Valuing the Health Benefits of Nutrition Labeling:
A Case Study for Fresh Meat and Poultry Products

Stephen Crutchfield

Fred Kuchler

Jayachandran N. Variyam[1]

A paper prepared for the 2001 Annual Meetings

American Agricultural Economics Association

Summary

New rules issued by the U.S. Department of Agriculture requiring provision of nutrition information on raw meat and poultry products may encourage consumers to make healthier food choices. Reduced intake of fat and cholesterol may prevent future cases of stroke, heart disease, and cancer. The benefits of these rules are estimated to be $62 to $125 million annually.

---

[1]The authors are Branch Chief, Senior Economist, and Economist (respectively) with the Economic Research Service of the U.S. Department of Agriculture. The views expressed are those of the authors, and do not necessarily reflect official USDA policy. The authors wish to thank the helpful suggestions of Joanne Guthrie of the Economic Research Service, and Ron Meekhof, Hyder Lakhani, and Rachel Edelstein of the USDA's Food Safety and Inspection Service .

Overview

The Food Safety and Inspection Service (FSIS) has issued new regulations requiring that nutrition information provided for raw meat and poultry products (U.S. Department of Agriculture 2001) . In the rule, FSIS will: 1) require labels on ground/chopped meat and poultry products; 2) require either labels or point-of-purchase information for the major cuts of single-ingredient, raw meat and poultry products; 3) and allow voluntary labeling of nonmajor cuts of single-ingredient, raw meat and poultry products that are not ground or chopped. In this analysis, we estimate the potential benefits associated with this proposed regulation. The benefits take the form of reductions in the incidence of coronary heart disease and three types of cancer which may accrue as consumers improve their diet quality through increased use of nutrition facts information generated by the regulation. We use survey data on nutrient intake and label use to correlate intake of fat, saturated fat and cholesterol to use of existing nutrition facts information. We value potential changes in intake of fat, saturated fat, and cholesterol as consumers respond to the newly-available nutrition information. We apply the model developed by Zarkin, et al. (Zarkin, Dean, Mauskopf and Neighbors 1991; Zarkin, Dean, Mauskopf and Williams 1993) which links changes in serum cholesterol rate to changes in percentage of total calories from total fat, saturated fat, and dietary cholesterol. Changes in serum cholesterol are then used to estimate the health outcomes, which are reductions in the number of cases and mortality from three cancers (breast, colorectal, and prostate) and coronary heart disease. Finally, we attach economic value to the public health changes by estimating the implied value of life associated with reductions in premature mortality.

Background

On May 30, 2000, USDA's Food Safety and Inspection Service (FSIS) announced a proposal to require nutrition labels on fresh meat and poultry. Such a label would provide consumers with the same type of information provided for processed foods, such as fat and cholesterol content, calories, and percent of calories from fat. The goal is to help consumers make better-informed food choices by allowing them to easily and accurately compare nutrition contents of fresh meats. The underlying premise is that more informed food choices lead to healthier diets, reduced risk of disease, fewer cases of disease and premature death, and lower costs to society from treating these diseases and premature death.

When FSIS published its final nutrition labeling rule in 1993, the Agency required labels only on processed foods that vary in composition by manufacturer and brand, such as hot dogs, luncheon meats, and sausage. Nutrition labeling for raw single ingredient products, like chicken breasts, hamburger, and steak, was encouraged on a voluntary basis. FSIS said at the time that it would monitor adoption of voluntary labeling every 2 years, beginning in 1995. If 60 percent of the fresh meat and poultry sold did not carry nutrition information, the Agency would initiate a mandatory program. Surveys show a participation rate below this goal, and the Agency has found that the nutrient and fat content of ground or chopped products varies enough that consumers cannot make informed comparisons.

Under the new rules, the label for fresh raw meat and poultry would use the same “Nutrition Facts” format used for processed meat and poultry products. Nutrition information could be placed either on a package label or displayed at the point of purchase. For example, retailers may choose to display information in the meat section of a grocery store listing nutrition information for typical cuts of popular meat products, rather than on a label applied to each package. Fresh foods regulated by FDA (fruits, fish, and vegetables) are also under a voluntary nutrition labeling program.

Why Economics Analysis is Necessary

Economic analysis of the benefits and costs of proposed government health and safety regulations is frequently an integral part of the rule-making process as practiced by the U.S. government. The objective is ensure that interventions by the Federal government in the private market economy are, in some sense, “worth” the cost. Formal demands for consideration of costs and benefits in regulatory programs began with President Nixon. Presidents Ford, Carter, Reagan, and Clinton each issued Executive Orders each demanding some consideration of costs and benefits in regulatory analyses (Executive Office of the President 1989) (Wiedenbaum 1997). Demands to balance costs and benefits have also come through the Legislative Branch. The Regulatory Flexibility Act (1980), for example, requires special attention to regulatory impacts on small businesses. Another, the Unfunded Mandates Reform Act (1995), requires Federal agencies to assess costs and benefits of regulatory actions that may result in expenditures by State, local, tribal governments, or the private sector of at least $100 million.

