



## Exploring Florida residents' food safety knowledge and behaviors: A generational comparison



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### ARTICLE INFO

#### Article history:

Received 21 July 2016

Received in revised form

15 October 2016

Accepted 20 October 2016

Available online 21 October 2016

#### Keywords:

Food safety

Food safety knowledge

Generational differences

Food safety education

Food safety behaviors

Florida food safety

### ABSTRACT

This study sought to determine if there were generational differences in Florida residents' food safety knowledge and food safety behaviors. A total of 510 Florida residents responded to an online survey and represented five generational categories. A significant association was found between food safety behaviors and generations for disinfecting counters before preparing food; separating raw meat, poultry, and seafood from ready-to-eat products; defrosting frozen foods in the refrigerator or microwave; and looking for expiration dates on food before eating. Millennials or younger, Generation X, and Old Baby Boomers indicated they learned the most about food safety from their parents, while Young Baby Boomers and the Silent Generation and older reported learning the most from television. The Millennials or younger generation were identified as having the least amount of food safety knowledge, but all generations appeared to have gaps in food safety knowledge. Recommendations included non-formal and formal food safety education for all generations, especially those generations raising children. Researchers also recommended tailoring educational efforts to each generation's preferred method of learning about food safety. Future research should determine the influence of non-formal and formal food safety classes and how individuals' perceived control over foodborne illnesses affects food safety behaviors.

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### 1. Introduction

Addressing food safety issues in the United States requires a holistic understanding of the food safety educational opportunities available to adults and youth. Researchers have found that general consumers exhibit food safety knowledge but gaps still exist in their comprehension of the issue (Cody & Hogue, 2003). Consumers are able to associate foodborne illness risks with certain foods but lack proper food safety practices to prevent some of those illnesses. Cody and Hogue (2003) found that almost three-quarters of consumers in their study believed foodborne illnesses were less likely to be contracted in their own homes, and 60% were unable to associate foodborne illness symptoms (i.e., fever, chills, and nausea) with food prepared at home. Additionally, research has found that

consumers with lower levels of food safety knowledge exhibited fewer food safety behaviors (Abbot, Byrd-Bredbenner, Schaffner, Bruhn, & Blalock, 2009).

Parents' limited food safety knowledge has also been considered a factor in the inconsistent food safety knowledge displayed by many young adults today (Lichtenstein & Ludwig, 2010). Unsafe food safety practices were particularly found to be linked to those individuals that relied on family and friends for their food safety information (Burke, Young, & Papadopoulos, 2016). Abbot et al. (2009) found that college students were only able to answer two-thirds of food safety knowledge questions correctly, while another study found that an overwhelming number of young adults did not believe foodborne illnesses were common (Mayer & Harrison, 2012). College students have displayed restricted food safety knowledge, which has been attributed to limited food safety learning, practicing, and educational opportunities (Mayer & Harrison, 2012).

School-based programs, like home economics, have provided students with the knowledge to care for and feed their families. These programs were phased out in the 80s, and their absence may

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be linked to many young adults' decreased awareness of safe food practices and preparation techniques (Lichtenstein & Ludwig, 2010; Siegel, 1993). The results in Lange, Göranson, and Marklinder's (2016) study showed that students were able to understand *how* to practice food safety behaviors as a result of formal food safety education, but there was needed focus on *why* certain practices were done. In doing this, Lange et al. (2016) believed that students would be able to critically think about their food safety decisions in any situation, especially those outside of the formal educational setting, and adopt proper food safety practices.

Developing effective methods to deliver food safety information can be accomplished through a series of pragmatic approaches (Lichtenstein & Ludwig, 2010). Websites; printed fact sheets, bulletins, brochures; and TV coverage were identified as the most preferred mediums for food safety information, with order indicating preference (Leal, Rumble, & Lamm, 2015). Comparatively, researchers have found that videos and YouTube videos on social media were identified as an effective source for food safety information for young adults (Mayer & Harrison, 2012). Yet, food safety informational sources, like TV cooking shows, are notorious for using unsafe food safety practices, likely contributing to poor food safety behaviors (Borda et al., 2014). Another study conducted by Burke et al. (2016) found that over half (53.4%) of the young adults in their study, between the ages of 19 and 29, did not favor social media as a method of receiving food safety information.

