

Evaluation of Consumer Food Safety Behaviors at Home

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**Abstract**

Foodborne pathogens are a major source of illness in the United States. In 2010, the Centers for Disease Control and Prevention (CDC) estimated that 1 in 6 Americans are sickened by a foodborne illness each year. While many steps in the farm to table process are well researched and regulated, little information is known about the time between purchase and plate. This study evaluated current food safety recommendations made by the Partnership for Food Safety Education on FightBAC.org. An online survey of consumers was conducted to determine how often they perform the recommended practices to reduce the risk of foodborne pathogens at home. A total of 1,034 consumers responded to the survey. The majority of respondents indicate they practice good personal hygiene, take steps to reduce cross contamination, and store food properly. Safe handling and proper cooking of meat and poultry are areas where consumers are inconsistent and knowledge of recommended practices could be reinforced to decrease the risk of foodborne illness.

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### **Introduction**

Foodborne illness is estimated by the Centers for Disease Control and Prevention (CDC) to affect 1 in 6 Americans each year (CDC, 2010). Food preparation and handling practices in the home are a leading source of foodborne illness cases (Scott, 1996). Food safety experts believe sporadic cases and small outbreaks caused at home are more common than larger case counts recognized as outbreaks. More than \$1.3 billion dollars are spent annually to reduce the burden of foodborne illness. It is necessary to understand what areas are of the most concern and where knowledge gaps still exist so resources can be spent appropriately (PEW Trusts, 2018). The purpose of this project was to identify behaviors between purchase and plate that may lead to a foodborne illness, identify what pathogens are linked to those behaviors, and determine how likely they are to occur. The information presented in this study can be used to guide future studies or direct resources to areas of concern.

### **Review of Literature**

Foodborne illness continues to be a burden across the country causing illness, hospitalizations, and in some cases death. The CDC estimates that 48 million people get sick, 128,000 people are hospitalized, and 3,000 people die annually from a foodborne illness (“Foodborne Illnesses and Germs,” 2018). It has been estimated that sporadic cases of foodborne illness are as much as 100 times greater than those reported by outbreak data and most of those cases are due to food prepared and consumed at home (Fein, Lin, & Levy, 1995). Previous studies suggest that private homes are the source of more outbreaks of foodborne illness than all other reported locations (Scott, 1996, Griffith, Worsfold, & Mitchell, 1998). While food safety experts recognize the risk in home kitchens, most consumers do not believe they are at risk of contracting a foodborne illness at home (Byrd-Bredbenner, Berning, Martin-Biggers, &

Quick, 2013). Multi-state outbreaks of foodborne illness and large recalls of food products are more likely to receive media attention than sporadic cases of illnesses acquired at home causing consumers to believe contaminated products or restaurants are the cause of illness not their own unsafe practices (Medeiros, Hillers, Kendall, & Mason, 2001).

With the passage of the Food Safety Modernization Act in 2011, those that produce, process, transport, and sell food were required to take preventative steps to reduce the risk of foodborne illness (Taylor, 2011). Consumers also have a responsibility to handle, prepare, and store food properly. Failing to take precautions at home or practice proper hygiene and handling recommendations can undermine steps taken earlier in the food chain to reduce contamination (Byrd-Bredbenner, Berning, Martin-Biggers, & Quick, 2013).

The Partnership for Food Safety Education recognize the need for consumers to take preventative measures to protect their health and categorize food handling and preparation at home into four core practices: clean, separate, cook, and chill (Partnership for Food Safety Education, 2011). It is not possible to eliminate all risk, but the core four practices include recommendations to reduce the risk of contracting a foodborne pathogen at home.

### *Clean*

Some of the key practices recommended by the Partnership for Food Safety Education include proper hand washing, washing cutting boards, utensils, and surfaces, and rinsing or washing fresh fruits and vegetables (“The Core Four Practices,” n.d.). A number of foodborne infections can be prevented through simple and effective cleaning practices (Scott, 1996). One of the first steps in food preparation and most important food safety measures is proper hand washing. In 39% of domestic foodborne outbreaks, hands have been documented as a contributing factor in the spread of illness (Fischer et al., 2007). Unwashed hands can introduce

pathogens to food during preparation and contaminate other ingredients, utensils, and surfaces in the kitchen and home (Scott, 1996). Aiello, Coulborn, Perez, and Larson cited handwashing as an important intervention strategy and found that hand washing reduces the number of gastrointestinal illnesses by 31% (2008).

