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# Public Response to the Contaminated Spinach Recall of 2006



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THE STATE UNIVERSITY  
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## INTRODUCTION

On September 14, 2006, the U.S. Food and Drug Administration (FDA) issued an advisory to consumers not to eat bagged fresh spinach because of suspected contamination by *E. coli* O157:H7<sup>1</sup>. This advisory was based on information provided to the FDA by the Centers for Disease Control and Prevention (CDC) concerning a multi-state foodborne illness outbreak possibly associated with the consumption of fresh spinach. The FDA also informed the public that *E. coli* O157:H7 causes diarrhea, often with bloody stools, and urged those who believed they experienced symptoms of illness after consuming bagged spinach to contact their health care providers.

The following day, the advisory was expanded to include all fresh spinach because the FDA had been informed that bagged spinach was sometimes sold in an un-bagged form at the retail level<sup>2</sup>. Simultaneously, a series of voluntary recalls of fresh spinach began nationwide, as stores and restaurants quickly removed fresh spinach from their shelves and menus. By then, however, some of the contaminated spinach had already been consumed, with most people having already become ill between August 19 and September 5, 2006<sup>3</sup>. As the investigation continued, the focus narrowed to products from Natural Selection Foods, LLC, of San Juan Bautista, California, with "Best if Used by Dates" of August 17, 2006 through October 1, 2006<sup>4</sup>.

On September 20, the FDA issued an updated press release, advising consumers to continue to avoid consuming fresh spinach or products containing fresh spinach. They added however, that it was safe to eat frozen spinach, canned spinach and spinach included in pre-made meals manufactured by food companies<sup>5</sup>. The following day, the FDA issued a statement that they, working closely with the CDC and the State of California, had determined that the spinach implicated in the outbreak had been grown in Monterey, San Benito, and Santa Clara counties in California. The FDA was cautious in stating that produce other than spinach grown in these counties had not been implicated in the outbreak<sup>6</sup>, however, the advisory against eating spinach was still in effect.

Finally, on September 22, the FDA advised the public that they could be confident in consuming spinach grown outside the three counties in California that had been implicated in the outbreak. They added that "industry is working to get spinach from areas not implicated in the current *E. coli* O157:H7 outbreak back on the market<sup>7</sup>"; suggesting that the incident was over. However, as late as October 6, the FDA continued to remind retailers, food service operators and consumers that they should not sell or consume raw spinach or blends that might contain spinach that were "the subject of the earlier recalls<sup>8</sup>."

Ultimately, nearly 200 people in 26 states were reported to the CDC as having potentially been infected with the outbreak strain of *E. coli* O157:H7<sup>9</sup>. More than 100 of these cases were hospitalized, and 31 developed a form of kidney failure called hemolytic uremic syndrome (HUS). This resulted in the deaths of three people (two elderly women and a two-year old boy) in confirmed cases of infection believed to be associated with the outbreak.

Due to the nature, scope, and significance of this contamination incident, and the potential lessons that might be learned from it, the Food Policy Institute (FPI) at Rutgers, the State University of New Jersey undertook an analysis of the information that key actors attempted to deliver as events unfolded, the media coverage of those messages and events, and the information that consumers received, remembered, and acted upon<sup>10</sup>. This report focuses on the third portion of this analysis; that is, what did consumers know, where did they get that information, and what did they do in response to the advisories issued by the FDA warning them not to eat fresh spinach.

## METHODS

### Sample

A nationally representative sample of 1,200 Americans from all 50 states was interviewed by telephone during November 8-29, 2006. Computer Assisted Telephone Interviews (CATI) were conducted with non-institutionalized adults aged 18 or over. Proportional random digit dialing was used to select survey participant households and the CATI system was programmed to provide prompts to select the appropriate proportions of male and female participants. Working non-business numbers were contacted using a 12 call-back design. The cooperation rate was 48%, with a resulting sampling error of  $\pm 2.8\%$ . Data were weighted by gender, age, race, ethnicity, and education to approximate U.S. Census figures.

### Survey Instrument

For convenience in referring to the period of time and the events associated with the contamination of fresh spinach with *E. coli* O157:H7 and the subsequent foodborne illness outbreak, we used the term “spinach recall” in the survey instrument, and adopted the same convention for this report. This is consistent with the terminology used in much of the media coverage that occurred during the period of interest, and as the results below suggest, was familiar to most of our respondents.

Some questions were tailored to respondents depending on whether they had heard about the spinach recall. For example, respondents who had heard about the spinach recall were asked “Did you eat spinach before the recall?” while consumers who were unaware of the recall were simply asked “Do you eat spinach?”

# RESULTS

## Demographics

The demographic make-up of the sample is presented in Table 1. The data are presented in their unweighted and weighted form. Unless otherwise noted, all other data presented in this report are weighted to be nationally representative.

**Table 1. Sample demographics**

	Unweighted %	Weighted %
<b>Sex</b>		
Women	57%	52%
Men	43%	49%
<b>Age</b>		
18-34	21%	31%
35-44	19%	21%
45-54	24%	18%
55-64	18%	12%
65 & over	19%	17%
<b>Ethnicity</b>		
White	79%	74%
Black	11%	11%
Other	8%	13%
Refused/Don't know	2%	2%
<b>Education</b>		
High school or less	36%	47%
Some college	25%	27%
4 year college degree	21%	15%
Graduate school	16%	10%
Refused/Don't know	2%	2%
<b>Income</b>		
Under \$35,000	26%	30%
\$35,001 - \$50,000	12%	14%
\$50,001 - \$75,000	22%	20%
\$75,001 & over	23%	20%
Refused/Don't know	17%	16%

Note. Totals may not add to 100% due to rounding.

