SOCIAL NETWORKING AS A STRATEGY FOR IMPROVING FOOD SAFETY: A PILOT STUDY

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ABSTRACT

The FDA [Food and Drug Administration], America's consumer watchdog for food safety, needs a more effective means of communicating with all participants from food sources to consumers. This paper presents a pilot study using responses from an online survey to explore the feasibility of using social media to enhance the current food safety system in the U.S. While more research is needed, the results suggest that, although the primary users of social media are young and well-educated adults, social media networking can play an important role in the rapid dissemination of food recall notices and other preventive information in a message form that is more likely to be read or heard. Thus, the FDA should consider social media as an important tool in increasing the effectiveness of its overall strategy.

Key Words: social network; social media; food safety; food recall

INTRODUCTION

The purpose of this pilot study was to determine whether food regulatory agencies such as the U. S. Food and Drug Administration (FDA) and the Food Safety and Inspection Service (FSIS) should adopt a strategy of using social networks to enhance the current food safety system. Research into organizational use of social networks is emerging (Carpenter, Li, & Jiang, 2012; Gulati, Nohria, & Zaheer, 2000; Rangan, 2000), but its strategic use by public organizations has not yet been studied (Mahon, Heugens, & Lamertz, 2004).

BACKGROUND

Food Safety and Public Policy

"The FDA is supposed to be a watchdog for consumers, and for too long,

this agency has been coming up short," said Jean Halloran, Director of Food Policy Initiatives at Consumers Union (Consumers Union, 2013). Corporations supplying processed foods in the United States are unable to guarantee the safety of their ingredients. Many do not even know who is supplying their ingredients, let alone if those suppliers are screening for microbes and other potential dangers (Moss, 2009).

Currently, the strategic focus of public policy regarding food safety is "control" (e. g., preventive control standards and science-based measures). That control is accomplished in a variety of ways, including product recalls. Food recalls occur for many reasons, including biological or physical contamination or other quality issues. Recalls may be initiated by the manufacturer, distributor, the FDA, or the Department of Agriculture. For the recall process to function effectively, it is important to have rapid dissemination of information and traceability so any affected product can be identified and withdrawn from the market as quickly as possible. But the Food Safety Modernization Act is changing that as it has shifted the direction of food safety management from reaction to prevention.

The U. S. President's Food Safety Working Group (FSWG) has advocated a new direction for the U.S. food safety system — a public health-focused approach. The FSWG is committed to modernizing food safety through partnerships with consumers, industry and regulatory agencies (Food Safety Working Group, 2009). The FSWG suggests a route toward a freedom-from-fear food safety environment through its charge: "To have safe food that does not cause us harm and to enhance our food safety systems" (Food Safety Working Group, 2009). Based on three principles set by the FSWG -- prioritizing prevention, strengthening surveillance and enforcement, and improving response and recovery -- FDA and FSIS are taking action on two initiatives: the FDA Food Safety Modernization Act (FSMA) and the FSIS HACCP-Based Inspection Models Project (HIMP).

Food Safety and Social Media

Although "…the systematic study of effective [food] recall communications is in its infancy" (Freberg, 2013; Hallman & Cuite, 2009), Freberg (2013) has shown that both attitudes and subjective norms influence consumers in their intention to comply with a food recall with attitudes having the greater impact. Both attitudes and subjective norms exist in social networks. Thus, social networks are "of central importance" (Granovetter, 1973), and the role of social media in those networks has important implications for public policy (Leyden, Link, & Siegel, 2014; Benkler, 2006 and 2011). In particular, this suggests that regulatory agencies should adopt

strategies that emphasize exploiting social media (Rutsaert, Pieniak, Regan, McConnon, Kuttschreuter, Lores, Lozano, Guzzon, Santare, & Verbeke, 2014). Using social media involves bringing together heterogeneous groups to form social networks and facilitating their coordination for the purpose of identifying food hazards and spreading the word about recalls (Burt, 2005; Peters & Golden, 2013; Inkpen & Tsang, 2005; Jackson & Watts, 2002).

Announcements about recalls are available on the FDA web site (http://www.fda.gov/), and consumers can request to receive e-mail alerts on recalls. Consumers can also report problems at that site, and FDA district offices have consumer complaint coordinators who take complaints on foods they regulate. In addition, traditional news outlets distribute recall information. However, with the increase in popularity of social media, regulatory agencies and news media can use social networks to reach more people in a shorter amount of time. Instead of hearing a broadcast on radio or television or reading a story in a newspaper about a recall sometimes long after it was issued, consumers may hear about a recall almost immediately through social media such as Facebook or Twitter. Plum Organics voluntary use of social media to spread the word of a recall is a good example of how it can be used (Crum, 2009).

Earlier research has shown that people hearing about a negative event such as a recall that directly impacts them will seek information from informal networks (Vihalemm, Kiisel, & Harro-Loit, 2012). Also, individuals are most likely to become involved when the recall or negative event applies to them and when they believe that the consequences are serious enough to warrant action (Hallmak, 2013). These highly involved consumers are more likely to be involved in spreading the word about negative events (Choi & Lin, 2008).

