IMPACTS OF SELECTED, MEDIA-REPORTED, BEEF SAFETY PROBLEMS ON CONSUMER BEEF PURCHASES

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ABSTRACT

Beef safety issues often lead to reduced beef consumption. A household survey in five major U.S. cities asked consumers to indicate whether media reporting of the Mad Cow Disease, Oprah Winfrey's TV (burger) statement and packer fresh beef recalls had led the respondents to reduce beef consumption, by how much and for what length of time. Packer recalls and Mad Cow Disease reduced beef consumption by 26 and 22 percent of respondents, respectively. These consumers reduced beef consumption by an average of one third for approximately 15 weeks. Important factors included frequency of beef consumption, consumer rating of safety of local beef supplies, city and single adult in households.

INTRODUCTION

Beef has been the most popular red meat in the United States for over 50 years. U.S. per capita beef consumption peaked at 94.4 lbs (retail weight) in 1976 (USDA 1995). Since then, beef consumption, in retail pounds per capita, has decreased to the mid 60s in 2003. Over the same period, consumption of broiler meat increased greatly and pork consumption increased slightly.

Why the big decrease in beef consumption? While beef's real price has risen more rapidly than that of competitive meats, which in itself is a serious problem, beef also has suffered relative to competitive meats due to nutrition issues (high saturated fat and cholesterol contents) and food safety issues (use of chemical growth stimulants and antibiotics during the production period, contamination with pathogens, such as *E. coli* and *Salmonella*, during processing, and susceptibility to diseases suspicioned to impact human health). For one or more of these reasons, some former beef consumers have either ceased consumption of beef entirely or are consuming less today than in the mid 1970s.

Consumers can handle higher prices by switching to lower priced cuts or even reducing quantity consumed. Higher fat and cholesterol content can be reduced through product selection and special precautions before and after preparation. On the other hand, consumers often feel powerless with reference to avoiding food safety problems. Food safety problems are often unobservable in the raw product, providing no warning to the consumer. These safety problems need to be prevented or corrected by those handling the product prior to its sale to the final consumer.

Concerns among consumers for the food safety of beef appear to have lessened somewhat but have not ceased. Growth stimulants have been changed to reduce their highly negative consumer perceptions. Concerns over the possible impacts of pathogens and animal diseases on the safety of beef as a food product have remained, however. While the industry has made strides in reducing the incidence of the latter safety problems, they have proven to be difficult to eliminate. The one treatment that could remove these problems of fresh beef at the point of sale (irradiation) has not been accepted by many consumers.

Consumers use personal experience and information they obtain from product labels or media messages in reacting to safety problems of fresh beef. If an individual's beef consumption leads to his or her personal illness or the individual's physical condition causes his or her doctor to recommend reduced beef consumption, the consumer reacts quickly. The typical beef consumer also reacts to new safety information obtained word-of-mouth from other consumers. This new information is compared with previous information the consumer has retained and he or she makes an appropriate response to beef consumption.

Consumers also receive beef safety-related information from local and national media (television, radio, newspapers, magazines, billboards, and the Internet). They question the accuracy and value of some new safety information because of its source, nature, and/or content. Consumers discard some of the new safety information and retain another part for later verification. The remaining information is accepted and adds to the consumer's current perceptions of the food safety of fresh beef.

New safety information provided by the popular media that is accepted can impact the individual beef consumer in one of several ways:

a. Cause consumers to become concerned or suspicious of the safety of fresh beef but lead to no immediate change in the purchase or consumption of fresh beef.
b. Cause consumers to immediately reduce fresh beef purchases by a given amount, or,
c. Cause consumers to reduce fresh beef purchases over an extended period of time.

Which of these alternatives the consumer will select depends on the individual's previous knowledge of the safety of fresh beef, the seriousness of the new safety information, the individual's willingness to accept risk, and the consumer's socioeconomic characteristics.

Recent LSU research provides estimates of the impacts resulting from three, media-covered, safety-related incidents (one *issue*, one *statemen*t and one *event*) of national significance that occurred over the most recent ten-year period. Consumer reactions to these incidents in terms of changes in beef consumption should provide guidance on how they respond to food safety issues in general. These results should also be useful in estimating the response of consumers to future safety incidents involving fresh beef.

OBJECTIVES

The general objective of the study is to estimate any reductions in consumer purchases of fresh beef as a result of selected safety incidents reported by the national media. The specific sub-objectives are:

1. Estimate the proportion of consumers who were concerned about the impact of three selected incidents on the safety of local beef supplies but who made no change in fresh beef consumption, by city and household socioeconomic characteristics.
2. Estimate the extent of reduced consumption of fresh beef resulting from the three selected incidents, by city and household socioeconomic characteristics.
3. Estimate the number of weeks consumers reduced their beef consumption as a result of the three selected incidents, by city and household socioeconomic characteristics.

THEORY AND METHODS

Utility theory is often used to explain why individuals purchase particular food products. Information on the safety of food products is an important component of determining these product utilities. Safety information can be obtained from personal experience or from secondary sources (such as the media, academic sources, industry, and government). Together, these two sources provide the information the consumer uses to help develop their perceptions of the safety of fresh beef. Concern with product safety negatively influences tastes and preferences, hence, reduces the consumer's demand for the product.

