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**HOW MUCH FOOD SAFETY DO CONSUMERS WANT?  
AN ANALYSIS OF CURRENT STUDIES AND STRATEGIES FOR FUTURE RESEARCH**

by

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When government enacts laws to ensure the safety of food, when government regulators decide whether to allow the use of new inputs to food production, and when food producers make production choices or develop new food products, each must ask the same question. How much food safety do consumers expect from the food system? The answers they give to this question determine the level of safety that food consumers experience. The answers they have given are controversial.

There is controversy because answers are difficult to come by. Safety is not a good that food consumers can go out to the supermarket to buy, thus revealing how much they want of it at different prices. Rather, safety is a characteristic of the goods and services they buy, and it is a characteristic that is extremely costly--and in some cases, impossible--to assess. It is costly to determine whether a particular food contains a substance which might pose health risks. It is costly to determine just what types of health risks might be involved ex ante since scientists cannot even identify ex post the cause of 50% of the outbreaks of foodborne disease. If consumers cannot discover these things, how can they articulate their true demand for food safety to the people who are responsible for supplying it?

It is precisely this information problem that provides justification for the regulation of food safety. It is the justification for labeling requirements for those substances where exposure information can be communicated. It is the justification for food tolerances and process standards for those substances where exposure cannot be accurately gauged or the health risks of exposure are difficult for individuals to assess. But the fact of regulation does not lessen the problem of determining consumers' demands for food safety. While political processes such as the notice and comment



procedures of rulemaking provide a mechanism for articulating consumer demands, the high costs to individuals of using this process relative to the benefits they receive make their participation unlikely.

Without adequate mechanisms for articulating consumer demand for food safety, we need some other means for discovering what their demands are. The purpose of this paper is to review the research that investigates these demands and to suggest research that may be appropriate for improving our knowledge of them. The first part of the paper surveys existing studies of consumer attitudes and behaviors with respect to food safety. The second part examines what it is we want to know about consumer demands for food safety and what approaches might be used to gain this knowledge.

#### ATTITUDES AND BEHAVIORS TOWARDS RISKS IN FOOD

While much has been written on the subject of food safety, very little empirical research exists on consumer demands for food safety. Fewer than a dozen studies could be identified on this subject. A computer search of data archives at the Roper Center uncovered little additional information (1). This section summarizes the available studies and provides an interpretation of their findings.

The analysis is organized around three major categories of data generated by these studies. The first is survey data on consumer concerns about food safety. Major trends in this data are summarized and potential explanations for the findings are proposed. The second category is survey data on attitudes about the proper role of consumers, government, and the food industry in assuring food safety and providing food safety information. The third category deals with the effect of food safety information on purchasing decisions. While some of the surveys have asked consumers about their food purchases, case studies of consumer response to food safety problems such as saccharin warnings and food contamination incidents provide the most insight.

Since the purpose here is to summarize, rather than to critique, little attention will be given to the methods employed by these studies. Therefore, a few general warnings



are in order. In some cases, the samples are nonrandom and unrepresentative of U.S. consumers. Furthermore, some of the questions asked in the surveys appear to be prone to response bias due to the wording of the questions. While comparisons among the findings of the different studies will be made, it is important to note that the questions and respondents in the studies are not comparable.

#### Are Consumers Concerned About Food Safety?

When asked whether they have particular concerns about food, safety turns out to be an important issue to consumers. For example, in 1985 Good Housekeeping Institute (GHI) asked 100 women in the Philadelphia area to volunteer a list of their main food concerns. Forty-one percent responded that their main food concern was avoiding harmful additives, preservatives, and chemicals (see Table 1). Other major responses were high food prices (35%), the freshness of food (19%), avoiding salt (13%), and finding nutritional foods (11%).

These results are similar to ones obtained by the Food and Drug Administration (FDA) in nationwide, random sample surveys conducted in 1978 and 1980 (Heimbach, 1981). The FDA asked respondents an open-ended question on what problems, difficulties, or concerns respondents had with food aside from prices. Hazardous ingredients was the most frequently mentioned item in both years (12% and 19%, respectively), followed by poor quality (14% in both years), freshness (8% and 9%, respectively), and labeling concerns (8% in both years).

When GHI asked this same question in a slightly different way in another study, a somewhat different ranking of food concerns emerged. In 1984, GHI asked 200 women in 20 major metropolitan areas to rate their level of concern with 15 food issues (see Table 2). In this study, 88% of respondents said they were extremely or very concerned about the freshness dating on food packages. This was followed by the price of food (85.5%), the nutritional value of food (84.5%), and, then, chemicals in food (76%) and the safety of



food (76.5%). In this ranking, food safety issues do not emerge as the number one concern, although the concern level is quite high.

There are some indications that the ranking of food concerns may be changing. National, random surveys conducted for the Food Marketing Institute (FMI) indicate that nutritional concerns may be becoming more important than food safety concerns. FMI has been asking their survey respondents for a number of years what concerns them most about the nutritional content of food they eat (see Table 3). While it might be expected that only nutritional issues would be mentioned in response to this open-ended question, respondents have also mentioned food safety issues. In 1983, the most frequent response to FMI's question was concern about food additives and chemicals. However, in their 1986 survey, the percentage of respondents mentioning this same response was smaller. In contrast nutritional concerns were mentioned more frequently in 1986. This result could be taken to mean that there is less concern now with food safety issues (Hammonds, 1986). However, it could also mean that respondents are now more educated about nutritional issues. Given the increased attention to nutrition in the press and by advertisers of food products, this alternative interpretation should not be ruled out. Thus, the FMI poll might not be indicative of a lessening of interest in food safety issues per se. Rather, consumers may simply have a larger set of concerns about food now.

