IDENTIFYING MARKET PREFERENCES
FOR HIGH SELENIUM BEEF

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ABSTRACT

Hovde, Scott Curtiss; M.S.; Department of Agribusiness and Applied Economics; College of Agriculture, Food Systems, and Natural Resources; North Dakota State University; December 2006. Identifying Market Preferences for High Selenium Beef. Major Professor: Dr. Cheryl Wachenheim.

Cancer is an enormous health concern in the United States and the rest of the world. Selenium is an element that has been scientifically proven to have some cancer-preventative characteristics. Thus, livestock and grain producers are exploring potential high-selenium food marketing opportunities. A choice experiment was conducted to identify characteristics of market segments that show interest in a high-selenium beef product. In a national survey, participants chose between different levels of health claim approval and research, prices, and selenium origin. A multinomial logit regression model was estimated.

Results indicate that typical marketing opportunities may be within the boundaries of functional food market segments. The fear of cancer and a general lack of knowledge regarding selenium appear to affect the purchase intentions of consumers regarding this product. Promotional marketing tactics may be effective when information is presented in a manner that is easily accepted and understood by consumers.
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CHAPTER I. INTRODUCTION

Cancer, the second leading cause of death in the United States, is a major public health concern. The American Cancer Society (2006) states that one of every four deaths in the United States is caused by some form of cancer, and the organization estimates 1,399,790 new cancer cases and 564,830 expected deaths due to cancer for 2006. Cancer can exist in many different forms and types, some of which are brought on by the destructive choices people make while others are less predictable and are not the result of destructive decisions. Consumers find themselves searching for inexpensive and easy methods to diminish the risk of obtaining certain forms of cancer. Food selection is becoming an increasingly common choice as a hopeful cancer prevention agent.

Many foods consumers choose in this scenario are referred to as “functional foods.” “A food can be regarded as ‘functional’ if it is satisfactorily demonstrated to affect beneficially one or more target functions in the body, beyond adequate nutrition, in a way that improves the health and well-being or reduces the risk of disease” (Gibson and Williams, p.1). However, to be considered a functional food, the food must remain a food, thus supplements are not considered to belong in this category. The functional food may be a completely natural food, a food to which a health-positive constituent has been added, or a food in which a particular element has been modified. Functional food sales have grown 10% annually since 1990, which represents the increased interest in and pursuit for these products (Lesch, 2004).

The value of a functional food is dependent upon the extra “function” characteristics it contains and how consumers value the health benefit associated with the
functional food. After an added health benefit is associated with a food or element of a food, that product is labeled according to its benefit and is marketed as a functional food.

Many consumers have heard little about functional foods and the benefits associated with them. Even if they have heard of them, many consumers still do not know what individual functional foods are worth to their health beyond basic nutrition. Consumers cannot choose functional foods that prevent cancer unless they are aware of them. Functional foods with cancer protection qualities need to be promoted to consumers once research has proven their functional creditability.

**Selenium**

Selenium is an essential trace mineral that is extremely important to basic human health. It is a necessary component for appropriate function of the immune system, muscle function, successful reproduction, and peak brain function. Also, selenium produces valuable antioxidant enzymes. Deficiencies in selenium have been linked to decreased thyroid function, cardiovascular disease, and cancers (Rayman, 2000).

Research has demonstrated that selenium is also linked to reduction in risk to some carcinomas (Clark, et al., 1996, 1998.) Selenium was first recognized as having some nutritional importance almost five decades ago (Schwartz and Foltz, 1957). Twelve years after that initial proposal, an inverse relation of U.S. local cancer rates and geographical distribution of selenium in American forage crops led to a suggested relation of selenium and cancer risk (Combs, 2000).

Selenium has not been approved for an unqualified health claim by the Food and Drug Administration (FDA) as a cancer protector or prevention aid due to the lack of conclusive evidence to date. Selenium has been petitioned to the FDA for validation of its
role as an anti-carcinogenic. However, the FDA concluded in 2003 that there was not “significant scientific agreement about the science underlying the statements that ‘Selenium may reduce the risk of certain cancers’ and that ‘Selenium may produce anti-carcinogenic effects in the body’” (Taylor, p.8). At the conclusion of current human health studies with regard to selenium intake and cancer protection, more conclusive and significant evidence is expected to be submitted.

Selenium levels in foods are greatly dependent on soil selenium levels in the region where the food is raised. Plants do not use the selenium for growth processes, so the selenium level of the soil is maintained in the plant; therefore, plants grown on high-selenium soils have higher selenium levels. Plants containing high selenium, wheat for example, can be harvested and used to make food products such as bread. The bread will contain a higher selenium level that is correlated with the selenium found in the soil in which the wheat grew. Animals require selenium for bodily processes and functions, and the excess amount consumed is then deposited into muscle tissue. Therefore, high selenium feeds are a direct influence to the quantity of selenium deposited in the animal muscle tissue.

Currently, there is no specific market value for selenium-enhanced beef. The specific level of selenium in beef products marketed to consumers now is generally unknown to the consumer or participants in the marketing channel. Estimating how much consumers will value selenium levels in beef is essential to evaluating the potential of marketing a high selenium product. If consumer value for selenium enhanced beef is estimated, it can then be used to help establish an expected premium for this product,
which can help producers and processors decide on the economic viability of introducing a
high-selenium beef product.

The general population’s intentional use of functional foods, such as high-selenium
products, has only recently become possible. Public awareness of the added health benefits
of certain foods has increased as new developments and research discoveries are realized.
Research studies on the effects of selenium on the human body have been underway for
several years but some are not yet completed. Upon completion, it is hoped these studies
will provide some crucial results to support current selenium claims.

A current goal for those administrating studies and sponsoring selenium research is
to obtain FDA authorization of a health claim with no discretionary circumstances for the
claim. This would present the opportunity for the general public to value well-defined
FDA approval stickers on high selenium food packages. When favorable nutrition
information or health claims are presented, consumers have more favorable attitudes
toward the product, nutrition attitudes, and purchase intentions (Kozup, Creyer, and
Burton, 2003).

**Objectives**

The goal of this project is to investigate consumer demand for selenium enhanced
beef. Since regions of North Dakota and South Dakota soils have high levels of selenium,
beef producers, processors, and landowners in the Dakotas have a special interest in the
consumer value of this cancer defense mineral. If selenium were approved as a cancer
prevention mineral, and beef producers and processors chose to target selenium enhanced
beef markets, premiums received would have to exceed the costs of testing the meat and
soils for selenium, possible identity preservation, new feeds, and additional slaughtering and marketing costs.

Specific objectives are as follows:

1. Identify preferred level of selenium beef attributes including price, origin of selenium, and label-claim made regarding the value of selenium as a cancer preventative.

2. Gauge level of knowledge concerning selenium health characteristics.

3. Identify market segments valuing a high-selenium beef product.

The conclusions will be useful for firm decision making in more than one way. First, an estimated demand will give the producer an educated conclusion regarding potential premiums from the product, which in turn will help guide decisions about whether to implement high-selenium production. Second, the conclusion should be useful to show how consumers respond to the information received about selenium. The response to information will help determine what, if any, marketing campaign is necessary.

Chapter II reports relevant findings from the literature in the areas of Functional Foods and Functional Food Consumers, Selenium, Health Claim Labeling, and methods of experimental design for this investigation. Chapter III presents the Methods used for survey design and deployment as well as a brief description of the survey population. Results of the survey are discussed in Chapter IV, followed by the conclusions and implications in Chapter V.
CHAPTER II. LITERATURE REVIEW

The literature review begins with definitions of functional foods and market segments for such. Selenium and its potential as a functional food, health claims, and labeling concerns are then discussed. Methods to assess willingness-to-pay are then considered.

**Functional Foods and Functional Food Consumers**

The term “functional food” originated in Japan in the late 1980s to describe foods fortified with ingredients that potentially would benefit consumers’ health (Stanton et al., 2001). Today, many current definitions vary as there is no legal definition, and growth has been rapid in the marketing of food products as functional foods. Ingredients that may be considered functional include probiotics, prebiotics, vitamins, and minerals found within products.

European functional food markets typically are made up of probiotics and prebiotic dairy foods. Probiotics are single or mixed cultures of live microorganisms that, when applied to animals or humans, beneficially affect the host by improving the properties of the indigenous micro-flora (Stanton et al., 2001). Prebiotics are indigestible food ingredients that beneficially improve host health by selectively stimulating the growth, activity, or both of one or a limited number of bacteria in the colon. Vitamin and mineral fortified functional foods are more common in the United States. The American functional food market is underdeveloped compared to markets in Europe and Japan (Stanton et al., 2001). A major factor for the furthering of the American market will be the rules, testing, and context of health claims associated with specific functional foods.
Strong health claims and changing consumer demands are critical to the success of functional foods. Consumers are increasingly demanding convenient, yet health-oriented, foods (Stanton et al., 2001). The typical functional food consumer is female, between 35 and 55 years of age, well educated, with a high income, and actively interested in health (Stanton et al., 2001). Consumers as a whole are increasing their knowledge of health, foods, and nutrition, which in turn should also increase the awareness of and demand for functional foods.

Maynard and Franklin (2003) conducted a willingness-to-pay (WTP) study regarding conjugated linoleic acid (CLA) dairy products. CLA has been shown in animal studies to prevent cancers from developing or growing. Typical human diets do not contain enough CLA to reach preventative levels. From the results of their contingent valuation experiment, consumer segments most likely to value the CLA products highly had children or health-conscious consumers in the household. Another notable result from the study was that some respondents’ WTP was dependent on the medical community’s support of the CLA cancer fighting evidence and research.

