & Massey, 2007), this may not be the case for female farmers, who represented a significant portion of the survey sample. A study of female farmers in Pennsylvania, for example, found that 58% reported that feeling isolated from other women farmers was a moderate to considerate problem, and 51% reported that feeling isolated from other farmers was a moderate to considerate problem. In addition, 54% of women reported that lack of family support for a role in managing the farm was a considerate to moderate problem (Barbercheck et al., 2009). It is also interesting to note that a large portion of those who responded to the survey were not even certain of the opinion of important others towards the license.

Ajzen (1991) initially proposed that the weight given to others' opinions be included within the subjective norm construct. Specifically, he proposed that subjective norms are a function of normative beliefs (i.e., the perceived behavioral expectations of important referent individuals or groups) weighted by motivation to comply with the referent in question. When testing this construct, Ajzen (1991) suggests that normative

beliefs (n) and motivation to comply (m) be aggregated, as shown in the following equation:

$$SN = \sum n_i m_i$$

Research investigating the impact of including both normative belief and motivation to comply as measures of subjective norms has reached inconsistent conclusions (Armitage & Conner, 2001; Budd, North, & Spencer, 1984; Chassin et al., 1981). Chassin et al. (1981), for example, found that adolescents' intentions to smoke cigarettes were better predicted by a model which contained normative beliefs than one which contained the full component of normative beliefs multiplied by motivation to comply. Thus, the utility of the motivation to comply measure has been questioned (Hale, Householder, & Greene, 2002) and for this reason was not included in the present study. Addition of the motivation to comply measure, however, may have explained the negative relationship between subjective norms and intentions.

Another unexpected finding in this study was the lack of association between perceived behavioral control and intentions, given the important role of perceived behavioral control in predicting behavior (Ajzen, 2002b; Armitage & Conner, 2001; Clayton & Griffith, 2008; Sparks et al., 1997; Tarkiainen & Sundqvist, 2005). The construct of perceived behavioral control has added significantly to the prediction of food choice (Sparks et al., 1997; Tarkiainen & Sundqvist, 2005) and the performance of work-based food safety behaviors (Clayton & Griffith, 2008) as well as a variety of other behaviors (Armitage & Conner, 2001). One possible reason for this finding could be due to the measurement of the construct. In this study, perceived behavioral control was measured by three indicator variables: PBC1: "I think that applying for a license is

easy", PBC2: "I have control over whether or not I get a license", and PBC3: "Whether or not I apply for a license is mostly up to me". These variables measure two separate constructs - self-efficacy (PBC1) and controllability (PBC2, PBC3). This is a common practice in studies of the TPB (Ajzen, 2002b), however, self-efficacy and controllability have been found to differentially affect intentions as well as actual performance of behavior (Ajzen, 2002b; Armitage & Conner, 2001; Terry & O'Leary, 1995). In their meta-analysis, Armitage and Conner (2001) found that self-efficacy correlates significantly more with behavioral intention than with perceived control. In this study, mean results of the indicator variables showed that respondents had higher perceptions of controllability towards applying for a license compared to efficacy, suggesting these may be distinct concepts which differentially affected behavioral intentions. The role of the distinct constructs of self-efficacy and controllability were tested in a separate analysis and will be discussed later.

In terms of the Health Belief Model constructs, the only significant direct relationships were found between the farmers' beliefs of perceived benefits and barriers and their attitudes. No other predicted relationships were found to be significant. When it comes to applying for a license, which is primarily a business decision, it is not particularly surprising that perceived benefits and barriers weighed so heavily on the farmers' attitudes towards the license. Indeed, non-compliance with regulations by small businesses in the UK have been attributed to, among other things, the calculation of the costs and benefits of compliance by the businesses (Henson & Heasman, 1998; Yapp & Fairman, 2006). Henson & Heasman (1998), for example, conducted a mail survey of technical directors from a variety of food manufacturers and retailers in the UK and

found that managers of food businesses, both large and small, reported that they would only comply with regulations once perceived benefits of compliance exceeded the perceived costs.

One of the factors which can affect the perception of the benefit to cost ratio is the ability of the business to actually identify the benefits and costs of compliance. Henson & Heasman (1998) suggest that benefits are more difficult for firms to identify than costs, which often leads to a bias towards higher perceived costs. In fact, when the standardized path coefficients of the model tested in this study are examined, they reveal that perceived barriers had a stronger effect on farmers' attitudes towards the license than perceived benefits. The barriers included in the model were BAR1: that there are too many steps to take in order to get a license, BAR2: the steps to get a license are not clearly outlined, and BAR3: there are too many regulations I have to follow in order to get a license. These barriers, and their importance within the model, suggest that the farmers may need more guidance with respect to the different steps required to obtain a license and that this information should be provided in a simple and clear manner. In addition, it is important that farmers perceive the benefits of applying for a license outweigh these perceived costs.

It should be noted that respecifications of the model suggest that perceived benefits had a significant, direct effect on intentions. This finding is in contrast to Azjen's (1991) assertion that such beliefs would act as antecedents to attitudes, subjective norms, and/or perceived behavioral control. As just discussed, it is possible that for a business decision, as opposed to a personal health decision, perceived benefits have a more direct effect on behavioral intensions. More research is needed to test the proposed

model, combining the Health Belief Model and Theory of Planned Behavior, within different contexts to better understand whether perceived benefits and barriers play as great of a role on behavioral intentions within non-business related contexts.

The lack of other significant predictors from the Health Belief Model was unexpected, given that each of the six factors in the model has been shown to impact the performance of food safety behaviors (Clayton et al., 2002; Hanson & Benedict, 2002; Riggins, 2006). The results for some of the other variables, however, did suggest some positive findings for regulators. For example, respondents generally disagreed with the statement measuring susceptibility (SUS1: If I sell meat at a farmer's market without a license, no one will know) and agreed with the statement measuring severity (SEV1: if I sell raw meat at a farmer's market without a license, the consequences would be very serious). These results suggest that farmers are aware that there is enforcement of the regulations and that the consequences for violation are severe.

In terms of model testing, it is important to note that the beliefs (as well as the Theory of Planned Behavior constructs and behavioral intentions measures) used in the model testing were all related to the actual license application as opposed to the other behaviors needed to be performed in order to get a license. Compatibility between the predictor constructs and intentions was identified by Fishbein and Ajzen (1980), in their discussion of the Theory of Reasoned Action, as important for maximizing predictive power. This suggestion has been supported by quantitative tests of the Theory of Reasoned Action (Kim & Hunter, 1993). Kim and Hunter (1993), in a meta-analysis of using the Theory of Reasoned Action, for example, found that attitude relevance affected the magnitude of the attitude – behavioral intentions correlation. As such, care was

taken in this study to select indicator variables that were compatible with the behavior in question: application of an on-farm processing license.

In reality, however, attainment of goals such as receiving a license requires that several behaviors be performed. In this case, farmers must conduct a process plan review with the MDHMH, receive food safety training, and allow for an inspection of their kitchen, before they can apply for a license. Previous research has found that food business managers' beliefs about safety predict their attitudes towards regulations (Kaplowitz & Ten Eyck, 2006). In this study, responses towards other variables included in the survey related to food safety suggest that these beliefs may have played a role in farmers' intentions to apply for a license. For example, a large proportion of respondents (>80%) reported that if they processed food on their farm, it was unlikely that customers would get sick from their food. In addition, respondents generally indicated that they did not perceive foodborne illness to be very severe. Such responses suggest farmers exhibit optimistic bias towards the risks associated with the foods that they produce (Weinstein, 1980); optimistic bias has been found to negatively correlate with performance of food safety behaviors (Clayton et al., 2002). These findings highlight a limitation of the models used in this study for predicting complex behaviors as these questions were not included because they lacked compatibility with the behavior of interest.

In addition to the limitations posed by using indicators which were compatible to the behavior of interest, it is possible that other variables could have been included in the model to increase the amount of variance explained in intentions. A number of additional variables have been identified as possible predictors of behavioral intentions, including moral obligations, self-identity, affect, and prior behaviors (Hale et al., 2002).

In the case of the on-farm processing license, it appears that affect could have played a role in influencing intentions which was not accounted for by the present study.

Affect has been found to have a profound effect on persuasion and decision-making (Dillard & Meijnders, 2002). The role of discrete emotions on persuasion and behavior has also been studied (Lerner & Keltner, 2000; Nabi, 2002; Turner, 2007). Such discrete emotions include anger, fear, guilt, hope, and happiness (Nabi, 2002). Importantly, each discrete emotion has been found to differentially affect behavior and behavior change (Lerner & Keltner, 2000; Nabi, 2002; Turner, 2007).

In this study, results from the survey, as well as comments received from survey participants, suggested that anger in particular may have played a role in the farmers' license application behavior along with the constructs already identified in the proposed model. Some of the survey responses suggested that farmers may feel anger towards the government agencies as well as the licensing program. In fact, after the survey was mailed, several phone calls were received from farmers who indicated their displeasure with the MDHMH as well as with the license program. In addition, some of the surveys which were mailed back incomplete contained comments which suggested that some farmers' felt a lot of anger towards government agencies and regulations in general. For example, one survey contained the following comment:

> "This survey really is a (sic) evasion of privacy and I wonder just what type of regulations will result in the future – If someone wants to sell to their neighbors – No lic[ense] should be required anything to give the state an extra fee of income – This should not be –".

Another respondent commented that on-farm processing should be:

"The right of anyone engaged in farming".

Such comments suggest that some farmers may feel that by being required to apply for a license to process food on-farm their rights are being violated or limited an appraisal which is likely to result in anger (Lazarus, 1991). The literature shows that individuals who feel angry tend to have highly focused attention and a desire to attack or get back at anger source (Lazarus, 1991). In addition, action tendencies of those who feel angry include being motivated to remove barriers that block goal attainment or to regain or maintain control of a threatening situation. According to The Anger Activism Model (Turner, 2007), individuals who experience high levels of anger and low levels of efficacy will be "angry" about the situation but will not perceive that anything can be done. As such, "angry" people will be unlikely to engage in high commitment behaviors. Finally, individuals who experience high levels of anger and high levels of efficacy will exhibit "activist" tendencies and will be the most likely to engage in more high commitment behaviors. This may explain why individuals were compelled to call to express their displeasure with the survey or why individuals went through the effort to return incomplete surveys with only their comments. It is also possible that such anger could explain why some farmers were not interested in applying for a license. More research is needed to explore this additional variable.

Perceived Behavioral Control as a Multi-dimensional Construct

In addition to the initial model tested (Model 1), an alternative model of the predictors of license application behavior (Model 2) was also explored. This second model was designed to explore whether the perceived behavioral control construct should be considered as a uni- or multi-dimensional construct (Ajzen, 2002b; Sparks et al.,

1997). Ajzen (2002b), proposed that perceived behavioral control be represented as a hierarchical construct with two lower-order constructs of perceived control and self-efficacy. Although results of other studies have suggested this relationship (Armitage & Conner, 2001), the hierarchical model had yet to be tested empirically.

In this study, since only three variables were initially used to measure perceived behavioral control, a hierarchical model could not be tested because at least three indicator variables would have been needed to measure each of the lower-order constructs (Byrne, 2006). Instead, the constructs of self-efficacy and controllability were represented as separate first-order latent constructs. As hypothesized, Model 2, in which perceived behavioral control was represented as two distinct constructs of self-efficacy and perceived control, had significantly better fit than Model 1 in which perceived behavioral control was represented as a uni-dimensional construct. Results from this study suggest that in the future, perceived behavioral control should be represented using a hierarchical model in which the constructs of self-efficacy and controllability are measured and tested for causality separately. More research is needed, however, to test this hierarchical representation within other behavioral contexts.

One of the benefits of measuring and testing these two latent constructs separately is that more detailed information can be garnered in terms of an understanding of the specific factors affecting behavior and behavioral intentions. For example, beliefs of perceived barriers, which were not found to be a significant predictor of perceived behavioral control for Model 1, were found to be a significant predictor of self-efficacy (and not of perceived control) in Model 2. This finding is not surprising given the types of barriers included in this study such as the number of steps to get a license or whether

those steps are clearly outlined. These barriers are more likely to affect perceptions of the ease or difficulty of applying for a license rather than perceptions of control over performance of the behavior which would likely be affected by perceptions of the actors involved in license application (i.e., the regulators who grant the license).