Do the results of these different surveys on food concerns mean that consumers believe that the food that they buy is unsafe? Survey results indicate that, on the whole, most consumers think that food is safe, but approximately 10% of consumers are seriously concerned.

A nation-wide survey conducted in 1980 by Market Facts, Inc. for the FDA asked respondents how confident they were in the safety of food and its effect on health (Heimbach, 1981). Forty-seven percent reported that they were totally confident that food is safe. Fourteen percent said that they were basically confident but with some doubt. Twenty-eight percent said that they were concerned about one or two specific



problems. Ten percent reported that they were generally very worried about food safety.

A similar result was obtained in 1982 and 1983 in the nation-wide, random sample surveys conducted for the Food Marketing Institute (FMI) by Harris. In their 1982 and 1983 polls, almost 90% of respondents said that they strongly or somewhat agreed with the statement that the food in supermarkets is safe to eat, but approximately 10% did not agree (see Table 4).

#### What Food Safety Issues Are Of the Greatest Concern?

While food safety is an important issue, consumers appear to have different levels of concern about different kinds of food safety issues. For example, polls conducted in 1984 by Roper and by FMI (Hammonds, 1984) asked national samples of randomly selected respondents to rate their level of concern for a variety of food safety and nutritional issues (Table 5). Pesticide residues appear to be the food safety issue of most concern. They were ranked as being of great concern by 77% of respondents. This was followed in level of concern by preservatives and additives, nutritional issues (e.g., cholesterol, salt, and sugar), artificial colors, and caffeine. Aspartame and saccharin were of the least concern.

This pattern of variable concern with different food safety issues occurs in other surveys as well. A national, random survey on food irradiation, jointly conducted by the Department of Energy and the National Pork Producers Council in 1984 (Wiese Research Associates), found that 55% of respondents rated pesticides as being of great concern. Diseases carried in food were mentioned as being of great concern by half of respondents, while preservatives were of great concern to 45% of respondents, and irradiation was of great concern to 38% of respondents.

The 1985 GHI survey asked respondents to rate their level of concern for four types of food safety issues: chemical sprays, chemical preservatives, ionization, and irradiation. Eighty percent responded that foods grown using chemical sprays were of major concern (Table 6). Seventy-five percent said that chemical preservatives were of

major concern, while 41% said that ionization was of major concern and 19% said that irradiation was of major concern. However, the percentage of respondents stating that they did not know their level of concern for ionization and irradiation was quite high.

A random survey of Kansas consumers conducted in 1983 (Kramer and Penner; Kramer) found the same type of pattern, though, again, respondents were presented with a somewhat different list of food safety issues. Kramer and Penner found that the food safety issue that ranked highest on concern was environmental contaminants, followed by disease-causing organisms, pesticide residues, and animal drug residues. Preservatives and artificial colors were ranked much lower in concern.

Across all studies, pesticide residues and environmental contaminants appear to be the food safety issues of very great concern to consumers. There is some evidence that disease or bacterial contamination is of the next greatest concern. Several surveys indicate that preservatives and artificial colors are of much lower concern. Last, irradiation and artificial sweeteners appear to be of the least concern to consumers.

#### Explaining Consumer Concerns

Why do consumers have the concerns they do? Why do we observe a pattern of differences in concern levels for different substances in foods?

One possible explanation is that level of concern is related to the actuarial health risks that would be posed by exposure to these substances through the diet if the individual did nothing to avoid that exposure. However, as Kramer has noted, consumers' level of concern with the major food safety issues is quite different from the level of concern expressed by scientists who rank risks on an actuarial basis. Food scientists rank pesticide residues as the least important health risk while disease-causing organisms are rated as the most important health risk. Thus, it would seem, consumers' concerns are not related to health risks calculated on an actuarial basis.



An alternative hypothesis is that concern is a function of perceived (as opposed to actuarial) health risks. Studies by Slovic, Fischhoff, and Lichtenstein suggest that risk perceptions are a function of the ability of an individual to recall or imagine the occurrence or possibility of sickness or injury associated with some activity (e.g., the consumption of a food additive). Their studies indicate that this ability depends on how long ago the image was received, with what frequency, and how memorable (i.e., personal or extraordinary) it was. Thus, an individual may overestimate the probability of an unlikely event because they had recent experience with or knowledge of the occurrence of that event. Similarly, an individual may underestimate the probability of an event because they had recent experience with or knowledge of the nonoccurrence of that event.

In terms of perceived food risks, then, we would expect more concern with substances whose health risks or presence in food has been frequently reported by the press. Similarly, we would expect less concern for those substances with which consumers have frequently had positive results following exposure.

There is some evidence for this interpretation in the FMI surveys (Hammonds) which show increasing levels of concern over nutritional issues and decreasing levels of concern over food safety issues. This result seems to coincide with trends in media coverage of these issues, although this observation is not based on a content analysis of media coverage of food-related health risks.

Other limited evidence for this interpretation is contained in the few surveys which have asked consumers about their perceptions of the severity of risk posed by different substances added to food. The results of the surveys indicate that rankings of risk perceptions may be similar to the rankings of concern reported above.

For example, a study of Pennsylvania households (Sachs, et. al.) asked respondents how much danger they felt there was to a person who eats fruits and vegetables that have been sprayed or dusted with pesticides. Over 70% of respondents reported that

there was a great deal of or some danger. While this question does not indicate actual risk perception because it does not indicate how likely people feel it is that fruits and vegetables have actually been sprayed or dusted, respondents were asked how much they agreed with the statement that foods sold at retail had been adequately inspected. Almost half of the respondents said they agreed or somewhat agreed with this statement.

