

Food Safety Plans: Opportunities and Barriers for Small MN Fruit and Vegetable Producers

A Plan B Paper

In Partial Fulfillment of the
Master of Science in Science, Technology, and Environmental Policy

Degree Requirements

The Hubert H. Humphrey School of Public Affairs

The University of Minnesota

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July 8th, 2014

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Date

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Table of Contents

Executive Summary..... 2

Introduction 3

 Literature Review..... 4

Study Approach and Methodology 10

 Study Challenges and Limitations 15

Results..... 16

 Description of Select Themes from Interview Datasets: 18

 Results of Introductory and Background Questions..... 19

 Results of GAP-Related Questions 21

 Results for Importance of Farm Safety Plans..... 22

 Results for Barriers to Creation and Implementation of Farm Plans..... 23

Discussion..... 27

Recommendations 32

Appendices..... 34

 Appendix A: Interview Questions and Prompts..... 34

Bibliography 36

Executive Summary

High-profile foodborne illness outbreaks have led to increased efforts to improve food safety in the U.S. food supply. New legislation called the Food Safety and Modernization Act (FSMA) requires some farmers to have written food safety plans. Many small fruit and vegetable growers in Minnesota do not currently have or use written food safety plans. Most of these growers are not required to have written plans, but some food safety stakeholders would like to encourage plan use since they believe written food safety plans encourage good practices.

The purpose of this research is to understand stakeholder views on the importance of food safety plans for small Minnesota fruit and vegetable farms, as well as discover the barriers to creating and implementing these plans. Key informant interviews were conducted with 23 stakeholders. They represented small fruit and vegetable farmers, food safety educators, university faculty, government employees, non-profit representatives, and other food chain stakeholders. To better compare between unequal group sizes, respondents were grouped into “farmer” and “non-farmer” categories. Twelve key themes were selected from the 25 identified in interview text. Eleven of the 23 respondents were asked directly about the importance of food safety plans. Five stakeholders agreed plans were important, four stated plans are conditionally important, and one respondent felt food safety plans were not important.

Barriers to creating farm plans included amount of time, increased paperwork, and increased cost, with these barriers usually interconnected in stakeholder responses. Access to information and appropriateness of plans given farm size were also highly discussed. Barriers to implementing farm plans were often identified as a combination of cost with issues like time, paperwork, and farm size. A few of the opportunities discussed to address the barriers to utilizing food safety plans include more farmer-to-farmer education, using Natural Resources Conservation Service (NRCS) support as a model for food safety plan support, and promoting further discussion on the nature of food safety between all stakeholders to reach consensus about feasible yet effective food safety expectations and measures for small Minnesota fruit and vegetable farmers.

After discussing several options, those that have a high simplicity of implementation, directly or indirectly increase plan usage, and are likely to benefit multiple stakeholder groups were selected for recommendation: 1) Research should be conducted to understand food safety risk of different farming scales and practices; 2) A neutral entity should lead conversations between stakeholder groups to identify common ground around ensuring fresh produce safety; 3) Food safety education efforts should be expanded through the Extension program; 4) Consumer food safety education should be increased.

Introduction

In light of major foodborne illness outbreaks in the United States, the Food Safety and Modernization Act (FSMA) was created to minimize contamination of products in the U.S. food supply. Part of the act focuses on the farm level minimization of risk by requiring usage of written food safety plans among large-scale produce farmers. Although not all farmers will be required to have plans under the FSMA, some stakeholders believe individual buyers and distributors may begin to expect, or require, written food safety plans. Many small fruit and vegetable growers in Minnesota do not currently have or use written food safety plans even though this is highly recommended to reduce the risk of microbial contamination at the farm level.

Food safety is an issue that is on the minds of the public, growers, and government organizations. The Center for Disease Control (CDC) estimates that 1 out of every 6 Americans becomes sick with a foodborne illness every year (CDC, 2013). Of those, 128,000 people are hospitalized, and 3,000 die each year. One study published in the *Journal of Food Protection* estimated the average cost of foodborne illness per case was \$1,626 which suggests a total annual cost of \$77.7 billion (Scharff, 2011) Food safety plans are seen as a way to reduce the number of incidents of foodborne illness at the farm level. Two survey-based studies (one of which was conducted in Minnesota) have examined current food safety practices on small fruit and vegetable farms. Another survey-based study in New York tried to understand the barriers to creating and implementing food safety practices among fruit and vegetable farmers in that state. A key informant interview method of understanding the barriers to creation and implementation of food safety plans has not been conducted on this issue, leaving an opportunity for this research to provide novel insight.

The purpose of this study is to better understand the barriers faced by small fruit and vegetable growers in creating written food safety plans from the perspectives of key stakeholder groups. It will specifically focus on growers who are currently exempt from the food safety requirement in the FSMA since most Minnesota fruit and vegetable growers are small enough to be considered exempt. This report will start with literature review of the issue followed by a description of methodology used to conduct the key informant interviews and analyze results. The resulting themes will be discussed for the interviews as a whole and for individual questions. The discussion section will highlight participant ideas and other options for addressing the barriers identified by stakeholders. Finally, the measures that have a high simplicity of implementation, directly or indirectly increase plan usage, and are likely to benefit multiple stakeholder groups will be recommended.

Literature Review

For more than a century, the U.S. Government has created a number of laws and regulations that attempt to improve the safety of the nation's food supply. The first two acts addressing this issue were the Food and Drugs Act and the Meat Inspection Act of 1906 (FDA(a), 2014). The Food Safety and Modernization Act (FSMA), signed into law on January 4, 2011, is the most recent piece of legislation that guides reform around food safety issues (FDA(a), 2014). One unique feature of the FSMA that distinguishes it from previous food safety legislation is that it focuses on prevention aspects of food safety. It has been estimated that the FSMA could reduce the number of foodborne outbreaks by 1.75 million cases per year from the approximately 50 million cases that occur yearly (FDA(b), 2013).

Although this is a promising estimate, it is unclear the extent to which changes in the farming practices or other points along the food chain contribute to this overall estimate. Major advances in research surrounding the relationship of farm size and food safety risk are needed to understand the extent to which certain farm practices increase or decrease risk in the food chain as a whole. Research is also needed to better understand if large-scale farm practices and small-scale farm practices have different likelihood of occurrence or distribution of pathogens. Being able to quantify the risk of specific practices and deciding on an acceptable level of risk are major challenges still under-addressed by the scientific and regulatory communities.

Currently research can only address incidence and contributing factors to microbial presence on produce, without specifically identifying how and if this incidence relates to farm size. Suslow et al. (2003) illustrate why research progress is slow in advancing our understanding and quantifying the risk of microbial presence on fresh produce: *"The potential risk (of microbial contamination) may be reduced or increased by seemingly minor deviations in timing, source of production input, degree of handling, method of cooling, or any dozens of different interacting factors"* (Suslow, 2003). The authors also credit various scales of operation, regional practices, environmental practices, and other factors with impeding attempts to quantify microbial risk for any particular product or management practice.

A few risks have been clearly associated with microbial contamination and form the basis of current food safety recommendations. For example, the risk of raw manure transferring pathogenic microbes is well studied and is thought to occur in situations when manure is incorrectly used pre- and post-harvest, or when fields are located near large-scale animal production areas (Suslow, 2003). Interestingly, even in this well studied area of microbial contamination, very little direct evidence exists, and findings are based primarily on epidemiological studies. The issue is complex, and one finding

illustrating this complexity is that some studies have indicated soils with high microbial activity, usually indicative of healthy soils, inhibit the establishment and persistence of pathogenic microbes better than soils with low microbial activity. Instead of the timing of raw manure being the only contributing factor to risk, other factors, like soil health, may alter the chance of pathogen establishment on fresh produce.

