Food Safety Perceptions and Practices of Older Adults

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SYNOPSIS

Objectives. Older adults are considered more vulnerable to foodborne illness due to lowered immune function. We compared the food safety perceptions and practices of older and younger adults and determined associations with demographic characteristics.

Methods. We focused on 1,317 participants ≥ 60 years of age from the U.S. Food and Drug Administration's 2006 Food Safety Survey, a telephone survey of a nationally representative sample of American consumers. We used data on participants < 60 years of age to compare younger and older adults, and used Pearson's Chi-square tests to determine whether perceptions and practices differed by age, gender, level of education, living arrangement, and race/ethnicity. We conducted multiple logistic regression analysis to assess relationships of demographic characteristics and food safety perceptions with food safety practices of older adults.

Results. We found that adults ≥ 60 years of age were more likely to follow recommended food safety practices than those < 60 years of age. Sixty-six percent of adults ≥ 60 years of age reported eating potentially hazardous foods in the past year compared with 81% of adults < 60 years of age. Among people ≥ 60 years of age, women, those with less education, and nonwhite individuals generally had better food safety practices and a greater awareness of food safety risk.

Conclusions. These findings suggest that certain subsets of the older adult population are less likely to follow recommended food safety practices and, thus, are at greater risk of foodborne illness. Food safety education for older adults should target men and those with more education and higher incomes.

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The Centers for Disease Control and Prevention (CDC) estimates that there are 76 million cases of foodborne disease in the U.S. each year and 5,000 deaths from foodborne illnesses.¹ Vulnerable populations, such as young children and adults >50 years of age, experience severe foodborne illness to a much greater degree than the rest of the population. Despite decreases in the incidence rates of reported foodborne illness from 1996 to 2005, rates have remained static since 2005. The most recent data show that although children ≤4 years of age have the highest incidence of foodborne illness infection, adults ≥50 years of age are hospitalized and die of foodborne illness at significantly greater rates than the rest of the population.²

Declines in immune system function account for older adults' greater vulnerability to foodborne illnesses.³ Age-related immune declines are caused by conditions that affect older adults more often than younger people or have more deleterious effects in older adults. Loss of stomach acidity, major surgeries, malnutrition, underlying illnesses, and diminished physiological capacity render infections in general and foodborne illnesses in particular of greater consequence for older adults.⁴ Furthermore, foodborne illness in older adults is a growing concern because the number of adults ≥65 years of age in the U.S. is expected to reach 55 million by 2020, and more older adults will remain in the community far into old age due to continuing improvements in public health and medical care.⁵ Staying healthy and independent into old age is important to individuals and comprises a key measure of public health.⁶

In general, studies have found older adults' food safety knowledge and practices to be better than those of younger people. Older adults are less likely to eat risky foods⁷⁻⁹ such as rare or raw beef, fish, shellfish, and eggs;¹⁰ more likely to wash their hands while preparing foods; and more likely to wash cutting boards with soap after cutting raw meat or chicken.^{8,9} A meta-analysis of studies on consumer food safety knowledge and behavior found better food safety practices and greater food safety knowledge among adults ≥55 years of age compared with those 30–54 years of age.¹¹

Several studies have revealed gaps in older adults' food safety knowledge and practices. Lin et al. found that older adults were less likely than younger adults to know about important foodborne pathogens.¹² A recent study from the United Kingdom Food Standards Agency showed that older people were less likely than younger people to recognize some circumstances in which food can be unsafe.¹³ Adults ≥65 years of age were much less likely than younger people to indicate that foods past their "use by" dates were a food

safety concern. Older adults in the Elderly Nutrition Program reported risky food-handling behaviors and were found to underestimate both the prevalence and risk of foodborne illness.¹⁴ Similarly, in a study of Kentucky consumers, older adults reported a high level of confidence in the safety of the U.S. food supply, and greater confidence in the food supply was associated with an increased likelihood of practicing unsafe food behaviors.¹⁵ Other research has shown that certain subgroups within the older adult population engage in practices that can lead to foodborne illness in the home. Cates et al. found that older men exhibited more risky behaviors than older women, as did older adults with higher education and higher incomes.¹⁶ The same study found that older adults with a health condition were more likely to eat risky foods.

