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## Food Safety and Fear: Factors Affecting Consumer Response to Food Safety Risk<sup>1</sup>

Gregory A. Baker <sup>a</sup> ①

<sup>a</sup> *Associate Professor in the Economics and Management Departments and Director of the Food and Agribusiness Institute in the Leavey School of Business, Santa Clara University, 500 El Camino Real, Santa Clara, CA 95053-0396, U.S.A.*

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### Abstract

The objective of this research was to explore the factors that affect consumers' responses to low probability food safety risks. A survey of two thousand consumers was conducted in mid-2003, yielding a response rate of 32.0%. The analysis indicated a family-oriented response to food safety risks. Primary meal planners, women, and members of households with young children were the most likely to have an extreme risk avoidance response.

### Introduction

Controversies involving agricultural chemicals, such as alar or organophosphates, or new technologies, such as the products of genetic engineering – commonly referred to as genetically modified organisms (GMOs) – inevitably pit producers and marketers of food products against consumers and consumer groups. The arguments are familiar. The consumer contingent often argues that any level of risk is unacceptable, that the chemicals are used for the benefit of growers, and that, in any case, the decision as to what constitutes acceptable risk should lie with the consumer not the producer. Food producers, on the other hand, argue that the

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① Correspondence to: Tel: 1-408-554-5172  
Fax: 1-408-554-5167  
Email: [gbaker@scu.edu](mailto:gbaker@scu.edu)

benefits of using agricultural chemicals far exceed the risks, that some produce would be almost impossible to grow without the use of chemicals, and that chemicals are used because consumers demand cosmetically perfect fruits and vegetables. Producer groups find themselves in the uncomfortable position of trying to explain to consumers why their perceptions are wrong.

In recent years, consumer and environmental groups have had some successes in modifying some of the regulations and underlying legislation that govern the production and labeling of produce. The laws governing the use of agricultural chemicals have been overhauled and legislation has been passed regulating organic foods. However, the fundamental question of what constitutes an acceptable risk for food products remains unresolved.

There are several challenges to meeting consumers' demands for safe food. The first challenge lies in understanding what consumers consider to be safe and the factors that influence their perception and response to food safety risks. Secondly, policies must be developed that address consumer concerns. Finally, we must learn how to effectively communicate risk information to consumers. The focus of this study is on the first challenge, more specifically, to investigate those factors that affect consumers' response to food safety risks.

## **Related Literature**

To date, little research has been conducted on factors affecting consumer perception of food safety risk. Dosman, Adamowicz, and Hrudehy (2001) found that women, older respondents, conservative voters, and people in households with more children and higher incomes tended to perceive food safety risks as greater than individuals in other categories. Nayga (1996) studied the sociodemographic factors that affected the perception of the safety of various food industry technologies among main meal planners. He found that those with the highest level of concern tended to be females, those living in nonmetro areas, and individuals with the highest levels of education and income. Lin (1995) studied factors that influenced the importance of food safety to main meal planners in food shopping, although he did not directly examine factors affecting risk perceptions. He found that those most concerned with food safety tended to be women, older, more educated, full-time homemakers, or have a member of their household in an at-risk group (older, very young, or pregnant).

In contrast, a great deal of research has been published on the more general topic of factors affecting the perception of environmental risks. Because of the limited number of studies that have examined factors influencing the perception of food safety risks, the more general literature on environmental risk perceptions will be explored to provide a broad basis for identifying variables to be included in this study.

The most consistent finding, supported by several dozen studies, is that women perceive risks to be higher than do men (Flynn, Slovic, and Mertz, 1994). However, there is little agreement as to why this is the case. The matter is further complicated because gender is interrelated with the role played by women within a household (Dosman, Adamowicz, and Hrudey, 2001). Flynn, Slovic, and Mertz (1994) suggest that future research focus more on sociopolitical factors, which may be associated with gender, than on gender itself.

Another factor that has been found to be associated with risk perception is age, with older individuals being more likely to rate risks higher than younger individuals (Krewski et al., 1994). Several explanations for this finding have been posited by Dosman, Adamowicz, and Hrudey (2001). Young people may be more familiar with certain risks, as is the case with risks associated with new technologies. Moreover, younger individuals may not have experienced the particular effects of certain health issues and therefore may not perceive them as risks. Lastly, young people may be exposed to many risks and therefore perceive all risks to be less threatening to them than do older people.