The three beef safety-related incidents selected for this study, which were widely reported by the national media, are suspicioned to have negatively influenced U.S. consumer' purchases and consumption of fresh beef:

1. The BSE (Mad Cow) Disease outbreak in England [*an issue*]. The first reported case of BSE occurred in mid 1985; however, it was the mid 1990s when England admitted it had a problem with BSE. Authorities also stated that the bovine disease was suspicioned to be linked to a similar human disease Creutzfeldt - Jacob Disease (CJD) (CDC 2002). Since the human form of the brain-wasting disease can have a long incubation period and is so debilitating on the individual, this information led to a serious food safety scare. No case of BSE has ever been reported in the U.S. and the U.S. hasn't imported fresh beef from England for years. The national media covered this story thoroughly over an extended period of time. This issue was included because of the high scare quotient and to test the confidence consumers have in the USDA's ability to keep such animal diseases from our food supply.
2. Oprah Winfrey's comments (April 17, 1996) on her television show [*a statement*]. A guest on her show (Howard Lyman) associated beef with BSE and a variant of the brain-wasting CJD (vCJD)(Lyman 1998). Lyman is a self proclaimed vegetarian and is associated with a group that has a goal of discouraging meat from being included in the human diet. Lyman's comments, followed by Oprah's "I'm stopped. I'll never eat another burger," led to several lawsuits being filed by cattlemen groups under defamation legislation (Anonymous 2002). Oprah's original statement and news of the two defamation trials were widely circulated in the national media. This statement was chosen as an example of the influence of strong personal opinion statements of well known TV personalities, sports figures

and other national icons on their perceptions of beef safety.

3. Voluntary beef recalls by major packers [*an event*]. A number of these recalls have occurred over the last 5-10 years, primarily because of the presence or expected presence of *E. coli, Salmonella* or other pathogen in previously distributed fresh beef. These recalls, by *IBP, Con Agri, Excel* and other packers, were covered both regionally and nationally by the media. These recalls represent legitimate indicators of potential health problems associated with given shipments of fresh beef from specified packer locations. As such, in the opinions of the authors, these recalls represent the most legitimate safety threat of the three.

Given the objectives of the study and the data, multinomial logit and ordered probit models were chosen as the means for analysis. These models are frequently used in agricultural economics to analyze consumer responses when household socioeconomic variables are employed to explain consumer utility.

Following Judge et al.(1988), qualitative choice models can be used to model the choice behavior of individuals (consumers or firm managers) when two or more alternatives are available and one must be chosen. Since the marginal effect on the dependent variable of a one-unit change in the explanatory variable is not constant over the entire range of the explanatory variable, the maximum likelihood estimation technique is used (Crown 1998). Use of the latter technique assures the large sample properties of consistency and asymptotic normality of the parameter estimates (Capps and Kramer 1985). The specification of the logit model follows in (1):

$$(1) E(Y_i) = \frac{1}{1+e^{-\alpha-\beta x_i}} = \frac{e^{\alpha+\beta x_i}}{1+e^{\alpha+\beta x_i}}$$

where $E(Y_i)$ is the probability that $Y_i = 1$, x_i are the independent variables, and $\forall$ and $\exists$ are the parameters to be estimated.

The maximum likelihood coefficients estimated through logit analysis have no direct interpretation, other than indicating a direction of influence on probability. The calculated changes in probabilities indicate the magnitude of the marginal effects (Maddala 1988). Changes in probability refer to the partial derivatives of the nonlinear probability function evaluated at the zero and one values of the explanatory variables (Pindyck and Rubinfeld 1991). The marginal effects are estimated as (2):

$$(2) \frac{\partial P_i}{\partial x_{ij}} = \frac{\beta_j e^{-\alpha-\beta x_i}}{1+e^{-\alpha-\beta x_i}}$$

where x_{ij} is the *j*th element of x_i.

In everyday terms, a logit analysis allows the researcher to estimate the relationship between a series of qualitative independent variables (such as the socioeconomic characteristics of households) and a qualitative dependent variable (such as a yes - no response to a question). A binomial logit analysis provides the probability, for example, that a household in a rural area having a specific socioeconomic characteristic will respond yes or no to a specific issue, such as

approval or disapproval of country-of-origin labeling of fresh beef in grocery stores. Policymakers can use the magnitude of these probabilities to identify target populations that approve or disapprove of the label.

The ordered probit model is used when variables are inherently ordered. For example, suppose we have a case with three options, where option 1 is greater in some respect than option 2, which is, in turn, greater than option 3. The ordered probit model can be used to estimate the probability of choosing each option. With the ordered probit model, the following probabilities (3)-(6),are estimated:

(3)

$$\Pr ob(y = 0) = \Phi(-\beta' x)$$

(4)

$$\Pr ob(y = 1) = \Phi(\mu_1 - \beta' x) - \Phi(-\beta' x)$$

(5)

$$\Pr ob(y = 2) = \Phi(\mu_2 - \beta' x) - \Phi(\mu_1 - \beta' x)$$

(6)

$$\Pr ob(y = J) = 1 - \Phi(\mu_{J-1} - \beta' x)$$

Where the :'s are unknown parameters to be estimated with ∃ and

$$\Phi < \mu_1 < \mu_2 < \ldots < \mu_{J-1}.$$

PERTINENT LITERATURE

Food safety scares have led to losses in consumer confidence in the quality and safety of beef products marketed in Europe and elsewhere (Roosen, Lusk and Fox 2003).With respect to product labels, they found that consumers preferred origin labels to private brands and overwhelmingly desired a mandatory labeling program on beef derived from cattle fed genetically modified grains.