In addition to washing hands, washing produce is another critical preventative measure. As consumption has increased, fresh produce has been linked to a growing number of foodborne illnesses including large, multi-state outbreaks of *Salmonella* and *Escherichia coli* (*E. coli*) (Bennett et al., 2018). Fruits and vegetables are often consumed raw or not heated to eliminate pathogens. The simple acts of washing and rinsing can reduce pathogens on produce prior to consumption (Yeni, Yavaş, Alpas, & Soyer, 2016). It is important to wash whole produce, but pre-packaged produce that has been commercially cleaned or triple washed does not require additional washing at home. Washing pre-packaged salads at home can increase the risk of cross-contamination from other items in the food preparation area, unwashed knives or cutting boards, or unclean hands (Palumbo et al., 2007).

While washing fresh produce is a recommended food safety practice, washing or rinsing meat and poultry prior to cooking is not recommended. Raw meat and poultry introduce foodborne pathogens such as *Campylobacter*, *E. coli*, and *Salmonella* into the home kitchen environment. Poultry is a primary source of *Campylobacter*, a foodborne pathogen recognized as the leading cause of bacterial gastroenteritis, and handling raw chicken in the kitchen is linked to an increased risk of infection (Friedman et al., 2004). Previous studies have shown that handling raw meat and poultry can readily spread pathogens to surrounding work surfaces and hands (Friedman et al., 2004, Dawkins, Bolton, & Hutchinson, 1984).

*Separate*

The Partnership for Food Safety Education has only one recommendation in this category: Do not cross-contaminate (“The Core Four Practices”, n.d.). Reducing the risk of cross-contamination is done by separating raw meat and poultry from other ingredients and clean areas of the home. Hands, kitchen knives, utensils, and cutting boards can spread bacteria between food products and throughout the kitchen (Byrd-Bredbenner, Berning, Martin-Biggers, & Quick, 2013). Organisms including *Campylobacter*, *Salmonella*, and *E. coli* from cutting boards and knives have been shown to transfer easily to lettuce and other vegetables (Ravishankar, Zhu, & Jaroni, 2010). A 2004 study evaluated the transfer rate of *Salmonella* and *Campylobacter* from cutting boards and knives to fresh cucumber slices and concluded both bacteria are readily transferred from contaminated kitchen surfaces to foods (Kusumaningrum, Van Asselt, Beumer, & Zwietering, 2004).

*Cook*

Undercooked meat and poultry can expose consumers to *Salmonella*, *E. coli*, and *Campylobacter*, and other foodborne pathogens which lead to serious cases of foodborne illness (Klontz, Timbo, Fein, & Levy, 1995). It is important to not only visually inspect but also confirm meat or poultry has reached the proper temperature. The recommended internal cooking temperatures for meat and poultry are listed in Table 1.

In 1996, the United States Department of Agriculture (USDA) advised consumers to use a meat thermometer when cooking hamburgers to confirm they are safe to eat and no longer rely on a visual inspection (Lyon, Berry, Soderberg, & Clinch, 2000). This guidance reversed previous literature that suggested ground beef patties should be cooked until they are hot and steaming or using the internal color of cooked meat to determine if it is safe to eat. A 1996 study

found that the internal color varied in ground beef patties cooked to an internal temperature of 160°F (Lyon, Berry, Soderberg, & Clinch, 2000). Additional studies on pork and chicken produced similar results. Refrigeration, meat quality, pH, and marinades can all affect the internal color of meat and this research concluded color is not a reliable indicator of endpoint temperature (Yang & Chen, 1993, Lien et al., 2002).

Table 1

*Recommended Internal Cooking Temperatures*

<b>Product</b>	<b>Minimum Internal Temperature</b>
Beef, Pork, Veal, & Lamb (steaks, roasts, and chops)	145°F
Ground meat	160°F
Poultry	165°F
Ham (fresh or smoked)	145°F
Leftovers	165°F

*Note.* The recommended cooking temperatures were taken from *Keep Food Safe! Food Safety Basics* published by the Food Safety and Inspection Service (FSIS) on 20 December 2016 and retrieved from [https://www.fsis.usda.gov/wps/portal/fsis/topics/food-safety-education/get-answers/food-safety-fact-sheets/safe-food-handling/keep-food-safe-food-safety-basics/CT\\_Index](https://www.fsis.usda.gov/wps/portal/fsis/topics/food-safety-education/get-answers/food-safety-fact-sheets/safe-food-handling/keep-food-safe-food-safety-basics/CT_Index)

*Chill*

Improper cooling of prepared food has been linked to outbreaks of food poisoning and gastroenteritis (Bryan, 1988). Often this happens unintentionally as hot food is left out with the intention to put it in the refrigerator once it has cooled. With enough time and at the right temperature, bacteria are given an opportunity to multiply within the food (Bryan, 1988). Current guidance from the Partnership for Food Safety Education recommends promptly storing perishable food items (“The Core Four Practices”, n.d.). Allowing food to sit at room temperature for 12 or more hours between preparation and consumption carries the most risk and

this practice has been linked to outbreaks caused by *Bacillus cereus*, *Clostridium perfringens*, *Salmonella*, *Vibrio parahaemolyticus*, and staphylococcal enterotoxin (Bryan, 1988).