President Clinton’s Executive Order, 12866, replaced previous Executive Orders. Executive Order 12866 requires, in the process of drafting rules, that regulatory agencies consider costs and benefits, identify alternative ways of meeting govenmental objectives, and use market-based alternatives and performance standards (Wiedenbaum 1997). Not all regulations are subject to a strict cost-benefit test. Some Federal actions affecting health and safety are made based on risk standards; agencies may not choose among the risks they might address, regardless of cost. In this case of nutrition labeling rules, however, the Office of Management and Budget has requested analyses which show the benefits of the proposed rules as well as their costs. The study by Zarkin, et al (Zarkin, et al. 1993) was used to justify the first nutrition labeling rules in the early 1990’s.

Analyses of the benefits of rules and regulations promoting public health are somewhat tricky. The benefits of these rules are improved health and well-being, reduction in illness, and prevention of premature death. Putting health benefits in an economic context requires placing dollar values on risks to life and health, a concept which has evoked considerable controversy among non-economists. In addition, the analysis requires that we make a large number of assumptions in order to determine the health outcomes which may arise from the new rules regarding nutrition labeling. Our study here shows how economists approach the task of evaluating the benefits of rules and regulations, and how our work can support the overall regulatory framework by providing an indication of whether or not the benefits of the proposed rules exceed the costs these rules impose.

Making the Link Between Labeling Policy and Health Benefits

Government requirements for labeling typically serve three main purposes: to ensure fair competition among consumers, to increase consumers' access information, and to reduce risks to individual consumer safety (Haddon 1986). Recently, a fourth goal has emerged: altering individual consumer choices to align them with wider social costs or benefits (Golan, Kuchler, Mitchell, Greene and Jessup 2000). In the case of nutrition labeling, the objective is to encourage better-informed food consumption decisions by giving consumers more information about the nutrient content of the foods they eat. The hope is that consumers, when given this information, will reduce consumption of foods with unhealthy attributes (high levels of fat, saturated fat, and cholesterol) and increase consumption of heathier foods. Lower intake of unhealthy nutrients would then, it is hoped, lead to reductions in diseases related to overconsumption of those nutrients, such as coronary heart disease, stroke, diabetes, hypertension, and some forms of cancer. Society would then achieve the goal of a healthier population, with reduced incidence of disease and premature death from these diet related conditions. Then, economic analysis can measure the social benefits which flow from these improved health outcomes.

To make the link between labeling and benefits, we must make a series of judgements about consumer behavior and resulting health outcomes. This analysis can be decomposed into a series of steps:

Step 1: Determine baseline nutrient intake for all consumers.

Step 2: Determine differences in nutrient intake for those who use nutrition labels and for those who do not use labels.

Step 3: Estimate the increases in label usage when nutrition labels are placed on meat and poultry products (or other information is given at the point of sale.)

Step 4: Estimate the changes in nutrient intake which flow from changes in consumer behavior given in Step 3.

Step 5: Estimate the health outcomes which flow from changes in nutrient intake determined in Step 3; i.e., reductions in deaths from coronary heart disease and cancer

Step 6: Apply non-market valuation techniques to estimate the economic benefits of reductions in premature death from these diet-related diseases.

Steps 1 and 2: Baseline Analysis of Current Label Usage and Nutrient Intake

We used data from USDA’s Continuing Survey of Food Intake by Individuals (CSFII), and the associated Diet and Health Knowledge Survey (DHKS) to establish a baseline for fat, saturated fat, and cholesterol intake (U.S. Department of Agriculture 1994-1996). Most recently, USDA conducted three separate one-year surveys for 1994-96. These surveys recorded two nonconsecutive days of food consumption, and collected information on what and how much individuals ate, and where the food was obtained. This information was used to develop estimates of nutrient intake for each individual respondent. The DHKS gathered data on consumers’ knowledge of issues related to diet and heath, and contained several questions relating to the use of nutrition information labels and nutrition information for food products. Linking information from the two surveys allowed us to correlate use of nutrition information from the DHKS with nutrient intake data from the CSFII. We focused here on two key questions pertaining to nutrition information use on all food products and on meat and poultry in particular:

> Q: When you buy foods, do you use the nutrition panel that tells the amount of calories, protein, fat, and such [e.g., sodium, total carbohydrate] in the serving of a food: Often (always), sometimes, rarely, or never? (Question 16-c, DHKS)
>
> Q: When you buy raw meat, poultry, or fish, do you look for nutrition information: Often (always), sometimes, rarely, or never? (Question 17-I, DHKS).

Using data from the CSFII and the DHKS, we estimated rates of nutrition information usage, based on these two questions. The results are presented in Table 1. Note that rates of label usage are uniformly higher for women than for men, and that rates of nutrition label usage are higher for food products as a whole than for raw meat, poultry and fish products.

Table 1: Consumer usage of nutrition information

	Often	Sometimes	Rarely/Never	Do Not Buy Meat, Poultry, or Fish
Use Nutrition Facts Panel	26.7 - Men 41.7 - Women	25.6 - Men 32.6 - Women	47.7 - Men 25.6 - Women	n/a
Look for Nutrition Information on Raw Meat, Poultry, or Fish	16.9 - Men 22.1 - Women	18.2 - Men 18.0 - Women	62.7 - Men 57.9 - Women	2.2 - Men 2.0 - Women

Note: Percent of respondents, based on 3 year weighted averages, 1994-1996.