Burn and Kishore (2000) explained how biological advancements and changes play a part in the role of foods. They stated that foods contain nutrients that can be effective toward promoting specific metabolic or bodily functions, rather than just meeting caloric and digestive needs. They noted that foods with molecules of these nutrients were often referred to as “nutraceuticals,” or functional foods. In an effort to better describe these molecules that positively affect the body’s functions and preservation, a new name, “vitalins,” was proposed by the authors. Functional foods would be foods with one or more of these vitalins or foods depleted in anti-vitalins. Burn and Kishore argued that this
would better educate consumers about nutrition at the molecular level. Due to the amount of misleading and false stories regarding food roles, Burn and Kishore believed there was an increasing need for science-based regulations that would help strengthen science-based nutrition and disease prevention.

Food and medicine are beginning to merge, which creates the need for a system that distributes the harvests of scientific research to consumers without creating confusion and compromising on scientific principles.

Gilbert (2000) tackled important aspects of reaching a target functional foods market based upon discoveries of the biennial HealthFocus® Trend Report. Most shoppers (93%) in this national study still desired foods naturally nutritious in key vitamins and minerals. This was much greater than those who agreed that supplements and fortified foods were important (62% and 55%, respectively).

Just over half of shoppers, 54%, believed that foods could reduce medicine or drug use. Those who strongly agreed with that, 11%, were labeled “food as medicine” shoppers—and are often the target of many functional food products entered in the market. Seventy-eight percent of “food as medicine shoppers” read labels, and they were more than twice as likely as other consumers to believe labels are regulated (48% versus 22% of other shoppers). However, they were also more likely to be skeptical of label claims.

In the study, label claims of “fresh” and “grown without pesticides” were most important to all shoppers. Positive health claims had a slightly higher appeal to these shoppers than a claim of fear. For example, “helps to maintain healthy cholesterol” was slightly favored over “may reduce risk of heart disease.”
The skepticism toward functional foods and health claims will continue, but educating the consumer is crucial to the successful marketing of functional food products. Gilbert (2000) contended that, to better educate the consumer, information regarding health claims must come in a variety of methods, such as product labels, media, and doctors’ offices.

Mark-Herbert (2003) explained a business strategy for marketing functional food products. This research indicated that most new food product entries into the market were discontinued within one year of that entry. Since functional food products have a different shape and spectrum than more traditional products, different strategies may be necessary for success. The first phase of marketing functional foods would be the clinical study phase where reputable research tests evaluate the food product’s functional effect on humans. Next would be public relations and advertisement phases, during which mediums of communication inform consumers about a product and its functional benefit. Using doctors or other professionals to vouch for a product’s benefit would help generate consumer interest and add validity to the impression of the information. The segment labeled “sufferers” would be the first and initial market to have an interest in the functional food for its added benefit, as that segment would be suffering from whatever problem that food would address. As awareness increased slightly, “at-risk” segments would start to consider the product, and efforts would then be devoted to increase awareness until the “prevention” segment became attracted and aware. Finally, if the functional food caught on beyond prevention segments, it would be a mass-marketed product for which the majority of an entire population would be aware and possibly consuming. Personal
experiences would greatly help to increase awareness of the product, primarily beginning with the “sufferers” and growing to the other segments.

Wilson and Abbott (2005) wrote about the functional food consumer. Two popular definitions were given for functional foods and are listed below (p. 58):

1. “Forms of food products that have been altered in order to serve a particular nutritional need and which is used as the primary selling point.”

2. “Naturally occurring foods particularly endowed with one or more beneficial nutritional properties that could reasonably be used as the primary selling point against similar foods.”

A basic understanding of functional foods is the knowledge that they provide some added benefit beyond the basic nutritional value of the food. Wilson and Abbott’s analysis indicated that education and income levels were significant to a household’s functional food purchases. Higher levels of either education or income resulted in more purchases of healthier food products. Women demonstrated higher functional food purchase tendencies than men.

Schmidt (2000) examined consumers’ evaluation of functional foods and questioned whether interest in functional foods was a temporary market trend or a major shift in consumers’ attitudes regarding foods. Ninety-five percent of consumers surveyed believed foods could have health benefits beyond the basic nutritional value. There was also a strong preference for foods occurring in their most “natural” states. From information gathered through a telephone survey and focus groups, Schmidt concluded that consumers were becoming increasingly aware of functional foods. He suggested that communication to the consumer is key to disseminating accurate information.
Positive statements are received much better than negative statements, and consumers do not want to be told what not to eat. Terminology is also important to the interpretation and impression of consumers and the food product. For example, using “may reduce risk of” rather than “will prevent” to explain attributes gives products a “natural food” impression, rather than a “medicine fortified” impression.

**Selenium**

The 2003 FDA response to the 2002 Health Claim Petition from Wellness Lifestyles, Inc. regarding selenium and reduced risk of certain cancers and selenium anticarcinogenic effects concluded that not enough significant scientific evidence had been shown to satisfy the petitioned claims (Taylor, 2003). The Institute of Medicine (IOM) directed a risk assessment of dietary selenium and found that an upper level of 400 micrograms per day of selenium intake from food and supplements was likely to present no adverse health risk to almost any person (Taylor, 2003). The FDA approves this level as safe and lawful (Taylor, 2003). Approximately 100 micrograms per day is estimated by the IOM to be the current average selenium intake from foods by one person. With the petition, five intervention cancer trials were submitted as scientific evidence. These trials were the Nutritional Prevention of Cancer Trial (Clark et al., 1996); the Linxian General Population Trial (Blot, et al., 1993; Li et al., 1993); Qidong Primary Liver Cancer Trial (Yu et al., 1991); Genova, Italy Colorectal Recurrent Adenoma Trial (Bonelli et al., 1998); and Andhra Pradesh, India Precancerous Lesions of Oral Cavity Trial (Prasad et al., 1995). The only trial pertinent to the conditions of the United States population, the Nutritional Prevention of Cancer Trial, showed no effect of selenium supplementation on the non-melanoma cancer that was primarily tested. Analyses following that study suggested
selenium supplementation led to potential reductions in certain and total cancers for which
the study was not designed. These other cancers’ relationships with selenium require
independent confirmation since that particular study was not researching for those effects.
Of 25 observational studies submitted and 11 additional observational studies recognized
by the FDA, none were able to show the effects of selenium separately from those of other
nutrients. However, four observational studies focusing on prostate cancer were
acknowledged to be consistent by showing a significant inverse relationship between
selenium intake and prostate cancer.

Although the FDA concluded there was insufficient evidence for the proposed
claims, it did state that existing evidence is strong enough to support qualified health
claims as long as they were appropriately worded and not misleading to consumers. Two
claims were proposed by the FDA (Taylor, 2003, p.8) as follows:

1. “Selenium may reduce the risk of certain cancers. Some scientific evidence
suggests that consumption of selenium may reduce the risk of certain forms
of cancer. However, the FDA has determined that this evidence is limited
and not conclusive.”

2. “Selenium may produce anticarcinogenic effects in the body. Some
scientific evidence suggests that consumption of selenium may produce
anticarcinogenic effects in the body. However, the FDA has determined that
this evidence is limited and not conclusive.”

Combs (2001) discussed the Nutritional Prevention of Cancer (NPC) trials that were
performed by Clark et al. (1996, 1998) and the development of results from that study. The
study found risk to cancer mortality, total cancer cases, and lung, colorectal, and prostate
incidences to be reduced as a result of selenium supplementation of 200 micrograms/day, an increase of 85 micrograms/day from what this study considered average diets. Plasma samples were obtained from the patients in the study to determine information regarding selenium concentration in plasma.

Combs suggested that a plasma selenium (Se) level of about 120 micrograms (ng)/ml might be an optimal cancer protection target, and that a previous equation prediction of an intake of 91 ng/day to reach a plasma Se level of 120 ng/ml, as predicted by Yang et al. (1989), may be under-estimated by as much as one-third. This underestimation can be accounted for by average participant weights between the Yang et al. study and the NPC trial. Adjusted for this difference, selenium intakes of 96 ng/day (for women) and 120 ng/day (for men) would be sufficient to sustain plasma Se levels of 120 ng/ml (Combs, 2001)—175% and 218% of the revised recommended dietary allowance (RDA) levels, respectively. Another selenium supplement study evaluated 400 micrograms/day and showed results consistent with that of the NPC study. Neither study had a subject with plasma Se levels near the upper safe limit, which suggests that the levels recommended by Combs were safe. Because of functional health benefits of nutrients such as selenium, Combs concluded that RDAs might need to include consideration for chronic disease prevention to best serve the public.

Since beef is one of the highest selenium-containing foods in North American diets (Shi and Spallholz, 1994), management practices may be important for making beef a permanent and reliable source for high selenium dietary intake. Beef in seleniferous areas (areas with high soil Se) has potential to be that supply source. From a moderately seleniferous area, beef samples average 0.7 micrograms Se/g or 70 micrograms Se for a
100g beef serving (Hintze et al., 2001). This is a greater amount of selenium than dietary reference intake numbers, at 55 micrograms daily. It is possible that animals from highly seleniferous areas might reach 200 micrograms Se/100g serving, which would be approximately the level for cancer fighting, according to recent research.

Hintze et al. (2002) examined how selenium levels in feed rations and environment affected Se accumulation in beef muscle tissue. Steers were taken from seleniferous areas and nonseleniferous areas, half from each, for the experiment. Half the steers from each geographical region were fed a high selenium supplemented diet, while the other half of each region was fed a moderate Se diet, as shown in Figure 2.1. Nonseleniferous steers fed the high Se diet reached Se plasma levels similar to those animals fed high Se diets from seleniferous regions within two months (Hintze et al., 2002). In the same time period, animals fed moderate Se rations from seleniferous regions had plasma levels equivalent to that of moderate Se nonseleniferous steers. Therefore, high selenium diets fed to livestock in nonseleniferous regions were equally as effective as diets in seleniferous regions. Importantly, selenium concentrations were found to be similar across all cuts of the individual steers.