Consumers who spread the word about negative events through blogs, tweets, and the use of other social media are known as social media influencers (SMIs) (Freberg, Graham, McGaughey, & Freberg, 2011). Their role may create noise in the system (Gorry & Westbrook, 2009) and their credibility sometimes questioned due to distortions or misinformation (Wright & Hinson, 2012; Carlson & Peake, 2013), but social media could be used to improve the overall performance of the system (Freberg, Graham, McGaughey, & Freberg, 2011; Golub & Jackson, 2010). Perhaps even more importantly, the adoption of a strategy to exploit social networks through the use of social media could not only expand the agencies' reactive role of disseminating information to the public but also enable their new preventive role by tapping into previously unused external resources (consumers and suppliers) regarding food hazard problems. The advance of information and communication technologies en-

ables a creative avenue for the public agency to learn about potential food hazards more quickly than in the past. Coordination by the public agency is still required to maintain the integrity of the system, but the strategic use of these new technologies permits coordination with more efficient regulatory interventions.

Social networks are extensively used, especially in times of negative events (Liu, Austin, & Jin, 2011). Should these new communication technologies be used as an integral part of the system by all participants in the food chain to exchange information about food safety? Or has little effort been made formally to involve consumers as participants in food safety (Williams & Hammitt, 2001)? Research into organizational use of social networks is emerging (Carpenter, Li, &Jiang, 2012; Gulati, Nohria, & Zaheer, 2000; Rangan, 2000), but its strategic use by public organizations has not yet been studied (Mahon, Heugens, & Lamertz, 2004).

A caveat in all of this is that at present social media can involve distortions or misinformation and can be manipulated to a degree. This could lead to "naïve learning" (Golub & Jackson, 2010). Because of the asymmetry of information (Siegel, 2009), organizations and individuals could potentially attempt to insert false information into social networks (Lauretti, 2013; Skelton, 2012; Ramsey, 2010; Grant, 2009) to raise their rival's costs (Barjolle, Jeanneaux, & Meyer, 2012; McWilliams, Van Fleet, & Cory, 2002). In addition, SMIs might have an incentive to manipulate information to increase their "popularity" in the social network. While efforts are being made to expose those who attempt to distort information on social media, it does exist. So any strategic efforts to utilize the benefits of social media must take into account and guard against such attempts.

What is the current situation? How does the general public use social media in response to food recalls and bad food experiences?

MATERIALS AND METHODS

To more specifically investigate the current situation in the United States, during December of 2013 and January of 2014, a survey was conducted. To focus the thinking of those responding to the survey, we began by focusing their attention:

""The purpose of this study is to examine aspects of responses to food recalls. A food recall is a request to return to the maker (or seller) a batch or an entire production run of a food product usually due to the discovery of safety issues or a product defect."

Since the use of social media was the predominant issue in this survey, we first examined that with the question: Which of the following (smartphone, tablet,

laptop computer, other computer) do you own or regularly have access to? Two questions were then asked about product recall experiences in general -- Have you ever heard of a food recall, and how did you hear about it? -- followed by seven demographic items. If a respondent indicated that he or she had not heard of a recall, they were automatically jumped to another section of the survey.

To focus more closely on personal experiences, the respondents were presented with four scenarios. The first two scenarios dealt with the respondents' personal experiences with food problems; the last two, with recall announcements (see Table 1). Again, if a respondent indicated that he or she had not experienced a particular scenario, they were automatically jumped to another section of the survey.

Table 1
Scenarios Used in the Survey

Scenario 1 Experienced Major Issue	"You ate lunch in a restaurant and during the afternoon you developed severe intestinal cramping and diarrhea causing you to seek assistance from the medical community (physician, urgent care or emergency room) for treatment."
Scenario 2 Experienced Minor Issue	"You ate lunch in a restaurant and during the afternoon you developed an upset stomach and mild diarrhea."
Scenario 3 Recall of Product You Use	"You heard (television, radio, online, newspaper, etc.) that a recall of packaged lettuce is being made and that it involves a brand/label that you generally use."
Scenario 4 Recall of Product You Do Not Use	"You heard (television, radio, online, newspaper, etc.) that a recall of packaged lettuce is being made but it involves a brand/label that you generally do NOT use."

The survey was conducted using SurveyMonkey.com® and ended with three open-ended questions.

"Think of a time when you heard about a food recall. Tell us about that incident—what was your reaction, how did you feel, did you talk to anyone about it, did it change your food buying or eating pattern?"

"Think of a time when you experienced a problem with something you ate at home or at an eating establishment. Tell us about that incident—what was your reaction, how did you feel, did you talk to anyone about it, did you seek medical help, did it change your food buying or eating pattern?"

"Would you like to add any comments?"

RESULTS AND DISCUSSION

A convenience sample of 214 people responded to the survey (212 complete and usable responses; see Table 2) from 22 states, the District of Columbia, and Canada. In terms of gender, the total sample consisted of slightly more females (58.5%) than males (41.5%). Respondent age groupings were 18-29 (26.4%), 30-49 (27.8%), 50-64 (22.6%), and 65 or older (23.1%). They were overwhelmingly White/Caucasian (83.5%) and well educated: 41.5% had advanced degrees, an additional 16.0% were college graduates, and 35.4% had some college. Only 7.1% had not at least graduated from high school. Most importantly, the use of social media by these respondents is quite similar to national usage rates as found by the Pew Research Center (Duggan & Smith, 2013).

