



Food Safety Knowledge, Beliefs and Behavior of *Persons with AIDS*: A Multicenter Study

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SUMMARY

Persons living with AIDS are highly vulnerable to foodborne enteric infections, including recurrent *Salmonella septicemia* and toxoplasmosis of the brain, which have the potential for substantial morbidity and mortality. Patients with immunologic AIDS in Chicago, New Orleans, and Bayamon were interviewed to determine gaps in food safety knowledge and prevalence of related behaviors in order to create targeted educational material for this population. A food safety score was calculated based on responses to 40 knowledge, belief and behavior questions. Among 268 AIDS patients interviewed, the overall food safety score was 63% (range 28% to 93%). Many patients believed that it was acceptable to eat higher-risk food (38% for eating eggs served loose or runny, 27% for eating store-bought hot dogs without heating them first), 40% did not know that unpasteurized cheese contains germs that could cause hospitalization and possibly death, and 40% would not throw away salad that had been splashed with a few drops of raw chicken juice. These data indicate substantial knowledge gaps and behavioral risk related to acquisition of foodborne disease among AIDS patients. Healthcare providers should incorporate education on foodborne disease risk into routine outpatient discussion of improving and maintaining their health.

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INTRODUCTION

Nearly half a million persons are living with AIDS in the U.S. (5), and they are highly vulnerable to foodborne enteric infections with the potential for substantial morbidity and mortality. The incidence rates of enteric infections caused by gram-negative bacteria (such as *Salmonella* and *Campylobacter*) are 20- to 100-fold higher in the HIV-infected population than in the general population (6). Several AIDS-defining conditions are commonly acquired from food, such as recurrent *Salmonella septicemia* and toxoplasmosis of the brain. AIDS patients also experience relatively high rates of disease from other pathogens that are commonly or occasionally associated with food, including *Listeria monocytogenes*, *Cryptosporidium parvum*, and *Mycobacterium avium-complex*.

More than one-third of new HIV infections are diagnosed in patients with immunologic AIDS (CD4 < 200 cells), especially among African Americans and Hispanics (4). Patients may spend months or years with relatively advanced immune suppression despite antiretroviral treatment (13). Much of the increased vulnerability of AIDS patients to foodborne pathogens is due to immune suppression, although other factors, such as decreased gastric acidity and the frequent use of antimicrobials that kill gut organisms that normally compete with intestinal pathogens (34), may also increase vulnerability.

Data on food safety knowledge among persons with HIV and AIDS are scarce (33) and have not been derived from large urban centers of the U.S. epidemic. Food safety educational material does exist for AIDS patients (8, 19, 32). However, the baseline knowledge of food safety information is not known for this population. To understand the potential risk for foodborne disease among AIDS patients by determining food safety knowledge, beliefs, and behaviors, we performed a survey at four health facilities in three cities that have a relatively high incidence of HIV (Chicago, New Orleans, and Bayamón, Puerto Rico).

MATERIALS AND METHODS

A 15-minute questionnaire was developed in English and Spanish to obtain information about food safety knowledge and behaviors among patients with AIDS (self- or physician-reported CD4 T-lymphocyte cell count < 200 cells/mL or < 14% within three months before the interview). The Spanish questionnaire was translated and backtranslated. Input regarding the questions was obtained from physicians, nursing staff, and dietitians. In addition to demographic information, the survey asked about fruit and vegetable washing, handling of raw and ready-to-eat foods, cooking, refrigeration, cross contamination, hand hygiene, and eating habits when outside the home that may be related to an increased risk for ingestion of foodborne pathogens. The questionnaire was pilot tested at the four HIV health facilities.

Patients were recruited by use of fliers and word of mouth to healthcare providers. Compensation of \$20 was offered for participation. Patients were excluded if they could not consent for themselves, did not speak either English or Spanish fluently, were prisoners, were younger than 18 years of age, or did not meet the CD4 count criteria.