Despite the improvement of model fit found in this study using the distinct constructs, neither self-efficacy nor controllability had a significant effect on farmers' intentions to apply for an on-farm processing license. Reasons for this finding are unclear. One possibility is that the farmers were unsure of the ease or difficulty of applying for a license since many had not gone past the contemplation stage of application. Indeed, 51% of respondents indicated that they were uncertain that applying for a license is easy (EFF1). Related to this reasoning is the possibility that perceptions of self-efficacy and controllability had more influence on the performance of actual behavior, in this situation. In the Theory of Planned Behavior, Azjen (1991) discusses that the perceived behavioral control construct was added to the theory to accommodate behaviors that are out of one's own personal control and that the construct can affect intentions by increasing effort and perseverance to want to perform a behavior. In addition, perceived behavioral control is also posited to directly affect behavior in this theory because individuals may have the best intentions to perform a behavior but they may lack the requisite skills or resources, preventing them from following through on their intentions. For this reason, perceived behavioral control was the only construct proposed by Azjen (1991) to have both a direct and indirect (via intentions) effect on behavior.

Predictors of License Application

In addition to understanding the predictors of Maryland farmers' intentions to apply for an on-farm processing license, the present study also aimed to determine the predictors of farmers' actual behavior. The same model, which combined the Theory of Planned Behavior and the Health Belief Model, was posited to predict intentions as well as behavior since behavioral intentions are considered to correlate highly with behavior (Ajzen, 1991; Armitage & Conner, 2001). The findings provide mixed support for the proposed model.

In terms of the constructs identified in the Theory of Planned Behavior, as with the intentions model, attitudes as well as subjective norms were significant predictors of behavior. In addition, perceived behavioral control was also found to be a significant predictor of behavior. That perceived behavioral control, rather than behavioral intentions, was a significant predictor of behavior is not surprising given that individuals may intend to perform a behavior but the actual performance may pose difficulties of execution (Ajzen, 2002b). The use of mean composite scores as opposed to latent factors measured by individual indicators, however, makes it very difficult to directly compare results from the latent variable path analysis and the rare events logistic regression.

The same reasoning may be applied to both the Health Belief Model constructs and the intentions model to posit why perceived benefits and perceived barriers were the only significant predictors of attitudes. It seems plausible that attitudes towards the on-farm processing license, which is primarily a tool to enhance farming operations, are driven by perceptions of the costs (e.g., time and energy) and benefits (e.g., increased income) of application.

Effect of Training

In addition to the factors just identified, it is also possible that the food safety training provided in 2005 played a role in dissuading farmers from applying for a license. Models of food safety education suggest that knowledge obtained from training may influence behavior by affecting the trainees' belief system and in turn their behavioral intentions (Rennie, 1995; Seaman, 2010). Thus, it was initially proposed that the model structure tested would be non-invariant between farmers who did and did not attend the 2005 training courses. The sample size was too small to conduct a multiple-group latent variable path analysis; instead, two-tailed independent *t*-tests were conducted for each of the indicator variables.

Results revealed that very few differences were found between responses of farmers who attended one of the 2005 training courses and those that did not. When considering the results of this survey, however, it is important to bear in mind the length of time that elapsed between the training courses and the survey administration (approximately four years), which may have dissipated any potential effect attributed to the training courses. Nevertheless, there were no significant differences in intentions to apply for an on-farm processing license between farmers who attended a course and those that did not. This result is important considering that the training was discontinued because it was perceived by the MDHMH to have dissuaded farmers from applying for a license.

Moreover, the survey results suggest that the training may have been somewhat successful in terms of delivery of food safety related content. Specifically, farmers who went to the training were found to be significantly more confident in their ability to

produce safe food and reported having more control over the safety of the food that they sell. Problematically, however, there were no significant differences in perceptions of foodborne illness severity between farmers who did and did not attend the training courses. Indeed, the majority of respondents reported that if food they produced caused a foodborne illness in their family as well in their customers, the illness would likely not be serious. The results also suggested that respondents who attended the training exhibited optimistic bias, as they felt it was unlikely that customers would get sick from food processed on their farm. Many of the presentations at the training discussed the risks of acquiring foodborne illness from food that is not processed properly, as well as the severity of the symptoms, including hospitalization and death. Thus, it is surprising that participants who attended the training seemed to exhibit optimistic bias towards the risks of foodborne illness. Reasons for this finding will be discussed in the next chapter, which describes a content analysis of the training materials.

A negative consequence of the training was that those who took the training courses were more likely to agree with the barrier that they had heard conflicting information about the license, compared to those who did not attend training. Conversations with former regulators suggest that some information provided to farmers by state and local government agency employees following the training courses may have been inconsistent or conflicting. In response, there is now only one person responsible for assisting farmers, who has a clear understanding of the on-farm processing regulation (Menikheim & Elkin, 2008). The finding that farmers who attended the courses are still reporting that they have received conflicting information suggests that this barrier in

particular should be addressed in future communication to farmers interested in on-farm processing license.

Regardless, these and other survey results suggest that the training may not have been the primary reason why farmers who attended one of the training courses were dissuaded from applying for a license. Rather, it is possible that the issues related to the license application process identified earlier such as the perception of benefits, barriers, attitudes, and subjective norms, played a greater role. Thus, future communication to farmers interested in applying for a license should not only cover the food safety element of the training but should also attempt to highlight the benefits of obtaining a license while reducing perceptions of barriers to the license application.

Although the food safety content is currently being provided one-on-one by the MDHMH, there may be several benefits to restoring the training courses. First, it would reduce burden on regulators who have to repeat the training material for each farmer interested in on-farm processing. Second, having the regulator as the sole presenter of the food safety content, as opposed collaborating with extension educators and university professors, puts the regulator in the role of both trainer and enforcer, which may present a conflict if a problem arises. Disseminating information related to the on-farm processing license in the form of training courses allows farmers to receive messages from individuals with varying perspectives and areas of expertise. These sources may also be available after the training to help with process and product development, allowing the regulators to focus on compliance and enforcement related issues.

Limitations

There are several limitations to this research that should be noted. The first is related to the sampling frame. As previously discussed, in order to be able to make generalizations beyond the survey sample, a systematic random sample of farmers in Maryland was selected from a database which contained the names of 5,957 farmers. The use of this database has several potential limitations. Most notably, farmers whose primary income was from horse farming were not able to be sorted out of the database. This contributed to the low usable response rate as a large portion of surveys were received from horse farmers who had no interest in on-farm processing. It is also possible that surveys weren't returned because they were received by horse farmers who found the survey to be irrelevant. For this reason, the total response rate may have been higher if a more targeted mailing was made (e.g., to farmers who are known to produce food); however, this would have limited the ability to make generalizations from the results to all farmers in the state.

Another potential limitation of the database is that it may not have been kept up-to-date as a large number of responses were received from farmers who were retired (or even deceased). In addition, the database did not contain the entire population of farmers in the state. According to the U.S. Census for Agriculture, there were 12,834 farms in Maryland in 2007 and the database used contained less than half this amount. Although there was no reason to suspect that the database contained a biased selection of the total number of farms, this is a possibility which could limit the true randomness of the sample.

In addition to the issues related to the sampling frame, the sample size posed several limitations. Mainly, the sample size was relatively small for some of the statistical analyses. Structural equation modeling is a large sample size technique, and a minimum sample size of 100 is usually recommended (Kline, 1998). For the latent variable path analysis conducted in study 1, the sample size used was 95 which is below the recommended minimum sample size. Thus, the sample size in this study is considered to be small (Kline, 1998). As with other statistical methods, results derived from small samples tend to have more sampling error and are less likely to be statistically significant (Kline, 1998). In addition, with small sample sizes, not all estimation algorithms and analyses can be used. In this study for example, a multiple-groups latent variable path analysis was unable to be conducted as proposed, because the number of respondents within each group was too small (i.e., less than 60).

Another limitation of the data used is that there were a number of surveys which contained missing values. Problematically, structural equation modeling requires that the data set be complete (Bentler, 2006). There are several ways to deal with missing data (Kline, 1998). For example, cases with missing data can be deleted or the missing values can be imputed with estimated scores (Kline, 1998). In this study, missing values were imputed using the expectation maximization (EM) algorithm because deletion of the cases would have rendered the sample size too small. In addition, discarding cases which may differ systematically from the rest results in estimates which may be seriously biased (Little & Rubin, 1987). The EM algorithm was chosen over other methods of imputation such as mean substitution because it is thought to provide better estimates of imputed scores and is the method that is generally recommended for structural equation modeling

(Bentler, 2006). The EM algorithm relies on a two-step iterative procedure. In the first step, known as the expectation or E step, a series of regression equations are constructed from the current estimate of the covariance matrix and the contribution of each missing value to the sufficient statistics (i.e., the variable sums and sums of the products $\sum X_{ij}$ and $\sum X_{ij}X_{ik}$) is the predicted value from a regression equation. In the second step, known as the maximization or M step, a new estimate of the mean vector and of the covariance matrix are computed using the sufficient statistics from the previous E step. The two-step algorithm is repeated until the difference between the covariance matrices in adjacent M steps becomes trivially small (Enders, 2006). Caution should be taken when performing structural equation modeling using a data which has been imputed with the EM algorithm because the standard errors and model fit statistics may be incorrect (Enders, 2006; Kline, 1998). In addition, EM assumes a missing-at-random (MAR) pattern of missing data. This is a weaker assumption than missing-completely-at-random in that missingness on a variable *X* can be related to one or more other observed variables in the model, but is unrelated to the values of *X* itself (Enders, 2006) and is more stringent than not-missing-at-random. There seem to be no tests for the MAR assumption that can generally be applied (Bentler, 2006).

Yet another limitation of the data set is related to the development of the scale used to measure intentions. Initially, the three intentions indicators (INT1: How likely are you to apply for an on-farm processing license?, INT2: How likely are you to request information about the on-farm processing license?, INT3: How likely are you to attend an information session about the on-farm processing license?) were developed with a 5-point Likert scale with response options ranging from 1="very unlikely" to 5="very

likely". In order to screen out responses of farmers who had no interest in on-farm processing (such as horse farmers), however, respondents first answered a series of screening questions. If farmers were not interested in on-farm processing as a result of problems with the on-farm processing program (as opposed to a general lack of interest), they were routed past the intentions questions directly to the questions related to the theoretical constructs. In order to include these respondents in the data analysis, they were assigned a "0" on the intentions scale. This was done to differentiate these respondents from those who indicated that they may be interested in on-farm processing but who reported that they were very unlikely to request information, etc.

The limitation of this operationalization of intentions is that the data may not be on an interval scale. This is important for the data analysis in this study as the statistical procedure used needs to match the level of data obtained in the research. The data analysis methods used in this study, such as regression and structural equation modeling, require at least interval level data. Extensive research has been conducted into the spacing of the labels used in scales such as the Likert-type scales used in this study so that the data may be considered interval (Jones & Thurstone, 1955). As a result, the scales are considered on a continuum and the scale points are able to be represented by numbers which take on significance with added interpretation during data analysis. The additional point on the intentions scale added in this study was not tested to determine whether or not it could be considered equidistant from the other scale points, potentially compromising the interval level nature of the data used and thus biasing the results.

Yet another limitation of this study was the amount of time which elapsed between the implementation of the on-farm processing regulation and the survey mailing.

The initial regulation for the on-farm processing license was issued in 2005 and the training courses were also held in 2005, which was four years prior to the survey mailing. This limitation mostly affects the conclusions made regarding the effect of the training on the predictors of survey respondents' intentions to participate in on-farm processing. Very few differences were found between survey respondents who did and did not attend the training. One reason for this finding is that the effect of the training may have dissipated over the years.

A final limitation with this study was that there was a potential for social desirability bias as some of the questions in the survey may have been perceived as sensitive, particularly those dealing with food safety and the government. For this reason, the survey was anonymous and participants were directed to not write any identifying information on their survey (Tourangeau et al., 2000). There were a number of missing values related to these questions, however, suggesting that some farmers were not comfortable answering these questions. The cognitive interviews also highlighted that these questions had the potential to be perceived as sensitive to the respondents. In addition, one survey was returned with comments stating that language related to anonymity of the survey was "not good enough!" Despite these potential concerns, the questions were still included because of their importance to farmers' perceptions of the license application process.

Conclusions

This study attempted to identify reasons why Maryland's On-Farm Home Processing regulation, initially enacted in 2005, has not been as successful in generating on-farm home processing license applications as initially expected. The study also

attempted to explore whether food safety training courses held throughout Maryland in 2005 played a role in dissuading farmers from applying for a license. A model which combines two dominant theoretical paradigms – the Health Belief Model (HBM) and the Theory of Planned Behavior (TPB) – was developed to predict Maryland farmers' intentions to apply for an on-farm processing license as well their actual license application behavior.