## ***PRIOR TO THE SPINACH RECALL***

### **Almost half of all Americans ate spinach prior to the recall**

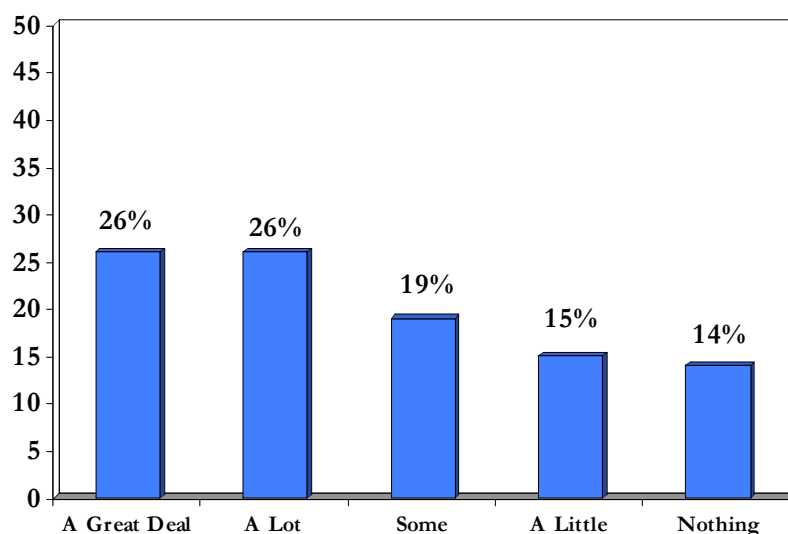
Nearly half of Americans (48%) report that they ate fresh spinach before the recall and most also did so relatively frequently. More than one-in-five (22%) of those who said they ate fresh spinach reported that they did so “a few times a week,” 18% did so “once a week,” 29% “a few times a month,” and 14% reported eating spinach “once a month.” The remainder said they ate fresh spinach ‘a few times a year’ (14%), ‘less than a few times a year’ (2%) or ‘only a few times in their life’ (1%). Thus, most (83%) of those who ate spinach before the recall did so at least once a month, and 40% did so at least once a week. Americans with more education ( $B= 1.49$ ;  $CI=1.33, 1.67$ ) or higher incomes ( $B= 1.11$ ;  $CI=1.05, 1.19$ ) were more likely to report having eaten fresh spinach before the recall than those with less education or lower incomes. However, there were no significant differences in age, race, or gender between those who reported that they did and did not eat spinach before the recall.

## ***DURING THE RECALL***

### **Americans’ awareness of the spinach recall was high**

The majority of Americans (87%) reported they were aware of the spinach recall. More than half (56%) of Americans knew that there had been a recent food recall and were able to volunteer that it had been a recall involving spinach. An additional one-third (31%) reported being aware of the spinach recall when asked specifically if they had heard about it. Only 13% of Americans said they were unaware of the spinach recall when asked specifically about it. Moreover, as shown in Figure 1, more than half (52%) of Americans report having heard “a lot” or “a great deal” about the spinach recall and 86% report having heard at least “a little” about it.

**Figure 1. How much Americans heard or read about the spinach recall**



Note. N= 1,200. Those who had heard “nothing” include those who reported being unaware of the recall.



## Americans wanted to know how the contamination happened, what was affected, and when it would be safe to eat spinach again

Those who were aware of the recall were asked what questions they had when they first heard about it. The responses to this open-ended question were then categorized based on content. Table 2 shows that 446 respondents (43%) of those who had heard of the recall volunteered one or more responses and that the majority of their questions focused on how the contamination happened, what products had been affected, and when the problem might end.

**Table 2. What Americans wanted to know when they first heard about the spinach recall**

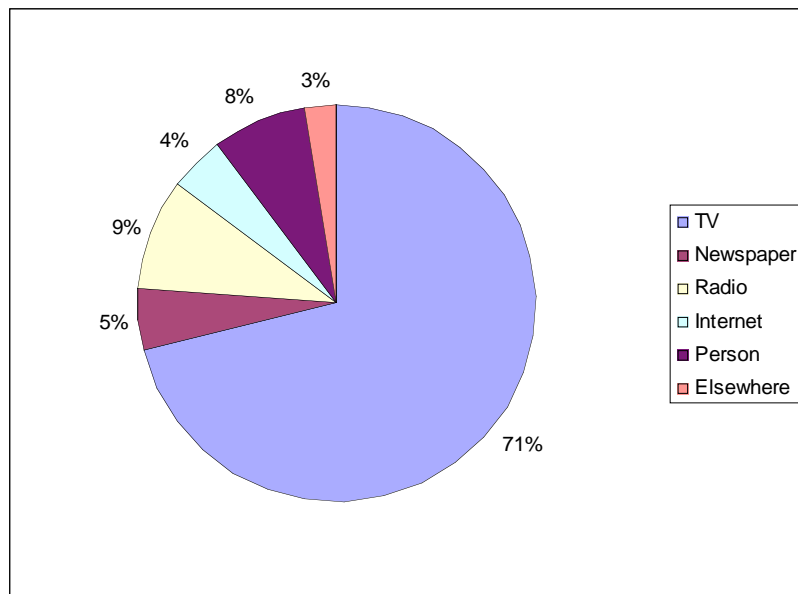
Topic of question	% of all questions
<b>What caused the problem?</b>	<b>39%</b>
What caused the contamination?	26%
Where did the contamination originate?	12%
Other source of contamination questions	1%
<b>What was affected?</b>	<b>38%</b>
Was frozen spinach contaminated?	3%
Was canned spinach contaminated?	2%
Was fresh spinach contaminated?	1%
Was packaged spinach contaminated?	2%
Was organic spinach contaminated?	<1%
Which brands/effective dates did it affect?	10%
What other foods are affected?	2%
Where was the spinach being sold?	9%
Was the spinach that I purchased affected?	5%
Was the spinach that I had eaten affected?	3%
Other product(s) affected questions	1%
<b>Health/Safety Questions:</b>	<b>8%</b>
What are the symptoms of illness?	3%
Does washing eliminate contamination?	<1%
Does cooking eliminate contamination?	<1%
A/O health/safety mentions	4%
<b>When will the problem be over?</b>	<b>5%</b>
When will spinach be safe to eat?	5%
<b>Other questions:</b>	
Can this be prevented from happening again?	3%
Why didn't we receive more timely information?	3%
Other miscellaneous questions	5%