Figure 2.1. Hintze et al. (2002) study’s steer groupings.
Lawler et al. (2004) demonstrated the effects of high selenium diets on performance, carcass characteristics, and selenium distribution in finishing beef steers. Forty-three beef steers were arranged by birth weight and placed into one of four experimental diet groups: control, high selenium wheat, high selenium hay, or sodium selenate supplement. Animals were fed and monitored for 126 days, then slaughtered and assessed for selenium results. Selenium did not affect performance, carcass characteristics, or quality regardless of source or concentration. In semitendinosus muscle, Se concentrations were lowest for the control and sodium selenate groups, thus indicating more absorption of organic occurring selenium. Se concentrations ranked highest in kidney, intermediate in liver, and least in skeletal muscle.

**Health Claim Labeling**

Garretson and Burton (2000) addressed some of the issues regarding consumers’ perceptions and evaluations of differences in nutrition facts information and health claims associated with food products. Specifically, they used fat and fiber as the nutrients tested in their experiment. The evaluation of nutrition facts panels, which have been included on food products since 1994, oftentimes can be affected by a health claim. The Nutrition Labeling and Education Act (NLEA) was designed to provide an opportunity for consumers to evaluate the foods they consume with accurate and understandable information. Although the intent of the NLEA’s related claim and nutrition information changes was to simplify labels and reduce confusion, many concerns surfaced of its actual ability to do so.

NLEA legislation developed two primary goals to help alleviate these concerns. The first was to reduce consumer confusion with nutrition and health claims, and the
second to produce useful nutrition information capable of helping the consumer make more
healthful decisions. Garretson and Burton center around these two NLEA objectives in
their paper by first investigating nutrition facts and health claim effects on consumers’
attitudes and purchase intentions. Second, they compared changes in consumers’
perceptions of disease risk and diet-disease knowledge with differing nutrition information
and health claims. Lastly, they observed how misleading information affect consumers’
trust and manufacturers’ credibility.

Five hypotheses were tested with a sample of 382 participants from an Arkansas
statewide mail survey. Results indicate that most consumers chose to rely upon nutrition
facts information rather than claims. When compared to conditions without health claims,
inclusion of a diet-disease health claim led to a marginal reduction in perceptions of risks
for cancer. Findings also suggested that misleading information had a negative effect on
consumers’ trust regarding nutrients with higher perceived disease relation.

Teratanavat and Hooker (2004) studied the ability of consumers to differentiate
between the scientific research supporting multiple levels of qualified health claims. The
FDA uses a four level system, levels A, B, C, and D, to clarify how strongly the claim is
backed with scientific evidence. Level A pertains to “unqualified health claims” where no
disclaimer is necessary since they meet the significant scientific agreement (SSA) standard
to support the health claim. Levels B, C, and D represent moderate, low, and extremely
low scientific evidence compared to the SSA standard, and thus need to be accompanied by
a disclaimer.

Two studies were designed with the first study focusing on consumers’ ability to
differentiate between the levels of health claims and their language. The second study
investigated the effect of including a claim level report card, which visually showed the contrasts in claim levels. Results from the first study suggested that differing levels of claim information did affect consumers’ attitudes and intentions to purchase. Participants reacted more positively to products bearing claims A, B, or C than products with no claim or level D. Level D can be differentiated from the other levels based upon the results, but A, B, and C levels seemed to have no significant discrimination. Consumers did not perceive a product to be healthy when little evidence supports the research (level D).

Roe, Levy, and Derby (1999) evaluated if consumers rely solely on health claims when present and, if so, how nutritional choices were affected by the health claim. They took three non-branded, different products and placed health claims and nutrition facts on them. With the presence of a health claim, consumers were significantly more likely to constrain their search for nutrition information to the front panel compared to looking at the Nutrition Facts information panel. Lesser-educated consumers were also more likely to limit nutrition searches to the front panel but were also more skeptical of health claims. Regardless of nutrition search methods and strategies, consumers were more likely to consider a product healthier and have higher purchase intentions when it featured a health claim. A large portion of consumers was likely to view both health and nutrient content claims as representing health information. Generally, both types of information had the same impact on consumers’ opinions and choices.

Kozup, Creyer, and Burton (2003) addressed the effects of nutrition information and health claims when placed on packaged foods as well as restaurant menus. Nutrition Facts panels, mandated on packages since 1994, show information about the contents and nutrients of the food product and are well recognized by consumers. Health claims were
also regulated during the same time period, but evidence about their effectiveness was less conclusive. The authors considered how customers’ attitudes and purchase intentions were affected by health claims and nutrition.

Measured were product evaluations, perceptions of source credibility, and consumers’ thoughts about developing specific diseases if a certain food was a staple in their diets. Participants were part of a consumer household research panel and screened to only include primary household shoppers. To represent the health claim for their research, a heart-healthy logo was placed on the food package or menu. When this logo was on the package or food, consumers generally believed that food would reduce the likelihood of heart disease or stroke. Positive nutrition information led to more positive attitudes towards the food product, nutrition, and reduction of disease risk, and increased purchase intentions. Nutrition information and health claims were not interactive in consumers’ decisions and intentions on packaged food, but the interaction was significant on the restaurant menu food items. The healthy-heart claim had no significant influence on evaluations or disease risk perceptions when nutrition information, favorable or unfavorable, was present. In situations where no nutrition information was available, the health claim was the only indicator to the consumer about the health quality of the product.

From the study, the authors concluded that consumers really do not know the health level of foods when they are dining out at restaurants. Consumers preferred to trust nutrition facts when available and used the health claim as a second resource. The best purpose for the healthy-heart claim was to influence consumers’ disease risk perceptions.

Wansink’s (2003) research on influences of front and back labeling worked to identify the most effective label—that which communicated the most relevant information
efficiently. Three front claims, long, short, and no label, were randomly displayed with a more informative back label. Participants recorded their thoughts when they read the labels on the product shown to them. These thoughts were evaluated as attribute-specific or general evaluations. Attribute thoughts are generally accepted to indicate the consumer has interpreted the label and its specific information better than a general evaluative thought. When attribute-specific thoughts are supportive of the claim or label, higher levels of persuasion can be achieved.

In Wansink’s research, all three front labels generated relatively the same number of thoughts, but it was the quality of thoughts that differed. Results showed that consumers who saw short claims made more attribute-specific thoughts and less evaluative thoughts than when seeing long claims or no claim on the front of the package. Higher numbers of positive attribute-specific thoughts led to higher levels of believability and persuasiveness of a health claim.

By including labels on two sides of the package, with a short claim on front and long on back, believability of health claims increases. Most studies use a label on only one side of the package, but this seems to inhibit the education of claim information. Detailed claim descriptions on the back of packages can inform consumers who want to know more without taking up too much space or having too many words on the front.

Methods of Willingness-to-Pay Valuation

Because selenium rich beef products considered in the current study are not commercially available, consumer’s preferences must be stated versus revealed. Therefore, stated preference methods of non-market valuation must be used. The challenge is to select a stated-preference method that will accurately and efficiently elicit preference for high-
selenium beef products. Different methods discussed in this evaluation are contingent valuation (CV), dichotomous choice (DC), choice-based conjoint analysis (CBC), and experimental auction.

Lusk and Hudson (2004) discussed the use of methods to elicit willingness-to-pay (WTP) methods and their agribusiness applications. These methods have received a great deal of attention within the environmental literature but have been used less often in agribusiness. Several studies have been conducted to estimate consumer WTP for quality enhanced foods and products, but these were concerned with policy issues or methodology and theoretical issues, rather than focused on product adoption or pricing choices. Lusk and Hudson specifically discussed the effectiveness of dichotomous choice, choice based conjoint analysis, and experimental auctions valuation methods for WTP discovery.

Dichotomous choice (DC) can be single bounded or double bounded, the difference being that a single bounded question has one “yes” or “no” question and double bounded starts with one “yes” or “no” question, then a second “yes” or “no” that is a higher or lower price offered depending on the response to the first question. Single bounded are most often used for environmental surveys and are estimated with a simple logit model. Higher statistical efficiency is achieved with the double bounded questioning as a more efficient mean WTP is calculated. However, double-bonded may not be incentive-compatible in a hypothetical context. Also, first and second responses may not be perfectly correlated, so the question of which answer to use arises. Finally, several authors have indicated a concern that the second responses depend upon the prices offered in the first. Both single and double bounded dichotomous choice experiments only elicit discrete choices.
Choice-base conjoint (CBC) analysis uses a product that is varied by the attributes it possesses, and consumers are faced with choosing which product they would purchase, given the attribute differences. This method has several advantages. First, it follows Lancaster’s theory of utility maximization, where consumers demand the attributes belonging to a good. Second, it closely mimics a consumers’ typical shopping experience, and that allows for analyzing consumers’ trade-offs within a product that they would normally see. Next, cross-price elasticities can be easily determined between novel and existing products, which is harder to do with other methods. Finally, the results from CBC have been shown to be similar to consumers’ revealed preferences.

Disadvantages are also associated with the use of CBC. Again, only discrete choices are observed, which complicates WTP identification and demand. It is also difficult to include demographics within a CBC experiment. Several studies have shown inconsistency among participants’ responses across choice questions, and responses may even be influenced by the complexity of the decision.

The last method evaluated was experimental auctions, which are scenarios in which customers bid on products. Individual bids are placed and exchange of money and goods takes place. Products for these auctions must exist, but do not necessarily have to be “on-the-market.” For example, Lusk, Pruitt, and Norwood (2006) evaluated WTP for an antibiotic-free pork chop offered to European consumers. This product is not commonly in the market, but was produced for the study and used. Alternatively, an experimental auction was rejected for the current study because of the bid complexity resulting from the variety of attributes considered, and because an FDA-label supporting the health benefit of selenium is not (yet) approved.
Lusk and Hudson drew the following conclusions: WTP of double bounded DC typically exceeded WTP of single bounded DC questions; WTP from open ended questions and experimental auctions were less than WTP of single bounded DC questions; WTP (single bound DC) was equivalent to WTP of CBC; and auctioning methods have lower WTP than CBC. The authors suggested that future studies try incorporating cross-price elasticity.