Table 2
Sample Demographics

Characteristic	Number in sample			
Age	56 18-29	59 30-49	48 50-64	49 65 and older
Gender	89 males	124 females		
Race	177 white	5 black	12 Asian	18 other
Education	15 high school	75 some college	34 college graduate	88 advanced degree

Use of Social Media by Survey Respondents

The respondents indicated that they have shared recall information or bad food experiences primarily with family, friends, and coworkers, with the use of social media. Sharing tended to be under particular circumstances, such as relevancy to the person contacted and seriousness of the problem.

The Pew Research Center had found that the use of social media was greatest in the 18-29 and 30-49 age groups and lowest in the 65 or older group (Duggan & Smith, 2013). Our results show rates similar to theirs, as shown in Table 3. "Smart phone" access decreases with age whereas "Other computer" (generally desktop or all-in-one computers) increases with age. As shown in Table 4, in this study the same overall pattern of decreases with age occurs. But usage varies with the specific form of social media. Specifically, "Facebook" and "YouTube" are fairly similar across age groups while "Google+" increases across the age groups and both "Instagram"

and "Twitter" decrease across the age groups.

Table 3
Respondents' Access to Communication Technology

Technology owned or used regularly	Sample	Age 18-29	Age 30-49	Age 50-64	Age 65 or older
Smartphone	153 (29.4%)	51 (36.4%)	49 (32.2%)	34 (26.8%)	19 (18.8%)
Tablet	90 (17.3%)	22 (15.7%)	28 (18.4%)	21 (16.5%)	19 (18.8%)
Laptop computer	160 (30.8%)	50 (35.7%)	46 (30.3%)	37 (29.1%)	27 (26.7%)
Other computer	117 (22.5%)	17 (12.1%)	29 (19.1%)	35 (27.6%)	36 (35.6%)
Total*	520 (100%)	140 (26.9%)	152 (29.2%)	127 (24.4%)	101 (19.4%)

Table 4
Social Media Used By Respondents

Which of the following do you use?	Sample	Age 18-29	Age 30-49	Age 50-64	Age 65 or older
Facebook	157 (26.9%)	51 (27.0%)	51 (26.6%)	35 (26.9%)	20 (27.4%)
Google+	86 (14.7%)	16 (8.5%)	25 (13.0%)	21 (16.2%)	24 (32.9%)
Linkedin	93 (15.9%)	20 (10.6%)	40 (20.8%)	25 (19.2%)	8 (11.0%)
MySpace	2 (0.3%)	1 (0.5%)	0 (0.0%)	1 (0.8%)	0 (0.0%)
Instagram	35 (6.0%)	21 (11.1%)	10 (5.2%)	4 (3.1%)	0 (0.0%)
Printerest	36 (6.2%)	15 (7.9%	9 (4.7%)	6 (4.6%)	6 (8.2%)
Twitter	48 (8.2%)	20 (10.6%)	17 (8.9%)	10 (7.7%)	1 (1.4%)
Badoo	1 (0.2%)	0 (0.0%)	0 (0.0%)	1 (0.8%)	0 (0.0%)
Tumblr	10 (1.7%)	4 (2.1%)	4 (2.1%)	2 (1.5%)	0 (0.0%)
Viadeo	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)
YouTube	116 (21.7%)	41 (21.7%)	36 (18.8%)	25 (19.2%)	14 (19.2%)
Total*	584 (100%)	189 (32.4%)	192 (32.9%)	130 (22.3%)	73 (12.5%)

Table 5
Familiarity with Food Recalls

Have you ever heard of a food recall?	Sample	Age 18-29	Age 30-49	Agee 50-64	Age 65 or older
No	11 (5.2%)	6 (10.7%)	3 (5.1%)	1 (2.1%)	1 (2.0%)
Yes	201 (94.8%)	50 (89.3%)	56 (94.9%)	47 (97.9%)	48 (97.9%)
Total	212	56	59	48	49

Table 6
How Respondents Heard of Food Recalls

If yes, how did you hear about it?	Sample	Age 18-29	Age 30-49	Age 50-64	Age 65 or older
Newspaper or other print media	112 (19.3%)	22 (20.6%)	28 (23.1%)	34 (31.5%)	28 (33.3%)
Television or radio	163 (28.2%)	37 (34.6%)	44 (36.4%)	42 (38.9%)	40 (47.6%)
Face-to-face	29 (5.0%)	16 (15.0%)	6 (5.0%)	6 (5.6%)	1 (1.2%)
Phone call	11 (1.9%)	2 (1.9%)	4 (3.3%)	4 (3.7%)	1 (1.2%)
Email	33 (5.7%)	5 (4.7%)	13 (10.7%)	7 (6.5%)	8 (9.5%)
Online social media (Twitter, Facebook, etc.)	55 (9.5%)	17 (15.9%)	21 (17.4%)	13 (12.0%)	4 (4.8%)
Other	17 (2.9%)	8 (7.5%)	5 (4.1%)	2 (1.9%)	2 (2.4%)
Total	420	107	121	108	84