The data moderately support the proposed model and show that the farmers' attitudes and subjective norms significantly influenced their intentions to apply for a license while their attitudes, subjective norms, and perceived behavioral control influenced their actual license application behavior. In addition, farmers' attitudes were found to be significantly affected by their perceptions of the benefits of the license and their perceptions of the barriers to license application. Importantly, results of this study also suggest that the food safety training provided in 2005 may not have dissuaded farmers from applying for a license as initially thought.

Rather, it appears from these results that future food safety training courses should be held and that these trainings should include technical content in addition to information that clearly communicates the steps needed to obtain a license as well as the benefits of license attainment. Moreover, survey results related to the demographics of farmers interested in on-farm processing also provide insight into other factors which should be considered in the design of future trainings. Most notably, farmers interested in on-farm processing and those who are currently processing tend to be owner/operators of small farms and tend to represent a higher proportion of females than the average Maryland farming population. Understanding the demographics of farmers interested in

on-farm processing is very important as future communications may need to be tailored to the needs of this audience in order to maximize their effectiveness.

More research is needed, however, to better understand Maryland farmers' decision-making processes. Specifically, future research is needed to identify other factors which may explain farmers' intentions to participate in on-farm processing as well as their license application behavior. Such research could explore the potential role of anger, as suggested by some of the survey results, in Maryland farmers' decision-making. In addition, more research is needed to better understand the negative relationship found in this study between farmers' subjective norms and their intentions to participate in on-farm processing.

Chapter 5: Study 2: Content Analysis of Training Materials

In order to answer the research question (RQ1): "Why were the training courses ineffective in generating applications for licenses?" the communication strategies utilized by presenters during the 2005 food safety training courses were quantified using a content analysis procedure. Content analysis is a technique in which desired information is extracted from a body of material by systematically identifying specific characteristics of the material (Krippendorff, 2004a). Applying an explicitly defined procedure consistently to all selected material generates objective results which are reproducible by other trained investigators (C. P. Smith, 2000). Content analysis also allows qualitative information to be transformed into quantitative information. Studying the language of communication in written material allows inferences regarding subjective experiences and intentions which influence overt behavior (C. P. Smith, 2000).

Content analysis has been used to quantify the use of message design strategies in a variety of contexts including food safety education (J. Gordon, 2003; Irlbeck & Akers, 2008). Gordon (2003), for example, conducted a content analysis of food safety messages which were nationally distributed to consumers to quantify the use of message design strategies which promoted self-efficacy and stimulated risk perceptions. The content analysis procedure was used in this study to identify the use of a variety of message design strategies by the presenters.

Methods

Materials

Print copies of the six PowerPoint presentations given during the 2005 training courses were obtained from the course organizers. The course was designed to meet a requirement in the On-Farm Home Processing regulation (COMAR 10.15.04.19B) which initially stated that "before an individual may be licensed, the individual shall complete a course given or approved by the Department which provides a minimum of 8 hours of training in: sanitation, cross-contamination controls, and food security".

The entire body of available print material was analyzed. Each PowerPoint presentation in the training was considered as the sampling unit, or the largest body of material subjected to analysis, and was thus analyzed separately. Within each presentation each slide was considered as the coding unit, or part of the text unit to which coding categories were applied. Each slide was considered as the coding unit because of the natural boundary and because the slide provided context. In addition, because graphs were used on some slides it was necessary to consider all of the written information on each slide rather than each bullet. This also controlled for the length of the coding unit such that slides with more bullets were not overrepresented in the data.

Coding Scheme

The coding scheme specifies the information to be obtained from the material being analyzed in an explicit manner to ensure the objectivity of the analysis (C. P. Smith, 2000). In this study, a coding scheme was developed to capture information on the use of emotion (Lerner & Keltner, 2000; Turner, 2007), evidence (Kazoleas, 1993), framing (Kahneman & Tversky, 1979), and relevant risk communication best practices

(Seeger, 2006). A coding manual was developed which included instructions to the coders along with the coding scheme. In addition, a training manual was developed based on the coding scheme in which examples were provided for applying the scheme to each variable. The operationalization of each variable will be described below. Where applicable, variables were operationalized to relate to food safety behaviors separately from license application behaviors.

Emotion. The use of two discrete emotional appeals, guilt and fear, were quantified. Guilt was operationalized as messages which indicated that the target audience had done something wrong/immoral or risked doing something wrong or immoral (or had avoided doing the correct thing) or that people should have felt badly if they did not do the right thing. Fear was operationalized in terms of the two components of threat: perceived susceptibility to the risk (i.e., whether the message communicated susceptibility towards the food safety issues or if it communicated susceptibility towards the consequences if the audience did not apply for a license) and perceived severity of the risk (i.e., whether the message made the food safety issue sound severe and whether it made the consequences for the business sound severe). For each of the emotion variables, coders response options were limited to -1 (this was NOT communicated in the message at all), 0 (this message was sort of in the message; it was implicit; it was ambiguous), and 1 (this message was definitely present!). These three ordinal categories were used because it was desired to have some measure of intensity of the language used in the slides, however, it is often difficult for coders to make reliable judgments for classification of intensity of words using intervals on a quantitative scale (C. P. Smith,

2000). Coders were also directed to check which emotion (guilt or fear) was primarily being employed in the message, if an emotion was being used at all.

Evidence. Two types of evidence were considered: statistical and narrative evidence. Statistical evidence was operationalized as quantitative information (i.e., information about an object, person, issue, etc., that is presented with numerical information such as percentages, means, correlations, bar charts, pie graphs, etc.). Narrative evidence was operationalized as qualitative information (i.e., stories, quotes, anecdotes, histories, narratives, testimonies, analogies, etc). Coders response options were limited to -1 or 1 because evidence was considered to be either present or not.

Framing. The presence of both gain and loss framing was considered. Gain-framed material was operationalized as that which conveyed the benefits gained. Messages which conveyed benefits gained from applying for the license were coded separately from those which conveyed the benefits of performing the recommended food safety behaviors. The loss frame was operationalized as messages which conveyed avoidance of loss. Messages which conveyed what you would lose by not applying for a license were considered separately from those which conveyed what you would lose by not performing the food safety behaviors. For each of the framing variables, coders' response options were limited to -1, 0, and 1. Coders were also directed to check which frame (gain or loss) was primarily being employed in the message, if a frame was being used at all.

Barriers. In addition to coding for messages related to the benefits of performing food safety behaviors and applying for a license (i.e., gain-framed messages), the use of messages which conveyed the barriers to performance of these behaviors were quantified

as well. Messages which conveyed the barriers to applying for a license were coded separately from messages which conveyed the barriers to performing the recommended food safety actions. The use of messages which communicated barriers was included in the coding because of the importance of this variable identified in the Health Belief Model (Janz & Becker, 1984; Rosenstock, 1974). For each of the barrier variables, coders' response options were limited to -1, 0, and 1.

Risk communication best practices. Four out of the ten risk communication best practices were relevant to the study of the training materials (Seeger, 2006). Each best practice was operationalized within the context of the training. For example, forming partnerships with the public was operationalized as messages which communicated the on-going collaboration with the speaker's organization as well as messages which communicated that the speaker was accessible after the training is over (i.e., they provided their contact information). Collaborating and coordinating with credible sources was operationalized as messages which included citations of the source (i.e., a reference to a journal article or webpage). Accepting uncertainty and ambiguity was operationalized as messages which communicated that it is important to understand that the issues being communicated can be ambiguous and uncertain. Finally, providing messages of self-efficacy was operationalized as messages which communicated that the recommended food safety behaviors were easy to perform, messages which communicated that it was easy to apply for an on-farm processing license, and messages which communicated that performing the recommended food safety behaviors worked (i.e., response efficacy). Coders' response options were limited to -1, 0, and 1.

Procedure

Two independent coders who were trained in risk communication coded all of the PowerPoint presentations. Coders were trained in three weekly one hour sessions in which the coding scheme was reviewed along with examples in the training manual. In the first session, the researcher reviewed each variable, the coding scheme, and the coding rules. Examples were provided from other food safety presentations. After the first one hour session, coders coded the first twenty slides of presentation #1. Then, coders met with the researcher for another one hour session to discuss their differences and resolve them. Next, the coders coded the remaining twenty slides in presentation #1. In the third training session, the researcher met with the coders again to discuss their differences and resolve them. The coders then coded the remaining presentations. At the end of the coding, which took approximately one month, the coders recoded the first presentation. Disagreements in the final coded materials were resolved by the researcher (Lombard, Snyder-Dutch, & Bracken, 2002).

Data Analysis

Intercoder reliability was determined using two measures, percent agreement and Krippendorff's alpha. Percent agreement is the percentage of all coding decisions made by the pair of coders in which they agree. Although percent agreement is a common measure of intercoder reliability, one limitation is that it can be inflated when categories are rarely used or rarely produce disagreement (Lombard et al., 2002). Another limitation of this measure is that it does not account for agreement that would occur by chance. One recommended measure which does account for chance agreement is Krippendorff's alpha. Unlike other measures such as percent agreement and Cohen's

Kappa, Krippendorff's alpha is also designed for variables at different levels of measurement from nominal to ratio (Hayes & Krippendorff, 2007). This is important in this study, because the response options for the variables were ordinal. One drawback of Krippendorff's alpha, however, is that in contrast to percent agreement, it is a conservative index (Perreault & Leigh, 1989). Another drawback of Krippendorff's alpha is that when there is insufficient variation (i.e., both coders agree that a variable was never or always present in the sampling unit) the value of alpha is 0. As a result of these drawbacks, percent agreement and Krippendorff's alpha were both reported to provide a more holistic view of the data reliability. Percent agreement was calculated manually in Excel while Krippendorff's alpha was calculated using a macro for SPSS GradPack 17.0 (SPSS Inc., Chicago, IL) (Hayes & Krippendorff, 2007). Both measures were calculated separately for each variable as recommended by Lombard et al. (2002) in order to determine if some variables were coded more reliably than others. In addition, intercoder reliability was calculated across all of the sampling units as both coders coded all material.

Frequency of the presence or absence of variables was quantified using SPSS GradPack 17.0 (SPSS Inc., Chicago, IL).

Results

Six PowerPoint presentations, containing a total of 193 slides, were coded in their entirety by two coders. See Table 13 for a summary of the descriptive information for each of the presentations coded including the number of slides per presentation.

Table 13. Descriptive information for coded presentations.

Presentation #	Title	Speaker	Speaker Affiliation	# Slides
1	*	Dr. Mark Kantor	University of Maryland	45
2	Food Characteristics and How They Relate to Food Preservation	**	**	60
3	On -Farm Processing Safety:	Carl S. Custer	United States Department of Agriculture	30
4	Good Manufacturing Practices (GMPs)	Thomas E. Rippen	University of Maryland	42
5 Part I	Food Defense	**	**	12
5 Part II	Agricultural Practices and Biosecurity	**	**	4

Note: *A title was not provided on this presentation. **This information was not included on the PowerPoint title slide because the speakers rotated.

Intercoder Reliability

Percent agreement across the two judges was greater than 93% for all variables measured and ranged from 93% to 100%. Krippendorff's alpha ranged from .42 to 1. See Tables 14 through 20 for intercoder reliability values for each variable. There is no consensus on an acceptable level of reliability when conducting content analyses (Lombard et al., 2002). Lombard (2002) recommends that coefficients greater than .90 be considered acceptable for such indices as percent agreement while more liberal criteria may be used for more conservative indices such as Krippendorff's alpha. Krippendorff (2004b) recommends $\alpha \geq .800$ as an acceptable cut-off "to assure the data under consideration are at least similarly interpretable by two or more scholars" and $\alpha \geq .667$ as the "lowest conceivable limit." Intercoder reliability for two variables fell below this criterion: self-efficacy (for food safety behaviors) and perceived severity (for food safety behaviors). The Krippendorff's alpha for these two variables was .42 and .57

respectively. These variables were included in the analyses because of high percent agreement but conclusions related to these results should be considered tentative.

Frequency of Message Design Strategies

Results revealed that few message design strategies were used by the presenters. Results for each of the strategies coded for are presented below. Only the frequency of the presence of variables (either implicit or explicit) is reported.