Race has also been studied as a factor that may affect risk perceptions. Savage (1993) found that blacks perceived several hazards to be more threatening than did whites.

Education has been found to be inversely related to the perception of risk (Slovic, 1997). However, this factor may be expected to influence the perception of risks in two disparate ways. First, people with higher levels of education are likely to be better informed and therefore may be more aware of some types of risks, such as the risk of food additives or pesticides in food, than people with less education (Dosman, Adamowicz, and Hrudey, 2001). On the other hand, more education may help people put small risks in perspective and make them less susceptible to sensational reporting of risks. Dosman, Adamowicz, and Hrudey (2001) suggest that education may also help individuals mediate risks because they better understand the relationship between risks and factors that mitigate those risks.

Another factor that has been found to influence risk perceptions is the age of children in the household. Hamilton (1985a and 1986b) and Lin (1995) found that individuals with the youngest children had the greatest concerns about environmental problems.

Finally, many other factors have been studied as possible predictors of risk perceptions, including political convictions (Flynn, Slovic, and Mertz, 1994), information sources (Zuo and Chern, 1996), knowledge of a technology (Kuklinski, Metlay, and Kay, 1982), and trust in institutions (Flynn et al., 1992).

## **Methods and Procedures**

The data analyzed in this study were collected in a random, national, mail survey of 2,000 households conducted in mid-2003. The mailing lists were purchased from a private company that maintained the names and addresses of individuals in over 110 million U.S. households. In addition to the survey instrument, the recipient received a letter that encouraged his or her participation in the study, instructions for completing the survey, and a postage-paid return envelope. A dollar bill was also included to encourage recipients of the survey to complete and return it. A follow-up post card was mailed approximately one month after the first mailing to encourage non-respondents to complete and return the survey. A total of 640 surveys were completed and returned, yielding 584 usable responses. The difference between the total responses and usable responses was largely because many respondents left one or two questions unanswered. After accounting for the 173 bad addresses, the net response rate was 32.0%.

The survey instrument was developed to measure consumers' response to a food safety risk. Previous surveys have typically asked respondents to rate the level of a given risk on a Likert-like scale (Dosman, Adamowicz, and Hrudehy, 2001; Flynn, Slovic, and Mertz, 1994). While such surveys are easy to administer, a key drawback is that responses are dependent on each individual's interpretation of the scale. This is usually mitigated by ensuring that the sample is sufficiently large to offset individual differences in interpretation. Nonetheless, because of the subjective nature of the question, comparisons across groups may be suspect when one or more groups contain only a few respondents.

The survey used in this study was designed to avoid the problems associated with a subjective question. Respondents were given risk information for a commonly consumed product and asked how this information would change their consumption of the product. Specifically, respondents were asked how much they would reduce their consumption of conventionally grown apples if it were known with certainty that the product posed a risk of one chance in a million of causing cancer.

Information was also collected in several other categories. Sociodemographic information included gender, age, ethnicity, the age of children living in the household, level of education, and level of income. Respondents were also asked whether there was anyone living in their household who was pregnant or chronically ill. Individuals in either of these two categories were considered to be "at-risk." In order to determine the role the respondents played regarding decisions about food, they were asked to indicate whether they were the primary meal planner in their household. Finally, respondents were asked to indicate, using a 9-point Likert scale, whether they were one of the first of their peers to adopt a cellular phone. Selected sample statistics for respondents are presented in table 1.

Table 1

## Sample Characteristics of Survey Respondents (N=584)

Characteristic	Sample Statistic
Gender (% female)	46.5
Mean Age (years)	50.2
Completed High School (%)	95.4
Ethnicity (%)	
• African-American	5.5
• Asian	2.9
• Hispanic	5.5
• White non-Hispanic	82.5
• Other	3.6
Primary Meal Planner (%)	63.1

## Results and Discussion

In order to examine the relationship between respondents' sensitivity to food safety risk and various descriptive factors, a qualitative choice model, in this case a logistic regression model, was estimated. Respondents were classified based on their response to the low probability food safety risk question. Respondents who indicated that they would greatly reduce their consumption of conventional apples (defined as a reduction of greater than 80 percent), based on a cancer risk of one chance in one million, were classified as being extremely risk averse. Respondents who indicated

that they would reduce their consumption by 80 percent or less (including no reduction), based on the risk information, were classified as moderately risk averse. Assuming a logistic probability distribution, the binomial logit model is defined as:

$$(1) \quad P(RISK = 1) = \frac{\exp(\mathbf{x}'\beta)}{1 + \exp(\mathbf{x}'\beta)},$$

$$P(RISK = 0) = \frac{1}{1 + \exp(\mathbf{x}'\beta)},$$

such that the dependent variable, *RISK*, is assigned the value of 1 if the respondent is extremely risk averse, and 0 if the respondent is moderately risk averse;  $\mathbf{x}'$  is the vector of independent variables including a constant; and  $\beta$  is the coefficient vector.

