SAFE HANDLING LABELS AND CONSUMER BEHAVIOR IN THE SOUTHERN U.S.

By

Kofi Adu-Nyako
Department of Agribusiness, and Applied Economics
NC A&T State University
Greensboro NC 27411

Danny Kunda
Department of Agribusiness, and Applied Economics
NC A&T state University
Greensboro NC 27411

Katherine Ralston
Economic Research Service
USDA
Washington DC 20250

Paper prepared for presentation at the American Agricultural Economics Association Annual meetings, Montreal Canada, July 27-30, 2003

The views expressed herein do not necessarily represent those of Economic Research Service or the U S Department of Agriculture

Safe Handling Labels and Consumer Behavior in the Southern U.S.

Abstract
The impact of safe handling labels on food handling practices is assesed using a two step procedure to adjust for sample selection bias in the label use decision. A significant postive influence of labels on safe handling practices is found. Food safety knowledge, consumer risk perception, and illness experience impacted handling practices positively.

Poor consumer food handling has been implicated in large number of cases of foodborne illness cases. To reduce the risk of foodborne illness consumers must be willing to change current behaviors that are not consistent with safe food handling and preparation recommendations. Change in such behaviors is contingent, among other things, on consumer knowledge of proper food handling practices. Efforts to reduce foodborne illness include safe handling labels as a means of shaping consumer's knowledge, purchasing patterns and use practices. Following the *E. Coli* O157:H7 outbreak in 1993, that resulted in 4 children deaths in Northwest, consumer groups sought to require USDA to issue warnings on food product warning that the products may contain bacteria capable of causing injury or death to the consumer together with safe handling instructions. USDA issued a ruling in 1994 that mandated safe handling instructions on all raw meat and poultry products. The safe handling labels mandated on meat and poultry products outline four steps critical to food safety: storage, cross-contamination prevention, proper cooking temperatures and handling of leftovers. In its regulator impact assessment of the rule requiring labels, FSIS estimated that a net positive benefit would accrue if foodborne illness were reduced by 3% as are result of the safe handling instructions on food labels.

While labeling has been a major focus of policy initiatives designed to provide consumers information necessary for safe handling of food, the impact on consumer food

handling behavior has not been rigorously assessed. Further, other sources of safe food handling information such as TV, newspapers, magazines, and consumer advocates may also contribute to change in behavior. The focus of this study is to identify the factors associated with awareness of safe handling labels by consumers, and how label awareness relates to consumers' safe food handling practices.

A conceptual framework

Research on health behaviors have used as theoretical basis the Health Belief Model (HBM) e.g. cooking hamburger behavior (Starke, 1999), condom use (Wulfert, 1995; Hiltabiddle, 1996), breast self-examination (Sensiba & Stewart, 1995; diabetes self-care (Pham, et al., 1996), needle risk practices for HIV (Falck, et al., 1995), alcohol consumption (Minugh, 1998), and fruit and vegetable consumption (Heimendinger et al., 1995; Dittus et al., 1995). The Health Belief Model consists of four constructs: perceived susceptibility, perceived severity, perceived benefits and barriers, and cues to action,. However, the model treats behavior as a function of two sets of beliefs. The first set of beliefs (readiness to act) provides motivation for taking action and the second set includes modifying factors (cues to action) that triggers a person's general desire to engage in health measures (Schafer[1], et al., 1993). Under the Health Belief Model, individuals are assumed to engage in preventive health measures if they believe threatened by an illness. Also, they are motivated if they believe the benefits of taking such measures outweigh the cost of said action (Rosenstock, 1974) In the economics literature on consumer demand for health-enhancing goods such as food safety and nutrition, the theory of household production (Becker, 1965) and the theory of demand for characteristics (Lancaster, 1971) have been adapted to include health as an argument