Maintaining a proper temperature in the refrigerator and routinely removing leftover food are practices included in the recommendations by the Partnership for Food Safety Education (“The Core Four Practices”, n.d.). Refrigerators should maintain a temperature of 4°C (40°F) or below but most consumers do not know the recommended temperature or monitor the temperature of their refrigerators. Kennedy et al. surveyed 100 domestic refrigerators and found the temperatures ranged from -1.7 to 11.8°C with the majority (n=71) having an average temperature above 5°C (2005). Leftover food in the refrigerator can also be a source of foodborne pathogens. A study on the microbiological quality of leftover food found that *Enterobacteriaceae* and *B. cereus* were detected in 10.7% of samples. The same study found that after 3 days at an improper storage temperature (10°C), the number of surveyed bacteria increased by 2 log units (Beumer & Kusumaningrum, 2003). When reheating leftovers, it is important they reach an internal temperature of 165°F to reduce the risk of foodborne illness. (“Leftovers and Food Safety”, 2013).

### **Project Design & Methodology**

A review of materials provided by the Partnership for Food Safety Education and available at FightBAC.org identified behaviors from purchase to plate that could either reduce the risk of contracting a foodborne pathogen or increase the risk to consumers. An online survey was created using Qualtrics, a web-based survey platform, to determine how often these behaviors occur. The questions were presented in chronological order from preparation of ingredients and food handling to storing food that has been prepared. Responses were recorded anonymously.

The survey was distributed through email and social media to a target audience of United States residents over the age of 18. The social media link circulated on Facebook generated 869 completed survey responses. The post was made public and shared 36 times by other Facebook users to their personal pages. The Facebook post and attached survey link were shared on several network pages in an effort to increase the size and diversity of the sample population. These network pages included local and regional neighborhood pages and professional and social organization pages. The link sent via email generated 165 completed responses. The email was distributed to personal contacts, family members, and coworkers. A picture of the Facebook post is included in Appendix A, Figure A.1. The survey questions are included in Appendix A, Table A.1.

### **Results**

A total of 1,034 responses were collected from the Qualtrics survey. Eighty-nine percent of respondents were female (n=924) and 10.1% of respondents were male (n=107). The remaining 0.29% (n=3) preferred not to answer. The majority of respondents (57.8%, n=598) were between 35-54 years of age. To report the results, the response data was organized into the core four practices presented by the Partnership for Food Safety Education.

Table 2

*Demographic data of survey respondents*

Question	Responses	
	n	%
What is your gender identity?		
Male	107	10.4%
Female	924	89.4%
Not listed	0	0.0%
Prefer not to answer	3	0.3%
What is your age?		
18-24 years old	36	3.5%
25-34 years old	229	22.2%
35-44 years old	364	35.2%
45-54 years old	234	22.7%
55-64 years old	123	11.9%
65-74 years old	37	3.6%
75 years or older	10	1.0%

*Demographic Significance*

Chi-squared tests were performed to determine if the surveyed behaviors were related to the age and gender identity of respondents. Gender identity and age were considered to be related to food handling practices if there was a significance level of 0.05 or lower (p-value  $\leq$  0.05). There was a significant relationship between gender identity and the following behaviors: washing hands after handling raw meat or poultry, washing fruit before consumption, and eating prepared food that has been in the refrigerator an unknown amount of time. Males were less likely than females to wash their hands after handling raw meat and poultry and wash fruit before consuming it. Males were more likely than females to consume food from the refrigerator that had been there for an unknown period of time. There were several behaviors that showed a significant relationship to age group. These behaviors were hand washing, rinsing or washing raw meat and poultry, rinsing or washing fruits and vegetables before consumption, and using the same cutting board for animal products and produce. Respondents over the age of 55 were

more likely to always adhere to the clean practices including hand washing and washing fruits and vegetables. The same age groups were also more likely to always perform behaviors that can lead to cross contamination including washing and rinsing raw meat and poultry (Figure 1) and using the same cutting board for meat, poultry, and produce. (Appendix A, Tables A.2 & A.3)