Lusk et al. (2005) conducted a meta-analysis of 25 studies reporting consumer willingness-to-pay (WTP) for or willingness-to-accept (WTA) genetically modified (GM) food products. The paper aimed to draw conclusions from 25 independent studies, each specific in product considered, population, study environment, and gift offered to participants. They also showed the effect of method of valuation estimates and reviewed the specific advantages and disadvantages of each method employed. There have been many studies designed and employed to estimate demand for GM foods, but the range of products, procedures, and subject pools make it difficult to effectively summarize consumer demand for the GM attribute. Variables specified by Lusk, et al. included sample description, elicitation format, valuation method, whether products were hypothetical or real, and whether researchers were eliciting WTP, WTA, or both.

They found that hypothetical WTP exceeded non-hypothetical WTP; WTA was greater than WTP, which is consistent with previous thoughts; and that conducting the valuation task in person for the non-GM foods resulted in lower premiums than not in person, such as through phone or mail surveys. The authors did not distinguish differences between valuation methods in accuracy or effectiveness.
Alpizar, Carlsson, and Martinsson (2003) explained the method of using choice experiments for valuating non-market goods. They provided a guide for constructing a choice experiment and discussed the steps to be taken to implement it correctly, thus eliminating some potential sources of error and question. The purpose of a choice experiment (CE) is to estimate the welfare effects of changes in an attribute. Choice experiments are similar to CBC methods to which other authors refer in that they both require a choice to be made among different alternatives. Since many of these attributes and products associated with choice experiments may be unknown, these authors claimed that it was harder for participants to respond strategically to the CE method when compared to the CV. Advantages for CE are that values for each attribute as well as marginal rate of substitution between non-monetary attributes can be determined. The success of a CE is dependent upon its construction including definitions, design, context, and evaluation.

Nalley et al. (2004) used a CBC experiment in a supermarket to evaluate WTP for “farm-raised” beef. Shopper intercepts took place at a counter adjacent to the meat department. Shoppers were informed about the product and the specifics regarding their participation. The product was given to them and they were to go home, prepare and eat the product, and complete the mail-in survey.

The two test products had three price variations each, with an option of “none” also included in each scenario. Participants were presented with seven of these scenarios and were asked to choose one of the choices in each scenario that they would purchase, if any. From the responses, the probability of choice at the different price levels was determined, which in turn was used to determine a mean WTP for each product.
This research was unique in that it specified a target audience by intercepting shoppers in an actual grocery store setting, and then giving them a mail-in survey. It also used a real product the customers took with them. Demographics could be captured on the survey, the assumed shopping decision-makers were participants at the store, and an actual stated preference was elicited for a non-hypothetical product.

Adamowicz, et al. (1998) explained how to use CV and CE to measure consumers’ stated preferences. They described CE as an extension of the CV method but with more than two alternative bundles with different attributes so that estimation of preferences of those attributes could be determined. The study in this paper pertained to consumers’ values of a woodland caribou habitat enhancement program using both CVM and CE methods of evaluation to test for differences between the preferences and error variances arising between the two methods.

The CE method appears to have many advantages versus the CVM approach, the first being that it allows the researcher to value the attributes as well as situational changes. Also, in the case of damage to a particular attribute, compensating amounts of other goods can be calculated, rather than compensating variation based on money. Attribute-based approaches are essential to measure the amount of other “goods” required for compensation. Finally, CVM pertains to a precise scenario, and respondents’ choices are based solely upon that scenario, while CE methods attempt to realize respondents’ preferences regarding the attributes of the scenario rather than the specific scenario itself.

Goldberg and Roosen (2005) composed the same experiment that used two different methods, CE and CV, to assess health risk and food safety perceptions of chicken breasts. Each survey was half CE and half CV, so they could capture and compare data
from both methods. They noted that revealed preferences were usually favored compared to stated preferences, but stated allowed for a few advantages. The most obvious was that preferences for non-existing products and attributes could be elicited. Also, an attribute’s range could be extended. However, on the other hand, respondents could misinterpret or ignore an attribute in question if it was hypothetical.

Choice experiments allow for the determination and valuation of individual attributes and characteristics of a product. However, this method is sensitive to misspecifications, such as the possibility of presenting the same scenario in both the CVM and CE portions of a respondent’s survey as well as ignoring interactions between attributes or excluding attributes that would be important to the participant. CVM methods provide valuation functions estimated from respondents’ preferences and attitudes. CV is often criticized for only providing hypothetical answers to hypothetical questions, which may be true in a poorly designed survey. Four qualifications of a poorly designed CV scenario listed by Goldberg and Roosen (2005) are as follows: strong incentives to misrepresent true WTP; strong incentives for respondents to rely improperly on elements of the scenario to determine their WTP; an incorrect description from the standpoint of economic theory of the good (theoretical misspecification) or a correct description in a way that respondents misunderstand (methodological misspecification); or inadequate sampling design, execution, or benefit aggregation.

To examine embedding was the third objective of Goldberg and Roosen’s (2005) experiment. Embedding implies that a respondent would not behave similarly in a real market setting at the level at which they had stated they would be WTP. For example, in experimental results from their study regarding health concerns in chicken breasts,
respondents may have indicated they would pay more for the decreased health risks as a means of “voting” for health risk reduction, but actually would not want to pay a premium for the reduction. Embedding could be an area of concern for many hypothetical attributes; this is an important concept to keep in mind.

This dual method survey allows for unique results. CE shows a higher maximum WTP and also has a wider range of WTP. Embedding effect is present in CE but not in the CVM format. The study cannot determine which values are closer to reality, but can identify that embedding in the CE suggests that results are biased. Goldberg and Roosen called for more research resulting in comparable WTP measures from CVM and CE methods.

A choice-based experiment will work best for the high-selenium beef project. It will provide an opportunity for multiple attributes to be evaluated with a product while forcing the participant to focus on the tradeoffs of the attributes for each individual choice in the set.
CHAPTER III. METHODS

Introduction

Consumers’ willingness-to-pay for a high level of selenium in beef products has not yet been estimated. Willingness-to-pay is defined as the amount an individual is willing to pay to acquire some good or service, elicited from stated or revealed preferences. Willingness-to-pay for particular product attributes depends upon how those respective attributes affect the individual’s utility for the product. Consumer i’s utility for a beef product, j, is represented by the equation $U_{ij} = V_{ij} + \varepsilon_{ij}$, where $V_{ij}$ represents the meat chosen for this particular utility function, which is characterized by its own individual variables different from other meat products in the experiment.

That is, WTP for ground or a cut of beef is a function of the attributes of the product. These could include, for example, selenium content, fat percentage, marbling, cut type, and animal background. Individuals are assumed to select among products to maximize utility. Because high-selenium products are not yet available to the marketplace, utility must be inferred from stated-preferences or revealed through individual choices in an experimental or hypothetical scenario.

Willingness-to-pay estimates will possibly vary among people. For example, middle-aged men might be willing to pay more than college-aged men for prostate cancer prevention because they might be considered more susceptible to having that form of cancer in the near future. Consumers with a family member with cancer or a personal association to a cancer victim or survivor might also be willing to pay more since they have a direct emotional link with cancer and its health risks. Identifying these types of market
segments is essential in launching new products. If certain target consumers exist for this product, demographics should help reveal them.

Many consumers have revealed they are willing to pay premiums for food products that can eliminate or reduce the probability of various health ailments, including cancer (Goldberg and Roosen, 2005). With recent research regarding selenium and its connection with certain cancers, interest has increased in the potential marketability of selenium-enriched products.

Since selenium naturally occurs in the earth’s soil, its availability and deficiency levels are correlated with geographic location. Because of this, regions with high levels of selenium foresee a potential economic opportunity to market this trace mineral in their food products. However, additional expenses, including testing, identity-preservation, and marketing, would result in premium costs for those products for them to be economically viable—and these costs would be passed along to consumers. The premium that consumers are willing to pay will be derived from their demand for naturally-occurring selenium and their desire for potential cancer prevention. This demand cannot be estimated using existing market data because this product and its selenium attribute are not specifically traded in the real market, thus a choice-experiment for non-market valuation will be used to accumulate consumers stated preferences. Limdep® will be used to analyze the data.

**Initial Survey Design**

A focus group was conducted on May 10, 2006. Specific objectives were as follows: gain information about consumers’ labeling preferences; evaluate consumers’ knowledge of functional foods and selenium; and determine product attributes with
potential to be co-integrated with selenium level in impact on willingness-to-pay and attribute ranges to be represented in the main survey instrument. The focus group was conducted according to recommendations specified in Krueger (1988). He specifies that focus groups should consist of seven to ten unfamiliar people in a non-threatening environment guided by a mediator or facilitator. A carefully planned outline should guide the facilitator’s discussion.

A few weeks prior to conducting the primary focus group, seven staff members in the Department of Agribusiness and Applied Economics at NDSU participated in an informal focus group. Participants included three administrative assistants and four research assistants, of which three were male and four were female, with ages ranging from 23 to 56. The objective was to refine the objectives and agenda for the primary focus group. Also, these participants helped to narrow the choice of photos and the context and style of questions to be posed in the focus group. The following outline is a result of the pre-focus group meeting, and was used to guide the focus group.

I. Welcome

II. Functional Foods
   a. Are you familiar with functional foods? (Moderator provides definition).
   b. Do you knowingly consume or purchase these products?