Table 2

## Description of Variables for Logit Model of Consumer Acceptance of Low Probability Food Safety Risk

Variable Name	Description
<b>Dependent Variable</b>	
<i>RISK</i>	1 if extremely risk averse 0 if moderately risk averse
<b>Independent Variables</b>	
<i>GENDER</i>	1 if female 0 if male
<i>AGE</i>	Years
<i>ETHNICITY</i>	1 if Anglo-American 0 otherwise
<i>CHILDHOME</i>	1 if child 12 or younger lives in household 0 otherwise
<i>ATRISK</i>	1 if someone who is pregnant or chronically ill lives in household 0 otherwise
<i>EDUCATION</i>	Highest level of education completed: 1 if elementary school 2 if some high school 3 if high school 4 if some college 5 if college 6 if grad school
<i>INCOME</i>	1 if \$0 to \$20,000 2 if \$20,001 to \$40,000 3 if \$40,001 to \$60,000 4 if \$60,001 to \$80,000 5 if \$80,001 to \$10,000 6 if greater than \$100,000
<i>PRIMEMEAL</i>	1 if primary meal planner in household 0 otherwise
<i>FIRSTCELL</i>	One of first of peers to own a cellular phone 1 if strongly disagree . . . 9 if strongly agree

The independent variables included sociodemographic characteristics, household role, and the psychographic variable relating to cellular phone adoption (table 2).

The logit analysis was performed using the SAS LOGIT procedure (Sas Institute, Inc.). The model is a reasonably good fit as indicated by the summary statistics (table 3). The -2 log likelihood of the intercept only model is 466.27 and the -2 log likelihood of the final model is 442.74, an improvement of 23.53. This is highly significant ( $p < 0.0001$ ). The model correctly predicted 65.4 percent of the observed responses. The results of this study indicate that two key sociodemographic variables and household role are key predictors of a consumer's reaction to food safety risk – *GENDER*, *CHILDHOME*, and *PRIMEMEAL* (table 3). The results may be interpreted as indicating that those individuals who had the strongest reaction to the low probability food safety risk tended to be women, have a child 12 years of age or younger living in the household, and are the primary meal planner in their household.

As with most previous studies of food safety and environmental risk, gender was a key determinate of the respondent's response to the stated risk. Women were more likely to exhibit an extreme risk avoidance response, by drastically reducing consumption of apples based on a low probability cancer risk, than were men. Several hypotheses have been offered to explain gender differences in the perception of risk. One explanation is that women tend to be more nurturing than men because of biological differences and traditional male and female roles. Other explanations focus on differences in vulnerability and the level of understanding of science and technology associated with gender. Flynn, Slovic, and Mertz (1994), in a study focusing on both race and gender, hypothesize that "women and nonwhite men see the world as dangerous because in many ways they are more vulnerable, because they benefit less from many of its technologies and institutions, and because they have less power and control."

The other sociodemographic variable that was found to be a predictor of the respondent's reaction to the low probability food safety risk was the presence of young children in the household. Individuals in households with a young child (12 years old or younger) were more likely to exhibit an extreme reaction to the food safety risk than were people in households without a young child. This is consistent with Lin's finding that food safety was more important to main meal planners when a young child (age 6 or younger) was present in the household. In a related finding, Dosman, Adamowicz, and Hruday (2001) found that the number (not the age) of children in the household was positively related to the perception of food safety risks. The results of this study indicate that respondents had an extreme risk avoidance response to cancer causing pesticides when young children were involved. It was interesting that a similar result was not found for respondents who lived in a household with a member of an at-risk group. This may be due to the long-term nature of the risk, causing respondents to be extra cautious with those who stand to

Table 3

Logit Model of Factors Affecting Consumer Acceptance of Low Probability Food Safety Risk