in the utility function, a health production function in the constraints, and the prices of health-enhancing goods in the budget constraint (Pitt and Rosenzweig, 1985). Information can be conceptualized as affecting both the marginal utility of health and the perceived effect of health-producing goods on health status. The optimal use of health-producing inputs (including time devoted to health-producing activities) is then a function of the prices of these inputs and the parameters of the utility and health production functions, including information. This framework can be easily reconciled with the Health Belief Model (and McIntosh's extensions) by interpreting the utility function as a description of the consumer's desire for better health, and interpreting the health production function as a perceived function incorporating the consumer's level of self-efficacyIn addition to Schafer's and McIntosh's earlier work, other researchers have used the Health Belief model or an economic adaptation of it and found a significant association between safer food handling and higher perceived risk (Fein et al. 1995, Woodburn 1997, Ralston et al. 2001). Researchers have also found significant associations between safer behavior and knowledge of proper food handling practices, awareness of harmful pathogens, and experience with foodborne illness (Altekruse et al 1995, Fein et al. 1995, Ralston et al. 2001).

Demographic variables as well as time spent in meal preparation, who prepares meals, and presence of more vulnerable individuals in the household, are also important (Guthrie 1995, Williamson et al 1992, Ingham and Thies, 1997).

Researchers studying nutrition behavior have found some similar associations examining nutrition knowledge, label use, and nutrition behavior (Nayga 2000, Variyam 1998) .

Empirical Model and Estimation

Of primary importance in this study is the impact of the safe handling instructions on meat and poultry packages on consumer safe handling behavior. In evaluating the influences of safe handling information, specifically the use of the mandated safe handling labels on meat and poultry products on consumer safe food handling behavior one can specify a general model of safe food handling behavior as follows:

$$y = \beta' x + \varphi z + \varepsilon \qquad (1)$$

where: y is the observed safe food handling practice, x is a vector of explanatory variables including personal characteristics and z is a dummy variable for label use (z=1 if the individual uses safe handling labels z=0 otherwise), β and φ are parameters to be estimated, and ε is the error term. In the evaluation literature z is referred to as the treatment variable.

A model of this type may suffer from two problems. Some of the elements of the vector x may be endogenous in that the errors of those variables may be correlated with the errors of the safe food handling behavior variable. Second, the decision to use safe food handling labels or not to use food labels is voluntary. The non-random assignment of individuals to label use status creates sample self-selectivity problem (Maddala, 1983). If the use of safe food handling information is based on individual self-selection, one might expect safe handling information users to systematically have different characteristics from non-information users. In that regard, the unobserved variables might influence both

information use decision and safe food handling practices, resulting in inconsistent estimates of the effect of safe handling label use on safe food handling behavior (Kim et al., 2000). Estimation of the impact of the safe handling labels on safe handling behavior by linear regression of y on x and z will result in biased estimates. Unbiased estimates of φ can be obtained by correcting for the sample selection bias. The primary equation, (1) can be corrected for selectivity bias by estimating a reduced form of z

$$z^* = \alpha' v + w \qquad (2)$$

where v is vector of exogenous variables and w is error term.

$z = 1$ *if* $z^* > 0$ and $= 0$ otherwise

by probit to obtain estimates α and σ which are used to compute the generalized residuals. The generalized residuals are

$$\hat{w} = E(w/z) = (z - \hat{\Phi})\hat{\phi}(1 - \Phi)^{-1}\hat{\Phi}$$

where $\hat{\Phi}$, and $\hat{\phi}$ are the cumulative distribution function and probability density function of the standard normal distribution evaluated at the probit estimates of $(\hat{\alpha}/\sigma_w)$. The generalized residuals are inserted into the primary equation as an additional variable to correct for the selectivity bias (Vella, 1993).

In this study, we adopt a two-step estimation procedure provided in LIMDEP, based on Barnow et al. (1981). The primary outcome equation the dependent variable is safe handling behavior. Safe food handling behavior is modeled as a function of label use, knowledge, risk perception, awareness of foodborne pathogens, information sources, and demographic characteristics (Equation 3). To take account of the possible sample selection bias arising from self selection in the decision to use safe handling labels or not

we specify a selection equation of safe handling label , where label use is a function of consumer demographic characteristics, awareness of foodborne pathogens and food safety risk perception (Equation 4). In the two step procedure we first estimate probit equation (4) by maximum likelihood approach to obtain the inverse mill ratio which is inserted into equation (3) and estimated by OLS.

$$\textit{Safe handling} = f(\textit{label use, risk perception, knowledge, awareness of foodborne pathogens, demographic factors, information sources}) \quad (3)$$

$$\textit{label use} = f(\textit{risk perception, awareness, demographic factors}) \quad (4)$$