Several food crises over the last 30 years have caused Americans to become increasingly concerned about the safety of their food, but many consumers still participate in risky food behaviors daily (Brewer & Rojas, 2008). Consumers have not been consistent with food safety behaviors when eating raw foods, carrying out other preparation practices, determining safe food-storage temperatures, and reading food safety labels (Altekruse, Yang, Timbo, & Angulo, 1999; Cody & Hogue, 2003; Finch & Daniel, 2005; Leal et al., 2015). Additionally, consumers under the age of 30 and over the age of 64 are most likely to ignore proper food safety procedures (Byrd-Bredbenner, Berning, Martin-Biggers, & Quick, 2013). In particular, Johnson et al. (1998) found that elderly consumers over the age of 65 stored their food in refrigerators that were too warm, and Lange et al. (2016) found young adults' responses to correct refrigerator temperatures for food varied. Young adults were found to be less likely to wash their hands before food preparation, ensure correct food storage temperatures, and follow proper food preparation behaviors (Abbot et al., 2009; Burke et al., 2016; Mayer & Harrison, 2012).

Despite inconsistent food safety knowledge and behaviors, consumers are interested in addressing food safety issues and seeking credible information (Byrd-Bredbenner et al., 2008; Cody & Hogue, 2003). However, consumer food safety education must consider generational differences to be effective (Sneed & Strohbehn, 2008). Researchers believe that educational programs could alleviate generational differences in food safety knowledge, which would influence food safety behaviors (Abbot et al., 2009). Therefore, the purpose of this study was to explore generational differences in Florida consumers' food safety behaviors and food safety knowledge.

## 2. Calculation

One way to approach food safety education is through the social cognitive theory, characterizing the interaction of personal, behavioral, and environmental determinants to obtain new information for future use (Bandura, 2001). People are able to learn knowledge, skills, strategies, beliefs, rules, and attitudes in social systems (Bandura, 2001; Schunk, 2012b). Learning within the social

cognitive theory is acknowledged as either enactive or vicarious (Schunk, 2012b). Enactive learning occurs through the consequences of performing actions. Consequences are viewed as a motivational and informative indicator of whether or not to repeat a behavior (Schunk, 2012b). Vicarious learning occurs through the observation of others (Schunk, 2012a). Observing others can transpire through multiple sources: in person, symbolic or nonhuman (i.e., cartoon characters), electronic (i.e. computers, videos, television), or print (i.e., books, magazines). Social media was linked with the social cognitive theory to be seen as a medium promoting social interaction, which provides a more engaging and better learning environment for students (Mayer & Harrison, 2012).

## 3. Research objectives

- RO1: Determine if there is an association between food safety behaviors and different generations of Florida consumers.
- RO2: Describe differences between where generations of Florida consumers learn the most about food safety.
- RO3: Determine if there is an association between food safety knowledge and different generations of Florida consumers.

## 4. Methods

### 4.1. Sampling

Quantitative methods were used to collect the data for this study. An online survey, following Dillman's tailored design (Dillman, Smyth, & Christian, 2009), was distributed to a panel of Florida consumers over the age of 18. Florida consumers were the population of interest in this study. Florida, in particular, is known for the amount of out-of-state residents that reside in the state, and Munzenrieder (2014) found that only a third of Florida residents were actually born in Florida as of 2012. Therefore, the population had the potential to represent a variety of educational backgrounds not confined only to the state of Florida. Non-probability sampling methods were used to collect the data. This type of sampling does not allow each individual in the population to have an equal chance of selection but is commonly used by social science researchers (Baker et al., 2013) and has been shown to be comparable to probability sampling (Twyman, 2008; Vavreck & Rivers, 2008). Post-stratification weighting of the respondents' demographics was used to help reduce biases associated with non-probability sampling (Baker et al., 2013). However, sample weighting can cause discrepancies in the data such as the total number of weighted cases not equaling the actual number of cases. This error is due to overrepresented cases being weighted lower and underrepresented cases being weighted higher (Maletta, 2007). Demographics from the sample were weighted to match the 2010 Florida Census (United States Census Bureau, 2014). Age, sex, race, ethnicity, and geographic location of the respondents were weighted, which allowed the data to be more reflective of the population (Baker et al., 2013; Kalton & Flores-Cervantes, 2003). Ages of the respondents were grouped into appropriate generations: Millennials or younger (1977–1996), Generation X (1965–1976), Young Baby Boomers (1955–1964), Old Baby Boomers (1946–1954), the Silent Generation and older (1945 and earlier; Zickuhr, 2010). Both the weighted and unweighted demographics of the respondents can be seen in Table 1. Only the weighted data were used for analysis in this study. The majority of respondents were in the Millennial Generation or younger ( $n = 157$ , 30.7%). More than three-fourths of respondents were white ( $n = 395$ , 77.1%) and 52.3% ( $n = 268$ ) were female.