Variable/Statistic	Coefficient ( Significance)	Marginal Probability
<i>CONSTANT</i>	-3.0500 (0.0002)**	
<i>GENDER</i>	0.5348 (0.0766)*	0.0436
<i>AGE</i>	0.0002 (0.9794)	0.0000
<i>ETHNICITY</i>	-0.3379 (0.2596)	-0.0287
<i>CHILDHOME</i>	0.4915 (0.0969)*	-0.0418
<i>ATRISK</i>	0.0502 (0.9093)	0.0041
<i>EDUCATION</i>	0.1683 (0.1772)	0.0181
<i>INCOME</i>	-0.0111 (0.9011)	-0.0012
<i>PRIMEMEAL</i>	0.6537 (0.0632)*	0.0506
<i>FIRSTCELL</i>	0.0025 (0.9585)	0.0003
-2 Log Likelihood	442.74	
$\chi^2$	23.53**	
Correct Predictions	65.4%	

Note: A single and double asterisk indicate significance at the 10% and 1% levels of probability, respectively. Marginal probabilities for the continuous variables and approximately continuous variables are calculated with all variables at their mean values. The marginal probabilities for the binary variables *GENDER*, *ETHNICITY*, *CHILDHOME*, *ATRISK*, and *PRIMEMEAL* are calculated as the change in probability resulting from changing the value of the binary variable from 0 to 1 holding all other variables at their mean values.



be exposed to the danger for the longest time, that is young children. Alternatively, this response may also reflect knowledge of the comprehensive and well-publicized study documenting the special susceptibility of infants and children to the effects of pesticides (National Academy of Sciences, 1993).

The lone household role variable, *PRIMEMEAL*, was also found to be a predictor of the respondent's reaction to the low probability food safety risk. Primary meal planners were more likely to greatly reduce their consumption of apples in response to the low probability food safety risk, than were individuals who were not the primary meal planners in their households. There is little previous research examining the impact of the role within the household on risk perceptions. Lin's (1995) and Nayga's (1996) studies of factors that influence the importance of food safety utilized only information from main meal planners, and therefore did not examine differences between main and non-main meal planners. One explanation for the behavior of primary meal planners is that they are more vigilant than those who do not have primary responsibility for meal planning because they realize that their decisions regarding food choices affect not only their health but that of their entire household as well.

It is interesting that many of the sociodemographic factors, which are often found to be associated with the perception of food and environmental risks, were not found to be related to the risk avoidance response in this study. Only gender and the presence of young children in the household were associated with a strong risk avoidance response. There was no statistically significant relationship between the other sociodemographic factors, including age, ethnicity, education, income, and the presence of an at-risk person in the household, and the risk avoidance response. This raises the possibility that the factors that influence the *perception* of a risk may differ from the factors that influence the actual *response* to a risk.

### Concluding Remarks

The results of this analysis provide insights into the factors that influence consumer reaction to food safety risks. They are consistent with a family-oriented response to food safety risks, indicating that food purchasing decisions are motivated by the desire to protect the health of members of the decision-maker's household. Primary meal planners (whose food choices impact the health of their entire household), individuals in households with young children (who are especially susceptible to pesticides), and women (who are often portrayed as more nurturing) were most likely to have an extreme risk avoidance response to the low probability food safety risk.

The results of this study are suggestive of potential strategies for addressing food safety concerns and food safety education programs. One of the key findings of this research is that those consumers who are the principal decision-makers, that is the

primary meal planners in their households, are the most likely to be very risk averse and unwilling to accept even very low probability food safety risks. Any program or message intended to influence consumer food safety behavior should target these key decision-makers because of their influential role in household food choices. A priority for future research is to explore the factors and motivations that influence the risk perceptions and responses of primary meal planners as well as how their fears may be assuaged.

Contrary to the findings of many previous studies of food safety and environmental risks, the results of this study indicate that many of the sociodemographic factors typically associated with the perception of risk did not influence the response to food safety risk. The only factors that influenced the response to food safety risk were gender and the presence of young children in the household. Future research is needed to explore whether the factors that influence the perception of food safety risk differ from the factors that influence the actual response to food safety risk.

Finally, while this research sheds some light on factors that explain consumers' response to low probability food safety risks, it falls short of fully explaining consumers' behavior in this regard. Future research should explore other indicators, such as values and lifestyles, that may lead to a deeper understanding of what motivates extreme responses to low probability food safety events.

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