Previous studies on the food safety attitudes and behaviors of older adults have some limitations, and our study built upon recent research. Our study population was relatively large and came from a nationally representative sample. While some studies focused only on older individuals,^{13,16} our study included a comparison of younger and older adults. In addition, some studies presented only cross-tabular analysis,^{13,16} which does not control for factors that may influence behaviors. We also used regression analysis, which isolates important factors and reveals those that do not have a real impact.¹⁷

METHODS

Study population

The Food Safety Survey (FSS) is a random-digit-dial telephone survey, periodically conducted by the U.S. Food and Drug Administration (FDA), of a nationally representative sample of American consumers. The FSS tracks consumers' knowledge, perceptions, and behaviors with respect to food safety. Results are used for consumer education and outreach, and input in regulatory and policy matters. Five waves of data have been collected: 1988, 1993, 1998, 2001, and 2006. At each wave, the questionnaire was updated to include current food safety topics. The 2006 FSS included 4,539 noninstitutionalized adults ≥18 years of age who spoke English or Spanish, in households with telephones, in the 50 states and the District of Columbia. The survey was conducted using a nationally representative single-stage sample of telephone numbers generated from the GENESYS sampling system.¹⁸ If a household had more than one adult ≥18 years of age, the adult with the most recent birthday was selected for the interview.

The data were weighted for (1) design effects, including the number of adults in the household,

the number of telephone lines in the household, and disproportionate sampling across the design strata; and (2) population weight, to adjust the sample to the U.S. Census Bureau March 2005 Current Population Survey proportions for gender, education, race/ethnicity, and age. Though data on participants <60 years of age were used to compare some food safety attitudes and behaviors of younger and older adults, our study mainly focused on 1,317 participants from the 2006 FSS who were ≥60 years of age. Exclusions were made in the analyses if participants had not provided responses to all relevant questions.

Food safety summary scores

We calculated a summary score for perceived food safety risk, based on participants' responses to the following questions: (1) "If you forget to wash your hands before you begin cooking, how likely are you to get sick?"; (2) "If vegetables you will eat raw happen to touch raw meat or chicken, how likely are you to get sick?"; (3) "If you eat meat or chicken that is not thoroughly cooked, how likely are you to get sick?"; and (4) "If you happen to leave a meat or chicken stew or a casserole out of the refrigerator for two to five hours after it has finished cooking and eat it, how likely are you to get sick?" We also calculated summary scores for eating certain types of foods considered hazardous with respect to foodborne illness. These scores were based on reported consumption of specific raw foods in the past year. One score included raw seafood (raw clams, raw oysters, sushi with raw fish, ceviche, other raw fish, raw shrimp, and raw crab), raw meat (steak tartare, raw hamburger meat, and other raw meat), raw poultry, and raw sprouts; another included cheese made from unpasteurized milk; and another included foods with raw eggs. An overall summary score included all of these potentially hazardous food categories.

Statistical analysis

We compared characteristics of men and women ≥60 years of age using Student's *t*-tests and Pearson's Chi-square tests. Pearson's Chi-square tests were also performed to determine whether adults ≥60 years of age differed from those <60 years of age in food safety perceptions and practices, and whether adults ≥60 years of age differed in food safety perceptions and practices according to gender, level of education, living arrangement, and race/ethnicity. For racial/ethnic comparisons, we compared participants who identified themselves as white with those who only reported other race/ethnicity categories, including black, Asian, native Hawaiian or other Pacific Islander, American Indian or Alaska Native, and Hispanic, due to the relatively

small sample sizes within these other groups. We constructed multiple logistic regression models to assess relationships of demographic characteristics and food safety perceptions with food safety practices of adults aged ≥60 years. We tested interactions among demographic characteristics and food safety practices, but because these interactions were not significant, we did not include them in the reported results. Statistical significance was set at $p \leq 0.05$, and analyses were performed using SAS®.¹⁹

RESULTS

Table 1 presents characteristics of the weighted study sample of adults ≥60 years of age. Women comprised approximately 54% of the weighted study sample, and more than 80% of the sample was white. Compared with women, men were more likely to have at least some college education, have a household income of at least \$20,000/year, and live with others.