Further demographic analyses showed that at least one-third of

**Table 1**  
Demographics of respondents.

	n	%	Weighted n	Weighted %
<b>Generation</b>				
Millennials or younger	130	25.5	157	30.7
Generation X	102	20.0	112	21.8
Young Baby Boomers	119	23.3	88	17.3
Old Baby Boomers	94	18.4	67	13.2
Silent Generation and Older	65	12.7	87	17.0
<b>Sex</b>				
Male	185	36.3	244	47.7
Female	325	63.7	268	52.3
<b>Hispanic</b>				
Hispanic	51	10.0	108	21.1
<b>Race</b>				
White	457	89.6	395	77.1
Black or African American	26	5.1	75	14.7
Asian or Pacific Islander	9	1.8	13	2.5
American Indian or Alaska Native	6	1.2	2	0.4
Multiracial	9	1.8	10	1.9
Other	3	0.6	17	3.4

participants in each generation, Millennials or younger ( $n = 85$ , 54.0%), Generation X ( $n = 47$ , 42.3%), Young Baby Boomers ( $n = 41$ , 46%), Old Baby Boomers ( $n = 31$ , 46.8%), Silent Generation and older ( $n = 33$ , 37.5%), indicated they had been a Florida resident for 20 years or less (Table 2). Over a quarter of Generation X ( $n = 30$ , 27.1%) and Silent Generation and older ( $n = 24$ , 27.5%) indicated they had been a Florida resident between 21 and 30 years.

#### 4.2. Survey instrument

Questions analyzed for this research were a part of a larger questionnaire, which collected data on consumer perceptions regarding food safety, genetically modified food, and food-related policies. The three questions used for this study asked about food safety behaviors, where respondents learned the most about food safety, and their food safety knowledge. Food safety behaviors were measured with a 10-item, five-point Likert-type scale with the following labels: *never* = 1, *rarely* = 2, *sometimes* = 3, *often* = 4, and *always* = 5. This scale was adapted from the International Food Information Council Foundation (2014). Respondents were asked where they learned about food safety using a check all that apply question. Their choices were carried forward to the next question, and they were asked to identify the source where they had learned the most about food safety. Information on where respondents learned the most about food safety was adapted from a question used by Byrd-Bredbenner et al. (2007).

Food safety knowledge was measured by using 12 true/false statements and was adapted from a previous study (Diehl, Pracht, Forthun, & Simonne, 2010). The correct answers were coded as a 1 and incorrect answers were coded as a 0. A count variable was created by summing the correct scores to determine the

respondents' overall knowledge of food safety behaviors. A score of 12 indicated complete knowledge and a score of zero indicated no knowledge. Real limits were created to prevent gaps between intervals, allowing for clearly defined parameters to help with the interpretation of respondents' food safety knowledge (Colwell & Carter, 2012). Real limits for the knowledge scale were 0.00 – 2.99 = *no knowledge*, 3.00 – 5.99 = *low knowledge*, 6.00 – 8.99 = *moderate knowledge*, 9.00 – 12.00 = *high knowledge*.

The instrument was distributed to a panel of experts before it was sent to respondents to check for content and face validity. Additionally, a soft launch was used to find any issues with the instrument before releasing the survey to the entire sample.

#### 4.3. Statistical analysis

After data was collected, descriptive statistics were run to check for normality. Assumptions for normality were not initially met, and 14 outliers were removed to ensure skewness and kurtosis for each dependent variable fell between  $\pm 2$  (George & Mallery, 2010). Objective one was analyzed using a chi-square analysis because the dependent variables were categorical. Significant findings were followed by a z-test to determine where the differences were between each generation. Objective two was analyzed using descriptive statistics. A chi-square analysis was not completed on objective two because there were not enough responses in the majority of squares to fulfill the expected frequency count assumption (Field, 2013). A one-way ANOVA was performed to satisfy objective three because overall knowledge was converted to a continuous scale. A Bonferroni test was used as a post-hoc analysis to determine which generational groups were significantly different from one another. All assumptions for chi-square analysis and ANOVAs were met (Field, 2013).