To establish a baseline of Intake of Fat, Saturated Fat, and Cholesterol, we used the same data sources to estimate dietary intake of fat, saturated fat, and cholesterol, along with the percentage of calories from fat and saturated fat. The CSFII contains information on the intake of these food components, based on the food consumption reported by survey respondents.

Tables 2 and 3 present the estimated intake of fat, saturated fat, and cholesterol from the CSFII, broken down by types of nutrition information usage reported in the DHKS.

Table 2: Dietary Intake of Fat, Saturated Fat, by Usage of Nutrition Facts Panel

	Often	**Sometimes**	**Rarely/Never**	**Average**
Total Fat	83.13 - Men 55.95 - Women	92.52 - Men 62.78 - Women	98.14 - Men 63.98 - Women	92.51 - Men 60.16 - Women
Saturated Fat	26.93 - Men 18.04 - Women	31.43 - Men 20.77 - Women	33.67 - Men 21.39 - Women	31.12 - Men 19.71 - Women
Cholesterol	293.4- Men 196.6 - Women	327.8 - Men 216.8 - Women	354.0 - Men 230.0 - Women	339.1 - Men 210.5 - Women

Note: fat intake in grams, cholesterol in milligrams

Table 3: Dietary Intake of Fat, Saturated Fat, by Usage of Nutrition Information on Raw Meat, Poultry, or Fish

	Often	**Sometimes**	**Rarely/Never**	**Do Not Buy Meat, Poultry, or Fish**	**Average**
Total Fat	81.64 - Men 53.90 - Women	92.49 - Men 61.70 - Women	96.09 - Men 62.18 - Women	74.48 - Men 57.23 - Women	92.51 - Men 60.16 - Women
Saturated Fat	27.20 - Men 17.39 - Women	31.09 - Men 20.60 - Women	32.44 - Men 21.41 - Women	24.02 - Men 17.27 - Women	31.12 - Men 19.71 - Women
Cholesterol	311.8 - Men 194.3 - Women	321.5 - Men 219.3 - Women	355.1 - Men 216.6 - Women	236.8 - Men 135.9 - Women	339.1 - Men 210.5 - Women

Note: fat intake in grams, cholesterol in milligrams

The estimated intake of fat and saturated fat can also be expressed as the percentage of calories from fat. This conversion is done with the following formula:

Percentage Calories from Fat = 900*fat / energy,

where energy is total caloric intake (kilocalories), as measured by the CSFII. Tables 4 and 5 show the percentage of calories from fat (and total cholesterol) broken down by label and nutrition information usage:

Table 4: Percentage of calories from fat and total cholesterol, by usage of nutrition facts panel

	Often	**Sometimes**	**Rarely/Never**	**Average**
Fat	31.54 - Men 31.14 - Women	33.63 - Men 33.40 - Women	35.27 - Men 34.49 - Women	33.44 - Men 32.49 - Women
Saturated Fat	10.19 - Men 10.00 - Women	11.38 - Men 11.38 - Women	12.00 - Men 11.59 - Women	11.19 - Men 10.65 - Women
Cholesterol	293.4 - Men 196.6 - Women	327.8 - Men 216.8 - Women	354.0 - Men 230.0 - Women	339.1 - Men 210.5 - Women

Note: Fat and Saturated Fat values are percentage of calories from fat source; cholesterol in milligrams

Table 5: Percentage of Calories from Fat and Total Cholesterol, by Usage of Nutrition Information on Raw Meat, Poultry, or Fish

	Often	**Sometimes**	**Rarely/Never**	**Do Not Buy Meat, Poultry, or Fish**	**Average**
Fat	31.67 - Men 31.62 - Women	34.03 - Men 32.94 - Women	33.88 - Men 32.87 - Women	26.69 - Men 26.79 - Women	33.44 - Men 32.49 - Women
Saturated Fat	10.53 - Men 10.15 - Women	11.36 - Men 10.82 - Women	11.37 - Men 10.82 - Women	9.52 - Men 9.19 - Women	11.19 - Men 10.64 - Women
Cholesterol	311.8 - Men 194.3 - Women	321.5 - Men 219.3 - Women	355.1 - Men 216.6 - Women	336.8 - Men 335.9 - Women	339.1 - Men 210.5 - Women

Note: Fat and Saturated Fat values are percentage of calories from fat source; cholesterol in milligrams

Step 3: Consumer Responses to Nutrition Labeling

The benefits of nutrition labeling depend on the extent to which consumers change their food consumption in favor of products that are more nutritious. As noted earlier, the absence of nutrition labeling to indicate nutrition contents of ground or chopped meat and poultry products and the major cuts of single-ingredient, raw products does not allow consumers to get adequate information for making their purchasing decisions. Provision of nutrition labels and point-of-purchase materials would disseminate nutrition information and enhance consumers' food purchasing decision-making process.

Consumption habits vary with knowledge of nutrition and health, preference for healthful diets, and socioeconomic status of different segments of the population. For example, consumers with preferences for healthful diets are likely to select products with lower fat and cholesterol levels to assist in the reduction of risk for coronary heart problems and cancerous diseases. Some consumers might perceive that a product is of higher quality or more nutritious if it has lower fat and cholesterol contents. Availability of nutrition labels on ground or chopped meat and poultry products and nutrition information for the major cuts of single-ingredient, raw products may help purchasing decision-making by these select groups of consumers.