Although we recognize the possibility of simultaneity bias arising from the right hand side variables in equation (3) due to such variables as knowledge of proper handling practices, risk perception, and awareness of food pathogens, we do not model these variables explicitly. We do not believe we have good instruments in the data that can be used for those variables in an instrumental variable estimation of a simultaneous equation model (Nakamura and Nakamura, 1998). Further, estimation of the safe handling behavior equation (3) may be complicated by possible endogeneity of the safe handling label variable. We test for endogeneity of the safe handling label use decision by including residuals from estimating the probit safe handling labels use equation as an additional variable in a regression of safe handling behavior on the other explanatory variables, and safe handling labels. Endogeneity of label awareness is rejected, as the parameter on the residual is not significant.

Hypothesis

We hypothesize that higher levels of food safety knowledge, risk perceptions, awareness of pathogens, and knowledge of specific safe handling practices would have positive influence on food safety behavior towards self protection. Use of the safe handling

labels would have a positive influence on food handling behavior. Greater use of information sources, and household illness experience, would be positively associated safer food handling. The expected direction of socio-demographic effects on food safety behavior are as follows: income is expected to have a positive influence through the effect of higher income enabling greater access to information; higher levels of education will positively influence information acquisition and processing; being a primary food preparer and female will likely have a positive effect through the influence of a greater stock of food safety knowledge and information; participation in food assistance programs imply low income and thus may have negative impact on food safety behavior.

Data

Data for this study were from 1999 regional telephone survey of consumers in the Southeastern Atlantic States. The survey was a collaborative effort between USDA Economic Research Service, Diet, Safety and Health Economics Branch, and North Carolina A&T State University.

A random sample of consumers in the Atlantic Virginia, North Carolina, South Carolina, Georgia, and Florida, were interviewed by telephone in which a slightly modified 1998 FDA Food Safety Survey instrument was used. . A sample size of 860 was obtained, representing a response rate of 60.6%.

Respondents were 27.9% black, 63.8% white and the remaining 8.3% of Asian, Hispanic, and Native American ethnic origin. The 2000 Census of the Population reported 12.3% blacks and 75% whites. The average age of the sample was 44. The median annual family income of the sample was greater than $40,000, which was lower than the census median income of about $42,000. About 11% of those sampled received

some form of government assistance. The questionnaire probed consumers for food safety perceptions and concerns, awareness of food-borne pathogens, food handling practices, food label use, and sources of food safety information. In addition, food-borne illness experience and consumers' socioeconomic and demographic information was elicited

Variables in the Model and Operationalization

The descriptions of the variables are provided in (Table 1). In this study, safe food handling behavior is a score of safe food handling practices employed to avoid or minimize food poisoning resulting from cross-contamination. To identify consumers who handle food safely, the survey asked respondents about their food handling and preparation practices consumers follow when they come in contact with raw meat or poultry products. The answers were combined into a score ranging from 0 to 16 points.

Respondents were recorded as label user if they responded " yes" to the question "have you seen the safe handling instructions on meat and poultry packages" . While no question covered actual label use, consumers were asked if they had made any changes in response to the labels. Respondents who did not answer at all (either yes or no) were virtually identical to those who said they had not seen the labels.

To measure safe food handling knowledge, we constructed a score of consumers' answers to questions on the likelihood of certain food handling practices causing food poisoning. Awareness of foodborne vectors was elicited from questions asking how familiar respondents were with the five common microorganisms or germs believed to cause food poisoning: *Salmonella*, *Campylobacter*, *Listeria*, *E coli*, and *Cyclospora*.

Consumer's risk perception was measured as composite score based on answers to questions as follows relating whether the respondent perceived that the US has a food safety problem and their perception of how common foodbrne illness may be contracted from home and away from home.

The survey questionnaire probed for consumer personal and household characteristics, including respondents or a family member recent foodborne illness experience. Consumers were also asked to indicate how much food safety information they receive from the following sources: cookbooks, newspapers, magazine, radio, television, government sources, relatives/friends and consumer groups.