### 5. Results

#### 5.1. Generations' food safety behaviors

A chi-square analysis was used to determine if there was an association between food safety behaviors and the generation of consumers. Out of the 10 food safety behaviors measured in this study, four were significantly associated with generation. A letter key was assigned to each generation to ease the interpretation of the chi-square results. If two generations have the same subscript, they cannot be differentiated from one another (at an  $\alpha = 0.05$ ). For example, if one number has a subscript *a* and another one also has *a*, they are not differentiable, but the subscripts *a* and *b* would be. Additionally, a subscript *ab* would mean the proportion is not statistically different from proportions with the subscripts *a* and/or *b*.

Table 3 shows that there was a significant association between disinfecting counters before preparing food and generation ( $\chi^2 = 23.71$ ,  $p = 0.003$ ). Generation X had a higher proportion of

**Table 2**  
Number of years as a Florida resident.

Years	Millennials and Younger %	Generation X %	Young Baby Boomers %	Old Baby Boomers %	Silent Generation and Older %
10 >	24.6	23.3	25.8	25.8	18.0
11–20	29.4	19.0	20.2	21.0	19.5
21–30	37.1	27.1	20.0	16.8	27.5
31–40	8.9	9.3	11.2	14.9	14.7
41–50	0.0	21.2	10.8	6.1	10.6
51–60	0.0	0.0	12.1	10.2	3.4
61–70	0.0	0.0	0.0	5.0	4.6
71–80	0.0	0.0	0.0	0.0	0.7

**Table 3**

Statement: Disinfect counters before preparing food.

	Key	n	Never/Rarely %	Sometimes %	Often/Always %	$\chi^2$	p
Millennials and Younger	a	157	10.2 <sub>a</sub>	17.2 <sub>a</sub>	72.6 <sub>ab</sub>	23.71	0.003
Generation X	b	112	11.6 <sub>a</sub>	10.7 <sub>a</sub>	77.7 <sub>b</sub>		
Young Baby Boomers	c	88	11.4 <sub>ab</sub>	17.0 <sub>a</sub>	71.6 <sub>ab</sub>		
Old Baby Boomers	d	67	7.5 <sub>a</sub>	20.9 <sub>a</sub>	71.6 <sub>ab</sub>		
Silent and Older	e	87	27.6 <sub>b</sub>	17.2 <sub>a</sub>	55.2 <sub>a</sub>		

Note. A letter key was assigned to each row category. Subscripts of the same letter denote frequencies that are not statistically different from one another between the corresponding generation categories.

respondents that often or always (77.7%,  $n = 87$ ) disinfected counters compared to the Silent Generation and older (55.2%,  $n = 48$ ). However, these two generations could not be differentiated from the other generations for that category.

A significant association was also found between generation and separating raw meat, poultry, and seafood from ready-to-eat products ( $\chi^2 = 32.14$ ,  $p < 0.000$ ; Table 4). Generation X had a significantly larger proportion of respondents reporting they often or always followed the behavior (93.7%,  $n = 104$ ) compared to Millennials or younger (79.7%,  $n = 126$ ), and the Silent Generation and older (73.6%,  $n = 64$ ). Additionally, there was a smaller proportion of the Silent Generation and older often or always following the behavior compared to Young Baby Boomers (90.9%,  $n = 80$ ).

A significant association between defrosting frozen food in the

refrigerator or microwave and generation can be seen in Table 5 ( $\chi^2 = 45.81$ ,  $p < 0.000$ ). The Millennial Generation and younger reported often or always performing this behavior (40.8%,  $n = 64$ ) less than Generation X (63.1%,  $n = 70$ ), Old Baby Boomers (74.6%,  $n = 50$ ), and the Silent Generation and older (79.3%,  $n = 69$ ). The proportion of Young Baby Boomers often or always performing the behavior (55.7%,  $n = 49$ ) was also less than the Silent Generation and older.

The results in the chi-square analysis between generation and observing the expiration date before eating can be seen in Table 6. A significant association ( $\chi^2 = 25.39$ ,  $p = 0.001$ ) was found. The proportion of Silent Generation or older that reported often or always performing the behavior (74.4%,  $n = 64$ ) was less than Millennials and younger (89.8%,  $n = 141$ ) and Generation X (91.1%,

**Table 4**

Statement: Separate raw meat, poultry and seafood from ready-to-eat products.