III. Selenium
   a. Have you heard of selenium? What have you heard of selenium? (Moderator provides definition).
   b. What are your perceptions of selenium?
   c. Moderator reviews recent selenium research suggestions.
IV. Product Labels (sing visual aids of label pictures)
   a. Where do you prefer labels on packages?
   b. What type of label is the most appealing and informative?
      i. Context
         1. Informational (e.g., Contains selenium, which has been known to reduce cancer.)
         2. Simple (e.g., High selenium)
         3. Combination
         4. FDA approval/research suggests—value of either label?
      ii. Location preference/effect of label on package (e.g., front/back/both)

V. Beef Product Type
   a. Purchase frequency of different types (e.g., hamburger versus cuts).
   b. Attributes of each of importance in purchase decision (e.g., What attributes are most important in considering a beef cut or hamburger?)

VI. How much information would it take for you to be comfortable buying this product or to believe you have enough knowledge about selenium/functional foods/high selenium beef product to make an educated decision?

VII. Potential Premiums
   a. What premium level range would you be willing to pay for a high-selenium beef product?
   b. Would it influence your willingness-to-pay if it was a product that would benefit the local economy, such as being raised in-state, for example?
Faculty and staff members of North Dakota State University, ages 25-55, were invited to participate. Other screening criteria included primary household shopper status, healthy food purchaser, and beef consumer. Nine participants, all women, registered with eight actually participating in the focus group. Demographic information obtained is as follows in Table 3.1.

<table>
<thead>
<tr>
<th>Table 3.1. Demographic information from focus group.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Range</strong></td>
</tr>
<tr>
<td>Age</td>
</tr>
<tr>
<td>Number of children</td>
</tr>
<tr>
<td>Youngest child age</td>
</tr>
<tr>
<td># of household members</td>
</tr>
<tr>
<td>Years in profession</td>
</tr>
<tr>
<td># grocery shopping occurrences/month</td>
</tr>
<tr>
<td>Beef consumption (lb) /week</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>Use dietary supplements</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>Overweight</td>
<td>5</td>
<td>3</td>
</tr>
<tr>
<td>Immediate family member with cancer experience</td>
<td>4</td>
<td>4</td>
</tr>
</tbody>
</table>

The majority of consumers seem to be vaguely aware of selenium and have very little knowledge of its relation to cancer or the research that supports its role in cancer-prevention and potential as part of a functional food. Some commented that the word selenium itself “sounds bad.” Most consumers were aware of the availability of functional foods in the marketplace and in fact purchase them (e.g., calcium enriched orange juice), but few were familiar with the actual term “functional food.”

The product labeling section of the discussion provided very useful information. Three different styles of labels were pictured on cuts of beef and displayed for participants.
to examine. An example is shown on the following page. Short labels were simple and were comprised of phrases such as “contains selenium” or “high in selenium.” Medium labels, as shown in Figure 3.1, had the short phrase with some additional information referring to selenium’s relation to cancer prevention. A large, very informational, label was also used and placed on the back of the package with a link to it on a short front label. According to participants, short labels did not provide enough information and formed slightly negative perceptions. Medium labels with suggestions from research were most accepted and preferred, and the large label was described as containing too much information. Participants in general indicated they “would never read that much.”

Figure 3.1. Medium label example.

FDA approval of selenium as a cancer fighter was generally accepted as positive and was described as likely to result in a slightly higher WTP for a beef product rich in selenium. Participants did not like the label placed over too much of the actual meat product, as they want to see the meat they are buying. For beef cuts in particular, participants noted that the visual attractiveness of the cut was the primary purchase-
motivating attribute (e.g., marbling and color). A final point from the discussion suggested a “catchy” label be used. All participants agreed that an aesthetically appealing label has more positive effects.

The stated willingness-to-pay premium for a product high in selenium initially ranged from 0.0% to 10%. Follow up discussions with the four participants with cancer incidences in their immediate family extended the maximum premium to 15%. Participants also indicated that a premium might be paid in order to support a locally based product and economy given the natural soil placement of selenium in the Dakotas (e.g., Dakota-raised beef).

**Experimental Design and Data**

The experimental design for this scenario is to create choice sets. Discrete choice methods were used to keep the choices presented to the participant reasonable and consistent. More common procedures, such as ranking, were also used to elicit consumers’ preferences, but ranking was not reliable for economic analysis (Champ, Boyle, and Brown, 2003) and, therefore, was not used.

This experiment was designed; approved by the NDSU Institutional Review Board; and then provided to Zoomerang Market Tools, an online survey company that manages survey panelists, to administer (www.zoomerang.com or www.zoompanel.com). Specific explanation of the design is provided below.

Appropriate experimental design is crucial to the analysis and must be created correctly. One must, first, identify and include all optimal attributes and levels of each attribute and, second, group these into choice sets. A common starting block is a full factorial design, which includes all possible combinations of attributes and attribute levels.
However, these are often too large and awkward for meaningful evaluation for choice experiments. This was the case in this experiment.

By developing a subset from the full factorial design within optimality guidelines, a more efficient choice set size is possible. For a choice design to be characterized as efficient, four properties must be considered, as indicated by Huber and Zwerina (1996). Based on a non-linear model, these properties are level balance, orthogonality, minimal overlap, and utility balance. Orthogonal design techniques have been the standard mode for creating choice sets in marketing, and orthogonality is often considered the principle requirement of efficient designs. Level balance requires attribute levels to occur with equal frequency within the design. For example, an attribute with two levels should be represented with each attribute appearing in half the cases. Orthogonality is satisfied when any levels of different attributes do not jointly occur in any choice sets, or the levels of the attributes are uncorrelated in all choice sets. Minimal overlap is important because it requires that occurrences of an attribute level repeating itself in a choice set be minimized. Utility balance is satisfied by simply keeping the participants’ utility of each choice within a choice set equal, thus no redundant or obvious choices in the set exist. Marketing researchers have created efficient and optimal design reduction techniques for this choice experiment based upon D-optimality.

**D-Optimality**

D-optimality minimizes the value of $D$, which is defined as the inverse of the $k^{th}$ root of the determinant of the information matrix ($\Omega$) and is represented by the equation

$$D - efficiency = [\frac{\Omega^{1/k}}{1}]^{-1}.$$
D-optimality measures the combined uncertainty of a model’s parameters and should be used when parameter accuracy is more important than the accuracy of the fit (Crary Group, 2001-2004).

The experimental design of the survey consisted of three attributes: premium, health claim, and origin, each having three levels. For the premium attribute, levels were established at 5%, 10%, and 15% of the market price, based on the feedback from the focus group. Health claim levels were that of FDA level A, FDA level C, and a suggestion based on recent research. As mentioned in the literature review, other studies have shown little difference between consumers’ purchase intentions when comparing level A and level C FDA health claims. However, since consumers’ awareness and knowledge of selenium is seemingly limited, an FDA level A claim would be considered a feasible contrast to a level C claim. The origin attribute referred to the label design, as well as the wording, and used “naturally rich in selenium” and “selenium fortified” phrases on the labels. The “naturally rich in selenium” phrase was used within a plain rectangular border as well as a North Dakota border, thus creating the third level within this attribute.

The full factorial design, offered with no reductions, presented a survey participant with far too many alternatives from which to make one selection. Therefore, reductions had to be made for respondents’ choices to be valuable. SAS macros made this possible. First, desired attributes and levels are entered. The SAS macros are then able to perform orthogonal reductions to the full factorial design and creating a possible experimental design for use. Since this design had three attributes with three levels each, the number of choice sets for an orthogonal and balanced experimental design needed to be a number divisible by nine \((3 \times 3 = 9)\). The saturated design had 13 choice set runs, but because nine
is not a factor of 13, the optimal design was 18 choice sets—since it was the lowest multiple of nine, greater than 13.

Eighteen choice sets may be too many for a respondent—given time requirements and the need to keep responses meaningful for analysis. Three surveys of six questions each is a logical strategy to determine the appropriate number of responses. This was arranged within the programming of the same code that used the macros to create the design and survey questions. Six of the 18 questions were taken on the first set of surveys, the next six on the second set, and the last six for the final set of surveys. This provided an opportunity to capture all 18 choice sets and still have an attractive survey for participation.

Each of the surveys began with a series of five beef consumption questions. They were included because of their potential to help identify market segments for high selenium beef. After the six choice experiment questions, each survey concluded with 15 general demographic questions (Appendix A).

Zoomerang MarketTools, an Internet market research company, was hired to administer and deploy the survey to a specific group of panelists. Quarterly, Zoomerang sends a profile update to each panelist which they must update demographic, technographic, and behavioral data in order to remain a survey panelist. Zoomerang MarketTools delivered the survey via email message to their own registered panelists, monitored completed survey numbers, and collected data. When the amount of surveys needed was completed, the responses were downloaded in a Microsoft Excel format for analysis. The population of the survey was limited to consumers registered with Zoomerang MarketTools of the following characteristics: primary household grocery shoppers, ages 25 and older, and regularly purchased beef and meals that included beef.
Individual completes for surveys one, two, and three were 485, 484, and 507, respectively, for a total of 1476 responses.

Data were cleaned to omit incomplete entries, entries by those who were not the primary shopper of the household, those who did not consume beef, and those entries with extreme outliers or extreme choices that differed greatly—such as shopping for groceries 100 times per month. A total of 172 responses were omitted resulting in 1,304 responses used for analysis.

Respondents of the survey were presented with an incentive of 50 Zoompoints. This is part of Zoomerang’s reward system for volunteering as a survey panelist. As they complete surveys, panelists were awarded points, which could be exchanged for physical goods.

**Survey Population**

The gender of the survey population was predominately female (77%). Most (89%) of the participants were white. Age is identified in five categories: 25-34 (16%), 35-44 (28%), 45-54 (32%), 55-64 (18%), and 65 and older (6%). Sixty-one percent of the respondents were married.