A number of scientific papers have attempted to draw some relationship between BSE and CJD (Brown 1996, Lacy 1992, and Anonymous 1996). The contention is that consuming meat from animals with BSE will lead to contracting CJD. Some evidence (CDC 2000) points to a causal relationship between consuming beef from cattle having BSE with a modified form of CJD (vCJD).

Lloyd, et al.(2001) examined the impact of food safety scares, predominantly BSE, on prices of beef at retail, wholesale and producer levels in the UK over the 1990s. They found that negative safety information had a negative impact on prices at all levels, in line with an inward shift in the demand curve. Safety scares were also found to impact producer level prices greater than retail level prices, leading to wider marketing margins.

What is the impact of an outbreak of BSE on a country's beef consumption? Japan's outbreak in 1999 provides some answers. In the first six months following the first known case of BSE in Japan, Japanese consumers reduced beef intake by 40-60 percent with a like drop in beef imports (Peterson 2002). Though McDonalds Corporation (Japan) advertised that their beef came from BSE-free countries, sales of beef in its outlets also dropped sharply.

Harvey, et al. (2001) report negative changes in beef consumption and attitude toward beef by supermarket shoppers in the UK over several time periods after major media coverage of the BSE issue. Curk (1999) reported that beef consumption declined in Slovenia when the possible link between BSE and CJD was publicized. Beef consumption dropped 16 percent from 1995 to 1996. Surveys of 500 households in each of six European countries (Germany, Italy, UK, Spain, Sweden and Ireland) found that 60 percent were concerned with hormone use, BSE, antibiotic use and bacteria in beef (Cowen 1998). A related 1996 survey of 1,200 high school children in the UK indicated that half were concerned with getting CJD from consuming beef.

Strak 1998, and Verbeke and Ward 2001 applied AIDS models to beef consumption data from England and Belgium, respectively, to estimate the influence of the media reporting of BSE and a beef promotion program on the demand for beef. They report that the negative BSE scare had much greater impact on beef consumption than the positive impact of nationwide beef promotion programs. The BSE Scare Index reached its peak in March 1996 in England and halved in strength within six months.

While these studies do not involve U.S. consumers, it is likely that U.S. consumers will react in a similar manner, though less severely, since BSE has not been found in U.S. beef cattle.

DATA AND PROCEDURES

A mail questionnaire was chosen as the survey instrument. It was developed, reviewed and revised (following Dillman1978) to collect the data needed to complete the study's objectives. Questions comprising the dependent variables in the logit and ordered probit analyses were included and will be discussed later. Questions relative to the respondent's own risk assessment level, frequency of beef consumption, overall assessment of the safety of local beef supplies and participation in a regular physical exercise program were also included in the questionnaire. These factors, as well as questions involving the typical socioeconomic characteristics, comprise the independent variables in the logit and probit analyses.

Names and addresses of 500 randomly selected households in each of five U.S. cities (New York City, Chicago, New Orleans, Denver and San Francisco) were obtained from a commercial source. A copy of the questionnaire, a cover letter explaining the study's objectives and a business reply envelope were mailed to each of the 2,500 households by first class mail in mid June 2001 (Dillman 1978). Approximately three weeks later, a duplicate questionnaire, a revised cover letter and a business reply envelope were mailed by first class mail to each household not responding to the first mailing. Approximately 8.6 percent of the mailings were returned as non-deliverable to the addressee or as not accepted.

Respondents who indicated that one or more of the three safety-related news stories had negatively affected their views of the safety of fresh beef were then asked a follow-up question: "Did you reduce your buying of fresh beef as a result of the issue (statement) (event)? Yes No A multinomial logit analysis was used to analyze the data from this question.

Respondents answering "Yes" for one or more of the three safety related problems to the aforementioned question then answered the following two questions for the problems for which they answered "Yes":

a. How much did you reduce your fresh beef purchases in percentage terms (less than 25, 25-49, 50-75, greater than 75).
b. How long in weeks did you reduce your buying of fresh beef (less than 5, 5-9,10-14, 15-19, 20-24, 24 or more).

These two questions were analyzed using ordered probit models.

Table 1
Identification and Expected Impacts of Independent Variables on Whether the Assumed Safety Event Poses a Safety Problem for Local Beef, Multinomial Logit Analysis, 2001.