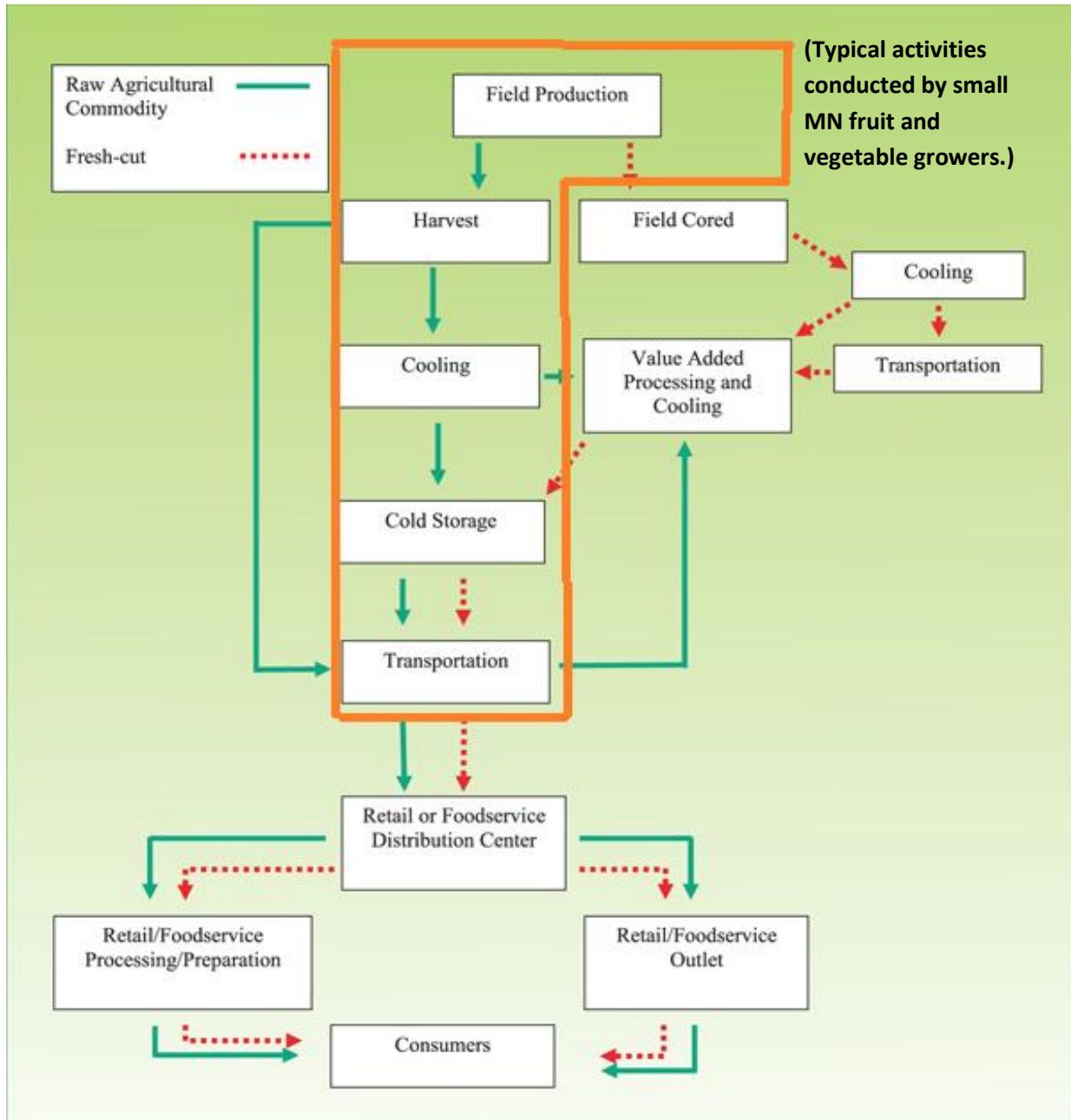
During harvesting, worker hygiene is very important given the high use of human hands to harvest, but the risk is hard to quantify given that the extent of hand contact varies widely by item (Suslow, 2003). Harvesting equipment and storage containers are also identified as potential sources of contamination if not properly sterilized. Once harvested, surface cleaning, worker hygiene, and vermin control are all very important factors in reducing the spread of pathogenic microbes. Quality of the water used for cooling produce is also important. Transportation practices recommended to minimize contamination include proper refrigeration, humidity control, and a design that minimizes damage to the product being transported.

Although the precautions listed above have been identified, it is difficult to estimate whether practices on small or large farms would be more likely to contribute to foodborne illness, because there is very little quantitative data to associate with these recommendations. As mentioned earlier, some studies have indicated that healthy soils with high microbial activity may inhibit or reduce the likelihood of establishment and persistence of pathogenic microbes (Suslow, 2003). Crop rotation and diversification methods have been shown to improve soil health (Altieri, 1999), indicating that small farms who are more likely to use these methods could be less at risk of contamination. On the other hand, consistent cooling practices are important in the transportation of harvested fruits and vegetables, and this has been specifically highlighted as a challenge area for small farmers since the cost of cooling equipment may be steep (Suslow, 2003). Points like the two made previously complicate the matter and make it difficult to determine whether small or large farms are more at risk of microbial contamination unless more studies are conducted.

There are many points along the supply chain where produce can be at risk for contamination besides the farm. **Figure 1** shows a general FDA supply chain diagram for produce. The FSMA attempts to address issues at many of these points (FDA(e) 2014), but the focus of this paper will be on the barriers to the written food safety plan requirement of the FSMA, which generally relates to the areas of field production, harvest, cooling, cold storage, and transportation. Food safety plans must: 1) Identify potential hazards to food safety, 2) Design controls to minimize or eliminate hazards, 3) Plan for monitoring established controls, 4) Maintain record of monitoring, and 5) State how problems will be

addressed if they occur. Example hazards that a food safety plan could address include wildlife intrusion into fields, water source contamination, soil contamination, and unsanitary worker hygiene. The FDA is authorized in the FSMA to access records of both farm food safety plans and records of the implementation of these plans if a farm is required to have a written plan. The FSMA has separate recommendations for other components of the food chain like value-added processing facilities.

Figure 1: General Supply Chain for Produce (FDA(d), 2009). Steps in orange box indicate typical activities of small Minnesota fruit and vegetable growers.



It should be noted that the FSMA written food safety plans apply to farms that “grow, harvest, pack or hold most fruits and vegetables when those fruits and vegetables are in their raw or natural (unprocessed) state” (FDA (d), 2013). The rule will not apply to types of produce which are rarely consumed raw, such as potatoes. Food safety plans for fresh produce often consumed raw are expected to address common causes of bacterial contamination. These include tainted agricultural water, poor worker hygiene, improper timing or use of additions to the soil (including manure), the presence of animals in growing areas, and contaminated equipment, tools, or buildings. Farmers earning less than \$25,000 per year, when taken as an average of the profit gained in the last three years, will not be required to comply with the FSMA. Farmers earning less than \$500,000 in food sales are also exempt if more than half of their produce is sold directly to consumers (ie: farmers’ market sales, Community Supported Agriculture (CSA) sales), or over half of their produce is sold to a restaurant within the same state or within 275 miles of the farm.

In the state of Minnesota, as of the 2012 USDA Census of Agriculture, 2623 farms had vegetables harvested for sale (Agricultural Census (2), 2012). The total acreage of these farms was 227,641 acres, making the average farm size a little less than 87 acres. There were 881 farms with land in orchards and a total of 5,043 acres of orchard land, leading to an average acreage per farm of approximately 5.7 acres. These statistics show how small many Minnesota fruit and vegetable farms are compared to their commodity crop counterparts. By comparison, 33,198 farms harvested corn for grain in the census, and these farms had a total acreage of 8,316,822 acres. This makes the average farm size approximately 250 acres per farm.

A question on the minds of many small Minnesota fruit and vegetable producers is whether the new FSMA rules will affect their business directly or indirectly. Given the exemptions listed above, most Minnesota producers would be exempt with the exception of a handful of large producers since those who do earn more than \$25,000 per year tend to sell a majority of their produce as CSA shares, farmers’ market sales, or some of the other exempt activities given above. In Minnesota the total market value of vegetables, melons, potatoes, and sweet potatoes sold in 2012 – including direct sales – was approximately \$150,000 in sales per farm producing these goods (Agricultural Census (1), 2012). For fruits, tree nuts, and berries, the sales per farm in Minnesota were approximately \$17,500 each year. Thus, a majority of farms will qualify as exempt under the FSMA rules. This is unlikely to change unless the FSMA rules would change since minimal farm expansion is predicted for Minnesota fruit and vegetable growers. Reasons for this include the short growing season, a tradition of using Minnesota

farm land for commodity crops, and/or farmers' personal values and beliefs supporting small-scale farming.