Table 2 shows the food safety perceptions and practices of adults ≥60 years of age compared with those of adults <60 years of age. A smaller percentage of older adults compared with younger adults reported that they left a dish with meat or chicken out at room temperature for two hours or more after cooking and before refrigeration (8% vs. 11%). In addition, older adults were less likely than younger adults to have eaten

Table 1. Characteristics of adults ≥60 years of age: U.S. Food and Drug Administration 2006 Food Safety Survey

Characteristic	Men (n ^a =434)	Women (n ^a =666)
Age (in years) ^{b,c}	69.3 ± 0.3	70.8 ± 0.3 ^d
White race/ethnicity (percent) ^{b,e}	83.8	83.7
Education ≥some college (percent) ^b	49.0	38.6 ^d
Household income ≥\$20,000/year (percent) ^b	76.7	63.7 ^d
Lives with others (percent) ^b	70.5	55.1 ^d

^aSample size before weighted adjustment; only includes participants with information available for all characteristics in table

^bData weighted for design effects, gender, education, race/ethnicity, and age

^cMean ± standard error of the mean

^dSignificantly different from men, $p \leq 0.05$ (Student's *t*-test for continuous variables and Pearson's Chi-square test for categorical variables)

^eParticipants who identified themselves as white vs. those who only reported other race/ethnicity categories, including black, Asian, native Hawaiian or other Pacific Islander, American Indian or Alaska Native, and Hispanic

Table 2. Food safety perceptions and practices of adults, by demographic characteristics:^{a,b} U.S. Food and Drug Administration 2006 Food Safety Survey

Perception/practice	Total study population		Adults ≥60 years of age					
	Age group		Gender		Education		Living arrangement	
	<60 years	≥60 years	Men	Women	≤High school graduate	≥Some college	Alone	White Nonwhite
Washes hands with soap before preparing foods all of the time (vs. not all of the time) (percent)	76	73	68	77 ^c	73	72	76	69 ^c 92 ^c
After cooking a large pot of soup, stew, or other food with meat or chicken, leaves at room temperature <two hours (vs. ≥two hours) before refrigerating (percent)	89	92 ^c	92	91	90	93	93	84 ^c
Ate last purchase of lunch meat or deli meat after open in refrigerator ≤five days (vs. more than five days) (percent)	39	47 ^c	38	54 ^c	51	41 ^c	45	50 47 48
Thinks it is very important (vs. somewhat or not at all important) to know specific refrigerator temperature (percent)	62	74 ^c	71	76	78	68 ^c	75	72 73 82 ^c
Refrigerator has built-in thermometer that shows temperature in degrees (percent)	36	39	35	42 ^c	40	37	38	40 36 54 ^c
Thinks it is very important (vs. somewhat or not at all important) to use a food thermometer when cooking (percent)	32	35	35	34	37	31	34	35 31 52 ^c
Has a food thermometer (percent)	67	73 ^c	76	70 ^c	69	79 ^c	78	64 ^c 76 54 ^c
At home, hamburgers usually served well done (vs. rare or with some pink in the middle) (percent)	79	81	79	84 ^c	87	74 ^c	81	82 79 99 ^c
Ate any raw meat, raw poultry, raw seafood, or raw sprouts in the past year (percent)	46	30 ^c	37	25 ^c	22	42 ^c	34	24 ^c 30 35
Ate any cheese made from unpasteurized milk in the past year (percent)	29	13 ^c	13	12	10	16 ^c	13	11 12 16
Ate any foods with raw eggs in the past year (percent)	64	52 ^c	58	47 ^c	53	51	51	54 52 54
Ate any potentially hazardous foods in the past year—all categories (percent)	81	66 ^c	74	60 ^c	61	74 ^c	66	67 66 70
Heard of <i>Salmonella</i> as a problem in food (percent)	89	90	86	93 ^c	88	93 ^c	90	90 91 81 ^c
Heard of <i>Listeria</i> as a problem in food (percent)	31	28	28	29	23	36 ^c	30	25 29 22
Thinks getting food poisoning in the U.S. because of how food is prepared at home is very or somewhat common (vs. not very common) (percent)	51	41 ^c	32	49 ^c	46	35 ^c	41	42 39 53 ^c
Thinks getting food poisoning in the U.S. from restaurant food is more common or about as common (vs. less common) as from food prepared at home (percent)	85	87	86	88	88	87	87	87 88 85
Thinks contamination of food by microorganisms, such as germs, is a serious food safety problem or somewhat of a food safety problem (vs. not a food safety problem at all) (percent)	91	86 ^c	81	89 ^c	85	86	87	83 85 90
Perceived food safety risk (summary score ranges from 4 to 20) is high to very high (12 to 20) (vs. low [4 to 11]) (percent)	70	70	63	77 ^c	74	65 ^c	72	68 69 79 ^c
Suspected foodborne illness in household in past year (percent)	25	10 ^c	12	8	7	14 ^c	12	7 ^c 9 14