Participants were asked to identify the highest level of education they had completed according to the following categories: high school diploma or equivalent (25%), some college (33%), associate’s degree (12%), bachelor’s degree (18%), and graduate studies or more (11%). The largest group (53%) of the respondents had full-time employment status followed by homemaker (21%), retired (16%), part-time (8%), and student (2%). Levels like these were also used for annual household income and are shown in Table 3.2.
Table 3.2. Income levels of survey participants.

<table>
<thead>
<tr>
<th>Income Level</th>
<th>Number of Responses</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Less than $15,000</td>
<td>81</td>
<td>6%</td>
</tr>
<tr>
<td>$15,000 - $24,999</td>
<td>144</td>
<td>11%</td>
</tr>
<tr>
<td>$25,000 - $34,999</td>
<td>161</td>
<td>12%</td>
</tr>
<tr>
<td>$35,000 - $49,999</td>
<td>226</td>
<td>17%</td>
</tr>
<tr>
<td>$50,000 - $74,999</td>
<td>359</td>
<td>28%</td>
</tr>
<tr>
<td>$75,000 - $99,999</td>
<td>190</td>
<td>15%</td>
</tr>
<tr>
<td>$100,000 – $150,000</td>
<td>107</td>
<td>8%</td>
</tr>
<tr>
<td>$150,000 and above</td>
<td>35</td>
<td>3%</td>
</tr>
</tbody>
</table>

In addition to these more common demographic questions, participants were also asked to respond to some survey specific behavioral questions. Results are shown in Table 3.3. These questions are included to help identify market segments to which a high-selenium beef product would appeal. Those reported here but not included in the model do not exhibit a statistically significant effect on respondent preferences.

Table 3.3. Survey-specific socio-demographic responses.

<table>
<thead>
<tr>
<th>Question</th>
<th>No number</th>
<th>%</th>
<th>Yes number</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Do you intentionally purchase functional foods?</td>
<td>425</td>
<td>33%</td>
<td>878</td>
<td>67%</td>
</tr>
<tr>
<td>Do you use tobacco products?</td>
<td>878</td>
<td>67%</td>
<td>425</td>
<td>33%</td>
</tr>
<tr>
<td>Do you take dietary supplements?</td>
<td>666</td>
<td>51%</td>
<td>637</td>
<td>49%</td>
</tr>
<tr>
<td>Are any of these following health conditions in your immediate family?</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cancer</td>
<td>973</td>
<td>75%</td>
<td>330</td>
<td>25%</td>
</tr>
<tr>
<td>Heart Disease</td>
<td>1002</td>
<td>77%</td>
<td>301</td>
<td>23%</td>
</tr>
<tr>
<td>Diabetes</td>
<td>870</td>
<td>67%</td>
<td>433</td>
<td>33%</td>
</tr>
<tr>
<td>High Blood Pressure</td>
<td>644</td>
<td>49%</td>
<td>659</td>
<td>51%</td>
</tr>
<tr>
<td>Osteoporosis</td>
<td>1158</td>
<td>89%</td>
<td>145</td>
<td>11%</td>
</tr>
<tr>
<td>Arthritis</td>
<td>793</td>
<td>61%</td>
<td>510</td>
<td>39%</td>
</tr>
<tr>
<td>None of these conditions</td>
<td>939</td>
<td>72%</td>
<td>364</td>
<td>28%</td>
</tr>
<tr>
<td>Do you have children in your household?</td>
<td>679</td>
<td>52%</td>
<td>624</td>
<td>48%</td>
</tr>
</tbody>
</table>

Indicate the number of alcoholic drinks you consume in an average week

<table>
<thead>
<tr>
<th>0</th>
<th>1–3</th>
<th>4–6</th>
<th>7–10</th>
<th>11+</th>
</tr>
</thead>
<tbody>
<tr>
<td>56%</td>
<td>24%</td>
<td>10%</td>
<td>4%</td>
<td>6%</td>
</tr>
</tbody>
</table>
CHAPTER IV. RESULTS

Multinomial Model

Results of the multinomial model indicate a good fit with a log-likelihood value of -9986.827 and significant chi-squared values of 0.0000. Standard errors on all estimated coefficients are low. Except for the survey specific attributes, only statistically significant variables are discussed. Results are also shown in Table 4.1. The base case for this model is the “none” alternative—the standard steak with no labeling or premiums.

As for the survey specific attributes and their levels, respondents do not prefer the FDA level A, FDA level C, or recent research health claims at very significant levels, 0.0000, 0.0050, and 0.0000, respectively. These claims include the words “cancer” and “selenium”; both may be perceived negatively as cancer is associated with a life threatening sickness and selenium is relatively unknown to consumers. As expected, price increases are not preferred with a Cp = 0.1265. The coefficient on “North Dakota Naturally Rich in Selenium” and “Selenium Fortified” labels is as expected (positive), but the variables are not significant.

The “Naturally Rich in Selenium” label was not included. The model would not run if both “Naturally Rich in Selenium” labels were included, presumably because they are not differentiated by respondents. Only the label border differed, and this only slightly (i.e., the North Dakota label border was in the shape of North Dakota).

Many socio-demographic and consumer behavior variables are included in the model to allow for investigation of them on consumers’ preferences toward individual health claims. Some of these variables are significant to only one of the purposed health claims and, therefore, are not discussed here (refer to Table 4.2 discussed later).
<table>
<thead>
<tr>
<th>Variable (Health Claim Interaction)</th>
<th>Coefficient and Sign</th>
<th>Standard Error</th>
<th>Level of Significance</th>
<th>Marginal Effect</th>
</tr>
</thead>
<tbody>
<tr>
<td>FDA Level A Health Claim</td>
<td>-1.837</td>
<td>0.398</td>
<td>0.0000</td>
<td></td>
</tr>
<tr>
<td>FDA Level C Health Claim</td>
<td>-1.576</td>
<td>0.455</td>
<td>0.0050</td>
<td></td>
</tr>
<tr>
<td>Recent Research Health Claim</td>
<td>-2.190</td>
<td>0.437</td>
<td>0.0000</td>
<td></td>
</tr>
<tr>
<td>Price</td>
<td>-0.679</td>
<td>0.444</td>
<td>0.1265</td>
<td></td>
</tr>
<tr>
<td>North Dakota Label</td>
<td>0.269</td>
<td>0.040</td>
<td>0.4978</td>
<td></td>
</tr>
<tr>
<td>Fortified Label</td>
<td>0.499</td>
<td>0.040</td>
<td>0.2126</td>
<td></td>
</tr>
<tr>
<td>Functional Food Purchaser (A)</td>
<td>0.613</td>
<td>0.067</td>
<td>0.0000</td>
<td>13.926</td>
</tr>
<tr>
<td>Functional Food Purchaser (C)</td>
<td>0.567</td>
<td>0.077</td>
<td>0.0000</td>
<td>2.029</td>
</tr>
<tr>
<td>Functional Food Purchaser (R)</td>
<td>0.833</td>
<td>0.076</td>
<td>0.0000</td>
<td>-0.890</td>
</tr>
<tr>
<td>≥ $50,000 household income (A)</td>
<td>0.171</td>
<td>0.065</td>
<td>0.0083</td>
<td>10.916</td>
</tr>
<tr>
<td>≥ $50,000 household income (C)</td>
<td>0.412</td>
<td>0.076</td>
<td>0.0000</td>
<td>9.992</td>
</tr>
<tr>
<td>≥ $50,000 household income (R)</td>
<td>0.249</td>
<td>0.071</td>
<td>0.0005</td>
<td>0.451</td>
</tr>
<tr>
<td>Age 35 – 45 (A)</td>
<td>0.302</td>
<td>0.154</td>
<td>0.0489</td>
<td>-0.337</td>
</tr>
<tr>
<td>Age 35 – 45 (C)</td>
<td>0.210</td>
<td>0.179</td>
<td>0.2409</td>
<td>3.814</td>
</tr>
<tr>
<td>Age 35 – 45 (R)</td>
<td>0.329</td>
<td>0.168</td>
<td>0.0506</td>
<td>-1.267</td>
</tr>
<tr>
<td>Age 45 – 55 (A)</td>
<td>0.171</td>
<td>0.064</td>
<td>0.0083</td>
<td>10.916</td>
</tr>
<tr>
<td>Age 45 – 55 (C)</td>
<td>0.412</td>
<td>0.076</td>
<td>0.0000</td>
<td>9.992</td>
</tr>
<tr>
<td>Age 45 – 55 (R)</td>
<td>0.249</td>
<td>0.071</td>
<td>0.0005</td>
<td>0.451</td>
</tr>
<tr>
<td>Age 55 – 65 (A)</td>
<td>0.566</td>
<td>0.103</td>
<td>0.0000</td>
<td>-0.562</td>
</tr>
<tr>
<td>Age 55 – 65 (C)</td>
<td>0.624</td>
<td>0.125</td>
<td>0.0000</td>
<td>-0.492</td>
</tr>
<tr>
<td>Age 55 – 65 (R)</td>
<td>0.697</td>
<td>0.111</td>
<td>0.0000</td>
<td>-1.073</td>
</tr>
<tr>
<td>Exercise 0 days / week (A)</td>
<td>-0.276</td>
<td>0.100</td>
<td>0.0059</td>
<td>10.916</td>
</tr>
<tr>
<td>Exercise 0 days / week (C)</td>
<td>-0.212</td>
<td>0.117</td>
<td>0.0709</td>
<td>-0.416</td>
</tr>
<tr>
<td>Exercise 0 days / week (R)</td>
<td>-0.561</td>
<td>0.110</td>
<td>0.0000</td>
<td>1.734</td>
</tr>
<tr>
<td>Exercise 1-2 days / week (A)</td>
<td>0.232</td>
<td>0.086</td>
<td>0.0071</td>
<td>3.887</td>
</tr>
<tr>
<td>Exercise 1-2 days / week (C)</td>
<td>-0.651</td>
<td>0.101</td>
<td>0.5186</td>
<td>-0.855</td>
</tr>
<tr>
<td>Exercise 1-2 days / week (R)</td>
<td>-0.170</td>
<td>0.923</td>
<td>0.0652</td>
<td>3.411</td>
</tr>
<tr>
<td>Exercise 3-4 days / week (A)</td>
<td>0.263</td>
<td>0.083</td>
<td>0.0015</td>
<td>-6.257</td>
</tr>
<tr>
<td>Exercise 3-4 days / week (C)</td>
<td>0.145</td>
<td>0.095</td>
<td>0.1271</td>
<td>-0.855</td>
</tr>
<tr>
<td>Exercise 3-4 days / week (R)</td>
<td>0.649</td>
<td>0.088</td>
<td>0.4610</td>
<td>4.926</td>
</tr>
<tr>
<td>Exercise 5-7 days / week (A)</td>
<td>0.167</td>
<td>0.105</td>
<td>0.1117</td>
<td>-5.272</td>
</tr>
<tr>
<td>Exercise 5-7 days / week (C)</td>
<td>0.300</td>
<td>0.121</td>
<td>0.0709</td>
<td>-0.855</td>
</tr>
<tr>
<td>Exercise 5-7 days / week (R)</td>
<td>0.113</td>
<td>0.111</td>
<td>0.3085</td>
<td>-0.850</td>
</tr>
<tr>
<td>High blood pressure (A)</td>
<td>0.162</td>
<td>0.066</td>
<td>0.0142</td>
<td>2.048</td>
</tr>
<tr>
<td>High blood pressure (C)</td>
<td>0.216</td>
<td>0.076</td>
<td>0.0045</td>
<td>-2.295</td>
</tr>
<tr>
<td>High blood pressure (R)</td>
<td>0.123</td>
<td>0.072</td>
<td>0.0879</td>
<td>-1.006</td>
</tr>
<tr>
<td>Hispanic / Latino / Spanish (A)</td>
<td>0.586</td>
<td>0.261</td>
<td>0.0247</td>
<td>-0.350</td>
</tr>
</tbody>
</table>
Table 4.1. (continued)