	Key	n	Never/Rarely %	Sometimes %	Often/Always %	$\chi^2$	p
Millennials and Younger	a	157	5.1 <sub>a</sub>	15.2 <sub>a</sub>	79.7 <sub>ab</sub>	32.14	<0.000
Generation X	b	112	2.7 <sub>a</sub>	10.6 <sub>b</sub>	93.7 <sub>c</sub>		
Young Baby Boomers	c	88	2.3 <sub>a</sub>	6.8 <sub>ab</sub>	90.9 <sub>bc</sub>		
Old Baby Boomers	d	67	6.0 <sub>ab</sub> <sup>a</sup>	9.0 <sub>ab</sub>	85.1 <sub>abc</sub>		
Silent and Older	e	87	16.1 <sub>b</sub>	10.3 <sub>ab</sub>	73.6 <sub>a</sub>		

Note. A letter key was assigned to each row category. Subscripts of the same letter denote frequencies that are not statistically different from one another between the corresponding generation categories.

<sup>a</sup> Indicates an expected count of less than five. Results should be interpreted cautiously (Field, 2013).

**Table 5**

Statement: Defrost frozen foods in the refrigerator or microwave.

	Key	n	Never/Rarely %	Sometimes %	Often/Always %	$\chi^2$	p
Millennials and Younger	a	157	19.7 <sub>a</sub>	39.5 <sub>a</sub>	40.8 <sub>a</sub>	45.81	<0.000
Generation X	b	112	15.3 <sub>ab</sub>	30.0 <sub>b</sub>	63.1 <sub>bc</sub>		
Young Baby Boomers	c	88	12.1 <sub>ab</sub>	30.7 <sub>ab</sub>	55.7 <sub>ac</sub>		
Old Baby Boomers	d	67	7.5 <sub>ab</sub>	17.9 <sub>b</sub>	74.6 <sub>bc</sub>		
Silent and Older	e	87	5.7 <sub>b</sub>	14.9 <sub>b</sub>	79.3 <sub>b</sub>		

Note. A letter key was assigned to each row category. Subscripts of the same letter denote frequencies that are not statistically different from one another between the corresponding generation categories.

**Table 6**

Statement: Look for expiration dates on food before eating.

	Key	n	Never/Rarely %	Sometimes %	Often/Always %	$\chi^2$	p
Millennials and Younger	a	157	1.9 <sub>a</sub> <sup>a</sup>	8.3 <sub>ab</sub>	89.8 <sub>a</sub>	25.39	0.001
Generation X	b	112	2.7 <sub>a</sub> <sup>a</sup>	6.3 <sub>b</sub>	91.1 <sub>a</sub>		
Young Baby Boomers	c	88	5.7 <sub>a</sub> <sup>a</sup>	5.7 <sub>b</sub>	88.6 <sub>ab</sub>		
Old Baby Boomers	d	67	1.5 <sub>a</sub> <sup>a</sup>	20.9 <sub>ac</sub>	77.6 <sub>ab</sub>		
Silent and Older	e	87	4.7 <sub>a</sub> <sup>a</sup>	20.9 <sub>c</sub>	74.4 <sub>b</sub>		

Note. A letter key was assigned to each row category. Subscripts of the same letter denote frequencies that are not statistically different from one another between the corresponding generation categories.

<sup>a</sup> Indicates an expected count of less than five. Results should be interpreted cautiously (Field, 2013).