Results

Descriptive Statistics

Eighty-five percent of the respondents reported handling food safely. Sixty-five percent reported being aware of the safe food handling labels. Eighty-six percent had a high knowledge of proper handling practices. They correctly identified at least 4 practices from a total of 6 practices that were more likely to cause food poisoning. On average, respondents recognized 3 foodborne pathogens out of 5. Forty-nine percent of the sample reported a low level of awareness of foodborne pathogens. Sixty-five percent of the respondents indicated a high-risk perception of food safety while thirty-four percent reported a low-risk perception.

With regard to alternative sources of food safety information, seventy-six percent of respondents cited television; seventy-two percent reported relatives/friends, while sixty-three percent cited magazines. Newspapers were cited by fifty-eight percent of the

respondents; government sources by fifty-five percent, cookbooks by fifty-one percent and consumer groups by fifty-eight percent of the respondents.

Model Results

Parameter estimates of a probit label use analysis and the ordinary least squares of safe food handling behavior equations are presented in (Table 2). The table contains estimated coefficients with respective standard errors.

Probit Label Use Equation

Food safety perceptions of consumers were associated with safe handling label use. Consumers who perceived food in the United States as highly risky were more likely to be aware of safe handling labels than those whose perceptions was that food safety is not a problem. Furthermore, there appears to be a possible relationship between label use and consumer awareness of the pathogenic vectors implicated in various foodborne illnesses. Consumers who were more knowledgeable about foodborne illness pathogens were more likely to be aware of safe food handling labels than consumers with low levels of awareness of foodborne illness pathogens. These results are consistent with Nayga's (2000) findings from the study on the relationship of nutrition knowledge, gender and food label use. Nayga found that consumers who believed that what a consumer eats could potentially increase the risk of contracting an illness were more likely to use nutrition labels.

Awareness of safe handling instructions on meat and poultry products was higher among primary food preparers. Consumers who are neither white nor black are less likely

to be aware of safe handling labels. Awareness of safe food handling labels was not different between blacks and whites, however.

Interestingly, education is negatively related to awareness of safe handling labels. This result is contrary to findings of Nayga (1996), who reported a positive relationship between a consumer's education and the likelihood of using nutritional information on food packages. Nayga (1996), linked the positive effect of education to the hypothesis that higher-educated main food planners are more aware of the relationship between diet and health, thus are more motivated to use labels.

Household size was positive and significant. Thus, households with a large number of individuals were likely to be cognizant of safe handling labels than smaller sized households. It is likely that larger family households include children who maybe more vulnerable to food poisoning and thus the need to take extra precaution including using preventive information provided by the labels.

Consumer marital status, age, income, government assistance, being black, geographic location, locality and experience with a foodborne illness were not significantly associated with whether consumers were aware of safe handling labels or not.

Safe Food Handling Behavior Equation

Table 2 shows the results of safe handling behavior equation. After controlling for unobserved characteristics of label users through correcting for self-selectivity, label use had significant positive effect on safe handling behavior of consumers. Use of safe handling instructions is associated with increasingly safer food handling behavior. Consumers where were aware of labels averaged almost 1 point higher on safe handling behavior score. Consumers' risk perceptions and experience with foodborne illness were

associated with higher levels of safe handling behavior. Knowledge has a significant ($p=0.00002$) positive relationship with safe food handling behavior. Consumers with specific knowledge of proper food handling practices are forty percent more likely to engage in safe food handling behavior. The positive influence of direct knowledge on safe handling behavior is further confirmed by the positive effect exerted by the pathogen vector awareness variable on safe handling behavior. In contrast, variables that are sometimes thought to proxy for knowledge e.g. years of formal education did not have the expected positive influence on food safety behavior. In our sample, consumers who possess higher levels of education tended to behave less safely in handling food. This result is surprising given that people with higher education are often found to be able to process label information more efficiently and therefore act more in accordance with safe handling instructions (Kenkel, 1991). Highly educated consumers may understate he threat of foodborne illness on their health and therefore are ignoring the safe handling warnings. This is consistent with the negative association between higher levels of education and awareness of labels in the first place.

Of the several alternative sources of food safety information only food safety information from newspapers seemed to be associated with safe food handling. Food safety information acquired from newspapers was positively and significantly associated with safe handling of food. Although not statistically significant, television--the most popularly cited source of food safety information--- had a negative influence on safe handling behavior. The negative relationship could reflect consumer lack of trust in this source of information.