As shown in Table 5, almost all (94.8%) of the respondents had heard of a food recall. All age groups except the youngest were 95% or more "yes," but even it was almost 90%. Not surprisingly, most respondents heard about food recalls by print or broadcast media (Table 6). The younger age groups received the news this way just over half the time (55.2% for ages 18-29 and 59.5% for ages 30-49) while the older groups heard the news this way much more frequently (70.4% for ages

50-64 and 80.9% for 65 or older). Social media was a more prevalent source in younger groups (15.9% for ages 18-29 and 17.4% for ages 30-49) compared with older groups (12.0% for ages 50-64 and only 4.8% for 65 or older). That same pattern exists when email is combined with social media (20.6% for ages 18-29; 28.1% for ages 30-49; 18.5% for ages 50-64 and 14.3% for 65 or older).

Logistic Regression Analysis

Using the outcome variable "social media," logistic regression was used to more systematically measure whether social media are involved when respondents receive food recall information. The model assumes that the logit (the log of odds) of the social media using behavior has a linear relationship with four predictor variables – age, gender, race, and education. To accomplish this, the data were coded as shown in Table 7.

Table 7
Data Coding

Variable	Coding
Social Media (Y)	1 = Use social media
Age (X1)	1 = 18-29 2 = 30-49 3 = 50-64 4 = 65+
Gender (X2)	1 = Male 2 = Female
Race (X3)	1 = White 2 = Black 3 = Asian 4 = Other
Education (X4)	1 = High school 2 = college 3 = college graduate 4 = advanced degree

Using this coding, then, "y" is the binary outcome variable indicating social media using behaviors where "1" indicates the use of social media and "0" indicates that social media are not used. "P" represents the probability that "y" equals 1. X1, X2, X3, X4 are then a set of predictor variables (age, gender, race, and education, respectively). The logistic regression of y on x1, x2, x3, and x4 estimates parameter values for β0, β1, β2, β3, and β4 through maximum likelihood method of the equation: $\text{Logit}(p) = \log(p / (1-p)) = \beta 0 + \beta 1 * X_1 + \beta_2 * X_2 + \beta_3 * X_3 + \beta_4 * X_4$. The likelihood ratio chi-square test examines whether all four predictor variables are simultaneously equal to zero, a sign indicating the model has no explanatory power. The null hypothesis is that all of the regression coefficients are zero.

The test result shows the likelihood chi square of 25.46 with a p-value 0.0045. Under the chosen level of significance, the willingness to accept a type I error, 0.05,

the smaller p-value supports the conclusion that at least one of the regression coefficients in the model is not equal to zero. Therefore, the individual variables were tested.

The coefficient for age is statistically significant under the level of significance 0.05, with p-value 0.006 < 0.05. The coefficient for gender is statistically significant under the level of significance 0.1, with p-value 0.067 < 0.1. The coefficients for race and education are not statistically significant, with p-values 0.3316 and 0.1938, respectively.

Within the age groups, a comparison of group 1 (ages18-29) and group 4 (65+), that of group 2 (ages 30-49) and group 4 (65+), and that of group 3 (ages 50-64) and group 4 (65+) are all statistically significant, with p-values 0.0034 (<0.01), 0.0008 (<0.01), and 0.0519 (<0.1) respectively.

The coefficients are in the form of the log of odds [logit (p) = log (p / (1-p))]. The exponential coefficient is the ratio of two odds, which indicates the change in odds in the multiplicative scale for a unit increase in a predictor variable when holding other variables constant. $p/(1-p) = \exp(\beta_0 + \beta_1*X_1 + \beta_2*X_2 + \beta_3*X_3 + \beta_4*X_4)$. As shown in Table 8, the odds ratios can be further transformed into probabilities:

$$P = \exp(\beta_0 + \beta_1*X_1 + \beta_2*X_2 + \beta_3*X_3 + \beta_4*X_4) / [1 + \exp(\beta_0 + \beta_1*X_1 + \beta_2*X_2 + \beta_3*X_3 + \beta_4*X_4)]$$

Logit Group Comparisons

Holding gender, race, and education constant, the probability for a social media user to be in the age group 18-29 is 86.81%, while the probability for a social media user to be in the age group 65+ is 13.19%. Thus, the odds for people age 18-29 are 6.58 times higher than the odds for people above age 65. So the 18-29-year-old respondents, compared to those age 65+, are more likely to use social media.

In like manner, holding gender, race, and education constant, the probability for a social media user to be in the age group 30-49 is 88.72%, while the probability for a social media user to be in the age group 65+ is 11.28%. So comparing these two groups, the odds for people age 30-49 are 7.86 times higher than the odds for people above 65 years. Compared to age 65+ respondents, those in the age 30-49 group are more likely to use social media.

Holding gender, race, and education constant, the probability for a social media user to be in the age group 50-64 is 77.35%, while the probability for a social media user to be in the age group 65+ is 22.65%. This, then, indicates that the odds for people age 50-64 are 3.41 times higher than the odds for people above 65 years.

So those in the age 50-64 group are more likely to use social media than those 65 or older.