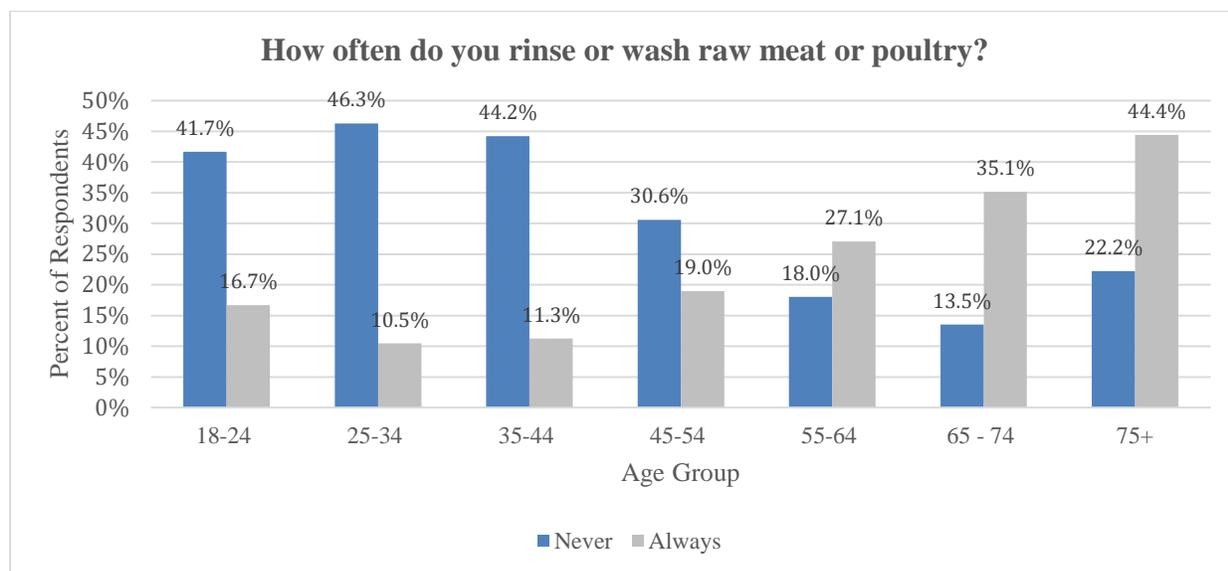


Figure 1. Age demographics and handling of raw meat and poultry. Survey respondents over the age of 55 are more likely to rinse or wash raw meat and poultry than those between the ages of 18-44.

*Clean*

Almost half (49.3%) of respondents reported always washing their hands prior to handling food. Close to half of female respondents (49.8%) report always washing their hands compared to 43.9% of males. The percentage of respondents that reported always washing their hands increased with age. Only 36.1% of respondents between the ages of 18-24 reported always washing their hands but in the age groups from 45 years of age and older, over 50% of respondents in those age groups reported always washing their hands. Ninety-one percent

(91.3%) of respondents reported always washing their hands after handling raw meat or poultry and this response was consistent across gender identity and age groups.

A majority of those surveyed reported always washing produce before consumption with 60.1% always washing their fruit and 60.2% always washing their vegetables and leafy greens before eating them raw. The number of respondents who reported always washing their vegetables and leafy greens before using them in a recipe was lower at 50.2%. Very few respondents (10.6%) always wash prepackaged produce and leafy greens before consumption. Washing produce followed the same trends as hand washing. Females (61.4%) were more likely than males (49.5%) to always wash their produce. The percentage of respondents who reported always washing their produce increased with age. The 18-24 year old and 25-34 year old age groups had less than half (38.9% and 49.8%, respectively) of respondents report always washing their produce before consuming raw. In the age groups from 35 years of age and older, more than 60% of respondents in each age group reported always washing their produce.

This trend was also observed in the responses to the question about rinsing or washing raw meat and poultry. While only 16.0% of the responses overall reported always washing or rinsing raw meat or poultry, 27.1% of respondents 55-64 years of age, 35.1% of those between the ages of 65-74, and 44.4% of respondents 75 years of age and older reported always washing or rinsing raw meat or poultry. These percentages are double the percentage of respondents from the 18-24 age group. Of those respondents between 18-24 years of age, only 16.7% reported always doing this.