Regarding demographic characteristics, the following factors were significantly associated with safe handling behavior: age, gender, marital status, and race. Age was negatively associated with safe handling behavior. This contradicted our expectation that older people--- with more experience in dealing with food preparation--- would be more likely to practice safer handling of food than younger people. On the other hand this same sense of experience may predispose older people to place less emphasis on the safe handling instructions thereby forgoing the advantage of that knowledge in food handling.

Consumers who were female, married, or black had significantly higher safe handling scores. The positive influence of gender and marital status can be related to traditional gender and marital roles in the household where married women have traditionally been the main food preparer. The experience and level of responsibility associated with providing for the family calls for diligence in handling food safely. Why blacks practice safer food handling than whites is not clear, although this may reflect cultural differences in upbringing. Regardless of the reasons, this finding may be important in identifying demographic sub sectors to target safe handling educational interventions.

Conclusions

Poor consumer food handling has been implicated in large number of cases of foodborne illness cases. The federal government is increasingly using information labeling as an important component of efforts to shape consumer's knowledge, and safe handling practices. Have the labels impacted consumers' behavior in respect of safe food handling practices? Results of our analysis show that label awareness was significantly associated with safe handling behavior even after accounting for perceived risk, which

label awareness could conceivably be a marker for rather than a cause of..

Newspapers, but not other sources of food safety information, were positively associated with safe handling behavior. Knowledge variables, such as being aware of various foodborne pathogens vectors and specific knowledge of safe handling practices were associated positively with safer handling behavior. Consumers who have had a food borne illness experience, and those who perceived a high risk of foodborne illness, practiced safer handling of food.

The finding that awareness of food safety labels is positively associated with safe handling behavior is reassuring--- labels may be contributing to a reduction in the incidence of foodborne illnesses. Further research is necessary to establish a causal link. The positive associations between perceived risk and safer food handling practices suggests messages stressing the threat factor could be an effective strategy.

REFERENCES

Altekruse, Sean F., Debra A. Street, Sara B. Fein and Alan S. Levy. "Consumers' Knowledge of FoodBorne Microbial Hazards and Food Handling Practices." *Journal of Food Protection.* 59(1995): 289-294.

Barnow, B., G. Cain and A Goldberger. "Issues in the Analysis of Selectivity Bias." In W. Stromsfrod and G. Farkas, eds. *Evaluation Studies Review Annual.* 5 (1981):43-59

Becker, G. S. "A Theory of the Allocation of Time." *Economic Journal.* 75(1965): 493-517.

Council on Agricultural Science and Technology. "Foodborne Pathogens: Risks and Consequences." *Taskforce Report No. 122. Washington, D.C., 1994*.

Dittus, Kim L. and Virginia N. Hillers. "Benefits and Barriers to Fruit and Vegetables Intake Relationship Between Attitudes and Consumption." *Journal of Nutrition Education.* 1995. 27(3): 120-127.

Falck, R.S., H. A. Siegal, J. Wang, and R. G. Carlson. "Usefulness of the Health Belief Model in Predicting HIV Needle Risk Practices Among Infection Drug Users." AIDS Education and Prevention. 1995. 7(6): 523-533.

Fein, Sara B., C.-T. Jordan Lin, and Alan S. Levy. "Foodborne Illness: Perceptions, Experience, and Preventive Behaviors in the United States." *Journal of Protection.* 1995. 58(12): 1405-1411.

Food Marketing Institute. "Trends in the United States: Consumer Attitudes and Supermarkets." 1996. 80-81.

Guthrie, Joanne F., Fox, Jonathan J., Cleveland, Linda E., and Welsh, Susan. "Who Uses Nutrition Labeling, and What Effects Does Label Use Have on Diet Quality?" *Journal of Nutrition Education*. 1995. 27: 163-172.

Heimendinger, J., and Mary Ann S. Van Duyn. "Dietary Behavior Change: The Challenge of Recasting The Role of Fruit and Vegetables in…." *American Journal of Clinical Nutrition.* June 1995 Supplement. 61(6): 1397-1402.