Note. 586 total responses; 446 respondents gave one or more responses.

## Most Americans first learned about the spinach recall from reports on TV

Nearly three-quarters (71%) of those aware of the recall reported that they first learned about it through television broadcasts (see Figure 2). Eight percent reported that they first heard about the recall from another person. The remainder said that they first learned about the recall from the radio, or through the newspaper or Internet.

**Figure 2. Where Americans first heard about the spinach recall**



Note. N=1,027

## The spinach recall was on Americans' agenda of things to talk about

While only a small portion of the population *first* heard about the recall from someone else, almost everyone who was aware of the spinach recall did eventually speak about it with others. More than eight-in-ten (84%) respondents who were aware of the recall said they talked with others about it. Nearly one-third (31%) reported they spoke with others about the recall “frequently” or “occasionally.” One-quarter (25%) reported they had discussed the recall “a few times” and 29% said they did so “once or twice.” Only 16% reported having never discussed the spinach recall with someone else.

## Most Americans were interested in stories about the recall, but passive consumers of information about it

Consistent with the finding that most Americans reported having first heard about the recall through reports on television, the majority of Americans appear to have been somewhat passive consumers of information on the topic. Overall, most people (59%) indicated that they had been interested in stories about the spinach recall. But, when asked about active types of information seeking, only 44% of Americans agreed that they had “closely followed news stories about the spinach recall,” 23% agreed that they had “watched the news specifically to hear about the recall,” and 12% agreed that they had “searched on the Internet to find more information about the spinach recall.”

It is not surprising, perhaps, that those who said that they ate fresh spinach before the recall were significantly more interested in and active seekers of information about the recall. Significantly more of those who ate spinach (73%) were interested in recall stories than those who did not eat spinach before the recall (44%;  $\chi^2(1, N = 1034) = 25.72, p < 0.001$ ). More than half (52%) of those who ate fresh spinach before the recall said that they had closely followed the news stories about the recall vs. only one-third (36%) of those who had not eaten spinach ( $\chi^2(1, N = 1019) = 92.30, p < 0.001$ ). Significantly more of those who ate spinach before the recall (14%) than those who had not eaten spinach (9%) reported that they had searched the Internet to find information about the recall ( $\chi^2(1, N = 1037) = 7.07, p < 0.01$ ). However, there were no significant differences in the percentage of people who reported having watched the news to specifically hear about the recall.

### Americans were not sure about the types of spinach contaminated

While it is clear that the majority of Americans had heard about the recall, and reported they had heard a fair amount about it, their knowledge of many of the details of the recall was significantly less robust.

One of the key messages during the spinach recall was that consumers should not eat any fresh spinach, whether sold loose or in a bag. However, neither frozen nor canned spinach were suspected of having been contaminated and were considered safe for consumers to eat. To test the extent to which consumers paid attention to these messages, respondents who were aware of the recall were asked a series of true/false questions about whether each of four types of spinach had been recalled (see Table 3).

**Table 3. Americans' knowledge of types of spinach recalled**

Type of Spinach	“True” (was recalled)	“False” (was not recalled)	“Don’t know”
<b>Recalled:</b>			
Bagged fresh	95%	1%	4%
Loose fresh	68%	16%	16%
<b>Not Recalled:</b>			
Frozen	22%	57%	21%
Canned	16%	70%	14%

**Note.** N=1,029; shaded boxes indicate correct answers

Nearly all (95%) the respondents correctly reported that it was true that “bagged fresh spinach” had been recalled. However, when asked whether other types of spinach had been recalled, the percentage of incorrect and “don’t know” responses increased substantially. For example, only two-thirds (68%) knew that “loose fresh spinach” had been recalled. There is variability in the frequency of “don’t know” responses, ranging from the 3% for bagged spinach to as high as 21% for frozen spinach. Thus, not only were a significant portion of Americans wrong about what was recalled, an almost equally sizeable portion did not know whether certain types of spinach were recalled.