Emotion. Only two presentations were found to contain messages which may have communicated message-relevant emotions. None of the presentations utilized messages which could have elicited guilt. Presentation #1 implied that the audience was susceptible to the consequences of food safety behaviors eight times and explicitly communicated this message twice; in addition the speaker implied that food safety issues were severe three times and explicitly communicated this message once. As a result, only presentation #1 was considered by the coders to contain fear appeals. Within the presentation, three slides were coded as primarily fear appeals. See Table 14 for the frequency of emotional appeals used across the presentations and Table 15 for the frequency of slides which were coded to primarily contain an emotional appeal.

Evidence. In general, statistical evidence was presented much more frequently than narrative evidence and was the most frequently used message design strategy. In particular, presentations #1 and #2 presented the largest amount of statistical evidence

Table 14. Frequency of emotional appeals used in 2005 training course presentations.

			Fear							
Presentation #	Guilt		Perceived severity: Food safety		Perceived severity: License		Perceived susceptibility: Food safety		Perceived susceptibility: License	
	0	1	0	1	0	0	0	1	0	1
1	0	0	8	2	0	0	3	1	0	0
2	0	0	2	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0	0	0	0
4	0	0	0	0	0	0	0	0	0	0
5 Part I	0	0	0	0	0	0	0	0	0	0
5 Part II	0	0	0	0	0	0	0	0	0	0
Total	0	0	10	2	0	0	3	1	0	0
% Agreement	100%		97%		100%		99%		100%	
Krippendorff's alpha	0		.73		0		.57		0	

Note: 0=message was implied, 1=message was explicit.

Table 15. Frequency of primary emotions used in 2005 training course presentations.

Presentation #	Guilt	Fear
1	0	3
2	0	0
3	0	0
4	0	0
5 Part I	0	0
5 Part II	0	0
Total	0	3
% Agreement	100%	100%
Krippendorff's alpha	0	1

Table 16. Frequency of evidence type used in 2005 training course presentations.

Presentation #	Statistical Appeal	Narrative Appeal	Message communicates contradictory information
1	11	1	0
2	10	0	0
3	1	1	0
4	1	0	0
5 Part I	0	0	0
5 Part II	0	0	0
Total	23	2	0
% Agreement	100%	100%	100%
Krippendorff's alpha	1	1	0

Table 17. Frequency of gain and loss framing used in 2005 training course presentations.

Presentation #	Gain frame				Loss frame				Primary frame	
	License		Food safety behaviors		License		Food safety behaviors			
	0	1	0	1	0	1	0	1	Gain	Loss
1	0	0	0	1	0	0	0	0	1	0
2	0	0	0	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0	0	0	0
4	0	0	2	0	0	0	0	0	1	0
5 Part I	0	0	0	0	0	0	0	0	0	0
5 Part II	0	0	0	0	0	0	0	0	0	0
Total	0	0	2	1	0	0	0	0	2	0
% Agreement	100%		100%		100%		100%		100%	
Krippendorff's alpha	0		1		0		0		1	

Note: 0=message was implied, 1=message was explicit.

Table 18. Frequency of barriers included in 2005 training course presentations.

Presentation #	The message conveys the barriers to applying for a license		The message conveys the barriers to performing the recommended food safety actions	
	0	1	0	1
1	0	0	3	4
2	0	0	0	0
3	0	0	0	0
4	0	0	9	0
5 Part I	0	0	3	0
5 Part II	0	0	0	0
Total	0	0	15	4
% Agreement	100%		98%	
Krippendorff's alpha	0		.88	

Note: 0=message was implied, 1=message was explicit.

Table 19. Frequency of best practice recommendations used in 2005 training course presentations.

Presentation #	Message communicated that these issues can be ambiguous and uncertain.		Message communicated that the recommended behaviors are easy to perform (i.e., self-efficacy)		Message communicated that it is easy to apply for an on-farm processing license (i.e., self-efficacy)	
	0	1	0	1	0	1
1	1	1	2	0	0	0
2	1	0	0	0	0	0
3	3	0	3	0	0	0
4	0	0	2	0	0	0
5 Part I	0	0	0	0	0	0
5 Part II	0	0	0	0	0	0
Total	5	1	7	0	0	0
% Agreement	99%		93%		100%	
Krippendorff's alpha	.73		.42		0	

Note: 0=message was implied, 1=message was explicit.

Table 19. Frequency of best practice recommendations used in 2005 training course presentations continued.

Presentation #	Message communicates that performing the recommended food safety behaviors works (i.e., response efficacy)		Message communicated the on-going collaboration with the speaker's organization		Message communicated that the speaker is accessible after the training is over	
	0	1	0	1	0	1
1	0	1	0	0	0	0
2	0	0	0	0	0	0
3	7	2	0	0	0	0
4	1	0	0	0	0	0
5 Part I	0	0	0	0	0	0
5 Part II	0	0	0	0	0	0
Total	8	3	0	0	0	0
% Agreement	99%		100%		100%	
Krippendorff's alpha	.96		0		0	

Note: 0=message was implied, 1=message was explicit.

Table 20. Frequency of sources cited in 2005 training course presentations.

Presentation #	# Sources Cited
1	7
2	7
3	0
4	1
5 Part I	0
5 Part II	0
Total	15
% Agreement	96%
Krippendorff's alpha	.68

(11 and 10 times respectively), followed by presentations #3 and #4 which each had one slide with statistical evidence. Presentation #1 was the only presentation found to contain narrative evidence. None of the messages contained contradictory evidence. See Table 16 for the frequency and type of evidence used across the presentations.

Framing. None of the presentations presented information about the performance of food safety behaviors or the license application in a loss frame. Two of the presentations, however, did present information in a gain frame. More specifically, one presentation explicitly communicated the benefits of performing food safety behaviors, while the other message implicitly communicated the benefits. Table 17 shows the frequency of gain and loss framed messages used.

Barriers. Several presentations listed potential barriers to performing the recommended food safety actions. Table 18 illustrates the number of slides within each presentation which were found to mention barriers. Presentation #1, for example, implied barriers in three of the slides and explicitly listed barriers in four of the slides. Presentation #4 implied barriers in nine of the slides and presentation #5 Part II implied barriers in three of the slides.

Risk communication best practices. Table 19 shows the frequency of risk communication best practices used across all of the presentations. The speakers implied that food safety issues can be ambiguous and uncertain five times across three presentations and explicitly communicated this message once. Speakers implied that the recommended food safety behaviors were easy to perform (i.e., self-efficacy messages) seven times across three presentations. Speakers implied that performing the recommended food safety behaviors worked (i.e., response-efficacy) eight times across

two presentations and explicitly mentioned that the behaviors worked three times across two presentations. None of the speakers provided messages of self-efficacy or response efficacy for applying for an on-farm processing license. Furthermore, none of the speakers provided contact information or indicated on their slides that they would be interested in continuing to assist the farmers following the training. In fact, in several cases the speaker's name was not provided on the title slide. Two speakers cited seven sources in their presentations (presentations #1 and #2), although one speaker cited the sources throughout the presentation while the other cited the sources at the end of the presentation on a references slide. Another speaker (presentation #4) cited one source for a total of fifteen sources cited across the five presentations. Table 20 presents the frequency of sources cited across the presentations.

Discussion

The purpose of this study was to investigate why the food safety training courses offered in 2005 may have dissuaded farmers from applying for on-farm processing licenses. To answer this question, the communication strategies utilized by presenters during the courses were quantified using a content analysis procedure. Overall, the results of the study revealed that few message design strategies were used by the presenters. Traditional approaches to training have assumed that effective training should provide knowledge about food safety in order to promote behavior change (Rennie, 1995). There is a recognition within the literature, however, that in order to be effective training must address the psychological and social determinants of behavior (Tones, 1990), while using message design strategies which are appropriate for the target audience and behavior (M. Allen & Preiss, 1997; Nabi, 2002).

One message design strategy which has been considered in the literature is the use of emotion. Although the relationship between emotion and behavior change has been established for a number of discrete emotions (Nabi, 2002), very few slides were found to contain message-relevant emotional appeals. Moreover, fear was the only emotion utilized in the messages. It is difficult to know whether the use of fear would be successful for promoting food safety behaviors as there has been little research investigating the role of affect or of any discrete emotions on the performance of safe food handling behaviors (Fischer et al., 2005). The literature does suggest that individuals who feel fearful will be motivated to protect themselves from risk by performing adaptive behaviors, but only when their perceptions of self-efficacy are high (Lazarus, 1991; Witte, 1992). This would suggest that fear appeals may be effective at promoting food safety behaviors if the audience also perceives that these behaviors are easy to perform. Importantly, none of the slides explicitly communicated that the recommended food safety behaviors being promoted in the trainings were easy to perform (i.e., self-efficacy), although several slides implied the ease of performance of the behaviors. Results of the On-Farm Home Processing Study (Study 1) revealed that farmers in Maryland do report having high perceptions of self-efficacy towards the performance of food safety behaviors and farmers who attended the training courses tended to have higher perceptions of self-efficacy than those that did not.

It should be noted that when considering the effectiveness of the use of fear in food safety messages, it is important to consider whether the messages would actually elicit fear in the audience. Indeed, it is important to distinguish between the emotions communicated by the elements of a message and the emotion that the audience actually

feels, as these may not be congruent (Pinto & Priest, 1991; Turner & Underhill, 2009). In addition, the strength of the emotional appeal can also affect the strength of the emotion experienced by the audience, and as a result the effectiveness of the appeal. A meta-analysis of the fear appeal literature suggested that strong fear appeals are more persuasive than low or weak fear appeals (Witte & Allen, 2000). More research would be needed to understand if the types of fear appeals coded for in the PowerPoint presentations would actually elicit fear within Maryland farmers and/or other emotions. It would also be important to understand the strength of the appeals and of the emotion(s) elicited.

In addition to fear, it is also possible that other discrete negative emotions and even some positive emotions may increase the performance of food safety behaviors. For example, Edwards, Erickson, Ballejos, & Staszah (2010) found that displays placed in retail stores utilizing positive messages (i.e., happy children) were more likely to result in increased sales of thermometers within those stores when compared with control retail stores which did not use these campaign displays. The authors attributed the results to the positive emotions used in the campaign materials. The study had several methodological limitations, however, which preclude generalization and application of these results. For example, the authors did not study a discrete emotion but rather tried to include general positive affect in the pictures and messages in the campaign. This makes it difficult to inform the development of future messages as the intrinsic message features which may have led to feelings of discrete emotion(s) were not clearly defined (O'Keefe, 2003). A related issue that may also impact the conclusions and applicability of the results is that the authors did not measure whether the materials actually elicited an

emotion in the audience. Without this information it is difficult to conclude that positive affect and/or a specific emotion was the cause of the change in sales (O'Keefe, 2003). Nevertheless, this research highlights a need for more formal and controlled research into the use of emotions (both discrete positive and negative) in food safety message campaigns.

In terms of evidence type, the results from the content analysis highlighted that the presentations tended to contain statistical as opposed to narrative evidence. The literature is mixed as to whether quantitative or qualitative evidence is more persuasive. Some authors have found that quantitative evidence is more persuasive (M. Allen et al., 2000; M. Allen & Preiss, 1997), while others have found that qualitative evidence is more effective (Borgida & Nisbett, 1977).

For the delivery of food safety content, the literature suggests that qualitative information may be persuasive with this target audience (Beegle, 2004; Chapman, 2005; Clayton et al., 2002). For example, food service workers have reported that they are more likely to change their behavior when information is presented in the form of stories with vivid examples that are related to their own experiences (Beegle, 2004). More specifically, the Oregon Environmental Health Specialists Network (EHS-Net) (2004) conducted focus groups and a questionnaire with food service workers, managers, and restaurant owners to explore their preferences for receiving food safety information. Results of the study revealed that the workers prefer to receive information from someone they know and that they prefer the information to be told in the form of a story with examples that they can relate to their day to day work activities. Interestingly, the authors also conducted interviews with regulators to determine their communication

preferences for giving and receiving information. The interviews revealed that the regulators preferred to receive information in print form and that they tend to read a number of sources on a subject before making a decision. It is important for regulators to understand that their audience may not be persuaded using the same style that they prefer.