Hiltabiddle, S. J. "Adolescent Condom Use, The Health Belief Model, and the Prevention of Sexually Transmitted disease." *Journal of Obstetric, Gynecologic and Neonatal Nursing.* 25(1996): 61-66.

Kenkel. D. S.,"Health Behavior, Health Knowledge, And Schooling." *Journal of Political*

Economy. 99 (1991): 287-305

Knabel, S. J. "Foodborne Illness: Role of Home Food Handling Practices." (Scientific and Status Summary). *Food Technology.* 1995. 49(4): 119-131.

Kim Sung-Yong, Nayga, R. M. Jr. and Capps, O. Jr. "The Effect of Food Label Use on Nutrient Intakes: An Endogenous Switching Regression Analysis." *Journal of Agricultural and Resource Economics*. July 2000. 25(1): 215-231.

Kim Sung-Yong, Nayga, R. M. Jr. and Capps, O. Jr. "Food Label Use, Self-Selectivity, and Diet Quality." 2001. 35(2):346-363.

Lancaster, K. *Consumer Demand: A New Approach*. Columbia University Press: New York, 1971.

Lee, L. F. "Estimation of Limited Dependent Variable Models by Two-Stage Methods." Ph. D. Dissertation. University of Rochester. 1976a.

Greene W.H. " *LIMDEP Version 7*." User's Manual Econometric Software Inc.(1995) pg 642-643

Lin, C-T. Jordan. "Demographic and Socioeconomic Influences on the Importance of Food Safety in Food Shopping." *Agricultural and Resources Economics Review.* October (1995): 190-198.

Maddala, G. S. and F. Nelson. "Switching Regression Models with Exogenous and Endogenous Variables." *Proceedings of the American Statistical Association (Business and Economic Section)*. Pp. 423-426.

Maddala, G. S. "Limited Dependent and Qualitative Variables in Econometrics." Cambridge: Cambridge University Press. 1983.

McIntosh, W., Fletcher, R., Kubena, K., and Landman, W. "Factors Associated With Sources of Influence/Information in Reducing Red Meat By Elderly Subjects." *Appetite*. 23(1994): 219-230.

McIntosh, W. "An Application of the Health Belief Model to Reductions in Fat and Cholesterol Intake." *Journal of Wellness Perspectives*. Winter 1994. 12(2): 98-108.

Minugh, P. Allison. "Gender, Health Beliefs, Health Behaviors and Alcohol Consumption." *American Journal of Drug and Alcohol Abuse.* 1998. 24(3): 483-508.

Nakamura, A. and M. Nakamura. "Model Specification and Endogeneity." *Journal of Econometrics.* 83(March/April 1998): 213-237.

Nayga, R. M. Jr. " Determinants of Consumers' Use of Nutritional Information on Food

Packages." *Journal of Agricultural and Applied Economics*. 1996. 28(2): 303-312.

Nayga, R. M. Jr. "Nutrition Knowledge, Gender, and Food Label Use." *Journal Consumer Affairs*. Summer 2000. 34(1): 91-112.

Pham, D. T., Fortin, F., and Thibaudeau, M. F. "The Role of the Health Belief Model in Amputees' Self Evaluation of Adherence to Diabetes Self-Care Behaviors." Diabetes Educator. 1996. 22(2), 126-132.

Pitt, M. M., and M. Rosenzweig. "Health and Nutrient Consumption Across and Within Farm Households," *The Review of Economics and Statistics*, Vol. 67, pp. 212-223, 1985.

Raab, Carolyn A., and Margy J. Woodburn. "Changing Risk Perceptions and Food-Handling Practices of Oregon Household Food Preparers." *Journal of Consumer Studies and Home Economics.* 21(1997): 117-130.

Ralston, Katherine L., and C-T. Jordan Lin. "Safe Handling Label for Meat and Poultry: A Case Study in Information Policy." *Consumer Interest Annual.* 2001. 47: 1-8.

Ralston, Katherine L., Y. Starke, P. Brent and T. Riggins. "Awareness of Risks Changing How Hamburgers Are Cooked." *Food Review*. 2000. 23(2): 44-50.

Rosenstock, I. M. Historical Origins of the Health belief Model. *Health Education Monographs,* 2(1974): 328-335.