Table 3

*Survey responses to questions about cleaning and hygiene practices*

Consumer Behavior	Number (%) of Responses					
	Never	Sometimes	Half the time	Most of the time	Always	N/A
Wash your hands before you start cooking	13 (1.3%)	117 (11.3%)	79 (7.6%)	316 (30.5%)	510 (49.3%)	0 (0.0%)
Wash your hands after handling raw meat or poultry	1 (0.1%)	12 (1.2%)	4 (0.4%)	45 (4.4%)	945 (91.3%)	28 (2.7%)
Rinse or wash raw meat or poultry before preparation	385 (37.3%)	245 (23.7%)	74 (7.2%)	131 (12.7%)	165 (16.0%)	32 (3.1%)
Rinse or wash fruits and berries	16 (1.5%)	77 (7.4%)	92 (8.9%)	228 (22.0%)	623 (60.1%)	0 (0.0%)
Rinse or wash whole vegetables or leafy greens before eating	13 (1.3%)	81 (7.8%)	66 (6.4%)	248 (24.0%)	622 (60.2%)	4 (0.4%)
Rinse or wash whole produce before using in a recipe	46 (4.5%)	129 (12.5%)	86 (8.3%)	246 (23.9%)	517 (50.1%)	7 (0.7%)
Rinse or wash prepackaged produce before eating	409 (39.6%)	293 (28.4%)	86 (8.3%)	124 (12.0%)	109 (10.6%)	12 (1.2%)
Rinse or wash prepackaged produce before using in a recipe	302 (29.3%)	289 (28.1%)	111 (10.8%)	165 (16.0%)	152 (14.8%)	11 (1.1%)

*Separate*

Consumers were not likely to use the same knife and cutting board for meats and produce. Of those who responded, 68.9% of consumers never use the same cutting board and 69.2% of consumers never use the same knife for meat and produce when they are preparing food.

Table 4

*Survey responses to questions about using separate utensils for meat, poultry, and produce.*

Consumer Behavior	Number (%) of Responses					
	Never	Sometimes	Half the time	Most of the time	Always	N/A
Use the same cutting board for meats and produce	710 (68.9%)	135 (13.1%)	30 (2.9%)	77 (7.5%)	56 (5.4%)	23 (2.2%)
Use the same knife for meats and produce	713 (69.2%)	128 (12.4%)	37 (3.6%)	79 (7.7%)	52 (5.0%)	22 (2.1%)

*Cook*

The majority of respondents (67.8%) said they always confirm food is fully cooked before serving, but only 8.8% of respondents reported always using a meat thermometer. Almost 27% of respondents reported never using a meat thermometer when cooking. Females and older respondents were more likely to use a meat thermometer than males and those between the ages of 18-24.

Table 5

*Survey responses to questions about cooking practices*

Consumer Behavior	Number (%) of Responses					
	Never	Sometimes	Half the time	Most of the time	Always	N/A
Confirm food is fully cooked before serving	17 (1.7%)	56 (5.4%)	19 (1.8%)	231 (22.4%)	700 (67.8%)	9 (0.9%)
Use a meat thermometer	274 (26.5%)	352 (34.1%)	103 (10.0%)	185 (17.9%)	91 (8.8%)	28 (2.7%)

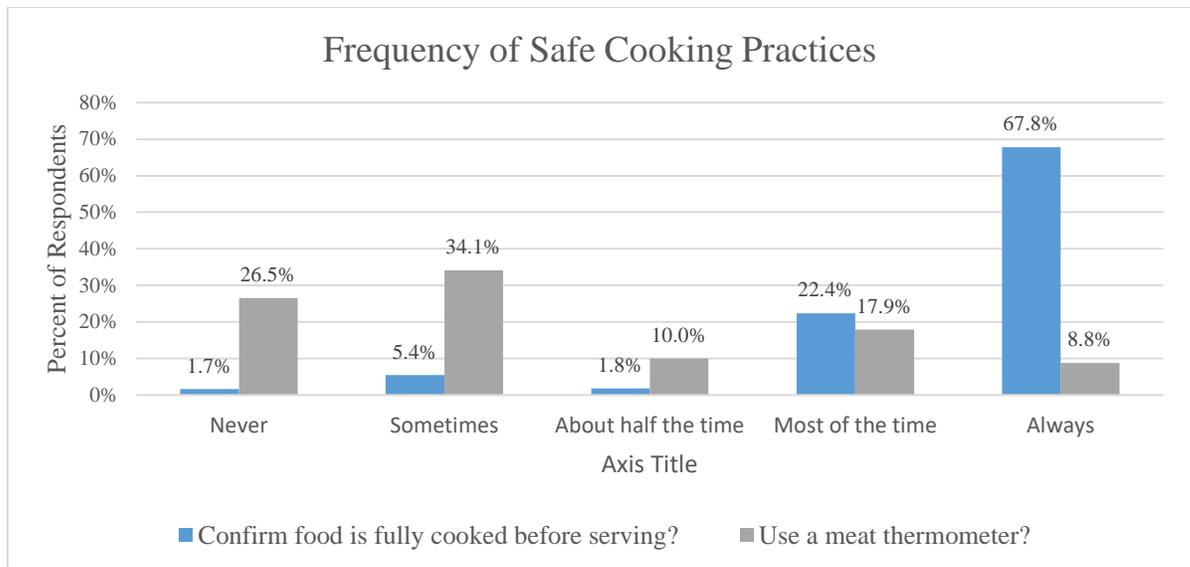


Figure 2. Frequency of Safe Cooking Practices. A majority of respondents said they always confirm their food is fully cooked, but only 8.8% of survey respondents always confirm the internal temperature of their food with a meat thermometer.