A signed consent form was obtained from each participant and confidentiality was assured. Approval from the Institutional Review Board for the Protection of Human Subjects was obtained from each of the four participating sites before the initiation of the study.

Statistical analysis was performed using SAS 9.2 for Windows (SAS, Chicago, Ill.). We created a variable called the food safety score based on the number of knowledge, belief, and behavior questions that were answered correctly. A response of "Not sure" was categorized as an incorrect response because it represented a lack of knowledge. The overall food safety score was determined by the number of the 40 knowledge/belief/behavior questions answered correctly out of all such questions. In the case of belief and behavior questions, responses that would place the patient at lower risk for foodborne disease were considered correct. For the question that asked about the safest option for handling raw fruits (watermelon, cantaloupe, papaya, and grapes), a food safety point was awarded if they did not eat any of these fruits and therefore were unlikely to put themselves at risk from mishandling any of them or if they safely handled all of those they ate. A point was not awarded if they did eat at least one of these fruits and did not handle it in the safest way. The scientific literature did not provide guidance as to what constituted a low food safety score in this population, so we defined it as < 80% to explore risk factors with this outcome. Bivariate and univariate analyses were performed using linear regression models. Differences in the distribution of covariates by food safety score were tested using Chi-square statistics. Logistic regression was performed to determine factors associated with a low food safety score and to produce odds ratios (OR) and 95% confidence intervals (95% CI).

RESULTS

The 268 AIDS patients interviewed during April 2010 through July 2011 consisted of 100 from Chicago, 97 from New Orleans, and 71 from Puerto Rico (Table 1). The highest level of education achieved was less than high school for 14%, high school for 53%, and college or higher for 33%. Only 16% of the patients were currently employed, and all those who were employed earned less than \$30,000 per year. More than half (56%) of the patients reported having worked as a food handler.

Many patients ate in restaurants at least once per week (4% ate in restaurants 6–7 days per week, 9% 4–5 days per week, 21% 2–3 days per week, 24% 1 day per week, 32% less than 1 day per week, and 9% never). Many patients ate take-out food at least once per week (4% ate take-out food 6–7 days per week, 6% 4–5 days per week, 23% 2–3 days per week, 21% 1 day per week, 32% less than 1 day per week, and 13% never). Most of the 260 patients who said that they eat at home were responsible for cooking some or all of their food: 37% all, 28% most, 18% sometimes, 7% rarely, and 8% never (data not shown). Regarding potential risk for travel-associated foodborne disease, including hepatitis A, 26 (10.0%) patients planned to travel to a foreign country during the next 12 months including 10 to a South American country and three to a location in the Caribbean. Other foreign locations mentioned were Africa, Canada, France, Mexico, Guam, Japan, and England.

TABLE 1. Characteristics of the population of AIDS patients overall and by site (N = 268). Percentages represent the number of patients with information and the number of patients with missing data is reported