Several studies in the literature have examined how and to what extent provision of nutrition information with labels changes consumer behavior and diet quality. (U.S. Department of Health and Human Services 1991 Kreuter, Brennan, Shriff and Lukwago 1997 Guthrie, Fox, Cleveland and Welsh 1995, Neuhouser, Kristal and Patterson 1999, Mathios and Ippolito 1998, Kim, Nayga and Capps 2000 Teisl, Bockstael and Levy 2001). Analysts generally found that consumers do respond to nutrition labeling information, and that diet quality improves with provision of nutrition information.

To determine how much of a behavioral response and change in dietary intake may result from providing more nutrition information on meat and poultry products, we makes the following assumption: We assumed that when labels and other sources of nutrition information are provided for raw meat and poultry products that nutrition information usage rates will rise to match label usage rates for food products as a whole (see Table 1).

Currently, some nutrition information is provided for some single-ingredient, raw meat and poultry products, but the information is not currently required. Mandatory nutrition labeling rules for the major cuts of single-ingredient, raw products and ground or chopped products would mean the nutrition information provided for these products would be comparable to that provided for other food products. We therefore could reasonably assume that nutrition information usage rates for raw meat and poultry products would then become the same as the label usage rates for all foods taken together. For example, before mandatory nutrition information labeling the data show that about 17 percent of men look for nutrition information on meat “Often.” (Row 2 of table 1). In this analysis, then,we assumed that after mandatory nutrition information labeling , 26.7 percent of men would use the nutrition fact panel or point-of-purchase materials for meat products, which is the label usage rate for all foods. (Row 1 of table 1). Similarly, the we assumed that the percentage of women using nutrition information on meat products “Sometimes” would rise from 18 percent to 32.6 percent.

What does this mean for diet quality? Here, we made another (admittedly strong) assumption: we assumed that as nutrition information usage rates rise for consumers eating meat and poultry, dietary patterns will change in a manner consistent with current data. As shown above, there is strong statistical evidence that people who use nutrition information to guide their food consumption decisions have healthier diets. While other factors may be at work, and the role of information use in causing dietary changes is unclear, we made the assumption that the provision of additional nutrition information and making that information available to more consumers will lead to behavioral shifts and increased diet quality. Thus, we assumed the effect of providing new information for meat and poultry products would make consumers who currently do not look for nutrition information on meat and poultry products more aware of the dietary implications of their food choices. As these consumers are see the new labels on packages of fresh meat and poultry products, they may begin to use the label or to use it more frequently. These consumers, we assume here, would then choose to consume the same mix of products as people who are currently aware of the nutritional quality of meat and poultry products because they look for such information as currently is available. For example, men who currently do not look for nutrition information on meat in the absence of mandatory nutrition information labeling who would begin using this information “Sometimes” after labeling is in place would see a decrease in fat intake from 96 grams to 92.5 grams (Row 1 of Table 3). Women who previously had been using labels “Sometimes” who now use them “Often” would see a decrease in saturated fat intake from 20.60 grams to 17.39 grams (Row 2 of Table 3).

Under these assumptions, then, we see how requirements for mandatory nutrition information labeling on raw meat and poultry products could possibly affect diet quality. Table 6 shows the estimated intake of fat, saturated fat, and cholesterol, by gender, after adjusting for the assumed change in patterns of label use. To reach the values shown in table 6, we multiplied each cell in table 3 (the dietary intake of fat, saturated fat, and cholesterol) by the associated percentage of label use (nutrition facts panel use) from table 1. By doing this, we increased the numbers of people in the “often” and “sometimes” cells, and decreased the number of people in the “rarely/never” cells, so that the distribution of label usage on meat and poultry products would reflect the distribution of label usage on all products. Aggregating across categories, we get a new weighted average intake, which could be seen after the imposition of mandatory labeling requirements. Table 7 shows the percentage of calories from fat and cholesterol intake which we derived in a similar manner.

Table 6 – Change in intake due to increased label usage

	Intake Prior to Mandatory Labeling for Meat & Poultry	**Intake After Adjusting for Increased Label Usage**	**Decrease in Intake**
Total Fat	92.51 - Men 60.16 - Women	91.31 - Men 58.57 - Women	1.30 % - Men 2.65 % - Women
Saturated Fat	31.12 - Men 19.71 - Women	30.69 - Men 19.21 - Women	1.37 % - Men 2.55 % - Women
Cholesterol	339.1 - Men 210.5 - Women	335.0 - Men 208.2 - Women	4.12 - Men 2.37 - Women

Note: Fat intake in grams, cholesterol in milligrams. Fat and saturated fat intake changes are in percentage terms, cholesterol intake changes are absolute changes in milligrams

Table 7 Change in percentage of calories from fat and cholesterol intake due to increased label usage

	Intake Prior to Mandatory Labeling for Meat & Poultry	**Intake After Adjusting for Increased Label Usage**	**Decrease in Intake**
Total Fat	33.44 – Men 32.49 – Women	33.33 - Men 32.37 - Women	0.11 % - Men 0.11 % - Women
Saturated Fat	11.19 – Men 10.64 – Women	11.14 - Men 10.54 - Women	0.04% - Men 0.10% - Women
Cholesterol	339.1 – Men 210.5 – Women	335.0 - Men 208.2 - Women	4.12 - Men 2.37 - Women