*Chill*

Overall, the majority of respondents do not allow food to sit at room temperature for an extended period of time. Almost 60% of respondents said they never allow food to sit at room temperature for 4 hours and 87.4% and 95.3% said they never allow food to sit out for 6 or 12 hours, respectively. Very few respondents (7.5%) always defrost meat or poultry at room temperature, but only 25.5% never do this. Most of the respondents (75.3%) reported never eating leftover food from the refrigerator if they did not know how long it had been there. Males were more likely than females to eat leftovers from the refrigerator. Of female respondents, 77.5% reported never eating leftover food if they did not know long it had been in the refrigerator compared to 55.7% of males. Almost half (46.4%) of respondents reported that they sometimes eat food from the refrigerator as long as it looks and smells okay.

Table 6

*Survey responses to questions about proper cooling and storage questions*

Consumer Behavior	Number (%) of Responses					
	Never	Sometimes	Half the time	Most of the time	Always	N/A
Defrost meat or poultry at room temperature	264 (25.5%)	333 (32.2%)	130 (12.6%)	190 (18.4%)	78 (7.5%)	39 (3.8%)
Allow cooked food to cool completely before refrigerating	85 (8.2%)	296 (28.7%)	179 (17.3%)	350 (33.9%)	123 (11.9%)	0 (0.0%)
Allow prepared food to sit at room temperature for more than 4 hours	615 (59.5%)	364 (35.2%)	39 (3.78%)	15 (1.5%)	1 (0.1%)	0 (0.0%)
Allow prepared food to sit at room temperature for more than 6 hours	902 (87.4%)	110 (10.7%)	13 (1.3%)	6 (0.6%)	0 (0.0%)	1 (0.1%)
Allow prepared food to sit at room temperature for more than 12 hours	980 (95.3%)	45 (4.4%)	2 (0.2%)	1 (0.1%)	0 (0.0%)	0 (0.0%)
Eat leftover food if you don't know how long it has been in the refrigerator	777 (75.3%)	217 (21.0%)	19 (1.84%)	14 (1.4%)	4 (0.4%)	1 (0.1%)
Eat food from the refrigerator as long as it looks and smells okay	239 (23.1%)	479 (46.4%)	101 (9.8%)	165 (16.0%)	48 (4.7%)	1 (0.1%)

### Discussion

The purpose of this project was to identify behaviors between purchase and plate that may lead to a foodborne illness and determine how likely they are to occur. Despite studies indicating that the majority of foodborne illnesses occur at home, the majority of consumers do not believe it is common to become ill as a result of the way food is handled or prepared at home (Cody & Hogue, 2003). Underestimating the risk of food handling, preparation, and consumption at home can determine the recommendations consumers choose to practice (Li-Cohen & Bruhn, 2002).

The majority of respondents self-reported following recommended food safety practices always or most of the time. As with similar studies, the survey relied on self-reporting which

can vary from actual practices (Griffith, Worsfold, & Mitchell, 1998). The questions focused on how often behaviors occur in the home and did not assess consumers' knowledge of or attitude about food safety. The favorable response to the key food safety practice questions indicate that consumers are aware of recommendations they should be following and have a basic knowledge of food safety. The survey did not include questions to assess knowledge. A limitation of this study was that no observational study was done to validate the results of the survey. General behaviors recommended to the public were included but the survey did not ask how adequately or accurately the behaviors are followed. Future studies could include observation of consumers at home to verify survey results, a knowledge assessment, or more detailed questions to determine how accurately recommendations are followed.

For one to become infected with a foodborne illness, the pathogen must be introduced to the food, survive on the food, multiply to infectious levels, and be ingested by a person (Bryan, 1988). The recommendations in each of the core four practices are important and it is important to follow all of the practices: clean, separate, cook, and chill. The recommended practices build on each other to protect individuals from becoming ill due to food safety mistakes at home. Survey responses indicate a willingness to follow hygiene, washing, and storage practices. Most of the recommended practices are easy to follow, but consumers are more likely to accept food safety practices that require little effort and do not affect the quality and taste of the food they are preparing.