There little evidence of outbreaks linked to Minnesota fruit and vegetable farm practices (Minnesota, 2005). Of the confirmed foodborne outbreaks in Minnesota in 2005, the majority of the contributing factors in these cases were infected food workers or attendees of events who were ill at the event. Other contributing factors included contaminated meat or dairy products, temperature/time abuse, and the presence of a natural fish toxin. Of the six incidents involving fresh produce as the vehicle for contamination, only one incident had an unknown contributing factor and the other incident involved *E. coli* O157:H7 on commercial bagged lettuce products. The other four incidents involved an ill worker or event attendee. Even though these incidents cannot be linked to fresh produce grown in Minnesota, it should be noted that foodborne illness can occur on any farm, so a lack of outbreaks directly related to Minnesota fruit and vegetable farmers does not necessarily indicate that these farms inherently grow safer food. Illness can occur on a scale which is not great enough to detect by the Minnesota Department of Health foodborne illness investigations.

Even though most Minnesota fruit and vegetable producers are not directly required to comply with the FSMA and food safety issues from Minnesota produce have been undetected, some farmers are concerned that buyers of their product will begin to expect or require documentation showing compliance with FSMA as the local food movement continues to grow (FDA (a),2013). Proof of this growth in local food interest can be seen in the growing number of farmers' markets and community-supported agriculture (CSA) ventures. In Minnesota, more than 156 farmers' markets were open in 2012 compared to only 100 markets in 2009 and 86 markets in 2007 (Gerder, 2012). CSA ventures are also on the rise in Minnesota. In 2007 there were 27 CSAs but by 2008 that number was 81, and a total of 128 CSAs were listed in the Minnesota Grown Directory in 2010 (Growing, 2010).

Very few studies have researched the use of good agricultural practices and/or food safety plans among small and mid-sized fruit and vegetable producers. Most studies similar to this research used survey methodology instead of a key informant interview method, limiting their ability to obtain in-depth, unrestricted information from respondents. In one survey somewhat similar to this research, the Penn State Extension program conducted a study of factors which affect growers' implementation of good agricultural practices (GAPs) (Tobin et al., 2013). These GAPs formed the basis of written food plan recommendations for the FSMA. Factors that encouraged some farmers to use GAPs on their farm included the belief that a GAP audit might soon be required as well as an intrinsic belief that GAPs could

deliver a safer product for their consumers. Factors that discouraged GAP implementation included the fact that some farmers don't yet see a demand from their customers for GAP practices. It was also indicated that the paperwork is burdensome and redundant; farmers felt that they could farm safely without having to complete paperwork proving their activities (Tobin et al., 2013). Other factors that discourage GAP implementation are cost, a lack of knowledge, and insufficient access to resources. Tobin et al. (2013) concluded that growers who are exempt from documentation requirements will likely benefit more from an emphasis on best practices to implement on the farm rather than focusing on documentation procedures.

Another study examined food safety practices of small and mid-sized farms and farmers' market managers in Georgia, Virginia, and South Carolina using a mail and internet survey (Harrison, 2013). Farmers were asked questions regarding the use and timing of raw manure application, whether they tested their water, and what sanitizing practices they used. Farmers' market managers were asked about food safety standards for their market, what questions they ask farmers about the safety of their produce, and whether they offer sanitation training to workers and vendors. Results showed that many farmers and farmers' market managers were using good practices, but that certain practices were occurring which could put consumers at risk of contracting a foodborne illness. For example, survey results indicated that over 75% of farmers' market managers lacked food safety training opportunities for market employees and vendors. A question designed for the farmers indicated that more than 27% of farmers use water sources which haven't been tested to irrigate their fields. To address these issues and others, Harrison et al. (2013) called for increased training of both farmers and farmers' market managers.

One last study to note, with a focus specifically on Minnesota, attempted to understand GAP usage among fruit and vegetable growers (Hultberg et al., 2012). Many food safety questions were asked to assess GAP adherence, and 65% of respondents reported that they were using good practices such as enforcing proper worker hygiene and utilizing sanitized wash water to clean vegetables, among other practices. The authors noted, however, that some food safety issues persist in key areas such as "treating wash and processing water, taking measures to keep animals out of production fields, and cleaning and disinfecting harvesting tools and containers on a scheduled basis" (Hultberg et al., 2012). In their conclusions, Hultberg et al. (2012) recognized the difficulty small Minnesota farmers face when trying to implement good agricultural practices. Most vegetable farms they surveyed sold multiple crops and would need to know how to be in compliance for each crop produced. As stated by the authors,

this requires “significant time, cost, and effort” on the part of the farmer, yet keeping the customer safe is also important. The authors conclude, “We suggest that for maximal adherence, guidelines should promote and encourage participation for all growers in a cost-effective and feasible manner.”

To promote and encourage farmer participation, it is important to understand the barriers which keep farmers from participating currently. The purpose of the key informant interviews conducted for this research is to tackle this issue and further understand barriers to both implementation and creation of farm plans. By understanding these barriers from farmers’ and other stakeholders’ perspectives, appropriate and effective guidelines to “promote and encourage (grower) participation” can be developed (Hultberg, 2012).

Study Approach and Methodology

Key informant interviews are an effective qualitative analysis tool when there is a need for in-depth understanding of stakeholder behaviors, motivation, and perspectives (USAID, 1996). These interviews are also an important tool when the main purpose of the investigation is to generate recommendations and when preliminary information is needed to design future studies that are more comprehensive. As highlighted in the literature review section of this paper, there is very little information on the usage and barriers surrounding food safety plans among small and mid-sized fruit and vegetable growers within the state of Minnesota. Utilizing a key informant interview approach allows a detailed picture of motivations surrounding the creation and implementation of food safety plans to be created. After identifying these motivations in this research, future studies may be able to ask more pointed research questions.

The recommended number of interviews when conducting key informant interviews is between 15 and 35 people (USAID, 1996). In this study, interviews were conducted with 23 stakeholders from around the state of Minnesota. Three question sets were used (see **Appendix A** or **Table 1**): Question Set 1 was developed by the author, Tatyana Venegas-Swanson, and Katie Shepard to investigate Good Agricultural Practices (GAPs) and their relation to food safety for the same target stakeholder group as this research but for a separate university course; Question Set 2 was developed for this research by the author specifically for farmer stakeholders; and Question Set 3 was developed for this research by the author to be used with any non-farmer stakeholders. This third question set was a combination of relevant questions from both Question Set 1 and Question Set 2. Although questions in each data set have some differences, it was determined that these differences would not be a major limitation given

the intent of this paper to generate preliminary information regarding barriers to food safety plan creation and use. (See **Table 1** for a comparison of each question set and intended interviewees.)

The questions developed were worded and ordered in a way to try to put interviewees at ease and maximize their elaboration on food safety issues. All three question sets began with a question asking the interviewee to talk about themselves. Given that the literature indicates there is contention and worry among stakeholders around the usefulness of current food safety recommendations, questions meant to assess interviewee opinions on current food safety recommendations were placed in the middle or end of question sets. For example, stakeholders were not asked about their opinion of the importance of written food safety plans until the third question in both Question Set 2 and Question Set 3. Questions related to barriers to implementation and creation of these plans were asked following interviewee responses on the importance of plans because it was logical to establish whether the interviewees viewed food safety plans as important before asking about barriers to creating and using these plans.

The studies mentioned in the literature review highlighted a variety of issues farmers identified with trying to follow food safety guidelines. After examining the issues these studies identified, such as cost and paperwork, these issues could be broadly categorized as issues related to either plan creation, plan implementation, or both. Thus, questions four and five of Question Set 2 and Question Set 3 asked farmers to comment on the barriers to plan creation and implementation in separate questions. Lastly, an opportunity to give other comments was added to Question Set 2 and Question Set 3 to capture any important information stakeholders wanted to add which the research questions may not have prompted.

Steps were taken to reduce potential interviewer bias. Questions given in **Appendix A** were read as written during each interview and given in the same order each time. The questions were written to encourage detailed responses and were ordered in a way which placed most neutral questions first and any potentially controversial or difficult questions later. Respondents were occasionally encouraged to provide more information using probing techniques if needed, but a neutral attitude toward responses was maintained. Because of a lack of funds to purchase equipment and to encourage respondent participation in the study, recording devices were not used. Instead, responses were typed as each interview was conducted.