### **Additional details of the recall were not as well known**

By September 20, 2006, the FDA had confirmed that the contaminated spinach had been grown in three counties in the Salinas Valley in California. On September 22, the FDA began advising consumers that it was safe to eat fresh spinach grown outside of these three counties. Yet, when asked where the contaminated spinach was grown, only slightly more than half (52%) of the respondents who were aware of the spinach recall correctly reported that the contaminated spinach had been grown in California. About four-in-ten (41%) reported that they didn't know where the contaminated spinach had been grown. About five percent reported that the contaminated spinach had been grown in states other than California, or in both California and other states and 2% provided other responses.

Every press release from both the FDA and the CDC, as well as most news stories concerning the spinach contamination and the resulting illnesses specifically named *E. coli* as the contaminant involved. Despite this, only about half (52%) of the respondents who said they were aware of the recall were able to correctly volunteer that *E. coli* was the contaminant that caused people to become ill. Most who did not say *E. coli* reported that they did not know (31%). There were a small number of incorrect responses, such as *Salmonella* (4%), animal waste (4%), or other general sources of exposure such as “a bacteria” (2%) or “a chemical” (1%).

### **Many Americans thought that washing contaminated produce would make it safe to eat**

In their September 15, 2006 update on the outbreak of *E. coli* O157:H7 infections from fresh spinach, the CDC provided general advice to consumers that they should “wash produce with clean cool running water just before eating and cut away damaged areas.” However, they also noted that “bacteria stick to produce even when it is washed, and sometimes the bacteria are inside the produce<sup>11</sup>.” In addition, Robert Brackett, Director of the FDA's Center for Food Safety and Nutrition (CFSAN), was widely quoted advising consumers to discard any spinach they had already purchased, noting that simply washing the spinach would not make it safe to eat.

Perhaps it was because of this contradictory advice, or because washing food is so often a recommended action for food safety<sup>12</sup> that there was some confusion about the role of washing in eliminating possible contaminants. Yet, whether they had heard of the recall or not, 44% of Americans thought it true that properly washing contaminated food makes food safe to eat, and nearly half (48%) reported that the spinach recall caused them to wash their food more thoroughly. However, 64% recognized that the statement, “bagged spinach marked as ‘Triple washed’ is certain not to have any *E. coli*” is untrue.

### **Most Americans were confused about the symptoms of infection with *E. coli* O157:H7**

In its Health Alert on September 14, 2006, the CDC noted that “the *E. coli* O157:H7 bacterium causes diarrhea that is often bloody and accompanied by abdominal cramps, but fever is absent or mild<sup>13</sup>.” The majority (87%) of Americans correctly recognized that cramping (or abdominal cramps) are a common symptom of *E. coli* infection (see Table 4). However, although according

to the CDC, bloody diarrhea is the distinguishing characteristic of *E. coli* O157:H7 infections, only about two-thirds (64%) of Americans correctly recognize this as a symptom. Instead, Americans are more likely to incorrectly associate the symptoms of nausea (88%) and vomiting (87%) with an *E. coli* O157:H7 infection. Moreover, though not generally associated with *E. coli* O157:H7 infections, more than three-quarters (77%) of Americans identified fever as a symptom, and nearly one-quarter (22%) reported that rashes were a symptom despite the fact that they are not commonly associated with any foodborne illness.

**Table 4. Percentage identifying symptoms as resulting from *E. coli* infection**

Symptom	Percentage
Nausea	88%
Vomiting	87%
Cramping	87%
Fever	77%
Bloody diarrhea	64%
Rash	22%

**Note.** Shaded boxes indicate common symptoms identified by the CDC.

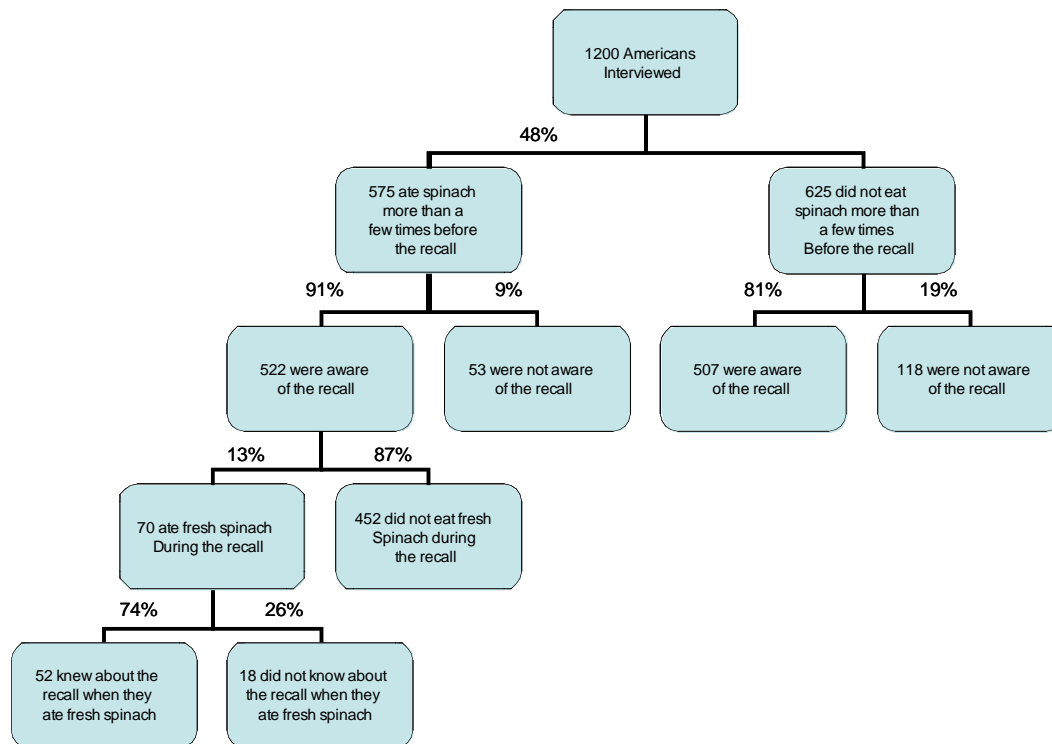
### **Some Americans chose to eat fresh spinach despite the recall**

One of the key messages promoted by the FDA between September 14 and 22, 2006 was that all fresh spinach should be discarded. Yet, only 64% of those who were aware of the recall said that they had heard that “during the recall, no fresh spinach was considered safe to eat.”