Iconic chef Julia Child taught viewers how to roast a chicken in 1971 and started the process by rinsing the raw poultry. She said at the time, "I just think it's a safer thing to do" (Godoy, 2013). Today, we know that this practice can contaminate hands, surfaces, and utensils and cause foodborne illness. At one time it was recommended to cook hamburgers until they

were hot and steaming or use the internal color to determine doneness. In 1996 new research showed neither of those methods determined if meat and poultry was actually safe to eat. Food safety recommendations can change over time as more research is done and new information becomes available. Recommended practices may change but consumer behaviors may not change with them. Consumers continue to follow outdated recommendations when preparing and cooking meat and poultry. The results of this study show that there is an opportunity to reinforce the risks associated with raw and undercooked meat and poultry and additional research may be needed to determine why consumers continue to follow unsafe practices.

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## Appendix A



I need your 'tude about handling food! Can you spare 5 minutes of your time to complete this survey?

It is a part of a research project to complete my degree of Master of Agricultural and Life Sciences in Food Safety and Biosecurity from Virginia Tech. The results will be used in my final project to evaluate the frequency of consumer behaviors when handling and preparing food at home. Respondents must be 18 years of age or older and live in the United States to participate. Participation is voluntary and anonymous. Please share it with your friends and colleagues. Feel free to contact me at jutaylor@vt.edu if you have any questions. Thank you very much!

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*Figure A.1.* A picture of the Facebook post used to share the consumer survey link

Table A.1

*Questions and available responses from the consumer survey*

Question	Response Choices
What is your gender identity?	Male Female Not Listed Prefer not to answer
What is your age?	18-24 years old 25-34 years old 35-44 years old 45-54 years old 55-64 years old 65-74 years old 75+ years old
<b>Before preparing food at home, how often do you...</b>	
Wash your hands before you start cooking? Wash your hands after handling raw meat or poultry? Defrost meat or poultry at room temperature? Rinse or wash raw meat or poultry before preparation? Rinse or wash fruits (e.g. apples, berries) before consuming raw? Rinse or wash whole vegetables (e.g. carrots, peppers) and leafy greens before consuming raw? Rinse or wash prepackaged vegetables (e.g baby carrots) and leafy greens (e.g. salad mixes, bagged spinach) before consuming raw? Rinse or wash whole produce before using it in a recipe? Rinse or wash prepackaged produce before using it in a recipe?	Never Sometimes About half the time Most of the time Always N/A – I do not prepare or consume this food at home
<b>While preparing food at home, how often do you...</b>	
Use the same cutting board for meats and produce? Use the same knife for meats and produce? Use a meat thermometer? Confirm food is fully cooked before serving?	Never Sometimes About half the time Most of the time Always N/A – I do not prepare or consume this food at home
<b>At home, how often do you...</b>	
Allow cooked food to cool completely before refrigerating? Allow prepared food to sit at room temperature for more than 4 hours? Allow prepared food to sit at room temperature for more than 6 hours? Allow prepared food to sit at room temperature for longer than 12 hours or overnight? Eat leftovers if you don't know how long they have been in the refrigerator? Eat food from the refrigerator as long as it looks and smells okay?	Never Sometimes About half the time Most of the time Always N/A – I do not prepare or consume this food at home

Table A.2

*Survey responses for questions that showed a significant relationship between gender identity and the frequency the behavior occurs*

Consumer Behavior	Number (%) of Responses					
	Never	Sometimes	Half the time	Most of the time	Always	N/A
Wash your hands after handling raw meat or poultry						
Male	1 (0.9%)	2 (1.9%)	0 (0.0%)	12 (11.2%)	91 (85.1%)	1 (0.9%)
Female	0 (0.0%)	10 (1.1%)	4 (0.4%)	33 (3.6%)	849 (92.0%)	27 (2.9%)
Rinse or wash fruits and berries						
Male	6 (5.6%)	8 (7.5%)	16 (15.0%)	27 (25.2%)	50 (46.7%)	0 (0.0%)
Female	10 (1.1%)	68 (7.4%)	75 (8.1%)	201 (21.8%)	570 (61.7%)	0 (0.0%)
Eat leftover food if you don't know how long it has been in the refrigerator						
Male	59 (55.7%)	32 (30.2%)	9 (8.5%)	4 (3.8%)	2 (1.9%)	0 (0.0%)
Female	715 (77.5%)	185 (20.0%)	10 (1.1%)	10 (1.1%)	2 (0.2%)	1 (0.1%)