In contrast, a national random survey conducted in 1979 (USDA, 1980) found that 63% of homemakers thought it was "not too likely" or "not at all likely" for inspected meat and poultry to have harmful bacteria, and a national random survey by the Roper Organization (1982) found that only 22% of respondents worried a lot or some about food poisoning. Thus, as with the concern levels, the percentage of respondents which perceive risks from pesticides in food appears to be greater than the percentage who perceive risks from bacteria in food. However, we might not find the same results today given recent media and congressional attention to the problem of bacterial contamination of milk, cheese, chicken and fish.

If correct, this interpretation of the genesis of consumer concerns has important implications because it suggests that (1) consumer concerns are at odds with scientific, and, possibly, regulatory concerns, and (2) consumer concerns are likely to change over time given media attention to particular food risks. The implication is that it will continue to be difficult for regulators and the food industry to respond to consumers concerns about food safety. It will be difficult for regulators because their methods of assessing health risks will lead them to address issues differently than the political climate would demand. It will be difficult for industry to respond because the length of time needed for new product development and introduction may exceed the time period of attention to particular food safety issues.

However, there is a third possible interpretation of the results. The third hypothesis is that level of concern with a substance added to food is related to the acceptability of risks, where acceptability depends on a substance's perceived risks and benefits and the



individual's ability to control their exposure to that substance. (See Fischhoff, et. al. for a test of this hypothesis with respect to more general health risk issues.) Exposure would be acceptable if risk from exposure is perceived to be low (i.e., either low probability of occurrence or small health consequence) relative to perceived benefits. Where exposure is acceptable, concern level would be low. Where exposure is not acceptable, but avoidance of or reduction in exposure is relatively easy to achieve, concern level would be moderate. Where exposure is not acceptable, and avoidance of or reduction in exposure is difficult, concern level would be high.

An interesting implication of this definition is that a high level of concern may result even if perceived risks are low. This would occur if exposure to a substance was not personally controllable and the substance was perceived to pose low risks and even fewer benefits.

There is some evidence in support of this third hypothesis. A Roper poll done in 1984 asked respondents whether they felt that the benefits of pesticide use outweighed its risks. Forty-five percent of respondents felt that the risks outweighed the benefits and 20% said they did not know. While this gives us some indication of why we might expect to find such high levels of concern about pesticides, it should be remembered that pesticide residues in food pose a much different level of risk than pesticide use (e.g., exposure of workers applying pesticides to crops), and the question asks about pesticide use.

Note that respondents may think that pesticide use has risks greater than benefits either because they perceive the risks of pesticides to be very great, as indicated by the survey results reported above, or because they perceive there are few benefits. The survey of Kansas consumers (Kramer) asked respondents what effect pesticide use has on food price, food quality, and food safety. Interestingly, 58% of respondents said that pesticide use increases food price (see Table 7). Over 40% said that pesticide use decreases or had no impact on food quality, and 22% said that they did not know what



effect pesticide use had on food quality. The effect on food safety was negative according to 43% respondents. These survey results indicate that individuals rank the benefits of pesticides quite differently from experts.

If hypothesis three is correct, the higher level of concern for pesticides than for other substances implies that consumers do not believe that they are sufficiently protected by government regulation because exposure to pesticides in food is personally difficult to control. In fact, the surveys indicate that approval of pesticide regulation is low. A random survey of Pennsylvania households in 1984 (Sachs, et. al.) found that slightly less than half of all respondents felt that government adequately regulates chemical use in or on food. This compares with a similar survey done in 1965 (Bealer and Willits, cited in Sachs, et. al.) which found that 98% of respondents felt government regulation was adequate. Similarly, a poll done by the Los Angeles Times in 1983, found that 47% of respondents felt that federal regulations on pesticides were not strict enough. Note, however, that this poll was done in the same year of the med-fly incident in California.

In contrast, national surveys conducted by the Roper Organization (1983 and 1984) indicate a fairly high level of approval for the general performance of food safety regulators. Over 70% of respondents reported highly or moderately favorable opinions of the FDA and the Food Safety and Inspection Service. Likewise, a study of 200 Good Housekeeping readers (GHI, April 1985) found that nearly three-quarters of respondents were somewhat to completely satisfied that the FDA is protecting them from harm.

In summary, the data suggest that the greater level of concern about pesticide residues in food may be due to perceptions among consumers that the health risk of pesticides are perceived to more severe, their benefits are smaller, and that they have less control over their exposure to them than they do for other substances added to food. However, we know little about what consumers believe about the other substances in terms of severity of risks, the amount of benefits, and control over exposure.



Nonetheless, if the hypothesis is correct, it has important implications for regulators and the food industry. If regulators or food producers perceive the benefits and risks of substances differently than consumers, their choices will be at odds with the desires of consumers.

#### Who Should be Responsible for Food Safety?

The idea that control over exposure may be an important factor in determining consumers' level of concern over different food safety issues is given further support by surveys of consumer attitudes on who should be responsible for food safety. In general, these surveys indicate that many consumers prefer to make choices about exposure to risks in food, rather than have the government make them.

A national, random survey done for the FDA by Harris in 1981 (Heimbach and Stokes) found that more than half of the respondents believed that they should be able to control their exposure to substances added to food. Fifty-four percent of respondents agreed with the statement that "the Government should make sure people are aware of any risks in eating certain foods or food ingredients, but should take things off the market only when the risks of eating the food are clearly greater than the benefits", while 40% agreed with the statement that it was government's responsibility to "remove from the market any food which poses even a small health hazard". More highly educated consumers were more likely to report agreement with the first of these two positions.

A more recent national poll conducted by Roper indicates that consumers overwhelmingly approve of warning labels for artificial food colors and sweeteners (see Table 8). On substances like sulfites, though, which is a newer issue and on which there is no warning label at this time, 46% of respondents felt that sulfites should be banned.