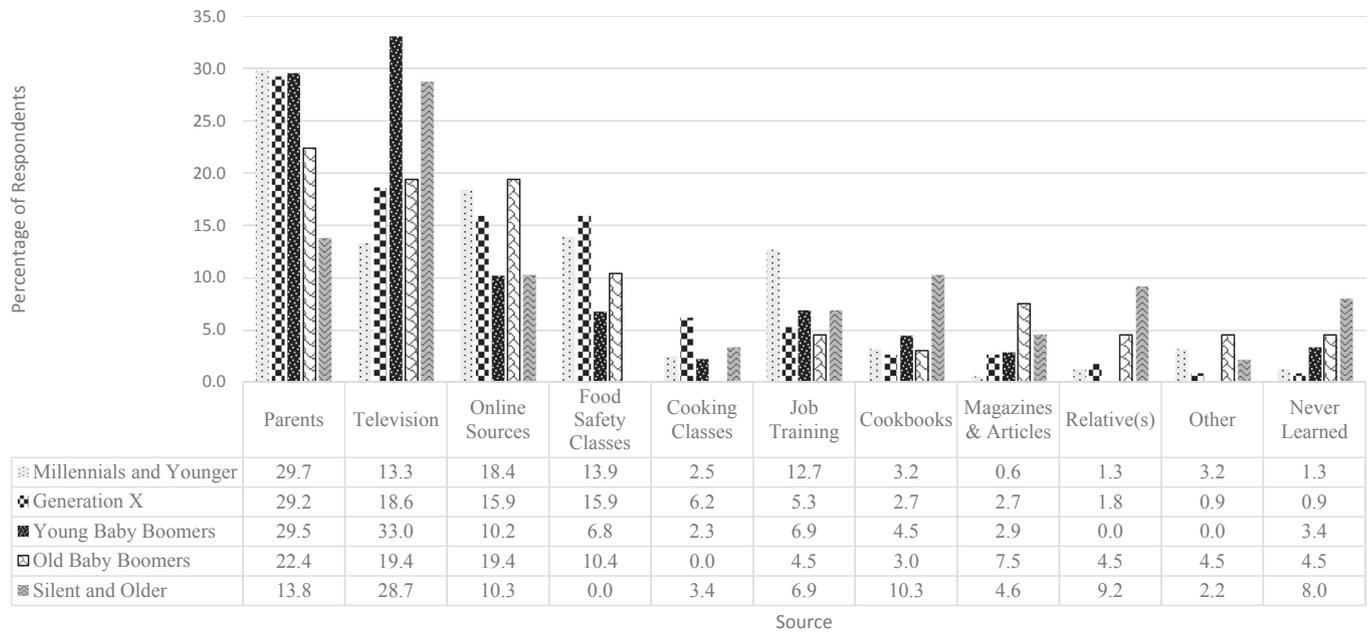


Fig. 1. Where respondents learn the about food safety by generation.

n = 102).

The following behaviors were not significantly associated with generation: washing fruits and vegetables before eating, peeling edible skins from fruits and vegetables, reading food labels for food safety information, washing hands before preparing food, washing hands before eating food, and using a thermometer to check the doneness of meat products.

5.2. Where generations learn about food safety

Fig. 1 shows the descriptive results for where respondents learned the most about food safety. Millennials and younger (29.7%, n = 47), Generation X (29.2%, n = 33), and Old Baby Boomers (22.4%, n = 15) reported learning the most from their parents (rounding error associated with post stratification weighting changed the n of Millennials and younger to 158 and Generation X to 113 for this analysis; Maletta, 2007). The Silent Generation and older reported learning the most about food safety from television (28.7%, n = 25), as did the Young Baby Boomers (33.0%, n = 29). The Millennials and younger generation (13.9%, n = 22) and Generation X (15.9%, n = 18) indicated they also learned from food safety classes. Old Baby Boomers reported learning the most form online sources as well (19.4%, n = 13). Millennials and younger also reported learning from online sources (18.4%, n = 29).

Other major differences consisted of a higher proportion of Silent Generation and older respondents learning from cookbooks (10.3%, n = 9) and relatives (9.2%, n = 8) compared to other generations. Additionally, the Silent Generation and older had the highest number of respondents reporting they had never learned about food safety (8.0%, n = 7). Among all generational groups, Millennials were found to learn more about food safety from job training (12.7%, n = 20).

5.3. Generations' food safety knowledge

Respondents were asked a series of true/false questions to gauge their knowledge of food safety behaviors. On a 12-point scale, where a higher score indicates a higher level of food safety

knowledge, all generations exhibited high knowledge: Millennials and younger = 9.67 (SD = 1.43), Generation X = 10.35 (SD = 1.11), Young Baby Boomers = 10.28 (SD = 1.00), Old Baby Boomers = 10.58 (SD = 0.93), and Silent Generation and older = 9.97 (SD = 1.22). An ANOVA (Table 7) indicated there were significant associations between generation and overall food safety knowledge (F(4,506) = 9.75, p < 0.01). Table 8 shows the results from the follow-up Bonferroni test. A significant difference was found between the Millennial Generation and younger and Generation X (p < 0.001), Young Baby Boomers (p = 0.001), and Old Baby Boomers (p < 0.001). Additionally, the Old Baby Boomers reported a higher level of food safety knowledge compared to the Silent Generation and older (p = 0.021). No other statistically significant differences in knowledge between the generational groups were found.

Table 7 ANOVA for food safety knowledge.

	SS	df	MS	F	p
Between Groups	56.49	4	14.12	9.75	0.00
Within Groups	732.63	506	1.45		
Total	789.12	510			

Table 8 Bonferroni Test for food safety knowledge.

	Mean Difference	p
Millennials and Younger		
Generation X	-0.681*	0.000
Young Baby Boomers	-0.618*	0.001
Old Baby Boomers	-0.917*	0.000
Silent Generation and Older	-0.312	0.528
Silent Generation and Older		
Millennials and Younger	0.312	0.528
Generation X	-0.368	0.325
Young Baby Boomers	-0.306	0.928
Old Baby Boomers	-0.605*	0.021

Note: \*p < 0.05.