Table A.3

*Survey responses for questions that showed a significant relationship between age and the frequency the behavior occurs*

Consumer Behavior	Number (%) of Responses					
	Never	Sometimes	Half the time	Most of the time	Always	N/A
Wash hands before cooking						
18-24 years of age	1 (2.8%)	6 (16.7%)	2 (5.6%)	14 (38.9%)	13 (36.1%)	0 (0.0%)
25-34 years of age	5 (2.2%)	40 (17.5%)	25 (10.9%)	82 (35.8%)	77 (33.6%)	0 (0.0%)
35-44 years of age	5 (1.4%)	44 (12.1%)	28 (7.7%)	111 (30.5%)	176 (48.4%)	0 (0.0%)
45-54 years of age	2 (0.9%)	18 (7.7%)	15 (6.4%)	68 (29.2%)	130 (55.8%)	0 (0.0%)
55-64 years of age	0 (0.0%)	6 (4.9%)	4 (3.3%)	30 (24.4%)	83 (67.5%)	0 (0.0%)
65-74 years of age	0 (0.0%)	3 (8.1%)	4 (10.8%)	8 (21.6%)	22 (59.5%)	0 (0.0%)
75+ years of age	0 (0.0%)	0 (0.0%)	0 (0.0%)	2 (20.0%)	8 (80.0%)	0 (0.0%)
Rinse or wash raw meat or poultry						
18-24 years of age	15 (41.7%)	8 (22.2%)	3 (8.3%)	3 (8.3%)	6 (16.7%)	1 (2.8%)
25-34 years of age	106 (46.3%)	53 (23.1%)	11 (4.8%)	26 (11.4%)	24 (10.5%)	9 (3.9%)
35-44 years of age	161 (44.2%)	86 (23.6%)	25 (6.9%)	41 (11.3%)	41 (11.3%)	10 (2.8%)
45-54 years of age	71 (30.6%)	53 (22.8%)	21 (9.1%)	35 (15.1%)	44 (19.0%)	8 (3.5%)
55-64 years of age	22 (18.0%)	31 (25.4%)	11 (9.0%)	21 (17.2%)	33 (27.1%)	4 (3.3%)
65-74 years of age	5 (13.5%)	13 (35.1%)	2 (5.4%)	4 (10.8%)	13 (35.1%)	0 (0.0%)
75+ years of age	2 (22.2%)	1 (11.1%)	1 (11.1%)	1 (11.1%)	4 (44.4%)	0 (0.0%)
Rinse or wash whole vegetables before eating						
18-24 years of age	2 (5.6%)	3 (8.3%)	5 (13.9%)	11 (30.6%)	14 (38.9%)	1 (2.8%)
25-34 years of age	3 (1.3%)	24 (10.5%)	23 (10.0%)	64 (28.0%)	114 (49.8%)	1 (0.4%)
35-44 years of age	4 (1.1%)	25 (6.9%)	22 (6.0%)	92 (25.3%)	219 (60.2%)	2 (0.6%)
45-54 years of age	2 (0.9%)	17 (7.3%)	14 (6.0%)	56 (24.1%)	143 (61.6%)	0 (0.0%)
55-64 years of age	1 (0.8%)	8 (6.5%)	2 (1.6%)	17 (13.8%)	95 (77.2%)	0 (0.0%)
65-74 years of age	1 (2.7%)	4 (10.8%)	0 (0.0%)	6 (16.2%)	26 (70.3%)	0 (0.0%)
75+ years of age	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	10 (100.0%)	0 (0.0%)
Use the same cutting board for meat and poultry						
18-24 years of age	20 (55.6%)	5 (13.9%)	2 (5.6%)	7 (19.4%)	1 (2.8%)	1 (2.8%)
25-34 years of age	150 (65.5%)	36 (15.7%)	10 (4.4%)	10 (4.4%)	15 (6.6%)	8 (3.5%)
35-44 years of age	270 (74.4%)	38 (10.5%)	5 (1.4%)	24 (6.6%)	19 (5.3%)	7 (1.9%)
45-54 years of age	165 (70.5%)	26 (11.1%)	9 (3.9%)	15 (6.4%)	14 (6.0%)	5 (2.1%)
55-64 years of age	81 (66.9%)	20 (16.5%)	3 (2.5%)	12 (9.9%)	4 (3.3%)	1 (0.8%)
65-74 years of age	18 (48.7%)	8 (21.6%)	1 (2.7%)	7 (18.9%)	3 (8.1%)	0 (0.0%)
75+ years of age	5 (50.0%)	2 (20.0%)	0 (0.0%)	2 (20.0%)	0 (0.0%)	1 (10.0%)