Variable	Total Study Population N (%)	Chicago N (%)	New Orleans N (%)	Puerto Rico N (%)
Number of pre-intervention participants	268 (100)	100 (37)	97 (36)	71 (27)
Mean age in years (Sd)	44.7 (8.95)	45.3 (9.07)	43.3 (9.34)	45.9 (8.07)
SEX				
Female	97 (36)	42 (42)	28 (29)	27 (38)
Male	168 (63)	58 (58)	66 (68)	44 (62)
Transgender	3 (1)	0	3 (3)	0
RACE/ETHNICITY				
Non-Hispanic White	27 (10)	6 (6)	18 (19)	3 (4)
Hispanic White	61 (23)	5 (5)	2 (2)	54 (77)
African-American	160 (60)	84 (84)	73 (76)	3 (4)
Multiracial	8 (3)	1 (1)	3 (3)	4 (6)
Other	10 (4)	4 (4)	0	6 (9)
Missing	2	0	1	1
COUNTRY OF BIRTH				
Foreign-born	74 (28)	8 (8)	4 (4)	62 (89)
U.S.-born	192 (72)	92 (92)	92 (96)	8 (11)
Missing	2	0	1	1
TYPE OF HOUSING				
House/apartment	228 (86)	83 (83)	82 (87)	63 (91)
Group housing	20 (8)	9 (9)	7 (7)	4 (6)
Homeless	4 (2)	2 (2)	2 (2)	0
Other	12 (4)	6 (6)	4 (4)	2 (3)
Missing	4	0	2	2
EDUCATIONAL ATTAINMENT				
< High school	37 (14)	8 (8)	6 (6)	23 (33)
High school	141 (53)	51 (51)	59 (62)	31 (44)
College or higher	88 (33)	41 (41)	31 (32)	16 (23)
Missing	2	0	1	1
EMPLOYMENT STATUS				
Employed	43 (16)	12 (12)	17 (18)	14 (20)
Not currently employed	223 (84)	88 (88)	79 (82)	56 (80)
Missing	2	0	1	1
EVER WORKED AS A FOOD HANDLER				
Yes	152 (57)	60 (60)	60 (62)	32 (45)
No	116 (43)	40 (40)	37 (38)	39 (55)
TRAVELING TO A FOREIGN COUNTRY IN THE NEXT 12 MONTHS?				
Yes	26 (10)	10 (10)	11 (11)	5 (7)
No	231 (89)	87 (90)	84 (88)	60 (90)
Don't know	3 (1)	0	1 (1)	2 (3)
Missing	8	3	1	4

TABLE 2. Distribution of selected characteristics by food safety score

Characteristic	Low Score n = 243 (91%)	High Score n = 25 (9%)	P-value
AGE (YEARS)			0.51
≤ 44	114 (92)	10 (8)	
≥ 45	129 (90)	15 (10)	
GENDER			0.98
Female	88 (91)	9 (9)	
Male	155 (91)	16 (9)	
RACE			0.04
Non-Hispanic White	21 (78)	6 (22)	
Hispanic White	59 (97)	2 (3)	
African American	145 (90)	16 (10)	
Multiracial and other	17 (94)	1 (6)	
EDUCATION			0.23
College or higher	77 (88)	11 (12)	
High school	129 (91)	13 (9)	
< High school	36 (97)	1 (3)	
SITE			0.20
New Orleans	84 (87)	13 (13)	
Chicago	92 (92)	8 (8)	
Puerto Rico	67 (94)	4 (6)	
FOOD HANDLER STATUS			0.73
Yes	137 (90)	15 (10)	
No	106 (91)	10 (9)	
PRACTICE OF EATING OUT			0.64
Never	22 (88)	3 (12)	
Ever	218 (91)	22 (9)	

The average overall food safety score was 63% (range 28% to 93%) and did not vary considerably depending on whether or not the patient had ever worked as a food handler (63% versus 64%, *P*-value 0.66). The mean food safety score was 60%, 61%, and 69% for Chicago, Puerto Rico, and New Orleans patients, respectively (data not shown).

The majority of Hispanic White and African American patients had low food safety scores (97% and 90%, respectively), compared with 78% of Non-Hispanic White patients (*P* = 0.04). Although the proportion of patients with low food safety scores differed by age and by site, these differences were not statistically significant. Among the patients in the study, food safety scores did not differ in terms of age, gender, food handler status, or practice of eating out (Table 2).

Compared with Non-Hispanic Whites, Hispanic Whites were

8.4 times more likely to have low food safety scores (95% CI 1.6–45.0), and African American patients were 2.6 times more likely to have low food safety scores (95% CI 0.9–7.4). Compared with New Orleans patients, Chicago and Puerto Rican patients were more likely to have low food safety scores (OR = 1.8, 95% CI 0.7–4.5 and OR = 2.6, 95% CI 0.8–8.3, respectively). Compared with patients with at least a college degree, patients with less than a high school education or a high school education were more likely to have low food safety scores. However, these estimates were not statistically significant, possibly because of small sample size (Table 3).