Table 1: Comparison of Question Set Questions and Intended Interviewees

	Question Set 1	Question Set 2	Question Set 3
Intended Interviewees	All Stakeholders	Farmers	Non-Farmers
Question 1	Tell me about yourself/your organization/your relation to food/food safety.	Tell me about yourself and your farming operation.	Tell me about your work and how it relates to food safety.
Question 2	Can you explain to me your own experience with or knowledge of food safety issues?	Given the increase in news coverage about foodborne illness, consumers are more concerned about food safety than in the past. What food safety practices do you routinely use to ensure food is safe when it reaches the consumer?	How appropriate/effective are current food safety guidelines for small and mid-sized fruit and vegetable growers?
Question 3	How appropriate/effective are the GAPs guidelines/aspects of certification?	Do you believe it is important for farmers to have written food safety plans? Why are these plans important or not important? (CONTINUE TO Q4 AND Q5 IF FOOD SAFETY PLANS IMPORTANT OR POTENTIALLY IMPORTANT)	Do you believe it is important for these farmers to have written food safety plans? Why are these plans important or not important?
Question 4	What is being or could be done to address the concerns regarding GAPs?	What major barriers do you see to implementing food safety plans?	What major barriers do you see to creating food safety plans?
Question 5		What major barriers do you see to creating food safety plans?	What major barriers do you see to implementing food safety plans?
Question 6		Do you have any other comments that you would like to add?	Do you have any other comments that you'd like to add?

Seven major stakeholder groups were identified before proceeding with Question Set 1 interviews. These included educators, farmers, government employees, food handlers, university employees, non-profit employees, and consumers (see **Table 2** for a description of each group). These stakeholders were identified by Venegas-Swanson, Shepard, and the author after a general review of the literature surrounding the topic of fruit and vegetable food safety in the United States.

Table 2: Description of stakeholder groups involved in small/mid-sized farm fruit and vegetable food safety

Stakeholder Group (Number in Group)	Description
Farmers (11)	Any farmer growing primarily fruits and vegetables within Minnesota. Farmers were selected using the Minnesota Grown Directory and by utilizing informal networks.
Educators (2)	Persons who work directly with farmers to teach food safety training and/or farm plan creation.
Government (3)	Those who hold any food-safety related position within government. Examples include illness investigators and auditors.
Food Chain Stakeholders (2)	Persons who work in directing food from farmers to consumers or who purchase food from farmers to sell to consumers. These stakeholders may be involved in grocery stores or running farmers' markets, for example.
University (2)	Academics or other employees in a university-setting who do not directly educate farmers on food safety but conduct research or do work on the issue.
Non-profit (2)	Any non-for-profit group where at least a portion of their work involves working with farmers on food safety and/or farm plan creation and implementation.
Consumers (1)	Persons who purchase and eat products from small fruit and vegetable farms in Minnesota.

Farmers were selected using the Minnesota Grown Directory and informal social networks. A search for producers within the Minnesota Grown Directory was conducted using the "Fresh Produce (Fruits and Vegetables)" category with all potential produce marked for the search and the random sort option selected. Producers were selected by starting with the 10th producer and contacting every 10th producer after that so long as the farm description indicated that fresh produce was a majority of farm sales.

Other stakeholders were selected using informal social networks and web-based searches for Minnesotans who represent each stakeholder group. A total of 65 stakeholders were contacted with 23 stakeholders (both farmer and non-farmer) who provided input. The original goal was to conduct 20 key

informant interviews in total. Regarding farmers specifically, the goal was to reach a broad contingent of small fruit and vegetable farmers. To do this, immigrant and/or minority producers, certified organic producers, and non-certified organic fruit and vegetable producers were all contacted for the project. One farmer was an immigrant and/or minority producer, five farmers were certified organic producers, and the other five farmers were non-certified organic fruit and vegetable producers.

Stakeholders contacted for the purposes of this research paper were promised anonymity but told general themes and some quotes would be used for this research. (Those stakeholders that were contacted for the GAP Interviews (Question Set 1) were not told they would have anonymity but will remain anonymous for this research.) Interviews were typed by the author as they were occurring instead of being recorded to encourage participation.

At the conclusion of the interviews, all text files were uploaded and qualitatively analyzed using NVivo (QSR International Pty Ltd, Doncaster, Victoria, Australia) content analysis software. Documents with interview text were uploaded into this software. The software allows users to highlight portions of text and label that section of text with a specific theme. The software tracks how many times themes are coded. After all stakeholders and themes are coded by the user, the software can cross-reference which themes were stated by which stakeholder groups. It can also show the themes and number of times themes were discussed for interview questions.

The text was coded for various themes that arose from participant interviews. These themes were determined using an inductive process that involved reading through all of the text files while noting topics raised by stakeholders, followed by grouping similar themes or meanings together under one broader topic. For example, both water testing and soil testing were noted by a few stakeholders, but after further examination, the author determined that these themes could be merged into one theme called "Testing". This process led to the selection of 25 themes which were systematically coded in NVivo by reading through the text files and searching for mention of the theme, one theme at a time.

Table 3 gives a description of each of the 12 selected themes and a count (number of coded sections) for each theme. Themes were coded every time that they were mentioned in the whole data set. This means that theme counts often exceeded the number of participants because themes could be mentioned multiple times by any given participant. A sample text selection that was coded for each theme is given in the table, and definitions of each theme are discussed before **Table 3**. These themes were selected by examining which of the 25 total themes were mentioned most often for each specific question. Themes which were coded highly because they were inherent to the question being asked

were eliminated from the list of highest coding themes. For example, the theme “Food Plans” was eliminated as a top theme from Question 4 of Question Set 2 (**Table 1**), even though it had been counted six times, because the question specifically stated the term food safety plans within the question.

Study Challenges and Limitations

A significant challenge in conducting this study involved securing interviews with local farmers. A major contributing factor to the lack of participation was the time period during which this study was conducted. Most interviews were conducted during March and April when farmers are at their busiest since they are preparing for the upcoming growing season. Future studies that wish to conduct key informant interviews or issue surveys to farmers should aim to gather results during the winter months when farm-related duties are at a minimum.

Comparing between groups was problematic due to the differing sizes of each stakeholder group (as shown in **Table 1**). To deal with this issue, stakeholders were reassigned into roughly equal groups of farmers (11 stakeholders) and non-farmers (12 stakeholders). Future work using a similar method should aim for roughly equal stakeholder groups as it would make comparing groups easier. It should be noted, however, that key informant interviews are not designed to be able to draw conclusions to a larger body of stakeholders. Aiming for equal group size would not allow for broad conclusions to be made about the relationships between stakeholder groups as a whole, but could offer interesting insights that future research studies utilizing a different methodology could examine.

Immigrant and/or minority producers, certified organic producers, and non-certified organic producers were three sub-groups identified under the umbrella of small fruit and vegetable producers. Attempts were made to reach members of each of these groups as equally as possible. One difficulty in reaching immigrant and/or minority producers is that an interpreter would be needed to communicate with many of these producers. Funding was not available for this study to hire an interpreter. Future studies should attempt to gain more insight from immigrant and/or minority producers.

Results

To understand stakeholders views on food safety for fruit and vegetable products in Minnesota fully, it is important to examine responses to questions overall as well as examine the responses to individual questions. **Table 3** shows top themes and example statement(s) coded for each theme as well as the amount of times that a given theme was recorded. It should be noted that themes could be coded multiple times per participant, so theme “counts” (the number of times a theme was coded) may exceed the number of stakeholders. On the following page, the 12 most discussed themes from the data set as a whole are described.

After examining results of the interviews as a whole, question-specific responses will be examined on a question-by-question basis, with a primary focus on stakeholder responses regarding the importance of and barriers to written food safety plans.

Table 3: Top themes and example statement(s) coded for each theme. "Counts" refers to the number of times a given statement was coded for each theme. Themes could be mentioned multiple times per stakeholder.

Theme (counts)	Example Statement
Access to Information (4)	“A major barrier in creating food safety plans is finding the proper information. Locating the information needed to create such a plan can be difficult. If the resources about the food safety plan could be located, accessed, and referenced easily then it would greatly benefit both producers and customers equally. The rules and regulations should also be organized and worded in such a way to make them accessible to everyone.”
Consumer (26)	“There needs to be - because of the nature of food safety – more education of the consumer. We can’t keep the consumer safe from themselves. When I go to the store and buy food I have to accept some of the responsibility for safety of that food. Food safety in the home is a major factor.”
Cost (24)	“While food safety is ‘priceless’ and can, I am told, be done relatively cheaply, cost is still an issue. Food safety adds cost to fixed and operating expenses without an increase in income on the other end – it eats into farmers’ already small margins. This is for the majority of farmers. The farmers I work with at (Non-profit A) are not a majority. Immigrant and minority farmers face steep barriers to implementing food safety guidelines.