Note: Fat intake in grams, cholesterol in milligrams. Fat and saturated fat intake changes are in percentage terms, cholesterol intake changes are absolute changes in milligrams

Step 5: Linking diet quality to changes in health status

In order to link changes in diet quality to changes in health status, we need to establish a link between intake of dietary fat and cholesterol and resultant health outcomes, such as stroke, heart disease, and cancer. Frazao (Frazao 1999), in her analysis of the costs of poor eating, attributed 20 percent of coronary heart disease and stroke deaths and 30 percent of cancer and diabetes deaths to poor diets. Kenkel and Manning (Kenkel and Manning 1999) make the following statement:

> "Based on McGinnis and Foege (McGinnis and Foege 1993) and Colditz (Colditz 1992) it is plausible to assume that dietary factors and sedentary lifestyles are associated with 60 % of diabetes, 35 % of breast, colon, and prostate cancers, 30 % of gall bladder disease, 25% of arthritis, and 20% of heart diseases and stroke." (Kenkel, et al. 1999, 148)

Although it is widely recognized that excessive dietary intake of fat and cholesterol increases the risk for these diseases, the exact cause-and-effect relationships are not fully understood. A complete review of the nutrition and health literature is beyond the scope of this paper. However, even a cursory review of the matter yields the conclusion that there continues to be disagreement among experts as to how much changing diet quality can affect health status. The role of dietary fat and cholesterol in increasing the risk of cardiovascular disease is clear; the evidence for cancers and other diseases is less clear (Law 2000). Law says:

> "We know more about the associations of dietary fat with cardiovascular disease than with cancer or other diseases for 2 reasons: First, serum cholesterol, and to a lesser extent clotting factor VII, is useful in dietary studies as an intermediate marker of cardiovascular disease risk; it is easier to show the effect of a dietary change on serum cholesterol than on death from cardiovascular disease. Second, the effect of dietary fat reduction on risk of ischemic heart disease is directly demonstrable in randomized trials because ischemic heart disease is common and its risk is rapidly reversible. Clinical trials record only a small number of cancers of any specific site and, even if more events were available, risk may be less rapidly reversible so that no such reduction can be show during the first few years of a trial. The relation between dietary fat and cancer must therefore be judged mainly from prospective epidemiologic studies or cohort studies, that relate cancer incidence to an initial dietary assessment." (Law 2000, 1291S)

To link changes in dietary intake to changes in health status, we follow the Law's approach and use serum cholesterol (SC) to make the link between fat intake and health risk. We use a model developed by Zarkin, et. al (Zarkin, et al. 1991; Zarkin, et al. 1993) which estimated the relationships between dietary intake of fat and cholesterol to serum cholesterol, and then linked reduction in serum cholesterol to reductions in risk of heart disease, stroke, and selected cancers. Zarkin et al. concluded that an increase in serum cholesterol by 20 mg/dl was associated with a 1.2-percent increase in the incidence of each of these diseases. We employed this rate to convert reductions in total fat, saturated fat, and cholesterol in Table 7 into SC. It is estimated that the reduction in mortality associated with changing dietary pattern from mandatory nutrition information labeling are 0.024 percent for men, and about 0.014 percent for women.

Table 8 presents data on the annual new cases of mortality associated with the three types of cancer and coronary heart disease for men and women in the United States in 1998. Data for the number of deaths for coronary artery disease came from the National Center for Health Statistics (National Center for Health Statistics 2000a). Data on cancer deaths came from the American Cancer Society (American Cancer Society 2000). Data on colorectal cancer were not available by gender; we assumed the estimated 56,000 cases were distributed equally between men and women.

Table 8 – Reduction in mortality, annual new cases of mortality, and estimated lives saved

	% Change in Calories from Total Fat	**% Change in Calories from Saturated Fat**	**Change in Serum Cholesterol Intake**	**Change in Serum Cholesterol**	**% Reduction in Mortality**
Men	0.11	0.04	4.12	0.399	0.0240 %
Women	0.11	0.04	2.37	0.231	0.0139 %

Step 6: Estimating the benefits of preventing premature death.

The benefits of the proposed nutrition information labeling rule would be the lives saved due to the estimated reductions in mortality rates associated with these diseases. However, placing reduction of the risk of premature death in an economic context is difficult and controversial (for an in-depth analysis of this issue, see Kuchler and Golan (Kuchler and Golan 1999). The problem is that there is no market for reducing diet-related fatal risks. If food were marketed by risk levels (say, probabilities of inducing cancer or heart disease) and consumers treated advertised risk levels like they do other objectively measurable product characteristics (e.g., weight or volume), there would be little difficulty in valuing food safety. Product prices could be statistically associated with risk levels, yielding the risk-dollar trade-off consumers make. That is, we could measure, based on consumer purchases, the dollar value consumers attach to particular types of risk reduction.

There is no price that can be tabulated from commercial transactions that reflects the value of reducing diet-related fatal risks. Actions that individuals might take to reduce these risks may not leave a behavioral trail for analysts to follow, although in principle one could track changes in purchases of nutritionally improved foods or foods considered healther (as was done by Teisl, et al.) This information void makes it difficult to evaluate programs that might reduce diet-related risks. In particular, there is no obvious dollar value to assign to the major benefit of such programs, namely lives saved.