Narrative evidence in the form of personal stories or stories about others' experiences with food safety related issues, such as outbreaks, are likely to be effective for the delivery of food safety content, as the use of stories has been found to reduce beliefs of optimistic bias (Chapman, 2005; Parry et al., 2004). Perceptions of optimistic bias have, in turn, been found to negatively correlate with the performance of food safety behaviors (Clayton et al., 2002). Results from the On-Farm Home Processing Study suggested that Maryland farmers do exhibit optimistic bias towards food safety issues on-farm (i.e., they believe the likelihood of a customer contracting foodborne illness from food that they produce to be low and that the illness would not be very severe). Therefore, in order to reduce such beliefs of optimistic bias and improve the performance of food safety behaviors on-farm, regulators and educators should consider adding narrative stories, perhaps even delivered by farmers, in future trainings to complement statistical evidence.

In addition to narrative stories, food service workers also report that they prefer to receive food safety information in the form of hands-on demonstrations (Beegle, 2004). Importantly, focus groups and surveys of female farmers, who represent a large proportion of farmers interested in on-farm processing, suggest that women would also prefer more interactive, hands-on trainings as opposed to sessions which consist of PowerPoint presentations (Barbercheck et al., 2009; Trauger et al., 2008). Although the

use of demonstrations was not quantified in this study, none were used in the training courses. Demonstrations which could be used in such training courses include a demonstration of how-to use a pH or water activity (a_w) meter or the use of a Glo-Germ™ kit, which shows the effectiveness or ineffectiveness of hand-washing using a powder that glows under UV light (Paster, 2008). Consideration should also be made as to the presenter of these demonstrations, as many female farmers report not feeling welcome in agricultural groups; thus extension educators have suggested the use of female presenters to alleviate this issue (Barbercheck et al., 2009).

In addition to the strategies just discussed, results of the On-Farm Home Processing Study suggested that the perceptions of benefits and barriers towards license application should also be addressed in messages to Maryland farmers. While it was the purpose of the training to provide food safety content, results of the survey suggest that such issues related to license application should be clearly addressed in future trainings in order to increase license applications. The framing literature suggests that gain-framed as opposed to loss-framed messages should be persuasive for behaviors which help individuals avoid risks (Kahneman & Tversky, 1979). This theory is supported by the regulatory compliance literature which has found that in order for a business to comply with a regulation, the firm must perceive that the benefits to complying with a regulation outweigh the costs (Henson & Heasman, 1998; Yapp & Fairman, 2006).

Not surprisingly, the content analysis revealed that messages stressing the benefits of applying for a license were not used in the training courses. In addition, a number of slides communicated barriers to performing the recommended food safety behaviors (such as skills and equipment needed), which are inherently necessary for the license

application. Presenting such information without also suggesting ways of overcoming these barriers may have dissuaded farmers from performing food safety behaviors and from applying for a license.

Results of the content analysis also revealed that only two slides included the benefits of performing food safety behaviors. Gain-framed messages should also be effective for promoting food safety behaviors as they are also performed to mitigate risks. One moderating variable of this relationship, however, is that individuals need to perceive that there is high certainty that the benefits of performing the behavior will be obtained (Kahneman & Tversky, 1979; Rothman & Salovey, 1997). One positive finding from the content analysis was that a number of slides implicitly and explicitly communicated response-efficacy for the food safety behaviors being promoted.

Finally, aside from the use of messages that foster self-efficacy, as previously discussed, no other risk communication best practices were utilized by the presenters. For example, none of the speakers included their contact information (or in some cases even their name) on their PowerPoint slides. In many cases this was because the presentations were put together with little notice and the speakers rotated depending on the location of the session. The PowerPoint slides were, however, provided to all training attendees in a course packet and were conceivably the only place where participants would have been able to find this information after the training was over. Such information would have helped to communicate the risk communication best practices to form partnerships with the public (Seeger, 2006).

Forming partnerships with the public fosters trust in an organization and allows the public to serve as a resource in risk and crisis situations (Sellnow & Vidoloff, 2009).

Results from the On-Farm Home Processing Study revealed that more than one-quarter of respondents do not trust the Maryland Department of Health and Mental Hygiene. In addition, respondents who attended the training reported that they received conflicting information about the license. It is possible that if the risk communication best practices were used, more trust would have been established in the presenter's organizations and training attendees would have had a point of contact in the event they had questions pertaining to the license.

Limitations

This study had a few limitations which are worth noting. One of the primary limitations was that the coding was conducted on PowerPoint presentation materials which were initially provided orally in training. It is possible that additional message design strategies were verbally communicated by the presenters but these were not explicitly captured on the slides. The written PowerPoint slides, however, were provided to all attendees and these were the only materials available for coding. Evaluation of training materials could be improved if future training sessions are recorded and subsequently analyzed.

Another limitation of this study was the lack of intercoder reliability for some of the measures. When measured by % agreement, intercoder reliability was high (> 93% for all variables). When measured by Krippendorff's alpha, however, intercoder reliability for two variables fell below the "lowest conceivable limit" of the criterion. These variables were self-efficacy (for food safety behaviors) and perceived severity (for food safety behaviors). The Krippendorff's alpha for these two variables was .42 and .57 respectively. As previously discussed, Krippendorff's alpha is a conservative index

(Perreault & Leigh, 1989) and one drawback of the measure is that when there is insufficient variation (i.e., both coders agree that a variable was never or always present in the sampling unit) than the value of alpha is 0. Krippendorf (2004a) argues that this result is valid because while it is possible that the material coded was in fact all the same, it is also possible that the coders were too tired to notice unusual variations or that they were lazy and simply coded all of the material the same. It is certainly possible that this was the case for this study; however, it was expected prior to conducting the study that few message design strategies would be found, given the suspected problems with the training and the fact that such trainings typically focus on providing knowledge. Therefore, both indices were reported and these variables were included in the analyses, but conclusions related to these results should be considered tentative. In the future, intercoder reliability for these and other variables could be increased if more training is provided.

Conclusions

Communicating food safety information to food processors during training is an important mechanism for communicating food safety risk information and is thus seen as one way to increase the performance of food safety behaviors and ensure the safety of the food supply. The literature suggests that in order for messages presented during training to be persuasive they need to be communicated using message design strategies that are appropriate for the audience and for the behavior being addressed. However, results of a quantitative content analysis of PowerPoint slides from a food safety training course designed for farmers interested in on-farm food processing found that few persuasive message design strategies were used by course presenters.

Of the message design strategies coded for, results show that statistical evidence was most often used by the presenters. Considering what is known about the target audience, the literature suggests that presenting narrative evidence, in the form of stories with examples that farmers can relate to in their day to day work activities, is likely to be effective. Thus, such stories should be presented along with statistical evidence. In addition, predictors of farmers' intentions to participate in on-farm processing identified in an earlier study, suggest that gain-framed messages which highlight the benefits to performing the recommended behavior(s) may also be effective with this audience. Results of the content analysis, however, show that gain-framed messages were also infrequently employed. More research is needed to empirically test whether gain-framed messages and narrative appeals, as well as such strategies as the use of discrete emotional appeals, would in fact be effective with farmers when promoting food safety behaviors and the on-farm processing program.

The lack of message design strategies used in the presentations may explain why the training sessions were ineffective in generating license applications. Results from an earlier study suggest that other issues related to the license application process may have also played a role in dissuading farmers from applying. Thus, if future training courses are conducted, presenters should consider using persuasive strategies as outlined in this study to promote food safety behaviors, as well as to directly address and facilitate the actual steps needed in order to apply for a license.

Chapter 6: Summary and Conclusions

In an effort to preserve farmland and nurture small family farms, the Maryland Department of Health and Mental Hygiene (MDHMH) promulgated the On-Farm Home Processing regulation in early 2005. This rule allows farmers in Maryland to obtain an on-farm processing license to sell food processed in their home kitchen provided they complete 8-hours of food safety training and allow for inspections of their facilities. Although more than 100 farmers completed one of four training courses offered throughout Maryland in 2005, to date, only 25 farmers have applied for and received a license. The failure of the licensing program has public health implications, as foods produced by farmers without licenses in other states have resulted in foodborne illness outbreaks. Consequently, regulators at the Maryland Department of Health and Mental Hygiene are continually looking for ways to encourage more farmers to apply for on-farm processing licenses.

Thus, the objectives of this study were to identify reasons why the regulation has not resulted in as many license applications as hoped and to explore whether the food safety training courses played a role in dissuading farmers from applying for a license. A model which combines two dominant theoretical paradigms – the Health Belief Model (HBM) and the Theory of Planned Behavior (TPB) – was proposed to predict Maryland farmers' intentions to apply for an on-farm processing license as well their actual license application behavior. To test the proposed model, a mail survey was administered to farmers who completed the training course, farmers who have an on-farm license, and to a systematic random sample of other Maryland farmers. To explore reasons why the

courses may have dissuaded farmers from applying, a content analysis of the training presentations was conducted by two trained coders.

Results of the mail survey moderately support the proposed model. In terms of the Theory of Planned Behavior constructs, the results suggest that farmers' attitudes and subjective norms significantly influenced their intentions to apply for a license while their attitudes, subjective norms, and perceived behavioral control significantly influenced their actual license application behavior. In addition, attitudes were found to have the greatest effect on farmers' intentions to apply for a license, a finding which is supported by past research testing the Theory of Planned Behavior in other contexts. More unexpected was the negative relationship found between farmers' subjective norms and their intentions to apply for a license and their actual license application behavior. One possible reason for this relationship may be that the farmers' motivation to comply with the opinions of others was low. Further study is needed, however, to better understand this finding. Finally, a test of an alternative model found that the perceived behavioral construct was best fit using a multi-dimensional representation in which self-efficacy and perceived control were considered as distinct constructs. This finding supports the argument in the literature that self-efficacy and controllability should be considered as distinct constructs within the perceived behavioral control construct, although more research is needed in other contexts to validate this conclusion.

In terms of the Health Belief Model constructs, results of the model suggest that farmers' attitudes were significantly affected by their perceptions of the benefits of the license and their perceptions of the to license application. These results highlight a common finding from the regulatory compliance literature, that in order for businesses to

comply with new regulations they need to perceive that the benefits of compliance outweigh the costs. Thus, in order to increase license applications these results suggest that future communication to Maryland farmers needs to highlight the benefits of license attainment (e.g., the increased income and diversification of product offerings) while addressing the barriers (e.g., the number of steps needed to apply for a license). Also of interest were survey results not included in model testing regarding farmers' perceptions of susceptibility to and severity of food safety risks. Specifically, results suggest that Maryland farmers exhibit optimistic bias towards food safety risks. Optimistic bias has been found in the literature to negatively correlate with performance of food safety behaviors and attitudes towards food safety regulations.

Despite the valuable findings obtained from the model testing, more research is needed to explore whether other variables such as discrete emotions may account for some of the unexplained variance in Maryland farmers' license application behavior. In addition, more research is needed to explore whether the model tested in this study has application within other contexts, particularly in other states which may be considering similar on-farm processing regulations. Until the proposed model is tested with a broader sample of farmers, care should be taken when applying the results of this study to the development of training courses and on-farm processing programs in other states, as the rules and regulations for on-farm processing may differ in other states along with farmers' perceptions.

Importantly, results of this study suggest that the food safety training provided in 2005 may not have dissuaded farmers from applying for a license as initially thought. No differences in intentions to apply for a license were found between farmers that did and

did not attend one of the training courses and farmers that attended the courses reported higher levels of self-efficacy towards the performance of food safety behaviors. Course attendees did, however, report significantly less self-efficacy towards applying for a license than farmers that did not attend the course. Results of the content analysis found that few persuasive message design strategies were utilized by course presenters and that the content of the PowerPoint slides mainly focused on food safety topics. Although it was the purpose of the training to provide food safety content, results of the survey suggest that there are a number of issues related to license application, such as the benefits obtained from the license and the steps needed to apply for a license, which should be clearly addressed in future trainings in order to increase license applications.

In addition, the literature in the field of risk communication indicates that in order for such messages to be effective they need to be presented using persuasive message design strategies. Of the message design strategies coded for in the food safety training course presentations, results show that statistical evidence was most often used by the presenters. Considering what is known about the target audience, statistical evidence may be most effective when presented along with evidence in the form of stories, as narrative evidence has been found to reduce perceptions of optimistic bias. In addition, the predictors of farmers' intentions to participate in on-farm processing suggest that gain-framed messages which highlight the benefits to performing the recommended behaviors may also be effective with this audience. Results of the content analysis, however, show that gain-framed messages were infrequently employed. Before making final conclusions as to the best message design strategy, however, further studies are needed which empirically test the effect of these and other strategies on Maryland

farmers' intentions to perform food safety behaviors and apply for the on-farm processing license.