Environmental Costs (11)	“When I hear about diversity strips and green areas around mono-cropped fields of vegetables being removed, and herbicides being used to burn off vegetation to bare ground to reduce the risk of wild birds flying over the crop (a GAP standard), I see GAP doing more harm than good!
Farm Size & Food Safety (51)	<p>“80% of fruit and vegetables come from California, so that is being regulated for the most part since it comes from large companies like Dole. It’s not fair for little guys to have to use these same food safety practices as large guys since don’t have resources to have in-house food safety groups and testing equipment.”</p> <p>“Frankly, many larger companies with very comprehensive food safety programs (even outside of the U.S.) actually provide us with a much safer scenario.”</p>
Fear/Frustration /Confusion (31)	<p>“I’m a little staggered – we’ll see how well we can implement it (food safety plan). There’s, like, 17 different weekly record things to keep going.”</p> <p>“It seems like a really overwhelming, boring process for many farmers.”</p>
Hand Washing (10)	“What is working well is that hand washing and bathroom facilities are available at field locations that were not available before.”
Organic Farming (21)	“We have clear access to knowledge through the National Organic Program Standards online – also through our certifier. If not an organic farmer, may not be true.”
Paperwork (16)	<p>“Record keeping – it doesn’t really exist unless you write it down. You should have a record of everything so if farm is every under the magnifying glass you have documents to show your food safety plan and what you’re doing.”</p> <p>“Most farmers already are using good practices – writing down is the hard part.”</p>
Raw Manure (15)	“Some of the challenges in MN are growing fields located near or adjacent to poultry, beef, or dairy production facilities, and use of turkey manure as a soil amendment.
Sanitizing (12)	“We sanitize water for high-risk crops even though we’re using totally potable water. We use sanitizer in wash water for leafy greens and vegetables that will be eaten raw.”
Time (11)	<p>“The biggest is inertia – farmers don’t have the time or major desire/incentive to adopt them (food safety plans). The other big one is cost (time and money) to implement and maintain (food safety plans) without seeing an increase in income.”</p> <p>“If they plan in advance, they will know how much time it takes to implement the parts of their written food safety plan.”</p>

Description of Select Themes from Interview Datasets:

1. ***Access to Information*** included any mention of locating and utilizing information about food safety, regulations, or food safety plan materials by stakeholders. Most respondents discussed barriers to finding information about food safety practices and food safety plans.
2. ***Consumer*** highlights any explicit mention or general reference to the end user of the fruits and vegetables being grown on the farms in this study. Both farmers and the non-farmers who mentioned this topic stated or implied that consumers could use better education around home food safety practices.
3. ***Cost*** refers to any explicit or implicit mention of monetary issues related to the creation and implementation of food safety plans or the support for these plans. Some stakeholders mentioned direct costs while others mentioned the opportunity costs related to food safety plans. Some discussed the expense of certifications. A few stakeholders thought costs of creating or implementing food safety plans were minimal and that fears that these plans would have a high cost were unfounded.
4. ***Environmental Costs*** captures any mention of negative effects on the environment relating to food safety practices and food safety plans. Most stakeholders who mentioned this theme discussed a disconnect between recommended food safety practices and best environmental practices.
5. ***Farm Size & Food Safety*** refers to any mention of the scale of farming operations related to food safety risk. It was by far the most coded theme in the interviews that were conducted. Every stakeholder group mentioned this theme at least once. Multiple stakeholder groups felt that food safety requirements should fit the size of the farm.
6. ***Fear/Frustration/Confusion*** was used to capture any explicit or implicit reference of these three feelings around food safety practice or food safety plans. At times stakeholders use words like “fear” or “confusion” explicitly while at other times the author judged the emotion behind a response to reflect this theme. This was another highly coded theme among the main themes.
7. ***Hand Washing*** referred to any mention of cleaning hands as a food safety practice. Many stakeholders who mentioned this referenced hand washing as a common-sense food safety practice. Only one negative comment toward hand washing was made by a farmer concerned that food safety requirements would force small farms to put hot water hand washing stations in the field.
8. ***Organic Farming*** captures any explicit mention of organic certification or organic farming practices. A few stakeholders mentioned there is an overlap between organic farming standards and GAP standards. Still other stakeholders mentioned that organic practices can vary greatly from farm to farm and that the food safety implications of organic farming practices are still largely unknown.
9. ***Paperwork*** was the descriptor used to describe any mention of the filling out of forms or other record-keeping tasks related to the focus of this research. Many comments revolved around the extra time it took to complete paperwork required for written food safety plans.
10. ***Raw Manure*** was used to describe any mention of human or animal-based waste products in or around farm fields where crops meant for consumption were being grown. Closely monitoring animal/human feces was referenced as a key part of food safety by multiple stakeholder groups.
11. ***Sanitizing*** describes any sterilization measure for farm equipment or high-risk crops before sale. Multiple farmers mentioned their specific sanitizing protocol, especially in response to the second question in Question Set 2.
12. ***Time*** was used to capture any specific mention of time in relation to food safety related activities and food safety plans. Time was seen as a barrier to both creation and implementation of food safety plans by many stakeholders.

Table 4 shows the mean number of times a given theme was mentioned by farmers and non-farmers. Certain themes were mentioned nearly equally by both farmers and non-farmers. These themes included environmental costs, fear/frustration/confusion, organic farming, and farm size & food safety. Other themes were mentioned more by farmers than non-farmers: raw manure, consumer, paperwork, and sanitizing. It is likely raw manure and sanitizing were more highly mentioned by farmers due to a question asked only of farmers about their current food safety practices. Lastly, non-farmers mentioned the themes cost and access to information more often than farmers. At first this seems strange, but it may be that farmers discuss a greater variety of themes because they are more familiar with the nuances of their work than a non-farmer and/or non-farmers may be accustomed to thinking in terms of cost and information availability when discussing an issue.

Table 4: Mean Number of Times Theme Mentioned by Farmers and Non-Farmers. Themes could be mentioned multiple times per stakeholder.

	Farmers (11)	Non-Farmers (12)	Total (23)
Access to Information	0.09	0.25	0.17
Consumer	1.55	0.75	1.13
Cost	0.64	1.42	1.04
Environmental Costs	0.45	0.50	0.48
Farm Size and Food Safety	2.64	1.83	2.22
Fear/Frustration/Confusion	1.55	1.17	1.35
Handwashing	0.55	0.33	0.43
Organic Farming	1.00	0.83	0.91
Paperwork	1.09	0.33	0.70
Raw Manure	0.91	0.42	0.65
Sanitizing	0.82	0.25	0.52
Time	0.55	0.42	0.48

Results of Introductory and Background Questions

Tell me about yourself (Question 1, all Question Sets)

There were very few similarities between the non-farmers who answered this question other than the fact that all were involved in food safety issues relating to small-scale fruit and vegetable farming in Minnesota. Many farmers who answered this question had started farming recently, most

within the past 3-10 years. Two farmers who were interviewed had been farming for large portions of their lives and came from families where relatives had farmed before them. A commonality among farmer respondents was that most mentioned that they sell their products in multiple ways. Community supported agriculture (CSA) shares, farmers' market sales, and wholesale arrangements with local restaurants were all mentioned as examples.

Experience with or knowledge of food safety issues (Question 2, Question Set 1)

Many respondents discussed settings in which food safety audits (which almost always require some form of written food safety plan) are required or not required. For example, one food chain stakeholder who was involved with farmers markets discussed how it wouldn't be appropriate for vendors at her market to be GAP certified since most farms were approximately 5 to 10 acres. One exception at the market was a farm with approximately 200 acres. This farm was also selling to a local grocery store chain, so the stakeholder believed that farm had GAP certification to be able to sell at that store.

Farmers who responded to this question either discussed their current practices to produce safe food, highlighted how GAP promoted practices do not always make sense in their farming situation, or discussed both of these topics. One farmer talked specifically about his processes and documentation to ensure food safety. Another farmer stated that he strongly believed in regulation based on science and common sense but felt that GAP recommendations are not based in either of these. To him, a more effective way to reduce food born outbreaks would be to produce food on smaller farms and reduce the practice of combining produce from multiple farms at large-scale distribution facilities.

Food safety practices used to ensure safe food (Question 2, Question Set 2)

This question was only asked when interviewing farmers. The farmers who were asked this question highlighted a variety of practices they used to ensure safe, high-quality food. All but one farmer explicitly mentioned washing techniques as being an important feature of their food safety practices. Four farmers mentioned the importance of applying raw manure appropriately and/or inspecting their fields for wild animal feces which could contaminate their produce. A few of the other practices discussed included cooling produce after harvest and testing water which was used for crop production.