<table>
<thead>
<tr>
<th>Variable (Health Claim Interaction)</th>
<th>Coefficient and Sign</th>
<th>Standard Error</th>
<th>Level of Significance</th>
<th>Marginal Effect</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hispanic / Latino / Spanish (C)</td>
<td>0.577</td>
<td>0.291</td>
<td>0.0472</td>
<td>0.384</td>
</tr>
<tr>
<td>Hispanic / Latino / Spanish (R)</td>
<td>0.582</td>
<td>0.305</td>
<td>0.0568</td>
<td>1.945</td>
</tr>
<tr>
<td>Tobacco User (A)</td>
<td>0.108</td>
<td>0.064</td>
<td>0.0915</td>
<td>5.978</td>
</tr>
<tr>
<td>Tobacco User (C)</td>
<td>-0.130</td>
<td>0.076</td>
<td>0.0879</td>
<td>7.255</td>
</tr>
<tr>
<td>Tobacco User (R)</td>
<td>0.822</td>
<td>0.071</td>
<td>0.2443</td>
<td>0.297</td>
</tr>
</tbody>
</table>

Marginal effects of socio-demographic variables are also included. Marginal effects are explained as the effect of a change in attribute ‘m’ of alternative ‘j’ on the probability that the individual would choose alternative ‘k’ (where k may or may not equal j) (Greene, 1998), mathematically written as

\[
\delta_{jk}(m) = \frac{\partial \text{Prob}(y_i = k)}{\partial x_{ji}(m)} = [1 - (j = k)]P_k \beta_m.
\]

As expected, the most influential variables towards preference of health claims are consistent with that of aforementioned qualities of functional food shoppers. Those who intentionally purchase functional foods prefer FDA health claims A and C, especially the level A, which is logical in that they are the segment who would have a greater probability of understanding the significance and implications of FDA health claims and their respective levels. Individuals with household income of $50,000 or greater prefer all three of the health claims at highly significant levels and the marginal effect is important for level A and C claims. Age affects health claim preferences. Marginal effects indicate that the most influential results are age’s 45-54’s preference for FDA level A and C health claims. All other categories are relatively unimportant. Those 55-65 years of age do not prefer the health claims.
Another attribute of functional food purchasers is exercising, which also is significant. Results of the study show those who exercise not at all or 1-2 times per week prefer FDA level A health claims. Exercising more than twice a week has a negative marginal effect on respondents’ preference for the FDA level A health claim. The last significant quality of this model that is related to functional food market segments is higher education. Having at least a bachelor’s of science degree is significant to FDA level A and C health claims, and has a positive marginal effect (Table 4.2).

Table 4.2. Health claim preferences: Inconclusive effect on health claim.¹

<table>
<thead>
<tr>
<th>Variable (Health Claim Interaction)</th>
<th>Coefficient and Sign</th>
<th>Standard Error</th>
<th>Level of Significance</th>
<th>Marginal Effect</th>
</tr>
</thead>
<tbody>
<tr>
<td>Has at least B.S. Degree (A)</td>
<td>-0.154</td>
<td>0.071</td>
<td>0.0317</td>
<td>3.124</td>
</tr>
<tr>
<td>Has at least B.S. Degree (C)</td>
<td>0.160</td>
<td>0.078</td>
<td>0.0403</td>
<td>3.703</td>
</tr>
<tr>
<td>Age (C)</td>
<td>-0.150</td>
<td>0.095</td>
<td>0.1143</td>
<td>-0.332</td>
</tr>
<tr>
<td>Arthritis in immediate family (R)</td>
<td>0.339</td>
<td>0.073</td>
<td>0.0000</td>
<td>0.670</td>
</tr>
<tr>
<td>Black / African American (R)</td>
<td>0.670</td>
<td>0.264</td>
<td>0.0112</td>
<td>0.153</td>
</tr>
<tr>
<td>Cancer in immediate family (R)</td>
<td>-0.214</td>
<td>0.082</td>
<td>0.0088</td>
<td>0.297</td>
</tr>
<tr>
<td>Diabetes (C)</td>
<td>-0.154</td>
<td>0.081</td>
<td>0.0572</td>
<td>5.295</td>
</tr>
<tr>
<td>Four Steaks / Month (A)</td>
<td>-0.208</td>
<td>0.064</td>
<td>0.0012</td>
<td>-4.733</td>
</tr>
<tr>
<td>Four Steaks / Month (R)</td>
<td>-0.144</td>
<td>0.070</td>
<td>0.0406</td>
<td>-0.834</td>
</tr>
<tr>
<td>Gender (R)</td>
<td>-0.227</td>
<td>0.083</td>
<td>0.0061</td>
<td>0.487</td>
</tr>
<tr>
<td>Has children (A)</td>
<td>0.138</td>
<td>0.067</td>
<td>0.0450</td>
<td>6.687</td>
</tr>
<tr>
<td>Heart Disease (R)</td>
<td>-0.181</td>
<td>0.087</td>
<td>0.0366</td>
<td>1.472</td>
</tr>
<tr>
<td>Married (C)</td>
<td>-0.141</td>
<td>0.073</td>
<td>0.0538</td>
<td>-2.486</td>
</tr>
<tr>
<td>Osteoporosis (A)</td>
<td>0.224</td>
<td>0.099</td>
<td>0.0231</td>
<td>-0.169</td>
</tr>
<tr>
<td>Osteoporosis (R)</td>
<td>0.167</td>
<td>0.107</td>
<td>0.1175</td>
<td>0.384</td>
</tr>
</tbody>
</table>

¹ Variables included in the table are those where impact on preference for health claim was inconclusive (i.e., significant for one or two health claims).

Health issues within the immediate family are potentially indicative of purchase behavior according to our focus group information. Although five health issues within individuals’ immediate families were asked within the survey, the only significant result
consistent with more than one health claim is having high blood pressure in the immediate family. These individuals prefer Level A health claims, but do not prefer the Level C or recent research health claims.

Hispanic respondents’ preference for all three health claims is significant, but marginal effects are small and conflicting. Lastly, tobacco users prefer Level A and C health claims.

Table 4.2 shows results of variables significant to only one or two health claims in the model. Of these, respondents with diabetes in their immediate family have a preference for the FDA level C health claim. Those respondents having children also exhibit a valuable positive preference for FDA level A health claims. The other significant demographic/health claim variables have small marginal effects.
CHAPTER V. CONCLUSIONS

Introduction

Chapter V presents a short summary of this thesis. A short discussion explains the methods used and the logit results obtained from the procedure. Key conclusions and results are described, followed by limitations and suggestions for further studies in this subject matter.

Summary of Thesis

Cancer is an enormous health concern in the United States and the rest of the world. Selenium is an element that has been scientifically proven to show some cancer preventative characteristics, thus livestock and grain producers are exploring potential high-selenium food marketing opportunities. A choice experiment was conducted to identify characteristics of market segments that show interest in a high-selenium beef product. Participants were able to choose between different levels of health claim approval and research, prices, and selenium origin.

Data were obtained from a nationwide Internet survey that was limited to primary grocery shoppers of a household who were older than 25 years of age. Participants were asked to choose among four beef products within each of six choice sets. They were informed before choosing that all steaks were equal, with only differences being in labels and prices as they appeared on the survey instrument. Socio-economic and behavioral data were also collected.

Data were analyzed using Limdep®. The dependent variable was choice, which was one of the four choices for each set from which each participant selected. Independent
variables included attribute levels of the choice product, price, and socio-demographic and behavioral variables.