Variable	Sign[a]	Definition
New York City	?	Resident of NYC = 1 Otherwise =0
New Orleans	?	Resident of New Orleans = 1 Otherwise = 0
San Francisco	?	Resident of SF = 1 Otherwise = 0
Denver	Pos	Resident of Denver = 1 Otherwise = 0
Chicago	Pos	Resident of Chicago = 1 Otherwise = 0 Base Variable
Frequency of Beef Consumption	Neg	Categorical 1 - 5 Infrequent to Highly Frequent
Safety Rating of Local Beef Supplies	Pos	Categorical 1 - 5 Very Good to Poor
Own Risk Classification	Neg	Categorical 1 - 5 Avoid Risks to a Risk Taker
Physical Exercise Program	Pos	Respondent on Exercise Program = 1 Otherwise = 0
Female	Pos	Respondent is Female = 1 Male = 0
Age	?	Continuous Variable
Single Adult Head	Pos	Household Head is Single = 1 Otherwise = 0
Children Present	Pos	Household Includes Children = 1 Otherwise = 0
White	?	Head is White = 1 Otherwise = 0
Homemaker	Neg	Homemaker present = 1 Otherwise = 0
College Degree or More	?	Head has college degree or higher = 1 Otherwise = 0
Family Income	?	Continuous Variable

[a] Sign is based on expected impact of the beef safety issue on the respondent's decision to reduce beef consumption.

As indicated previously, multinomial logit and ordered probit models were developed for the analyses. The dependent variable used in the multinomial logit analysis was "Did you reduce your buying of fresh beef as a result of the issue (Mad Cow Disease, Oprah Statement, or a major packer recall)." The dependent variables for the ordered probit analyses were "a" and "b" above. The independent variables include the common socioeconomic household characteristics, the five cities surveyed and four other variables: the individual's own risk assessment level; the individual's personal assessment of beef's safety (a proxy for the consumers previous knowledge of the safety of fresh beef), whether the individual was on a regular physical exercise program, and the individual's frequency of beef purchase. These variables, their definitions and expected signs for the logit analysis are given in Table 1.

The signs of the city variables are based on the prevalence of the beef industry to the state wherein the city is located. The more important the beef industry is to the economy of a particular state, the more its citizens are assumed to be familiar with beef and its characteristics. Colorado is a leading beef cattle feeding state and Denver is home of the National Cattlemen's Beef Association. Chicago, which is the base variable in the binomial logit analysis, has a long history of beef packing and Illinois is a leading cattle producing state. These cities are expected to have positive signs for the binomial logit analysis. The remaining cities are given indeterminate signs based on their states lesser involvement in the beef industry.

Individuals who are heavy beef consumers were expected to be less likely to be influenced by the safety issues. Given their heavier beef consumption habits, these consumers were expected to be somewhat immune to new safety information on fresh beef. The respondents personal assessment of the safety of beef in local markets and the respondent's own risk preference levels were expected to be positively and negatively associated, respectively, with a decision to reduce beef consumption because of the three safety issues. The respondents safety rating was based on a scale of 1-5, where 1 = very good, 3 = average and 5 = poor while personal risk preference was measured through the following question "On a scale of 1-5, where 1 = avoid risks, 3 = risk neutral, and 5 = take risks, where would you rate yourself with regard to taking risks of all kinds?" Respondents on a regular physical exercise program were expected to be more likely to reduce beef consumption based on knowledge of the three well publicized safety issues.

Since females tend to be more concerned with food safety problems than males (Altekruse, et al.1995), female respondents were expected to be more impacted by the three safety issues. Likewise, single household heads tend to be more alert to food safety issues based on eating more outside the home. Households with children are likely headed by a member with more interest in food safety and nutrition, hence, more likely to decide to reduce beef consumption when confronted with new negative safety information. Households with a homemaker present are expected to be less likely to reduce beef consumption because of the three safety issues, based on the homemakers greater knowledge of food and its characteristics.

The impacts of age, education, family income, and race on the respondent's likelihood of reducing beef consumption based on the three safety issues cannot be predicted based on previous research; thus, they are considered indeterminate. While age tends to make individuals more risk averse, there is also evidence that resistance to change could keep older people from deviating from established consumption patterns. Higher educated consumers generally are thought to have greater knowledge of most issues, including food safety issues. However, some recent research by

Albrecht (1995), Daniels (1998) and Wolf (1995) indicate that higher education is not correlated with higher food safety knowledge. Higher incomes would appear to be associated with a desire for quality; the absence of food safety concerns could be interpreted to add quality. However, some recent evidence also indicates that the higher income consumers follow their own drumbeat and often act indifferently to established norms or relationships. Higher educated/income consumers tend to eat high risk "status foods,' such as sushi, sashimi and tuna or beef tartare, which could also present a risk problem. The authors have no basis upon which to predict a sign for race (white).

RESULTS

Approximately 8.6 percent (215) of the 2,500 household surveys were returned as non-deliverable or unclaimed. A total of 778 forms were returned, of which 57 did not consume fresh beef on a monthly basis, a specified condition for completing the remainder of the form. The remaining 721 questionnaires (31.4% of those delivered) were used in the analysis.

Means for the socioeconomic variables of the responding 721 households are presented by city in Table 2. The percentage of households responding by city ranged from a low of 21.4 percent for New York City to a high of 35.9 percent for Denver. Given the differing locations of cattle production relative to the major cities, the differences in response rate were expected.