Table 8
Logit Results

Model result:				
		Estimate	**P-value**	**Significance**
1	Age (18-29) vs. (65+)	1.8846	0.0340	Yes(<0.05)
	Age (30-49) vs. (65+)	2.0620	0.0008	Yes (<0.01)
	Age (50-64) vs. (65+)	1.2281	0.0519	Yes(<0.10)
2	Gender (Male vs. Female)	-0.6500	0.0670	Yes (<0.10)
Transformed probabilities:				
		Log of Odds	**Odds Ratio**	**Probability**
1	Age (18-29) vs. (65+)	1.8846	6.5837	86.81%
2	Age (30-49) vs. (65+)	2.0620	7.8617	88.72%
3	Age (50-64) vs. (65+)	1.2281	3.4147	77.35%
4	Gender (Male vs. Female)	-0.6500	0.5220	34.30%
95% Wald confidence interval:				
		Probability	**Lower Limit**	**Upper Limit**
1	Age (18-29) vs. (65+)	86.81%	65.13%	95.87%
2	Age (30-49) vs. (65+)	88.72%	70.16%	96.34%
3	Age (50-64) vs. (65+)	77.35%	49.75%	92.17%
4	Gender (Male vs. Female)	34.30%	20.70%	51.12%

Finally, holding age, race, and education constant, the negative value of the log of odds -0.65 indicates that being male decreases the log odds of using social media. The probability for a social media user to be a male is 34.3%, while the probability for a social media user to be a female is 65.7%. Males are less likely than females to use social media.

Respondents' Concern and Experience with Food Problems

Many respondents indicated a growing concern about food safety, particularly the ability of companies and the Government to successfully monitor what goes

into the products we consume.

In commenting on whether informal communication helps or hinders the food safety system, respondents generally were positive but noted that caution would be needed. They appreciate hearing from someone about food recalls but recognize that a person reporting the bad food may have been self-diagnosing inaccurately. They usually do mention recalls to family and friends but feel there is a need to make the public aware of how to notify the correct authorities when experiencing a food related illness.

Table 9
Experiences With and Responses to Food Problem Scenarios (Percentages)

	Scenario 1 Medical Help Needed %	Scenario 2 Medical Help Not Needed %	Scenario 3 Do Use Product %	Scenario 4 Don't Use Product %
All Respondents				
Have experienced	20.6	65.1	66.4	75.0
Have told others	86.0	73.6	69.0	39.1
Would tell others	83.7	57.1	68.2	50.0
18-29 Age Group				
Have experienced	17.9	80.3	44.6	73.2
Have told others	70.0	75.6	64.0	36.6
Would tell others	84.8	90.9	74.2	46.7
30-49 Age Group				
Have experienced	26.3	75.4	43.9	77.2
Have told others	80.0	62.8	68.0	31.8
Would tell others	76.2	64.9	59.4	53.8
50-64 Age Group				
Have experienced	25.0	58.3	88.0	76.6
Have told others	100.0	89.3	63.6	38.9
Would tell others	80.6	35.0	52.0	63.6
65 or older Age Group				
Have experienced	12.5	41.7	30.6	72.9
Have told others	100.0	70.0	86.7	51.4
Would tell others	92.9	46.4	73.5	38.5

NOTE: Only those who experienced a scenario were asked to respond to each scenario.

As shown in Table 9, respondents had experienced Scenario 2 more than Scenario 1 and, except for the 50-64 age group, they had also experienced Scenario 4 more than Scenario 3. Except for the youngest age group, respondents indicated that they had told or would tell others about the experience if Scenario 1 than they would if it were Scenario 2. Those who had told others were greater for Scenario 3 than Scenario 4 and that pattern holds for those who would tell except for the 50-64 age group. Consistent with previous research (Vihalemm, Kiisel, & Harro-Loit, 2012; Hallman, 2013), these results suggest that individuals are more likely to tell others if the event was severe and they are also more likely to tell others about a recall if that recall was for a product that they used.

Symphony© (http://www.activejava.com/) software was used to analyze these comments to see if patterns occurred. While no distinct pattern existed, nearly 40 different foods were mentioned in the comments (see Table 10).

Table 10
Specific Foods Mentioned

bacon	beef	berry	brownie	butter
cabbage	cantaloupe	cereal	cheese	chicken
chili	corn	fruit	hamburger	lettuce
meat	peanuts	peanut butter	pizza	pork
poultry	rice	salad	salmon	sausage
seafood	shell	shellfish	shrimp	soup
spinach	steak	strawberry	sushi	tomato
tuna	turkey	vegetables	yogurt	

The basic question raised through this is: What are the characteristics of those who inform others about experiences/recalls through the use of social media? To answer that question, all respondents who used social media for one or more of the scenarios were grouped together. The results of that are shown in Table 11. This would suggest, then, that if an agency wants to spread the word of a food recall, it needs to make sure that young, well-educated adults are informed.

Table 11
Characteristics of those who inform others through social media

Gender:		**Age:**		**Education:**	
Female	38	18-29	21	No high school diploma	0
Male	26	30-49	28	High school graduate	4
		50-64	10	College graduate (Bachelor's degree)	24
		65 or older	5	Advanced degree (Master's, Doctor's)	23

To further examine the scenario results, generalized estimating equations (GEE) were used. GEE is a quasi-likelihood approach to model changes and marginal effects particularly useful for initial explorations. First Scenarios 1 and 2 were examined to see how or if the use of social media changed between a major issue and a minor one. The response variable was set as 0= social media was not used and 1= social media was used. The predictor variables, then, were experience, age, and gender. Experience was coded as 0= the individual did not personally have the experience and 1= the individual did personally have the experience. Age was coded into four groups (1, 2, 3, 4 in ascending order), and gender as 0= male and 1= female.