Kramer also found in her survey of Kansas consumers that respondents would be willing to pay for increased information about the safety of meat. When asked whether they would be willing to pay more for meat items if there were food safety information on the label, 67% said they would pay slightly more, and a small percentage said they would pay considerably more. When asked how much they would be willing to pay, 42%



said they would be willing to pay one to two cents more per pound of meat, and 22% said they would be willing to pay even more than that (see Table 9).

When asking consumers on whom they rely to make sure their food is safe, the Food Marketing Institute has found an increase over time in the percentage of respondents saying that they rely on themselves (see Table 10). The percentage of respondents saying that they rely on the federal government has increased as well. But note the decrease in reliance on consumer groups, food manufacturers, and retailers. The survey results suggest that people want to make food safety decisions themselves and that they want information from unbiased sources on food safety.

#### What Does Concern Mean?

Are consumers likely to avoid substances they are concerned about and not those that they have little concern about? Do changes in the percentage of the population who are concerned about food safety signal changes in food demands?

It is frequently asserted that declines in purchases of red meat and increases in purchases of chicken, fish, and vegetables are indicators that food safety concerns are increasingly being expressed in the marketplace. However, many other factors, such as changes in relative food prices, personal income, and demographic composition of the U.S. population, may also explain these trends. The fact is that we do not know if there is a relationship between stated concerns and food purchasing behavior.

Concern is defined by psychologists as being a mental state of readiness to become aware of and to process information or experience (Renn and Swaton). In other words, an individual who is concerned about a substance in food might be more alert to information about potential exposure to that substance. If concerns reported in surveys are related to actual states of concern, surveys on consumer concerns about substances in food may reveal consumer alertness to information on exposure to those substances. If this hypothesis were true, changes in attention to information on exposure might result in different food purchases.

There is some limited behavioral evidence that changes in information on exposure



to food risks does change food purchases. (Note that a change in information is not necessarily the same thing as a change in attention to information, but we might expect a similar effect.) For example, Schucker, et. al. found that average bimonthly sales of diet sodas were 6% below expected levels in the two years following the introduction of saccharin warning labels. A later study (Orwin, et. al.) found that the warning label has had a long-term effect on sales. Even five years after the introduction of saccharin labeling, sales were found to be below originally projected levels.

Similarly, a quasi-experimental study (Levy, et. al.) found an average gain of 4 to 8 percent in sales of brand name products involved in a two-year "Special Diet Alert" program. The program involved sodium, calories, fat, and cholesterol and received media support. Sales of over 400 brand name products in 20 food categories which were specially labeled as being low or reduced in sodium, calories, fat or cholesterol were monitored.

Changes in food purchases may also occur when consumers become uncertain of the risks in food. This can happen when consumers lose their trust in the ability of government or industry to protect them from risks for which it is difficult for individuals to control their exposure.

Two studies illustrate the effect that uncertainty or lack of accurate information on exposure to risks can have on purchases. Smith, et. al. estimated the effects on milk purchases when milk was recalled in Hawaii in 1982 because it was contaminated with the pesticide heptachlor. Even though the contaminated milk was removed from store shelves and substitute milk supplies were provided, consumers' purchases of milk were below expected levels even 15 months after the incident occurred. Likewise, a study by Swartz and Strand showed a 5% decline in oyster sales in Baltimore following the closure of oyster beds in the James River in Virginia due to kepone contamination. This decline occurred despite the fact that oysters sold in Baltimore were not contaminated.

While the evidence is limited, it suggests that at least some consumers will change



their food purchases in light of information about the possibility of exposure to risky substances in food. The consumers who actually change their behavior may be people with existing concerns about food safety issues. This is a testable hypothesis. Until more work is done on the relationship between attitudes and behavior, the meaning of results of surveys of consumers' concerns about food safety issues is uncertain.

#### WHAT DO WE WANT TO KNOW?

The main reason we want to know about consumer attitudes and behaviors toward food safety is that market mechanisms for articulating consumer demands break down in the face of the high costs of determining the safety of food. Because consumers can not easily determine their exposure to risks in individual foods, they can not accurately articulate their demand for safety. This means that food producers and government regulators can not easily ascertain how much food safety consumers want and are willing to pay for.

The studies reviewed above do not answer this question. However, they do suggest that the question is an important one. They indicate that there is a fair amount of concern about food safety issues among consumers, and they suggest that these concerns may affect food demands. But we have yet to find out how much food safety consumers want and are willing to pay for either in the market place through premium prices for foods certified to have certain safety characteristics, or through higher public expenditures for food safety monitoring and/or education.

The remainder of this paper examines strategies for research on consumer demands for food safety. It begins with a more precise statement of the problem and then suggests approaches for studying it.

Suppliers of food safety are the ultimate users of information about consumer demands for food safety. For government the main reason for obtaining knowledge of consumer demands for food safety is to guide legislative decisions about how safe the food supply should be. For example, there continues to be a great deal of controversy



over whether government should use a zero actuarial risk standard, such as that embodied in the Delaney Clause of the Food, Drug and Cosmetic Act, an actuarial risk-only standard, such as a one in one million lifetime risk of cancer, or whether we should balance the actuarial risks and benefits of substances added to food. Likewise, there is controversy over whether health risk choices should be made by government or by consumers (i.e., whether labeling should be allowed). While such choices are likely to be made using a variety of sources of input, knowledge of how much individuals would be willing and able to pay for increments of actuarial risk reduction or for information about actuarial risks would be helpful in making these choices.

The perspective of food producers, however, is quite different. While regulators would want to know how consumers would value actuarial risk reductions given full information, producers must sell food safety to consumers that are not fully informed. Thus, knowledge of how consumers would value known increments of risk reduction would not be useful in helping food producers to decide, for example, how much consumers would be willing to pay for a product that guarantees it contains no artificial preservatives. What food producers need to know is what consumers would be willing to pay for reductions in the perceived risks of substances in or other attributes of particular food products.