Mean data on percentage white, education level and income suggest that the respondents were above the city averages for these three variables. The percentage of whites are higher than expected, especially in Chicago and Denver. The proportion of respondents with college degrees or higher (56.8%) is above the expected mean. The sample is also biased upward on income. These biases, unfortunately, are expected to be present in data obtained by mail from randomly selected households. Readers need to recognize these biases in making their interpretation of the results. Since the costs of living among the five cities varies greatly, a net-based Costs-of-Living Calculator (Fast Forward, Inc 2003) was used to adjust family incomes prior to their use in either of the logit or probit models.

New York City had the highest consumption rate for fresh beef among the five cities (slightly more than once per week). It also had the highest respondent rating for the safety of its local beef supply (Good) and the highest proportion of its respondents were on physical exercise programs (56.7%).

The proportion of the responding households reporting a reduction in consumption of fresh beef resulting from one or more of the three safety related issues is presented by city in Table 3. Only 158, 29, and 191 of the respondents indicated that they had reduced fresh beef consumption as a result of the incidents of Mad Cow, Oprah, and Packer Recall, respectively. Respondents from Chicago (New York City) were most (least) likely to reduce beef consumption when they became aware of the three issues. Respondents from Denver made the largest reductions in consumption while New Orleans respondents made the smallest reductions. As to time of reduction in consumption, Denver respondents were longest and New York City respondents the shortest.

Table 2
Selected Socioeconomic Characteristics of the Responding Households, Beef Safety Survey, Selected U.S. Cities, 2001.

	City					
Characteristic	**New Orl**	**NYC**	**Chicago**	**San Fran**	**Denver**	**Total**
% HH Responding	32.2	21.4	25.4	34.1	35.9	31.0
Frequency of Beef Consumption [a]	3.94	4.23	4.01	3.83	3.99	3.98
Safety Rating of Local Beef Supplies[b]	2.20	2.02	2.35	2.34	2.18	2.23
Own Risk Assessment[c]	2.7	2.8	2.8	3.0	3.0	2.9
% Physical Exercise Program	53.8	56.7	54.2	45.4	42.9	50.0
% Female	54.5	44.3	47.9	44.8	37.3	45.6
Average Age (yrs)	49.7	50.3	50.7	52.8	48.2	50.4
% with Children	55.2	36.1	47.9	31.3	39.1	41.9
% H S Educ or less	23.4	21.6	12.7	10.4	9.3	14.8
% College Deg or more	44.1	59.8	56.3	68.7	54.7	56.8
% Homemaker	11.1	1.0	7.7	3.1	3.1	5.4
% Single Adult Head	24.3	23.0	23.9	32.3	23.9	25.8
% White	75.2	63.9	87.3	79.1	85.7	79.4
% Income < $15,000	7.6	6.2	4.2	2.5	3.1	4.5
% Income > $135,000	4.8	14.4	9.9	17.2	9.3	11.0

Note: See Table 1 for definitions of variables
[a] Scale used was: 1 = Less than once per month; 2 = Once per month; 3 = 2-3 times per month; 4 = Once per week; 5 = More than once per week
[b] Scale used was: 1 = Very Good; 2 = Good; 3 = Average; 4 = Below Average; 5 = Poor
[c] Scale used was: 1 = Avoid Risktaking; 3 = Risk Neutral; 5 = Risk Taker

Table 3
Impact of Three Beef Safety Related Issues on Household Consumption of Beef, Percentage Reduction in Consumption and Length of Time Consumption was Decreased, Beef Safety Survey, Selected U.S. Cities, 2001.

Household	City						
Response[a]	New Orl	NYC	Chicago	San Fran	Denver	Mean	Total[d]
% Reducing Beef Cons							
Mad Cow Dis	25.7	12.0	28.2	23.3	17.8	21.9	158
Oprah Statement	4.7	3.0	4.9	4.2	3.0	4.0	29
Packer Recall	26.4	16.0	32.4	30.5	23.9	26.5	191
Average	18.9	10.3	21.8	19.0	14.9	17.5	---
% Decrease in Cons[b]							
Mad Cow Dis	2.45	2.50	2.45	2.69	3.07	2.63	158
Oprah Statement	2.14	2.33	2.71	2.29	3.00	2.48	29
Packer Recall	2.49	2.38	2.39	2.67	2.77	2.56	191
Average	2.36	2.40	2.52	2.55	2.95	2.55	---
# Wks Reduced Cons[c]							
Mad Cow Dis	3.29	2.83	2.98	4.18	4.03	3.49	158
Oprah Statement	3.28	3.67	3.71	3.29	3.60	3.48	29
Packer Recall	3.08	2.81	3.09	3.68	3.85	3.38	191
Average	3.22	3.10	3.26	3.72	3.83	3.45	---

[a] Percentage of households decreasing beef consumption because of the three issues, percentage decrease in beef consumption, and length in weeks of the consumption decrease.
[b] 1-4 (<25, 25-49, 50-75, >75)
[c] 1-6 (<5, 5-9, 10-14, 15-19, 20-24, 25 or more)
[d] Number of respondents who replied Yes to issue causing a reduction in fresh beef consumption.