^aData weighted for design effects, gender, education, race/ethnicity, and age

^bResults only include participants who responded to the specific questions.

^cPercentages are significantly different at $p \leq 0.05$.

their last purchase of lunch meat or deli meat after it had been open in the refrigerator for more than five days (53% vs. 61%). More older adults considered it very important to know the refrigerator temperature (74% vs. 62%), and they were more likely to have a food thermometer than younger adults (73% vs. 67%). Older individuals were less likely than younger adults to have eaten any potentially hazardous foods in the past year (66% vs. 81%) and less likely to report suspected foodborne illness in the household in the past year (10% vs. 25%).

While adults ≥ 60 years of age reported better compliance with food safety recommendations than younger adults, a substantial percentage of older adults did not follow certain important recommendations. More than a quarter of adults ≥ 60 years of age did not always wash their hands before preparing foods, and the majority did not have a refrigerator with a thermometer that displays the temperature. As mentioned previously, most older adults reported eating one or more potentially hazardous foods in the past year, and, of these foods, soft-boiled eggs or other foods that contain raw eggs were consumed by the highest percentage of older participants.

Table 2 also shows food safety perceptions and practices of adults ≥ 60 years of age according to gender, education, living arrangement, and race/ethnicity. Women were more likely than men to wash their hands all the time before preparing foods (77% vs. 68%). They were less likely than men to have eaten their last purchase of lunch meat or deli meat after it had been open in the refrigerator for more than five days (46% vs. 62%). Women were more likely than men to have a built-in refrigerator thermometer that shows the temperature (42% vs. 35%), but less likely to have a food thermometer (70% vs. 76%). They were less likely than men to serve hamburgers rare (16% vs. 21%) and to have eaten potentially hazardous foods in the past year (60% vs. 74%). Furthermore, women were more likely than men to have heard of *Salmonella* as a problem in food (93% vs. 86%), and more likely to perceive food safety risk as high to very high (77% vs. 63%).

Those with some college education were more likely than those with a lower level of education to have eaten their last purchase of lunch meat or deli meat after it had been open in the refrigerator for more than five days (59% vs. 49%). Also, more educated people were less likely than less educated people to consider it very important to know the refrigerator temperature (68% vs. 78%), but more likely to have a food thermometer (79% vs. 69%). Those with more education were also more apt than those with less education to serve hamburgers rare (26% vs. 13%) and to have eaten poten-

tially hazardous foods in the past year (74% vs. 61%). They were more likely to have heard of both *Salmonella* (93% vs. 88%) and *Listeria* (36% vs. 23%) as problems in food and to report suspected foodborne illness in the household in the past year (14% vs. 7%). In addition, those with a higher level of education were less likely than those with less education to perceive food safety risk as high to very high (65% vs. 74%).

People who lived alone were less likely than those who lived with others to wash their hands all the time before preparing foods (69% vs. 76%), have a food thermometer (64% vs. 78%), and report suspected foodborne illness in the household in the past year (7% vs. 12%).