Despite the difference between these two questions, the methods that could be used to obtain answers to them are similar. The main difference is in the type of action that consumers would be asked to value. In the case of governmental risk reduction programs, we would want to know the distribution of food consumers' willingness to pay for increments of actuarial risk reduction in the diet. In the case of product development in the private sector, we would want to know willingness to pay for reduction in exposure to a particular substances in particular foods. In the former case, the type and levels of actuarial risks would have to be made known to consumers. In the latter case, actuarial risks would not be at issue, only the degree of presence or absence of the substance in



food would have to be known.

One method for obtaining estimates of consumers' willingness to pay is contingent valuation (see Bentkover, et.al. for a review). In this method, randomly selected respondents are presented with various risk reducing or exposure reducing programs or products and asked what they would be willing to pay for them. For example, respondents could be asked how much they would be willing to pay to achieve different levels of risk in food, or how much they would be willing to pay for particular brands of food with different claims regarding exposure to risky substances. The result is a bid curve for each respondent.

Since individuals' bids for each increment of risk or exposure reduction are likely to vary, it is useful to examine whether this variation is explained by demographic characteristics (age, income, education, etc.). If variation is consistent with particular demographic profiles, willingness to pay estimates for those profiles can be developed and used to derive population estimates. This is especially important if demographic characteristics are not randomly distributed in the population of interest. Furthermore, information on variation in willingness to pay among demographic groups could be important in developing marketing strategies for firms interested in introducing products with new safety features.

The contingent valuation approach has obvious drawbacks which have been much discussed in the literature (Bentkover, et.al.). For example, individuals' bid responses may not reflect actual choice behavior and are likely to be very sensitive to the way that risk or exposure information is presented to them. However, this approach is less costly than actual market experiments and avoids difficult statistical problems encountered in estimating willingness to pay from actual market data.



An alternative approach to estimating willingness to pay for risk or exposure reduction is to derive it from the demand for food. To explain how this might be done we need to examine the theory of demand for the characteristics of goods.

The key feature of this theory is the assumption that a consumer's utility is derived from the characteristics of goods rather than from the goods themselves (Lancaster, Ladd). These characteristics may be thought of as attributes or services provided by goods. For example, the attributes of a food would be its ingredients (e.g., sugar, preservatives), colors, texture, temperature, or nutritional content (e.g., vitamins, calories, protein). The services provided by a food would be its contribution to sensory satisfaction, health, convenience in preparation, or storability.

The implication of this assumption is best illustrated in a diagram. Figure 1 is a hypothetical indifference map for an individual for two characteristics of food. On the horizontal axis is safety, or one minus the probability of disease or premature death that would result from eating the food. On the vertical axis is percentage of calorie reduction. Curve I represents combinations of the two characteristics which yield identical levels of utility to a hypothetical consumer.

To determine preferences for goods, we need to know how much of each of the two characteristics various goods will supply. The amount of each characteristic they supply is determined by the producers of those goods. Assume for the moment that the supplier has made this information known to the consumer. The points X and Y on the map show how much of the two characteristics are delivered by one unit of foods X and Y, each with the same unit price.

Let's say Y is a low calorie cola and X is regular cola. Since one unit of both X and Y lie on the same indifference curve, they are equally good in the consumer's eyes. Now, suppose that the maker of X cola changes its composition by including caffeine. This new formulation is designated by X'. One unit of X' supplies the same amount of calories as X, but less safety, so one unit of X' lies on the lower indifference curve I'. That is, the



consumer prefers one unit of the Y cola to one unit of the X' cola. Thus, we see that the amount of various characteristics in goods affect preferences for those goods.

Now let's assume that the supplier has not made all information available to the consumer. The same indifference map can be used to show the effect of new product information on a consumer. For example, suppose that the X cola had caffeine in it all along, but that the consumer did not know that caffeine was harmful. Receipt of the information has the same effect as changing product composition.

Figure 1 can also be used to examine the effect of a change in preferences for characteristics. Suppose that the relative importance of calorie reduction increases. The consumer becomes less willing to give up calorie reduction to get increases in safety. This is represented by indifference curve I". Now, one unit of Y cola is preferred to one unit of X.

Ladd has derived three models from the theory of demand for the characteristics of goods. One of the models expresses the demand for a good, such as food, as a function of its characteristics, prices, and income. This model could be used to examine how changes in characteristics, such as the amount of risk, change purchases of a product, such as milk. An example is the study by Smith, et. al. of the heptachlor incident in Hawaii discussed above.

This model would probably not be useful in estimating the benefits of risk reduction achieved by food safety regulation because the amount of risk posed by a single unit of food such as an ounce of apples or a glass of milk asymptotically approaches zero and is not measureable with an acceptable degree of precision or validity. However, the model would be useful in obtaining estimates of the effect of publicized changes in certain attributes of food products. It may also be of interest in evaluating market test data for the introduction of a product with new safety features. In essence, the model would be used to see whether a change in a single characteristic of a product (e.g., a change in additives or a change in information about the safety of a product) would, ceteris



paribus, shift demand for the product. The amount of the shift would provide an estimate of willingness to pay for (or avoid) the characteristic. The actual application of the model would face the usual identification problems involved in demand estimation, however. One way around this problem might be to collect simulated purchase data where consumers were faced with alternative prices.

Ladd's second model is a hedonic price function. It expresses the price of a good as a function of the amount of each characteristic it supplies. The coefficients estimated for each of the characteristics are used to derive marginal implicit prices for each characteristic (i.e., by the partial derivatives of the hedonic price equation with respect to these characteristics). Theoretically, the model could be used to find the marginal implicit price of characteristics of food that pose (or reduce) health risks. Examples of the use of this model are studies of implicit prices for nutrients (Ladd and Suvannunt) and the implicit prices for the characteristics of breakfast cereals (Morgan, et. al.).