The results of the binomial logit model for respondents reporting a reduction in consumption of fresh beef because of Mad Cow and/or Packer Recall are given in Table 4. There was an inadequate number of responses for the model to run with the Oprah data. The overall models for Mad Cow and Packer Recall were significant, based on chi squared tests with 15 degrees of freedom, at less than the one percent level, with coefficients of 98.067 and 64.621, respectively. The Mad Cow and Packer Recall models predicted 80.6 and 67.3 percent, respectively, of actual responses. For

decrease in consumption associated with Mad Cow Disease, the binomial logit model detected seven significant variables: New York City, Denver, San Francisco, Single Adult Head, White, Frequency of Beef Consumption and Safety Rating of Local Beef Supplies. Only Single Adult Head and Safety Rating of Local Beef Supplies had positive signs. Therefore, single adult head respondents and respondents who were more likely to rate the safety of their local beef supplies as being below average were more likely to decrease beef consumption due to news of the Mad Cow Disease in England. Respondents from New York City, Denver, and San Francisco were less likely to lower beef consumption due to Mad Cow Disease. Whites or more frequent beef eaters were less likely to reduce beef consumption with Mad Cow Disease. The binomial logit model for Packer Recalls had four significant variables. Female, Single Adult Head and Safety Rating of Local Beef Supplies had negative signs while race (White) was positive.

Table 5 presents the results of the ordered probit analysis of the reduction in quantity of fresh beef consumed resulting from Mad Cow and Packer Recall incidents. The model for Mad Cow was significant at the five percent level based on a coefficient of 29.971, with 15 degrees of freedom. The Mad Cow and Packer Recall models predicted 45.2 and 39.2 percent, respectively, of actual responses. Three variables were significant: Frequency of Beef Consumption, with a negative sign, and Safety Rating of Local Beef Supplies and San Francisco, with positive signs (each being the expected sign). The ordered probit model for Packer Recall was significant at the one percent level with a coefficient value of 32.753 and 15 degrees of freedom. It had two significant variables with negative signs: White and Frequency of Beef Consumption.

Estimated coefficients and probability levels for the ordered probit analysis of the effect of Mad Cow and Packer Recall incidents on the length of reduction in fresh beef consumption are presented in Table 6. The Mad Cow and Packer Recall models were significant at the five percent level, with a coefficient value of 29.798 and 26.875, respectively, with 15 degrees of freedom. The Mad Cow and Packer Recall models predicted 35.5 and 32.2 percent, respectively, of actual responses. Five variables were significant for the Mad Cow model: Denver, Female, Adjusted income, Homemaker and Frequency of Beef Consumption. All but Female and Frequency of Beef Consumption had positive influences on the length of reduced consumption period. Only one variable was significant for the Packer Recall model and that was Frequency of Beef Consumption with a negative sign, as expected.

Table 4
Estimates of the Binomial Logit Model for Impact of Mad Cow and Packer Recall Issues[a] on the Decision to Reduce Fresh Beef Consumption, Five U.S. Cities, 2001.

Variable	Mad Cow Disease[b]		Packer Recall[b]	
	Coefficient	Probability	Coefficient	Probability
Constant	0.4885	0.5610	0.3142	0.7534
New Orleans	-0.4442	0.2380	0.1276	0.7534
New York City	-0.8172*	0.0533	0.2842	0.5068
Denver	-0.7167*	0.0310	0.0965	0.7824
San Francisco	-1.0106*	0.0042	0.5141	0.1644
Female	0.3579	0.1254	-0.7858*	0.0012
Single Adult Head	0.5211*	0.0433	-0.8231*	0.0028
Children Present	-0.0165	0.9462	-0.1876	0.4691
White	-1.1353*	0.0000	1.0678*	0.0005
Income	0.0330	0.3845	-0.0252	0.5407
Education	-0.0884	0.7317	0.1078	0.6915
Age	-0.0084	0.2728	0.0036	0.6596
Homemaker	-0.1081	0.8324	0.0773	0.8891
Own Risk Assessment	-0.1446	0.1882	0.0340	0.7794
Frequency Beef Consumption	-0.3316*	0.0007	0.1019	0.3771
Safety Rating of Local Beef	0.4710*	0.0001	-0.3848*	0.0035

[a] There were insufficient responses for the Oprah statement for it to be included in the analysis.
[b] Pseudo R-squared values were 0.159 for Mad Cow and 0.130 for Packer Recalls.
* Significant at the five percent level.

Table 5
Estimates of the Ordered Probit Model for the Impact of Mad Cow and Packer Recall Issues[a] on Quantity Decrease in Fresh Beef Consumption, Five U.S. Cities, 2001.

Variable	Mad Cow Disease[b]		Packer Recall[b]	
	Coefficient	Probability	Coefficient	Probability
Constant	1.5520*	0.0499	2.1838*	0.0042
New Orleans	-0.1204	0.7184	-0.0622	0.8367
New York City	0.2675	0.5032	0.1327	0.7049
Denver	0.3306	0.2459	0.2851	0.2483
San Francisco	0.5841*	0.0869	0.1435	0.6087
Female	-0.0598	0.7730	0.2681	0.1570
Single Adult Head	0.0830	0.7268	0.0741	0.7268
Children Present	0.3131	0.1587	0.2035	0.3140
White	-0.0301	0.8928	-0.4016*	0.0569
Income	-0.0278	0.3887	0.0009	0.9767
Education	-0.0181	0.9376	-0.0843	0.6837
Age	0.0067	0.3582	0.0047	0.4890
Homemaker	-0.0717	0.8749	-0.0174	0.9640
Own Risk Assessment	-0.0600	0.5706	-0.1198	0.2156
Frequency Beef Consumption	-0.1992*	0.0190	-0.2847*	0.0009
Safety Rating of Local Beef	0.2245*	0.0379	-0.1198	0.2156
Mu1	0.9249*	0.0000	0.9462*	0.0000
Mu2	2.0746*	0.0000	1.7651*	0.0000

[a] There were insufficient responses for the Oprah statement for it to be included in the analysis.
[b] Pseudo R-squared values were -0.09 for Mad Cow and 0.08 for Packer recalls.
* Significant at the five percent level.