Of particular concern from a public health perspective is that more than one-in-eight Americans (13%) who were aware of the recall and ate spinach prior to the recall report having eaten fresh spinach *during* the recall. Moreover, nearly three-quarters of these (74%) said that they knew about the recall when they ate it (see Figure 3).

Nearly one-third (30%) of those who eat spinach and were aware of the recall say that they had fresh spinach in their homes when they first learned about it. While more than three quarters (77%) reported ultimately discarding the spinach once they learned about the recall, more than one-quarter (27%) say they consumed some or all of the spinach they had at home and 72% of these say they knew about the recall at the time they ate it.

**Figure 3. Classification of sample by awareness of recall and eating spinach prior to and during the recall**



### **Effects of spinach recall went beyond spinach to other produce**

Americans appear to have generalized their concern about spinach to other, similar produce. Nearly one-fifth (18%) of those aware of the recall said they stopped buying *other bagged produce* because of the spinach recall. Notably, an equal proportion of those who did and did not eat spinach before the recall stopped buying other bagged produce. As such, the spinach recall had an impact not just on the sales of spinach, but on the sales of other produce as well. It also suggests that the recall had an effect on both those who ate spinach and those who did not.

### ***AFTER THE RECALL***

#### **Many Americans were unsure whether the recall was still in effect as of November, 2006**

More than six weeks after the FDA had issued its statement on September 22, 2006, advising consumers that they could be confident in eating spinach grown outside the three counties in California that had been implicated in the *E. coli* contamination, more than one-tenth (13%) reported incorrectly that “the spinach recall is still in effect” (7% said this was definitely “true” and 6% said it was “likely true”) and nearly one-fifth (18%) said they were not sure. About half

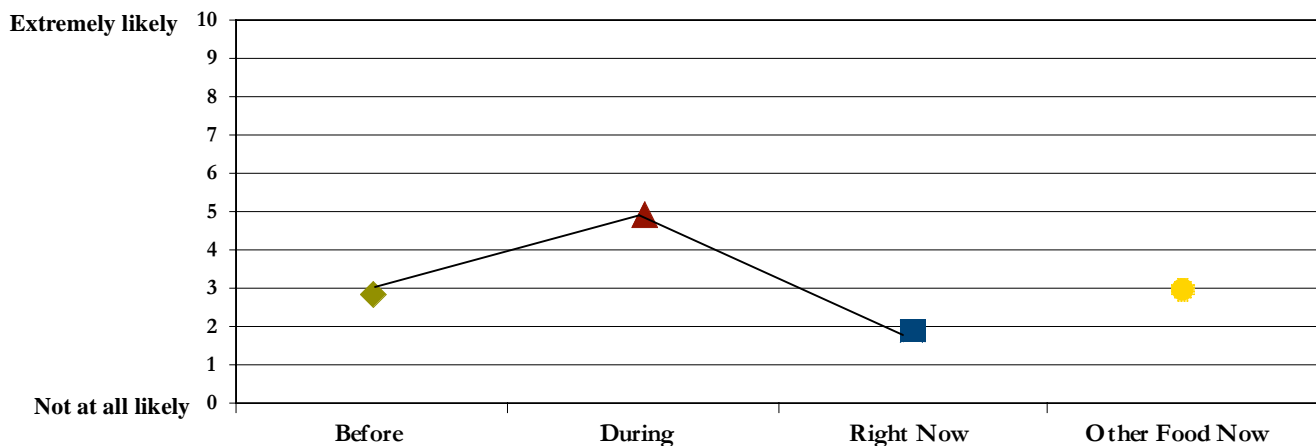
(55%) said that it was definitely “false” that the spinach recall was still in effect and 14% said that it was “likely false.”

This indicates that, at the time the survey was conducted, almost half of people who were aware of the spinach recall (45%) were not confident that the recall had ended.

### Many Americans think they are less likely to get sick from eating spinach now than before the recall

To examine perceptions of the threat of contracting a foodborne illness, respondents were asked to rate the likelihood of becoming infected from eating “uncooked fresh spinach” and “a food other than spinach” using a semantic differential scale where 0 represented “not at all likely” and 10 represented “extremely likely.” As represented in Figure 4, respondents who were aware of the recall, reported their likelihood of infection from eating fresh spinach *before* the recall to be relatively low ( $M= 2.86, SD= 2.94$ ). Not surprisingly, respondents reported their likelihood of infection from eating fresh spinach *during* the recall ( $M= 5.09, SD= 3.24$ ) to be significantly higher than before the recall ( $t(954)= -21.71, p<0.001$ ).