It would be difficult to use this second model to estimate willingness to pay for regulatory actions that reduce risk because risk is not a characteristic of a product that is generally known to consumers. In fact, it is the lack of knowledge about risk that creates the rationale for some regulation. However, it might be possible to obtain implicit risk prices if food purchase data were collected in an experimental setting. For example, a representative sample of individuals could be given a budget and the opportunity to purchase diets from a selection of foods which vary in terms of price and a "risk rating." The food purchases would then be used to derive the implicit (negative) price of the risk characteristic. However, it is difficult to imagine setting up such an experiment in such a way that individuals made purchases that reflected their probable market behavior. It would also be extremely difficult to come up with a meaningful "risk rating."

The model is more likely to be useful in examining willingness to pay for reduction in exposure to particular attributes. For example, market test data or experimental data



could be collected on purchases of products that vary in the amount of a safety-related characteristic (i.e., whether the product contains preservatives or says that it does not). The prices paid for the products would then be regressed on the characteristics of the products to obtain the hedonic price function from which the marginal implicit prices of the safety characteristic would be derived.

The third model derived by Ladd expresses the total demand for a characteristic (from all goods consumed) as a function of implicit marginal prices of characteristics, the amount of characteristics supplied by all goods consumed, implicit marginal prices of characteristics, and income. Theoretically, this model could be used to find the demand for food safety in the diet, using the kind of data described above for a simulated food purchase experiment. The reason for using simulated purchases is that information on the safety characteristic of foods is not readily communicated in the market. However, this model has been applied to market data. For example, Eastwood, et. al. used household food budgets to estimate the demand for nutrients in food.

There are many problems that would have to be solved in applying these models to derive the demand for food risk reduction. One very important problem is that risk levels are not readily known to consumers, rather, major ingredients are known. While it might be possible to supply consumers with risk information in a laboratory setting, little is known about the best way to provide such information or the validity of using laboratory behavior as a proxy for actual purchase or consumption behavior. Furthermore, it would be difficult to develop an index of risk that could be applied to all the different food safety problems. For example, the health effects of pesticides might be cancer, nerve damage, or birth defects. There is no valid way to come up with an index that ranks or quantifies these risks. But without such an index, we cannot estimate implicit prices for risk or the demand for risk reduction. Rather, we can only measure the demand for absence of attributes thought to be related to risk.



A more general problem with the method is in determining the relevant characteristics of food which influence purchase decisions. It is critical to get an accurate picture of these characteristics because consumers make tradeoffs among characteristics in selecting foods. For example, more risk may be tolerated if a food has other highly desirable characteristics such as long shelf life, ease of preparation, or is low in calories. In-depth marketing studies are needed to determine what the relevant characteristics are.

A third method for estimating willingness to pay for risk reduction by government is to infer what bids might be by examining the cost of risk assumption. In this approach, an estimate is made of the health effects that would be avoided by a specific risk reduction action. The economic cost of these effects can be estimated in a variety of ways. A traditional, but highly criticized approach, is the human capital method which values health consequences in terms of medical costs and lost income. Another alternative is to use estimates of "risk premiums" obtained in analyses of labor market data. Examples of these approaches are estimates of the cost of foodborne diseases (Roberts) and the benefits of reductions in tolerances for PCBs in fish (Gold and van Ravenswaay).

While this method does give an indication of the cost savings that are likely to result in a population from actuarial risk reductions, it does not provide an estimate of what consumers are willing and able to pay for risk reduction. While cost savings are likely to be important to individuals, it is still true that individuals have limited budgets and face alternative ways to allocate those budgets. An analysis of the cost savings of a particular action does not indicate individuals' preferences for reducing perceived food risks.

Throughout this section it has been assumed that the key research question has been individuals' willingness to pay for risk or exposure reductions. However, there are related issues. For example, an important role of government is to educate consumers

about risks as well as to provide risk reduction. To answer the question of what consumers want government to do in this capacity we need different sorts of research from those already described.

To determine where government should direct its educational efforts, we need to learn how consumers perceive food risks and what information sources they depend on. The surveys reported above provide some valuable clues, but further survey work should be undertaken. For example, what do consumers believe about the severity of risks? What do they believe the benefits to be? Why do they hold the beliefs they do? An analysis of differences among consumers in level of knowledge should be developed so that educational programs can be targeted to the groups that are most likely to benefit from them.

A related avenue of research is to explore the alternative hypotheses discussed above for explaining consumer concerns about food safety. For example, are concern levels related to actuarial risk, perceived risk, or acceptable risk? An understanding of the factors explaining concern would aid interpretation of attitudinal data on concern.

Finally, work is needed on the relationship between reported concerns and food purchase or consumption behavior. Without knowledge of this relationship, the benefit of future survey work on consumer concerns is doubtful. This could be done, for example, by coupling data on respondents' food safety concerns with data on those respondents' food purchases.

To date, questions on what consumers want and are willing to pay government and food producers to do about food safety have received little research attention. It is difficult to interpret what existing data on consumers' concerns means. There is virtually no knowledge of whether consumers believe current levels of risk are acceptable or what level would be. We know nothing about the demand for food safety and very little about its supply. If we are to improve our food production and regulatory decisions, research is needed to find ways to articulate consumer demand for food safety.