Appropriateness and effectiveness of current food safety guidelines (Question 2, Question Set 3)

The stakeholders who were asked this question identified a few issues with current food safety guidelines that made the guidelines inappropriate or ineffective. One stakeholder, who works for a non-profit, mentioned that cost barriers exist for all farmers. For immigrant and minority farmers, these barriers are even steeper given that food safety information is usually in English. Even the cost to travel to a training workshop might be more difficult for this group of farmers than for other farmers. On top of this, there is a cost to the lost time spent while attending a workshop. Two government stakeholders mentioned that it is hard to construct separate food safety guidelines for small-scale producers since there is an absence of data on where food safety issues come into play on small scale farms and an absence of data on the extent of the risk.

Results of GAP-Related Questions

Appropriateness and effectiveness of GAPs guidelines (Question 3, Question Set 1)

There was large variation between responses to this question. Some respondents saw both benefits and issues with current food safety guidelines while others felt strongly for or against the recommendations. Common issues identified included that GAPs are costly to implement, small farms have a harder time implementing GAPs than larger fruit and vegetable producers, and record keeping can be a major time burden. Benefits identified included that consumers may benefit from more transparency about how the product they are purchasing has been handled, farmers develop a pathogen workflow mindset to improve the safety of their farming, and farmers can gain peace of mind knowing that steps have been taken to make the produce they are selling as safe as possible.

Addressing the concerns regarding GAPs (Question 4, Question Set 1)

The answers to this question varied widely by respondent. One point made by a respondent was that food safety goals need to be adjusted to reflect farm size instead of current GAP recommendations which they saw as more appropriate for large-scale operations. Another point made by a few respondents was that education, especially the right type of educational efforts, could be useful. Specifically, two respondents mentioned that farmer-to-farmer and on-farm training about food safety practices can be more helpful for time-pressed farmers than traveling to attend workshops.

Results for Importance of Farm Safety Plans

A key focus of this research paper was to understand stakeholders' views on the importance of farm food safety plans. Since the GAP dataset (Question Set 1) was created before the questions specific to this research project, only the results from Question Set 2 and Question Set 3 which explicitly asked this question can be used. Ten stakeholders were asked this question (7 Farmers and 3 Non-farmers). The results are given in **Table 4** along with one example response for each category "Agree", "Conditionally Agree", and "Disagree".

Table 5: Results for Importance of Farm Safety Plans with Example Statement

	Farmers	Non-Farmers	Total	Example Statement
Agree	2	3	5	"Yes. A written plan is a key piece of the overall effectiveness of their food safety pursuits. It is onerous to create and takes commitment to stand-by but once adopted becomes part of the flow. It provides a written, shareable item for the farmers' customers to view and generates confidence in their farmers' food safety. They are also important because they can communicate the plan to other workers on the farm.
Conditionally Agree	4	0	4	"No, but with qualifications. (A farm safety plan is) not important for <i>all</i> . What qualifies as a farm? A ½ acre of produce? If people are coming by a market stand, I'm not sure (farm safety plans are) really that important for small growers. I'm reluctant to have a blanket law. Written plans become important to sell to grocery stores, sell to farmers' markets, or sell CSA shares."
Disagree	1	0	1	"(Farm safety plans) will certainly involve a bunch of time, for dubious reasons, for farmers who are already stressed for time. I can sympathize about why they want plan but my fear is that underneath it all this is just one more step to a permitting or licensing process to require farmers to learn things they already know how to do."

Main points on the Importance of Food Safety Plans

Of the 10 responses to this question, six farmers discussed farm size in their responses and four people talked about food safety plans as an instrument for training farm employees. Regarding farm size, many people who had responded that farm plans are conditionally important mentioned that food safety plans are not appropriate for farmers below a certain size. For example, one respondent stated, *“To me these plans seem to work very well on very large scale monoculture operations – 1000 acres of salad mix and a well oiled machine. For 50 crops in two acres and only two or three employees, it’s a lot of work.”*

Another topic brought-up by farmers who both agreed and conditionally agreed with using farm plans was the ability to use farm plans as training manuals for employees. One farmer stated, *“For us, even if I was farming by myself, it’s really important when you have employees or volunteers to have protocols to go back to and say, ‘we wrote this plan and you do need to wash out the van every time you harvest.’ I don’t think our food will become more safe or less safe with or without it (a farm plan) but I do think it reduces the risk of someone doing something really dumb on the farm, like, ‘I can’t believe you had diarrhea and you came and harvested!’”*

The one farmer who did not feel farm plans were important felt that small farmers already knew safe practices and were using them appropriately. This farmer felt any licensing or other requirements by the government would *“push the small local farms out of business and they’re (licensing/requirements) not going to help.”* He went on to discuss that farmers already have low profit margins and compliance requirements in farm plans would increase costs which would cause small producers to have to leave their business.

Results for Barriers to Creation and Implementation of Farm Plans

In both Question Set 2 and Question Set 3 (**Table 1**), questions four and five asked respondents to identify barriers to the creation and the implementation of food safety plans for small Minnesota fruit and vegetable growers. **Table 5** shows the count results for these questions for the 12 most discussed themes. A few themes were mentioned as both creation and implementation barriers (Cost, Farm Size&Food Safety, Organic Farming, Paperwork, and Time). Although Fear/Anxiety/Confusion was coded for both creation and implementation barriers, it was coded more as a creation barrier. The other issue seen primarily as a creation barrier was “access to information”. “Environmental costs” and “raw manure” were coded under implementation barriers but not creation barriers.

Table 6: Barriers to Creation and Implementation of Food Safety Plans. Counts indicate the number of times the theme was mentioned. Themes could be mentioned multiple times per stakeholder.

	Creation Barriers	Implementation Barriers
Access to Information	2	0
Consumer	1	2
Cost	2	6
Environmental Costs	0	1
Farm Size&Food Safety	4	2
Fear/Anxiety/Confusion	7	2
Handwashing	0	0
Organic Farming	1	2
Paperwork	3	4
Raw Manure	0	1
Sanitizing	0	0
Time	2	4

Some theme results illustrate the tendency for conversation to flow away from the question topic. For example, consumers were not tied directly to barriers in creating and implementing food safety plans, but one respondent brought up consumers after mention that one barrier is creating more understanding that location doesn't make a difference in food safety risk. This respondent when on to state, *"People are paying a premium for what they think is a better product but there's no evidence that either locally grown or organic is safer."*

Barriers to Creating Food Safety Plans

An interesting result of speaking with stakeholders about barriers to creating food safety plans was that most of the barriers identified were not identified in isolation. For many stakeholders, barriers - such as time, paperwork, cost, and access to information – are interconnected. For example, one farmer linked paperwork, time, and access to information by stating,

"If I had to write (a farm plan) from scratch, I'm not sure I would do that unless it really was required. Educational tools allow farmers to realize, 'Oh, this is what needs to be included, this is what I should be thinking about, this is what I need to tell my workers about...' They are learning as they read through it. (In food safety plan workshops) you're almost able to make the whole plan at the workshop. Because farmers are so busy - office work/paper work; they need that structured workshop time."

Another stakeholder connected the barriers of paperwork and access to information when he stated, *"We started a Hmong farmer co-op which can now help farmers with paperwork and safety plans. Now*

there is training for each individual farmer. FLAG, a non-profit, helps us put everything in legal terms regarding paper work.” A few stakeholders thought that information on how to create food safety plans and use effective food safety practices is already available. To them, the access to information was instead a problem of being able to locate the information specific to an individual farmers needs.

Beside access to information, another barrier to food safety plan creation was farm size. Two farmers who mentioned farm size in relation to safety plan creation had very different viewpoints. One farmer stated that having an inspector come out to your farm a few times a year to help you identify ways you could improve food safety on your farm was reasonable for farms above a certain production level. On the other hand, a different farmer attributed outbreaks to being an issue of large-scale industrial farms and stated *“my fear underneath is that this is just one more step to a permitting or licensing process to require farmers to learn things they already know how to do.”*

One unexpected theme that came-up was organic farming. Farmers who have been certified organic have access to information through the National Organic Program Standards, which are available online. Certifiers who come out to the farm to check that farmers are meeting the standards of the program are able to give advice on food safety practices if they see an issue. The farmer who mentioned this thought this was an advantage organic farmers had in understanding food safety plans and practices over farmers who are not certified organic.

Barriers to Implementing Food Safety Plans

Some of the barriers to implementing food safety plans that were identified were combinations of issues, as was the case with many of the barriers to food safety plan creation. In the case of implementation, cost was identified in combination with issues like time, paperwork, and farm size. For example, one farmer stated that time was the biggest hindrance and, *“Big agribusiness can hire people (to complete daily paperwork) but small farmers can’t necessarily do this. They either have to farm less or have to find other ways to adapt to time and cost losses.”* This same farmer highlighted that there is an opportunity cost to the time lost while taking classes, consulting with others, and training staff.