Ultimately, we want to monetize the benefits of diet-related fatal health risk reduction. Other risks do leave a clear behavioral trail that analysts have followed, measuring the risk-dollar trade-off individuals make. Our goal was to find a method of transferring market-based risk-dollar trade-off estimates to diet-related fatal cancer and heart disease risks.

The most studied risk choices are those for on-the-job risks of accidental injury and death. Analysts have estimated the compensation required to induce workers to accept such risks. Many studies of labor market behavior have been carried out because the wide range of risk levels workers accept and the wide range of wages paid are amenable to statistical analysis. Available evidence suggests that workers' subjective assessments of risks they face are plausible. Viscusi summarized the empirical work estimating the value of risk of premature death (Viscusi 1992). Several studies estimate the risk-dollar trade-off in the labor market by dividing the wage premium for risky jobs by the risk of a fatal job injury. Drawing on the compiled results of these studies, he stated:

> "Although the estimates of the risk-dollar tradeoff vary considerably depending on the population exposed to the risk, the nature of the risk, and similar factors, most of the reasonable estimates of the value of life are clustered in the $3 to $7 million range" (Viscusi 1992, 73)

Thus, compensating wages indicate that, on average, industrial workers value a statistical life at $5 million (December 1990 dollars), the midpoint of the range. ERS currently uses the $5 million per life estimate (adjusted upwards for inflation to 2000 dollars) to measure the benefits of preventing premature death from foodborne diseases caused by microbial pathogens (such as *E. coli* O157:H7, *Salmonella*, and *Listeria monocytogenes.*) (Crutchfield and Roberts 2000) This estimate has been used by other government agencies to evaluate the benefits of regulations designed to reduce the risk of premature death. For example, The Food and Drug Administration and the Consumer Product Safety Commission currently use Viscusi's mid-point value of $5 million for each life saved (Kuchler, et al. 1999, 25). EPA updates it benchmark value, $4.8 million in 1990 dollars, with an inflation adjustment.

We used the $5 million estimate as reflecting willingness to pay to avoid health risks. This is not the value an individual would pay to save his own life, but the aggregate value paid by many individuals to reduce a small risk of death each faces. To make this transfer, we assumed that individuals make consistent risk choices, reducing health risks as much as their budgets allow. We assume individuals focus on the likelihood of health outcomes and how bad the outcomes might be, without regard to the different physical characteristics of hazards that give rise to health risks. The assumption critical for making the transfer from valuing job risks to valuing cancer risks is that individuals value years of life, and all years are equally valuable. All individuals are assumed to value a year of life equally.

We adjusted for differences between years of life lost to cancer and heart disease fatalities and years of life lost to workplace fatalities. The value of statistical life estimate is based on a worker anticipating a fatal injury and losing an average life expectancy of 36.5 years (Viscusi 1995). Potential life years lost to cancer and heart disease deaths were calculated using data from National Centers for Health Statistics (National Center for Health Statistics 2000b). NCHS reports the number of years lost before age 75 per 100,000 population under the age of 75. These data were divided by the number of cancer and heart disease deaths for the population under 75 years of age to estimate the average number of life years lost up to age 75. The average number of life years lost were 14.9 for breast cancer, 3.9 for prostate cancer, 9.6 for colorectal cancer, and 10.2 for coronary heart disease. Thus, to calculate a value of life lost to cancer or heart disease, we adjusted the $5 million estimate downward to reflect the fewer years of life lost to cancer or heart disease, compared to work-related deaths. This calculation is similar to that carried out by Viscusi for estimating the value of statistical lives lost to environmental tobacco smoke (Viscusi 1995).

We treated the last 36.5 years of life ($L_{36.5}$) as a capital asset with a current value of $5 million. If the risk market could be characterized as an efficient market, the asset price should be equal to the present value of the service flow the asset produces.

$$L_{36.5} = \$5 million = \int_0^{36.5} \mathrm{Re}^{-rt} dt = r^{-1} R[1 - e^{-36.5r}$$

R is the (assumed) constant annual value of life and *r* is the time preference rate used to discount future benefits. Consider now the case of an individual facing an expected loss of 10.2 years of life from coronary heart disease. From this perspective, the value of the last 10.2 years of life for a victim of coronary heart disease is $L_{10.2} = e^{-26.3r} r^{-1} R(1-e^{-10.2r})$. The equations for both $L_{36.5}$ and $L_{10.2}$ can be solved for *R* and equated, yielding $L_{10.2} = L_{36.5}\, e^{-26.3r}(1-e^{-10.2r})/(1-e^{-36.5r})$. The value of cancer or heart disease avoidance depends on an individual's rate at which future years of life are discounted. At an interest rate of 7 percent, the value is $438,934. At an interest rate of 3 percent, the value is $899,823.