Among the food safety knowledge/belief/behavior gaps identified, 38% of patients believed it was okay to eat eggs served loose or runny, 27% believed it was okay to eat store-bought hot dogs without heating them first, and 40% would not throw away

TABLE 3. Predictors of low food safety score

Characteristic	Low Score OR (95%CI)
AGE (YEARS)	
≤ 44 (Reference)	1.0
≥ 45	1.0 (0.96–1.05)
GENDER	
Male (Reference)	1.0
Female	1.0 (0.43–2.38)
RACE	
Non-Hispanic White (Reference)	1.0
Hispanic White	8.4 (1.6–45.0)
African American	2.6 (0.9–7.4)
Multiracial and other	4.9 (0.5–44.3)
EDUCATION	
College or higher (Reference)	1.0
High school	1.4 (0.6–3.3)
< High school	5.1 (0.6–41.4)
SITE	
New Orleans (Reference)	1.0
Chicago	1.8 (0.7–4.5)
Puerto Rico	2.6 (0.8–8.3)
FOOD HANDLER STATUS	
Yes (Reference)	1.0
No	1.2 (0.5–2.7)
PRACTICE OF EATING OUT	
Ever (Reference)	1.0
Never	0.7 (0.2–2.7)

salad that had been splashed with a few drops of raw chicken juice (Table 4). Also, 22% and 40%, respectively, did not know that eating unpasteurized cheese and undercooked (medium-rare) lamb may bring germs into the body that could cause hospitalization and possibly death.

Concerning the patients' common practices that may increase their risk of infection with a foodborne pathogen, among the 249 patients who prepare or order eggs, 40% usually had them incompletely cooked (scrambled loose, sunny side up, or over easy). Among all patients, raw fish was consumed by 8% sometimes and by 1% weekly (no respondents from Puerto Rico ate raw fish). Raw shellfish was consumed by 9% sometimes and 1% weekly.

Raw fruit was consumed by 98% (sometimes 32%, weekly 27%, and daily 39%) of the patients. Raw berries were washed infrequently (sometimes, rarely, or never) before being consumed by 17% of the 197 raw berry-consuming patients. It was also not rare for patients to consume other fruits without washing them first. Among the patients who consumed these fruits, many stated that consuming without washing best described their behavior: 29% of 229 watermelon-eaters, 29% of 201 cantaloupe-eaters, 20% of 114 papaya-eaters, and 8% of 251 grape-eaters. Among 229 watermelon-consuming patients, 37% of them consumed watermelon sold from roadside stands.

Raw meat, poultry products, and seafood were often handled by the 250 patients who reported preparing food for themselves or others. Handling these foods sometimes or frequently was reported by 71% of the patients for raw eggs, 77% for raw chicken, 66% for raw pork, 71% for raw beef, 47% for raw seafood, and 28% for raw shellfish. Since raw meat or poultry handling can lead to opportunities for cross-contamination within the kitchen, we stated, "Imagine this situation: raw chicken is cut up on a cutting board. Next, the cutting board is rinsed with warm water, and then fresh fruit is cut on the cutting board." The patient was then asked if this was OK or not OK. Twenty-four percent believed this was OK and another 6% were unsure if it was OK.

Concerning attention to temperatures, few patients (23%) owned a meat thermometer, and ownership of one was least frequent in Puerto Rico (33% in Chicago, 24% in New Orleans, and 7% in Puerto Rico). Among the 61 patients who owned a meat thermometer, only 28% used it frequently. Thirty-seven percent of the patients stated that their refrigerator had a thermometer, but only 2% of patients knew at what temperature a refrigerator should be kept.