TABLE 1

The Women Report Their Main Food Concerns Today

Total number of women interviewed	100
Above considered as:	100%
Avoiding harmful additives/preservatives/chemicals	41%
High food prices	35
Freshness/availability of fresh foods	19
Avoiding salt	13
Finding nutritional foods	11
The quality of the meat/foods	7
Avoiding sugar	5
No food concerns	4
Serving a well-balanced meal	4
Avoiding high calorie foods	4
Spoilage	3
Tampering	3
Checking expiration dates	3
Avoiding fat	3
Tainted food/botulism/food poisoning	3
Shopping for food: preparing and serving no problem	3
Buying all natural food	2
Labels are difficult to understand/misleading	2
Proper in-store care of frozen food	2
Time consumed in reading labels on everything	2
Store cleanliness	2
Children's eating away from home/avoiding junk foods	2
Time saving/convenience	2
Avoiding cholesterol	1
Keeping a picky family happy	1
Insecticides and DDT on foods in growing	1
Finding enough variety in low calorie foods	1
Time spent shopping and in check-out line	1
Ease of preparation of foods	1
Unit pricing	1
My problem of too little storage space	1

SOURCE: GOOD HOUSEKEEPING INSTITUTE, WOMEN'S ATTITUDES TOWARD  
NEW FOOD TECHNOLOGIES, 1985. 100 PERSONAL INTERVIEWS IN  
PHILADELPHIA AREA.

TABLE 2

Women's Degree of Concern With Each of 15 Food-Related Areas

Total number of women interviewed	200			
Above considered as:	100%			
	<u>Extremely Concerned</u>	<u>Very Concerned</u>	<u>Somewhat Concerned</u>	<u>Not Concerned</u>
Freshness dating on food packages	48.0%	40.0%	11.0%	1.0%
The price of food	46.5	39.0	14.0	.5
The nutritional value of food	41.5	43.0	14.5	1.0
The chemicals in foods	41.5	34.5	20.0	4.0
The safety of the food	41.0	35.5	19.0	4.5
Foods to prevent health problems	33.0	43.0	20.0	4.0
Keeping weight down	30.0	32.5	29.5	8.0
Food additives	27.5	34.5	31.5	6.5
Keeping on a balanced diet	26.5	48.0	23.5	2.0
The sodium content in food	25.0	34.0	29.5	11.5
The calorie content of food	24.5	36.0	30.0	9.5
The sugar content in foods	23.0	42.5	27.0	8.5
The energy value of food	19.0	41.0	35.5	4.0
The caffeine content in beverages	19.0	32.5	29.5	19.0
Keeping on a medical diet	6.5	11.5	21.0	61.0

SOURCE: GOOD HOUSEKEEPING INSTITUTE, CONSUMER FOOD AND NUTRITION STUDY,  
MAY 1984. 200 PERSONAL INTERVIEWS IN 20 MAJOR METROPOLITAN AREAS.



TABLE 3

NATURE OF SHOPPERS' CONCERN ABOUT THE NUTRITIONAL  
CONTENT OF FOOD (VOLUNTEERED)

Q.: What is it about the nutritional content of what you eat that concerns you and your family the most? What else?

	<u>1983</u>	<u>1986</u>	<u>Change</u>
Vitamin/mineral content	24 %	22 %	-2 %
Salt content, less salt	18	20	+2
Sugar content, less sugar	21	18	-3
Fat content, low fat	9	17	+8
Chemical additives (e.g., flavoring MSG, steriods)	27	16	-11
No preservatives	22	15	-7
Making sure we get a balanced diet	10	14	+4
Cholesterol levels	5	13	+8
Food/nutritional value	10	11	+1
Calories, low calories	6	11	+1
Freshness, purity, no spoilage	14	8	-6
Desire to be healthy/eat what's good for us	-	6	+6
No harmful ingredients, nothing that causes illness/cancer	10	5	-5
Protein value	5	5	
As natural as possible, not overly processed	12	3	-9
Fiber content	2	3	+1
Empty calories, junk food	4	2	-2
Excess food coloring/dyes	6	2	-4
Carbohydrate content	1	2	+1
Less red meat	-	2	+2
Artificial sweetner	-	1	+1
Quality of food	3	1	-2
Starch content	1	1	
Other	2	5	+3
Don't know/refused	5	5	

SOURCE: TIM HAMMONDS, "THE SECOND FIFTY YEARS: PUBLIC ATTITUDES TOWARD NUTRITION," WASHINGTON, D.C., FOOD MARKETING INSTITUTE, MARCH 17, 1986. (TELEPHONE SURVEY OF 1001 RESPONDENTS IN 1983 AND 1004 RESPONDENTS IN 1986.)

TABLE 4

THE FOOD IN  
SUPERMARKETS IS  
SAFE TO EAT

	1982	1983
STRONGLY/SOMEWHAT AGREE	89%	88%
STRONGLY/SOMEWHAT DISAGREE	9	11
NOT SURE	2	1

SOURCE: LOUIS HARRIS AND ASSOCIATES, 1982 AND 1983,  
"CONSUMER ATTITUDES AND THE SUPERMARKET,"  
SURVEY DONE FOR THE FOOD MARKETING  
INSTITUTE, JANUARY AND FEBRUARY.



TABLE 5

## HOW CONCERNED ARE YOU ABOUT

	SOURCE QUESTION	VERY	SOMEWHAT	NOT AT ALL	(DON'T USE)	DON'T KNOW
ASPARTAME	(1)	11%	19%	42%	24%	3%
SACCHARIN	(1)	15	21	34	29	1
CAFFEINE	(1)	23	30	42	4	1
ARTIFICIAL COLORS	(2)	26	53	15	—	5
SALT	(1)	35	35	27	—	3
	(2)	37	53	9	—	1
SUGAR	(1)	30	33	34	1	3
	(2)	31	53	15	—	1
CHOLESTEROL	(1)	32	33	33	1	1
	(2)	45	48	5	—	2
PRESERVATIVES AND ADDITIVES	(2)	32	55	8	—	4
PESTICIDE RESIDUES	(2)	77	18	2	—	3

(1) ROPER ORGANIZATION, REPORT 84-7, SEPTEMBER 1984 (N = 2000)  
(HOW MUCH PERSONAL CONCERN)