This estimate is in December, 1990 dollars. Using the CPI-U to update this estimate from 1990 to 2000 dollars (CPI-U = 133.8 in December 1990, and 171.3 average for 2000), the value becomes $516,954 (7 percent discount rate) and $1,152,015 (3 percent) in 2000 dollars. Similar calculations were made for deaths associated with the other three diseases considered (which take into account the different number of life years lost for each disease). The results are reported in Tables 9 and 10. To arrive at an estimate of the benefits associated with reductions in mortality due to changes in fat and cholesterol intake, we multiplied the dollar value assigned to each premature death prevented by the number of lives saved due to changes in diet quality. This estimate is reported for each disease as "Total benefits per year" in Tables 9 and 10. The total for all diseases is $61.9 million dollars at a 7 percent discount rate and $126.1 million at 3 percent.

It should be noted that the calculations used to estimate present value explicitly account for the time factor associated with delayed health impacts of dietary change. Decreases in intake of saturated fat, fat, and cholesterol will reduce the incidence of heart disease and cancer, but not immediately –- the reductions in illness and death will begin to occur years into the future. However, the formulas used for calculating the present value of the benefits explicitly take this into account, for they reflect the value placed on lost years of life occurring in the future.

Table 9 – Estimated lives saved and associated economic benefits, using a 7 percent discount rate

	Breast Cancer	**Prostate Cancer**	**Colorectal Cancer**	**Coronary Heart Disease**	**All Diseases**
Deaths per year	41,200	31,900	28,028	228,231	329,359
Lives saved due to dietary changes	6	8	11	87	112
Years of life lost per premature death	14.9	3.9	9.6	10.2	n/a
Dollar value of one life saved	$990,950	$169,264	$516,662	$561,954	n/a
Total benefits per year	$5,945,700	$1,354,112	$5,683,280	$48,889,970	$61,873,062
20 year present value of benefits	$62,988,827	$14,345,483	$60,208,748	$517,941,038	$655,484,096

Note: Cancer deaths are for 2000, heart disease deaths are for 1998. Number of lives saved is rounded to the nearest integer. All benefits estimates are in year 2000 dollars.

Table 10 – Estimated lives saved and associated economic benefits, using a 3 percent discount rate

	Breast Cancer	**Prostate Cancer**	**Colorectal Cancer**	**Coronary Heart Disease**	**All Diseases**
Deaths per year	41,200	31,900	28,028	228,231	329,359
Lives saved	6	8	11	87	112
Years of life lost per death	14.9	3.9	9.6	10.2	n/a
Dollar value of one life saved	$1,813,755	$399,426	$1,074,057	$1,152,015	n/a
Total benefits per year	$10,882,529	$3,195,408	$11,814,628	$100,225,308	$125,117,873
20 year present value of benefits	$161,904,553	$47,539,605	$175,771,829	$1,491,099,497	$1,876,315,484

Note: Cancer deaths are for 2000, heart disease deaths are for 1998. Number of lives saved is rounded to the nearest integer. All benefits are in year 2000 dollars.

It should be kept in mind that these estimates are based on annual data, and represent only one year's benefits. We assumed that the reduction in mortality would continue each year. Using a twenty-year time horizon, we estimate the present value (discounted at seven percent and three percent) of continuing reduction in premature deaths. This estimate was $655 million for all diseases at 7 percent, and $1,876 million at 3 percent.

Discussion and Conclusions

Is the new rule efficient from an economic perspective? That is, do the benefits of the rule outweigh the costs? FSIS, in its regulatory impact assessment, estimated the costs of the rule (including fixed costs, paperwork costs, and operating costs) to be between $60.2 and $80.4 million per year (U.S. Department of Agriculture 2001, 4988). The annual benefits of the proposed rule are $61.8 million at a 7 percent discount rate, and $125 million at a 3 percent discount rate. Accordingly, we cannot unambiguosly state that the benefits of the new nutrition labeling rule are greater than the costs, but there is some reason to expect that benefits may turn out to be greater than costs.

Of course, our estimate of the benefits depends critically on the assumptions made, particularly the assumptions about how introduction of nutrition labels for meat and poultry products would change consumer food choices, dietary intake, and health outcomes. It is possible, for example, that consumers may already be using nutrition information that is currently being provided. (Some stores already label the percent fat content of hamburger, for example, and others voluntarily provide nutrition information on meat and poultry products, either with labels or point-of-sale information). If consumers have already made adjustments in their consumption pattern based on existing information, then the benefits of the new rule would be less than indicated here. Also, it should be noted that the link between fat intake, serum cholesterol, and cancer risk is less clear than for coronary heart disease. If we consider only the benefits attached to preventing deaths from coronary heart disease, then the benefits of the rule are between $49 and $100 million per year.

On the other hand, the behavioral shifts we have assumed here result in fairly small changes in dietary intake of fat, saturated fat, and cholesterol. The results of the study by Kim, et al. show a much larger reduction in fat and cholesterol intake (and increases in fiber intake) when nutrition labels as a whole are considered. This may mean that we have underestimated the nutrition benefits. Second, we consider only a subset of diet-related health conditions: we did not include in our analysis potential benefits from preventing other health complications, such as diabetes or stroke. Finally, as Teisl et al. point out, there are other, non-health benefits associated with providing additional information about food attributes to consumers, and so the benefits of the proposed rule may be greater than we have estimated.

References

American Cancer Society. *2000 Facts and Figures: Selected Cancers*, 2000. Http://www.cancer.org/statistics/cff2000/selectedcancers.html.

Colditz, G. A. “Economic Costs of Obesity.” *American Journal of Clinical Nutrition* 55 (1992): 503S-507S.