Two different stakeholders mentioned that a major issue with implementing food safety plans is that farmers do not see direct monetary gains from making these plans. One stated, *“The biggest (barrier) is inertia. Farmers don’t have time or major incentive to adopt them (food safety plans). The other big one is cost (time and money) to implement and maintain without seeing an increase in income.”* The second said, *“Food safety measures are sometimes the first thing to get cut... I would think*

that's what MDA (Minnesota Department of Agriculture) people can help with – implementation could be a resource problem.”

Some unique perspectives on this question were provided by an urban farmer. Farming in multiple small locations instead of a few large fields created different implementation problems for him compared to other farmers. Regarding farm size, the respondent stated,

“We’re a very unusual farm – most farms aren’t in the middle of a city matrix or are so spread-out. There will be weird things that we can’t control: what if someone walks through our lot to get to their back door and walks over our kale? We can make sure nobody dumps trash but can’t control other things.”

Paperwork was also a slightly different problem because record books are needed at all locations where farming occurs.

“I’m making sure we have log books in farm trucks and in sheds and in the packing shed and that employees are collecting the books each week and putting new books out. Whenever you do something, you’re recording it. I’m going to try to head that up but at least pass some responsibility off to an employee because sometimes I get too scattered to do all of that detail work. Urban farmers are such a weird beast. I have no expectations that we will pass our first year – may take us a while to figure it all out.”

Discussion

As noted at the beginning of this research, many small fruit and vegetable growers in Minnesota do not currently have or use written food safety plans. Most farmers are exempt from FSMA requirements for written food safety plans, yet the GAPs required in these plans are currently seen as the best way to prevent the spread of foodborne illness. Besides this, food safety plans may be expected in the near future from certain buyers, like farm-to-school programs, even from farmers exempt under the FSMA. The purpose of this research was to identify barriers to creation and implementation of food safety plans to inform solutions to this issue.

There are a few main ideas that should be highlighted. First, if government or other stakeholders want more farmers to utilize farm plans, the recommendations or requirements for these plans must be appropriate and flexible. It will be important to ensure farmers can follow GAPs but keep costs and other barriers as low as possible. Secondly, attempts to increase plan usage must be able to address multiple barriers to creation and implementation since many stakeholders illustrated interconnections between barriers. Only addressing paperwork problems, for example, may not be helpful if cost barriers are not also addressed.

Three criteria were developed to analyze options for increasing food safety plan usage among Minnesota fruit and vegetable farmers: 1) Simplicity of implementation 2) Effect on plan usage and 3) Number of stakeholder groups that benefit. The options that have a high simplicity of implementation, increase plan usage directly or indirectly, and will benefit multiple stakeholder groups were most desired. For the purposes of this analysis, “simplicity of implementation” describes the amount of change from the status quo, with the assumption that greater amounts of change will be more difficult to implement and obtain stakeholder buy-in. A comparison of options and the ability of these options to meet these criteria are given in **Table 7**.

Table 7: Comparison of options for moving forward and the ability of these options to meet the given criteria

Options to Address Issues Highlighted in Key Informant Interviews:	Criteria		
	Simplicity of Implementation	Likelihood of increased plan usage by farmers	Potential stakeholder groups who would benefit
Do Nothing	High Simplicity	Unlikely	Farmers
Extension funded farmer-to-farmer education	Medium-High Simplicity: Requires additional funding for additional educator salaries through existing funding stream	Likely	Farmers, Educators, Consumers
Non-profit funded farmer-to-farmer education	Medium-Low Simplicity: Requires designation of budget for new program development and implementation	Likely	Farmers, Non-profits, Consumers
Government provided technical service (similar to NRCS model)	Low Simplicity: Needs development of new department, a source of funding, and staff to offer technical assistance	Likely	Farmers, Educators, Consumers
Consumer education efforts on safe food handling practices	Medium-High Simplicity: Some funding required for educational materials and part-time educator(s)	Unlikely	Consumers
Require food safety plans from all MN fruit and vegetable growers	Low Simplicity: Requires more regulators, may increase demand on educators, and forces some farmers to make major changes	Likely	Consumers
Conduct research on risk and magnitude of food borne outbreaks related to farm size	Medium-High Simplicity: Some additional research funding may need to be secured by current food safety researchers	Unclear (Results may influence some farmers to use plan but not others)	University Academia, Farmers, Educators, Government Regulators, Consumers
Multi-stakeholder conversation around food safety best practices for MN fruit and vegetable farmers.	Medium Simplicity: Requires careful identification of neutral party, meeting locations, and ground rules/goals. Minimal costs for part time facilitator and other basic meeting expenditures.	Likely	Farmers, Educators, Government Regulators, Food Chain Stakeholders, University Academia, Non-profits, Consumers

Stakeholder Ideas

As the interviews were conducted, a few ideas were mentioned by stakeholders that could help address the barriers identified earlier and encourage more farmers to create and implement food safety plans. Some stakeholders mentioned that providing food safety knowledge works best when that information is coming from other farmers. It reduces the fear and confusion that can arise when working with government regulators or outside educators. Farmer-to-farmer interactions remove the fear of being “turned-in” if some on-farm practices need to be critiqued. Besides this, farmers share similar experiences and vocabulary that may make the learning process easier. As one stakeholder described it, *“(A farmer-to-farmer educator) was a farmer for decades, and she knows how to show the right pictures and tell the right stories to break through that denial and hostility and get people to see their farming operations with new eyes.”*

One method to increase food safety plan use could be for the state to allocate additional funding to a state-supported group like the University of Minnesota Extension for increased food safety plan workshops and training. Extension could use part of this funding to hire current or former farmers to act as farmer-to-farmer food safety resources. Having current and former farmers available to help trouble-shoot food safety on individual farms would be more comfortable and less threatening than inspectors and even Extension employees with no direct farming experience. The state would incur some cost from supporting extra positions and resources, but this cost may be lower than other options discussed shortly. Increased public safety and support of farmers may also be determined to produce benefits which outweigh this cost.

Besides the state government and Extension, farmer-to-farmer training programs may be supported by a variety of different organizations if these organizations are able and willing to provide the funding. One stakeholder mentioned that some farmer co-ops, food hubs, and other aggregators of local farm products have offered a “group GAP” program. The distributor who buys products from these aggregation entities agrees not to require a formal GAP audit if these aggregators run yearly food safety education and certification programming for all of its farmers. It was also suggested that local non-profits which represent small farmers (for example, Land Stewardship Project or National Young Farmers Coalition) may be appropriate organizations to support farmer-to-farmer training on food safety. Organizations have the potential to address some of the cost and paperwork concerns noted by the stakeholders interviewed for this research by negotiating GAP audits with distributors and having farm plan templates which are designed specifically for small fruit and vegetable farmers in this region.

An interesting idea behind the organization-supported farmer-to-farmer model of increasing food safety plan usage is that it is flexible to fit the needs of immigrant and/or minority farmers. One interviewee reported, *“We have a difficult time to write plans because of the language. We have to have somebody who is knowledgeable about writing and composition so that it makes sense for other people to read. It’s very hard for us to do it...We started a Hmong farmer co-op which can now help farmers with paperwork and safety plans. Now we have training for each individual farmer. FLAG (Farmers Legal Action Group) – a non-profit – helped to put everything in legal terms regarding paperwork.”* As this stakeholder illustrated, the combination of the Hmong Co-op and FLAG was able to cater to the unique needs of Hmong farmers in the community.

Instead of supporting the increased adoption of food safety plans by changing who delivers food safety education and training, an alternative is to increase the responsiveness of government to small farmers’ needs. One stakeholder used the example of the Natural Resources Conservation Service (NRCS) and the technical support they give to farmers who want to put land into conservation contracts. For this program, NRCS staff write a conservation plan for the farmer as well as offer other training and assistance in meeting the requirements of the contract. This would address some of the top creation barriers mentioned by farmers, including cost, lost time, and paperwork. This alternative may not be the best choice, however, given the distrust of government intentions by some farmers interviewed. Besides this issue, the cost of creating such a program would likely be too much for one state and may fit better as a national program like the NRCS model. Given the current political climate in Washington, new programs are unlikely to be developed and supported with funding in the near future.