## 6. Discussion

### 6.1. Generations' food safety behaviors

Generational differences between Florida consumers' food safety knowledge and behaviors were explored in this study to determine if specialized educational programs are necessary to promote proper food safety procedures with the public. The following behaviors were not significantly associated with generation: washing fruits and vegetables before eating, peeling edible skins from fruits and vegetables, reading food labels for food safety information, washing hands before preparing food, washing hands before eating food, and using a thermometer to check the doneness of meat products.

The proportion of Silent Generation and older consumers who often or always perform a behavior was significantly less than at least one other generation for disinfecting counters before preparing food, separating meat products from ready-to-eat products, and viewing the expiration date on food before eating. The proportion of Millennial Generation and younger respondents was less than at least one other generation for separating raw meat products from ready-to-eat products and defrosting frozen food in the refrigerator or microwave. These differences in food safety practices were reflective of prevalent food safety issues related to food preparation (Altekruse et al., 1999; Cody & Hogue, 2003; Finch & Daniel, 2005; Leal et al., 2015). The differences identified between the Millennial Generation and younger and the other generations were consistent with prior research, which concluded that young adults were less likely to follow proper food handling procedures (Abbot et al., 2009; Mayer & Harrison, 2012). Based on these findings, food safety educators should focus on teaching younger consumers basic food preparation and handling techniques, raw meat preparation practices and risks, ready-to-eat handling procedures, common foodborne illness vectors and how they are contracted, and practices to reduce the occurrence of foodborne illnesses. Educators should also reiterate why certain behaviors are performed to encourage proper food safety practices outside of an educational setting, which can encourage young consumers to actively consider the choices they make when handling and preparing food (Lange et al., 2016).

Even though literature has concluded that young adults have not always exhibited proper food safety practices, this research found that the Silent Generation and older was participating in less food safety practices than any other generation. This finding was reflective of research that indicated young and elderly consumers alike were most likely to mishandle food (Byrd-Bredbenner et al., 2013; Johnson et al., 1998). These respondents were born during or before World War II and may not have had exposure to home economics programs (Lichtenstein & Ludwig, 2010), learning mostly about food safety in the home during a time when Americans simply did not know as much as they do today about proper food preparation. Even though differences between generation and food safety behaviors were identified, differences were only found in four of the 10 behaviors measured. This finding should be considered when interpreting results; performing correct food safety behaviors may be an issue across all generations, namely the Silent Generation and older and Millennials and younger.

### 6.2. Where generations' learn about food safety

Respondents universally reported learning the most about food safety behaviors from their parents, with the exception of the Silent Generation and older respondents who reported learning the most from television. Since there were few differences in food safety behaviors, parents may be passing on information from one

generation to the next, regardless if it is correct or incorrect (Burke et al., 2016; Lichtenstein & Ludwig, 2010). This information flow could explain why food safety habits have not improved in recent generations, especially with limited formal educational classes. The older generations' use of television, magazines, and relatives for food safety information is consistent with literature that indicated these were previous sources used among consumers to learn about food safety (Cody & Hogue, 2003). These learning methods may also indicate that older generations are vicarious learners; they learn about food safety by reading and observing rather than actually participating (Schunk, 2012a). However, the unsafe food safety practices identified in TV shows by Borda et al. (2014) suggests that older generations may be inadvertently exposed to poor food safety practices.

A higher proportion of younger generation respondents reported learning the most from food safety classes compared to other sources. The respondents' who learned from this source were likely engaged in enactive learning because a formal course would have positive and negative outcomes associated with it (Schunk, 2012b). This finding conflicted with literature that indicated younger consumers would not have been exposed to food safety classes or programs in schools (Lichtenstein & Ludwig, 2010; Siegel, 1993); however, the instrument did not ask where the food safety classes were taught. Television and online sources were additional sources of food safety information preferred by Generation X and Millennials and younger. This finding partially aligns with Mayer and Harrison's (2012) conclusion that young adults prefer to use social media and YouTube videos to learn about food safety due to higher level of engagement with the audience. Respondents were not asked which online source they prefer though, and considering that young adults did not prefer social media as a source when receiving food safety information in the study conducted by Burke et al. (2016), this finding must be further explored to better understand what online sources are preferred. Additionally, the same unsafe food safety practices identified in TV shows that may be affecting older generations may also be exposing younger generations to poor food safety practices.