As shown in the first part of Table 12, all the predictors except one (Age 30-49 vs. Age 65+) were significant. The second part of the table shows the probabilities associated with the significant predictors. Perhaps counterintuitively, these results suggest that when a health issue becomes more severe the use of social media in general decreases, younger groups tend to not use it, but males do tend to use it. It may well be that a reluctance to share a very personal, possibly even embarrassing, event or the level of concern leads to this decrease in the use of social media so that the information is more likely shared only through more direct means (face-to-face, phone calls, or the like).

Using the same coding, Scenarios 3 and 4 were examined to see how or if the use of social media changed between a relevant recall and one that was not particularly relevant. The predictor variables were as before except that experience was coded as 0= the individual is not personally impacted by the recall and 1= the individual is personally impacted.

Table 12
GEE Results: Use of Social Media for Major vs Minor Issue

Predictor variable	Estimate	P-value	Significance
Experience (no vs. yes)	0.8203	0.0768	Yes (<0.10)
Age (18-29) vs. (65+)	-0.5828	<0.0010	Yes (<0.01)
Age (30-49) vs. (65+)	-0.1992	0.4526	No
Age (50-64) vs. (65+)	-0.2229	<0.0010	Yes (<0.01)
Gender (Male vs. Female)	0.2148	0.0001	Yes (<0.01)
	Log of Odds	**Odds Ratio**	**Probability**
Experience (no vs. yes)	0.8203	2.2712	69.43%
Age (18-29) vs. (65+)	-0.5828	0.5583	35.83%
Age (50-64) vs. (65+)	-0.2229	0.8002	44.45%
Gender (Male vs. Female)	0.2148	1.2396	55.35%

Table 13
GEE Results: Use of Social Media for Relevant vs Non-relevant Issue

Predictor variable	Estimate	P-value	Significance
Experience (no vs. yes)	0.0493	0.0251	Yes (<0.05)
Age (18-29) vs. (65+)	-0.8806	<0.0001	Yes (<0.01)
Age (30-49) vs. (65+)	-0.2640	0.2063	No
Age (50-64) vs. (65+)	-0.3671	0.2249	No
Gender (Male vs. Female)	-0.1400	0.0103	Yes (<0.05)
	Log of Odds	**Odds Ratio**	**Probability**
Experience (no vs. yes)	0.0493	1.0505	51.23%
Age (18-29) vs. (65+)	-0.8806	0.4145	29.31%
Gender (Male vs. Female)	-0.1400	0.8694	46.51%

Again, the first part of Table 13 shows that all the predictors except two (Age 30-49 vs. Age 65+ and Age 50-64 vs. Age 65+) were significant. The second part of the table shows the probabilities associated with the significant predictors. These results, then, suggest that when a food recall involves a more familiar product people tend not to use social media (however the difference is small) and, again, that

younger age group tend not to use social media, but contrary to the previous results, females tend to use social media.

Taken together, the scenario results suggest that there is a situational effect on the use of social media when dealing with negative food experiences and food recall announcements. Indeed, these results imply that at present people use social media mainly for socializing and spreading the word primarily when they are not personally involved or impacted.

LIMITATIONS

As with most survey research, this pilot study is limited but suggests future research. We used a convenience sample and, although the respondent characteristics were similar to some national data, this was not a representative sample. In addition, we did not gather information about income or employment. Clearly a representative sample covering an extensive list of demographics would be especially useful in examining this topic more fully.

CONCLUSIONS

In the food safety process, hazard communication is the exchange of food hazard knowledge and information. Given the characteristics of the food safety system, this paper has argued that a key to an efficient and effective food safety process is the adoption of a strategy by regulatory agencies to exploit social networks through the use of social media. This might be achieved by facilitating the creation of collections of individuals and organizations representing heterogeneous backgrounds (what might be referred to as competitive cohorts; Flint & Van Fleet, 2011).

An important implication of this pilot study is that due to the dynamics of networking through social media, food safety agencies need more than good ideas, sufficient resources, and intelligence. They need to have a strategy that provides a particular alertness in terms of information on social media, the formation of their social media groupings/cohorts, and how they manage that network (Kirzner, 1985). Developing trust so as to be perceived positively by participants in the food safety social network is then an important aspect of the agencies' strategic ability to effectively manage that social network (San Martin & Camarero, 2008; Chen, Chien, Wu, & Tsai, 2010; Sparrowe, Liden, Wayne, & Kraimer, 2001). The use of hashtags associated with recalls would greatly facilitate searching and grouping messages to spread the word quickly. Voluntary posting of recall information on the websites and Facebook pages of manufacturers, suppliers, distributors, grocers, restaurants, and

the like could go a long way to help establish that trust. In that event, being required to do so by a regulatory agency would not be necessary.