Options to Address the Issue

There are other options to try to increase food safety plan use among small fruit and vegetable producers in Minnesota not mentioned by stakeholders. One of these options is the choice of doing nothing. Most small fruit and vegetable growers are exempt from the food safety plan requirements of the FSMA, so the option to not make any effort to increase voluntary farmer adoption of these plans is a possibility. Although this is a low, up-front cost solution, it is not a very sustainable option, since interest in ensuring that food is safe is likely to increase with the growing popularity of local produce. If buyers begin to ask to see written food safety plans in the future, it is better to address the barriers to creating and implementing plans now rather than wait until they become more critical for farmers to sell their produce.

An extreme measure for addressing the lack of use of written food safety plans would be for the state to decide to require all Minnesota farmers to have written food safety plans even though it is not required of all farmers in federal law. This could potentially increase food safety, but the potential benefit cannot be shown to definitively outweigh the likely consequences of this action. As mentioned in the literature review, Minnesota has seen impressive growth in farmers markets, CSAs, and other venues that promote consumption of local foods. Enforcing that all farmers have written food safety plans would place undue burden on farmers given that barriers discussed in this research have not yet been resolved. Some farmers might be forced to leave the business because of cost, time constraints, and/or some of the other issues identified. Lastly, Wisconsin growers who sell at farmers markets and sell CSA shares within Minnesota would have an unfair advantage over Minnesota growers.

Academia can help increase the adoption of food safety plans by measuring current understanding of pre- and post-harvest food safety hazards. It is unclear still whether farm scale contributes to the likelihood of pathogen contamination. If farm scale or specific farm features can be more definitively linked to risk and magnitude of foodborne illness, more appropriate recommendations and regulations can be made for both large-scale and small-scale fruit and vegetable growers. Studies which examine amount and magnitude of risk for Minnesota farmers could help to determine which practices would be especially important in this state.

Throughout interviewing stakeholders for this research, it became apparent that there is distrust and misunderstanding between different stakeholder groups interviewed. For example, some statements by both farmers and government regulators indicated a mutual distrust between these groups. A key to creating fair food safety expectations within Minnesota will be bringing these groups together to find common ground among the interests of each group. It will be important for a neutral party, or a party which is as neutral as possible, to facilitate discussions on food safety plans and implementation of these plans. Once some common ground around food safety issues and practices is established, it is hoped stakeholders could begin to negotiate a healthy balance between reducing contamination risk and creating food safety plans that include feasible measures for small farmers who are currently exempt from FSMA to implement. State funding or grant funding could be used to support the neutral party who would be convening stakeholders.

There are a few points on which many stakeholders agreed from which common ground can begin to be established. One of these points was that consumers have a significant role to play in reducing foodborne illness. A few national campaigns have attempted to increase public awareness of

how to maintain safe produce at home, but more could be done at the state and local level. Farmers markets would be a good place to increase consumer awareness of good food safety practices in the home. Many farmers markets have educational efforts built into their market design and consumers are open to stopping by educational booths to learn. Having the farmers' market lead the education of consumers is better than farmers directly educating their customers since customers may begin to worry that the farmer's educational effort is due to their produce being riskier than other farmers, even if that is not the case.

Recommendations

Four main recommendations can be made from the options that had a high simplicity of implementation, increased plan usage directly or indirectly, and were likely to benefit multiple stakeholder groups:

1. Conduct more research around the relationship of farm size and food safety.
2. Have a neutral organization lead a multi-stakeholder conversation around food safety.
3. Set-aside state funding for farmer food safety plan education efforts.
4. Increase state and local consumer education efforts on food safety in the home.

This study highlights stakeholder views on the importance of food safety plans for small Minnesota fruit and vegetable farms and uncovers barriers to creating and implementing these plans. The key informant interview process helped reveal these sentiments and barriers around food plans. A focus of future food safety research should be on determining whether farm scale or other farm features can be related to risk of foodborne illness. Providing more direct evidence between specific practices and illness risk, instead of epidemiological evidence related to large-scale operations, may help convince some small farmers to adopt written food safety plans.

Secondly, the issue of how to create manageable food safety expectations for farmers could benefit from a neutral organization convening the stakeholder groups around this issue. Suslow et al. (2003) specifically mention in their conclusion that more dialogue is needed between scientists and growers to balance both public health and economically feasible practices (Suslow, 2003). Unfortunately, these stakeholders are traditionally wary of others' positions on food safety issues. It is

important to begin to break apart preconceived notions and to find common ground on food safety issues. Once common ground has been found, it is more likely that policies and practices can be developed that benefit both Minnesota fruit and vegetable farmers and non-farmer stakeholders. From the interviews conducted for this research, it is clear that there are already points of agreement among groups. For example, each stakeholder group wants consumers to have safe and healthy food, and each group also does not wish to waste time on practices which don't actually provide any benefits. With a neutral entity to convene stakeholder groups and focus on these points of agreement, it may be possible to build a set of actions which are feasible for farmers to implement but which also increase food safety.

While building a positive relationship between stakeholder groups is important, a step state officials can take to improve food safety on small farms immediately would be for the state to set aside funding for food safety programming through an entity like the University of Minnesota Extension program. As noted in the Discussion section, farmer-to-farmer training can be very effective. It is even more valuable if this training can occur on-farm, because trainers can see the exact practices farmers are using to keep their food safe. Farmers are more likely to have a comfortable relationship with other farmers, and this situation is less threatening than an inspector making recommendations. Having an MDA official or designated inspector makes less sense than an Extension employee because most fruit and vegetable farmers are still exempt from any requirements to have farm food safety plans. Extension has typically been an organization which works with farmers surrounding best practices that are not necessarily required by law. As noted earlier, non-profits can also provide assistance for farmer-to-farmer training, but since many non-profits have a limited budget, state funding through Extension may be more feasible.

Lastly, both farmers and non-farmers mentioned the importance of consumers knowing how to safely handle fresh produce. Contamination from other food sources can occur in consumers' homes, so it is important for consumers to know good food safety practices as well. Some nationwide efforts have been made on this front, such as the foodsafety.gov website sponsored by the Department of Health and Human Services. More local efforts could be made, including having food safety information sponsored at venues such as farmers' markets. This may be better than farmers providing the consumer safety information individually, since some farmers fear this would cause consumers to wonder about the quality of their product. Having the market staff lead a consumer education effort would reduce consumer questioning of the quality of any specific farmer's produce at the market.

Appendices

Appendix A: Interview Questions and Prompts

(Prompts are given in parentheses but were only used if needed.)

Question Set 1: GAP Dataset Questions

1. Tell me about yourself/your organization/your relation to food/food safety.

(Mission of organization? How long in the area?)

(What services do your organization/farm provide?)

(Who are the primary beneficiaries of those services?)

2. Can you explain to me your own experience with or knowledge of food safety issues?

(Explain to me what Good Agricultural Practices mean to you)

3. How appropriate/effective are the GAPs guidelines/aspects of certification?

(What works well or makes sense? What are the benefits of adoption?)

(What are major issues or concerns you see surrounding the adoption of good agricultural practices (GAPs)?)

4. What is being or could be done to address the concerns regarding GAPs?

Question Set 2: Farmer Interview Questions

1. Tell me about yourself and your farming operation.

(How long have you farmed?)

(What services do you provide?)

2. Given the increase in news coverage about foodborne illness, consumers are more concerned about food safety than in the past. What food safety practices do you routinely use to ensure food is safe when it reaches the consumer?

(In-field measures: hand-washing stations, toilet accessibility?)

(Post-harvest measures: water sanitizers, tool sanitation?)

(Transportation measures: Cooling methods, clean boxes?)

3. Do you believe it is important for farmers to have written food safety plans? Why are these plans important or not important?

(CONTINUE TO Q4 AND Q5 IF FOOD SAFETY PLANS IMPORTANT OR POTENTIALLY IMPORTANT)

4. What major barriers do you see to implementing food safety plans?

5. What major barriers do you see to creating food safety plans?

6. Do you have any other comments that you would like to add?

Question Set 3: Revised Interview Questions for Other Stakeholder Groups

1. Tell me about your work and how it relates to food safety.

(How long doing this work?)

(What services do you provide?)

(Who is the primary beneficiary of your work?)

2. How appropriate/effective are current food safety guidelines for small and mid-sized fruit and vegetable growers?

3. Do you believe it is important for these farmers to have written food safety plans? Why are these plans important or not important?

4. What major barriers do you see to creating food safety plans?

5. What major barriers do you see to implementing food safety plans?

6. Do you have any other comments you'd like to add?

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