Lastly, it should be noted that this research adds to the field in several ways. First, the results of this research greatly add to our knowledge of Maryland farmers processing interests and the factors affecting farmers' decision-making related to on-farm food processing, areas which have received limited attention in the literature. Second, the results add to our knowledge of farmers' perceptions of food safety risks, another area which has received limited attention. Third, the current research adds to the regulatory compliance literature because it provides a theoretical model for understanding decision-making behavior related to food safety regulations. Fourth and finally, this research has the potential to serve as a bridge connecting the academic disciplines and literature in the fields of food safety education, regulatory compliance, persuasion, and human behavior. Consequently, it is hoped that this research may encourage new ways of thinking about the design of messages targeted to this audience.

Appendix A: Cognitive Interview Protocol

Initials_____ Date_____

INTERVIEW CONSENT FORM

Project Title	*On-Farm Home Processing Research Study (Cognitive Interviews)*
Why is this research being done?	*This is a research project being conducted by Meryl Lubran and Mark Kantor at the University of Maryland, College Park. We are inviting you to participate in this research project because you are a farmer in the state of Maryland. The purpose of this research project is to improve Maryland's on-farm processing program.*
What will I be asked to do?	*The procedure involves completing a questionnaire and providing your thoughts and opinions about the questions.*
What about confidentiality?	*We will do our best to keep your personal information confidential. We will store the data in locked filing cabinets and storage areas, and use password-protected computer files. Your name will not be included on the data collected.* *This research project involves making audiotapes of you. The audiotapes are being made so that the research can accurately record the remarks made during the sessions. Only the researchers will have access to the audiotapes and they will be stored in a locked cabinet. The audiotapes will be destroyed (i.e., erased) when they are no longer needed, after data collection and no less than 10 years after the completion of the research.* ___ I agree to be audiotaped during my participation in this study. ___ I do not agree to be audiotaped during my participation in this study. *If we write a report or article about this research project, your identity will be protected to the maximum extent possible. Your information may be shared with representatives of the University of Maryland, College Park or governmental authorities if you or someone else is in danger or if we are required to do so by law.*
What are the risks of this research?	*There are no known risks associated with participating in this research project.*

What are the benefits of this research?	*This research is not designed to help you personally, but the results may help improve the availability of safer food at farmers markets and retail outlets as well as help the investigator learn more about decision-making. We hope that, in the future, other people might benefit from this study through improved understanding of the on-farm processing program.*	
Do I have to be in this research? May I stop participating at any time?	*Your participation in this research is completely voluntary. You may choose not to take part at all. If you decide to participate in this research, you may stop participating at any time. If you decide not to participate in this study or if you stop participating at any time, you will not be penalized or lose any benefits to which you otherwise qualify.*	
What if I have questions?	*This research is being conducted by Mark Kantor, Department of Nutrition and Food Science, at the University of Maryland, College Park. If you have any questions about the research study itself, please contact Mark Kantor at: 301-405-1018, 0112 Skinner Building, College Park, MD 20742, mkantor@umd.edu.* *If you have questions about your rights as a research subject or wish to report a research-related injury, please contact:* **Institutional Review Board Office, University of Maryland, College Park, Maryland, 20742; (e-mail) irb@deans.umd.edu; (telephone) 301-405-0678** *This research has been reviewed according to the University of Maryland, College Park IRB procedures for research involving human subjects.*	
Statement of Age of Subject and Consent	*Your signature indicates that:* *you are at least 18 years of age;,* *the research has been explained to you;* *your questions have been fully answered; and* *you freely and voluntarily choose to participate in this research project.*	
Signature and Date	**NAME OF SUBJECT**	
	SIGNATURE OF SUBJECT	
	DATE	

COVER LETTER

Date:

Dear Respondent,

We are inviting you to participate in a research project to study Maryland's On-Farm Home Processing Regulation. We are inviting you to participate in this project because you own a farm in the state of Maryland. The purpose of this research project is to help farmers increase profits by improving Maryland's on-farm processing program. Enclosed with this letter is a brief questionnaire. We are asking you to look over the questionnaire and, if you choose to do so, complete the questionnaire and send it back to us in the enclosed postage-paid envelope.

If you choose to participate, do not write your name on the questionnaire. We will do our best to keep your personal information confidential. To help protect your confidentiality, the surveys are anonymous and will not contain information that may personally identify you. If we write a report or article about this research project, your identity will be protected to the maximum extent possible. Your information may be shared with representatives of the University of Maryland, College Park or governmental authorities if you or someone else is in danger or if we are required to do so by law.

There are no known risks associated with participating in this research project. This research is not designed to help you personally, but the results may help us learn more about the on-farm processing regulation. We hope that, in the future, other people might benefit from this study through improved understanding of the on-farm processing program.

This research is being conducted by Mark Kantor and Meryl Lubran, Department of Nutrition and Food Science, at the University of Maryland, College Park. If you have any questions about the research study itself, please contact Mark Kantor at: 0112 Skinner Building, College Park, MD 20742; mkantor@umd.edu; (telephone) 301-405-1018. If you have questions about your rights as a research subject or wish to report a research-related injury, please contact: Institutional Review Board Office, University of Maryland, College Park, Maryland, 20742; (e-mail) irb@deans.umd.edu; (telephone) 301-405-0678.

Sincerely,

Mark Kantor, Ph.D.
Associate Professor

Meryl Lubran
Graduate student

Enclosure

On-Farm Home Processing Research Study

START HERE:

1. Have you ever heard of the on-farm home processing license offered by the Maryland Department of Health and Mental Hygiene? The on-farm home processing license allows an individual who owns a farm to process food in a home or domestic kitchen located on the individual's farm. *Check one box.*

□ Yes
□ No (If no, please go to item #48)

2. How did you, personally hear about the license? *Please check all that apply.*

□ My extension agent
□ Friend
□ Brochure
□ Internet
□ Other, please specify:
_____

3. Have you applied for an on-farm processing license? *Check one box.*

□ Yes
□ No (If no, please go to item #5)
□ I don't know

***4. If yes,* have you received an on-farm processing license?**

□ Yes
□ No (If no, please go to item #6)
□ I don't know

5. How likely is it that you will apply for an on-farm processing license?

□ Very likely
□ Somewhat likely
□ Uncertain
□ Somewhat unlikely
□ Very unlikely

6. How likely are you to request more information about the on-farm processing license?

□ Very likely
□ Somewhat likely
□ Uncertain
□ Somewhat unlikely
□ Very unlikely

7. How likely are you to attend an information session about the on-farm processing license?

□ Very likely
□ Somewhat likely
□ Uncertain
□ Somewhat unlikely
□ Very unlikely

8. Did you, personally attend one of the all-day On-Farm Food Processing Courses held in March 2005? These courses were held throughout Maryland by Maryland Cooperative Extension, MDHMH, MDA, and the USDA. Participants received a certificate for their participation.

□ Yes
□ No (If no, please go to item #12)
□ I don't know (Please go to item #12)

The following questions address your opinions about the **On-Farm Food Processing Courses held in March 2005**. If you did not attend one of the courses, please skip to Question #12. *Please check the box that best applies.*

Training	**Completely Disagree**	**Disagree**	**Uncertain**	**Agree**	**Completely Agree**
9. The material covered in the presentations at the training courses was too technical.	☐	☐	☐	☐	☐
10. The presentations did not provide enough detail for how I could process my own product.	☐	☐	☐	☐	☐
11. I felt overwhelmed by the amount of information covered in the presentations.	☐	☐	☐	☐	☐

The following questions address your personal attitudes towards the on-farm processing license. *Please check the box that best applies.*

TPB – Attitudes	**Completely Disagree**	**Disagree**	**Uncertain**	**Agree**	**Completely Agree**
12. The on-farm processing license is valuable.	☐	☐	☐	☐	☐
13. Having an on-farm processing license is beneficial.	☐	☐	☐	☐	☐
14. The on-farm processing license is worthless.	☐	☐	☐	☐	☐

The following questions address how others feel about the on-farm processing license.

TPB - Subjective Norms	Completely Disagree	Disagree	Uncertain	Agree	Completely Agree
15. Other producers that I know think that getting an on-farm processing license is a good idea.	☐	☐	☐	☐	☐
16. Most people who are important to me think that I should get the on-farm processing license.	☐	☐	☐	☐	☐
17. The people in my life whose opinions I value would approve of me getting the on-farm processing license.	☐	☐	☐	☐	☐
18. It is expected of me that I get an on-farm processing license.	☐	☐	☐	☐	☐

The following questions address how often you hear about the on-farm home processing license.

TPB – Cues to Action	Never	Rarely	Occasion-ally	Fairly Often	Very Often
19. I receive information in the mail about the license.	☐	☐	☐	☐	☐
20. My extension agent gives me information about the license.	☐	☐	☐	☐	☐
21. At professional/association meetings, the speakers talk about the license.	☐	☐	☐	☐	☐

The following questions regard possible barriers to receiving an on-farm home processing license.

HBM – Barriers	**Completely Disagree**	**Disagree**	**Uncertain**	**Agree**	**Completely Agree**
22. There are too many steps I have to take in order to get a license.	☐	☐	☐	☐	☐
23. The $30 fee for a license is too high.	☐	☐	☐	☐	☐
24. There are too many regulations I have to follow in order to get a license.	☐	☐	☐	☐	☐
25. I have other priorities than getting a license.	☐	☐	☐	☐	☐
26. Getting a license will take too long.	☐	☐	☐	☐	☐
27. I do not trust the Maryland Department of Health and Mental Hygiene.	☐	☐	☐	☐	☐
28. There is not enough technical assistance to help me develop recipes for food products that I would like to sell.	☐	☐	☐	☐	☐
29. There is too much liability if I get the license.	☐	☐	☐	☐	☐
30. If the Maryland Department of Health and Mental Hygiene comes to inspect my kitchen for the license; I am worried they will find some kind of violation.	☐	☐	☐	☐	☐

The following questions address possible benefits of obtaining an on-farm home processing license.

HBM – Benefits	**Completely Disagree**	**Disagree**	**Uncertain**	**Agree**	**Completely Agree**
31. Getting the license would be a good way for me to earn extra income.	☐	☐	☐	☐	☐
32. Getting the license would be a good way for me to diversify the types of products I sell.	☐	☐	☐	☐	☐
33. Getting the license would allow me to sell more products at farmer's markets.	☐	☐	☐	☐	☐
34. If I intend to process and sell my own food products, getting a license would help me to abide by the law.	☐	☐	☐	☐	☐
35. If I sell raw meat at a farmer's market without a license, no one will know.	☐	☐	☐	☐	☐
36. If I sell raw meat at a farmer's market without a license, the consequences would be very serious.	☐	☐	☐	☐	☐

The following questions address how confident you feel in your ability to obtain an on-farm processing license and produce and sell a safe product.

TPB - Perceived behavioral control/HBM Self-efficacy/	**Completely Disagree**	**Disagree**	**Uncertain**	**Agree**	**Completely Agree**
37. If I were to process food on my farm, producing a safe product would be easy.	☐	☐	☐	☐	☐
38. I have control over the safety of the food I sell.	☐	☐	☐	☐	☐
39. I am confident in my ability to produce safe food.	☐	☐	☐	☐	☐
40. I think that applying for a license is easy.	☐	☐	☐	☐	☐
41. I have control over whether or not I get a license.	☐	☐	☐	☐	☐
42. Whether or not I apply for a license is mostly up to me.	☐	☐	☐	☐	☐

The following questions address the safety of food you might produce in your on-farm kitchen.

HBM – Susceptibility	Completely Disagree	Disagree	Uncertain	Agree	Completely Agree
43. If I processed food on my farm, I am confident that the food I make would be safe.	☐	☐	☐	☐	☐
44. If I processed food on my farm, it is unlikely that customers would get sick from my food.	☐	☐	☐	☐	☐
45. The food I prepare for my family is more likely to cause foodborne illness than the food I prepare for my farm-based business	☐	☐	☐	☐	☐
46. If I processed food on my farm, the food that I prepare for sale will likely be safer than the food prepared for sale by other farmers.	☐	☐	☐	☐	☐

The following questions address the consequences of foodborne illness.

HBM – Severity	Not At All Serious	Not Serious	Uncertain	Serious	Very Serious
47. If food I produced caused a foodborne illness in my <u>family</u>, the illness would likely be …	☐	☐	☐	☐	☐
48. If food I produced caused a foodborne illness in my <u>customers</u>, the illness would likely be …	☐	☐	☐	☐	☐
49. If I developed a foodborne illness it would likely be….	☐	☐	☐	☐	☐
50. If my customers became ill from the food I sold, the damage to my business would be…	☐	☐	☐	☐	☐

For this last set of questions, please check the box that best applies (only one response per question).