Two questions specific to Puerto Rican culture were asked only in Puerto Rico. Among 70 patients with information, 64% had consumed coquito (a Christmas season rum drink that includes a raw egg in the recipe) in the past year and 14% had consumed grape juice with a raw egg (commonly known as ponche de huevo or jugo de ponche) in the past year.

DISCUSSION

These data reveal food safety knowledge gaps among AIDS patients and relevant behaviors that might place them at increased risk for foodborne illnesses. All of these AIDS patients had self- or provider-reported CD4 T-cell counts below 200, indicating significant immune suppression that may magnify their risk for foodborne disease infection and complications. While Hispanic race/ethnicity was associated with a lower food safety score, the majority of patients in all race/ethnicity categories did not have high food safety scores. Although behavior is not always modifiable with improved risk-related knowledge, improving such knowledge is an important first step, and recognition of knowledge gaps is therefore fundamental to determining what knowledge areas need improvement.

The survey results revealed several knowledge gaps and behavioral practices that may increase the risk of acquiring infections caused by bacterial pathogens such as *Salmonella* and *Campylobacter*. For example, 20 percent of these patients consumed raw eggs, more than one-third consumed eggs that were not fully cooked, and more than one-fourth consumed raw sprouts (a raw vegetable specifically warned against in the U.S. Public Health Service's Guidelines for Prevention and Treatment of

Opportunistic Infections) (6). They also commonly handled raw eggs or raw meat. Approximately one-fourth of these patients stated that it was “okay” to use a cutting board for both raw chicken and then raw fruit, with only a warm water rinse in between, and another seven percent were unsure if that was “okay.” The lack of a sanitizing step after the exposure of the board to raw chicken is a highly risky practice, given that raw chicken is frequently contaminated with *Salmonella* and *Campylobacter*. For example, in a study of poultry from 59 retail stores in the greater Washington, D.C. area (including suburban Maryland), 71% of the chicken was contaminated with *Campylobacter* and 4% with *Salmonella* (36).

Many *Salmonella* outbreaks have been associated with consumption of lightly cooked eggs in foods such as French toast, hollandaise sauce, crab cakes, and bread pudding (29). Other food sources of *Salmonella* are raw and undercooked meat (especially poultry), raw fruits and vegetables, unpasteurized dairy products such as raw milk and raw milk cheeses, and cream containing desserts and toppings (27). *Campylobacteriosis* has been associated with eating undercooked chicken or runny eggs, eating or drinking while preparing raw chicken (22), drinking raw milk or untreated surface water, and exposure to pets (15). Consumption of fresh (unfrozen) chicken is shown to be a stronger risk factor for *Campylobacter* infection than consumption of previously frozen meat, because freezing meat results in a 2-log reduction in load of *C. jejuni* (1). Thawing meat on the counter, however, may allow pathogens such as *Campylobacter* to survive and even replicate, thus offsetting the benefit of freezing. The data presented here demonstrate that handling and/or consumption of many of these potentially contaminated foods is not uncommon in this vulnerable population, and it is therefore important that they understand the risks and how to minimize them.

Data from observational studies conducted since the mid-1980s reveal that HIV-infected patients are more likely to present with *Salmonella* species infections, develop *Salmonella* species bacteremia, and have recurring *Salmonella* infections and higher mortality rates (23). Among 1,115 diarrhea episodes in U.S. patients with HIV-infection from 1992 to 2002, 82 (7.4%) had *Salmonella* (28). These data demonstrate the potential vulnerability of AIDS patients, especially those not prescribed, not adherent, or not benefiting from highly active anti-retroviral therapy.

Listeria monocytogenes, another bacterial pathogen that disproportionately affects persons with weakened immune systems, manifests as bacteremia and meningitis, with a case-fatality rate as high as 70% in untreated patients (24). A recent study of nonperinatal patients in Los Angeles County reported a case-fatality rate of 19% (18), and a study of U.S. death certificates demonstrated that listeriosis patients were significantly more likely to have HIV infection (3). This foodborne pathogen, commonly reported in raw dairy products, raw fruits and vegetables, raw foods of animal origin and the environment, has accounted for several outbreaks (7, 16). The incidence of listeriosis in the U.S. is 0.7 cases per 100,000 persons per year (14); however, the incidence among persons with AIDS is estimated at 115 cases per 100,000 persons per year, or 145 times the incidence of listeriosis among the general population (21).