While more research is clearly needed particularly about specific strategic applications of the use of social media for health and safety (Chang & Hsiao, 2013; Kaplan & Haenlein, 2010; Kietzmann, Hermkens, McCarthy, & Silvestre, 2011; Coulson & Knibb, 2007), the results of this pilot survey suggest that the use of social media to spread the word regarding negative events (experiences or recalls) would not only help people to cope with that event both emotionally and cognitively, but also would increase the effectiveness of the food safety system (Vihalemm, Kiisel, & Harro-Loit, 2012). That increase will occur because of the rapid dissemination of information through social media and because information sent by a friend, relative, or contact may be more likely to be read than a message being circulated via public news media such as a newspaper.

The results of this pilot study suggest that, in general, the primary users of social media are young, well-educated adults but optimal targets for spreading the word may not be just those with the most friends (Campbell, 2013). There are clear situational effects on its use when dealing with negative food experiences and food recall announcements. When gender, race, and education are held constant, (1) younger age groups are more likely to use social media than are older age groups, and (2) males are less likely than females to use social media. Further, at present people appear to use social media mainly for socializing and for spreading the word primarily when they are not personally involved or impacted. Upon hearing about a recall, then, individuals, especially females, are more likely to tell others about that recall if it was for a product that is familiar to them or that they use. After personally experiencing a food problem, individuals are more likely to tell others (1) if the event was severe and (2) if that recall was for a product that they used, although they are less likely to do so through the use of social media. This suggests, then, that agencies wanting to spread the word of a food recall need to adopt strategies and formulate policies to make sure that young, well-educated females are involved.

Effective hazard communication among diverse stakeholders in a complex environment requires an information structure. Clearly, social media will be part of that structure whether formally or informally.

REFERENCES

Barjolle, D., Jeanneaux, P., & Meyer, D. (2012). Raising rivals' costs strategy and localized agro-food systems in Europe. *International Journal on Food System Dynamics, 3*(1), 11-21.

Benkler, Y. (2006). *The Wealth of Networks: How Social Production Transforms Markets and Freedom.* New Haven, CT: Yale University Press.

Benkler, Y. (2011). *The Penguin and the Leviathan: How Cooperation Triumphs over Self-Interest.* NY: Crown Business.

Burt, R. S. (2005). *Brokerage and Closure: An Introduction to Social Capital.* Oxford: Oxford University Press.

Campbell, A. (2013). Word-of-mouth communication and percolation in social networks. *American Economic Review, 103*(6), 2466-98.

Carlson, C. C., & Peake, W. O. (2013). Rethinking food recall communications for consumers. *Iridescent: Icograda Journal of Design Research, 3*(3), 11-23.

Carpenter, M. A., Li, M., & Jiang, H. 2012. Social network research in organizational contexts: A systematic review of methodological issues and choices. *Journal of Management, 38*(4), 1328-1361.

Chang, T. S., & Hsiao, W. H. (2013). Factors influencing intentions to use social recommender systems: A social exchange perspective. *Cyberpsychology, Behavior, and Social Networking, 16*(5), 357-363.

Chen, Y. H., Chien, S. H., Wu, J. J., & Tsai, P. Y. (2010). Impact of signals and experience on trust and trusting behavior. *Cyberpsychology, Behavior, and Social Networking, 13*(5), 539-546.

Choi, Y., & Lin, Y. H. (2008). Consumer response to crisis: Exploring the concept of involvement in Mattel product recalls. *Public Relations Review, 35*(1), 18–22.

Consumers Union. (2013). Call for FDA review "Good News" for consumers. Consumers Union 2013. consumersunion.org/news/call-for-fda-review-good-news-for-consumers/ (accessed Feb. 22, 2014).

Coulson, N. S., & Knibb, R. C. (2007). Coping with food allergy: Exploring the role of the online support group. *Cyberpsychology & Behavior; 10*(1), 145-148.

Crum, C. 2009. Baby food recall shows social media done right. Available at http://www.webpronews.com/baby-food-recall-shows-social-media-done-right-2009-10 [accessed 1 October 2014].

Duggan, M., & Smith, A. (2013). Social Media Update 2013. Pew Research Internet Project 2013. www.pewinternet.org/2013/12/30/social-media-update-2013/ (accessed Feb. 22, 2014).

Flint, G. D., & Van Fleet, D. D. (2011). The competitive cohort: An extension of strategic understanding. *Journal of Business Strategies, 28*(2), 97-122.

Food Safety Working Group. (2009). Food Safety Working Group 2009. www.foodsafetyworkinggroup.gov/Home.htm (accessed Mar. 14, 2014).

Freberg, K. (2013). Using the theory of planned behavior to predict intention to comply with a food recall message. *Health Communication, 28*(4), 359-365.

Freberg, K., Graham, K., McGaughey, K., & Freberg, L. (2011). Who are the social media influencers? A study of public perceptions of personality. *Public Relations Review, 37*( ), 90-92.

Golub, B., & Jackson, M. O. (2010). Naïve learning in social networks and the wisdom of crowds. *American Economic Journal: Microeconomics, 2*(1), 112-49.

Gorry, G. A., & Westbrook, R. A. (2009). Winning the internet confidence game. *Corporate Reputation Review, 12*(3), 195–203.