Figure 4. Perceived likelihood of getting sick from consuming spinach



Respondents reported their likelihood of becoming infected at the time of the interview ( $M= 1.92, SD= 2.59$ ) as significantly lower on average than during the recall ( $t(965)= 28.32, p<0.001$ ). Notably however, respondents reported their likelihood of infection at the time of the interview as also significantly lower than their estimates of likelihood of infection from eating fresh spinach *prior* to the recall ( $t(953)= 8.88, p<0.001$ ). Further, the participants reported their likelihood of infection from eating a food *other* than spinach at the time of the interview to be low ( $M= 2.95, SD= 2.81$ ). Thus, respondents’ current estimates of their likelihood of infection from eating a food other than spinach are nearly equivalent to their estimates of the likelihood of infection from eating spinach *prior* to the recall, but significantly higher than the likelihood associated with eating spinach now ( $t(956)= -9.64, p<0.001$ ).

### Most Americans say they have or will eat fresh spinach again

More than four-in-ten respondents (44%) who had heard about the recall and ate spinach say they have eaten spinach since the recall ended (see Table 5). These respondents reported that it took approximately two weeks after the recall ended for them to resume eating ( $M= 14.50$  days,  $SD= 12.01$ ;  $Mdn= 14.00$ ). Those who had not yet eaten spinach since the recall said it will take an average of about two months for them to start eating fresh spinach again ( $M= 56.98$  days,  $SD= 74.81$ ;  $Mdn= 30.00$ ) and their estimates ranged from one day to one year. Only 5% of those who ate spinach and heard about the recall say they will never eat fresh spinach again.

**Table 5. Likelihood of eating spinach as of November, 2006**

	Percentage
Have already eaten spinach	44%
Definitely will eat spinach in the future	20%
Likely to eat spinach in future	13%
As likely as not to eat spinach in future	10%
Unlikely to eat spinach in future	5%
Definitely will not eat spinach in future	5%
Don't know if or when they will eat spinach in the future	3%

Note. N = 494.

### Demographics related to who is eating spinach after the recall

There are important demographic differences among those people who had already begun eating spinach again as of November and those who had not. As shown in Table 6, among those who were aware of the recall and ate spinach prior to the recall, older people ( $\chi^2(4, N = 502)=14.99$ ;  $p<.005$ ) and those with lower incomes ( $\chi^2(3, N = 430)=20.53$ ;  $p<.001$ ) were *less* likely to have eaten spinach since the recall ended. Conversely, whites were *more* likely to have eaten spinach since the end of the recall ( $\chi^2(2, N = 487)=8.65$ ;  $p<.05$ ). Education and sex were not related to eating spinach after the recall.



**Table 6. Whether respondents have eaten spinach at time of survey by demographic variables**

	As of November, 2006	
	Have eaten spinach	Have not eaten spinach
<b>Age***</b>		
18-34	44%	56%
35-44	46%	54%
45-54	55%	45%
55-64	44%	56%
65 & over	27%	73%
<b>Education</b>		
High school or less	37%	63%
Some college	34%	66%
4 year college degree	45%	55%
Graduate school	42%	58%
<b>Ethnicity***</b>		
White	47%	53%
Black	25%	75%
Other	33%	67%
<b>Income***</b>		
Under \$35,000	27%	73%
\$35,001 - \$50,000	43%	57%
\$50,001 - \$75,000	51%	49%
\$75,001 & over	54%	46%
<b>Sex</b>		
Women	43%	58%
Men	45%	55%

Note. Includes only participants who ate spinach prior to the recall and had heard of the recall.

\*\*\* Represents significant differences on that demographic variable between those who have and have not eaten spinach.

### Additional factors related to who has eaten spinach after the recall

In addition to the demographic variables, two other variables are strongly related to eating spinach after the recall. Those people who ate spinach more frequently prior to the recall were more likely to report having eaten spinach since the recall ended ( $\chi^2(12, N = 525)=33.90$ ;  $p<.001$ ) (see Table 7). Not surprisingly, those Americans who were able to identify the recall as being over were significantly more likely to have eaten spinach since the recall ( $\chi^2(2, N = 513)=39.6, p<.0001$ ).

**Table 7. Whether respondents have eaten spinach at time of survey by frequency of eating spinach prior to the recall and awareness that the recall has ended**

	As of November, 2006	
	Have eaten spinach	Have not eaten spinach
<b>Frequency of eating spinach prior***</b>		
A few times a week	53%	47%
Once a week	55%	45%
A few times a month	49%	51%
Once a month	34%	66%
A few times a year	20%	80%
Less than a few times a year	0%	100%
<b>Awareness of recall having ended***</b>		
Believe that recall ended	51%	49%
Believe that recall has <i>not</i> ended	18%	82%
Don't know if recall has ended	19%	81%

Note. Includes only participants who ate spinach prior to the recall and had heard of the recall.

\*\*\* Represents significant differences on that variable between those who have and have not eaten spinach.

### Some Americans say they will avoid specific brands of spinach and spinach grown in particular regions of the country

While many Americans are clearly hesitant about eating spinach again, the results indicate that some may eat spinach more selectively in the future. As part of the recall, consumers were advised to discard packages of specific brands of spinach suspected of containing contaminated product, and investigations revealed that the contaminated spinach was grown in California. When respondents who eat spinach and were aware of the recall were asked if they would avoid specific brands of spinach, 15% said that they would. Similarly, 19% reported that they would avoid spinach grown in particular areas of the country.

## CONCLUSIONS

The results of the survey show that the FDA's main message to consumers warning that bagged fresh spinach had been contaminated and should not be eaten was heard by most Americans. Moreover, the data clearly indicate that the majority of consumers *did* stop eating spinach during the recall. As a result, the main public health goal of the recall was met.