The survey data presented here specifically addressed consumption of the most risky soft cheese, unpasteurized cheese. Twelve percent of these U.S. AIDS patients consumed unpasteurized cheese. A much larger proportion of patients were unaware of the potential risk of disease (such as listeriosis) that could occur from consuming raw vegetables (especially those directly in contact with soil on the farm) or consuming deli meat that has not been reheated. The U.S. FDA recommends for persons with weakened immune systems that hot dogs and luncheon meats should be reheated until steaming hot to decrease the potential risk of listeriosis (33).

Regarding foodborne parasitic disease risk, *Toxoplasma gondii* is the pathogen of greatest concern. In patients with AIDS, toxoplasmosis often involves the brain (26). In the U.S., it is estimated that 16% to 40% of the population are infected (10). Among 225,000 cases of infection with *Toxoplasma gondii*, 50% were foodborne, and the majority of the toxoplasmosis-related deaths occurred in patients infected with HIV (25). The seroprevalence of *Toxoplasma* infection for HIV-infected individuals ranges from 3% to 22% (17, 35). These data suggest that many HIV-infected persons in the U.S. may still be at risk for acquiring new foodborne (and feline-related) *Toxoplasma* infection.

Toxoplasmosis has been reported to follow consumption of raw or undercooked vegetables, pork, mutton, lamb, beef, and mincemeat products (2). Recent U.S. studies found that 18% of lamb and almost 3% of pigs slaughtered for human consumption tested seropositive for *T. gondii* (11, 12, 30) and it has been speculated that organic farming may lead to an increase in pig seroprevalence (9). Nearly 30% of the patients in this survey did not believe that medium rare lamb might make a person with AIDS seriously ill, and approximately 7% either thought it was “okay” or were unsure if it was “okay” to eat a pork chop cooked rare.

A limitation of this study was the use of self-reported rather than confirmed CD4 T-lymphocyte counts as an inclusion criterion. However, because all HIV-infected patients are at potential risk of progression to AIDS, the knowledge of HIV-infected patients without AIDS is still of interest.

AIDS patients are a highly vulnerable population and many lack knowledge of information relevant to the prevention of foodborne diseases. Future research should include improving their knowledge and influencing their behavior to reduce their risk of foodborne disease. Educational materials should be targeted to this population (20) and readily available in English and Spanish. The efficacy of existing educational materials and the extent of their dissemination to this target population is also an area in need of attention, especially given that many of these patients lack the knowledge that is obtainable through a thorough reading and understanding of the information they contained (8, 31, 32). Healthcare providers should incorporate education regarding foodborne disease risk into routine outpatient discussion of improving and maintaining health (31).

TABLE 4. Responses to food safety knowledge, attitudes, and behavior questions that were used to calculate the patient food safety score