Table 6.
Estimates of the Ordered Probit Model for the Impact of Mad Cow and Packer Recall Issues[a] on Length of Period of Decreased Fresh Beef Consumption, Five U.S. Cities, 2001.

Variable	Mad Cow Disease[b]		Packer Recall[b]	
	Coefficient	Probability	Coefficient	Probability
Constant	0.6994	0.9060	-0.1007	0.8913
New Orleans	-0.1636	0.6216	-0.2295	0.4437
New York City	0.0964	0.8088	-0.1929	0.5765
Denver	0.5699*	0.0431	0.0674	0.7811
San Francisco	0.3007	0.3643	0.1493	0.5886
Female	-0.3953*	0.0552	0.0072	0.9693
Single Adult Head	0.3571	0.1313	0.3134	0.1308
Children Present	-0.0792	0.7187	0.0642	0.7487
White	0.0704	0.7490	0.2379	0.2481
Income	0.0573*	0.0761	0.0219	0.4613
Education	0.1027	0.6510	0.0696	0.7326
Age	-0.0011	0.8815	-0.0109	0.1052
Homemaker	1.1731*	0.0119	0.4266	0.2838
Own Risk Assessment	-0.0115	0.9106	0.1420	0.1337
Frequency Beef Consumption	-0.1420*	0.0863	-0.2316*	0.0061
Safety Rating of Local Beef	0.0727	0.4956	0.1338	0.1459
Mu1	0.4270*	0.0000	0.5300*	0.0000
Mu2	0.9634*	0.0000	1.0564*	0.0000
Mu3	1.4107*	0.0000	1.3655*	0.0000
Mu4	1.8051*	0.0000	1.7328*	0.0000

[a] There were insufficient responses for the Oprah statement for it to be included in the analysis.
[b] Psuedo R-squared values were 0.07 for Mad Cow and 0.05 for Packer recalls.
* Significant at the five percent level.

CONCLUSIONS AND IMPLICATIONS

Given their proximity to beef production and/or slaughter centers, Denver and Chicago were expected to have the highest rates of beef consumption. Beef consumption, however, was highest in New York City, which is located some distance from the beef production area.

Respondents from New York City were particularly resistant to ascribing the news of the three beef safety incidents as pertaining to the safety of their local beef supplies. New York City respondents also reported the second lowest quantity of reduction in consumption and the shortest period of reduction. Obviously, the surveyed New York consumers have a more favorable opinion of beef as a food than respondents in the other cities.

While the Texas cattlemen may have feared that the statements made by Oprah regarding beef consumption caused beef cattle prices to decline, the results of this survey indicate only a minor proportion of consumers used her statement as an excuse for reducing beef consumption. The decisions of advertising agencies indicate their strong belief that celebrity status sells products. In this case, Oprah's decision to cease beef consumption was followed by very few respondents.

This study revealed that media reports concerning the remaining two incidents had only minor impacts on the beef consumption rates of the majority of respondents. The most influential, packer recalls, caused only slightly more than one fourth of respondents to reduce their beef consumption. As expected, the BSE Outbreak influenced U.S. beef consumers much less than it did beef consumers in England and adjoining countries. The overall impact of the outbreak of BSE in England on U.S. beef consumption and prices was a mere ripple, attesting to the success the USDA has had in excluding BSE from the country and the overall confidence the U.S. consumer has in the safety of the food supply (USDA 2000). The more recent Canadian outbreak is likely to have had a greater impact on beef consumption in the US than the original outbreak in England.

Differences attributable to city existed only for Mad Cow Disease in impacting the respondent's decision to reduce beef consumption and the length of time he or she reduced beef consumption. Consumers in the base city, Chicago, were the most influenced by the media's presentation of the Mad Cow Disease issue. Consumers in the remaining cities were less inclined to reduce beef consumption based on the Mad Cow issue. When they did reduce beef consumption due to the Mad Cow Disease, consumers in Denver reduced beef consumption over a longer period than those in Chicago. Just as a hometown often gives less respect to one of its own who makes good, familiarity may reduce support for products as well.

White respondents were less likely to reduce beef consumption due to Mad Cow and inclined to reduce consumption by a smaller amount for Packer Recall. This may mean whites have a greater overall knowledge of beef safety than minorities. Since more than one packer recall of fresh beef occurred over the years preceding the survey, locality of the impact could not be ascertained, hence, no significant city differences.