However, fewer Americans were aware of important details related to the recall. Many were confused about the types of spinach affected, the organism that caused the contamination, the symptoms of the resulting illness, and perhaps most significantly, whether or not the recall had ended. As a result, the data suggest that there were also some unintended consequences of the recall.

While most consumers stopped eating spinach as a result of the recall, the data show that many stopped buying other bagged produce as well. This is reflected in the decline in sales of spinach and other produce reported by industry<sup>14</sup>. However, our data are likely to underestimate the full effect of the recall on produce sales. All of the respondents to the survey were interviewed by November 29, 2006. Soon after, on December 6, 2006, the FDA announced that it was investigating *E. coli* O157:H7 infections associated with multiple Taco Bell restaurants in four states<sup>15</sup>. This outbreak sickened 71 people, resulting in the hospitalization of 53, and in 8 cases of hemolytic uremic syndrome by the time it was considered over on December 14, 2006<sup>16</sup>. Green onions contaminated with *E. coli* were originally suspected as the cause of the outbreak, and were voluntarily recalled from Taco Bell restaurants; however, the FDA narrowed its investigation by focusing its efforts on finding the sources of shredded iceberg lettuce served at the restaurants<sup>17</sup>.

The result of two serious, widely publicized *E. coli* contamination incidents occurring in rapid succession has likely amplified consumer awareness and concerns about the safety of eating fresh produce. In part, this may be due to a violation of consumer expectations regarding foods such as spinach and lettuce that have typically been viewed as healthy, and are often eaten as a way of maintaining one's personal well-being. In addition, because these types of produce are often eaten in a raw form, consumers have little ability to make the products safer once they have been purchased. Indeed, the one post-purchase action consumers can take, thoroughly washing produce, was dismissed as ineffective in the case of the spinach contamination.

Most food product recalls are limited in scope and are normally issued to recover the products of a single manufacturer or distributor, and are often restricted to the food manufactured or processed at a single location, to specific lot numbers, and distributed within a circumscribed area<sup>18</sup>. Thus, the broad nature of the recall, suggesting that *all* fresh spinach across the country should be considered as potentially contaminated and therefore unsafe to eat, combined with a message that no amount of washing would make it safe, distinguished it from the more routine advisories and notice of recalls typically issued by the FDA.

The unusual nature of the spinach recall, suggesting that *anyone* who ate fresh spinach was vulnerable to becoming ill, that there was little that consumers could do to avoid getting sick

other than to stop eating it, and the potentially serious consequences of being infected with *E. coli* O157:H7 likely lead to both the extensive media coverage it received and to the large number of conversations Americans report having had about it.

In addition, there remains considerable ambiguity concerning the vector responsible for the presence of the *E. coli* on the contaminated spinach. Although a genetic match for the particular strain of *E. coli* O157:H7 responsible for making some people sick was found in samples taken from a stream and from feces of cattle and wild pigs present on ranches implicated in the outbreak<sup>19</sup>, it is unlikely that investigations will ever reveal the exact mechanism by which the spinach was contaminated and speculations about its cause continue. The fact that a definitive cause of the outbreak has not been definitively identified or remediated may help to explain the reluctance of some consumers to resume eating spinach or other produce grown in the same way, or in the same geographic areas as the contaminated spinach. For some consumers, the spinach recall may be a type of “signal event” indicating a wider problem that they do not yet see as having been solved.

This may have been reinforced by the lack of a definitive statement by the government indicating that spinach was now “safe” to eat. Instead, the FDA issued a press release on September 22, 2006 indicating that “the public can be confident that spinach grown in the non-implicated areas can be consumed<sup>20</sup>.” This also likely generated much less press coverage than the original press releases warning consumers that they should not eat any fresh spinach.

Whether due to a lack of a definitive statement, lack of press coverage, or lack of attention by consumers, it is clear that many Americans did not get or believe the message that spinach is now safe to eat. As of November 2006, nearly half of those who had heard about the spinach recall were not completely confident that it had ended. In addition, only a little more than half thought it definitely true that authorities had declared that fresh spinach available in supermarkets “safe to eat.”

The ambiguity regarding the end of the recall and lack of closure to the incident may explain why, though most people say they will go back to eating spinach, many said that they would wait an average of two months before doing so. In part, this waiting period would likely be used by consumers to make sure that the contamination problem was truly over. The *E. coli* O157:H7 infections associated with Taco Bell restaurants occurred during this “wait and see” period likely reinforced some consumers’ beliefs that contamination problems involving produce had not yet been resolved. The fact that produce sales have not yet recovered following these outbreaks supports this speculation<sup>21</sup>.

Finally, while purposeful contamination was not suspected in this incident, it may be possible to draw some applicable lessons. Since the probable goal of intentional contamination is to create maximum uncertainty about the safety of the food supply, had the spinach been purposefully adulterated, the ambiguity surrounding the cause, scope, and impacts of the contamination would likely have been significantly greater. Moreover, without apprehending the perpetrators accompanied by definitive information and action designed to prevent further contamination by others, it might not be possible for the government to give an “all clear” signal that would be accepted by consumers. In the absence of such a definitive signal, consumers would likely

continue to mistrust the safety of the product and would likely generalize their concerns to other products. Moreover, the length of the “wait and see” period imposed by consumers concerned with the safety of these products would likely be considerably longer.