<i>QUESTION (CORRECT OR PREFERRED RESPONSE)</i>	<i>% Correct</i>	<i>% Incorrect</i>
<i>QUESTIONS RELATED TO RISKY FOOD CONSUMPTION BEHAVIOR</i>		
“A hamburger is served rare or raw in the center. What would you usually do?” (I would not eat it like that/I would return the food)	96	4
“Scrambled eggs are served loose or runny” (I would not eat it like that)	85	15
“There seems to be something wrong with the taste of the food” (I would not eat it like that)	95	5
“Chicken is served pink in the center” (I would not eat it like that)	98	2
“Is it okay to eat a pork chop that is rare (not completely cooked in the center)?” (Not okay)	94	6
“How often did you eat the following foods?” (Never for each of these foods)		
Raw bean sprouts or alfalfa sprouts	73	27
Raw eggs	80	20
Hamburger that was prepared rare or medium-rare	82	18
Meat that was prepared rare or medium-rare	85	15
Raw fish	91	9
Fresh unpasteurized cheese	88	12
Raw shellfish	90	10
Fresh unpasteurized milk	97	3
<i>QUESTIONS RELATED TO RISKY FOOD CONSUMPTION KNOWLEDGE</i>		
“Is it okay to eat ordinary eggs (not pasteurized eggs) served loose or runny such as soft-scrambled or sunny-side up?” (Not okay)	62	38
“Is it okay to eat store-bought hot dogs (such as those that come in a plastic package) without heating them first?” (Not okay)	73	27
“Is it okay to eat food that requires refrigeration past its expiration date if it does not look or smell bad?” (Not okay)	78	22
“In a person with AIDS, eating which of these following foods may get germs inside your body that could cause hospitalization and possibly death?” (All of these foods are risky for persons with AIDS, especially with very low CD4 T-lymphocyte counts)		
Raw carrots	24	76
Bean sprouts	29	71
Lettuce	31	69
Raw spinach	34	66
Cooked eggs with loose yolks	49	51
Unpasteurized apple cider	49	51
Unpasteurized cheese	60	40
Cold cuts like salami or bologna	39	61
Medium-rare lamb	78	22
Hamburger served medium-rare	80	20
Pork that is not completely cooked	91	9
Fried chicken that is pink in the center	98	2

(continued)

TABLE 4. Responses to food safety knowledge, attitudes, and behavior questions that were used to calculate the patient food safety score (continued)

<i>QUESTION (CORRECT OR PREFERRED RESPONSE)</i>	% Correct	% Incorrect
QUESTIONS RELATED TO RISKY FOOD HANDLING BEHAVIOR		
“Which method of handling watermelon, cantaloupe, papaya, and/or grapes best applies to you?” (I wash the fruit with plain water before cutting or eating it)*	65	35
“Imagine you are making a salad and preparing to cook chicken for the same meal. If a few drops of raw chicken juice are splashed on to the salad, what should be done with the salad?” (Throw away the salad)	60	40
FOOD HANDLING KNOWLEDGE		
“Is it okay to thaw frozen ground meat (hamburger) on the counter?” (Not okay)	78	22
“Imagine this situation: raw chicken is cut up on a cutting board. Next the cutting board is rinsed with warm water, and then fresh fruit is cut on the cutting board.” (Not okay)	70	30
“Cooked and ready-to-eat foods (like salad) should be kept separated from raw meat, poultry, seafood, and their juices.” (Yes)	89	11
“Packaged meat, poultry, or fish should be wrapped in plastic bags to prevent their juices from dripping onto other groceries or onto each other.” (True)	91	9
TIME AND TEMPERATURE KNOWLEDGE/BELIEFS		
“To what temperature should leftovers (like cooked chicken, other cooked meat, or other cooked dishes) be reheated before eating?” (>140°F)	2	98
“Do persons with AIDS need to heat lunch meats even if they are labeled “fully cooked, ready to eat?” (Yes)	50	50
“Do you believe that leftovers (like cooked chicken, other cooked meat, or other cooked dishes) should be reheated before eating?” (Yes)	85	15
“At what temperature should a refrigerator be kept at in order to make sure that food is kept at a safe temperature to prevent germs from growing?” (40°F)	2	98
“Do you assume that your refrigerator is set at a safe temperature?” (No)	3	95**
“Do you believe that relying on the built-in temperature control dial is an effective way of making sure your refrigerator is kept at a safe temperature?” (No)	12	88

* Incorrectly washing any of these fruits (such as not washing the fruit at all before consumption) was considered a wrong answer.

**Two percent of respondents did not own a refrigerator so the total percent of correct and incorrect is 98%

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