As expected, frequent beef eaters were less likely to consider Mad Cow Disease as justification for reducing beef consumption. Moreover, frequent beef eaters who did reduce beef consumption because of either Mad Cow or Packer Recall reported smaller reductions in consumption and for shorter periods of time. Heavy beef consumers are either more informed on beef safety than others or they did not consider these specific incidents to be of importance.

Respondents who had a poorer perception of the safety of local fresh beef supplies were more likely to use Mad Cow Disease as a reason for reducing beef consumption and opted for larger reductions over longer periods of time. They also were more inclined to reduce beef consumption due to Packer Recalls. These results tend to show that individuals with a poorer perception of the safety of local beef supplies tend to blame factors beyond the local area.

The respondent's own risk assessment level was expected to be important but was not. In general, gender, family income, education, age and homemaker status had little influence on the respondent's decisions on the three safety incidents studied. Beef safety appears to cover the entire spectrum of these traditional socioeconomic characteristics.

The effectiveness of the media for each issue could not be estimated due to the lack of information on the extent, depth and length of coverage of these issues in the five cities. Hence, this study should not be used to cast any implication of intent to influence by any media member in any of the five cities.

REFERENCES

Albrecht, J.A. "Food Safety Knowledge and Practices of Consumers in the USA." *Journal of Consumer Studies*. 19 (1995):119-134.

Altekruse, S.F., D.A. Street, S.B. Fein and A.S. Levy. "Consumer Knowledge of Foodborne Microbial Hazards and Food Handling Practices." *Journal of Food Protection*. 59 (1995):287-294.

Anonymous. "Bovine Spongiform Encephalopathy; Mad Cow Disease." *Nutri Revs.* 54(7)1996: 208-210.

Anonymous. "Famous Veggie Quotes." Http://www.famousveggie.com/quotes.cfm. 2002.

Brown, Paul. "*Bovine Spongiform Encephalopathy* and *Creutzfeldt-Jacob Disease*: The Link is Unproven, but no Better Explanation is Presently Forthcoming." *British Medical Journal*. v 312 n 7034 (1996): pp790-2.

Capps, Oral, Jr. and Randall Kramer. "Analysis of Food Stamp Participation using Qualitative Choice Models." *American Journal of Agricultural Economics*. 67-1 (1985):49-59.

Center for Disease Control and Prevention. 2002. "New Variant CJD: Fact Sheet."USDept of Health and

Human Services. Http://www.cdc.gov/ncidod/diseases/cjd/cjd_fact_sheet.htm

Cowen, C. "Irish and European Consumer Views on Food Safety." *Journal of Food Safety*. 18 (4) 1998:275-295.

Crown, William H. Statistical Models for the Social and Behavioral Sciences. Praeger Westport Connecticut. 1998.

Curk, A. "Bovine Spongiform Encephalopathy Crisis in Europe and its Impact on Beef Consumption in Slovenia." *Revue Scientifique Et Technique De L Office International Des Epizooties.* 70(3) 1999: 758-763.

Fast Forward, Inc. "Sperling Best Places." Http://www.bestplaces.net/html/col1/asp. 2003

Lacy, R.W. "The BSE Epidemic." *J Nutri Med.* 3 (2) 1992: 149-151.

Daniels, R.W. "Home Food Safety." *Food Technology*. 52(1998):54-56.

Dillman, D. Mail and Telephone Surveys: The Total Design Method. Wiley, NY. 1978.

Judge, G.G., W.E. Griffiths, R.C. Hill, H. Lutkepohl, and L. Tsoung-Chao. *The Theory and Practice of Econometrics*. Second Edition. New York: John Wiley and Sons. 1988.

Lloyd, T., S. McCorriston, C.W. Morgan and A.J. Rayner. "The Impact of Food Scares on Price Adjustment in the UK Beef Market." *Agricultural Economics: The Journal of the International Association of Agricultural Economists*. 25 (2/3) 2001:347-357.

Lyman, Howard. Mad Cowboy: Plain Truth from the Cattle Rancher Who Won't Eat Meat. Scribner Publishing 192 pages. 1998.

Madalla, G.S. Introduction to Econometrics. Macmillan. New York. 1988.

USDA/ERS/MTED. Red Meat Yearbook 1970-2000. August 2000

United States Department of Agriculture. Livestock and Meat Statistics. Various Issues. 1995-2001.

Peterson, H.H. "The Japanese Meat Market." Staff Paper No 02-02 Department of Agricultural Economics, Kansas State University. 19 pp 2002.

Roosen, J., J.L. Lusk and J.A. Fox. "Consumer Demand for and Attitudes Toward Alternative Beef Labeling Strategies in France, Germany and the UK." *Agribusiness: An International Journal*. 19 (1) 2003: 77-90.

Strak, John. "The Effectiveness of MLC's Beef Promotion During the BSE Crisis." *Journal of Food Distribution Research*. 29)1) 1998: 22-27.

Verbeke, W. and R. Ward. "A Fresh Meat Almost Ideal Demand System Incorporating Negative TV Press and Advertising Impact." *Agricultural Economics: The Journal of the International Association of Agricultural Economists*. 25(2/3) 2001:359-374.

Wolf, I..D. "Home Food Handling: A Timely Scientific Status Summary." *Food Technology*. 49(1995):28.