51. In which of these groups is your age?

- □ Under 30
- □ 30 to 44
- □ 45 to 64
- □ 65 or older

52. Are you male or female?

- □ Male
- □ Female

53. Which of the following best describes your race?

- □ African American
- □ American Indian
- □ Asian
- □ White
- □ Other Pacific Islander
- □ Other, please specify: _____
  _____

54. Which of the following best describes your ethnicity?

- □ Hispanic
- □ Not Hispanic

55. What is your job responsibility at the farm?

- □ Owner/Operator
- □ Hired Manager
- □ Partner
- □ Other, please specify: _____
  _____

56. How large is the farm that you are employed at?

- □ 1 to 99 acres
- □ 100 to 499 acres
- □ 500 to 999 acres
- □ 1,000 or more acres

57. Which enterprise accounts for the majority of the income at your farm?

- □ Beef cattle
- □ Tobacco
- □ Grains
- □ Poultry
- □ Vegetables
- □ Fruit trees
- □ Dairy
- □ Aquaculture
- □ Hogs
- □ Other, please specify:_____
- □ I prefer not to answer

58. In which county is the farm you are employed at located?

Please specify:_____

Thank you for taking the time to complete this survey. Your responses will help improve the on-farm processing program.

PROBES

Cover Letter

- Do you think the cover letter provides enough benefits for participation?
- Can you repeat the purpose of the survey in your own words?

Survey

1. Do you think that most people know what the license is? Do we need the question and/or the extra definition?
2. Is there a category we are missing?
3. How do you interpret "you", would you answer yes if someone else on your farm applied? Who in your farm would apply for the license? You or someone else?
4. Can you tell me more about why you answered this way?
5. Do you think that you would apply for a license in 6 months? 1 year? 2 years? Does time matter for the question?
6. What do you think we mean by "information"?
7. What do you think we mean by "information session"?
8. If you attended the training, do you think we need the extra information to help people recall that they attended?
9. If you attended the training, can you recall what the question is asking?
10. If you attended the training, what do you think we mean by "detail"?
11. If you attended the training, did you feel any other emotions?
12. Do you have any other opinions about the on-farm processing license?
13. Can you tell me more about that, what benefits do you think it gives?
14. Can you tell me more about that?
15. How would you interpret "other producers"
16. How would you interpret "people who are important to me"
17. How would you interpret "people whose opinions I value"
18. Who expects it of you?
19. Are there other ways that you receive information? Through e-mail?
20. Can you tell me more about that?
21. What professional meetings do you go to?
22. Can you tell me more about that, what kinds of steps do you have to take?
23. Can you tell me more about why you answered this way?
24. What other regulations are you thinking about or not?
25. Can you tell me more about that, what other priorities do you have?
26. Is there one part that you think would take longer?
27. Can you tell me more about that? Do you feel comfortable answering that question?
28. How do you interpret "technical assistance"?
29. How do you interpret "liability"
30. Do you feel comfortable answering this question?
31. How confident are you in your answer?
32. Can you tell me more about why you answered this way?
33. Can you think of any other benefits?
34. Do you know what laws we are referring to?
35. Do you feel comfortable answering this question?

36. Do you feel comfortable answering this question?
37. Can you tell me more about why you answered this way?
38. Can you tell me more about why you answered this way?
39. Can you tell me more about why you answered this way?
40. Can you tell me more about why you answered this way?
41. Can you tell me more about why you answered this way?
42. Who do you think has control over whether you get a license?
43. Can you repeat the question in your own words? What do you think we mean by "safe"? Do you feel comfortable answering this question?
44. Do you feel comfortable answering this question?
45. What do you think we mean by "foodborne illness"?Do you feel comfortable answering this question?
46. Do you feel comfortable answering this question?
47. Can you tell me more about why you answered this way?
48. Can you tell me more about why you answered this way?
49. Can you tell me more about why you answered this way?
50. Can you tell me more about why you answered this way?
51. Do these age groups make sense to you?
52.
53.
54.
55. Is there a job function that is missing?
56.
57. Is there an enterprise that is missing?
58.

Close

Is there anything else that came to mind as you were answering the questions that was not asked?

If you could offer us one piece of advice how to improve the survey, what would that be?

If you could offer us one piece of advice how to improve the regulation or license approval process, what would that be?

Those are the questions that I had.

Thank you very much for your time.

Appendix B: On-Farm Processing Survey

Thank you for taking time to complete this survey. The results will be used to improve on-farm processing programs. We hope you enjoy the opportunity to voice your opinions.

START HERE:

Q1. Are you currently processing (either on-farm or through a processor) value-added food products? For example dairy, meat, fruit pies or canned acid foods such as pickles, salsa, jams, or jellies? *Check one box.*

□ Yes →
□ No (Go directly to Page 2, Q6)

Q2. *If yes,* what types of products are you processing? *Check all that apply.*

□ Dairy products
□ Meat products
□ Canned acid foods (i.e., salsa, jams, jellies)
□ Other, please list:_____

Q3. Where are your products being sold? *Check all that apply.*

□ Restaurants
□ Retail Outlets
□ Farmer's Markets
□ Other, please list:_____

Q4. Where are you processing your products? *Check all that apply.*

□ On my farm
□ Through a processor in Maryland
□ Through a processor in a different state
□ Other, please list:_____

Q5. Do you have an on-farm processing license? The on-farm processing license allows an individual who owns a farm to process non-potentially hazardous foods in a home kitchen, or to store and distribute raw meats and/or dairy products. *Check one box.*

□ Yes (If yes, go directly to Page 4 Q16)
□ No (If no, go directly to Page 3, Q11)

Q6. If you are <u>not</u> currently processing value-added food products, would you like to in the future? *Check one box.*

- □ Yes
- □ Maybe
- □ No (Go directly to Q10)

Q7. *If yes or maybe,* what types of products would you consider processing? *Check all that apply.*

- □ Dairy products
- □ Meat products
- □ Canned acid foods (i.e., salsa, jams, jellies)
- □ Other_____

- □ I don't know

Q8. Where do you think you would like to sell your products? *Check all that apply.*

- □ Restaurants
- □ Retail Outlets
- □ Farmer's Markets
- □ Other_____

- □ I don't know

Q9. Where do you think you would like to process your products? *Check all that apply.*

- □ On my farm
- □ Through a processor in Maryland
- □ Through a processor in a different state
- □ Other_____

- □ I don't know

Please go directly to Page 3, Q11…

Q10. *If no,* is the reason you are not interested in processing due to problems with the on-farm processing program? *Check one box.*

- □ Yes (Go directly to Page 4, Q16)
- □ No

If no, please specify your reason(s) and go to Page 8, Q56:
_____

Q11. Do you intend to apply for an on-farm processing license? The on-farm processing license allows an individual who owns a farm to process non-potentially hazardous foods in a home kitchen, or to store and distribute raw meats and/or dairy products. *Check one box.*

- □ Yes
- □ Maybe
- □ No (Go directly to Q15)
- □ I haven't heard of the license (Go to Q56)

Q12. *If yes or maybe,* how likely are you to apply for an on-farm processing license?

- □ Very likely
- □ Somewhat likely
- □ Uncertain
- □ Somewhat unlikely
- □ Very unlikely

Q13. How likely are you to request information about the on-farm processing license?

- □ Very likely
- □ Somewhat likely
- □ Uncertain
- □ Somewhat unlikely
- □ Very unlikely

Q14. How likely are you to attend an information session about the on-farm processing license?

- □ Very likely
- □ Somewhat likely
- □ Uncertain
- □ Somewhat unlikely
- □ Very unlikely

Please go directly to Page 4, Q16…

Q15. *If no,* is the reason you do not intend to apply for a license due to problems with the on-farm processing program? *Check one box.*

- □ Yes (Go directly to Page 4, Q16)
- □ No

If no, please specify your reason(s) and go to Page 8, Q56:

_____

Questions 16, 17, and 18 address your personal attitudes towards the on-farm processing license. *Please check the box that best applies.*

	Completely Disagree	Disagree	Uncertain	Agree	Completely Agree
Q16. The on-farm processing license is valuable.	☐	☐	☐	☐	☐
Q17. Having an on-farm processing license is worthwhile.	☐	☐	☐	☐	☐
Q18. The on-farm processing license is useless.	☐	☐	☐	☐	☐

Questions 19, 20, and 21 address how others feel about the on-farm processing license.

	Completely Disagree	Disagree	Uncertain	Agree	Completely Agree
Q19. Other producers that I know think getting an on-farm processing license is a <u>good</u> idea.	☐	☐	☐	☐	☐
Q20. Other producers that I know think getting an on-farm processing license is a <u>bad</u> idea.	☐	☐	☐	☐	☐
Q21. The people in my life whose opinions I value would approve of me getting the on-farm processing license.	☐	☐	☐	☐	☐

Questions 22, 23, and 24 address how often you hear about the on-farm processing license.

	Never	Rarely	Occasion-ally	Fairly Often	Very Often
Q22. I receive information about the license in the mail.	☐	☐	☐	☐	☐
Q23. My county extension agent gives me information about the license.	☐	☐	☐	☐	☐
Q24. At professional/association meetings, the speakers talk about the license.	☐	☐	☐	☐	☐

Questions 25 through 37 regard possible barriers to receiving an on-farm processing license.

	Completely Disagree	Disagree	Uncertain	Agree	Completely Agree
Q25. There are too many steps I have to take in order to get a license.	☐	☐	☐	☐	☐
Q26. The steps to get a license are not clearly outlined.	☐	☐	☐	☐	☐
Q27. I don't have the time to process my products during the peak season.	☐	☐	☐	☐	☐
Q28. I have heard conflicting information about the license.	☐	☐	☐	☐	☐
Q29. There are too many regulations I have to follow in order to get a license.	☐	☐	☐	☐	☐
Q30. Getting a license will take too long.	☐	☐	☐	☐	☐
Q31. I do not trust the Maryland Department of Health and Mental Hygiene.	☐	☐	☐	☐	☐
Q32. There is too much liability if I get the license.	☐	☐	☐	☐	☐
Q33. Retail outlets are reluctant to carry on-farm processed products.	☐	☐	☐	☐	☐
Q34. With the $40,000 limit, the profit margin is not there.	☐	☐	☐	☐	☐
Q35. There is not enough technical assistance to help me develop recipes for food products that I would like to sell.	☐	☐	☐	☐	☐
Q36. If the Maryland Department of Health and Mental Hygiene comes to inspect my kitchen for the license; I am worried they will find some kind of violation.	☐	☐	☐	☐	☐

Q37. Please list any other barriers that you have experienced:

_____

Questions 38 through 43 address possible benefits of obtaining an on-farm processing license.

	Completely Disagree	Disagree	Uncertain	Agree	Completely Agree
Q38. Getting the license would be a good way for me to earn extra income.	☐	☐	☐	☐	☐
Q39. Getting the license would be a good way for me to diversify the types of products I sell.	☐	☐	☐	☐	☐
Q40. Getting the license would allow me to sell more products at farmer's markets.	☐	☐	☐	☐	☐
Q41. If I intend to process and sell my own food products, getting a license would help me to abide by the law.	☐	☐	☐	☐	☐
Q42. If I sell meat at a farmer's market without a license, no one will know.	☐	☐	☐	☐	☐
Q43. If I sell meat at a farmer's market without a license, the consequences would be very serious.	☐	☐	☐	☐	☐

Questions 44, 45, and 46 address how confident you feel in your ability to produce and sell a safe product.

	Completely Disagree	Disagree	Uncertain	Agree	Completely Agree
Q44. If I were to process food on my farm, producing a safe product would be easy.	☐	☐	☐	☐	☐
Q45. I have control over the safety of the food I sell.	☐	☐	☐	☐	☐
Q46. I am confident in my ability to produce safe food.	☐	☐	☐	☐	☐

Questions 47, 48, and 49 address how confident you feel in your ability to obtain an on-farm processing license.

	Completely Disagree	Disagree	Uncertain	Agree	Completely Agree
Q47. I think that applying for a license is easy.	☐	☐	☐	☐	☐
Q48. I have control over whether or not I get a license.	☐	☐	☐	☐	☐
Q49. Whether or not I apply for a license is mostly up to me.	☐	☐	☐	☐	☐

Questions 50, 51, and 52 address the safety of food you might produce on your farm.