(2) TIM HAMMONDS, "PUBLIC ATTITUDES TOWARD FOOD SAFETY,"  
WASHINGTON, D.C., FOOD MARKETING INSTITUTE, MARCH 26, 1984.  
(N = 1008) (CONCERN & SERIOUSNESS OF HEALTH HAZARD)

TABLE 6

THE WOMEN'S CONCERN ABOUT FOURTEEN TYPES OF FOOD PRODUCTS

Total number of women interviewed	100
Above considered as:	100
<u>Foods Grown Using Chemical Sprays</u>	
Major concern	80
Some concern	16
Little or no concern	4
<u>Foods With Chemical Preservatives</u>	
Major concern	75
Some concern	18
Little or no concern	7
<u>Foods Treated With Electromagnetic Energy/Ionized</u>	
Major concern	41
Some concern	21
Little or no concern	6
Don't know	32
<u>Foods Irradiated To Prevent Spoilage</u>	
Major concern	19
Some concern	31
Little or no concern	26
Don't know	24

SOURCE: GOOD HOUSEKEEPING INSTITUTE, WOMEN'S ATTITUDES TOWARD  
NEW FOOD TECHNOLOGIES, 1985. 100 PERSONAL INTERVIEWS  
IN PHILADELPHIA AREA.



TABLE 7

WHAT EFFECT  
DOES PESTICIDE USE HAVE ON:

	FOOD PRICE	FOOD QUALITY	FOOD SAFETY
DECREASES	19%	22%	43%
NO IMPACT	9	22	6
INCREASES	58	34	31
DON'T KNOW	15	22	21

SOURCE: CAROL KRAMER, SURVEY OF 390 KANSAS RESIDENTS, 1983.

TABLE 8

## WHAT SHOULD BE DONE ABOUT...

	BANNED	WARNING LABEL	DON'T KNOW
CHEMICALS USED TO KEEP VEGETABLES LOOKING FRESH IN SALAD BARS	46%	45%	9%
ARTIFICIAL FOOD COLORINGS	18	63	10
CYCLAMATES	22	55	22
SACCHARIN	17	77	7
ASPARTAME	10	80	11

SOURCE: ROPER ORGANIZATION, 1986, "OPINION ROUNDUP," PUBLIC  
OPINION, VOL. 9, NO. 1, FEB/MARCH, P. 24.



TABLE 9

WOULD YOU BE WILLING TO PAY MORE  
FOR MEAT ITEMS IF THERE  
WERE SAFETY INFORMATION  
ADDED TO THE LABEL?

WOULD NOT PAY MORE	27%
WOULD PAY SLIGHTLY MORE	67
WOULD PAY CONSIDERABLY MORE	4
I DO NOT BUY MEAT	2

HOW MUCH PER POUND?

0¢ - I'M SATISFIED NOW	19%
0¢ - TAXPAYER SHOULD PAY	11
1 - 2¢/lb.	42
3 - 5¢/lb.	22
6 - 10¢/lb.	5
OVER 10¢/lb.	1

SOURCE: CAROL KRAMER, SURVEY OF 390 KANSAS  
RESIDENTS, 1983.

TABLE 10

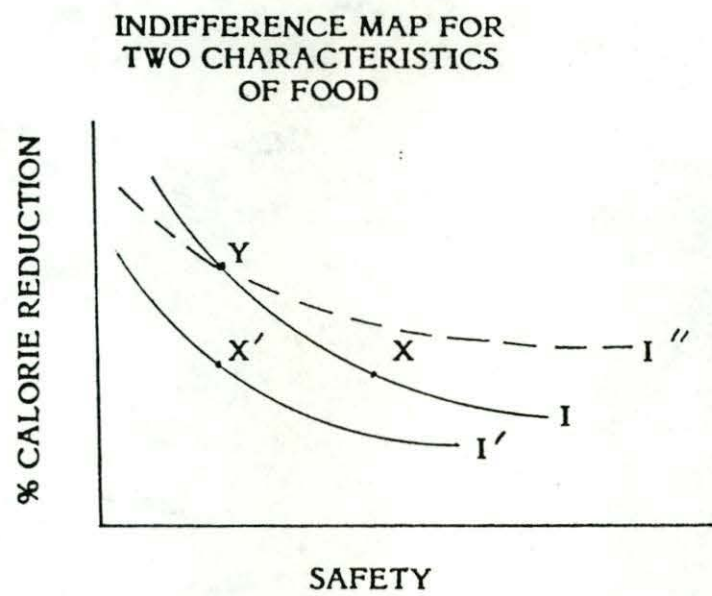
WHO DO YOU RELY ON  
TO BE SURE THE PRODUCTS  
YOU BUY ARE SAFE

	1979	1983	1986
YOURSELF	39%	46%	48%
FEDERAL GOV'T	18	24	29
CONSUMER ORGANIZATIONS	19	6	9
MANUFACTURERS	17	13	8
RETAILER	5	5	2

SOURCE: TIM HAMMONDS, "PUBLIC ATTITUDES TOWARD FOOD SAFETY," MARCH 22, 1984 AND "THE SECOND FIFTY YEARS: PUBLIC ATTITUDES TOWARD NUTRITION," MARCH 17, 1986, WASHINGTON, D.C., FOOD MARKETING INSTITUTE.



FIGURE 1



## FOOTNOTES

- (1) The Roper Center, University of Connecticut, Storrs, maintains archives of opinion polls done by various polling firms. A search of their archives for the years 1980 to 1985 yielded survey questions and responses for national polls done by the Roper Organization, Los Angeles Times Polls, and Louis Harris Associates for the Food Marketing Institute. Some of the survey data reported in this paper coming from Louis Harris was obtained directly from Tim Hammonds of the Food Marketing Institute.



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