**Conclusions and Explanations**

The first objective of this study was to identify the preferred level of selenium beef attributes, including price, origin of selenium, and label-claim made regarding the value of selenium as a cancer preventative. As expected, consumers prefer a lower priced product, which agrees with economic theory. Actual values for a high-selenium beef product were not determined because if they are not willing to pay a premium for this product, there is no reason to pursue a WTP level until further consumer education is accomplished. Health claims have a negative effect on preference compared to the control steak. This may be due to the fact that the word “cancer” is used in the labeling and has a negative effect on preferences. This is consistent with Gilbert’s (2000) and Schmidt’s (2000) findings that a positive claim has higher appeal than a claim of fear or negative claim, such as “can reduce risk of cancer.”

Due to a general lack of knowledge pertaining to selenium, its higher level in beef may have been interpreted negatively. Focus group participants revealed that selenium does “sound bad.” This viewpoint may be widespread. The same type of perception (i.e., negative interpretation of a positive attribute) has been found for irradiated beef.

Labeling or proclaiming selenium origin based upon the “Naturally Rich in Selenium,” “Naturally Rich in Selenium” with a North Dakota border, and “Selenium Fortified” labeling is ineffective. These labels might need to be differentiated more to make an impact on the results obtained from participants. Another possibility is that consumers may not care how the product became high in selenium.
Gauging consumers’ level of knowledge concerning selenium health characteristics is the second objective. The focus group shows that a lack of knowledge regarding selenium and its role in health is dominant. It was therefore not considered necessary to include this query in this experiment.

Lastly, this study aimed to find market segments that would potentially be valuable to a high-selenium beef industry. From previous research mentioned in Chapter II, functional foods are more frequently purchased by consumers with higher education and income. This held true to this experiment as income levels greater than $50,000 and having at least a bachelor’s degree both had positive preferences on the FDA health claims. Higher education might be an indicator of the significance that an FDA approval or label carries. These positive preferences for either FDA health claim also could be related to previous research indicating consumers’ preference for a FDA level A, B, or C health claim to a level D health claim or no FDA health claim.

**Limitations and Further Work**

Identifying a well-articulated health claim will be very important to future studies. This will allow the consumer to make a decision on just selenium rather than trying to define a level of health claim that would be acceptable for an element they know nothing about. The labeling of selenium origin should be more differentiated. If the North Dakota origin is important to include, it should be more than just a North Dakota border versus the rectangular border of the regular “Naturally Rich in Selenium” label. For example, the label might specify “North Dakota Grown Beef.”

Due to the widespread lack of knowledge, point of purchase information about selenium would be beneficial to inform consumers about the benefits and hopefully remove
the consumers’ fear of including a previously foreign nutrient in their food. This may be the most important limitation of this research, since promotion of an unknown substance approaches a high level of difficulty. As Schmidt (2000) indicated, communication from producer to consumer is key to obtaining accurate information. Without an understanding of selenium, consumers will not be able to discern a value for a selenium rich product. For example, fluoride was perceived negatively until consumers were educated and comfortable enough with their level of understanding to make informed purchase decisions.
REFERENCES


APPENDIX A. SURVEYS
Survey 1

This study is a graduate student research project in the Department of Agribusiness and Applied Economics at North Dakota State University. The research is to explore consumer food consumption and product preferences. Results of this study will help us learn more about potential market opportunities.

You are invited to participate in this research study. Your participation is voluntary; however, your assistance would be greatly appreciated in making this a meaningful survey. It should take about 5-10 minutes to complete the survey.

Your identity will not be revealed in the experiment results. Only group comparisons will be made and reported in summary form.

If you have questions about the rights of human participants in research, or to report a problem, you should contact the NDSU IRB Office, (701) 231-8908. Any questions about the research project can be addressed by contacting Scott Hovde, graduate student at NDSU, at scott.hovde@ndsu.edu, or by calling Cheryl Wachenheim, Scott’s advisor and NDSU Agribusiness and Applied Economics faculty member, at (701) 231-7452.

Thank you for your participation in this study.
1. Are you the primary grocery shopper for your household?
   □ Yes
   □ No

2. Do you intentionally purchase foods with additional health benefits beyond basic nutrition? (e.g. calcium-enriched orange juice)
   □ Yes
   □ No

3. On average, how many times do you shop for groceries each month?
   __________ times.

4. Including dining out, how many servings of hamburger would you estimate you purchased in the last month?
   □ 0
   □ 1
   □ 2
   □ 3
   □ 4
   □ 5
   □ 6
   □ 7
   □ 8
   □ 9
   □ 10 or more

5. How many unprepared four ounce servings of each of the following would you estimate you purchased in the last month?
   
   Hamburger    __________
   Steak        __________
   Roasts       __________
   Ribs         __________
   Other Beef Products __________
6. How many prepared four ounce servings of each of the following would you estimate you purchased in the last month?

<table>
<thead>
<tr>
<th>Item</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hamburger</td>
<td>________</td>
</tr>
<tr>
<td>Steak</td>
<td>________</td>
</tr>
<tr>
<td>Roasts</td>
<td>________</td>
</tr>
<tr>
<td>Ribs</td>
<td>________</td>
</tr>
<tr>
<td>Other Beef Products</td>
<td>________</td>
</tr>
</tbody>
</table>

Please read the following product description for a new product.

Selenium is an essential trace mineral to our health and has shown some recent evidence of having cancer prevention qualities. The beef product shown below is a top sirloin steak. The white-out area is just where the store’s label was. Please respond as though you are going to purchase this sirloin steak. All pictures following this steak are of steaks similar to the one in this picture. Choice “D” is the standard steak without any selenium labeling at the current market price.
7. Which of the above four products would you prefer to purchase?

□ A
□ B
□ C
□ D
8. Which of the above four products would you prefer to purchase?

□ A

□ B

□ C

□ D
9. Which of the above four products would you prefer to purchase?

- □ A
- □ B
- □ C
- □ D
10. Which of the above four products would you prefer to purchase?

□ A
□ B
□ C
□ D
11. Which of the above four products would you prefer to purchase?

- □ A
- □ B
- □ C
- □ D
12a. Which of the above four products would you prefer to purchase?

- □ A
- □ B
- □ C
- □ D
13. Do you use tobacco products?
   □ Yes
   □ No

14. How many alcoholic beverages do you consume in an average week?
   □ 0
   □ 1-3
   □ 4-6
   □ 7-10
   □ 11-15
   □ 15 or more

15. Do you take dietary supplements?
   □ Yes
   □ No

16. How many days do you exercise in a typical week?
   □ 1
   □ 2
   □ 3
   □ 4
   □ 5
   □ 6
   □ 7

17. Have you or anyone in your family experienced any of the following health conditions? (check all that apply)
   □ Cancer
   □ Heart Disease
   □ Diabetes
   □ High Blood Pressure
   □ Osteoporosis
   □ Arthritis
   □ None of the Above
18. Please indicate your gender.
   □ Male
   □ Female

19. Please select the category that indicates your age.
   □ 25 – 34
   □ 35 – 44
   □ 45 – 54
   □ 55 – 64
   □ 65 – 74
   □ 75 and older

20. Do you have children under the age of 18 living in your household?
   □ Yes
   □ No

21. If you have children in household, please indicate the number of children in the appropriate age group.

   0 – 4   __________
   5 – 9   __________
   10 – 14 __________
   15 – 17 __________

22. Which of the following best describes your marital status?
   □ Single, never married
   □ Married
   □ Living with partner
   □ Divorced
   □ Separated
   □ Widowed
   □ Prefer not to answer
23. Which one of the following best describes your employment status?

- □ Employed full-time
- □ Employed part-time
- □ Self employed
- □ Not employed, looking for work
- □ Not employed, not looking for work
- □ Retired
- □ Student
- □ Homemaker
- □ Prefer not to answer

24. What best describes your level of education?

- □ Some high school or less
- □ High School graduate or equivalent
- □ Some college
- □ Associate’s degree
- □ Bachelor’s degree
- □ Graduate or professional degree
- □ Prefer not to answer

25. Which one of the following ranges includes your total yearly household income before taxes?

- □ Less than $15,000
- □ $15,000 - $24,999
- □ $25,000 - $34,999
- □ $35,000 - $49,999
- □ $50,000 - $74,999
- □ $75,000 - $99,999
- □ $100,000 - $149,999
- □ $150,000 or more
26. Which one of the following best describes you?
   □ White/Caucasian
   □ Spanish/Latino/Hispanic
   □ Black/African American
   □ Asian
   □ Pacific Islander
   □ Native American
   □ Other
   □ Prefer not to answer

27. In which state do you live?

_______________________
Survey 2

Question 7a.

7. Which of the above four products would you prefer to purchase?

□ A
□ B
□ C
□ D

1 Socio-demographic and behavioral questions were the same as Survey 1 and, therefore, are not included again. Only the six choice experiment questions were different.
8. Which of the above four products would you prefer to purchase?

□ A
□ B
□ C
□ D
Question 9a.

9. Which of the above four products would you prefer to purchase?

☐ A

☐ B

☐ C

☐ D
10. Which of the above four products would you prefer to purchase?

☐ A
☐ B
☐ C
☐ D
11. Which of the above four products would you prefer to purchase?

□ A
□ B
□ C
□ D
12. Which of the above four products would you prefer to purchase?

□ A
□ B
□ C
□ D
Survey 3

Question 7a.

7. Which of the above four products would you prefer to purchase?

☐ A
☐ B
☐ C
☐ D

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2 Socio-demographic and behavioral questions were the same as Survey 1 and, therefore, are not included again. Only the six choice experiment questions were different.
8. Which of the above four products would you prefer to purchase?

☐ A
☐ B
☐ C
☐ D
Question 9a.

9. Which of the above four products would you prefer to purchase?

☐ A

☐ B

☐ C

☐ D
10. Which of the above four products would you prefer to purchase?

□ A
□ B
□ C
□ D
11. Which of the above four products would you prefer to purchase?

□ A  
□ B  
□ C  
□ D
12. Which of the above four products would you prefer to purchase?

☐ A
☐ B
☐ C
☐ D