Florida serves as the third largest state in the U.S. with almost 40,000 eating and drinking place locations (National Restaurant Association, 2014; National Restaurant Association, 2016). With 28% of employees in eating and drinking places being enrolled in school (National Restaurant Association, 2014), it's logical that Millennials identified job training as one of the top five places where they receive food safety training.

### 6.3. Generations food safety knowledge

The Millennial and younger respondents reported lower knowledge compared to the three previously stated generations. This difference in knowledge is reflective of the differences that were identified in food safety behaviors. Previous research has found that young adults were not knowledgeable about food safety (Abbot et al., 2009; Lange et al., 2016). Old Baby Boomers were found to have higher food safety knowledge than the Silent Generation, suggesting that older consumers may not be as knowledgeable when compared with other generations. Therefore, education efforts are needed for both younger and older consumers alike. Each generation answered between nine and 11 questions out of 12 correct, on average, which further supported Cody and Hogue's (2003) conclusion that consumers were knowledgeable of food safety, but there was still opportunity for improvement to narrow the knowledge gap. Specifically, Millennials and younger and the Silent Generation and older were less knowledgeable than the other generations.

## 7. Policy implications

Researchers in this study recommend food safety experts promote safe food behaviors to all generations, especially to those who are currently raising younger generations. With parents serving as the primary source of food safety information across all generations, and Millennials and younger displaying less safe food behaviors than their parents, it is likely that Millennials and younger could continue passing unsafe food safety practices to their children. Alternative methods for school-based programs to teach children about food safety are needed, especially for adolescence aged children, to help reduce the occurrence of foodborne illness. Formal educational food safety classes may not be as prominent as they used to be (Lichtenstein & Ludwig, 2010; Siegel, 1993), but an interactive based instruction is needed to accommodate the hands on generations. Interactive settings will also provide experiential learning opportunities for students, which would be effective in teaching food safety. Additionally, instructors should consider providing supplemental material to students in an online format (Mayer & Harrison, 2012), but the use of social media should be further explored to determine if these platforms are actually effective vehicles for food safety information. These materials have the ability to engage younger generations in food safety practices and provide them with a better learning environment (Mayer & Harrison, 2012). More training opportunities for educators to learn about food safety can also help in teaching accurate and up to date information to students.

Audience segmentation should be used to encourage proper food safety behaviors among older generations. All generations older than Millennials and younger could benefit from non-formal food safety classes. The Silent Generation and older should specifically be targeted since this group exhibited less proper food safety behaviors than the other generations and were less knowledgeable comparatively. Non-formal education through food safety and cooking classes could be offered in retirement communities to focus on this generation. Also, a cookbook that includes proper food handling procedures could be offered by educational groups. Cookbooks could be mailed to areas with higher populations of retired consumers or offered as an instructional piece to cooking classes. With an increase in knowledge of proper food safety behaviors, older generations should be able to disseminate the information to the next generation, thus decreasing the number of annual foodborne illnesses.

Future research should identify if each generation is participating in non-formal or formal food safety classes, identify what organization the classes are being offered through, and the impact of the classes. Awareness of current educational resources may be able to guide future food safety education efforts. Researchers should further investigate the use of social media as a source to deliver food safety information to better understand the preference of receiving information using an online platform in this study. An experimental study could use a food safety course as an intervention and measure the students' knowledge before and after the class to gain deeper insight into the influence of education on food safety knowledge. Observational studies would provide more accurate information regarding food safety behaviors since the ones in this study were self-reported. Research efforts should also determine whether consumers are seeking out food safety information or if they are exposed to it through their normal routine during food preparation. Individuals' learning styles should also be investigated as they relate to food safety behaviors, which can aid educators in disseminating targeted food safety education. Furthermore, future research should explore how perceived control of foodborne illnesses influences food safety behaviors. Replicating this study with a larger sample and using probability sampling

methods would help to generalize these findings.

## 8. Conclusions

The oldest and youngest generations were not only found to participate in risky food safety behaviors the most, but they also possessed the least amount of food safety knowledge in this study. With parents being identified as the primary source of food safety information across all but one generation, it is likely that poor food safety behaviors and knowledge are being passed down to each generation. Some preferred methods of receiving food safety information may also be contributing to poor food safety behaviors. A variety of methods should be considered when delivering food safety information, customizing the experience with generational preferences. Formal and non-formal educational efforts may serve as methods to provide all generations with accurate, hands-on opportunities to learn about food safety. Food safety education is imperative to the development of safe food behaviors and knowledge for current and future generations.

## Funding

This research was supported by funding from the UF/IFAS Center for Public Issues Education.

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