Crutchfield, S., and T. Roberts. "Food Safety Efforts Accelerate in the 1990's." *Food Review* 23, no. 3 (December 2000): 44-49, assisted by P. Frenzen and J. Buzby.

Executive Office of the President, Office of Management and Budget. "Regulatory Program of the United States Government, April 1, 1988-March 31, 1989." Washington, DC, 1989.

Frazao, E. "High Costs of Poor Eating in the United States." In *America's Eating Habits: Changes and Consequences*, edited by E. Frazao, 5-32. U.S. Dept. of Agriculture, Agriculture Information Bulletin 750, 1999.

Golan, E., et al. *Economics of Food Labeling*. Agricultural Economic Report No. 793. USDA Economic Reserch Service, 2000.

Guthrie, J. A., J. Fox, L. Cleveland, and S. Welsh. "Who Uses Nutrition Labeling and What Effects Does Label Use Have on Diet Quality?" *Journal of Nutrition Education* 27 (1995): 153-72.

Haddon, Susan G. *Read the Label: Reducing Risks by Providing Information*. Boulder, Co: Westview Press, 1986.

Kenkel, D.S., and W. Manning. "Economic Evaluation of Nutrition Policy. Or, There's no Such Thing as a Free Lunch." *Food Policy* 24, no. 2-3 (April-June 1999): 145-62.

Kim, Sung-Yong, Rodolfo M. Nayga, and Oral Capps. "The Effect of Food Label Use on Nutrient Intakes: An Endogenous Switching Regression Analysis." *Journal of Agricultural and Resource Economics* 25, no. 1 (2000): 215-31.

Kreuter, M.W., L.K. Brennan, D.P. Shriff, and S. N. Lukwago. "Do Nutrition Label Readers Eat Healthier Diets? Behavioral Correlates of Adults' Use of Food Labels." *American Journal of Preventive Medicine* 13, no. 4 (1997): 277-83.

Kuchler, F., and E. Golan. *Assigning Value to Life: Comparing Methods for Valuing Health Risks*. Agricultural Economic Report No. 784. U.S. Department of Agriculture, Economic Research Service, 1999.

Law, Malcom. "Dietary Fat and Adult Diseases and the Implicaitons for Childhood Nutrition: An Epidemiologic Approach." *American Journal of Clinical Nutrition* 72, no. 5 (suppl) (2000): 1291s-1296s.

Mathios, A.D., and P. M. Ippolito. "Food Companies Spread Nutrition Information Through Advertising and Labels." *Food Review*, August 1998, 38-43.

McGinnis, J. M., and W.H. Foege. "Actual Causes of Death in the United States." *Journal of the American Medical Association* 270, no. 18 (1993): 2207-12.

National Center for Health Statistics. *Health, United States, 2000*. Hyattsville, MD: U.S. Deparntment of Health an Human Services, Centers for Disease Control and Prevention, Division of Data Services, 2000a.

------. *National Vital Statistics Report*. Vol. 48, No. 11. Hyattsville, MD: U.S. Deparntment of Health an Human Services, Centers for Disease Control and Prevention, Division of Data Services, 2000b.

Neuhouser, M.L., A. R. Kristal, and R.E. Patterson. "Use of Food Nutrition Labels is Associated with Lower Fat Intake." *Jorunal of the American Dietetic Association* 99, no. 45 (1999): 45-53.

Teisl, Mario F., Nacny E. Bockstael, and Alan Levy. "Measuring the Welfare Effects of Nutrition Information." *American Journal of Agriultural Economics* 83, no. 1 (2001 February 2001): 133-49.

U.S. Department of Agriculture, Food Safety and Inspection Service. "Nutrition Labeling of Ground or Chopped Meat and Poultry Products and Single-Ingredient Products." *Federal Register* 66, no. 11 (18 January 2001): 4969 - 99.

U.S. Department of Agriculture. *Continuing Survey of Food Intake by Individuals (CSFII), and Companion Diet and Health Knowledge Survey (DHKS)*. Survey Years 1994-1996. Washington, DC: USDA, 1994-96.

U.S. Department of Health and Human Services, Food and Drug Administration. "Regulatory Impact of the Proposed Rules to Amend the Food Labeling Regulations." *Federal Register* 56, no. 229 (1991): 60856 - 78.

Viscusi, W. K. "Cigarette Taxation and Social Consequences of Smoking." In *Taxation Policy and the Economy*, edited by James. M. Poterba, 51 - 101. Cambridge, MA: MIT Press for National Bureau of Economic Research, 1995.

------. *Fatal Tradeoffs--Public & Private Responsibilities for Risk*. New York: Oxford University Press, 1992.

Wiedenbaum, M. "Regulatory Process Reform from Ford to Clinton." *Regulation* 21 (Winter 1997): 20-26.

Zarkin, G.A, N Dean, J. A. Mauskopf, and D Neighbors. *"Estimated Benefits of Nutrition Label Changes: Final Report, Volume 1*. Research Triangle park, NC 27709: Center for Economics Research, Research Triangle Institute, 1991.

Zarkin, G.A., N. Dean, J.A. Mauskopf, and R. Williams. "Potential Health Benefits of Nutrition Label Changes." *American Journal of Public Health* 83 (May 1993): 717-24.