Schafer, Robert. B., Elizabeth Schafer. "Relationship Between Gender and Food Roles in the Family." *Journal of Nutrition Education.* 1998. 21(3): 119-126.

Schafer, Robert. B., Elizabeth Schafer, Gordon L. Bultena and Eric O. Hoiberg. "Food Safety: An Application of the Health belief Model." *Journal of Nutrition Education.* 25(1993): 17-23.

Sensiba, M. E. and Stewart, D. S. "Relationship of Perceived Barriers to Breast Self-Examination in Women of Varying Ages and Levels of Education." *Oncology Nursing Forum.* 1995. 22(8): 1265-1268.

Starke, Yolanda M. "The Role of Food Safety Knowledge, Risk Perceptions and Taste Preferences in Cooking Hamburger Behavior." *Graduate Thesis,* (1999). North Carolina A&T State University.

Variyam, Jayachandran N., James Blaylock, and David Smallwood. "Informational Effects of Nutrient Intake Determinants on Cholesterol Consumption." *Journal of Agricultural and Resource Economics.* July (1998): 110-125.

Variyam, Jayachandran N., James Blaylock, and David Smallwood "Modeling Nutrient

Intake: The Role of Dietary Information." Technical Bulletin Number 1842. USDA/Economic Research Service, May 1995.

Vella Francis. "A simple Estimator for Simultaneous Models with Censored Endogenous Regressors." Interntional Economic Review. 1993 34(2): 441-457.

Williams, Lashawn. "Consumers' Use of Safe Handling Label Instructions on Meat and Poultry." *Graduate Thesis,* (2001). North Carolina A&T State University.

Williamson, Donna M., Robert B. Gravani, and Henry T. Lawless. "Correlating Food Safety with Home Food-Preparation Practices." *Food Technology*. May 1992. 46(5): 94-100.

Wulfert, Eldergard. "Safer Sex Intentions and Condom Use Viewed From a Health Belief, Reasoned Action, and Social Cognitive Perspective." *Journal of Sex Research.* 1995. 32(4): 299-312.

Internet

Ingham, Steven PhD, and Monica L. Thies. "Changing Demographics and Lifestyles."

(1997). http://www.eatright.org/adap0297.html . (Accessed November 2002).

Table 1. Variable definitions and sample statistics

Variables	Description	Sample Proportion
Label Use	Seen the safe handling labels Yes = 1 No = 0	 65.5% 34.5%
Risk perceptions index	Low safety = index 0-3 High Safety = index 4-5 Index is the score from survey questions as follows: Do you think that the United States has a food safety problem? (yes = 1) How common do you think it is for people in the United States to become sick because of the way food is prepared in the homes? (Very common or somewhat common = 1) How common do you think it is for people in the United Sates to become sick because of the way food is prepared away from the home (very common or somewhat common = 1) Would you say that the number of people becoming sick during the past five years has …(1 for increased) Do you feel that certain foods may cause foodborne illnesses more than others? (1 for yes)	34.1% 65.6%
Awareness index	Low = index 0-2 Medium= index 3-4 High= index 5 Index equals the number of pathogens that the respondent had heard of, out of a list consisting of *Salmonella, Campylocbacter, Listeria, E. coli and Cylospora.*	49.5% 41.9% 8.6%
Safe Handling Behavior	Low = index 0-6 Medium= index 6-12 High= index 13-16 Index equals sum of safe answers to following questions: Whether or not you are the primary food preparer, before	1.4% 4.0% 84.7%

	you prepare any food, do you wash your hands? (safe = everytime (4) or most of the time (3)). After cracking open raw eggs, do you wash your hands before you continue preparing other foods? (safe = every time or most of the time). In preparing foods in which raw meat will be cooked do you wash your hands before you continue preparing the rest of the meal—(safe = every time or most of the time) In preparing foods in which raw meat will be cooked, how often do you wash off the surface area before you continue preparing the rest of the meal? (safe=every time or most of the time)	
Safe handling knowledge index	Low= 1 Medium =2-3 High= 4 Index equals sum of correct answers to the following questions: (For each practice is food poisoning more likely to occur, less likely to occur, makes little difference or don't know) Serving meat on the same platter it was prepared without washing first. (correct = more likely to occur) Ground beef is still mostly pink inside. (correct = more likely to occur) Leaving food on counter for 4 hours. (correct = more likely to occur) Only rinsing hands with water before preparing food (correct = more likely to occur)	3.1% 39.9% 57.0%