Granovetter, M. S. (1973). The strength of weak ties. *The American Journal of Sociology, 78,* 1360-1380.

Grant, B. (2009). Elsevier published six fake journals. The Scientist 2009. www.the-scientist.com/?articles.view/articleNo/27383/title/Elsevier-published-6-fake-journals/ (accessed Mar. 22, 2014).

Gulati, R., Nohria, N. and Zaheer, A. (2000). Strategic networks. *Strategic Management Journal, 21*(3), 203–215

Hallman, W. K. (2013). *Addressing the Potential for Food Recall Fatigue.* Rutgers, NJ: Food Policy Institute, New Jersey Agricultural Experiment Station.

Hallman, W. K., & Cuite, C. L. (2009). *Food Recalls and the American Public: Improving Communications.* Rutgers, NJ: Food Policy Institute, Rutgers University. FPI publication number RR-0310-020.

Hathi, S. (2009). Communicators remain unclear on business case for social media. *Strategic Communication Management, 14*(1), 9.

Inkpen, A. C., & Tsang, E. W. (2005). Social capital, networks, and knowledge transfer. *Academy of Management Review, 30*(1), 146-165.

Jackson, M. O., & Watts, A. (2002). The evolution of social and economic networks. *Journal of Economic Theory, 106*(2), 265-295.

Kaplan, A. M., & Haenlein, M. (2010). Users of the world, unite! The challenges and opportunities of social media. *Business Horizons, 53*(1), 59-68.

Kietzmann, J. H., Hermkens, K., McCarthy, I. P., & Silvestre, B. S. (2011). Social media? Get serious! Understanding the functional building blocks of social media. *Business Horizons, 54*(3), 241-251.

Kirzner, I. M. (1985). *Discovery and the Capitalist Process.* Chicago: University of Chicago Press.

Lauretti, D. (2013). 19 SEO companies fined for creating fake reviews. 2013: Examiner.com, http://www.examiner.com/article/19-seo-companies-fined-for-creating-fake-reviews

Leyden, D., Link, A.N., & Siegel, D. S. (2014). A theoretical analysis of the role of social networks in entrepreneurship. *Research Policy,* forthcoming.

Liu, B. F., Austin, L., & Jin, Y. (2011). How publics respond to crisis communication strategies: The interplay of information form and source. *Public Relations Review, 37:* 345–353.

Mahon, J. F., Heugens, P. P., & Lamertz, K. (2004). Social networks and non-market strategy. *Journal of Public Affairs, 4*(2), 170-189.

McWilliams, A., Van Fleet, D. D., & Cory, K. D. (2002). Raising rivals' costs through political strategy: An extension of resource-based theory. *Journal of Management Studies, 39*(5), 707-723.

Moss, M. (2009). Food companies are placing the onus for safety on consumers. NY Times 2009. www.nytimes.com/2009/05/15/business/15ingredients.html?ref=michaelmoss&_r=0 (accessed Feb 22, 2014).

Peters, R., & Golden, P. (2013). Stakeholder networks and strategy: The influence of network consistency and network diversity on firm performance. *Journal of Business Strategies, 30*(2), 120-144.

Ramsey, L. P. (2010). Brandjacking on social networks: Trademark infringement by impersonation of markholders. *Buffalo Law Review, 58*(4), 851-929.

Rangan, S. (2000). The problem of search and deliberation in economic action: When social networks really matter. *Academy of Management Review, 25*(4), 813-828.

Rutsaert, P., Pieniak, Z., Regan, A., McConnon, A., Kuttschreuter, M., Lores, M., Lozano, N. Guzzon, A., Santare, D., & Verbeke, W. (2014). Social media as a useful tool in food risk and benefit communication? A strategic orientation approach. *Food Policy, 46:* 84-93.

San Martín, S., & Camarero, C. (2008). Consumer trust to a web site: Moderating effect of attitudes toward online shopping. *Cyberpsychology & Behavior; 11*(5), 549-554.

Siegel, D.S. (2009). Green management matters only if it yields more green: An economic/strategic perspective. *Academy of Management Perspectives, 23*(3), 5-16.

Skelton, V. (2012). "Best blog post ever" – the rise of fake reviews and why it matters. Information Today Europe 2012. www.infotodayeurope.com/2012/09/20/best-blog-post-ever-the-rise-of-fake-reviews-and-why-it-matters/ (accessed Mar. 22, 2014).

Sparrowe, R. T., Liden, R. C., Wayne, S. J., & Kraimer, M. L. (2001). Social networks and the performance of individuals and groups. *Academy of Management Journal, 44*(2), 316-325.

Vihalemm, T., Kiisel, M., & Harro-Loit, H. (2012). Citizens' response patterns to warning messages. *Journal of Contingencies and Crisis Management, 20*(1), 13–25.

Williams, P. R. D., & Hammitt, J. K. (2001). Perceived risks of conventional and organic produce: Pesticides, pathogens, and natural toxins. *Risk Analysis, 21*(2), 319–330.

Wright, D. K., & Hinson, M.D. (2012). Examining how social and emerging media have been used in public relations between 2006 and 2012: A longitudinal analysis. *Public Relations Journal, 6*(4), 1-42.

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