	Completely Disagree	Disagree	Uncertain	Agree	Completely Agree
Q50. If I processed food on my farm, it is unlikely that customers would get sick from my food.	☐	☐	☐	☐	☐
Q51. If I processed food on my farm, the food I prepare for my farm-based business will likely be safer than the food I prepare for my family.	☐	☐	☐	☐	☐
Q52. If I processed food on my farm, the food that I prepare for sale will likely be safer than the food prepared for sale by other farmers.	☐	☐	☐	☐	☐

Questions 53, 54, and 55 address the consequences of foodborne illness.

	Not At All Serious	Not Serious	Uncertain	Serious	Very Serious
Q53. If food I produced caused a foodborne illness in my <u>family</u>, the illness would likely be …	☐	☐	☐	☐	☐
Q54. If food I produced caused a foodborne illness in my <u>customers</u>, the illness would likely be …	☐	☐	☐	☐	☐
Q55. If my <u>customers</u> became ill from the food I sold, the damage to my business would be…	☐	☐	☐	☐	☐

For this last set of questions, please check the box that best applies (only one response per question).

Q56. In which of these groups is your age?

- □ Under 30
- □ 30 to 44
- □ 45 to 64
- □ 65 or older

Q57. Are you male or female?

- □ Male
- □ Female

Q58. Which of the following best describes your race?

- □ African American
- □ American Indian
- □ Asian
- □ White
- □ Other Pacific Islander
- □ Other, please specify: _____
  _____

Q59. Which of the following best describes your ethnicity?

- □ Hispanic
- □ Not Hispanic

Q60. What is your job responsibility at the farm?

- □ Owner/Operator
- □ Hired Manager
- □ Partner
- □ Other, please specify: _____

Q61. Did you personally attend one of the all-day On-Farm Food Processing Courses held in March 2005? These courses were held throughout Maryland by Maryland Cooperative Extension, MDHMH, MDA, and the USDA.

- □ Yes
- □ No
- □ I don't know

Q62. How large is the farm that you are employed at?

- □ 1 to 99 acres
- □ 100 to 499 acres
- □ 500 to 999 acres
- □ 1,000 or more acres

Q63. Which enterprise accounts for the majority of the income at your farm?

- □ Beef cattle
- □ Tobacco
- □ Grains
- □ Poultry
- □ Vegetables
- □ Fruit trees
- □ Dairy
- □ Aquaculture
- □ Hogs
- □ Other, please specify:_____
- □ I prefer not to answer

Q64. In which county is the farm you are employed at located?

Please specify:_____

Thank you for taking the time to complete this survey. Your responses will help improve the on-farm processing program.

Appendix C: Pre-Notice Letter

March 1, 2009

Dear Maryland Farm Owner/Operator,

We are writing to ask for your help with an important study being conducted by the University of Maryland to understand the attitudes and beliefs of Maryland farmers towards value-added processing and value-added processing programs. In the next few days you will receive a request to participate in this project by answering questions about important issues that currently face farmers in Maryland.

We would like to do everything we can to make it easy and enjoyable for you to participate in the study. We are writing in advance because many people like to know ahead of time that they will be asked to fill out a questionnaire. This research can only be successful with the generous help of people like you.

We know your time is valuable, and have tried to mail this questionnaire to reach you in a less busy time of year. The questionnaire is estimated to take between 15 to 20 minutes of your time. Please know that the results of this research will be used to improve value-added processing programs in Maryland. Most of all, we hope that you enjoy the questionnaire and the opportunity to voice your thoughts and opinions.

Best wishes,

Meryl Lubran
Graduate student

Mark Kantor, Ph.D.
Associate Professor

301-405-1018 ■ FAX 301-314-3313

0112 Skinner Building ■ College Park, MD 20742

LOCAL GOVERNMENTS ■ U.S. DEPARTMENT OF AGRICULTURE COOPERATING

EQUAL OPPORTUNITY PROGRAMS

Appendix D: Survey Cover Letter

March 7, 2009

Dear Maryland Farm Owner/Operator,

We are inviting you to participate in a research project conducted by the University of Maryland to study value-added processing and Maryland's On-Farm Processing regulation (Code of Maryland Regulations [COMAR] 10.15.04.19). You were chosen to participate in this project because you own and/or operate a farm in the state of Maryland. The purpose of this research project is to improve the on-farm processing program.

Enclosed with this letter is a brief questionnaire. We are asking you to look over the questionnaire and, if you choose to do so, complete the questionnaire and send it back to us in the enclosed postage-paid envelope. The questionnaire is estimated to take between 15 to 20 minutes of your time.

If you choose to participate, do not write your name on the questionnaire. We will do our best to keep your personal information confidential. To help protect your confidentiality, the surveys are anonymous and will not contain information that may personally identify you. If we write a report or article about this research project, your identity will be protected to the maximum extent possible. Your information may be shared with representatives of the University of Maryland, College Park or governmental authorities if you or someone else is in danger or if we are required to do so by law.

There are no known risks associated with participating in this research project. This research is not designed to help you personally, but the results may help us learn more about value-added processing and the on-farm processing regulation. We hope that, in the future, other people might benefit from this study through improved understanding of important issues that currently face farmers in Maryland.

This research is being conducted by Mark Kantor and Meryl Lubran, Department of Nutrition and Food Science, at the University of Maryland, College Park. If you have any questions about the research study itself, please contact Mark Kantor at: 0112 Skinner Building, College Park, MD 20742; mkantor@umd.edu; (telephone) 301-405-1018. If you have questions about your rights as a research subject or wish to report a research-related injury, please contact: Institutional Review Board Office, University of Maryland, College Park, Maryland, 20742; (e-mail) irb@deans.umd.edu; (telephone) 301-405-0678.

Best wishes,

Meryl Lubran
Graduate student

Mark Kantor, Ph.D.
Associate Professor

Appendix E: Follow-up Postcard

March 14, 2009

Last week a questionnaire was mailed to you because you were randomly selected to help in a study about on-farm processing in Maryland.

If someone at your address has already completed and returned the questionnaire, please accept our sincerest thanks. If not, please have the appropriate person in your household do so right away. We are especially grateful for your help with this important study.

If you did not receive a questionnaire, or if it was misplaced, please e-mail us at mlubran@umd.edu or call us at (301) 405-1018 and we will get another one in the mail for you today.

Best wishes,

Meryl Lubran
Graduate student

Mark Kantor, Ph.D.
Associate Professor

Appendix F: Notification E-mail

Dear extension specialists,

My name is Meryl Lubran and I am a graduate student at the University of Maryland. I wanted to notify you about an important study that I am conducting with Dr. Mark Kantor to understand the attitudes and beliefs of Maryland farmers towards value-added processing and Maryland's On-Farm Processing regulation (COMAR 10.15.04.19).

During the month of March, surveys will be mailed out to farmers in Maryland asking them to answer questions about important issues that they currently face. The surveys are being mailed out now in an effort to reach farmers during a less busy time of year.

We hope that if they are selected to participate that they will take the time to complete this survey. The survey is estimated to take between 15 to 20 minutes of their time.

All responses will be anonymous and will not contain any identifying information. If a report or article is written about this research project, results will only be reported in aggregate and participants' identity will be protected to the maximum extent possible.

I wanted to notify you about this survey because I know that extension specialists are a trusted source of information for farmers. If anyone contacts you with questions about the survey, or if you have any questions yourself, please feel free to contact me.

This research can only be successful with the generous help of people like you.

Best regards,
Meryl Lubran
0112 Skinner Building
College Park, MD 20742
mlubran@umd.edu

Appendix G: Model 1 Covariance Matrix

		INT1	INT2	INT3	ATT1	ATT2
		V3	V4	V5	V6	V7
INT1	V3	3.892				
INT2	V4	4.116	4.770			
INT3	V5	4.215	4.732	4.954		
ATT1	V6	0.522	0.611	0.549	1.132	
ATT2	V7	0.595	0.691	0.618	1.061	1.153
ATT3	V8	0.300	0.354	0.313	0.764	0.798
SN1	V9	0.094	0.121	0.103	0.531	0.577
SN2	V10	0.007	0.044	0.022	0.270	0.323
SN3	V11	0.611	0.694	0.702	0.389	0.425
CUE1	V12	-0.087	-0.085	-0.077	0.185	0.182
CUE2	V13	0.158	0.149	0.147	0.056	0.097
CUE3	V14	0.022	-0.016	-0.050	0.181	0.190
BAR1	V15	-0.434	-0.498	-0.506	-0.289	-0.306
BAR2	V16	-0.019	-0.067	-0.015	-0.366	-0.343
BAR3	V19	-0.481	-0.544	-0.576	-0.361	-0.410
BEN1	V27	0.465	0.550	0.526	0.348	0.407
BEN2	V28	0.568	0.670	0.666	0.409	0.457
BEN3	V29	0.428	0.477	0.473	0.404	0.441
SUS1	V31	-0.016	-0.068	-0.069	-0.014	-0.029
SEV1	V35	-0.034	-0.107	-0.095	0.027	0.004
PBC1	V41	0.289	0.319	0.321	0.203	0.186
PBC5	V43	0.269	0.276	0.323	0.069	0.084
PBC6	V44	0.087	-0.012	-0.040	0.048	0.055

		ATT3	SN1	SN2	SN3	CUE1
		V8	V9	V10	V11	V12
ATT3	V8	1.186				
SN1	V9	0.417	0.785			
SN2	V10	0.333	0.479	0.699		
SN3	V11	0.428	0.301	0.192	0.802	
CUE1	V12	0.138	0.030	-0.042	0.064	0.592
CUE2	V13	0.064	0.051	0.025	0.027	0.304
CUE3	V14	0.107	0.225	0.030	-0.015	0.340
BAR1	V15	-0.217	-0.147	-0.135	-0.167	-0.022
BAR2	V16	-0.301	-0.211	-0.100	-0.117	-0.149
BAR3	V19	-0.411	-0.193	-0.159	-0.283	-0.075
BEN1	V27	0.325	0.359	0.215	0.219	-0.017

		ATT3	SN1	SN2	SN3	CUE1
		V8	V9	V10	V11	V12
BEN2	V28	0.388	0.401	0.262	0.292	0.083
BEN3	V29	0.394	0.394	0.263	0.265	0.039
SUS1	V31	0.049	0.026	0.024	-0.026	-0.002
SEV1	V35	-0.026	0.119	-0.040	0.034	0.081
PBC1	V41	0.086	0.161	0.081	0.183	0.047
PBC5	V43	0.055	0.131	-0.001	0.189	-0.162
PBC6	V44	0.152	0.161	0.099	0.105	-0.148

		CUE2	CUE3	BAR1	BAR2	BAR3
		V13	V14	V15	V16	V19
CUE2	V13	0.634				
CUE3	V14	0.427	1.005			
BAR1	V15	0.052	0.033	0.697		
BAR2	V16	-0.042	-0.088	0.241	0.636	
BAR3	V19	0.053	0.159	0.610	0.322	0.912
BEN1	V27	0.036	-0.038	-0.103	-0.124	-0.263
BEN2	V28	0.073	0.139	-0.115	-0.156	-0.224
BEN3	V29	0.124	0.184	-0.100	-0.069	-0.155
SUS1	V31	0.013	-0.031	0.146	-0.041	0.006
SEV1	V35	0.034	0.018	0.073	-0.177	-0.010
PBC1	V41	0.036	-0.035	-0.329	-0.171	-0.383
PBC5	V43	-0.024	-0.026	-0.105	-0.096	-0.095
PBC6	V44	0.001	0.094	-0.034	0.001	0.010

		BEN1	BEN2	BEN3	SUS1	SEV1
		V27	V28	V29	V31	V35
BEN1	V27	0.746				
BEN2	V28	0.574	0.798			
BEN3	V29	0.527	0.633	0.874		
SUS1	V31	0.117	0.044	0.090	0.786	
SEV1	V35	0.106	0.127	0.124	0.396	0.867
PBC1	V41	0.164	0.105	0.037	-0.082	0.006
PBC5	V43	-0.114	-0.119	-0.165	-0.127	0.000
PBC6	V44	-0.051	-0.034	0.029	0.021	0.117

		PBC1	PBC5	PBC6
		V41	V43	V44
PBC1	V41	0.592		
PBC5	V43	0.237	1.048	
PBC6	V44	0.127	0.525	1.076

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