Nonwhite individuals were considerably more likely than white people to wash their hands all the time before preparing foods (92% vs. 69%). However, they were also more likely to leave a dish with meat or chicken out at room temperature for two hours or more after cooking and before refrigeration (16% vs. 7%). More nonwhite than white individuals considered it very important to know the refrigerator temperature (82% vs. 73%) and had a built-in refrigerator thermometer that shows the temperature (54% vs. 36%). More nonwhite vs. white people also considered it very important to use a food thermometer when cooking (52% vs. 31%), but they were less likely to have a food thermometer (54% vs. 76%). In addition, nonwhite individuals were substantially less likely than white individuals to serve hamburgers rare (1% vs. 21%). They were also less likely than white individuals to have heard of *Salmonella* as a problem in food (81% vs. 91%), and were more likely to perceive food safety risk as high to very high (79% vs. 69%).

Associations of demographic characteristics and food safety perceptions with food safety practices of adults ≥ 60 years of age are presented in Table 3. In the logistic regression analysis, characteristics positively associated with washing hands with soap all the time before preparing foods included being female (vs. male), being nonwhite (vs. white), living with others (vs. living alone), perceiving higher food safety risk, and having heard of *Salmonella* as a problem in food. Factors positively associated with having eaten potentially hazardous foods in the past year included being male, being 60–69 years of age (vs. ≥ 70 years of age), having more education, and perceiving lower food safety risk. Eating the last purchase of lunch meat or deli meat within five days of being open in the refrigerator was more common among women and among those who perceived higher food safety risk. Leaving a dish with meat or chicken out at room temperature for less than two hours before refrigeration was positively related

Table 3. Associations of demographic characteristics and food safety perceptions with food safety practices among adults ≥60 years of age: U.S. Food and Drug Administration 2006 Food Safety Survey^a

Characteristic	Washes hands with soap before preparing foods (n = 1,142)			Ate potentially hazardous foods in past year (n = 1,065)			Ate last purchase of lunch meat or deli meat after open in refrigerator for ≤ five days (n = 991)			After cooking a large pot of soup, stew, or other food with meat or chicken, leaves at room temperature for < two hours before refrigerating (n = 971)			At home, hamburgers usually served well done (n = 1,055)		
	OR (95% CI)	P-value	OR (95% CI)	OR (95% CI)	P-value	OR (95% CI)	OR (95% CI)	P-value	OR (95% CI)	OR (95% CI)	P-value	OR (95% CI)	OR (95% CI)	P-value	
Gender (men vs. women)	0.59 (0.42, 0.83)	0.0022	1.90 (1.37, 2.63)	0.60 (0.44, 0.82)	0.0001	1.06 (0.60, 1.90)	1.03 (0.68, 1.54)	0.8383	1.03 (0.68, 1.54)	0.9049					
Age category (60–69 years of age vs. ≥70 years of age)	0.87 (0.62, 1.22)	0.4256	1.48 (1.08, 2.02)	0.82 (0.60, 1.10)	0.0151	0.83 (0.47, 1.48)	0.61 (0.41, 0.91)	0.5302	0.61 (0.41, 0.91)	0.0161					
Race/ethnicity (white vs. nonwhite)	0.13 (0.06, 0.29)	<0.0001	0.67 (0.43, 1.05)	1.02 (0.66, 1.56)	0.0799	2.20 (1.13, 4.26)	0.05 (0.01, 0.29)	0.0203	0.05 (0.01, 0.29)	0.0007					
Education (≥some college vs. ≤high school graduate)	1.05 (0.75, 1.47)	0.7848	1.59 (1.15, 2.21)	0.78 (0.57, 1.06)	0.0053	1.36 (0.77, 2.43)	0.55 (0.37, 0.82)	0.2919	0.55 (0.37, 0.82)	0.0031					
Living arrangement (lives with others vs. alone)	1.72 (1.22, 2.42)	0.0020	0.93 (0.67, 1.29)	0.91 (0.66, 1.24)	0.6480	1.34 (0.76, 2.35)	1.10 (0.72, 1.66)	0.3097	1.10 (0.72, 1.66)	0.6631					
Perceived food safety risk (high vs. low)	1.94 (1.37, 2.74)	0.0002	0.60 (0.42, 0.87)	1.53 (1.09, 2.13)	0.0062	2.21 (1.24, 3.92)	3.01 (2.01, 4.49)	0.0069	3.01 (2.01, 4.49)	<0.0001					
Heard of Salmonella as a problem in food (yes vs. no)	1.75 (1.01, 3.05)	0.0480	1.35 (0.80, 2.28)	0.69 (0.42, 1.16)	0.2685	0.52 (0.16, 1.71)	1.47 (0.75, 2.85)	0.2808	1.47 (0.75, 2.85)	0.2614					
Heard of Listeria as a problem in food (yes vs. no)	1.04 (0.73, 1.50)	0.8189	1.10 (0.77, 1.56)	0.97 (0.69, 1.35)	0.6011	1.66 (0.82, 3.35)	0.80 (0.53, 1.21)	0.1607	0.80 (0.53, 1.21)	0.2934					