## ENDNOTES

<sup>1</sup> Food and Drug Administration (September 14, 2006). FDA Warning on Serious Foodborne *E. coli* O157:H7. Outbreak: One Death and Multiple Hospitalizations in Several States. <http://www.fda.gov/bbs/topics/NEWS/2006/NEW01450.html>

<sup>2</sup> Bracket, R. E. (November 15, 2006). Statement of Robert E. Brackett, Ph.D. Director, Center for Food Safety and Applied Nutrition, Food and Drug Administration, before the Committee on Health, Education, Labor and Pensions, United States Senate. <http://www.fda.gov/ola/2006/foodsafety1115.html>

<sup>3</sup> Centers for Disease Control and Prevention (October 6, 2006). Update on Multi-State Outbreak of *E. coli* O157:H7 Infections from Fresh Spinach, October 6, 2006. <http://www.cdc.gov/ecoli/2006/september/updates/100606.htm>

<sup>4</sup> Food and Drug Administration (September 15, 2006). FDA Statement on Foodborne *E. coli* O157:H7 Outbreak in Spinach. <http://www.fda.gov/bbs/topics/NEWS/2006/NEW01451.html>

<sup>5</sup> Food and Drug Administration (September 20, 2006). FDA Statement on Foodborne *E. coli* O157:H7 Outbreak in Spinach. <http://www.fda.gov/bbs/topics/NEWS/2006/NEW01459.html>

<sup>6</sup> Food and Drug Administration (September 21, 2006). FDA Statement on Foodborne *E. coli* O157:H7 Outbreak in Spinach. <http://www.fda.gov/bbs/topics/NEWS/2006/NEW01460.html>

<sup>7</sup> Food and Drug Administration (September 22, 2006). FDA Statement on Foodborne *E. coli* O157:H7 Outbreak in Spinach. <http://www.fda.gov/bbs/topics/NEWS/2006/NEW01462.html>

<sup>8</sup> Food and Drug Administration (October 6, 2006). FDA Statement on Foodborne *E. coli* O157:H7 Outbreak in Spinach. <http://www.fda.gov/bbs/topics/NEWS/2006/NEW01486.html>

<sup>9</sup> *Ibid*

<sup>10</sup> The research described herein was supported by a grant provided to the Rutgers Food Policy Institute by the Cooperative State Research, Education, and Extension Service (CSREES) of the United States Department of Agriculture (USDA) under the National Integrated Food Safety Initiative (NIFSI) grant # 2005-51110-02335 "Food Biosecurity: Modeling the Health, Economic Social, and Psychological Consequences of Intentional and Unintentional Food Contamination," Dr. William K. Hallman, Principal Investigator. The opinions expressed in the article are those of the authors and do not necessarily reflect official positions or policies of the USDA, or of the Food Policy Institute, Rutgers University.

<sup>11</sup> Centers for Disease Control and Prevention (September 15, 2006). Update on Multi-State Outbreak of *E. coli* O157:H7 Infections from Fresh Spinach, September 15, 2006.

<sup>12</sup> Food and Drug Administration (retrieved on February 4, 2007). Preparation tips for fresh produce. (<http://www.cfsan.fda.gov/~dms/prodsafe.html#prep>)

<sup>13</sup> CDC (September 14, 2006) Multiple States Investigating a Large Outbreak of *E. coli* O157:H7 Infections. <http://www2a.cdc.gov/HAN/ArchiveSys/ViewMsgV.asp?AlertNum=00249>

<sup>14</sup> Julie Schmit (January 29, 2007). *E. coli*'s long gone, but spinach sales are still hurting. USA Today. [http://www.usatoday.com/money/industries/food/2007-01-29-spinach-usat\\_x.htm](http://www.usatoday.com/money/industries/food/2007-01-29-spinach-usat_x.htm)

<sup>15</sup> Food and Drug Administration (December 6, 2006). FDA Investigating *E. Coli* O157 Infections Associated with Taco Bell Restaurants in Northeast. <http://www.fda.gov/bbs/topics/NEWS/2006/NEW01517.html>

<sup>16</sup> Food and Drug Administration (December 14, 2006). UPDATE: *E. coli* O157:H7 Outbreak at Taco Bell Restaurants Likely Over; FDA Traceback Investigation Continues. <http://www.fda.gov/bbs/topics/NEWS/2006/NEW01527.html>

<sup>17</sup> Food and Drug Administration (December 14, 2006). UPDATE: *E. coli* O157:H7 Outbreak at Taco Bell Restaurants Likely Over; FDA Traceback Investigation Continues. <http://www.fda.gov/bbs/topics/NEWS/2006/NEW01527.html>

<sup>18</sup> United States Government Accountability Office (2004). Food Safety: USDA and FDA Need to Better Ensure Prompt and Complete Recalls of Potentially Unsafe Food. GAO-05-51 <http://www.gao.gov/new.items/d0551.pdf>

<sup>19</sup> Bracket, R. E. (November 15, 2006). Statement of Robert E. Brackett, Ph.D. Director, Center for Food Safety and Applied Nutrition, Food and Drug Administration, before the Committee on Health, Education, Labor and Pensions, United States Senate. <http://www.fda.gov/ola/2006/foodsafety1115.html>

<sup>20</sup> Food and Drug Administration (September 22, 2006). FDA Statement on Foodborne *E. coli* O157:H7 Outbreak in Spinach. <http://www.fda.gov/bbs/topics/NEWS/2006/NEW01462.html>