Household and Personal Characteristics	Variable definitions	Proportion
Education		
High School	12 years of less of schooling	44.3%
College	13-16 years of schooling	45.6%
Garduate	More than 16 years of schooling	10.2%
Age		
18-39	Individual is between 18 and 39 years old	40.7%
40-60	Individual is between 40 to 60 years old	36.5%
Over 60	Individual is 60 years or above	22.8%
Income		
	Less than $15,000 per annum	12.2%
	$15,000-29,999	28.1%
	$30000 and above	59.7%
Household size		
	Individuals living in household is 2 or less	52.6%
	Individuals living in household is 3 –5	43.8%
	Individuals living in household is 6 or more	3.6%
Married	= 1 if individual is married and 0 otherwise	54.3%
African-American	= 1 if respondent's ethnicity is African-American, 0 otherwise	27.9%
Other ethnicity	= 1 if respondent's ethnicity is not African-American or European-American, 0 otherwise	8.3%
Female	= 1 if respondent is female and 0 otherwise	68.3%
A household member experienced foodborne illness in the past year	= 1 if there has been a foodborne illness experience in the household in the past year and 0 otherwise	19.2%
Household food preparer	= 1 if respondent is the primary food preparer and 0 otherwise	74.4%

Information Sources		
Cookbook	=1 if the respondent receives a lot or some of safe handling information from Cookbook and 0 otherwise	51.0%
Newspaper	=1 if the respondent receives a lot or some of safe handling information from Newspaper and 0 otherwise	58.0%
Magazine	=1 if the respondent receives a lot or some of safe handling information from Magazine and 0 otherwise	63.0%
Radio	=1 if the respondent receives a lot or some of safe handling information from Radio and 0 otherwise	76.0%
Television	=1 if the respondent receives a lot or some of safe handling information from Television and 0 otherwise	76.0%
Government	=1 if the respondent receives a lot or some of safe handling information from Government and 0 otherwise	55.0%
Relatives	=1 if the respondent receives a lot or some of safe handling information from Relatives and 0 otherwise	72.0%
Consumer Groups	=1 if the respondent receives a lot or some of safe handling information from Consumer Groups and 0 otherwise	44.0%

Table 2 :Parameter Estimates of the Probit Label Use and the OLS Safe Food Handling Behavior Equations.

Variable	Probit Label Use		Safe Handling Behavior	
Constant	-0.367		8.940	(0.936)
Illness Experience	-0.102	(0.157)	0476**	(0.239)
Primary Prep.	0.571**	(0.159)	0.327	(0.206)
Age	-0.003	(0.004)	0.012**	(0.006)
Gender	-0.081	(0.144)	0.669***	(0.196)
Education	-0.147 *	(0.088)	-0.275**	(0.122)
Marital Status	0.184	(0.132)	0.334*	(0.189)
Race-Black	-0.049	(0.144)	0.458**	(0.229)
Race-Other	-0.661	(0.216)	0.423	(0.301)
Govt. Assist.	-0.187	(0.199)	0.219	(0.297)
Income	0.076	(0.049)	-0.060	(0.066)
Family Size	0.211*	(0.123)	-0.053	(0.223)
Urban	-0.031	(0.165)	0.681	(0.257)
Rural	0.547	(0.444)	-0.432	(0.536)
Risk Perception	0.225*	(0.165)	0.193***	(0.078)
Pathogen Awareness	0.186*	(0.105)	0.397***	(0.153)
Knowledge			0.408***	(0.094)
Label Use			0.790***	(0.265)
Newspaper			0.447***	(0.145)
Magazine			0.104	(0.144)
Television			-0.130	(0.124)
Government			0.098	(0.132)
Relatives/Friends			0.123	(0.112)
Consumer Groups			0.002	(0.144)
σ_ε			2.221	(0.063)
Rho			0.072	(0.164)

Asterisks (*) denote significance at the (*) .10, (**) .05, and (***) .01 levels.