^aData weighted for design effects, gender, education, race/ethnicity, and age

OR = odds ratio

CI = confidence interval

to being white and perceiving higher food safety risk. Serving hamburgers well done was positively associated with being ≥ 70 years of age (vs. 60–69 years of age), being nonwhite, having less education, and perceiving higher food safety risk.

DISCUSSION

Our study found that adults ≥ 60 years of age were more likely to follow recommended food safety practices than those < 60 years of age. Among people ≥ 60 years of age, those who had better food safety practices and a greater awareness of food safety risk were more likely to be women, in an older age category, less educated, and nonwhite.

Results of this study generally support findings of the few previous studies on food safety perceptions and practices of older adults.^{16,20} A recent study of adults ≥ 60 years of age also found riskier food safety behaviors among men; people with higher incomes; those with a higher level of education; and people with diabetes, kidney disease, or cancer.¹⁶ Research on younger adults has revealed similar associations. In a telephone survey of U.S. residents ≥ 18 years of age, unsafe food handling practices were more often reported by men, younger adults, those with more education, and occasional food preparers.²¹ As in our study, a disparity was found between knowledge of food safety principles and self-reported food safety practices. Several other studies have found raw shellfish consumption to be more common among men, younger adults, those with higher education, and those with higher incomes.^{22,23}

Knowledge alone does not appear to be a sufficient motivator for older adults to follow recommended food safety practices. In this study, people with more education were more likely to have heard of both *Salmonella* and *Listeria* as problems in food, yet they were less likely than their less educated counterparts to follow food safety guidelines. There are at least two potential explanations for why more educated people have consistently reported riskier food safety practices and a lower level of concern about food safety. In our study, income and education had very similar associations with food safety perceptions. Most unsafe foods considered in our study, such as raw shellfish, are considered delicacies and are relatively expensive, and people with more education and higher incomes may be more likely to purchase these foods. In addition, people with higher education and incomes have repeatedly been found to take more risks in general.²³

Risk perception is thought to greatly influence personal decisions and behaviors.^{15,24,25} Our study showed

strong positive associations between food safety risk perception and adhering to recommended food safety practices. Interventions that simply state basic food safety principles may not be sufficient to improve food safety practices. To be successful, interventions may need to stimulate participants' risk perception regarding foodborne illness and increase participants' confidence in their capability to develop better food safety practices.²⁴

Limitations and strengths

Limitations of this study included the use of self-reported data, which can be subject to recall bias and social desirability bias. In the development of the FSS, however, questions that might evoke socially desirable answers were minimized.²⁶ Strengths of this study included the use of a relatively large, nationally representative sample, which allowed extrapolation of findings from the study population to a larger population of older adults. A further strength of this study was the use of multiple regression analysis to control for potential confounding variables when examining associations of demographic characteristics with food safety practices.

CONCLUSIONS

The findings of this study suggest that while adults ≥ 60 years of age are more likely to follow recommended food safety practices than those < 60 years of age, certain subsets of the older adult population are less likely than others to follow recommended practices and, thus, are at greater risk of foodborne illness. Food safety education for older adults may need to especially target men and those with more education and higher incomes. In addition, food safety education should stimulate participants' risk perception regarding foodborne illness and increase participants' confidence in their ability to improve their food safety practices.

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